# APPENDIX H

## SPECIALIST STUDIES

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# APPENDIX H1

AGRICULTURAL IMPACT ASSESSMENT

# AGRICULTURAL IMPACT ASSESSMENT FOR:

## UPGRADING OF THE EXISTING VAAL GAMAGARA REGIONAL WATER SUPPLY SCHEME PHASE 2 (VGRWSS-II)

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# 1 BACKGROUND

The VGRWSS is located in the Northern Cape Province and was completed in 1968 by the then Department of Water Affairs. The existing scheme transfers water from Delportshoop on the Vaal River (60km to the north west of Kimberley) via Postmasburg to the iron ore mines at Kathu. From Kathu, a pipeline continues to the manganese mines at Hotazel and finally terminates at Black Rock.

The current scheme is operating at capacity and is not able to supply the increasing future water demands. The major driving force of the increased water demand is the iron ore and manganese mining operations.

Secondary to the expected increased water demand are water supply interruptions that are amplified due to the aging infrastructure. The infrastructure, being 50 years old, is nearing the end of its useful life and needs to be upgraded.

The localities of the features are as follows (Figure 1):

Two groundwater abstraction zones were proposed to augment the supply to Olifantshoek. The impact of the abstraction programme is dealt with in a separate report.

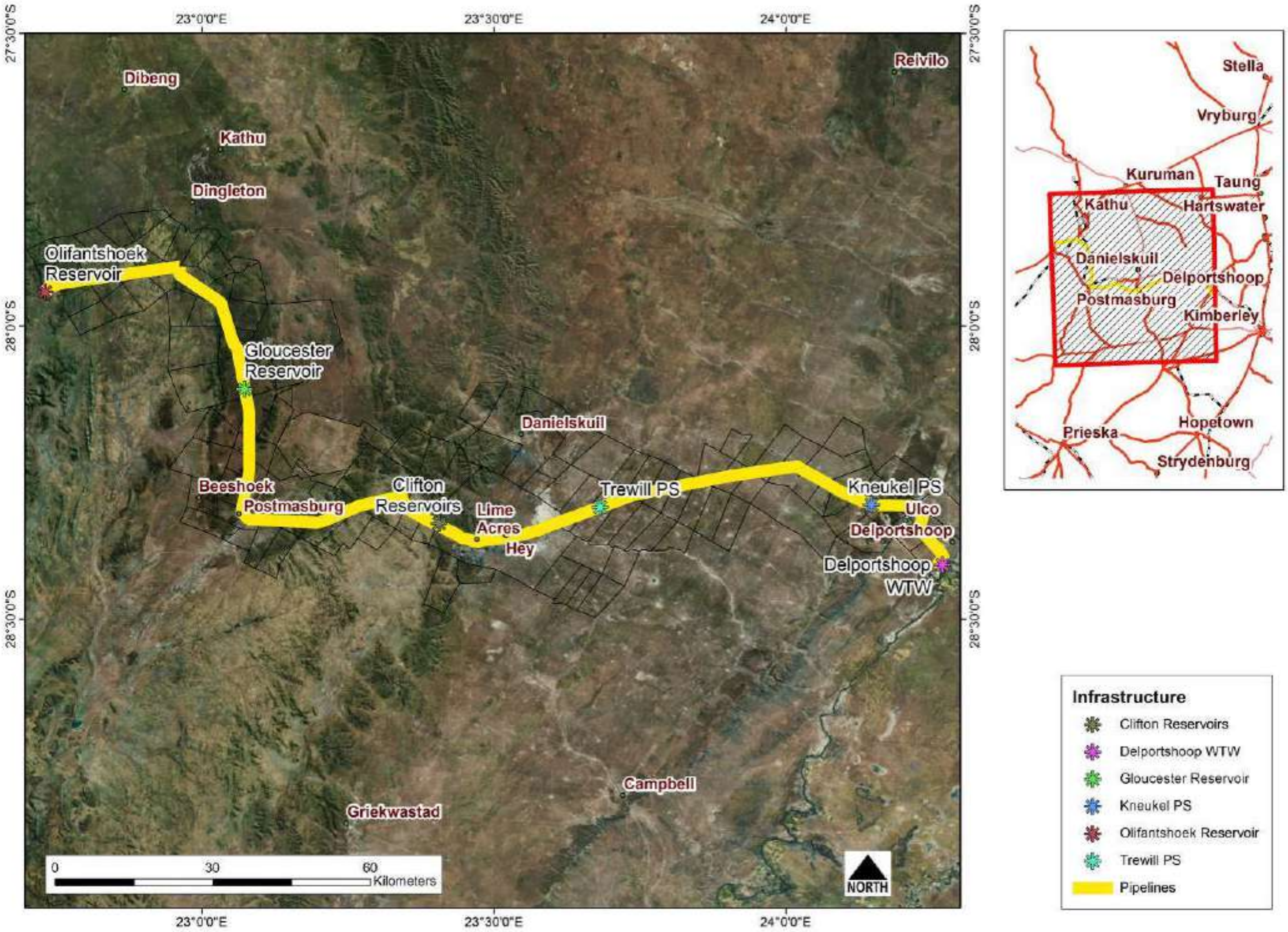



**Figure 1. Locations of features**

This report deals with the transfer pipeline from Deplortshoop to Olifanshoek. The individual components assessed are as follows:

***Water Abstraction Works and Water Treatment Works (WTW)***

Provision was made to undertake refurbishment on pipework and repairs to buildings. The footprint of the WTW will remain the same before and after construction, and therefore will not impact agriculture.

***Pipelines***

Water is pumped from the Delportshoop WTW via a pipeline to Olifantshoek. The proposed scope of work with regards to pipelines includes the following:

- Replacing of Pipeline from Beeshoek Connection to Roscoe;
- Replacing of Pipeline between Clifton and Beeshoek Connection;
- Replacing of the Rising Main from Delportshoop to Kneukel;
- Replacing of the Rising Main from Kneukel to Trewill;
- Replacing of the Rising Main from Trewill to Clifton; and
- Refurbishment of Gravity Main from Roscoe to Olifantshoek.

Replacement of these sections of pipelines will take place within the exiting servitude, and the existing pipelines will be decommissioned. It is anticipated that the construction servitude (temporary) will be 50m wide.

***Pump Stations***

The pump stations at Delportshoop, Kneukel and Trewill will be upgraded without major civil works. The footprint of the pump stations will remain the same, and will, therefore not impact on agriculture.

***Reservoirs***

The Project proposes the upgrading of the following:

- Clifton, Gloucester Reservoirs,
- Trewill and Kneukel Sumps

***Borrow Areas***

Borrow pits will be required to source construction material. A total of 20 borrow pits will be located at approximately 10km intervals along the pipeline route.

The locations of the borrow areas will only be determined once the geotechnical investigations had been completed and was not assessed as part of this study.

# 2 OUTPUT OF THE REPORT

The key issues that are considered in the agricultural assessment are the following:

- Loss of high potential agricultural land;
- Loss of cultivated areas;
- Loss of grazing land;
- Disruptions to farming practices during construction;
- Determine impacts of project from an agricultural perspective; and
- Suggest suitable mitigation measures to address the identified impacts.

The output of the report is:

- a discussion of the natural resources that influence agricultural potential;
- impact on agricultural resources;
- an indication of the impact of the development on the farmers and ways to mitigate the effect of the project during and after construction.

# 3 PROCESS OF THE ASSESSMENT

The present land use was identified from various satellite images sources, dated from 2010 to 2018. These are available on the internet.

The land uses were delineated as four categories:

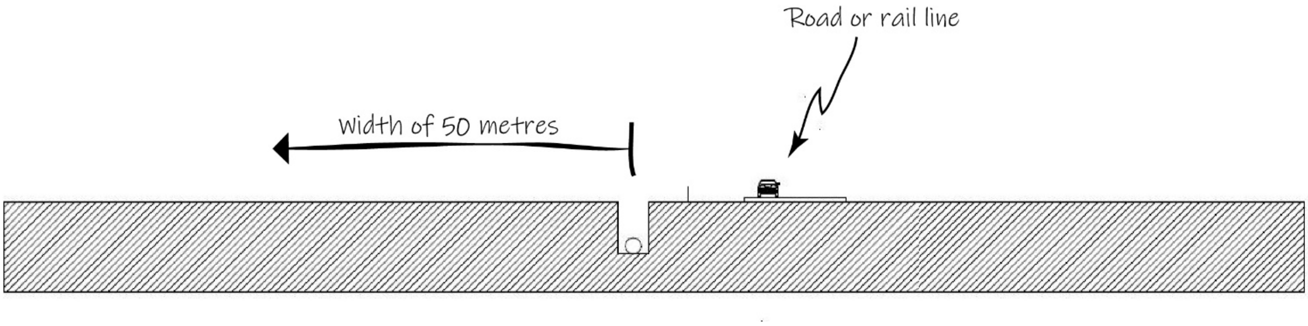
1) Irrigated land;
2) Mining land;
3) Land with social infrastructure (housing and landing strip); and
4) Grazing (open veld or pastures).

The impact assessment will assign values to each category in a matrix to indicate significance of loss.

- It is accepted that the permanent loss in the case of grazing and arable land will be only the footprint of reservoirs and pump station sites. There are all already fenced;
- The irrigated land will temporary be lost for a strip of not more than 50 metres on each side of construction, and will last for one season, which is the time allowed for the vegetation to recover;
- A temporary loss for arable or grazing land will be for a strip of 50 metres wide (to allow for vehicle movement) and will last for one season, which is the time allowed for the vegetation to recover.

The width of the impact during upgrading of the pipeline was assumed as follows:

1) In general, a distance of 50 metres from the centre line of the pipe is assumed (100 metres width in total);
2) Where the pipeline runs along a line feature like roads or the railway line, the width is only 50 metres, and will consist of the portion away from the road or rail line.




# 4 AGRICULTURAL LAND USE

Land use in agriculture is dynamic and constantly changes, depending on the climate and socio-economic conditions of the farmer and of the region.

The dominant land use for the entire length of the line is animal grazing, irrigation takes place in isolated instances where water is available, and then only to produce supplement animal feed.

## 4.1 Land uses along the pipeline routes

The land uses along the pipelines within the strip that could be affected by construction (refer to Section 3) are indicated below.

The land uses are as follows:

**Table 1. Land uses along pipelines in the survey area**

| Line | Area per land use in the affected area (ha) |
|---|---|
| **Clifton - Gloucestor** | **308,03** |
| Grazing | 288,17 |
| Infrastructure | 19,87 |
| **Delportshoop - Kneukel** | **149,73** |
| Grazing | 141,28 |
| Mines | 8,45 |
| **Gloucester - Roscoe** | **137,53** |
| Grazing | 137,53 |
| **Kneukel - Trewill** | **245,30** |
| Grazing | 243,96 |
| Irrigated | 1,34 |
| **Roscoe - Olifantshoek** | **126,27** |
| Grazing | 110,61 |
| Infrastructure | 12,33 |
| Mines | 3,33 |
| **Trewill - Clifton** | **231,91** |
| Grazing | 122,86 |
| Infrastructure | 8,34 |
| Mines | 100,71 |
| **TOTAL area** | **1 198,77** |

**Table 2. Land uses per enterprise of the affected land along the pipeline route**

| Line | Area |
|---|---|
| Grazing | 1044,40 |
| Infrastructure | 40,53 |
| Irrigated land | 1,34 |
| Mines | 112,50 |
| **TOTAL** | **1 197,77** |

***Conclusions***

- Grazing is the dominant land use with approximately 1 044 that will be affected for the duration of construction followed by the time it takes for the land to recover from it being disturbed.
- Infrastructure and mining combined is 153,03 hectares or 12,7% of the land.
- The irrigated land at Ulco is a maximum of 1,3 hectares. It appears from the satellite images that there is an uncultivated strip of 25m between the pipeline and the lands. If construction vehicles can remain in this strip, then no impact is foreseen.

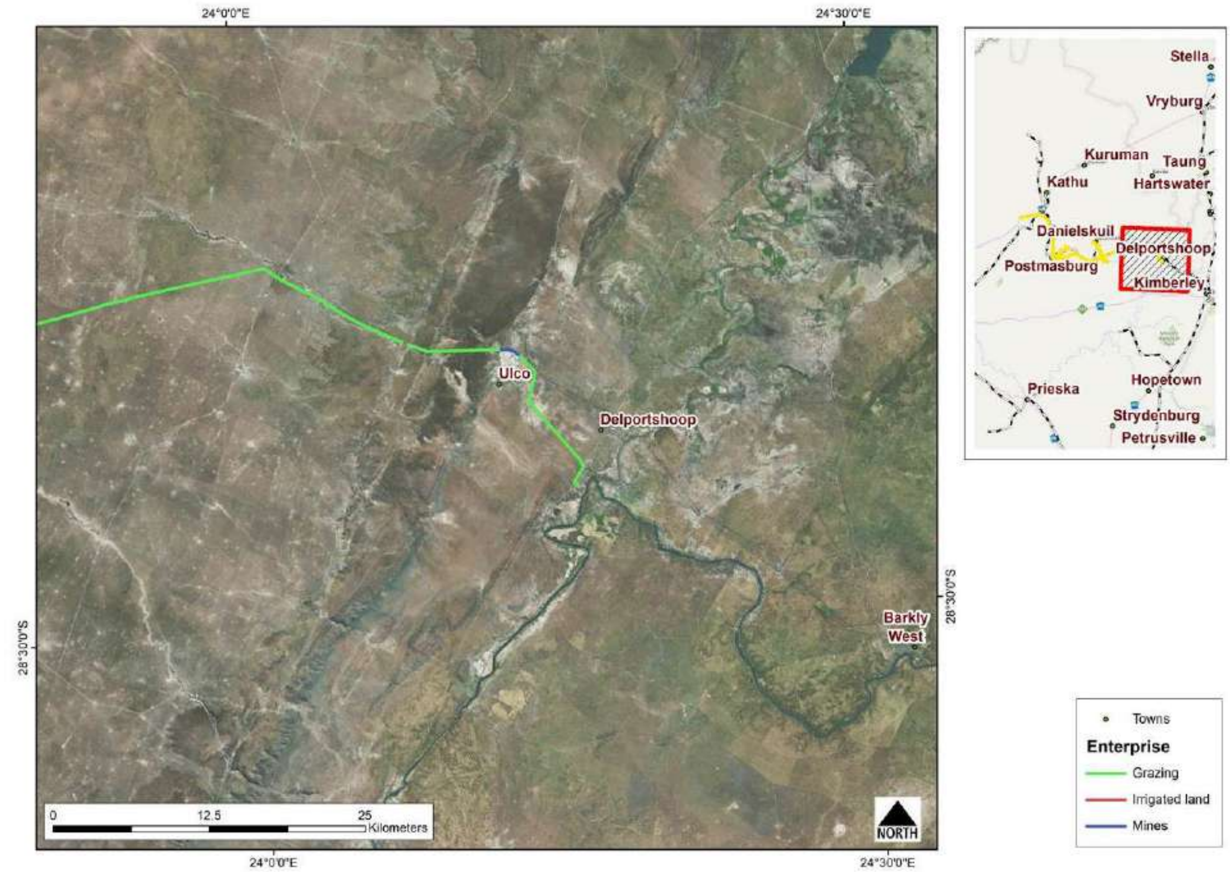



**Figure 2. Land uses of the construction reserve in the eastern section**

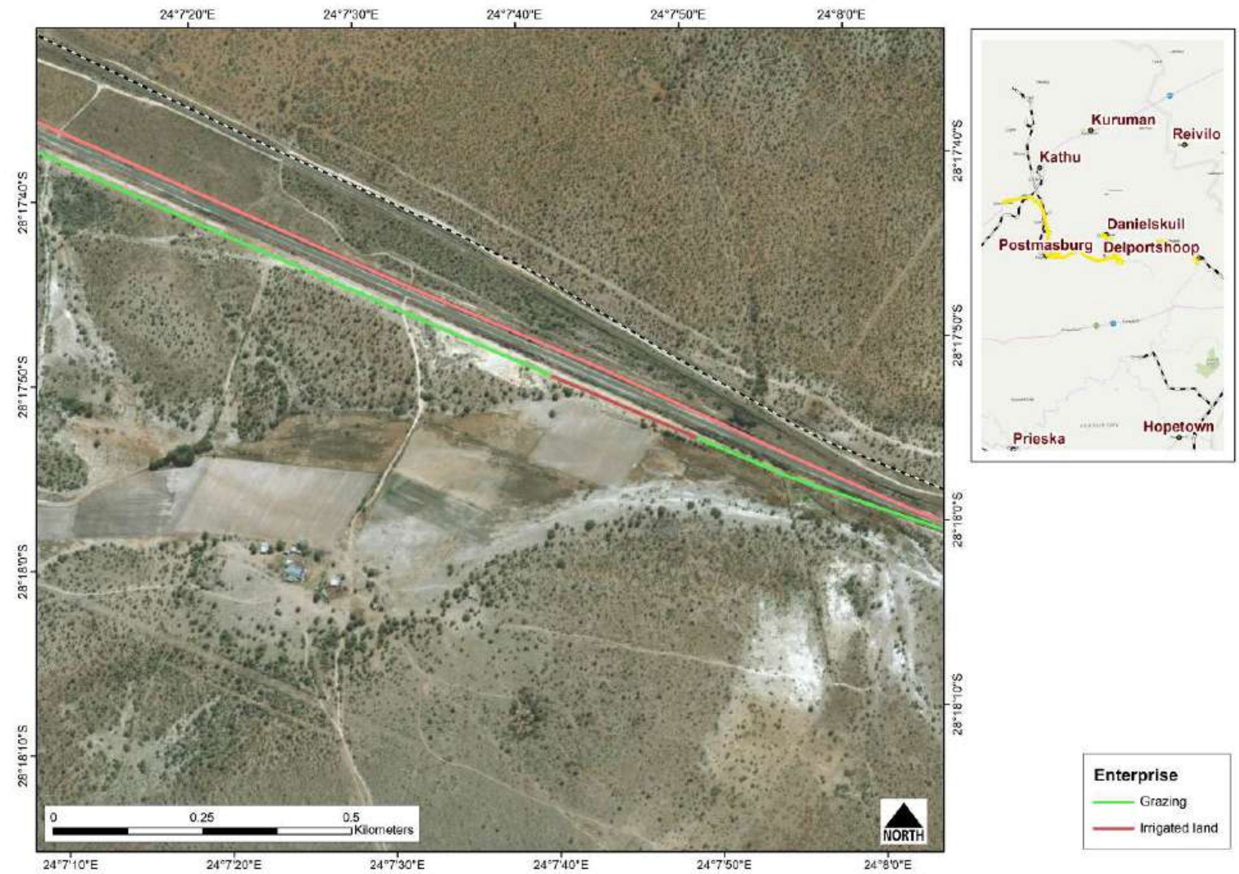



**Figure 3. Irrigated land just west of Ulco**

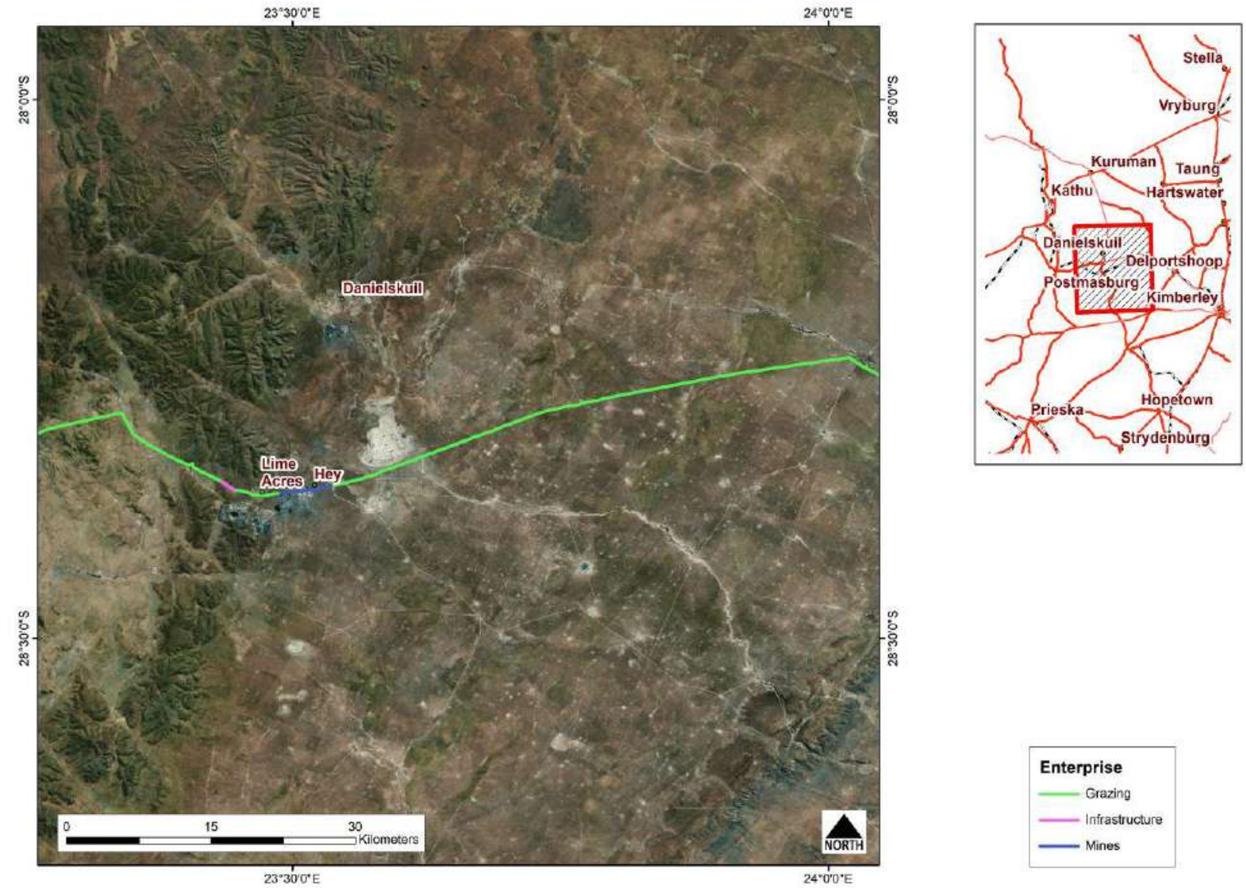



**Figure 4. Land uses of the construction reserve in the middle section**

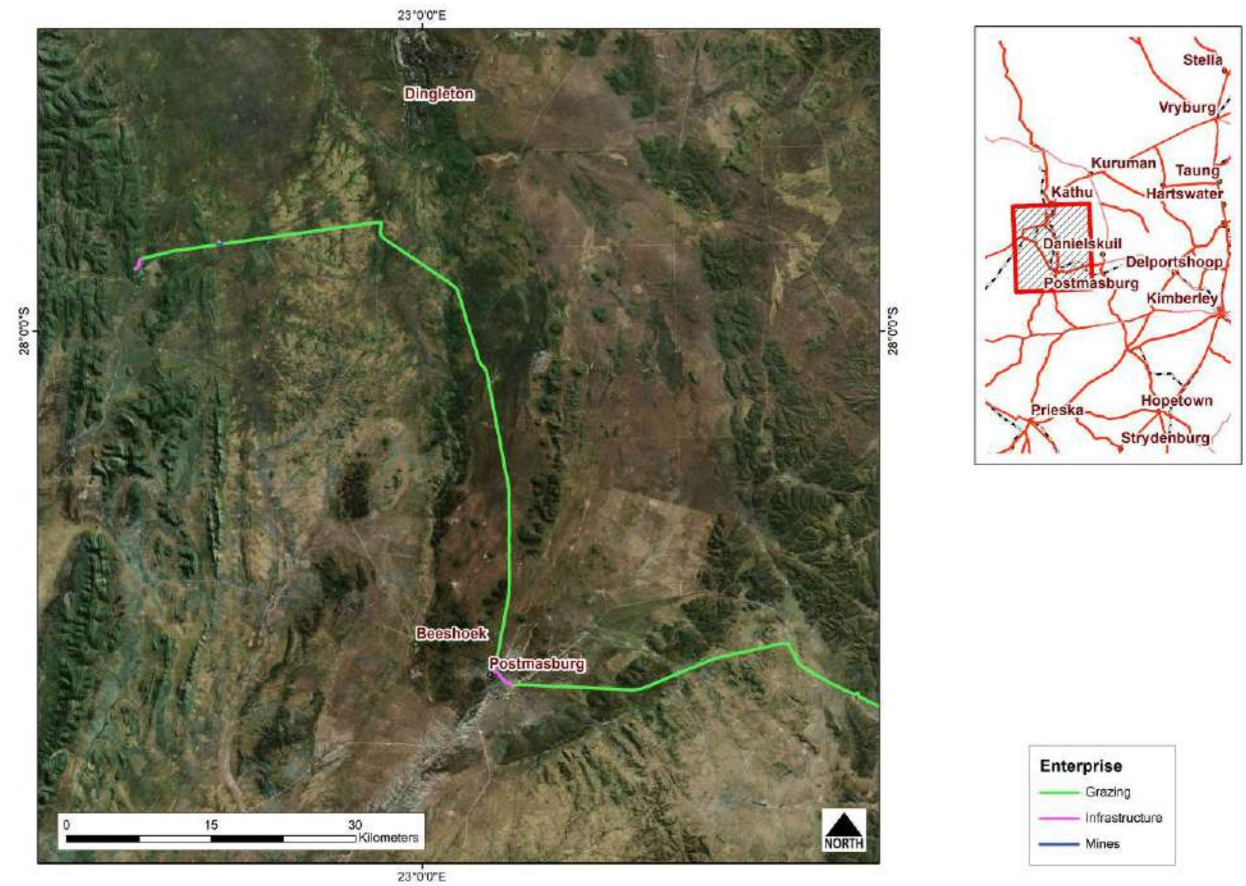



**Figure 5. Land uses of the construction reserve in the eastern section**

## 4.2 Pumping and storing infrastructure

The pump stations at Delportshoop, Kneukel and Trewill will be upgraded without major civil works.

The Project further proposes the upgrading of Clifton, Gloucester Reservoirs, and Trewill and Kneukel Sumps

The footprint of pumping and storage infrastructure will also not change. It is now not used for farming purposes. There will, therefore be no impact on farming resources. Gloucester Reservoir footprint in increase by 0,58 ha.

Pump stations and reservoirs are found at the following coordinates:

**Table 3. Pump and storage infrastructure**

| NAME | Type | X coordinate | Y coordinate |
|---|---|---|---|
| Delportshoop WTW | Pump Stations | 24,268363 | -28,407220 |
| Kneukel PS | Pump Stations | 24,146900 | -28,304749 |
| Trewill PS | Pump Stations | 23,682225 | -28,308941 |
| Clifton Reservoirs | Reservoir | 23,406096 | -28,336758 |
| Gloucester Reservoir | Reservoir | 23,073013 | -28,107385 |
| Olifantshoek Reservoir | Reservoir | 22,731761 | -27,941647 |

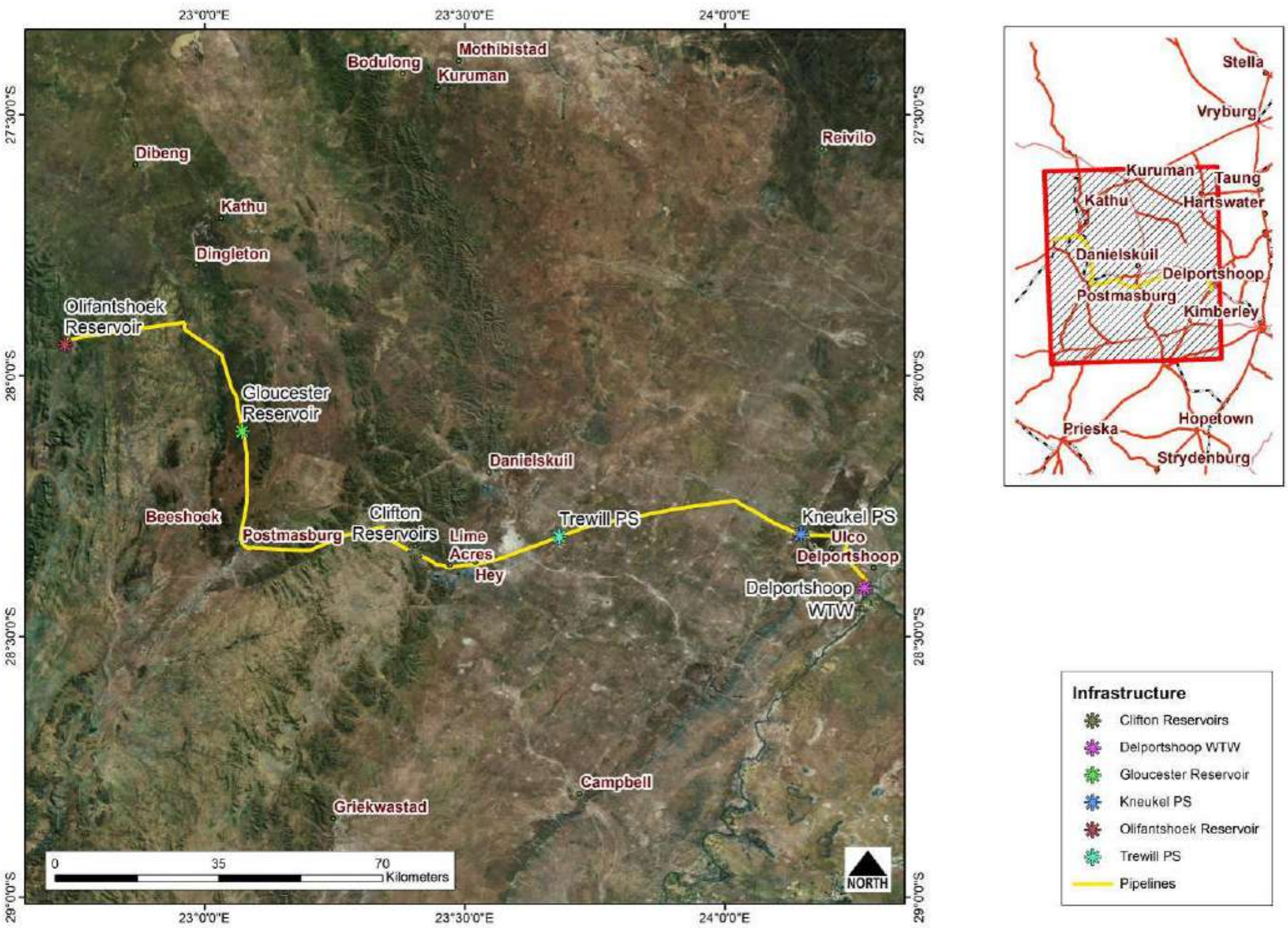



**Figure 6. Pump and storage infrastructure**

# 5 AGRICULTURAL INFRASTRUCTURE

The impact on agriculture has three components;

1) Loss of permanent infrastructure,
2) loss of income in cases where the farming opportunity is lost or reduced in size, and
3) a temporary loss of income during the period of construction because the land cannot be cultivated or used as animal grazing.

Infrastructure mapped is the following:

1) Buildings in proximity of the route;
2) Cattle watering facilities, and
3) Poultry housing.

The farm infrastructure on each route is as follows (refer to Figure 7):

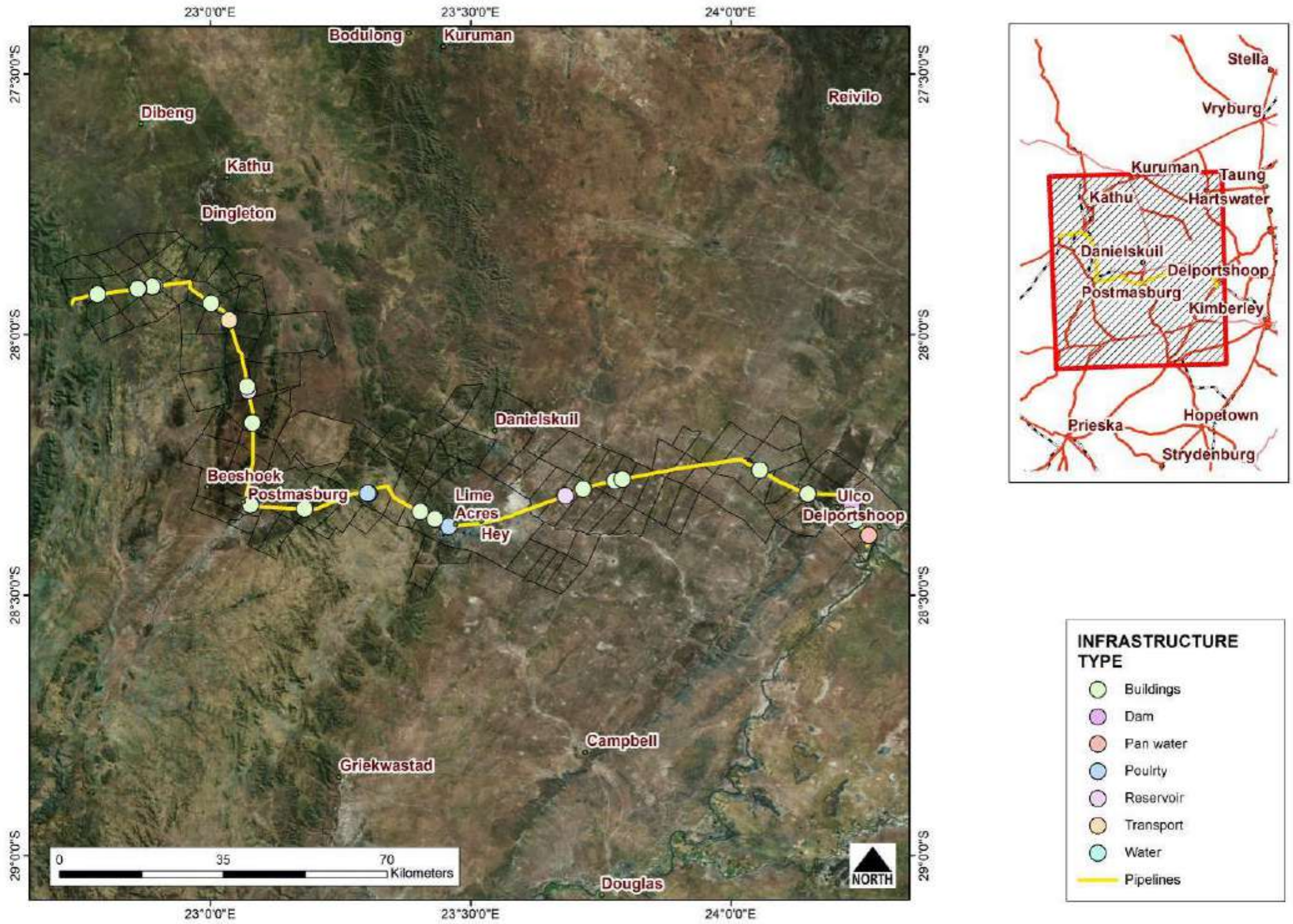



**Figure 7. Farm infrastructure along the pipeline route**

| X Coordinate | Y Coordinate | Type |
|---|---|---|
| -28.353617 | -28.353617 | Buildings |
| -28.339499 | -28.339499 | Buildings |
| -28.334248 | -28.334248 | Buildings |
| -28.326489 | -28.326489 | Buildings |
| -28.169738 | -28.169738 | Buildings |
| -27.939776 | -27.939776 | Buildings |
| -27.907088 | -27.907088 | Buildings |
| -27.908086 | -27.908086 | Buildings |
| -27.911655 | -27.911655 | Buildings |

| X Coordinate | Y Coordinate | Type |
|---|---|---|
| -27.912331 | -27.912331 | Buildings |
| -27.923017 | -27.923017 | Buildings |
| -28.296264 | -28.296264 | Buildings |
| -28.280469 | -28.280469 | Buildings |
| -28.277351 | -28.277351 | Buildings |
| -28.259735 | -28.259735 | Buildings |
| -28.305479 | -28.305479 | Buildings |
| -28.346191 | -28.346191 | Buildings |
| -28.304495 | -28.304495 | Buildings |
| -28.099792 | -28.099792 | Buildings |
| -28.331067 | -28.331067 | Dam (animal watering) |
| -28.385121 | -28.385121 | Pan water (animal watering) |
| -28.368103 | -28.368103 | Poultry |
| -28.304272 | -28.304272 | Poultry |
| -28.107583 | -28.107583 | Reservoir |
| -28.308942 | -28.308942 | Reservoir |
| -27.972882 | -27.972882 | Transport yard |
| -28.35639 | -28.35639 | Animal watering |

# 6 NATURAL RESOURCES

## 6.1 Climate

The site is located in the Northern Cape, which experiences typical summer rainfall. Postmasburg is in the centre of the area and was be taken as representative for evaluation related to agricultural potential.[1]

The long-term average climate data are as follows:

***Temperature***

The average daily maximum of 32,9 $^{O}$C is reached in January while the minimum of 2 $^{O}$C is in July. The high summer temperatures will limit crop selection but is suitable for animals.

***Rainfall***

The average annual rainfall is 241mm per year for most of the study area. That area is arid and not suitable for crop production under dryland conditions.

***Wind***

Average wind speeds are around 8 km/h, but can experience gusts of more than 1km/h or higher. Wind will not affect enterprise choice.

## 6.2 Vegetation

When rainfall is plotted against temperature at a ratio of 1:2 the resulting graph indicates the growing season.

[1] https://www.worldweatheronline.com, 2019, South African Weather Bureau, www.weathersa.co.za, Pretoria.

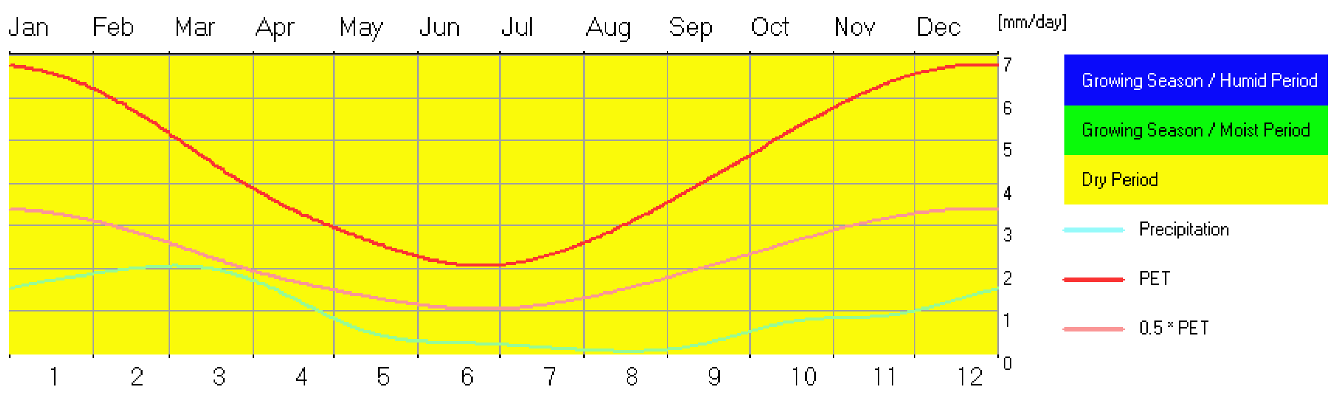



**Figure 8. Climatogram for Postmasburg** [2]

The region is classified as arid; plant growth occurs following rain.

The grazing capacity of natural veld, according to the Department of Agriculture, is estimated at between 13 and 18 hectares per large stock unit (LSU) under natural veld conditions (Department of Agriculture, 2019).

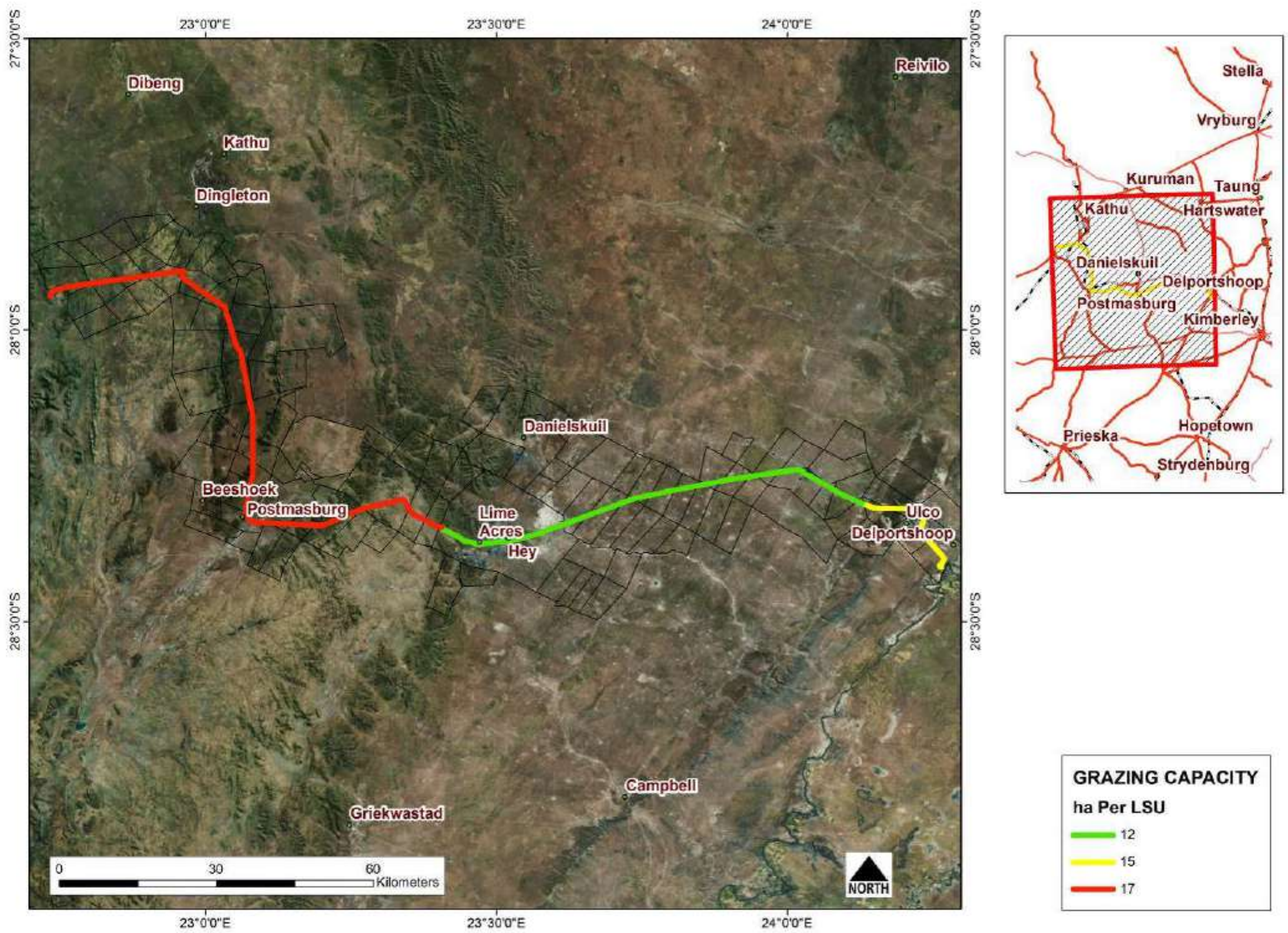



**Figure 9. Grazing capacity of natural veld along the pipeline route**

Game and goats rely on the leaves of trees and shrubs for feed.

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[2] Grieser, 2006.

**Table 4. Animal carrying capacity of the land affected by the pipeline construction**

| Line | Area | Average ha/LSU | Total LSUs |
|---|---|---|---|
| Clifton - Gloucestor | 308,03 | 17,0 | 16,95 |
| Delportshoop - Kneukel | 149,73 | 17,0 | 8,31 |
| Gloucester - Roscoe | 137,53 | 17,0 | 8,09 |
| Kneukel - Trewill | 245,30 | 14,5 | 16,83 |
| Roscoe - Olifantshoek | 126,27 | 17,0 | 6,51 |
| Trewill - Clifton | 231,91 | 12,0 | 10,24 |
| **TOTAL** | **1 198,77** | **14,3** | **66,93** |

The total carrying capacity of the land that will be disturbed by construction is 66 LSUs.

## 6.3 Soil potential

The area is arid with insufficient rainfall for rainfed cropping. The soil potential is, therefore, classified as low.

The agricultural capability of the land is low, as per definition in the land use capability classification used by the Department of Agriculture. Refer to the addenda for details.

# 7 IMPACT ASSESSMENT

## 7.1 Assumptions

### 7.1.1 General

The project entails upgrading existing infrastructure. The impact will, therefore be of a temporary nature and will last for the duration of construction or the time the land takes to recover to its natural state. Pending rainfall patterns, the period for the land to recover is expected to be less than two years.

The fenced area of pumping and storage infrastructure will remain the same and is now not used for farming purposes. There will, therefore be no impact on farming.

### 7.1.2 Land uses

Land uses on which the impact is based are as follows:

#### 7.1.2.1 Pipelines

This is the area within the area reserved for construction.

**Table 5. Land uses within the construction area of the pipelines**

| PIPELINE | Area per land use in the affected area (ha) |
|---|---|
| Grazing | 1 044,41 |
| Irrigated | 1,34 |

#### 7.1.2.2 Pump and storage infrastructure

The pump stations at Delportshoop, Kneukel and Trewill, and reservoirs at Clifton, Gloucester Reservoirs, and sumps at Trewill and Kneukel Sumps will be upgraded without major civil works. The footprint of these will essentially remain unchanged. The present land use is infrastructure and is not used for farming purposes.

There will, therefore be no impact on farming.

### 7.1.3 Land use potential classes [3]

High potential land is defined as follows:

- land best suited to, and capable of consistently producing acceptable levels of goods and services for a wide range of agricultural enterprises in a sustainable manner, taking into consideration expenditure of energy and economic resources; and
- includes:
  - Land Capability Classes i, ii and iii;
  - unique agricultural land;
  - irrigated land; and
  - land suitable for irrigation (deep well-drained soils and assuming irrigation water is available).

## 7.2 Rating criteria

The following rating was used to indicate impacts:

***Extent***

- Local - extend to the site and its immediate surroundings.
- Regional - impact on the region but within the province.
- National - impact on an interprovincial scale.
- International - impact outside of South Africa.

***Magnitude***

Degree to which impact may cause irreplaceable loss of resources.

- Low - natural and social functions and processes are not affected or minimally affected.
- Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

***Duration***

- Short term - 0-5 years.
- Medium term - 5-11 years.
- Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

***Probability***

- Almost certain - the event is expected to occur in most circumstances.
- Likely - the event will probably occur in most circumstances.
- Moderate - the event should occur at some time.

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[3] Refer to the Addenda for detail on the criteria used to decide land use capability

- Unlikely - the event could occur at some time.
- Rare/Remote - the event may occur only in exceptional circumstances.

***Significance***

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

- 0 – Impact will not affect the environment. No mitigation necessary.
- 1 – No impact after mitigation.
- 2 – Residual impact after mitigation.
- 3 – Impact cannot be mitigated.

## 7.3 Impact description

### 7.3.1 Pipelines (From Delportshoop to Olifantshoek)

#### 7.3.1.1 Loss of high potential agricultural land and cultivated land

- Extent: Local
  - Irrigated land is the only land that is considered as high potential.
  - Approximately 1,34 hectares occur in the construction reserve along the pipelines.
- Magnitude: Low
  - No irrigated land will permanently be lost.
- Duration: Short
  - Irrigated land will be lost for duration of construction.
- Probability: Certain
  - The land where the line traverses will be lost for a maximum of one production season.
- Significance on local level: 1 (no impact after mitigation)
  - Not all the land is planted in one season; it is, therefore, possible to plant other land for the period that construction takes place.

<u>Mitigation</u>

1) Replace any irrigation infrastructure that may be damaged or destroyed, or compensate farmers for what is lost.
2) Keep the area that is used by construction vehicles as small as possible, or use the side of the construction buffer that will lead to the least disturbance.
3) It appears from the satellite images that there is an uncultivated strip of 25m between the pipeline and the lands. If construction vehicles can remain in this strip, then no impact is foreseen.
4) The impact is temporary. The construction period is at most for one production season. By planting fallow land on the same property, no income will be lost.

#### 7.3.1.2 Loss of grazing land

The loss of grazing land is temporary and will be for one rain season. The land will remain as grazing after construction.

- Extent: Local
  - The land that will be temporarily lost is approximately 1 044 hectares. This is sufficient for 67 large livestock units.
- Magnitude: Low
  - Natural and social functions will not be affected.
- Duration: Temporary
  - The duration is for one rainy season for the portion of land where the pipeline is constructed.
- Probability: Certain
  - The activity is certain to occur.
- Significance rating on local community: 1 (no impact after mitigation)
  - The land will remain grazing after construction.

<u>Mitigation</u>

1) Compensate farmers for what is lost.
2) Keep the construction period as short as possible.
3) Employ dust-supressing practices to protect adjoining grazing land.

### 7.3.2 Pump and storage infrastructure

The pump stations at Delportshoop, Kneukel and Trewill, and reservoirs at Clifton, Gloucester Reservoir, and sumps at Trewill and Kneukel Sumps will be upgraded without major civil works. The footprint of these but Gloucester Reservoir will remain the same. The present land use is infrastructure and is not used for farming purposes.

There will, therefore be no impact on farming resources.

Gloucester Reservoir's footprint will increase be 0.58 hectares. At a grazing capacity of 17 ha per LSU at the site, the land lost will not have any significance. It will result in the loss of grazing land of 3% of one animal.

### 7.3.3 Loss of farming infrastructure

The loss of farming infrastructure in this assessment is limited to structures that are directly linked to production, i.e., irrigation supply lines, chicken houses and fencing.

Jackal proof fencing is used to protect small stock against and game fences to protect larger animals against predators. Construction along these fences may have to be temporary removed to facilitate the vehicle movement.

There are some buildings within the buffer and even in the construction servitude that will have to be removed. However, no farmhouses are affected.

- Extent: Local
  - Farmers may be impacted for the period that construction takes place on their specific farms.
- Magnitude: Low
  - Natural and social functions will not be affected.
- Duration: Temporary
  - The duration is for the period of construction and the time to replace what is lost.
- Probability: Likely
  - The activity is likely to occur.
- Significance on local level: 1 (no impact after mitigation)

Mitigation

1) Replace buildings or compensate farmers for what is lost.
2) Ensure that the construction buffer is fenced to the same standard as that which is impacted. This is particularly important for the game farmers; fences should be erected before any construction takes place.
3) The impact is temporary. The construction period is for a short period. Discuss the possible restriction of access to farm housing or farming infrastructure like watering facilities, boreholes, etc. with the farmers and come up with solutions.

### 7.3.4 Indirect Impact of development

Access to the farms during the period of construction may be hampered. The effect is inconvenience rather than actual.

Poultry houses are located at 28°18'15.38"S, 23°18'8.93"E. The houses are about 500 metres from the pipeline and on the far side of the R385 road.

Noise can adversely impact on poultry production, even at that distance.

Theft and vandalism usually increase during construction and have to be managed.

- Extent: Local
  - Farmers may be impacted for the period that construction takes place on their specific farms.
- Magnitude: Low
  - Natural and social functions will not be affected.
- Duration: Temporary
  - The duration is for the period of construction.
- Probability: Likely
  - The activity is likely to occur.
- Significance on local level: 1 (no impact after mitigation)

Mitigation

1) The impact is temporary. The construction period is for a short period. Discuss the possible restriction of access to farm housing or farming infrastructure like watering facilities, boreholes, etc. with the farmers and come up with solutions.
2) Coordinate all potential very noisy activities (like blasting) with the farmer to reduce noise where poultry is produced.
3) Compensate farmers for any proven loss in poultry products.
4) Theft and vandalism can be reduced by providing security to farmers where necessary.

### 7.3.5 Biological

Some possible environmental impacts of the development are the following:

- Dust along the main roads that is created by large trucks has an impact on the livestock carrying capacity of adjoining properties.

Mitigation

Keep the construction period as short as possible and employ dust reduction methods.

## 7.4 Summary of impacts

The impacts are as follows:

**Table 6. Impact assessment**

| | Potential impact | Proposed Management Objectives / Mitigation Measures | Extent | Magnitude | Duration | Probability | Significance | Area lost (ha) |
|---|---|---|---|---|---|---|---|---|
| | **1. PIPELINES (UPGRADING OF THE VAAL GAMAGARA REGIONAL WATER SUPPLY SCHEME PHASE 2)** | | | | | | | |
| **1.1** | **Loss of high potential arable land** | | | | | | | |
| | Before mitigation | Temporary loss of irrigated land. | Local | Low | Temporary | Certain | Low | 1,34ha |
| | After mitigation | Keep the area that is used by construction vehicles as small as possible, or use the side of the construction buffer that will lead to the least disturbance. | Local | Low | Temporary | Certain | Remote | 1,34ha |
| **1.2** | **Loss of cultivated land** | | | | | | | |
| | Before mitigation | Temporary loss of irrigated land. | Local | Low | Temporary | Certain | Low | 1,34ha |
| | After mitigation | Keep the area that is used by construction vehicles as small as possible, or use the side of the construction buffer that will lead to the least disturbance. | Local | Low | Temporary | Certain | | 1,34ha |
| **1.3** | **Loss of grazing land** | | | | | | | |
| | Before mitigation | Temporary loss of grazing land | Local | Low | Temporary | Certain | Low | 1 044 ha |
| | After mitigation | Keep the construction period as short as possible. | Local | Low | Temporary | Certain | Low | 1 044 ha |
| **1.4** | **Loss of agricultural production** | | | | | | | |
| | Before mitigation | Temporary loss of irrigated fodder on 1,3ha | Local | Low | Temporary | Certain | Low | <5t of feed |
| | | Loss of grazing land. The loss will be for one production season. | Local | Low | Temporary | Certain | Low | 67 LSU |
| | After mitigation | Loss of irrigated land<br>Keep the area that is used by construction vehicles as small as possible, or use the side of the construction buffer that will lead to the least disturbance. | Local | Low | Temporary | Certain | Remote | Winter feed |
| | | Grazing land<br>Keep the construction period as short as possible.<br>Employ dust-reducing practices to protect adjoining grazing land. | Local | Low | Temporary | Certain | Low | 67 LSU |

| | Potential impact | Proposed Management Objectives / Mitigation Measures | Extent | Magnitude | Duration | Probability | Significance | Area lost (ha) |
|---|---|---|---|---|---|---|---|---|
| | **2. PUMP AND STORAGE INFRASTRUCTURE** | | | | | | | |
| **2.1** | **Loss of high potential arable land** | No impact | | | | | | |
| **2.2** | **Loss of cultivated land** | No impact | | | | | | |
| **2.3** | **Loss of grazing land** | No impact | | | | | | |
| **2.4** | **Loss of agricultural production** | No impact | | | | | | |
| | **3. LOSS OF FARMING INFRASTRUCTURE** | | | | | | | |
| **4.1** | **Loss of high potential arable land** | No impact | | | | | | |
| **4.2** | **Loss of cultivated land** | No impact | | | | | | |
| **4.3** | **Loss of grazing land** | No impact | | | | | | |
| **4.4** | **Loss of agricultural production** | No impact | | | | | | |
| **4.5** | **Loss of agricultural infrastructure** | No impact | | | | | | |
| | **5. INDIRECT IMPACT OF DEVELOPMENT** | | | | | | | |
| **5.1** | **Loss of high potential arable land** | No impact | | | | | | |
| **5.2** | **Loss of cultivated land** | No impact | | | | | | |
| **5.3** | **Loss of grazing land** | No impact | | | | | | |
| **5.4** | **Loss of agricultural production** | | | | | | | |
| | Before mitigation | Loss of poultry production due to noise during construction | Local | Low | Temporarily | Possible | Low | |
| | After mitigation | Coordinate all potential very noisy activities (like blasting) with the farmer to reduce noise where poultry is produced. | Local | Low | Temporarily | Possible | Low | |
| | **6. Biological** | | | | | | | |
| **6.1** | **Loss of high potential arable land** | No impact | | | | | | |
| **6.2** | **Loss of cultivated land** | No impact | | | | | | |
| **6.3** | **Loss of grazing land** | No impact | | | | | | |
| **6.4** | **Loss of agricultural production** | No impact | | | | | | |

# 8 SUMMARY AND CONCLUSIONS

The project area is located in the Northern Cape Province and was completed in 1968 by the then Department of Water Affairs. The existing scheme transfers water from Delportshoop on the Vaal River via Postmasburg to Kathu. From Kathu, a pipeline continues to Hotazel and finally terminates at Black Rock.

The current scheme is operating at capacity and is not able to supply the increasing future water demands.

Provision was made to undertake refurbishment on pipework and repairs to buildings. The affected pipeline is from Delportshoop WTW to Olifantshoek. Replacement of these sections of pipelines will take place within the exiting servitude, and the existing pipelines will be decommissioned.

In general, a distance of 50 metres from the centre line of the pipe is assumed (100 metres width in total); where the line is along a line feature like roads or the railway line, the width is only 50 metres, and will consist of the portion away from the road or rail line.

The pump stations at Delportshoop, Kneukel and Trewill will be upgraded without major civil works. The footprint of the pump stations will remain unchanged, and will, therefore not impact on agriculture.

***Impact***

- The assessment found that there will be no permanent loss of high potential land.
- The significance and magnitude of the loss of grazing land is low and of a temporary nature – it will be for one rainy season.
- Entrances to some farms will be affected and needs to be managed in consultation with the farmers.
- Some farm infrastructure will be lost and has to be replaced.
- Fencing of farms needs to be maintained where construction is taking place. This is to ensure that animals do not escape and/or fall into the trench at the construction site.

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# 10 ADDENDA

## 10.1 Agricultural potential – land use capability

Land capability classes are interpretive groupings of land with similar potential and limitations or similar hazards. Land capability involves consideration of: (i) difficulties in land use owing to physical land characteristics, (ii) the risks of land damage from erosion and other causes; and (iii) climate.

The classic eight-class land capability system (Klingebiel & Montgomery, 1961) was adapted for use with Agriculture Geographic Information System (AGIS) in South Africa.

Land capability is classified according to guidelines published by the National Department of Agriculture in AGIS.

Land Capability is determined by the collective effects of soil, terrain and climate features and shows the most intensive long-term use of land for rain-fed agriculture. At the same time, it indicates the permanent limitations associated with the different land-use classes (refer to Table 7).

- Order A: Arable land – high potential land with few limitations (Classes i and ii)
- Order B: Arable land – moderate to severe limitations (Classes iii and iv)
- Order C: Grazing and forestry land (Classes v, vi and vii)
- Order D: Land not suitable for agriculture (Class viii)

**Table 7. Land capability classes – intensity of land uses**

| LAND CAPABILITY | | | Wildlife | Grazing and Forestry | | | Crop production | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order | | Class | | Forestry | Veld | Pastures | Limited | Moderate | Intensive | Very |
| Arable | A | i | | | | | | | | |
| | | ii | | | | | | | | |
| | B | iii | | | | | | | | |
| | | iv | | | | | | | | |
| Non arable | C | v | | | | | | | | |
| | | vi | | | | | | | | |
| | | vii | | | | | | | | |
| | D | viii | | | | | | | | |

*Note: the shaded area indicate the suitable land use*

## 10.2 Capability classification

Guidelines published on the AGIS website of the NDA was used to determine the capability of soils and their agricultural potential. These guidelines are discussed below.

Soil properties will determine the soil capability for different intensity of use. This is combined with terrain factors and climate to determine the land use capability.

The matrix of qualifications is indicated below:

**Table 8.Terrain and soil classes constituting soil capability classes i to viii**

| Soil Capability class | Terrain | | Soil factors | | | | |
|---|---|---|---|---|---|---|---|
| | Flooding Hazard | Erosion hazard | Soil depth | Soil texture | Internal drainage | Mechanical limitations | Acidity |
| **i** | F1, F2 | E1; E5 | D1 | T1 | W2, W3 | MB0 | P1 |
| **ii** | F1-F3 | E1,E2; E5 | D1,D2 | T1,T2 | W2, W3 | MB0 | P2 |
| **iii** | F1-F4 | E1-E3; E5 | D1-D3 | T1-T3 | W1-W4 | MB0-MB1 | P2 |
| **iv** | F1-F4 | E1-E4; E5 | D1-D4 | T1-T3 | W1-W4 | MB0-MB1 | P2 |
| **v** | F1-F5 | E1-E5 | D1-D4 | T1-T3 | W1-W5 | MB0-MB1 | P2 |
| **vi** | F1-F5 | E1-E6 | D1-D4 | T1-T3 | W1-W5 | MB0-MB3 | P2 |
| **vii** | F1-F5 | E1-E7 | D4-D5 | T1-T3 | W1-W5 | MB2-MB4 | P2 |
| **viii** | F1-F5 | E1-E8 | D4-D5 | T1-T3 | W1-W5 | MB2-MB4 | P2 |

The criteria to determine the soil capability for each soil factor are as follows (see figure 9 for details):

- Soil depth, texture, internal drainage is based on soil types; and mechanical limitations.

### 10.2.1 Terrain factors

***Flooding hazard***

The stream is classified as channelled valley according to the HGM system employed by the Department of Water Affairs.

The rating for flood hazard is indicated below:

**Table 9. Criteria for flooding hazard**

| Class | Frequency | Duration | Class description |
|---|---|---|---|
| F1 | None | None | No reasonable possibility of flooding (near 0% chance of flooding in any year). |
| F2 | Rare | Very brief | Flooding unlikely but possible under unusual weather conditions (from near 0 to 5% chance of flooding in any year, or near 0 to 5 times in 100 years). Flooding will last less than 2 days. |
| F3 | Occasional | Brief | Flooding is expected infrequently under usual weather conditions (5 to 50 times in 100 years). Area flooded for a period of 2 to 7 days. |
| F4 | Frequent | Long | Flooding is likely to occur often under usual weather conditions (more than a 50% chance of flooding in any year or more than 50 times in 100 years). Flooding commonly lasts from 7 days to 1 month. |
| F5 | Common | Very long | Flooding is a regular feature under usual weather conditions and may last a very long time. Examples are wetlands and active streambeds of rivers. |

### 10.2.2 Climatic factors

The parameters used are length of growing season, temperature and hazards related to hail and frost. Climate conditions will not affect the land use capability.

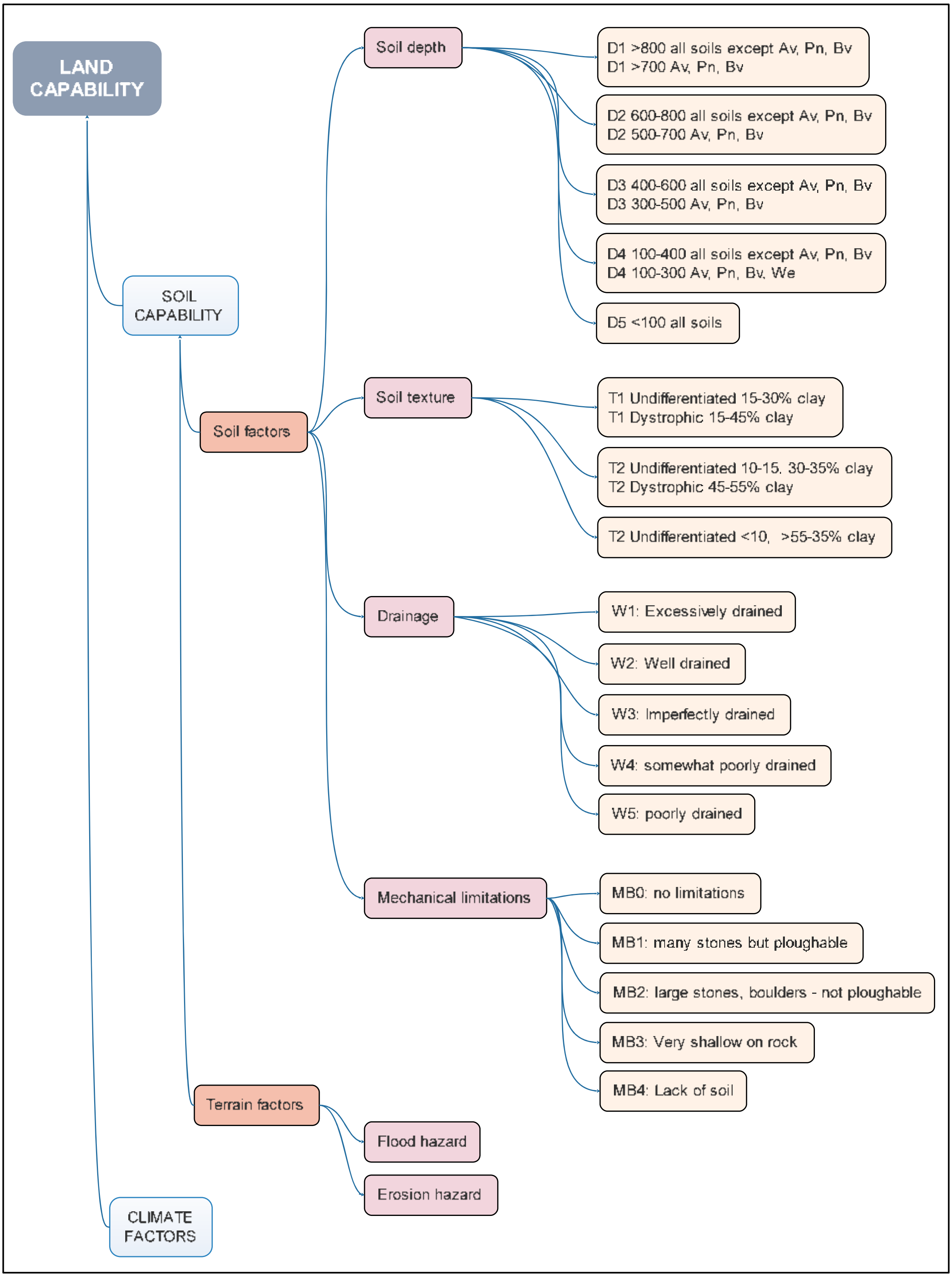


**Figure 10. Flow diagram to determine land capability**

# APPENDIX H2

WETLAND AQUATIC IMPACT ASSESSMENT

# Wetland and Aquatic Assessment for the proposed Phase 2 Upgrade of the Vaal Gamagara Regional Water Supply Scheme Pipeline

# Northern Cape Province, South Africa

May 2019

**CLIENT**


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| | | |
|---|---|---|
| **Report Name** | **Wetland and Aquatic Assessment for the proposed Phase 2 Upgrade of the Vaal Gamagara Regional Water Supply Scheme Pipeline, Northern Cape Province, South Africa** | |
| **Submitted to** | **Nemai Consulting** | |
| **Survey/Report (Wetlands)** | **Tyron Clark MSc (in progress, Zoology)** | |
| **Survey/Report (Aquatics)** | **Michael Ryan BSc Hons (Earth Sciences)** | MRyan |
| **Review** | **Andrew Husted, MSc Aquatic Health (Pr. Sci. Nat. 400213/11)** | |

*Perennial spring along the Steenbok FEPA*

## Executive Summary

The arid nature of the wetlands within the study area and their position within one of South Africa's largest karstic regions 'presented challenges for their delineation and classification. Nevertheless, the systems encountered within the study area presented sufficient terrain, soil and vegetation indictors to be mapped and classified following the national classification system (Ollis *et al*. 2013). These comprised six hydrogeomorphic (HGM) types classified to Level 5 to distinguish them in terms of saturation levels (a highly important distinction in such arid settings). These included intermittent and seasonal channelled valley bottoms, intermittent and seasonal unchanneled valley bottoms and intermittent exorheic and endorheic depressions. Based on these HGM types, a total of 61 individual HGM units were identified within the study area. To facilitate practical assessment and meaningful interpretation these systems were grouped into 12 wetland groups which involved grouping HGM units by the main systems with which they were associated. These systems were rated in terms of their respective PES, EIS and ecosystem services. The overall ratings for these assessments is provided below in Table 1. In summary Wetland Groups 3, 4, 9, 11 and 12 are the most intact and are in a largely natural state while Wetland Groups 4, 5, 6, 10, 11 and 12 are considered to be the most ecologically important and sensitive while at the same time providing the most important ecosystem services.

*Table 1: Summary of the PES, EIS and ecosystem services for the 12 wetland groups*

| Wetland Group | PES | EIS | Ecoservice |
|---|---|---|---|
| 1 | C: Moderately Modified | Moderate | Intermediate |
| 2 | C: Moderately Modified | High | Intermediate |
| 3 | B: Largely Natural | Moderate | Intermediate |
| 4 | B: Largely Natural | Very High | High |
| 5 | C: Moderately Modified | High | Moderately High |
| 6 | C: Moderately Modified | High | Moderately High |
| 7 | C: Moderately Modified | Moderate | Intermediate |
| 8 | C: Moderately Modified | Moderate | Intermediate |
| 9 | B: Largely Natural | Moderate | Intermediate |
| 10 | C: Moderately Modified | High | Intermediate |
| 11 | B: Largely Natural | Very High | Moderately High |
| 12 | B: Largely Natural | High | Intermediate |

Although most of the risks associated with the pipeline upgrade were considered low, certain activities and their impacts (mainly associated with site clearing and trench excavation) are likely to take place within the delineated boundary of some wetlands (prompting the mandatory assignment of a severity rating of 5) and thus a moderate post mitigation risk. However, the impacts associated with this critical service development are unlikely to negatively impact wetland systems to any appreciable level, provided that the suggested mitigations measures are effectively implemented, and it is the opinion of The Biodiversity Company that a the project be considered for general authorisation in terms with regards to water use licencing. Aquatic habitat is limited on site and the risks posed to aquatic ecosystems considered low.

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## Figures



## Tables

## Declaration

I, **Tyron Clark** declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

**Tyron Clark**

**Wetland and Terrestrial Ecologist**

The Biodiversity Company

29th of May 2019

# 1 Introduction

The existing VGRWSS infrastructure was installed in 1968 (by the Department of Water Affairs) its primary role being to transports water from the Delportshoop Water Treatment Works located on the Vaal River to Kathu and ultimately Hotazhel. The scheme comprises of a water treatment works (WTW) that can treat 13.27 million $m^3/a$ water, pumps, 11 reservoirs and 370km of pipes that deliver clean water. The pipeline has the capacity to convey approximately 15 million $m^3/a$ into the D41J and D41K catchments. However, the pipeline is currently running at capacity and needs to be upgraded to meet the rapidly growing water demands of the region.

The Biodiversity Company was appointed by Nemai Consulting to conduct a wetland and aquatic (habitat depending) baseline and impact (risk) assessment as part of this Phase 2 VGRWSS upgrade project situated in the Northern Cape Province, South Africa. The study area is presented in Figure 1. The proposed VGRWSS project includes two components for which separate applications will be submitted to the DEA. The one is concerned with the upgrading of the existing Vaal Gamagara Regional Water Supply Scheme Phase 2; while the other is concerned with groundwater abstraction from the SD1 and SD2 well fields. This report is concerned with the VGRWSS Phase 2 pipeline upgrade project which would involve the installation of a pipeline (max diameter of 762 mm) from Delportshoop WTW in the east to Olifantshoek in the north-west via the towns of Ulco, Lime Acres and Postmasburg (hereafter referred to as the proposed pipeline route).

This assessment was conducted in accordance with the 2014 EIA Regulations (No. R. 982-985, Department of Environmental Affairs, 4 December 2014) emanating from Chapter 5 of the National Environmental Management Act (Act No. 107 of 1998). The findings and information herein is in terms of Appendix 6 of the 2014 NEMA EIA Regulations (amended in 2017).

Fieldwork was conducted between the $15^{th}$ and $18^{th}$ of April 2019. Due to the scale of the project in-field delineation was restricted to a 50 m corridor on either side of the proposed pipeline route. Aquatic habitat was limited, nevertheless opportunistic sampling was conducted in a non-flowing reach (large pool) of the Groenwaterspruit. Additionally, the field investigations took cognisance of sensitive biotic receptors within the study area and included them within the section on wetland ecological importance and sensitivity. Risks / impacts to these wetland dependant species and the functioning of the wetlands themselves are assessed in light of the groundwater reports conducted by Golder Associates (2014) towards the end of this report.

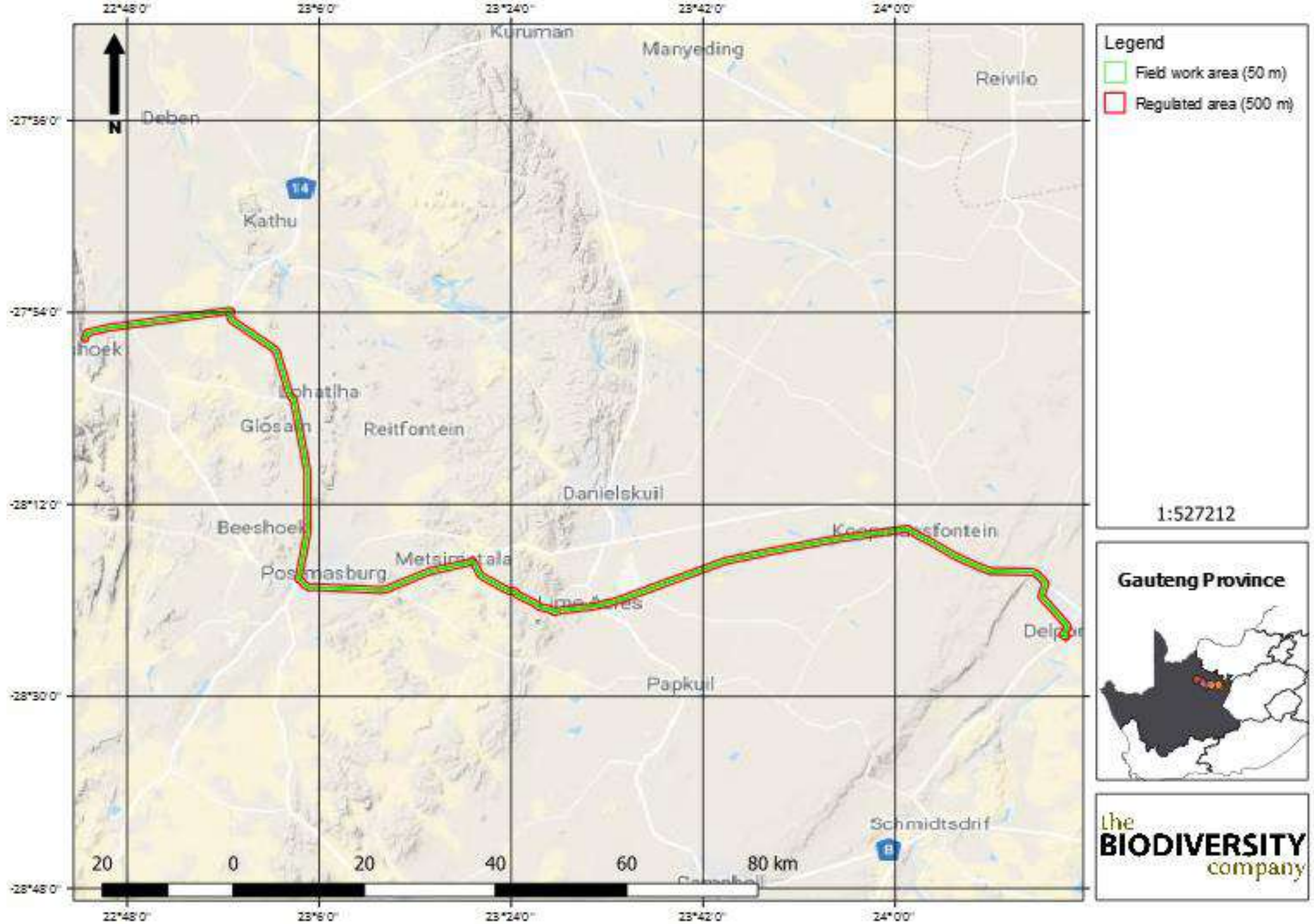



*Figure 1: Locality map*

## 2 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this study:

- The delineation and assessment of water resources within the study area;
- An ecological integrity (health) assessment of water resources;
- An ecosystem services assessment of water resources;
- Assessment of risks associated with the proposed activities; and
- Prescription of mitigation for the associated impacts.

## 3 Receiving Environment

### 3.1 Prevailing Land Uses

The prevailing land uses within the study area centre on livestock grazing (predominantly sheep but also cattle) and game farming. The vast majority of the landscape is in a natural to pristine state although some mining (predominantly limestone, diamonds, ferrous metals). Other land uses within the study area includes agricultural properties and cultivated fields; various secondary farm roads and minor tar roads; power lines – especially Eskom powerlines transecting multiple farm portions; telephone lines; and agricultural homesteads. Figure 2 provides examples of the dominant land uses.

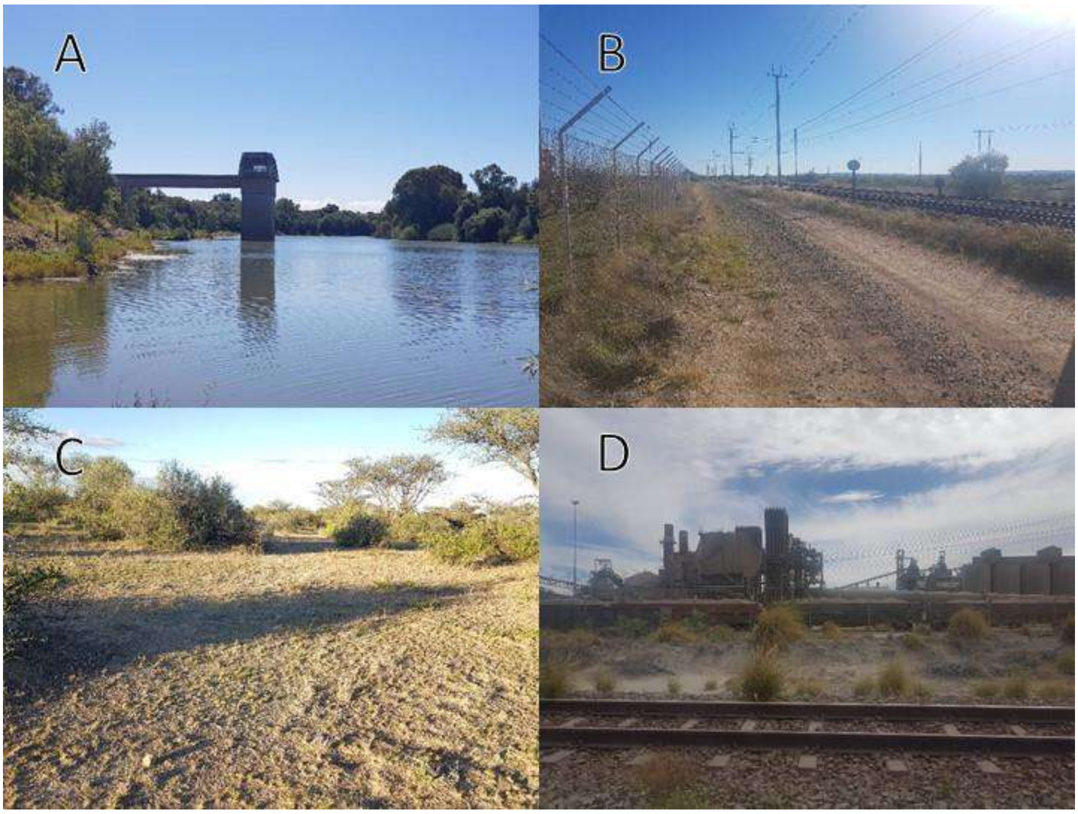



*Figure 2: Dominant land uses within the study area; A) water works infrastructure, B) roads, railway lines and pump stations, C) natural land used for livestock grazing and D) limestone and diamond mining*

## 3.2 Northern Cape Conservation Plan

The Northern Cape Conservation Plan uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- Critical Biodiversity Area – 1 (CBA 1: Irreplaceable);
- Critical Biodiversity Area – 2 (CBA 2: Optimal);
- Ecological Support Area (ESA);
- Other Natural Area (ONA);
- Protected Area (PA); and

**CBAs** are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (BGIS, 2017).

CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species.

**ESAs** are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).

**ONAs** consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI-BGIS, 2017).

The study area traverses a wide variety of conservation important features including both CBA 1 and 2 areas, ESAs and ONAs but does not traverse any statutorily protected areas. The Steenbok, Klein Riet and Groenwaterspruit Phase 1 NFEPA rivers are classified as CBA 1 areas. So too the numerous FEPA listed wetlands (E.G. Great Pan).

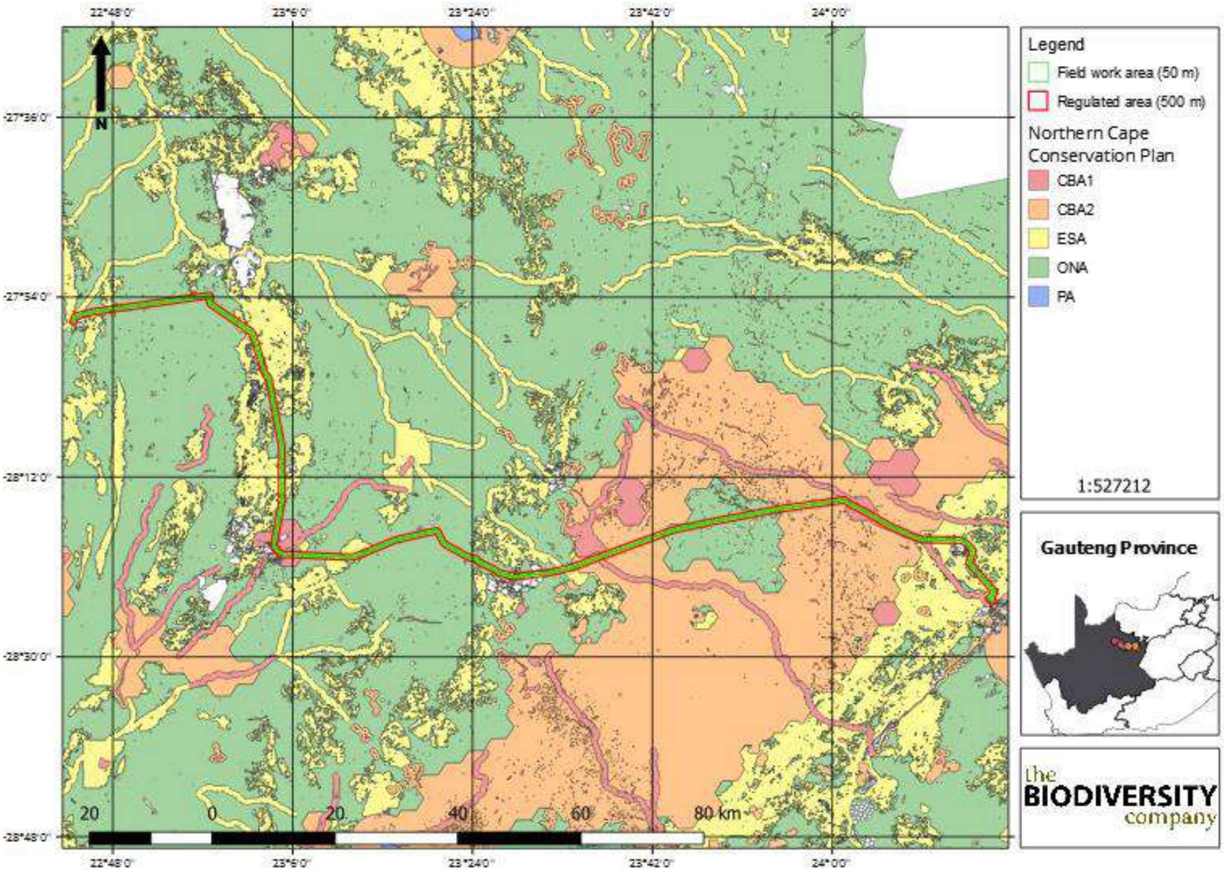



*Figure 3: Northern Cape Conservation Plan*

## 3.3 National Freshwater Ecosystem Priority Areas

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

### 3.3.1 NFEPA Rivers

Figure 4 shows the location of the study area in relation to River FEPAs. Based on this information, the study area traverses three Phase 1 FEPAs Rivers namely the Steenbok (crosses the proposed pipeline route near Delportshoop), the Klein Riet (near Lime Acres) and the Groenwaterspruit (near Postmasburg). Additionally, three Phase 4 FEPAs cross the pipeline route namely the Klein Riet (western tributary), the un-named tributary (near Lime Acres) of the Ga-Mogara (near Kathu) and the Olifantloop (near Olifantshoek).

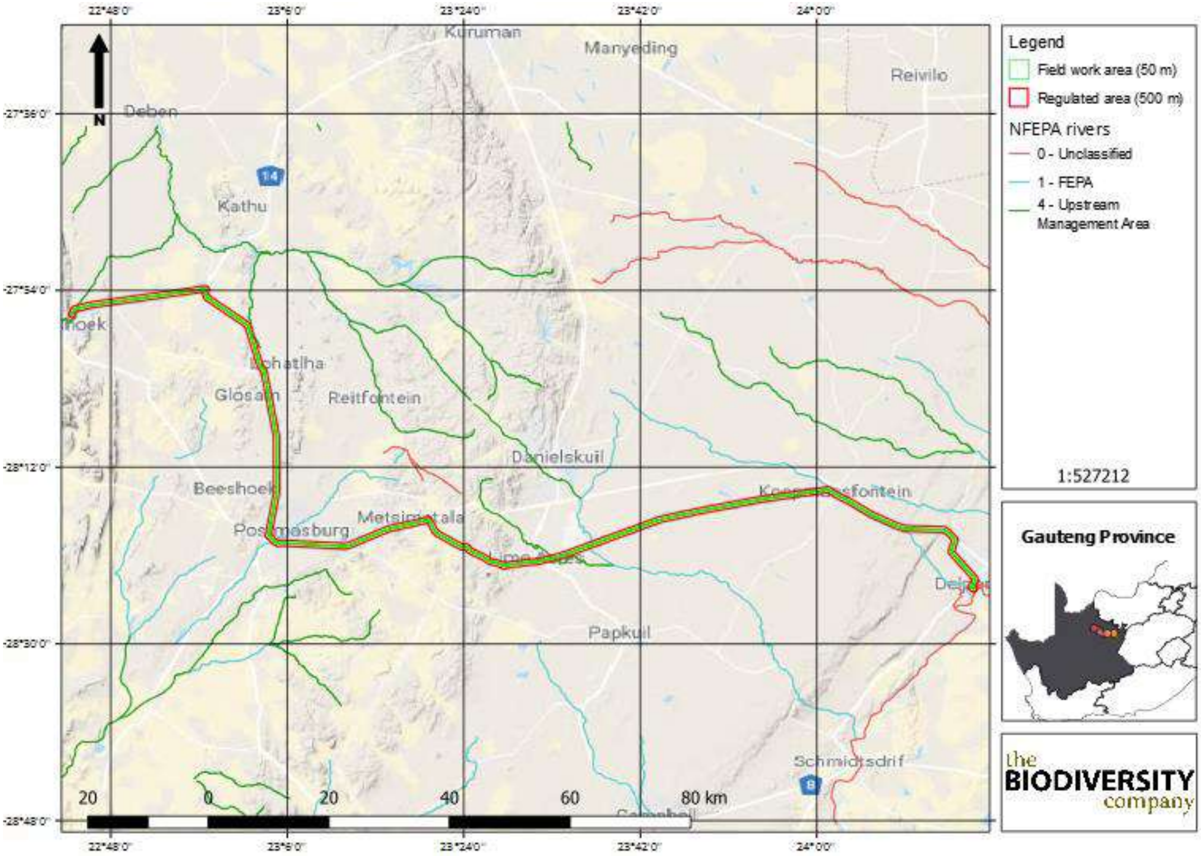



*Figure 4: NFEPA Rivers within and surrounding the study area*

### 3.3.2 NFEPA Wetlands

Figure 5 shows the location of the study area in relation to wetland FEPAs. It is evident from this map the study area traverses a multitude of FEPA listed wetlands. The vast majority of these systems occur in the east of the study area between Lime Acres and Delportshoop in a very flat pan-veld type habitat. The majority are pans the most notable of which being Great Pan, although some do include linear systems (e.g. the Steenbok, Klein Riet).

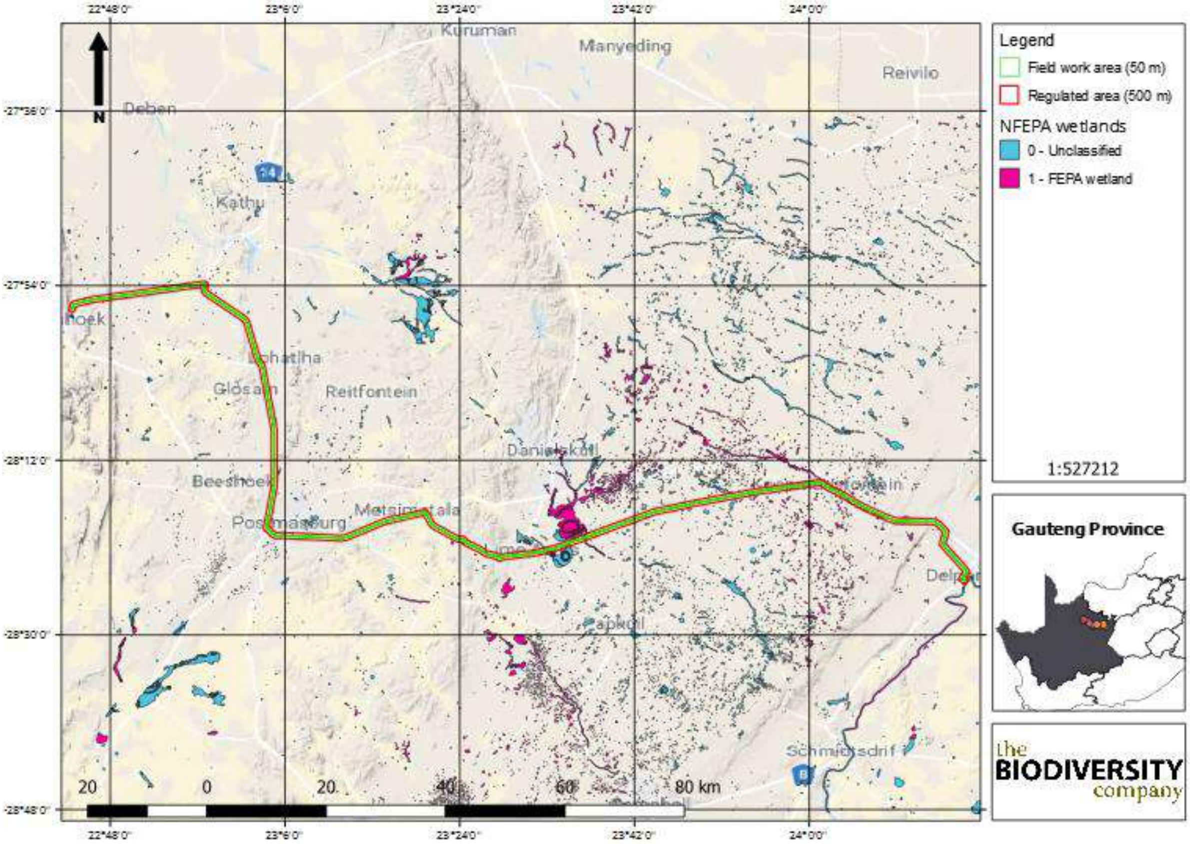



*Figure 5: NFEPA Wetlands within and surrounding the study area*

## 3.4 Important Bird & Biodiversity Areas

No Important Bird and Biodiversity Areas (IBAs) are situated within the study area (Figure 6). The nearest IBAs are Spitskom Dam (SA028, 37 km NE), Dronfield (SA031, 54km SE), Kamfersdam (55 km SE) and Benfontein (68 km SE). Of these the Benfontein IBA contains habitats that are most similarly represented within the study area and as such the compliment of rare, conservation important and biome restricted species found here are also likely to occur at some of the large systems within study area such as Great Pan. Trigger species within this IBA include the (1) globally threatened White-backed Vulture, Blue Crane, Lesser Flamingo, Blue Korhaan, Secretarybird and Ludwig's Bustard, the (2) regionally threatened Tawny Eagle and Greater Flamingo and the (3) biome-restricted birds are Sociable Weaver, Kalahari Scrub Robin, White-bellied Sunbird and Burchell's Sandgrouse.

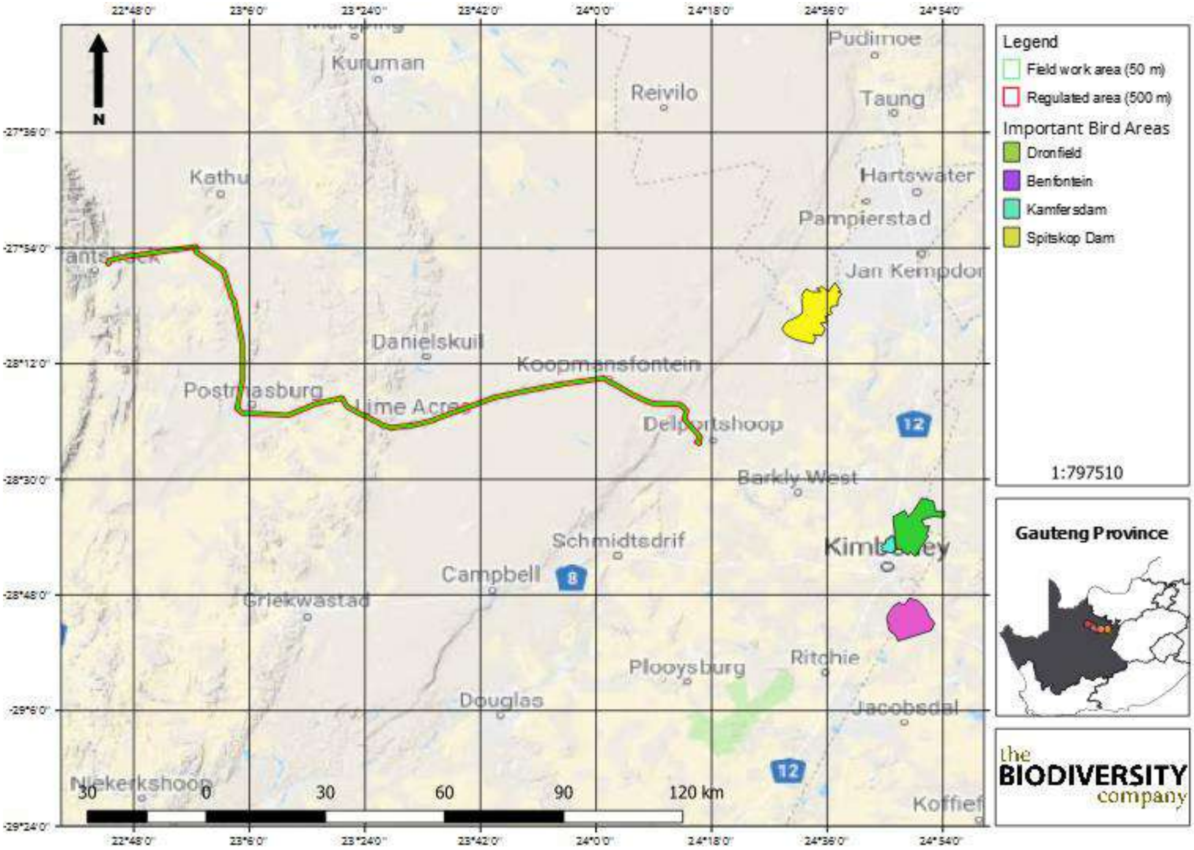



*Figure 6: Important bird and biodiversity areas in the vicinity of the study area*

# 4 Key Legislative Requirements

## 4.1 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource;
- The rehabilitation of the water resource;

A watercourse means;

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

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

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

### 4.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in December 2014, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

## 5 Methodology

### 5.1 Wetland Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 7. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is one of the primary indicators. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

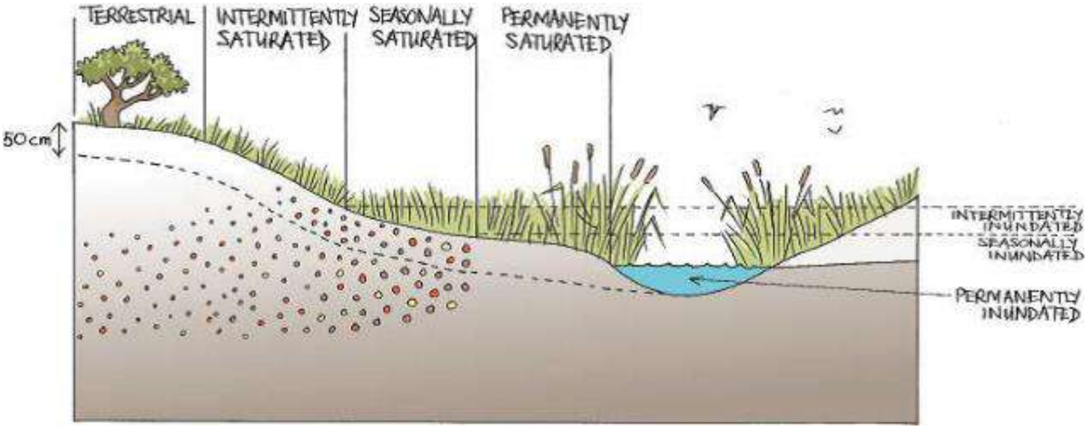



*Figure 7: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)*

## 5.2 Wetland Delineation

The wetland indicators described in "5.1" were used to determine the boundaries of the wetlands within the study area. These delineations are then illustrated by means of maps accompanied by descriptions.

## 5.3 Wetland Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serve as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2).

*Table 2: Classes for determining the likely extent to which a benefit is being supplied*

| Score | Rating of likely extent to which a benefit is being supplied |
|---|---|
| < 0.5 | Low |
| 0.6 - 1.2 | Moderately Low |
| 1.3 - 2.0 | Intermediate |
| 2.1 - 3.0 | Moderately High |
| > 3.0 | High |

## 5.4 Determining the Present Ecological Status (PES) of wetlands

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 3.

*Table 3: The Present Ecological Status categories (Macfarlane, et al., 2009)*

| Impact Category | Description | Impact Score Range | PES |
|---|---|---|---|
| **None** | **Unmodified, natural** | **0 to 0.9** | **A** |
| **Small** | **Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. | **1.0 to 1.9** | **B** |
| **Moderate** | **Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact. | **2.0 to 3.9** | **C** |
| **Large** | **Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred. | **4.0 to 5.9** | **D** |
| **Serious** | **Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable. | **6.0 to 7.9** | **E** |
| **Critical** | **Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota. | **8.0 to 10** | **F** |

## 5.5 Determining the Ecological Importance and Sensitivity of Wetlands

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 4, (Rountree *et al*., 2012).

*Table 4: Description of Ecological Importance and Sensitivity categories*

| EIS Category | Range of Mean | Recommended Ecological Management Class |
|---|---|---|
| **Very High** | 3.1 to 4.0 | **A** |
| **High** | 2.1 to 3.0 | **B** |
| **Moderate** | 1.1 to 2.0 | **C** |
| **Low Marginal** | < 1.0 | **D** |

## 5.6 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.* 2013).

## 5.7 Aquatic Ecosystems Scan

Standard River Ecosystem Monitoring Programme (REMP) methodologies were applied at each of the sampling points (Table 5). This included water quality analysis, habitat, macroinvertebrate and fish community assessments.

*Table 5: Methods used in this study*

| Method | Reference |
|---|---|
| South African Scoring System version 5 | Dickens and Graham (2002) |
| Biotope Ratings | Tate and Husted (2015) |
| Macroinvertebrate Response Assessment Index | Thirion (2007) |

## 5.8 Determining Buffer Requirements

The “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries” (Macfarlane *et al.* 2014) was used to determine the appropriate buffer zone for the proposed activity.

## 5.9 Limitations

The following aspects were considered as limitations:

- The use of two of the main wetland indicators namely hydromorphic soils and hydrophytic vegetation was somewhat limited and classification of the systems was challenging due to their unique characteristics (see results section for more detail).
- Due to the very large scale of the study area in field delineations were restricted to within a 50 m corridor on either side of the proposed pipeline route. As such the delineations end abruptly outside this corridor. Wetlands within the 500 m regulated area were considered but not explicitly mapped or assessed, wetland delineations within these areas should be considered desktop.
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.

# 6 Results and Discussion

The study area is situated within the Vaal Water Management area. The proposed pipeline upgrade route traversers seven quaternary catchments. From east to west these include C91E, C33, C92A, C92C, D71B, D73A and D41J. Surface water drainage largely mirrors groundwater flow directions (Golder, 2014) driven primarily be the prevailing terrain aspect. The flow accumulation model (Figure 9) generated from digital elevation data reveals the extent of the drainage network covering the study area as well as the stream order. From this data it is apparent that drainage from the area occurs in three main directions namely south-east towards the Vaal River (some via the Harts) for systems between Delportshoop and Lime Acres, south-west towards the Orange River for systems between Lime Acres and Postmasburg and north-west towards the Ga-Mogara (and ultimately to the Orange via the Kuruman and Molopo rivers) for systems between Delportshoop and Olifantshoek.

The ephemeral wetlands within the study area provide critical ecosystem services and generally support higher plant productivity and wildlife densities. In addition to providing the usual wetland services (moving water, nutrients, and sediment throughout the watershed as well as attenuating floodpeaks) these systems provide an important source of moisture in an otherwise arid landscape, supporting a higher floristic diversity while at the same time providing hydration, cover and foraging habitat to a wide range of often rare, unique or conservation important biota adapted to their erratic inundation (Levick *et al*. 2008). Research on wetlands in 'South Africa's arid regions is limited, hampering our understanding of their importance.

*Figure 8: Wetland vegetation in Wetland Group 4 (Steenbok unchanneled valley bottom)*

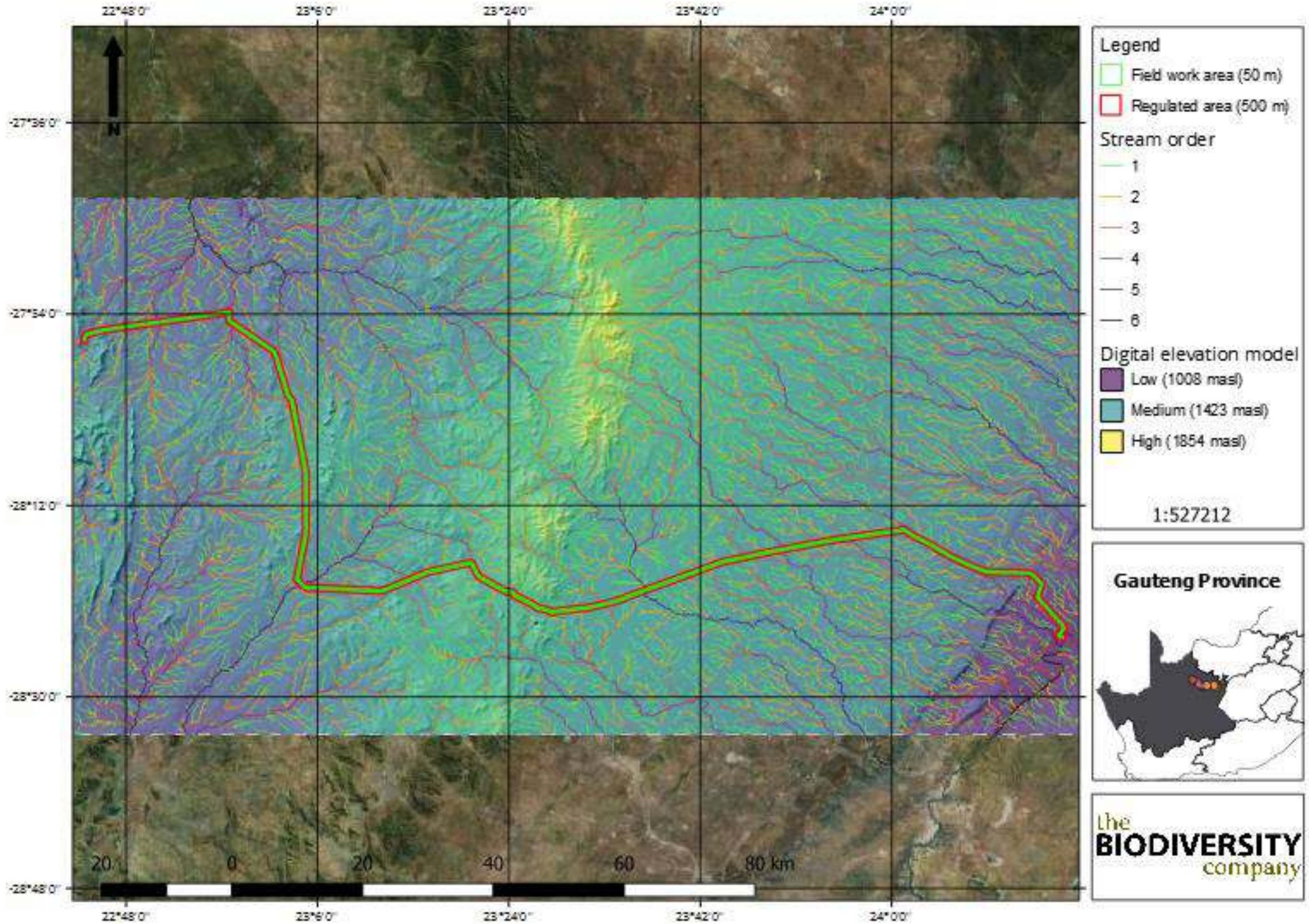



*Figure 9: Digital elevation model showing drainage network and stream order*

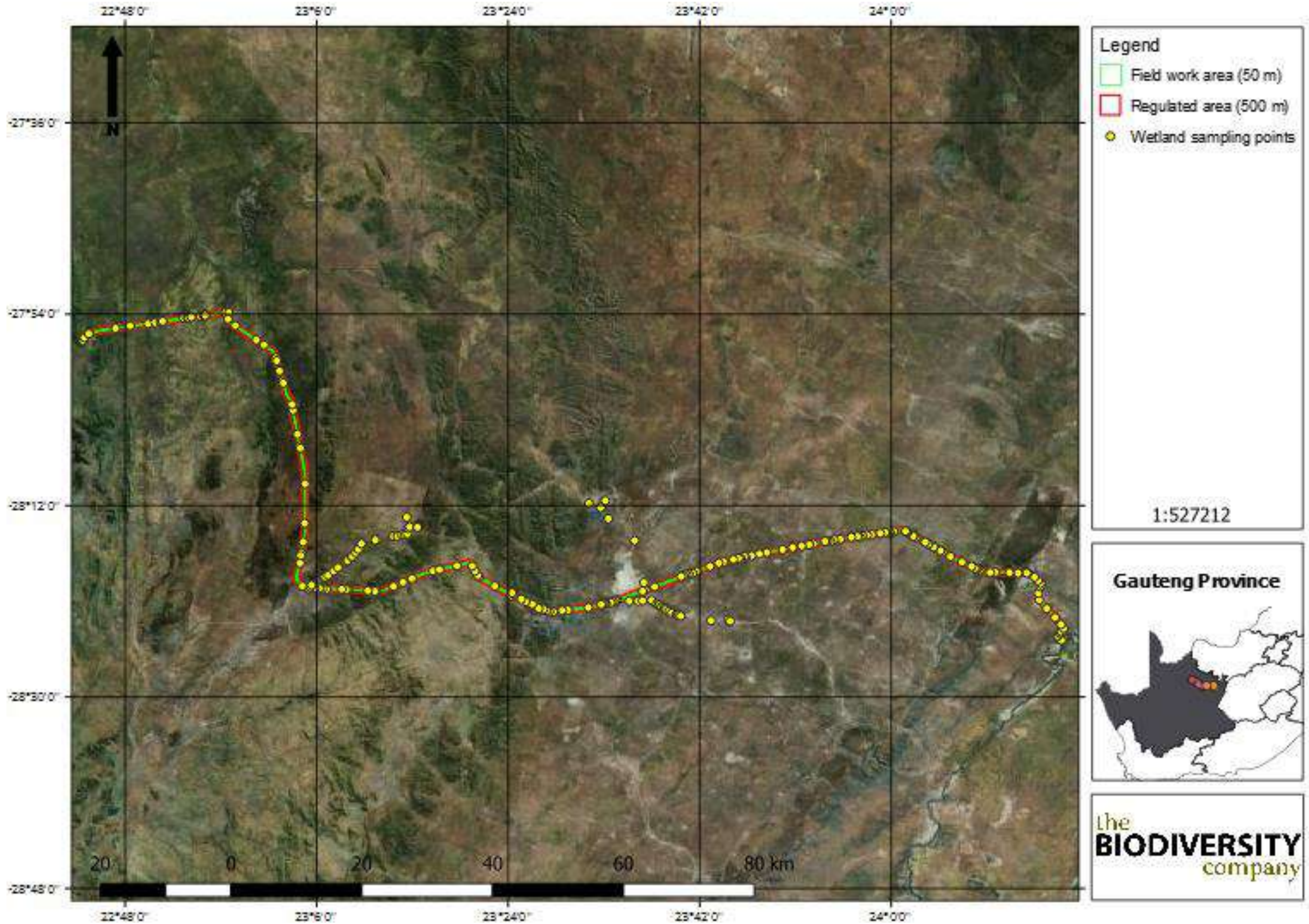



*Figure 10: Wetland sampling points*

## 6.1 Wetland Classification

In spite of their recognised importance research on ephemeral and intermitted wetlands is limited, hampering the understanding of their functionality (Tooth, 2015) and presenting challenges regarding their classification (this prompted the theme of the last wetland indaba; *Wetlands in Drylands* hosted in Kimberly).

Arid land wetlands do not always display the stereotypical compliment of terrain, hydrophytic vegetation and hydromorphic soil indictors (particularly in dolomitic areas such as this) typically associated with wetlands as defined by the DWAF (2005) wetland delimitation guidelines. Furthermore, it is important to note that the study area is situated within the country's largest, contiguous deposit of carboniferous rock, adding to the complexity and uniqueness of the systems within study area. Wetlands in Karstic landscapes such as this are not only renowned for facilitating strong ground to surface water interaction, by means of karstic springs but also for their general lack of redoximorphic soil features (mottles). The use of mottles as a reliable wetland indicator on dolomitic ground (even in areas of high soil moisture) is limited due to the high manganese content of the soil which leads to a high oxidative and electron demand capacity which, in turn, serves to inhibit the reduction of iron to its more mobile ferrous ($Fe2+$) state and consequently mottle formation (Mudaly, 2015). Furthermore, the use of vegetation indicators was limited due to the semi-arid conditions, overgrazing and ephemeral nature of the wetlands within the study area. As a result, wetland boundaries had to be delineated using primarily terrain (contour data), alluvial deposits and vegetation indicators (using a combination of species composition and change in vegetation structure).

For these reasons many of the systems encountered on site did not fit neatly into the currently recognised hydrogeomorphic (HGM) types, nevertheless, an attempt was made to classify these systems following Ollis *et al*. 2013.

Broadly these HGM types included channelled and unchanneled valley bottoms as well as both endorheic (inward draining) and exhoreic (outward draining) depressions. The valley bottom systems showed considerable variation in their degree of saturation and as such were further divided in this regard (level 5 classification). At level 5, all the wetland systems were first classified as intermittently inundated and a further distinction made with regards to the valley bottom systems by distinguishing between (1) permanently to seasonally saturated and (2) intermittently saturated systems. The level 5 classification was done to highlight their greatly differing ecological importance and sensitivity between the permanent/seasonal and intermittent wetlands in this arid landscape. The depressions (both endorheic and exorheic) are all intermittently inundated and as such no distinction was made between them in this regard. All other systems for which inundation was classed as rare / never were classified as drainage lines and excluded from the assessment. Guidelines, research and legislation are lacking on these systems and as such they do not currently conform clearly to the definitions of a watercourse, as defined by the NWA (See Section 4.1.). As such their protection status as defined in the National Water Act, Act 36 of 1998 is unclear.

Using this classification method, a total 61 individual HGM units were identified along the proposed pipeline route (17 valley bottom systems and 44 depressions). These HGM units were numbered from east to west and coded according to their HGM type. To facilitate the practical assessment of these systems a decision they were divided into wetland groups. All linear systems (excluding depressions) were grouped according to the main watercourse into which they drain namely the Harts, Vaal, Steenbok, Klein Riet, Groenwaterspruit and Ga-Mogara. Results of the level 1-5 wetland classification for the wetland systems within the study area is presented in (Table 6).

*Table 6: Wetland classification as per SANBI guideline (Ollis et al. 2013)*

| Wetland Group | HGM Units | Level 2 | | Level 3 | Level 4 | | |
|---|---|---|---|---|---|---|---|
| | | Eco-region | NFEPA Wet Veg Group | Landscape Unit | 4A | 4B | 4C |
| **Harts** | | | | | | | |
| 1 | UVBI 1 | 30 | EKBG 3 | Valley floor | UVB | NA | NA |
| **Vaal** | | | | | | | |
| 2 | **CVBS 1** | **30** | EKBG 3 | Valley floor | CVB | NA | NA |
| 3 | CVBI 1-3 | 30 | EKBG 3 | Valley floor | CVB | NA | NA |
| **Steenbok** | | | | | | | |
| 4 | **UVBS 1** | **30** | EKBG 5 | Valley floor | UVB | NA | NA |
| **Klein Riet** | | | | | | | |
| 5 | **UVBS 2-4** | **30** | EKBG 5 | Valley floor | UVB | NA | NA |
| **Groenwaterspruit** | | | | | | | |
| 6 | **CVBS 2** | **29** | EKBG 3 | Valley floor | CBS | NA | NA |
| 7 | CVBI 4-5 | 29 | EKBG 3 | Valley floor | CVB | NA | NA |
| 8 | UVBI 2-4 | 29 | EKBG 3 | Valley floor | UVB | NA | NA |
| **Ga-Magora Tributary** | | | | | | | |
| 9 | CVBI 6 | 29 | EKBG 3 | Valley floor | CVB | NA | NA |
| **Olifantsloop** | | | | | | | |
| 10 | CVBI 7 | 29 | EKBG 3 | Valley floor | CVB | NA | NA |
| **Throughout the study area** | | | | | | | |
| 11 | EXD 1-10 | 29 | EKBG 3 | Plain | D | Exhoreic | WOCO |
| 12 | END 1-34 | 29 | EKBG 3 | Plain | D | Endorheic | WCO |

## 6.2 Broad Wetland Settings

At their broadest level the wetlands on site can be divided into four wetland settings (Level 4 of the national classification system; Ollis et al. 2013). These include channelled valley bottoms, unchanneled valley bottoms, exhoreic depressions and endorheic depressions.

Channelled valley bottom wetlands are typically found on valley floors with a clearly defined, finite stream channel and lacks floodplain features, referring specifically to meanders. Channelled valley bottom wetlands are known to undergo loss of sediment in cases where the wetlands' slope is high and the deposition thereof in cases of low relief. Unchanneled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows.

Unchanneled valley bottom wetlands are typically found on valley-floors where the landscape does not allow high energy flows. Figure 12 presents a diagram of HGM 2, showing the dominant movement of water into, through and out of the system. Unchanneled valley bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

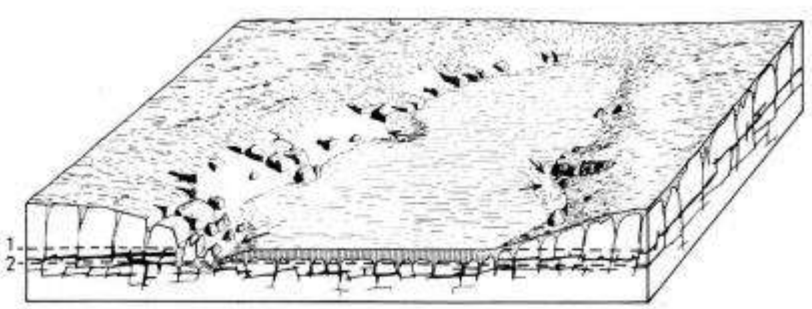



*Figure 11: Schematic representation of a polje from Martini and Kavalieris (1976), arrows indicate absorption points, water-table at maximum (I), and at minimum (2)*

Depressions are inward draining basins with an enclosing topography which allows for water to accumulate within the system. Depressions, in some cases, are also fed by lateral sub-surface flows in cases where the dominant geology allows for these types of flows. The depressions in the study area were divided into inward draining (endorheic) and outward draining (exorheic) systems. Within the study area, the latter resemble poljes, a type of depression that typically occurs in arid karstic regions (mot well known in eastern Europe). Martini and Kavalieris (1976) provide an account of such systems in their paper entitled the Karst of the Transvaal (South Africa). In this paper they document and describe a number of polje type systems in the Ottoshoop area. They describe these systems as being depressions located on flat arid terrain and floors filled with clay, calcrete and occasionally peat. Water drains along the margins of these seeps into underlying dolomitic aquifers. Conversely it is reported that during significant rainfall periods, and for a short time after, these systems may be flooded by the rising of the water table. An event such as this occurred (on a very large scale) in 1974 following prolonged rainfall, completely inundating the Klein Riet and associated Great Pan system.

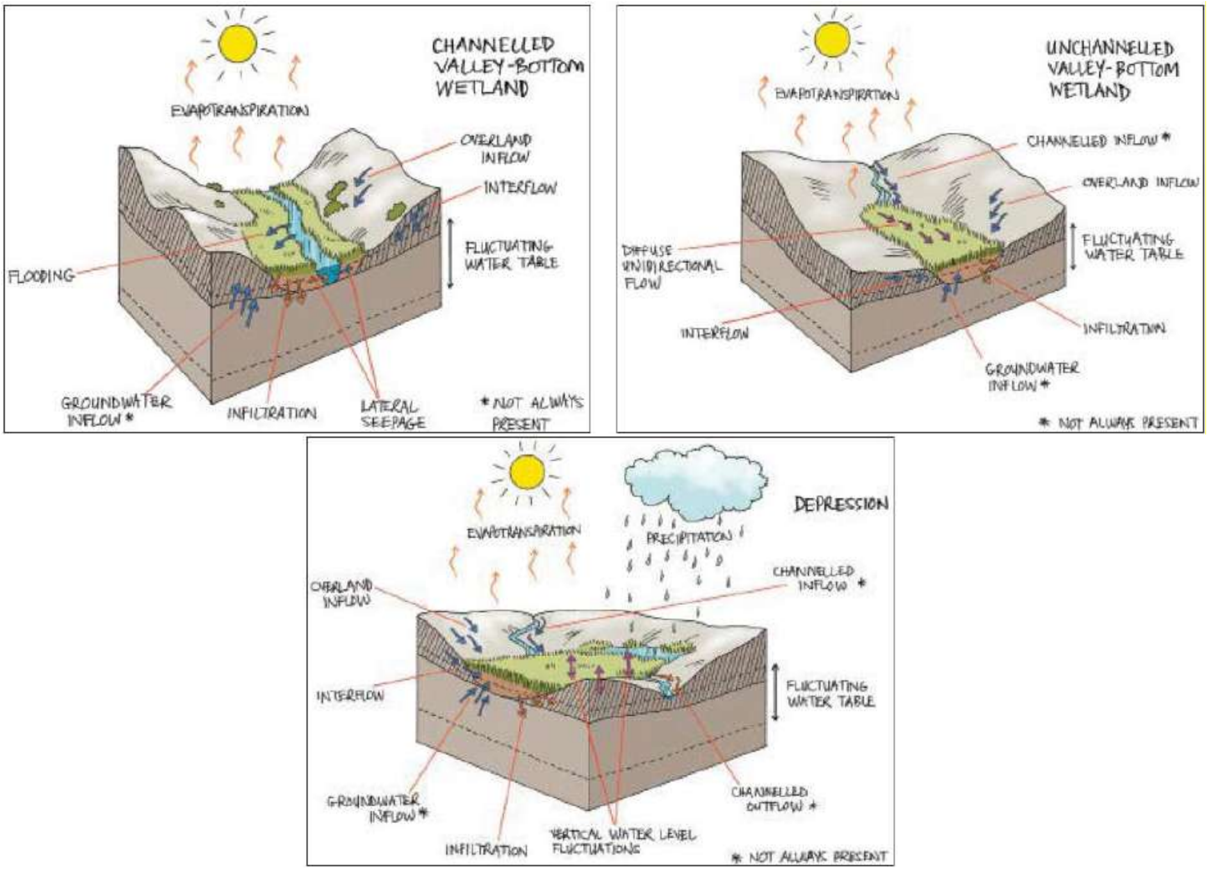
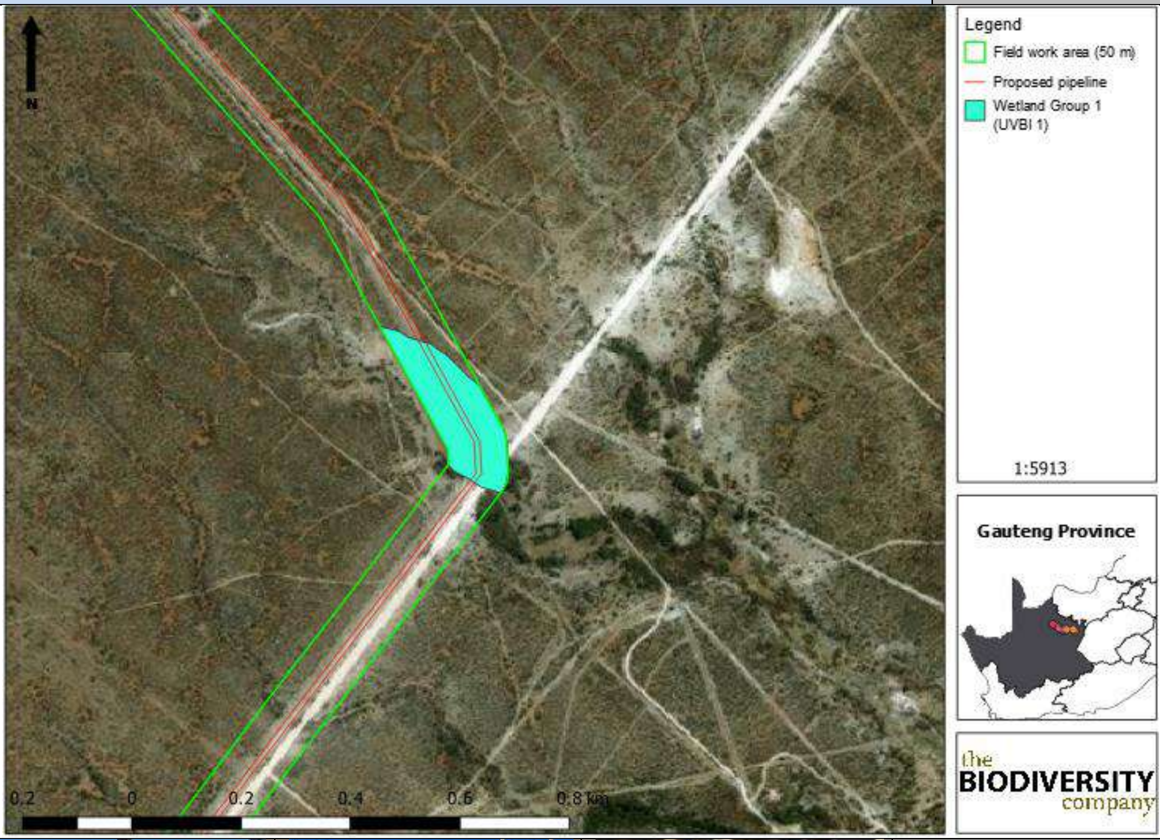


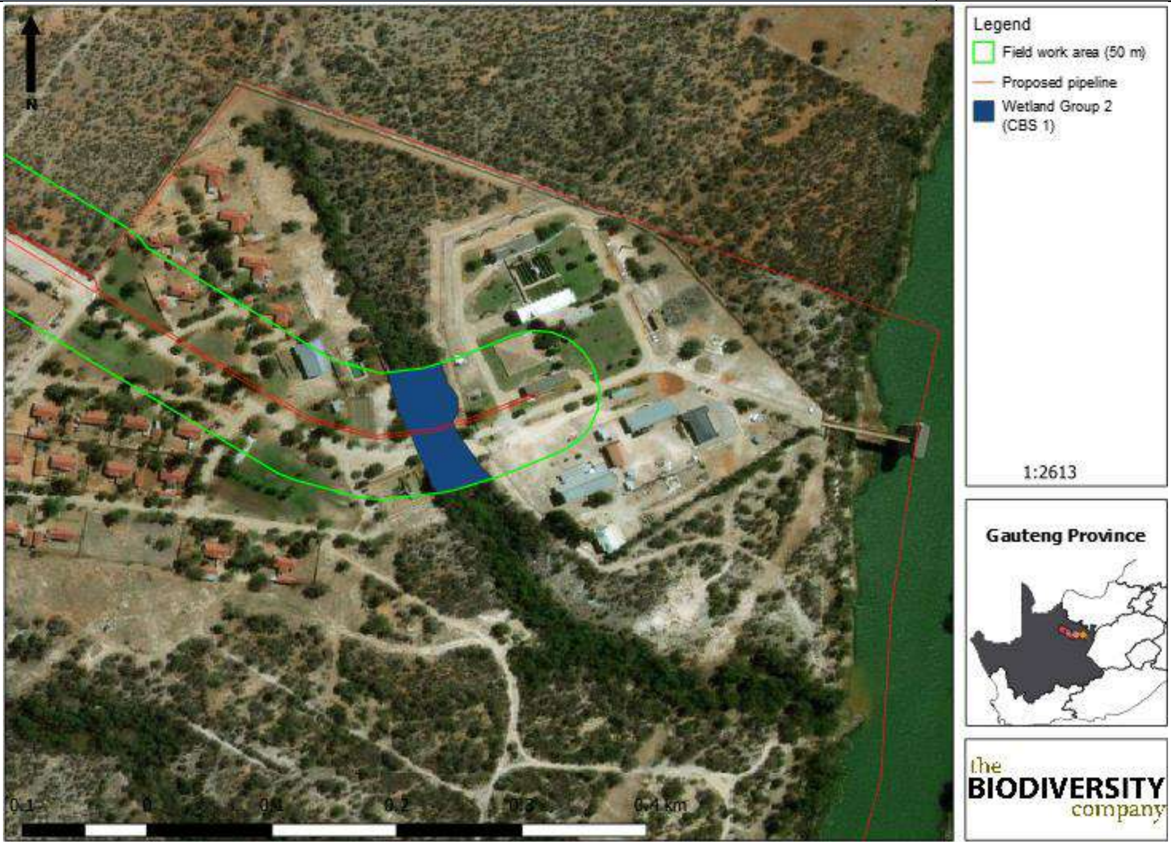

*Figure 12: Amalgamated diagram of the HGM type, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)*

## 6.3 Wetland Groups

Presented below in text boxes is a summary of the key findings for each of the 12 wetland groups identified within the study area.

| Wetland Group 1 | | | |
|---|---|---|---|
| **Harts Unchanneled Valley bottom - Intermittent** | | | **UVBI 1** |
|  | | | |
|  |  |  |  |
| Upstream | Downstream | Alluvial deposits | *Robinia pseudoacacia* (alien) |
| **Wetland FEPA** | No | **Saturation period** | |
| **River FEPA** | No | **Flow Direction** | |
| **Description** | Very Intermittently inundated system, hydrophytic indicators few, bed covered by grass (*Themeda triandra* dominated). Deep alluvial deposits with feint signs of mottling. | | |
| **Impacts** | Powerlines, road crossings, alien and invasive plants present but minor and restricted to road verge. Mild grazing pressure from game. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **C: Moderately Modified** | **Moderate** | **Intermediate** |

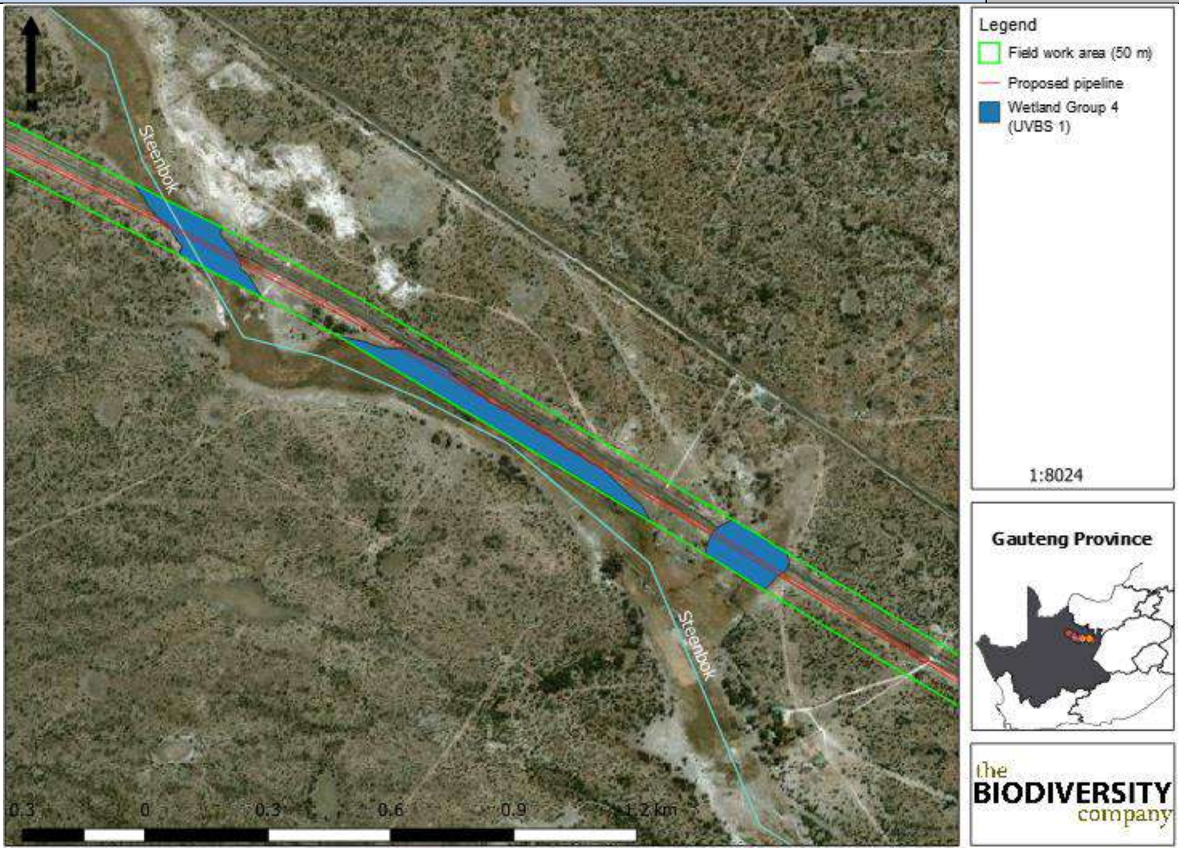
| Wetland Group 2 | | | |
|---|---|---|---|
| **Vaal Channelled Valley bottom - Seasonal** | | | **CVBS 1** |




|  |  |  |  |
|---|---|---|---|
| Upstream | Downstream | Katspruit soil form showing G-horizon | *Searcia lancea* dominated thicket |
| **Wetland FEPA** | No | **Saturation period** | Seasonal |
| **River FEPA** | No | **Flow Direction** | South-west |
| **Description** | Deeply incised but well vegetated narrow channel. Wetland saturation ends abruptly beyond channel bed. | | |
| **Impacts** | Evidence of considerable water inputs downstream of Delportshoop WTW as well as signs of increased floodpeaks. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **C: Moderately Modified** | **High** | **Intermediate** |

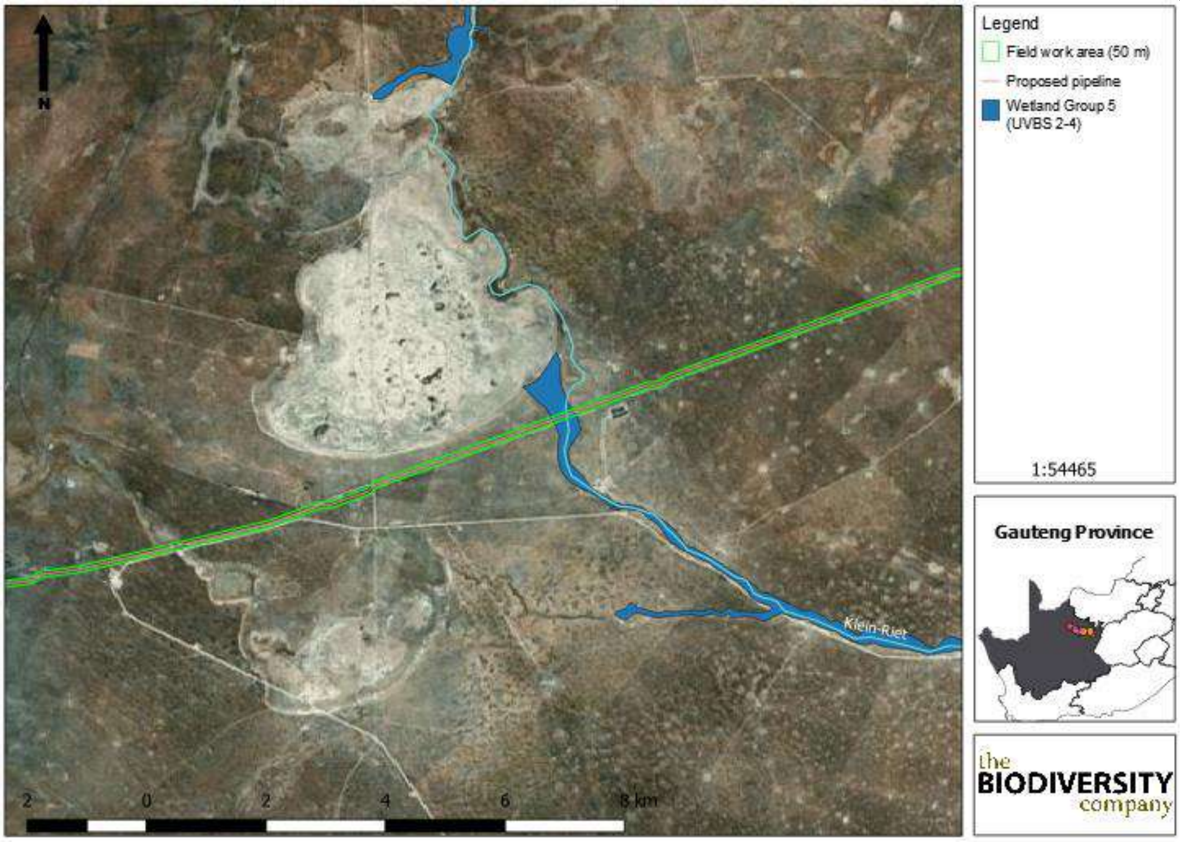
| Wetland Group 3 | | | |
|---|---|---|---|
| Vaal Channelled Valley bottom - Intermittent | | | CVBI 1-3 |
|  | | | |
|  |  |  |  |
| Upstream | Downstream | Soil mottling | Sedimented culvert |
| **Wetland FEPA** | No | **Saturation period** | Intermittent |
| **River FEPA** | No | **Flow Direction** | South-west |
| **Description** | Largely natural, highly intermittently inundated system. No signs of obligative hydrophytes, trees and grass in flow path. Signs of soul mottling at 40 cm. | | |
| **Impacts** | Impacts are few but include moderate levels of grazing by game and a sand road crossing. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **B: Largely Natural** | **Moderate** | **Intermediate** |

| Wetland Group 4 | |
|---|---|
| **Steenbok Unchanneled Valley bottom – Permanent / Seasonal** | **UVBS 2-4** |



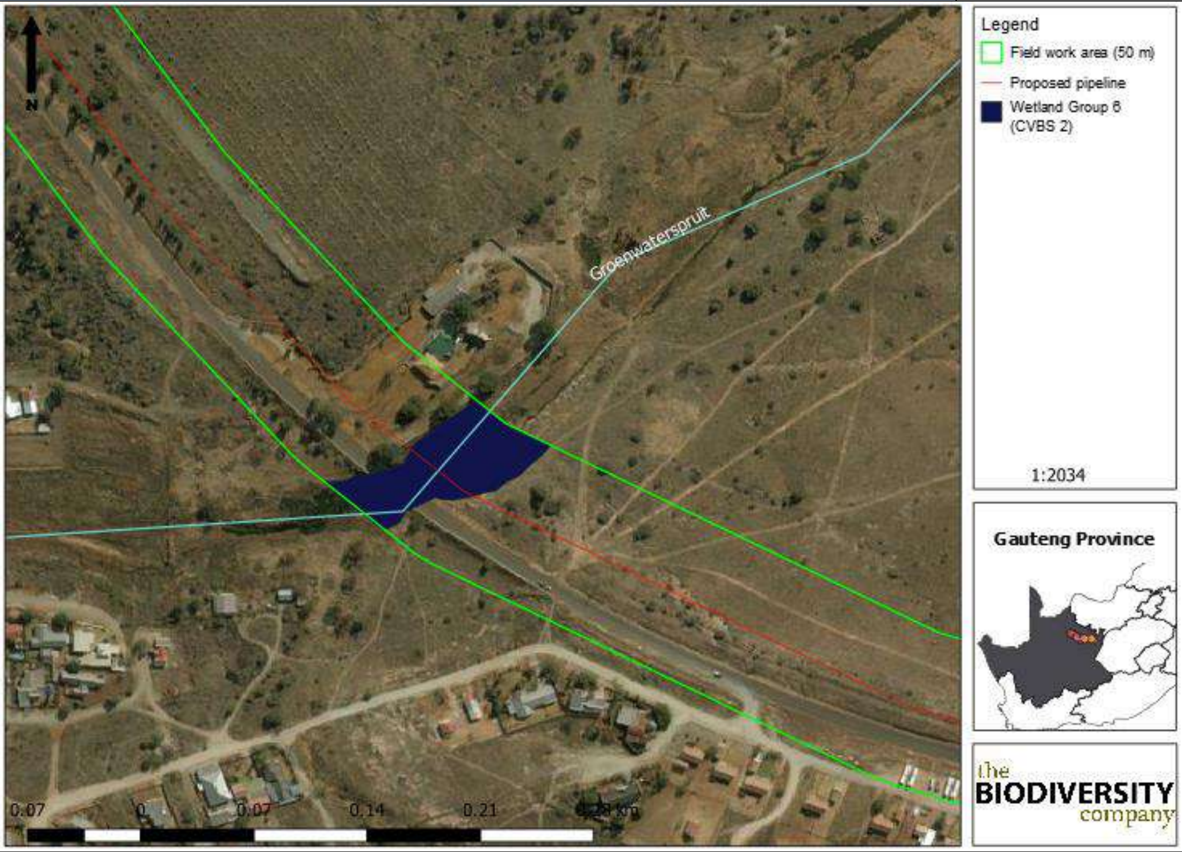

|  |  |  |  |
|---|---|---|---|
| Upstream (spring) | Downstream | Organic, peat-like material | *Juncus rigidis* (obligative hydrophyte) |
| **Wetland FEPA** | Yes | **Saturation period** | Permanent / seasonal |
| **River FEPA** | Yes, Steenbok Phase 1 | **Flow Direction** | South-west |
| **Description** | A significant, largely natural system with varying degrees of saturation along its length with permanent / seasonal zones associated with springs, some of which are perennial. In these areas and for some distance downstream the system is well vegetated by a wide variety of obligative and facultative hydrophytes. | | |
| **Impacts** | Impacts centre on small scale crop cultivation, heavy grazing pressure by sheep and multiple tar road crossings. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **B: Largely Natural** | **Very High** | **High** |

| Wetlands Group 5 | | | |
|---|---|---|---|
| **Klein Riet Unchanneled Valley bottom - Seasonal** | | | **UVBS 2-4** |

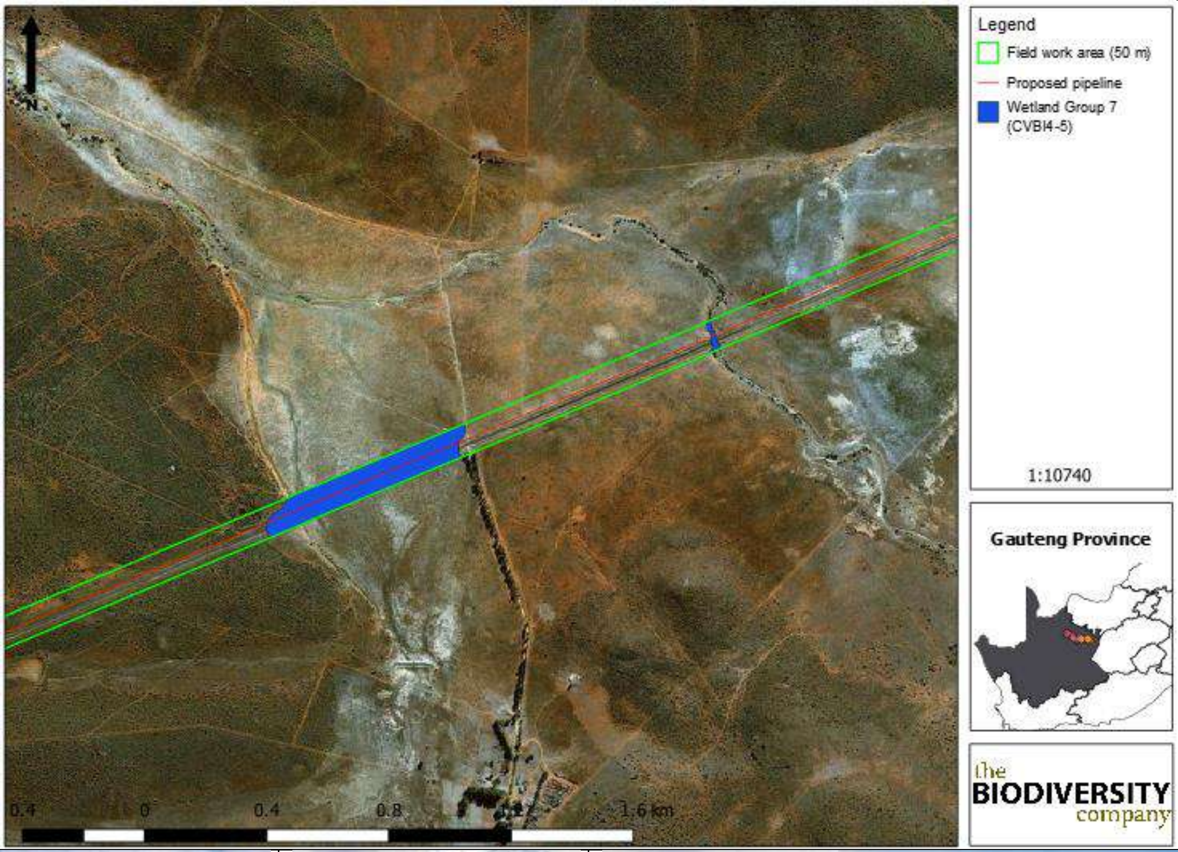


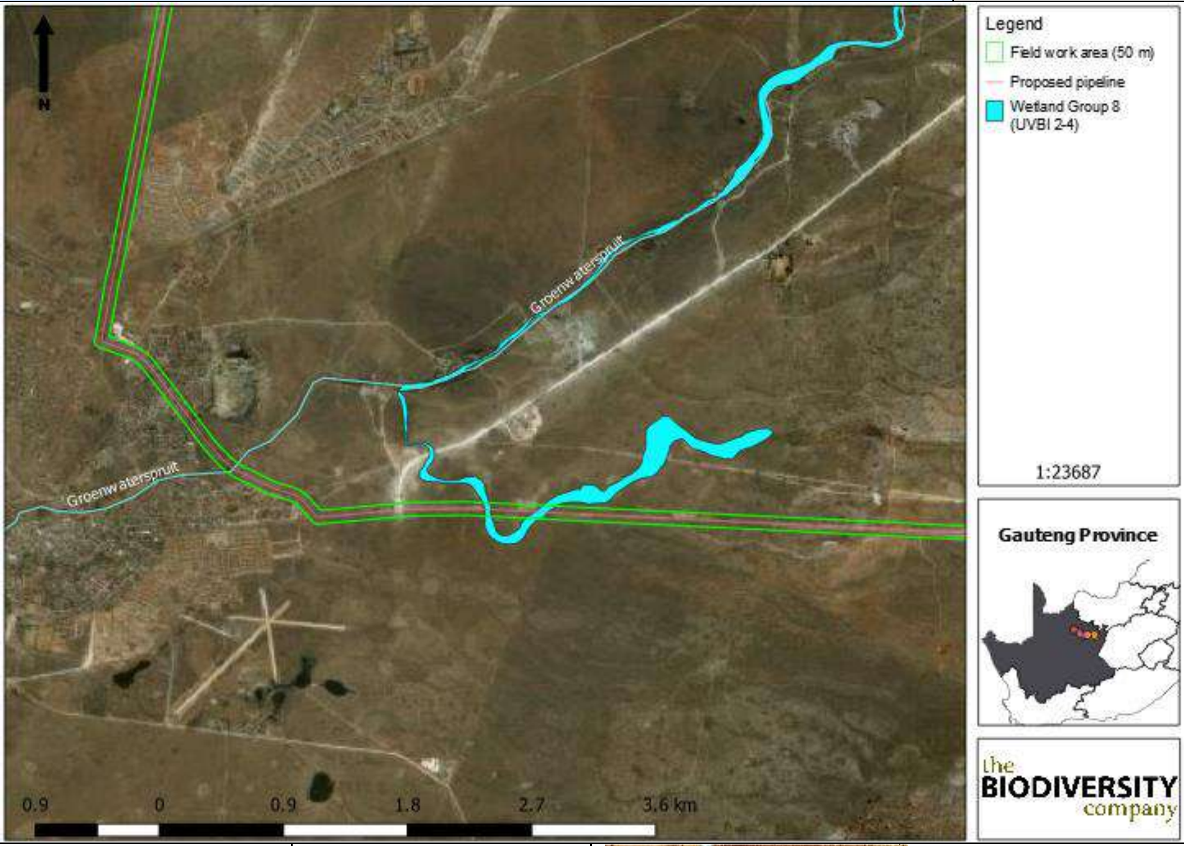

|  |  |  |  |
|---|---|---|---|
| Upstream | Downstream (spring) | Organic material | *Phragmites australis* |
| **Wetland FEPA** | Yes | **Saturation period** | Permanent / seasonal |
| **River FEPA** | Yes, Klein Riet Phase 1 | **Flow Direction** | South to south-east |
| **Description** | A significant system in a moderately modified state. Like the Steenbok this system is fed by a number of springs along its length (in addition to sporadic rainfall inputs from the catchment) the most notable of which being the Danielskuil spring near its source. The system drains into the Great Pan and continues downstream of it to merge with the Vaal near Schmidsdrift. | | |
| **Impacts** | Livestock grazing, dirt roads. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **C: Moderately Modified** | **High** | **Moderately High** |

| **Wetlands Group 6** | |
|---|---|
| **Groenwaterspruit Channelled Valley bottom – Permanent / Seasonal** | **CVBS 2** |



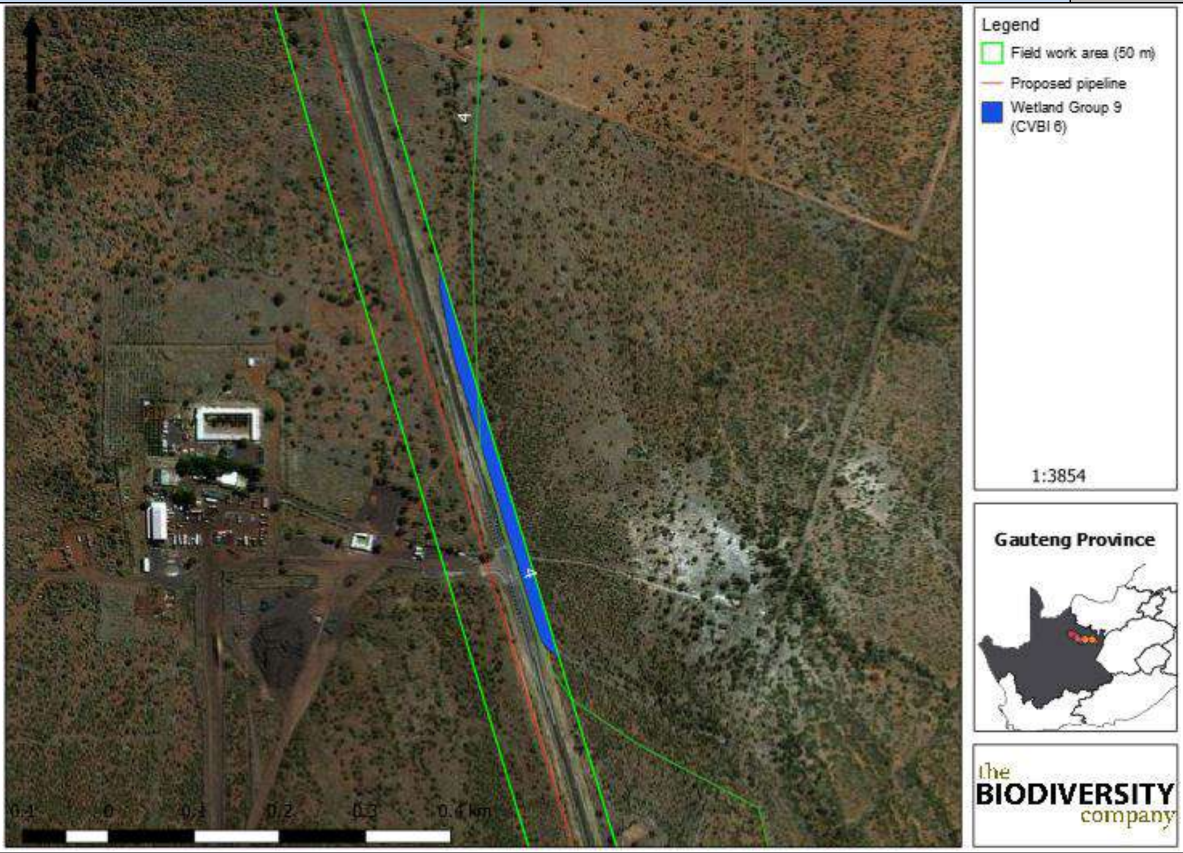

| Upstream | Downstream | Alluvium | African Clawed Frog (*Xenopus laevis*) |
|---|---|---|---|
| **Wetland FEPA** | No | **Saturation period** | Permanent / seasonal |
| **River FEPA** | Yes, Groenwaterspruit Phase 1 | **Flow Direction** | South-west |
| **Description** | A fairly large moderately modified system fed by a multitude of drainage lines in a large catchment. A large dry alluvial fan enters this system in the north near Jenn Haven. | | |
| **Impacts** | Limestone mining, damming, minor canalisation, cultivation, football pitches. System shows signs of eutrophication. System flows through Postmasburg. Alien bush clumps present (*E. camaldulensis*) | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **C: Moderately Modified** | **High** | **Moderately High** |

<table>
<tr><th colspan="4">Wetlands Group 7</th></tr>
<tr><td colspan="3">Groenwaterspruit Channelled Valley bottom – Intermittent</td><td>CVBI 4-5</td></tr>
<tr><td colspan="4">
</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Upstream</td><td>Downstream</td><td colspan="2">Extent of the system</td></tr>
<tr><td>Wetland FEPA</td><td>No</td><td>Saturation period</td><td></td></tr>
<tr><td>River FEPA</td><td>No</td><td>Flow Direction</td><td></td></tr>
<tr><td>Description</td><td colspan="3">Avery large system with a large catchment area but situated above banded iron formation and devoid of any significant springs. As such the system is very dry and only intermittently inundated during significant rainfall events.</td></tr>
<tr><td>Impacts</td><td colspan="3">Its large and steep-sloped catchment together with the high erosivity of the soils (intensified by overgrazing) make this system prone to erosion. Indeed, this system shows signs of serious erosion along its western margin. Otherwise the system and its catchment are largely intact.</td></tr>
<tr><td rowspan="2">Assessment Rating</td><td>PES</td><td>EIS</td><td>Ecosystem Services</td></tr>
<tr><td>C: Moderately Modified</td><td>Moderate</td><td>Intermediate</td></tr>
</table>

<table>
<tr><th colspan="4">Wetlands Group 8</th></tr>
<tr><td colspan="3">Groenwaterspruit Unchannelled Valley bottom – Intermittent</td><td>UVBI 2-4</td></tr>
<tr><td colspan="4">
</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Upstream</td><td>Downstream</td><td>Deep sandy soils</td><td>Signs of standing water</td></tr>
<tr><td>Wetland FEPA</td><td>No</td><td>Saturation period</td><td>Intermittent</td></tr>
<tr><td>River FEPA</td><td>Yes, Groenwaterspruit Phase 1</td><td>Flow Direction</td><td>South-west</td></tr>
<tr><td>Description</td><td colspan="3">A large but relatively dry system. Clearly receives considerable flows during rainfall events. Vegetation in flow path vegetated (dominated by Themeda triandra).</td></tr>
<tr><td>Impacts</td><td colspan="3">Scattered alien bushclumps, farm steads, livestock grazing, limestone mining.</td></tr>
<tr><td rowspan="2">Assessment Rating</td><td>PES</td><td>EIS</td><td>Ecosystem Services</td></tr>
<tr><td>C: Moderately Modified</td><td>Moderate</td><td>Intermediate</td></tr>
</table>

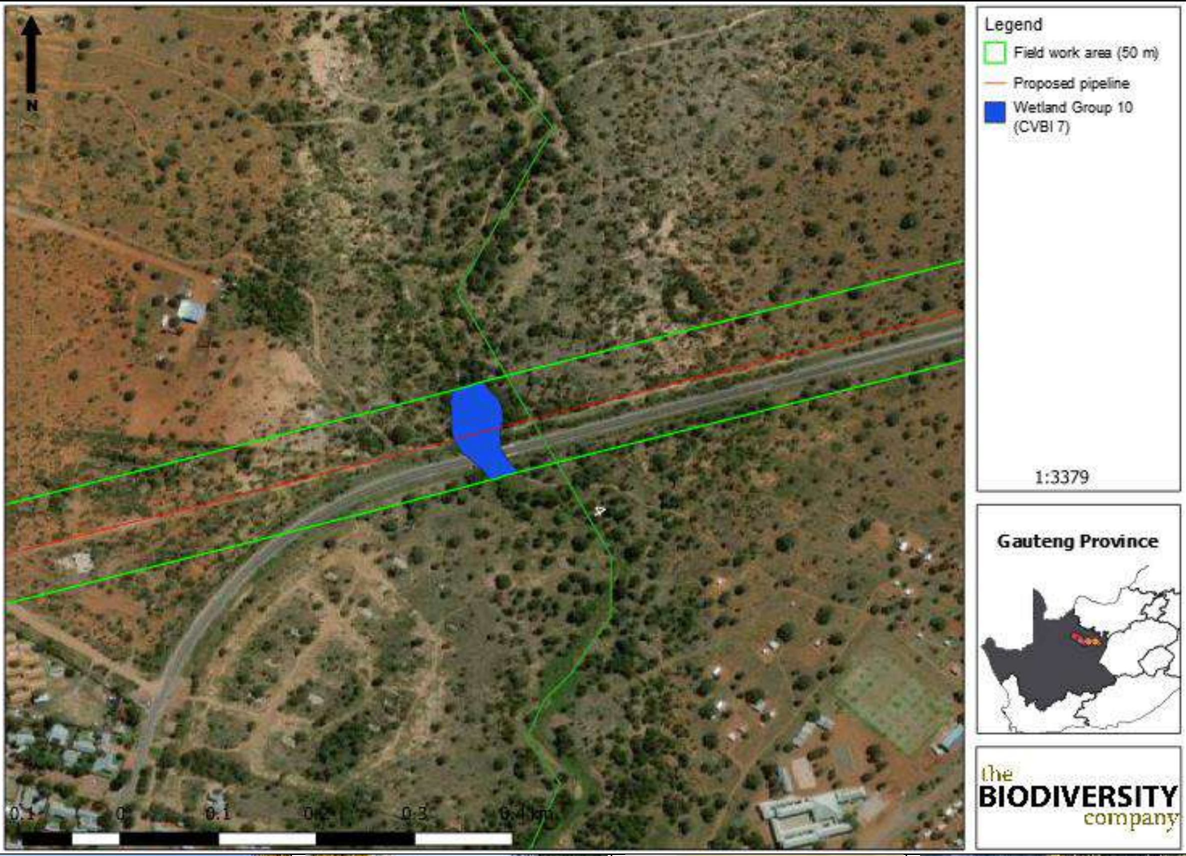
| Wetlands Group 9 |
|---|

| Ga-Magora Tributary | CVBI 6 |
|---|---|

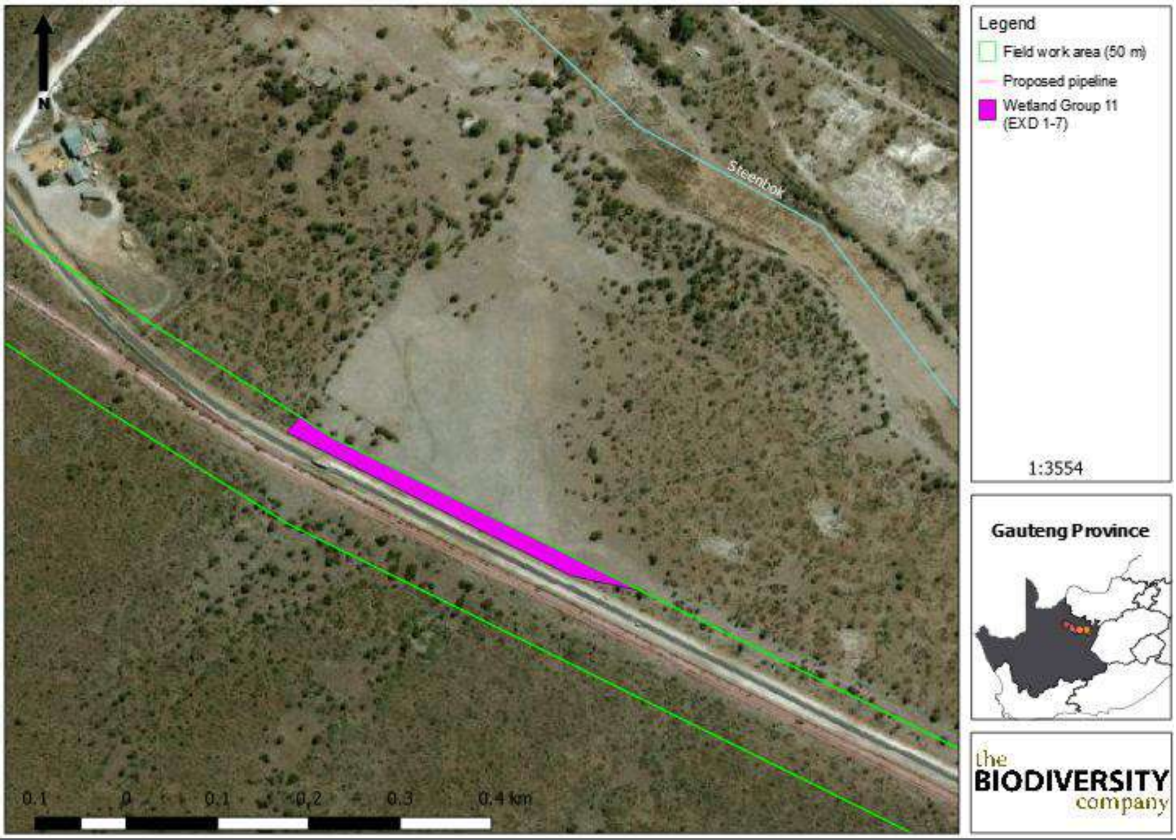



| Channel | | Outcropping dolomite bedrock | |
|---|---|---|---|
| **Wetland FEPA** | No | **Saturation period** | Intermittent |
| **River FEPA** | Phase 4 FEPA | **Flow Direction** | North |
| **Description** | Highly intermittently inundated, largely natural system. The receiving environment is notably more arid than other parts of the study area. Dolomite bedrock outcrops in the channel. Ultimately drains the Ga-Mogara | | |
| **Impacts** | Livestock grazing, iron ore mining (dust and sediments evident in channel). System is partially truncated by the R35 tar road. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **B: Largely Natural** | **Moderate** | **Intermediate** |

**Wetlands Group 10**

| **Olifantloop Channeled Valley bottom – Intermittent / seasonal** | | | **CVBI 6** |
|---|---|---|---|
|  | | | |
|  |  |  |  |
| Upstream | Downstream | Mottling in G horizon | Litter in channel |
| **Wetland FEPA** | No | **Saturation period** | Intermittent / seasonal |
| **River FEPA** | Phase 4 FEPA | **Flow Direction** | |
| **Description** | A large but relatively dry channelled system in a particularly arid setting. The pipeline crosses this system in its upper reaches. Dry red sandy soils characterise this system. Provides an important corridor for local fauna. | | |
| **Impacts** | Trash dumping, tar road crossings and moderate amounts of bank erosion. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **C: Moderately Modified** | **High** | **Intermediate** |

| Wetlands Group 11 | |
|---|---|
| **Exorheic Depressions** | **EXD 1-10** |

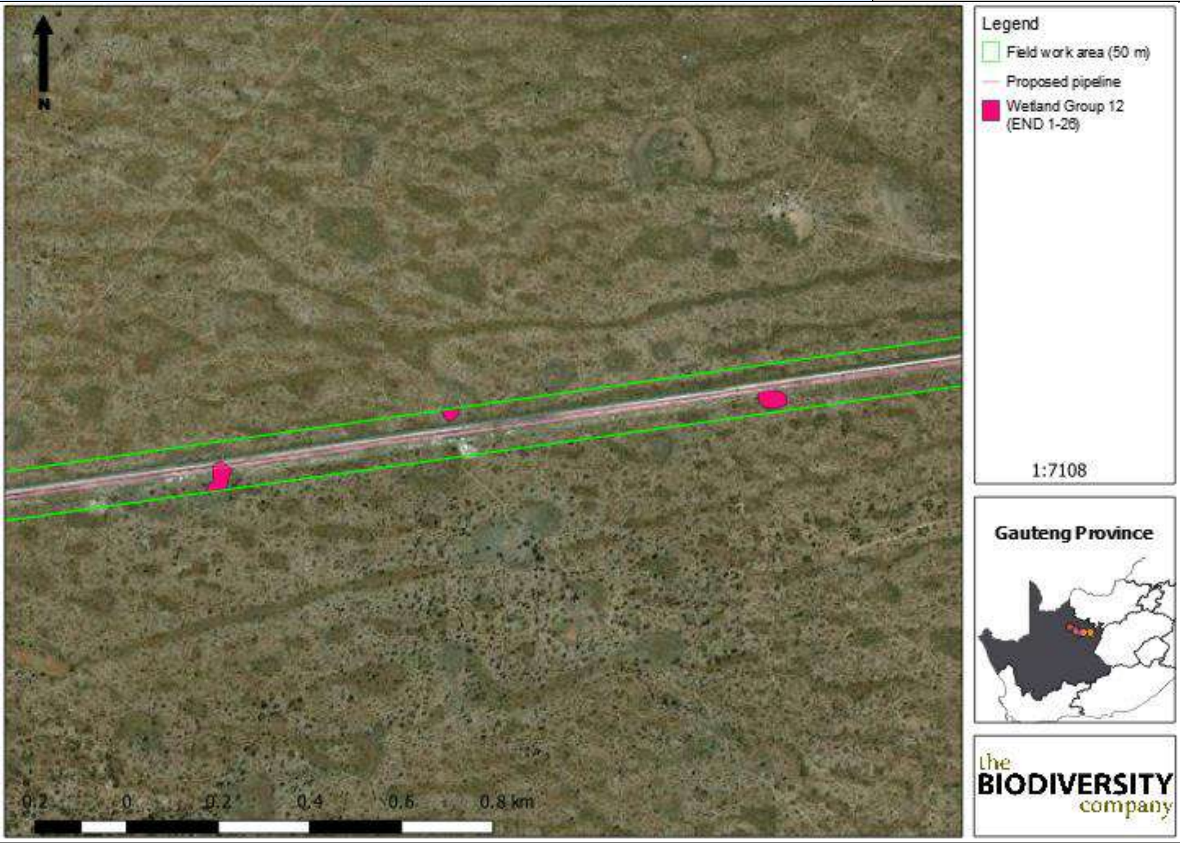



| Wild Olive (*Olea europaea* subsp. *Africana*) | Calcareous deposits in pan |
|---|---|

| | | | |
|---|---|---|---|
| **Wetland FEPA** | Yes e.g. Great Pan | **Saturation period** | |
| **River FEPA** | Yes, Klein Riet Phase 1 | **Flow Direction** | South |
| **Description** | At least 10 significant exorheic depressions occur within the study area, most notable of which being Great Pan along the Klein Riet. These systems are underlain by calcrete, in some dolomite outcrops at surface. Reminiscent of poljes. | | |
| **Impacts** | Livestock grazing. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **B: Largely Natural** | **Very High** | **Moderately** |

| | | | |
|---|---|---|---|
| | | | High |

| Wetlands Group 12 | |
|---|---|
| Endorheic Depressions - Intermittent | END 1-34 |




| Inundated depression near Olifantshoek | | Signs of erosion | |
|---|---|---|---|
| **Wetland FEPA** | Yes | **Saturation period** | |
| **River FEPA** | No | **Flow Direction** | |
| **Description** | Small to medium-sized endorheic depressions are scattered throughout the study area but concentrated in the east. | | |
| **Impacts** | Livestock grazing, minor erosion in north-western depressions. | | |
| **Assessment Rating** | **PES** | **EIS** | **Ecosystem Services** |
| | **B: Largely Natural** | **High** | **Intermediate** |

## 6.4 Wetland Ecosystem Services

The ecosystem services provided by the HGM types identified on site were assessed and rated using the WET-EcoServices method (Kotze et al. 2009). The summarised results for the HGM groups are shown in Table 7.

The ecosystem services provided by the various wetland groups was closely associated with their degree of saturation and size. Overall WG 4 (HGM 4) is considered the most important (Highly) in terms of the ecosystem services it provides followed by WG 5, 6 and 11. All other systems were rated as Intermediate. In terms of flood attenuation, all of the wetland systems have a relatively high opportunity to receive floods following rainfall events (due to the inherent runoff potential of the soils within their sparsely vegetated catchments). However, HGM units 4, 5, 6 and 10 play an important role in attenuating potential floods due their low slope, relatively high vegetation cover, number of depressions along their length and in the case of WG 10 its channel width and high sinuosity. All systems except for WG 12 (endorheic depressions) make a Moderately-High contribution to streamflow regulation. All of the systems play an important role in trapping sediments although this service was highest in WG 4, 5, 6, 8, 11 and 12 due to their efficacy at attenuating stormflows.

*Table 7: The EcoServices being provided by the HGM types (or Wetland Groups (WG))*

| Service | HGM Unit | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Flood attenuation | 1.7 | 1.9 | 1.7 | 2.3 | 2.5 | 2.4 | 1.9 | 1.9 | 1.9 | 2.1 | 2.4 | 2.5 |
| Streamflow regulation | 2.5 | 2.7 | 2.5 | 3.5 | 3.0 | 2.8 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 1.4 |
| Sediment trapping | 2.9 | 3.0 | 2.9 | 3.2 | 3.6 | 3.6 | 2.3 | 3.1 | 2.5 | 2.4 | 3.2 | 3.1 |
| Phosphate assimilation | 2.5 | 2.4 | 2.1 | 3.3 | 3.4 | 3.3 | 1.8 | 2.4 | 2.1 | 1.9 | 2.3 | 2.0 |
| Nitrate assimilation | 2.1 | 2.1 | 1.8 | 3.5 | 3.3 | 3.1 | 1.7 | 2.0 | 1.8 | 1.7 | 1.6 | 0.9 |
| Toxicant assimilation | 2.2 | 2.2 | 1.9 | 3.2 | 3.2 | 3.2 | 1.7 | 2.2 | 2.0 | 1.7 | 2.1 | 1.7 |
| Erosion control | 2.5 | 2.1 | 2.0 | 3.1 | 3.0 | 2.6 | 1.7 | 2.2 | 2.0 | 1.8 | 1.8 | 1.8 |
| Carbon storage | 0.0 | 0.5 | 0.0 | 3.0 | 1.5 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Biodiversity maintenance | 2.0 | 1.8 | 1.8 | 3.3 | 3.3 | 3.3 | 1.8 | 1.8 | 1.8 | 2.8 | 3.3 | 2.0 |
| Provisioning of water for human use | 1.3 | 1.4 | 1.3 | 3.3 | 3.0 | 3.0 | 1.3 | 1.3 | 1.3 | 1.3 | 1.6 | 1.4 |
| Provisioning of harvestable resources | 1.8 | 1.8 | 1.8 | 3.4 | 3.4 | 3.4 | 1.8 | 1.8 | 1.8 | 1.8 | 3.4 | 2.8 |
| Provisioning of cultivated foods | 1.8 | 1.8 | 1.8 | 3.6 | 3.6 | 3.6 | 1.8 | 1.8 | 1.8 | 1.8 | 3.6 | 3.0 |
| Cultural heritage | 1.0 | 1.0 | 1.0 | 1.8 | 1.8 | 1.8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.3 | 1.3 |
| Tourism and recreation | 1.6 | 1.6 | 1.6 | 3.6 | 3.6 | 3.1 | 1.6 | 1.6 | 1.6 | 1.6 | 4.0 | 2.6 |
| Education and research | 1.5 | 2.0 | 2.0 | 2.3 | 2.0 | 1.3 | 2.0 | 2.0 | 2.0 | 1.7 | 3.0 | 2.3 |
| **Average** | 1.8 | 1.9 | 1.7 | 3.1 | 2.9 | 2.8 | 1.7 | 1.8 | 1.7 | 1.7 | 2.4 | 1.9 |
| **Threats** | 2.0 | 2.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 |
| **Opportunities** | 2.0 | 2.0 | 2.0 | 4.0 | 4.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 4.0 | 2.0 |

Most of the systems with the exception of WG 6 (HGM 6) are non-eutrophic and (based on current land use) practices, likely relatively free of toxicants. The higher saturation levels, lower slope and greater extent of vegetation cover affords these systems a Moderately High capacity to trap and assimilate nutrients (phosphates and nitrates) and toxicants. These attributes allow for the creation of a depositional environment and as such the risk for erosion is low within these systems. The greater extent of bare ground and steeper slopes (higher stormflow velocities) in the catchments of HGM units 7 and 10 and similar efficacy to deal with such floodpeaks makes these systems less important in terms of erosion control and indeed erosion was present within these systems. Only WG 4 and potentially WG 5 make a meaningful contribution to carbon storage. The springs within these systems increase saturation levels and allow for the proliferation of vegetation. This has led to a significant accumulation of organic material within the soil profile.

In terms of biodiversity maintenance WG 4, 5, 6 and 11 are considered Highly important (see EIS section for greater detail in this regard). These systems are also considered Highly important in terms of their provisioning of water for human use, harvestable resources, cultivated foods as well as their potential for tourism and recreation. None of the systems are considered to provide significant cultural benefits.

## 6.5 Wetland Health

The PES for each of the identified wetland groups is presented in Table 8. Overall WG 3, 4, 9, 11 and 12 are considered to be in a Largely Natural (class B) state. In contrast WG 5 is the most impacted system and is classified as Largely Modified (class D). All other systems were assessed as Moderately Modified (class C).

In terms of hydrology WG 4, 7, 9, 11 and 12 are least impacted (Largely Natural) as their catchments remains relatively intact, undeveloped and free of alien and invasive vegetation. Within system impacts that would alter the water distribution and retention time within these systems is low. In contrast WG 1, 3, 5 and 8 are somewhat more impacted (Moderately Modified) mostly due to within system impacts mainly associated with impeding features, excavation and the presence of alien and invasive species (particularly *E. camadulensis* at WG 6). Of all the systems WG 2 and WG 5 had the most impacted hydrology (Largely Modified) due to artificially increased inputs and moderately high abstraction (limestone mining) respectively.

From a geomorphological perspective the most impacted system is WG 7. This system has a large catchment with relatively steep slopes. This together with low vegetation cover from overgrazing and high soil erosivity has led to notable incisement of the channel banks. The geomorphology within the systems WG 2, 5, 7, 8, 9, 10 was rated as Moderately Modified (mostly due to altered runoff characteristics) while all other systems were considered to be in a Largely Natural state due to their low slope angle, lower grazing pressure and relatively good vegetation cover.

In terms of vegetation WG 3, 4, 9, 11,12 were considered to be in a Largely Natural state. The remaining systems were rated as Moderately Modified with the main impacts being livestock overgrazing, roads, infrastructure (particularly for WG 5 where limestone mining operations are taking place), crop cultivation (particularly for WG 4 and 5).

*Table 8: Summary of the scores for the wetland PES*

| Wetland Group | Hydrology | | Geomorphology | | Vegetation | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | Rating | Score | Rating | Score | Rating | Score | Rating | Score |
| 1 | C: Moderately Modified | 3.0 | B: Largely Natural | 1.2 | C: Moderately Modified | 2.0 | C: Moderately Modified | 2.2 |
| 2 | D: Largely Modified | 4.0 | C: Moderately Modified | 3.3 | C: Moderately Modified | 2.5 | C: Moderately Modified | 3.4 |
| 3 | C: Moderately Modified | 3.0 | B: Largely Natural | 1.0 | B: Largely Natural | 1.1 | B: Largely Natural | 1.9 |
| 4 | B: Largely Natural | 1.0 | B: Largely Natural | 1.0 | C: Moderately Modified | 2.6 | B: Largely Natural | 1.5 |
| 5 | D: Largely Modified | 6 | C: Moderately Modified | 3.0 | C: Moderately Modified | 3.2 | D: Largely Modified | 4.3 |
| 6 | C: Moderately Modified | 3.0 | B: Largely Natural | 1.3 | D: Largely Modified | 5.2 | C: Moderately Modified | 3.1 |
| 7 | B: Largely Natural | 1.5 | D: Largely Modified | 4.0 | B: Largely Natural | 1.9 | C: Moderately Modified | 2.3 |
| 8 | C: Moderately Modified | 3.5 | C: Moderately Modified | 2.6 | B: Largely Natural | 1.9 | C: Moderately Modified | 2.8 |
| 9 | B: Largely Natural | 1.0 | C: Moderately Modified | 2.6 | B: Largely Natural | 1.9 | B: Largely Natural | 1.7 |
| 10 | B: Largely Natural | 1.5 | C: Moderately Modified | 2.7 | C: Moderately Modified | 2.4 | C: Moderately Modified | 2.1 |
| 11 | B: Largely Natural | 1.0 | B: Largely Natural | 1.0 | D: Largely Modified | 4.0 | B: Largely Natural | 1.9 |
| 12 | B: Largely Natural | 1.0 | B: Largely Natural | 1.0 | C: Moderately Modified | 3.1 | B: Largely Natural | 1.6 |

## 6.6 Ecological Importance and Sensitivity

The wetland EIS assessment was applied to the wetland groups described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 9. Some examples of important faunal taxa supported by the wetlands in the study area are shown in Figure 13.

From an ecological importance perspective wetland groups WG 4 and 11 were assigned a Very High ecological importance while WG 1, 3, 7, 8 and 9 were rated as High with all other systems rated as Moderate. Due to the arid nature of the receiving environment the ecological importance of each system closely was aligned with its level of saturation, size and / or potential to support open waterbodies (e.g. Great Pan and other depressions), and as such, its potential to support Species of Conservation Concern (SCC), unique species or provide important migration and movement / foraging corridors. Wetlands such as these have the potential to support a considerable number of the regions SCC. Anecdotal observations made by local landowners (most of which confirmed through photographic evidence provided by Mrs. York) suggest the presence of White-backed Vulture (CR), Cape Vulture (EN), Secretary Bird, Verreaux's Eagle (VU), Black-footed Cat (VU), Kori Bustard (NT), Brown Hyaena, African Hedgehog, Giant Bullfrog. Other potentially occurring species include Ludwig's Bustard (EN), Burchel’s Courser (VU), Blue Crane (EN), Macoa Duck (NT), Tawny Eagle (EN), Greater and Lesser flamingos (NT).

Natural springs within WG 4 (Steenbok unchanneled valley bottom) and WG 5 (Klein Riet unchanneled valley bottom) provide an important water resource to local wildlife (e.g. Aardwolf, Aardvark, Cape Fox which are abundant in the area). The considerable increase in saturation levels also provides important foraging habitat, cover and has the potential to support unique or conservation important flora.

The large exorheic depressions of WG 11 (e.g. Great Pan) as well as some of the larger endorheic pans, although very intermittently inundated, are considered important for the potential to support large congregations of SCC and migratory water birds. Long-term Coordinated Waterbird Count (CWAC) data from a nearby and similar pan within the Benfontein IBA (SA033) reveals that during periods of exceptionally high rainfall the pan supports in excess of 1700 waterbirds representing 65 species. WG 11 and particularly Great Pan have the potential to receive similar visitation. Based on this data most likely to occur include Black-winged Stilt, Cape Shoveler, Chestnut-banded Plover, Greater and Lesser flamingos (especially considering the proximity to Kamfersdam IBA), herons, grebes, ibises and storks. It is also important to consider the presence of the Ghaap Plateu Woodland which supports a considerable density of Wild Olive Trees (*Olea europaea* subsp. *africana*). This woodland is not however, confined to wetland areas.

The Hydrological/Functional Importance closely mirrored the ecological importance in terms of ratings. Importance to humans for all systems is somewhat lower due to the ephemeral nature of the systems and their relative inaccessibility (low cultural significance, many situated on privately owned land). These services are covered in greater detail in the section on wetland ecosystem services.

*Table 9: The EIS results for the delineated HGM types*

| Wetland Importance and Sensitivity | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecological Importance & Sensitivity | 2.0 | 2.7 | 2.0 | 3.3 | 3.0 | 3.0 | 2.0 | 2.0 | 2.0 | 2.7 | 3.7 | 2.7 |
| Hydrological/Functional Importance | 2.0 | 2.1 | 1.9 | 3.1 | 2.9 | 2.8 | 1.7 | 2.0 | 1.8 | 1.7 | 2.0 | 1.7 |
| Direct Human Benefits | 0.5 | 1.6 | 1.6 | 3.0 | 2.9 | 0.5 | 1.6 | 1.6 | 1.6 | 1.5 | 0.5 | 2.2 |


*Figure 13: Evidence supporting the presence of conservation important or unique species within the study area wetlands; A) Flap-necked Chameleon, B) Rock Monitor, C) Leopard Tortoise juvenile, D) Bubbling Kassina, E) African Hedgehog (NT) and F) Small-spotted Cat (VU). Photos courtesy of Mrs K. York (local landowner)*

## 6.7 Aquatic Ecosystems

The proposed pipeline runs from the Southern Kalahari ecoregion in the east at Delportshoop, into the Ghaap Platreau ecoregion and then back into the Southern Kalahari ecoregion as the pipeline proceeds west. The pipeline crosses through four quaternary catchments being the C33C, C92A, D73A, D41J from east to west within the lower Vaal Water Management Area (WMA).

The Sub Quaternary Reach's (SQR's) considered in the assessment included the C92A-02988 (Vaal), C92A-02964 (Steenbokspruit), C92A-02679 (Danielskuil), C92A-02823 (Klien-Ruit) C92A-02837 (unnamed), C92A-02839 (Klien-Ruit), D73A-02705 (Groenwaterspruit), D41J-02554 (unnamed), D41J-02511 (Olifantsloop) from east to west.

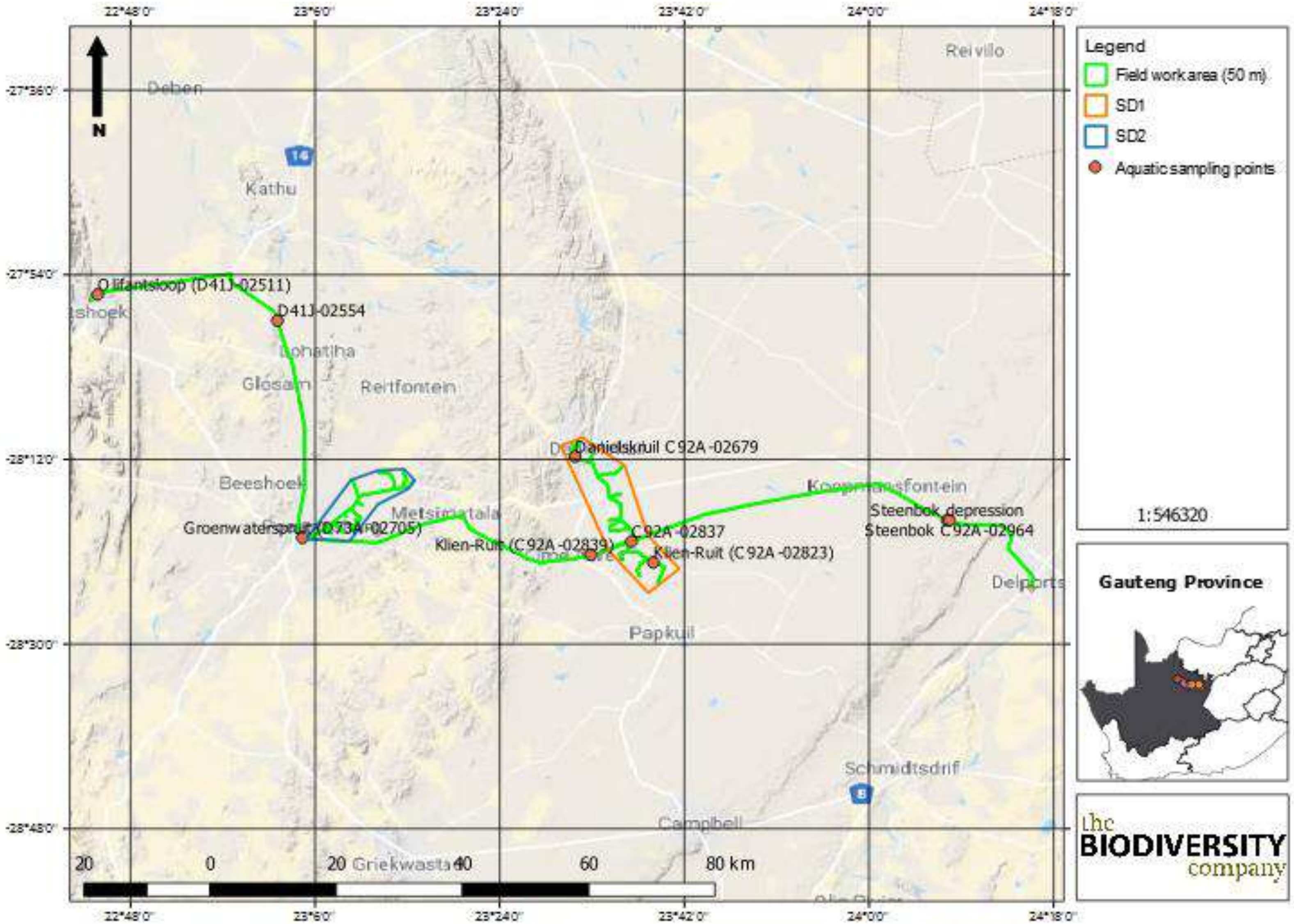



*Figure 14: Aquatic sampling points*

The Steenbok is a tributary of the Vaal system in the upper reaches of the project. The Danielskuil joins the C92A-02664 SQR to form the unnamed second order stream C92A-02837 which is a tributary of the Klein-Riet. The Klein-Riet forms a confluence with the Vaal further downstream. The Groenwaterspruit flows into a depression downstream. All these systems except the Groenwaterspruit were dry, which was artificially filled through burst pipes. These are Kalahari ephemeral watercourses where there are washes which flow into depressions and don't reach large systems as surface flow.

The sampling points selected in this study were, at each point where a SQR would be physically crossed by the proposed pipeline. The location of the sites are presented in Table 10.

*Table 10: Photographs of Survey Points considered for the study (April 2019)*

| Site | Co-Ordinates | April 2019 |
|---|---|---|
| Steenbok (C92A-02964) | -28.2989388° 24.1326358° |  |
| Steenbok Depression (C92A-02964) | -28.29950874° 24.13231764° |  |

| Site | Co-Ordinates | April 2019 |
|---|---|---|
| Danielskuil (C92A-02679) | -28.19493709° 24.52423303° |  |
| Klien-Ruit (C92A-02823) | -28.36695129° 23.65127821° |  |
| C92A-02837 | -28.333134° 23.61512538° |  |

| Site | Co-Ordinates | April 2019 |
|---|---|---|
| Klien-Ruit (C92A-02839) | -28.3551818° 23.5486166° |  |
| Groenwater spruit (D73A-02705) | -28.32721616° 23.07751246° |  |
| D41J-02554 | -27.97256192° 23.03720585° |  |

| Site | Co-Ordinates | April 2019 |
|---|---|---|
| Olifantsloop (D41J-02511) | -27.92918069° 22.75337353° |  |

### 6.7.1 Water Quality

*In situ* water quality analysis was conducted at two (2) sites with water and is presented in Table 11. Depressions with water were considered if forming part of an ephemeral channel. The Target Water Quality Range (TWQR) presented in the table below was obtained from the Target Water Quality Guidelines for Aquatic Ecosystems (DWAF, 1996).

*Table 11: In situ water quality results (April 2019)*

| Site | pH | Conductivity (mS/m) | DO (mg/l) | Temperature (°C) |
|---|---|---|---|---|
| **TWQR*** | **5.5-9.5**** | **(<700)** | **>5.00*** | **5-30*** |
| Steenbok Depression (C92A-02964) | 4.37 | 1904 | 1.56 | 14,8 |
| Groenwaterspruit (D73A-02705) | 4.73 | 866 | 1.47 | 22 |
| ***TWQR – Target Water Quality Range<br>**: Water Use License Condition Limit** | | | | |

The results of the water quality assessment indicated poor water quality for the sites assessed as they are bellow recommended limits for pH and dissolved oxygen and being above recommended limits for electrical conductivity. This is however expected for standing water such as at the Steenbok Depression (C92A-02964). The Groenwaterspruit (D73A-02705) conforms to the prescribed limits to a greater degree however isn't considered significant as it artificially fed by a burst pipe.

### 6.7.2 Aquatic Macroinvertebrates

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al*., 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing robust information for interpreting cumulative effects (Barbour *et al*., 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

#### 6.7.2.1 Invertebrate Habitat and Biotope Assessments

The invertebrate habitat at each site was assessed using the more reliable South African Scoring System version 5 (SASS5) biotope rating assessment as applied in Tate and Husted (2015). The results of the biotope assessment are provided below (Table 12).

*Table 12: Biotope scores at each site during the April 2019 survey*

| Biotope | Weighting | Groenwaterspruit (D73A-02705) |
|---|---|---|
| Stones in current | 10 | 0 |
| Stones out of current | 10 | 1 |
| Bedrock | 3 | 0 |
| Aquatic Vegetation | 5 | 2,5 |
| Marginal Vegetation In Current | 5 | 1 |
| Marginal Vegetation Out Of Current | 5 | 2,5 |
| Gravel | 4 | 1 |
| Sand | 2 | 1 |
| Mud | 1 | 3 |
| **Biotope Score** | | 12 |
| **Weighted Biotope Score (%)** | | 13 |
| **Biotope Category (Tate and Husted, 2015)** | | F |

Habitat availability within the assessed watercourses are presented however not discusses as the site is considered to be artificial. This ephemeral system is being considerably fed by a burst pipeline and not natural hydrological processes as seen in Figure 15. This doesn’t allow for the formation of natural biotopes or habitats.

*Figure 15: Source of water which fills the ephemeral channel*

#### 6.7.2.2 South African Scoring System (version 5)

The results of the SASS5 assessment for the April 2019 survey are presented in Table 13.

*Table 13: Macroinvertebrate assessment results recorded during the April 2019 survey*

| Site | SASS5 | Taxa | ASPT | *Class (Dallas, 2007) |
|---|---|---|---|---|
| **Groenwaterspruit (D73A-02705)** | 58 | 15 | 3,866667 | Class D |
| *** Southern Kalahari ecoregion<br>ASPT: Average Scope Per Taxon** | | | | |

The results of the SASS5 assessment derived SASS5 score would be classed as a Largely Modified, or class D. While some species have established themselves, this data should however be heavily scrutinised as this artificial system doesn't allow for the establishment of natural biotopes or ecosystems. It is therefore presented but not considered further.

### 6.8 Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.* 2014) was used to determine the appropriate buffer zone for the proposed activity. The DWS buffer tool recommends at a desktop level that the required buffer for high impact developments be 180 m.

A minimum buffer width (to protect core wetland habitat and aquatic functioning) is calculated based on a simple classification of wetland types and land use categories, broadly grouped as riverine and palustrine systems. Ecological and landscape characteristics are then assessed to establish the need to increase the buffer width, if at all.

The size of the pre mitigation buffer zones for the wetlands delineated within the study area is 32 m and 15 m for the construction and operational phase respectively. These buffer requirements are however expected to decrease given the successful application of recommended mitigation measures. The post mitigation buffer requirements are 18 m and 15 m for the construction and operational phases respectively. However, it is recommended that a conservative approach be opted for and the pre mitigation buffer width of 32 m adopted.

# 7 Impact Risk Assessment

Based on the information provided it is assumed that the installation of the new VGRWSS pipeline will largely parallel existing pipeline infrastructure. This inherently reduces the impacts to receiving wetlands. Nevertheless, the sheer scale of the project and number of wetlands crossings suggests that any potential impacts should not be undermined. Although most of the risks were considered low certain activities and their impacts (mainly associated with site clearing and trench excavation) are likely to take place within the delineated boundary of some wetlands (prompting the mandatory assignment of a severity rating of 5) and thus a moderate post mitigation risk. No High post mitigation risks are anticipated to occur as a result of the upgrading of the pipeline. Overall, in spite of this, the impacts associated with this critical service development are unlikely to negatively impact wetland systems to any appreciable level provided that the suggested mitigations measures are effectively implemented. Additionally, the pipeline will convey clean water, thus risks associated with leaks are considered low provided they are timeously fixed before erosion damage can occur.

The potential risks posed to wetlands as a result of the proposed project are detailed in Table 14. These ratings are based on the DWS Section 21 (c) and (i) Risk Assessment matrix. As per the DWS risk matrix guidelines all activities associated with construction, operation and decommissioning have been accounted for. Ratings are given for scenarios with mitigation. Mitigation is listed alongside each impact.

*Table 14: DWS Risk Impact Matrix for the proposed powerline*

| Activity | Aspect | Impact | Wetland Type | Severity | | | | | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Significance | Risk Rating | Control Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow Regime | Water Quality | Habitat | Biota | Severity | | | | | | | | | | | |
| **Construction** | | | | | | | | | | | | | | | | | | | |
| Site clearing and preparation | Clearing of vegetation and stripping and stockpiling topsoil as well as storage of equipment. | Direct loss, disturbance and degradation of wetlands. | SVBs | 2 | 2 | 2 | 2 | 5 | 2 | 2 | 9 | 2 | 1 | 5 | 1 | 9 | 81 | M | • Restrict the disturbance footprint to within 25 m on either side of the proposed pipeline route.<br>• Request the wetland spatial data from TBC, load it onto a GPS and use it to mark out the positions where the pipeline will enter and exits the 32 m buffer on the boundary of a wetland. Try to reduce the 25 m disturbance footprint nd the unnecessary clearing of vegetation on either side of the trench as far as possible when traversing wetlands.<br>• Demarcate with high visibility plastic fencing<br>• Signpost the area beyond the construction footprint as an environmentally sensitive area and keep all excavation, soil stockpiling, general access and construction activities out of this area.<br>• Construct the boreholes and reticulation network during winter when flow volumes are lowest. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest |
| | | | IVBs | 1 | 1 | 1 | 1 | 5 | 2 | 2 | 9 | 3 | 1 | 5 | 1 | 10 | 90 | M | |
| | | | ENDs | 1 | 1 | 1 | 1 | 5 | 2 | 2 | 9 | 3 | 1 | 5 | 1 | 10 | 90 | M | |
| | | | EXDs | 1 | 1 | 1 | 1 | 5 | 2 | 2 | 9 | 3 | 1 | 5 | 1 | 10 | 90 | M | |

| Activity | Aspect | Impact | Wetland Type | Severity | | | | | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Significance | Risk Rating | Control Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow Regime | Water Quality | Habitat | Biota | Severity | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | during this time. |
| | | Increased bare surfaces, runoff and potential for erosion | SVBs | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | 3 | 3 | 1 | 1 | 8 | 48 | L | • Apply the above-mentioned mitigation.<br>• Keep trench excavation neat and tidy. Only stockpile on one side of the trench.<br>•Limit construction activities to the dry season when storms are least likely to wash concrete and sand into wetlands.<br>• Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash.<br>• Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished.<br>• Do not situate any of the construction material laydown areas within any wetland.<br>• No machinery should be allowed to parked in any wetlands.<br>• Ensure topsoil is spread back over trench area.<br>• Landscape and lightly till (no deeper than 30 cm) denuded areas to encourage vegetation establishment as soon as possible. |
| | | | IVBs | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 5 | 3 | 1 | 1 | 1 | 6 | 30 | L | |
| | | | ENDs | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 5 | 3 | 1 | 1 | 1 | 6 | 30 | L | |
| | | | EXDs | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 5 | 3 | 3 | 1 | 1 | 8 | 40 | L | |
| | | Degradation of wetland vegetation and the introduction and spread of alien and invasive | SVBs | 1 | 1 | 3 | 1 | 1.5 | 1 | 2 | 4.5 | 3 | 3 | 5 | 1 | 12 | 54 | L | • Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) |
| | | | IVBs | 1 | 1 | 2 | 1 | 1.3 | 1 | 2 | 4.3 | 3 | 1 | 5 | 1 | 10 | 43 | L | |
| | | | ENDs | 1 | 1 | 2 | 1 | 1.3 | 1 | 2 | 4.3 | 3 | 1 | 5 | 1 | 10 | 43 | L | |

| Activity | Aspect | Impact | Wetland Type | Severity | | | | | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Significance | Risk Rating | Control Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow Regime | Water Quality | Habitat | Biota | Severity | | | | | | | | | | | |
| | | vegetation | EXDs | 1 | 1 | 3 | 1 | 1.5 | 1 | 2 | 4.5 | 3 | 3 | 5 | 1 | 12 | 54 | L | must be removed.<br>• The use of herbicides is not recommended in or near wetlands (opt for mechanical removal).<br>• Appropriately stockpile topsoil cleared from the study area.<br>• Clearly demarcate construction footprint, and limit all activities to within this area.<br>• Minimize unnecessary clearing of vegetation.<br>• Landscape and re-vegetate all denuded areas as soon as possible. |
| Installation of infrastructure | Trench excavation | Increased sediment loads to downstream reaches | SVBs | 2 | 2 | 2 | 2 | 5 | 2 | 2 | 9 | 3 | 3 | 1 | 1 | 8 | 72 | M | • See mitigation for increased bare surfaces, runoff and potential for erosion<br>• Re-instate topsoil and lightly till disturbance footprint.<br>• At all crossings install sandbags on downstream side of the footprint to trap sediment until the site has been constructed and vegetation has re-established. |
| | | | IVBs | 1 | 1 | 1 | 1 | 5 | 2 | 2 | 9 | 3 | 1 | 1 | 1 | 6 | 54 | L | |
| | | | ENDs | 3 | 3 | 3 | 3 | 5 | 2 | 2 | 9 | 3 | 1 | 1 | 1 | 6 | 54 | L | |
| | | | EXDs | 1 | 1 | 1 | 1 | 5 | 2 | 2 | 9 | 3 | 1 | 1 | 1 | 6 | 54 | L | |
| | | Contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as Contamination and eutrophication of wetland systems with human sewerage and | SVBs | 2 | 2 | 2 | 3 | 2.3 | 2 | 2 | 6.3 | 3 | 2 | 5 | 1 | 11 | 69 | M | • Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility.<br>• Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on |
| | | | IVBs | 1 | 2 | 1 | 2 | 1.5 | 2 | 2 | 5.5 | 3 | 1 | 5 | 1 | 10 | 55 | L | |
| | | | ENDs | 1 | 2 | 1 | 2 | 1.5 | 2 | 2 | 5.5 | 3 | 1 | 5 | 1 | 10 | 55 | L | |

| Activity | Aspect | Impact | Wetland Type | Severity | | | | | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Significance | Risk Rating | Control Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow Regime | Water Quality | Habitat | Biota | Severity | | | | | | | | | | | |
| | | litter. | EXDs | 2 | 3 | 2 | 2 | 2.3 | 2 | 2 | 6.3 | 3 | 2 | 5 | 1 | 11 | 69 | M | site (e.g. concrete) in such a way as to prevent them leaking and entering the north-western seep.<br>• Mixing of concrete must under no circumstances take place within the permanent or seasonal zones of the wetland.<br>• Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter.<br>• Provide appropriate sanitation facilities during construction and service them regularly.<br>• Monitor water quality in significant springs and beneath the bridge along the Groenwaterspruit in Postmasburg. |
| | Backfilling of trench | Disruption of wetland soil profile and alteration of hydrological regime | SVBs | 3 | 2 | 2 | 2 | 5 | 2 | 3 | 10 | 3 | 3 | 5 | 3 | 14 | 140 | M | • Document the soil profile on removal and check the order in which soil is replaced.<br>• Ensure that topsoil is appropriately stored and re-applied during trench backfilling.<br>• Make sure that the soil is backfilled and compacted to accepted geotechnical standards to avoid flow canalisation along the trench and the potential for sinkhole formation. |
| | | | IVBs | 1 | 1 | 1 | 1 | 5 | 2 | 3 | 10 | 2 | 1 | 5 | 1 | 9 | 90 | L | |
| | | | ENDs | 1 | 1 | 1 | 1 | 5 | 2 | 3 | 10 | 2 | 1 | 5 | 1 | 9 | 54 | L | |
| | | | EXDs | 1 | 1 | 1 | 1 | 5 | 2 | 3 | 10 | 2 | 1 | 5 | 1 | 9 | 54 | L | |
| **Operation** | | | | | | | | | | | | | | | | | | | |

| Activity | Aspect | Impact | Wetland Type | Severity: Flow Regime | Severity: Water Quality | Severity: Habitat | Severity: Biota | Severity: Severity | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Significance | Risk Rating | Control Measures |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Routine operation and monitoring | Pipeline leaks | Increased water inputs (clean) to downstream wetlands | SVBs | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 3 | 1 | 5 | 1 | 10 | 40 | L | • Conduct regular inspections along the pipeline route and fix leaks timeously.<br>• Monitor water quality regularly at pump stations. |
| | | | IVBs | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 3 | 1 | 5 | 1 | 10 | 40 | L | |
| | | | ENDs | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 3 | 1 | 5 | 1 | 10 | 40 | L | |
| | | | EXDs | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 3 | 5 | 5 | 1 | 14 | 56 | L | |
| **Decommissioning** | | | | | | | | | | | | | | | | | | | |
| Removal of pipeline ad borehole infrastructure | Vehicle access | Degradation of wetland vegetation and proliferation of alien and invasive species | SVBs | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 5 | 3 | 2 | 5 | 1 | 11 | 55 | L | • See mitigation for the impacts on direct loss, disturbance and degradation of wetlands and spread of alien and invasive plants. |
| | | | IVBs | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 5 | 3 | 1 | 5 | 1 | 10 | 50 | L | |
| | | | ENDs | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 5 | 3 | 1 | 5 | 1 | 10 | 50 | L | |
| | | | EXDs | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 5 | 3 | 2 | 5 | 1 | 11 | 55 | L | |
| | Re-excavation of trench and backfilling of wetland soils | Disruption of wetland soil profile, hydrological regime and increased sediment loads | SVBs | 3 | 2 | 2 | 2 | 2.3 | 2 | 1 | 5.3 | 3 | 2 | 5 | 2 | 12 | 63 | M | • See mitigation for increased bare surfaces, runoff and potential for erosion and increased sediment loads during construction<br>• See mitigation for Disruption of wetland soil profile and alteration of hydrological regime |
| | | | IVBs | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 3 | 1 | 5 | 2 | 11 | 44 | L | |
| | | | ENDs | 2 | 1 | 1 | 1 | 1.3 | 2 | 1 | 4.3 | 3 | 1 | 5 | 2 | 11 | 47 | L | |
| | | | EXDs | 3 | 2 | 2 | 2 | 2.3 | 2 | 1 | 5.3 | 3 | 2 | 5 | 2 | 12 | 63 | M | |

# 8 Conclusion and Specialist Recommendation

Considering the status and functioning of the wetland ecosystems, and furthermore the nature and requirements of the project, the proposed VGRWSS pipeline upgrade will result in minimal disturbance to wetlands (local to regional scale influence). Aquatic habitat is limited on site and the risks posed to aquatic ecosystems considered low. Consequently, the construction and operation of the pipeline is not anticipated to pose significant threats to the receiving wetlands and aquatic ecosystems, provided the mitigation measures stipulated in this report are effectively implemented.

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# APPENDIX H3

HERITAGE IMPACT ASSESSMENT

# McGregor Museum
# Department of Archaeology

**Phase 1 Heritage Impact Assessment for the proposed Upgrade of the Vaal Gamagara Regional Water Supply Scheme Phase 2**

Abenicia Henderson assisted by Jani Louw

May 2019

**Phase 1 Heritage Impact Assessment for the proposed Upgrade of the Vaal Gamagara Regional Water Supply Scheme Phase 2**

Abenicia Henderson assisted by Jani Louw
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McGregor Museum, Kimberley
May 2019

## 1. INTRODUCTION

The McGregor Museum archaeology department was subcontracted by Nemai Consulting (contact: Samantha Gerber 147 Bram Fischer Driver Ferndale, email: samathahag@nemai.co.za; Donavan Henning 147 Bram Fischer Drive Ferndale, email donavanh@nemai.co.za) to conduct a Phase 1 Heritage Impact Assessment with focus on archaeology around the proposed Vaal Gamagara Regional Water Supply Scheme Phase 2 that runs from Delportshoop to Olifantshoek, Northern Cape Province. Njabulo Mkhosana of NM Environmental (tel: 065 921 9371. email: nmkhosana@nmenvironmental.co.za) provided details of the extent of the proposed Vaal-Gamagara Water Supply Upgrade Scheme which starts at Delportshoop WTW runs past the towns Ulco, Lime Acres and Postmasburg and ends at Olifantshoek. Contact details of relevant people to gain access to the landscape for assessment purposes was also provided.

During site visits by Abenicia Henderson and Jani Louw the week 15-17 May 2019 successive portions of the landscape in question were visited and archaeological observations made. Some parts of the properties could not be accessed and the individuals/organizations concerned could not be approached.

This report gives provisional insight into the archaeological heritage resources to be found and expected to occur in the proposed footprint.

Field notes and photographs are lodged with the McGregor Museum, Kimberley.

### 1.1. Focus and Content of Specialist Report: Heritage

This archaeology and heritage specialist study is focused on the site of the proposed development.

This study outlines:

- Introduction, explaining the focus of the report (1.1) and introducing the author in terms of qualifications, accreditation and experience to undertake the study (1.2)
- Description of the affected environment (2) providing background to the development and its infrastructural components (2.1); background to the heritage features of the area (2.2); and defining environmental issues and potential impacts (2.3)
- Methodology (3) including an assessment of limitations (3.1).
- Observations and assessment of impacts (4); Specific observations (4.1); characterizing archaeological significance (4.2); and Summary of significance of impacts (4.3).
- Measures for inclusion in a draft Environmental Management Plan for the development are set out in tabular form (5).
- Conclusions (6).

### 1.2. Author of this Report

The author is independent of the organization commissioning this specialist input, and provides this heritage assessment (archaeology and colonial history but not palaeontology) within the framework of the National Heritage Resources Act (No 25 of 1999).

The author (Abenicia Henderson) is a qualified archaeologist (Honours) and has worked as a field assistant previously in the Eastern Cape and now Northern Cape (under the guidance of Dr. David Morris) jointly for just under 6 years.

Jani Louw is a qualified archaeologist (Mphil) who has worked as an intern at the McGregor Museum through 2017-19.

Dr David Morris as supervisor who is a professional archaeologist (PhD) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists.

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites/places, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This means that a Heritage Impact Assessment should be performed, resulting in a specialist report as required by the relevant heritage resources authority/ies to assess whether authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

Where archaeological sites and palaeontological remains are concerned, the South African Heritage Resources Agency (SAHRA) at national level acts on an agency basis for the Provincial Heritage Resources Agency (PHRA) in the Northern Cape. The Northern Cape Heritage Resources Authority (formerly called Ngwao Bošwa ya Kapa Bokone) is responsible for the built environment and other colonial era heritage and contemporary cultural values.

## 2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The proposed pipeline route extends between the Vaal River near Delportshoop to the vicinity of Olifantshoek. The study area is underlain by Ventersdorp rocks of the Vaal basin, the Precambrian dolomites of the Ghaap plateau and the combination of dolomite, banded ironstone, manganese and quartzite of the Kuruman Hills.

Superficial sediments of late Cenozoic age include aeolian sands of the Gordonia Formation (Kalahari Group), calcrete hardpans, colluvial banded ironstone surface rubble and scree, river alluvium and pan deposits. The Gordonia Formation aeolian sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle et al., 1983, p. 291, cited by Almond 2013:14). (The recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch - Almond 2013).

West from Lime Acres towards Postmasburg and Olifantshoek the general terrain is characterized by a number of low rising dolerite outcrops, with the geological substrate, a combined dolerite and banded iron stone surfacing at intervals.

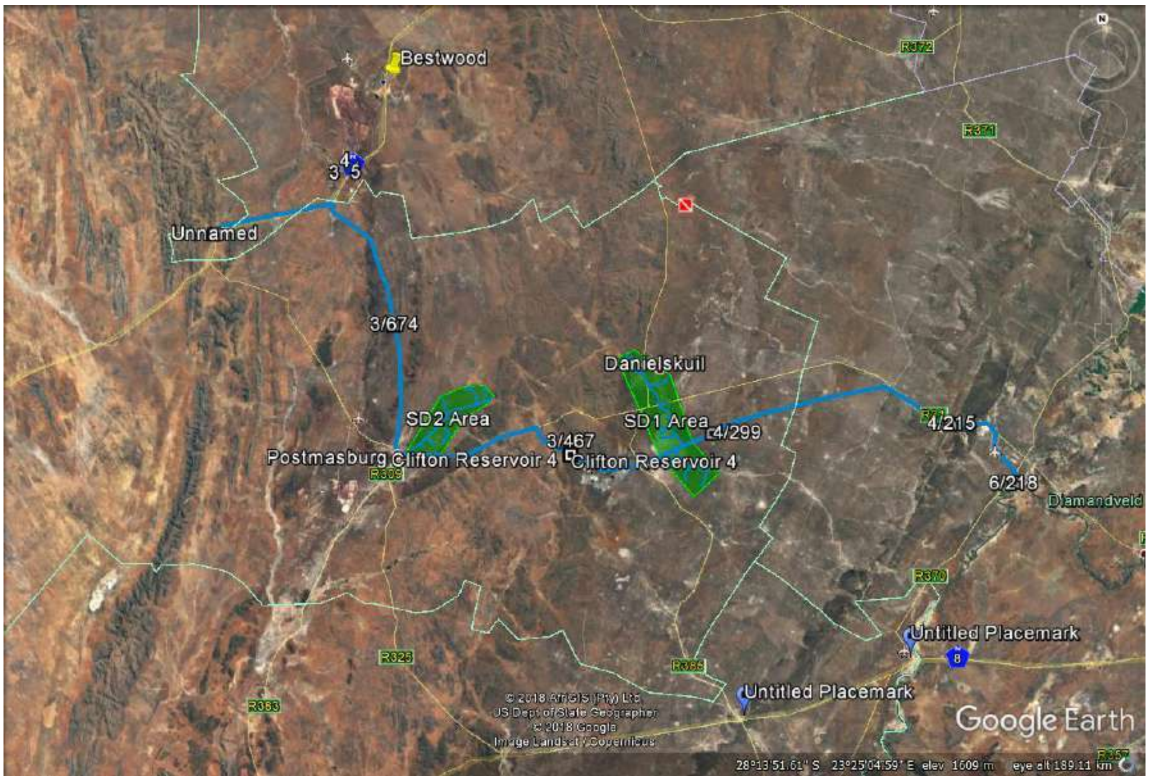


Figure1: Proposed pipeline route for the Vaal Gamagara Water Supply Upgrade (VGWSU)

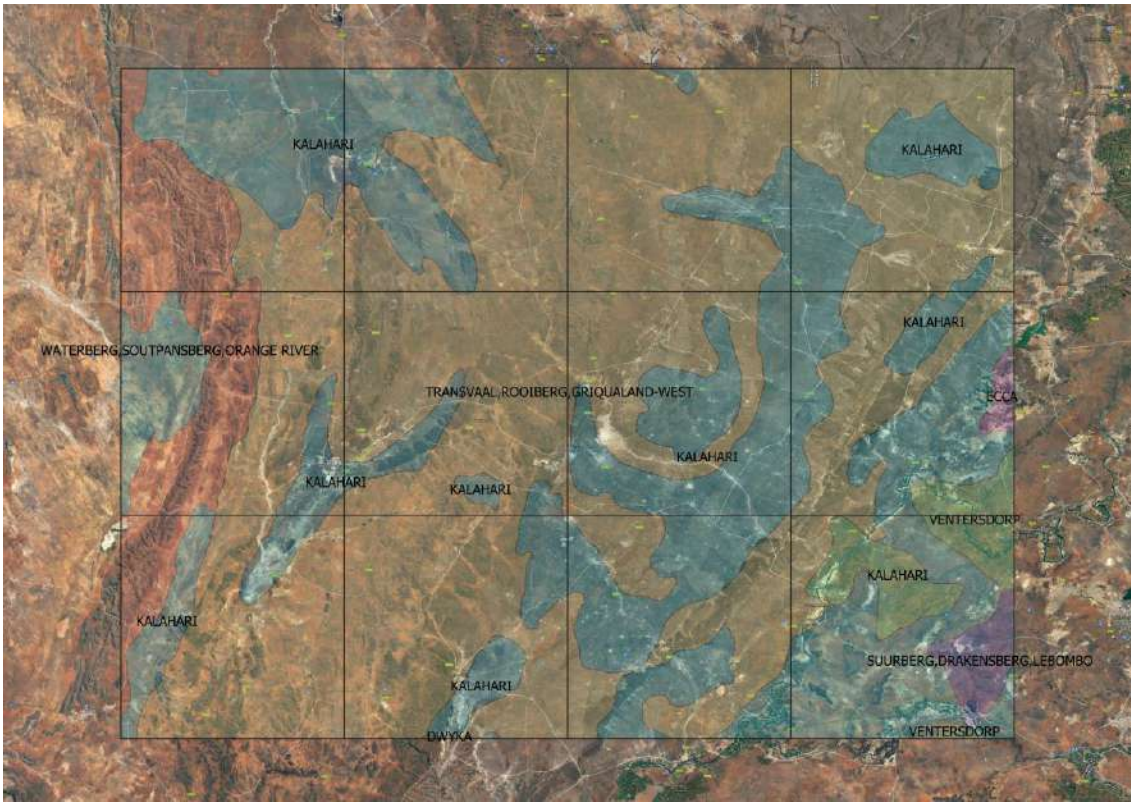

Figure 1b: Geological sequence of VGWSU

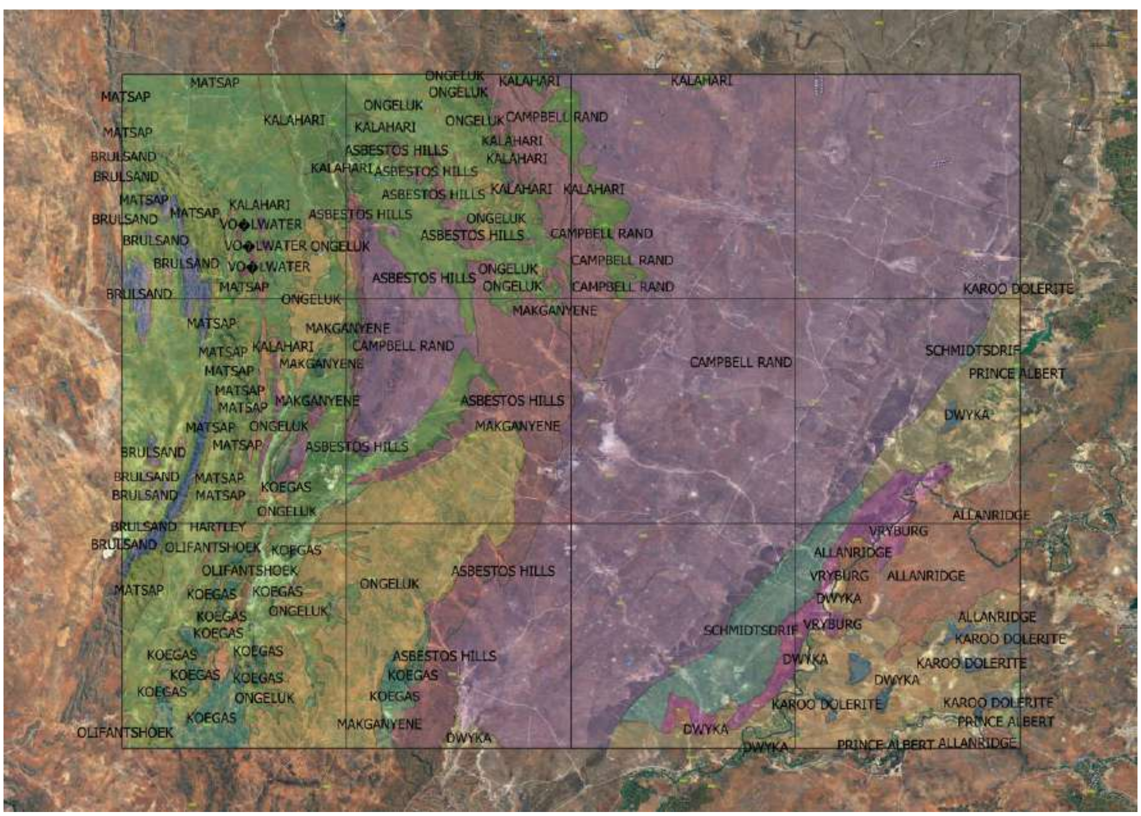

Figure1c: Lithographic view of VGWSU

Figure 2: Plant where water is drawn from the Vaal River

Figure 3:  Area within the proposed footprint opposite Sedibeng water

Figure 4: Old Delportshoop and Ulco road from 1930s (adjacent to area proposed for the second pipeline)

Figure 5: Piles from previously constructed pipeline built in 1968

Figure 6: Area within SD1 footprint

Figure 7: Kneukel Pump Station

Figure 8: Clifton Reservoir area

Figure 9: Groenwater

Figure 10: Area within footprint 3km from Groenwater where old cemetery is

Figure 11: Area within footprint near Metsimatala

Figure 12: Area within  footprint 2.57km Soutwest of Metsimatala

Figure 13: Dolomite exposures on Farm next to New Gloucester Reservoir (Glossam)

Figure 14: Old pipeline just near Boskop Farm and mine (en route to Olifantshoek)

Figure 15: Identified New reservoir in Olifantshoek

## 2.1. Project components

A detailed proposal for and background to the Vaal Gamagara Water Supply Upgrade Scheme project has been provided by Nemai Consulting. The new scheme will be used in conjunction with the existing scheme that  transfers water from Delportshoop on the Vaal River (60km NW of Kimberley) via Postmasburg to the mines north of there. The route and affected areas of impact  for the new proposed scheme is outlined Figure 1.

### 2.2 Background to the heritage features of the area

The archaeology of the Northern Cape is rich and varied, covering long spans of human history. Stone Age material found in this area spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times. Late Iron Age inhabitation is not as yet well documented (see Beaumont and Morris 1990 for the Kathu area; Morris & Seliane 2008 for the Taung area ). Of note in the area near Limeacres are rock engraving sites on dolomite exposures outside the town and at Danielskuil. Known rock engraving sites are recorded on the properties Ouplaas, Boplaas, Klipvlei and Carter Block (Wilman 1933; Morris 2009; Morris 2014; McGregor Museum records; Morris & Beaumont 2014). Rock paintings occur in the shelters along the Ghaap escarpment, as well as in the Kuruman Hills, Asbestos Mountains and the Langeberg (Fock and Fock 1989).

The Ghaap Escarpment traversed by the pipeline at Ulco contains shelters rich in archaeological traces (Humphreys & Thackeray 1984) but is perhaps most notable for its fossil sites such as that at which the Taung Skull was found, at Buxton (Beaumont & Morris 1990).

Groot Kloof about 3km south of Ulco. The site bears significant archaeological and paleontological deposits, a result of the karstic deposits that in turn create tufa fan deposits and eroded tufas rich in archeological and fossil-bearing sediments (Curnoe et al 2006).

Further west near Postmasburg is the renowned specularite sited Tsantsabane and Blinkklipkop (Humphreys and Thackery 1983), just north of the pipeline route. Further afield are the major sites Wonderwerk Cave, and Kathu  a suite of sites around sink-hole depressions and raw material sources (Wilman 1933; Humphreys & Thackeray 1983; Beaumont & Morris 1990; Morris & Beaumont 2004; Wilkins & Chazan 2012; McGregor Museum records).

Historical events relating to the conquest of the Southern Tswana unfolded mainly to the north, e.g. at Phokwane, Koning, Dithakong, and in conflicts in the Langeberg in 1878 and 1897 (Shillington 1985). Colonial settlement followed conquest, while mining has burgeoned since the mid-twentieth century.

Some areas are richer in archaeological traces than others, and not all sites are equally significant. Heritage impact assessments are a means to facilitate development while ensuring that what should be conserved is saved from destruction, or adequately mitigated and/or managed.

**2.3 Environmental issues and potential impacts**

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear developments can have a permanent destructive impact on these resources in cases where they are impacted. The objective of this study is to assess the significance of such resources, where present, and to recommend no-go or mitigation measures (where necessary) to facilitate or constrain the development. Area impacts would occur where the pipeline will be drilled in the locale under consideration.

The route proposed to construct the pipeline includes sections parallel with the existing pipeline. The linear development is expected to have relatively minimal impact on the heritage/archaeological resources of the area. Number of broad expectations/concerns might be expressed for this vicinity:

2.3.1. Based on previous experience in the area, the terrain is likely to include a generally low density and widespread occurrence of mainly Pleistocene Stone Age material as "background scatter" . It would tend to occur on calcrete where exposed, or in the lower margins of aeolian sands that veneer the landscape.

2.3.2. The particularly dolomite area is known to be rich in fossils, Precambrian stromatolites and Pleistocene fauna and tufa deposits. So a Palaeo-exposure is noted at 28°19'35.60"S 23° 4'43.10"E. Features such as hills and rocky outcrops are minimal on the proposed footprint which in other parts of this landscape provide shelter or relatively resource-rich micro-habitats that attracted people particularly of the Later Stone Age.

2.3.3. Considerable historical and recent surface disturbance has already occurred within the servitude resulting from the construction of a gravel road in the 1930s and pipeline 1968. Rock piles were noted from the disturbance. The implications are that the chances of *in situ* Stone Age occurring in the servitude are minimal.

2.3.4. In the adjacent landscape in places mining has taken place or is currently active ( i.e. Koopmansfontein, Ulco, Lime acres, Postmasburg and the iron-ore, manganese belt north of Postmasburg

2.3.5. Significant intangible heritage values are not expected to be attached to the servitude itself which in most places is a much-modified area. Large and small scale mining, has sprouted in the area a social landscape and a transformed late capitalist, generating material traces as noted above.

## 3. METHODOLOGY

The area proposed for servitude was partially inspected on foot on 15-17 May 2019. Access could not be gained to some of the properties due to gates being locked, overgrown vegetation, mines and no entry signs. Where possible an assessment was made of the significance of heritage traces present.

### 3.1 Assumptions and Limitations

The areas for proposed impact encompass the railway to farms, mines and various residentially zoned areas, which made some areas inaccessible due to stringent access policies.

It was assumed that, by and large in this landscape, with its shallow soil profiles, and erosional regime over much of the terrain that some sense of the archaeological traces to be found in the area would be readily apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features). It was not considered necessary to conduct excavations as part of the assessment to establish the potential of sub-surface archaeology.

A proviso is routinely given, that should sites or features of significance be encountered during construction (this could include an unmarked burial, an ostrich eggshell water flask cache, or a high density of stone tools, for instance), specified steps are necessary (cease work, report to heritage authority).

With regard to fossils, a preliminary assessment of the likelihood of their occurring here should be obtained from a palaeontologist; this report does not address palaeontology.

## 4. OBSERVATIONS AND ASSESSMENT OF IMPACTS

The manner in which archaeological and other heritage traces or values might be affected by proposed Upgrade of the Vaal-Gamagara Regional Water Supply Scheme phase 2 may be summed up in the following terms: it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999). The expected impact in this instance would be area disturbances in already disturbed vicinity.

Relative desktop predictions (2.3 above), it was found that the area had a generally low density of dispersed surface artefacts of limited significance. Some areas within the footprint were covered in vegetation at the time of the visit which limited visibility in areas where rock outcrops or soil erosion did not occur. There was a background scatter of lithics sometimes in dense concentrations especially where the jaspilite outcrops occur 7km NW from Lime Acres, North of the proposed pipeline. There were no archaeological traces found on the northern side of the main proposed pipeline here however, where secondary pipes are to be lain. The impact of the development seems to be of low significance here and no further mitigation is considered necessary.

### 4.1 Fieldwork observations

The area for the new proposed pipeline by Abenicia Henderson and Jani Louw was visited from the 15-17 May 2019. The assessment was done over a period of three days and various employees from Sedibeng water assisted us in areas that fall under their jurisdiction and in advising on access to properties along the route.

#### 4.1.1 Occurrence of Stone Age traces:

Most of the area within the servitude during the survey, was found to have minimal traces of in-situ archaeological materials. The observations that are presented here indicate specific instances that provide a sense of the range of heritage resources along the servitude, with a limited number of medium and high significance occurrences.

By and large generally low density and poor integrity heritage traces were found in the development footprint areas, comprising usually jaspilite flakes and cores as isolated surface occurrences in densities less, and often significantly less, than 1/m$^2$. The higher density end of the spectrum occurs in areas where banded ironstone rubble is exposed at the surface.

**Table1: Plotted artefact scatters and observations made.**

| | Latitude (S) | Longitude (E) | Comment | Significance |
|---|---|---|---|---|
| 2 | 28°23'35.8" | 24°16'11.9" | Graves found near turn pipe | HIGH |
| 3 | 28°23'34.8" | 24°16'13.2" | Isolated flake found on low hill | LOW |
| 5 | 28°23'33.2" | 24°16'12.2" | Widely dispersed MSA flakes exposed on surface slope. | LOW |
| 6 | 28°23'31.1" | 24°16'08.6" | Isolated large MSA flake | LOW |
| 7 | 28°23'28.4" | 24°16'06.4" | Isolated flake near disturbed calcrete area | LOW |
| 8 | 28°23'28.6" | 24°16'04.5" | Quartzite flakes on exposed roadway | LOW |
| 9 | 28°23'21.5" | 24°16'04.6" | Isolated occurrences of Pleistocene flakes and cores | LOW |
| 10 | 28°23'20.5" | 24°16'03.4" | Chert, quartzite and jaspilite flakes. Flakes are found about a meter apart along a road exposure. | LOW |
| 11 | 28°23'16.5" | 24°16'01.2" | Pleistocene dispersed flakes | LOW |
| 12 | 28°21'42.1" | 24°14'35.1" | Quartzite flakes surface scatter | LOW |
| 13 | 28°19'51.9" | 24°13'56.9" | Surface scatter of artefacts in low density | LOW |
| 14 | 28°19'26.6" | 24°14'04.5" | Surface scatter of artefacts on open exposure | LOW |
| 16 | 28°18'19.1" | 24°09'11.5" | Artefacts observed in gravel that was brought in | LOW |
| 20 | 28°20'26.1" | 23°24'28.0" | Clifton Reservoir high concentration of banded iron stone cores and flakes in dense concentration. | MEDIUM |
| 21 | 28°20'25.0" | 23°24'27.0" | Dense Pleistocene surface scatter | MEDIUM |
| 22 | | | Jaspilite flake and cores in high density | MEDIUM |
| 23 | 28°20'17.6" | 23°24'22.5" | Pile of Banded Iron Stone found near old pipeline outlet with dispersed artifact scatter | LOW |
| 24 | 28°22'28" | 24°41'12.1" | Quartzite flakes surface scatter | LOW |
| 25 | 28°22'28.9" | 23°41'12.1" | Subsurface artefact exposure | LOW |
| 26 | 28°22'26.4" | 23°41'13.6" | LSA low density surface scatter exposed on open surfaces | LOW |
| 27 | 28°22'26.0" | 23°41'11.7" | Isolated occurrence of Pleistocene flakes in low density | LOW |
| 28 | 28°20'29.7" | 23°35'31.7" | Surface scatter of artefacts in | LOW |

| | | | | |
|---|---|---|---|---|
| | | | low density | |
| 38 | 28°17’30.6” | 23°20’26.3” | Cemetery (just outside footprint area) | HIGH |
| 39 | 28°17’33.5” | 23°20’26.9” | Possible Fauresmith handaxe found near what looks like mine trench | LOW |
| 40 | 28°17’14.5” | 23°19’05.0” | LSA flakes in high concentration but isolated to this area | MEDIUM |
| 41 | 28°17’59.0” | 23°17’59.0” | Pleistocene flakes predominant in sandy area. | LOW |
| 42 | 28°17'14.50" | 23°19'5.00" | Low density of artefacts visible where rock exposure occurs | LOW |
| 44 | 28°19’56.4” | 23°08’14.7” | Surface scatter of artefacts in low density | LOW |
| 45 | 28°18'17.30" | 23°16'32.80" | Surface scatter of artefacts on farm 4 km from Metsimatala | LOW |
| 47 | 28°19'35.60" | 23° 4'43.10" | Palaeo surface exposure | LOW |

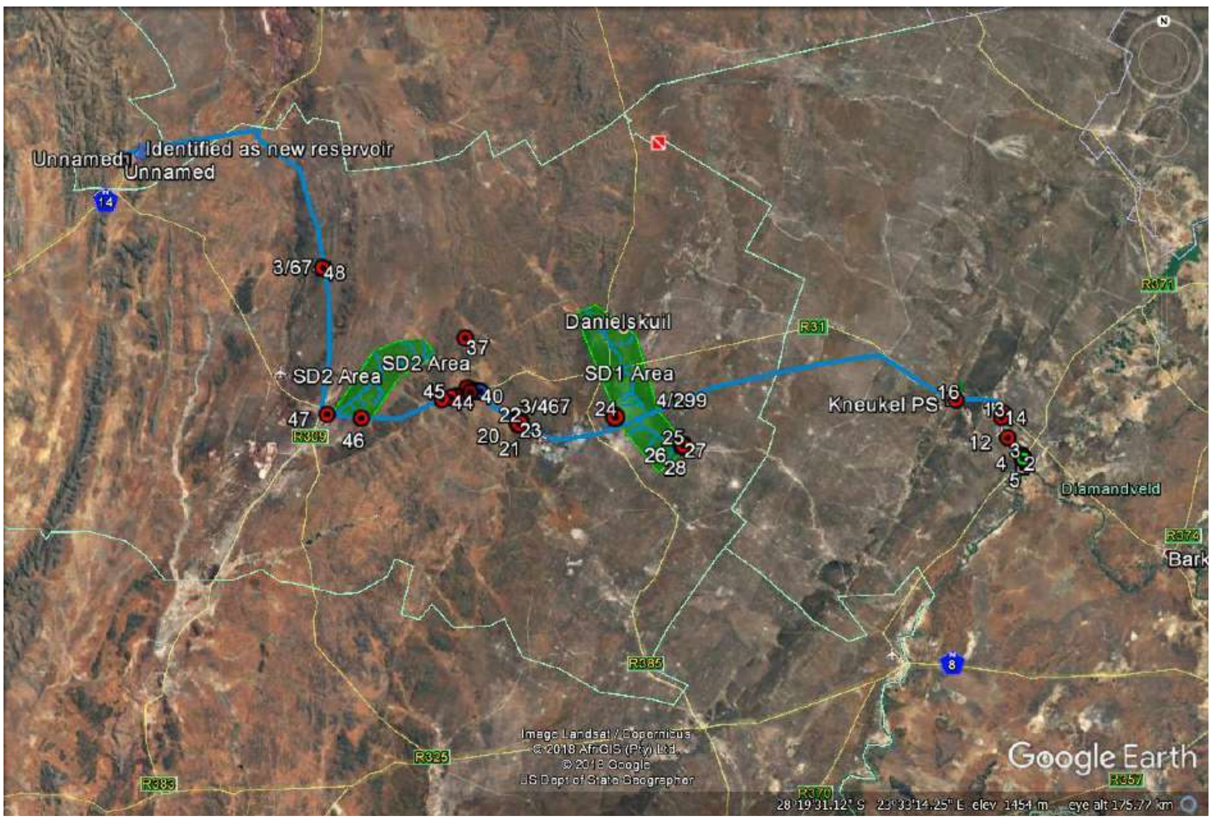

Figure 16: Plotting of archaeological observations as tabulated in Table 3.


Figure 16b:

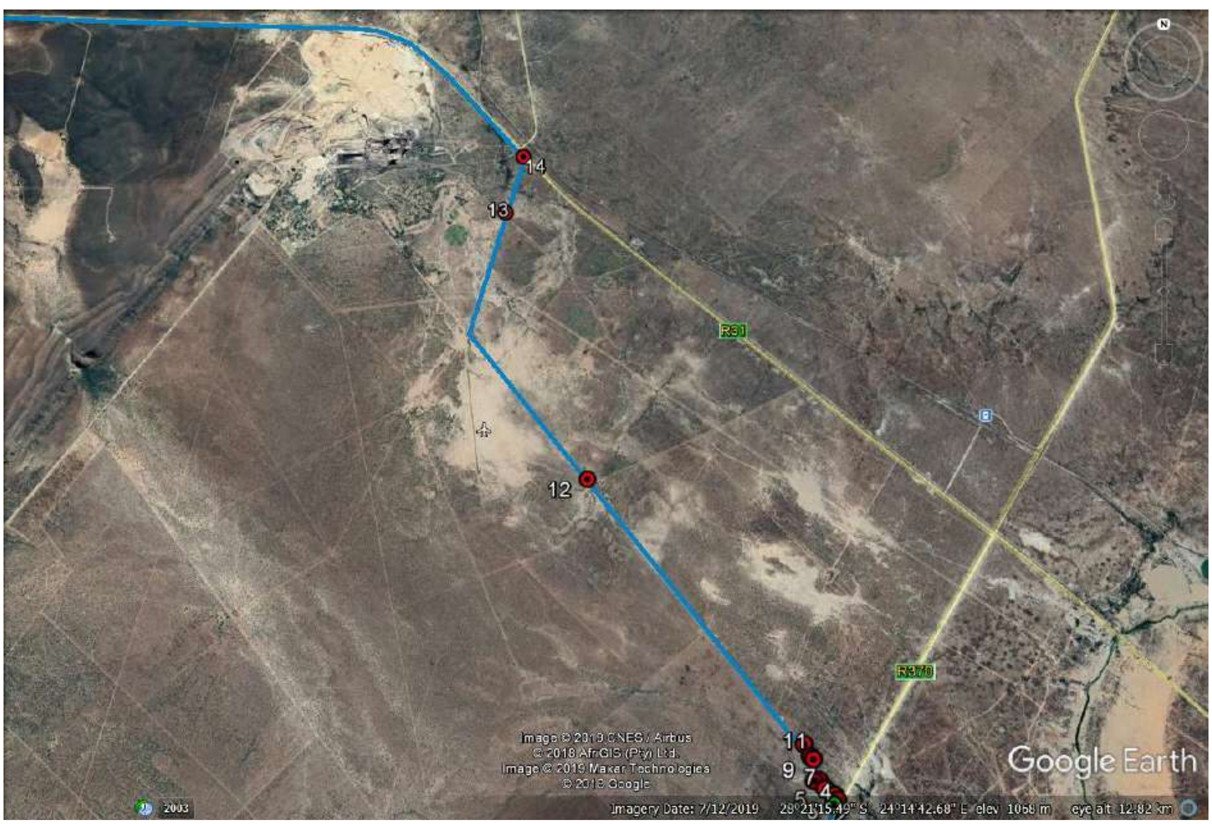


Figure 16c:

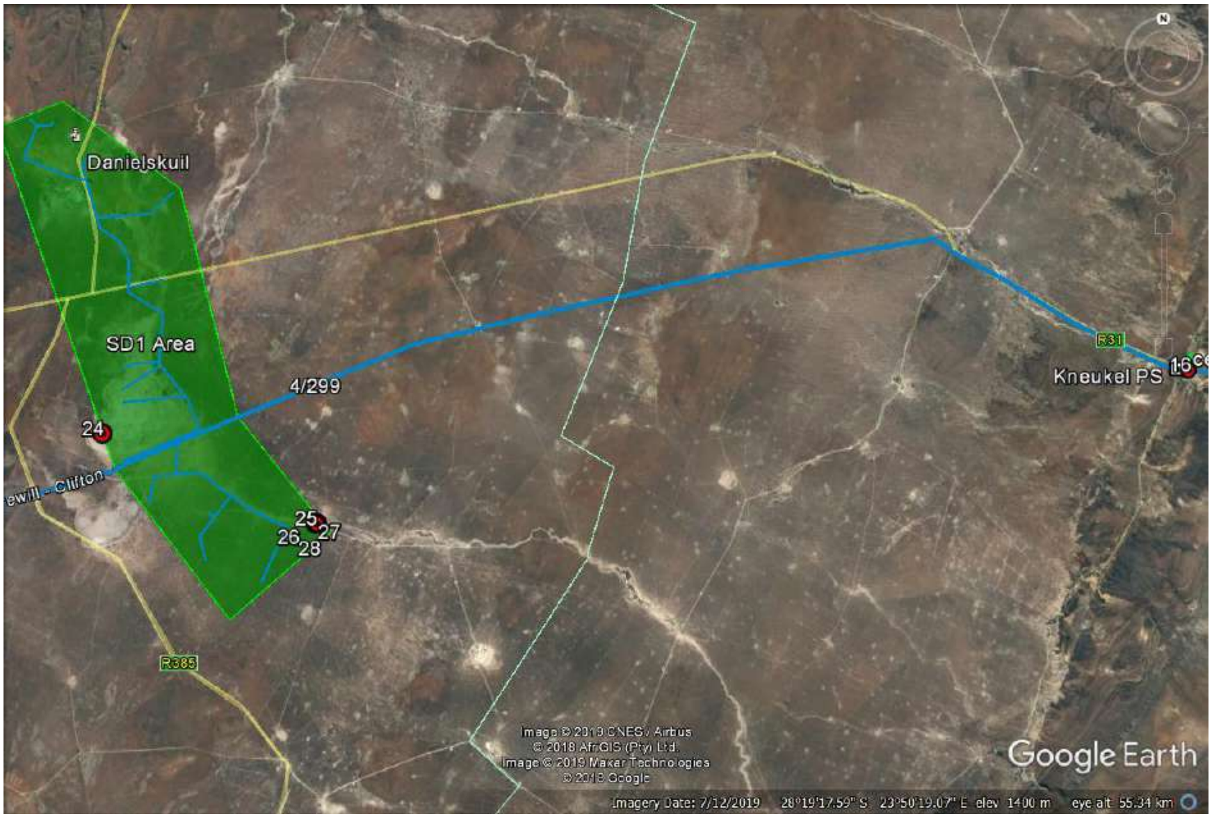

Figure 16d

Figure 16e


Figure 16f


Figure: 16g

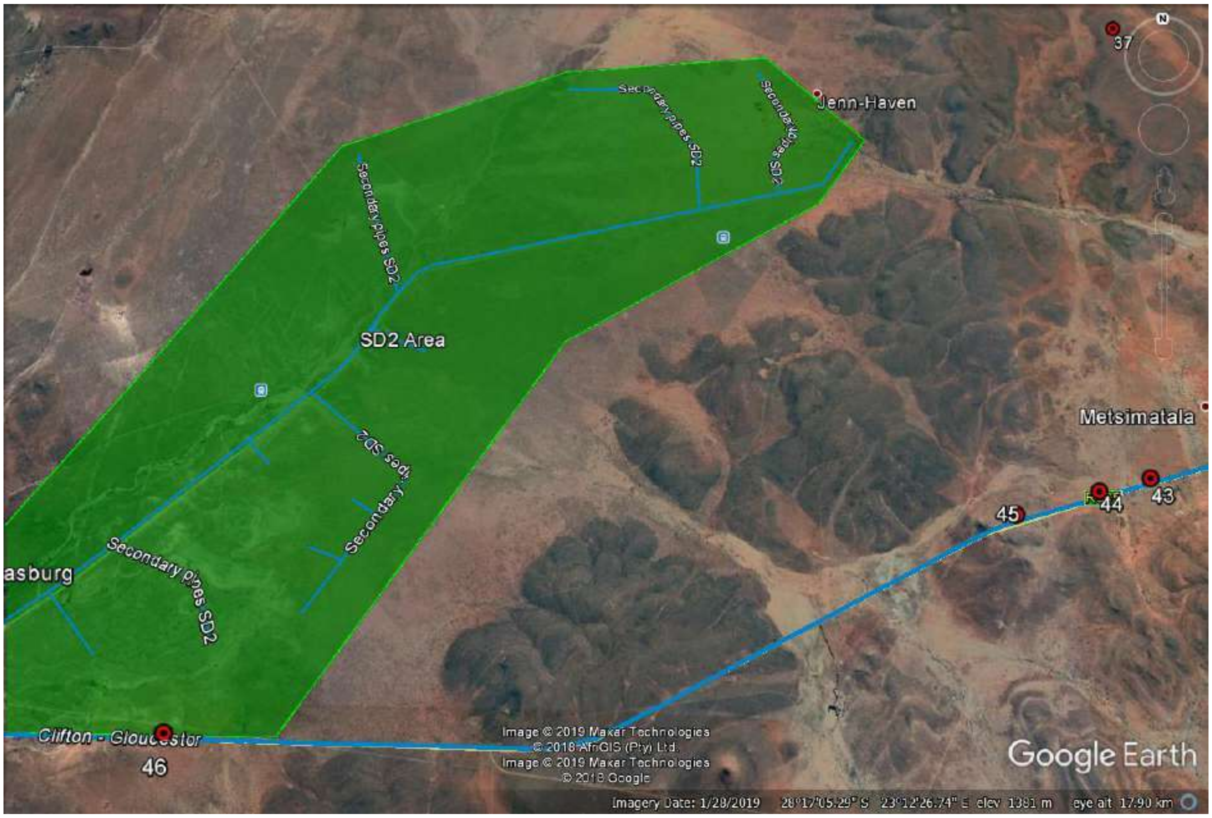

Figure: 16h

Figure: 16i

***A generally low density and widespread occurrence of mainly*** MSA and some LSA material was found to have occurred as predicted with indications of this being generally isolated stone tools or background scatters on exposed substrate and gravel layers, often in poor or secondary context. The artefacts noted are not likely to be in situ or complete and cannot be construed as being significant occurrences.

Figure 17: Observation 5

Figure 18: Observation 10

Figure 19: Observation 12

Figure 20: Observation 20

Figure 21: Observation 26

Figure 22: Observation 40

Figure 23: Observation 45

***The absence of features such as hills or rocky outcrops*** within the servitude precluded the possibility of rock engravings.

***Considerable historical and recent surface disturbance had already occurred over the servitude*** Graves were found at two localities close to the proposed route, the first at $28^{0}$ 23’ 35.8”S $24^{0}$ 16’ 13.2” E which is approximately 45 meters from the new proposed route, at a turn pipe near an open valve. The second was at $28^{0}$ 17’ 34.0” S $23^{0}$20’ 26.3” E, an old cemetery, which lies beyond the proposed route, but noted here for precautionary measures to be put in place. Under NHRA 25 (1999) a permit is required to remove or destroy a grave or headstone marker outside a formal cemetery. a buffer of at least 30 m is recommended, with fencing to protect such graves.

Figure 24: Graves found $28^{0}$ 23’ 35.8”S $24^{0}$ 16’ 13.2” E

Figures 25 : Headstones found at 28$^0$ 17’ 34.0” S 23$^0$ 20’ 26.3” E

***Industrial archaeological traces*** are noted in the form of the old pipeline, structures and mining infrastructure adjacent to the footprint. There is an existing activerailway being used to service the mines.

Figure 26: Railway being used for transport for the mines

Figure 27 : "Laaiskal"

***Recent activity*** a range of current landscape uses was observed from livestock and game farming, areas zoned for residential use, and mining.



Figures 28: A few images of recent activity in the area

### 4.2 Characterizing the overall significance of impacts

The criteria on which significance of impacts is based include **nature**, **extent**, **duration**, **magnitude** and **probability of occurrence**, with quantification of significance being grounded and calculated as follows:

- The **nature**, namely a description of what causes the effect, what will be affected, and how it will be affected.

- The **extent**, indicating the geographic distribution of the impact:
  - local extending only as far as the development site area – assigned a score of 1;
  - limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
  - impact is regional – assigned a score of 3;
  - impact is national – assigned a score of 4; or
  - impact across international borders – assigned a score of 5.

- The **duration**, measuring the lifetime of the impact:
  - very short duration (0–1 years) – assigned a score of 1;
  - short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4;

    - or permanent - assigned a score of 5.

- The **magnitude**, quantified on a scale from 0-10:
    - 0 is small and will have no effect on the environment;
    - 2 is minor and will not result in an impact on environmental processes;
    - 4 is low and will cause a slight impact on environmental processes;
    - 6 is moderate and will result in environmental processes continuing but in a modified way;
    - 8 is high (environmental processes are altered to the extent that they temporarily cease); and
    - 10 is very high and results in complete destruction of patterns and permanent cessation of environmental processes.

- The **probability of occurrence**, indicating the likelihood of the impact actually occurring (scale of 1-5)
    - 1 is highly improbable (probably will not happen);
    - 2 is improbable (some possibility, but low likelihood);
    - 3 is probable (distinct possibility);
    - 4 is highly probable (most likely); and
    - 5 is definite (impact will occur regardless of any prevention measures).

- The **significance**, determined by a synthesis of the characteristics described above and expressed as low, medium or high. Significance is determined by the following formula:
  S= (E+D+M) P; where S = Significance weighting; E = Extent; D = Duration; M = Magnitude; P = Probability.

- The **status**, either positive, negative or neutral, reflecting:
    - the degree to which the impact can be reversed.
    - the degree to which the impact may cause irreplaceable loss of resources.
    - the degree to which the impact can be mitigated.

- **The significance weightings for each potential impact are as follows:**

    - < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),

    - 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

    - > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

## 4.3 SUMMARY OF THE SIGNIFICANCE OF IMPACTS

**Significance of Impacts, with and without mitigation – based on the worst case scenario – for all areas investigated. *Note that some areas could not be accessed and hence this assessment is provisional.***

<table>
<tr><td colspan="3">Nature:<br>Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological or other heritage material or object (what affected).<br>The following assessment refers to impact on physical archaeological/heritage traces.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>1</td><td>Not needed</td></tr>
<tr><td>Duration</td><td>5</td><td>Not needed</td></tr>
<tr><td>Magnitude</td><td>6</td><td>Not needed</td></tr>
<tr><td>Probability</td><td>2</td><td>Not needed</td></tr>
<tr><td>Significance</td><td>22</td><td></td></tr>
<tr><td>Status (positive or negative)</td><td>WEAKLY NEGATIVE</td><td>But locally low to very low significance</td></tr>
<tr><td>Reversibility</td><td>No</td><td></td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>Low density and significance</td><td>Loss of context but possible to mitigate.</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Not needed</td><td>Not needed</td></tr>
<tr><td colspan="3">Mitigation: the burial site or its associated features, which as far as possible should be left intact.<br>The area is question is heavily disturbed so it is not needed at this stage however, note need for monitoring in management plan recommendations, there is a probability that although highly unlikely in this case; artefacts occur subsurface. Other possible occurrences are burials and ostrich eggshell on pottery caches.<br>.</td></tr>
<tr><td colspan="3">Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur, direct impacts are once-off permanent destructive events. Secondary cumulative impacts may occur with the increase in development and operational activity associated with the life of the proposed development area.</td></tr>
<tr><td colspan="3">Residual Impacts: -</td></tr>
</table>

## 5. MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

### The objective

Archaeological or other heritage materials that may be encountered during any surface and sub-surface disturbance associated with any aspect of the proposed prospecting and may be subject to destruction, damage, excavation, alteration, or removal. The objective is to limit such possible impacts.

| | |
|---|---|
| **Project component/s** | Any road or other infrastructure construction over and above what is outlined in respect of the proposed Prospecting area. |
| **Potential Impact** | The potential impact if this objective is not met is that wider areas or extended linear developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects (minimal as they are) from their current context along the route.. |
| **Activity/risk source** | Activities which could impact on achieving this objective include deviation from any planned development without taking heritage impacts into consideration. |
| **Mitigation: Target/Objective** | An environmental management plan that takes cognizance of heritage resources in the event of any future extensions of infrastructure.<br><br>Mitigation (based on present observations and development proposal as communicated) is not considered to be necessary. |

| **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
|---|---|---|
| Provision for on-going heritage monitoring in an environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of development. | Environmental management provider with on-going monitoring role for the upgrade and for any instance of periodic or on-going land surface modification thereafter. | Environmental management plan to be in place before commencement of upgrade. |
| Should unexpected finds be made (e.g. precolonial burials; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery, ash midden with bone/pottery; military remains), the relevant Heritage Authority should be contacted. | Environmental Control Officer should report to the Heritage Authority as needed (see next column). | In the event of finding any of the features mentioned in column 1, reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms N. Higgins 021-4624502 or NC Heritage Resources Authority Mr Andrew Timothy 0790369294. |

| | | |
|---|---|---|
| | | |

| | |
|---|---|
| **Performance Indicator** | Inclusion of further heritage impact consideration ahead of upgrade given that not all areas could be accessed; heritage impact consideration in all ensuing phases of activity. |
| **Monitoring** | Officials from relevant heritage authorities (National, Provincial or Local) to be permitted to inspect the site at any time in relation to the heritage component of the management plan. |

## 6. CONCLUSIONS AND RECOMMENDATIONS

Significance of impact on archaeological and cultural heritage features was found to be low. It would remain possible that material of significance may occur, which is not identified and such chance finds, if encountered, should be brought to the attention of heritage authorities for further assessment and mitigation if necessary.

**Acknowledgements**
I thank Miss Jani Louw (McGregor Museum Archaeology Intern) who assisted with fieldwork together with Sedibeng Water personnel who accompanied and showed us the various areas the pipeline will be running through.

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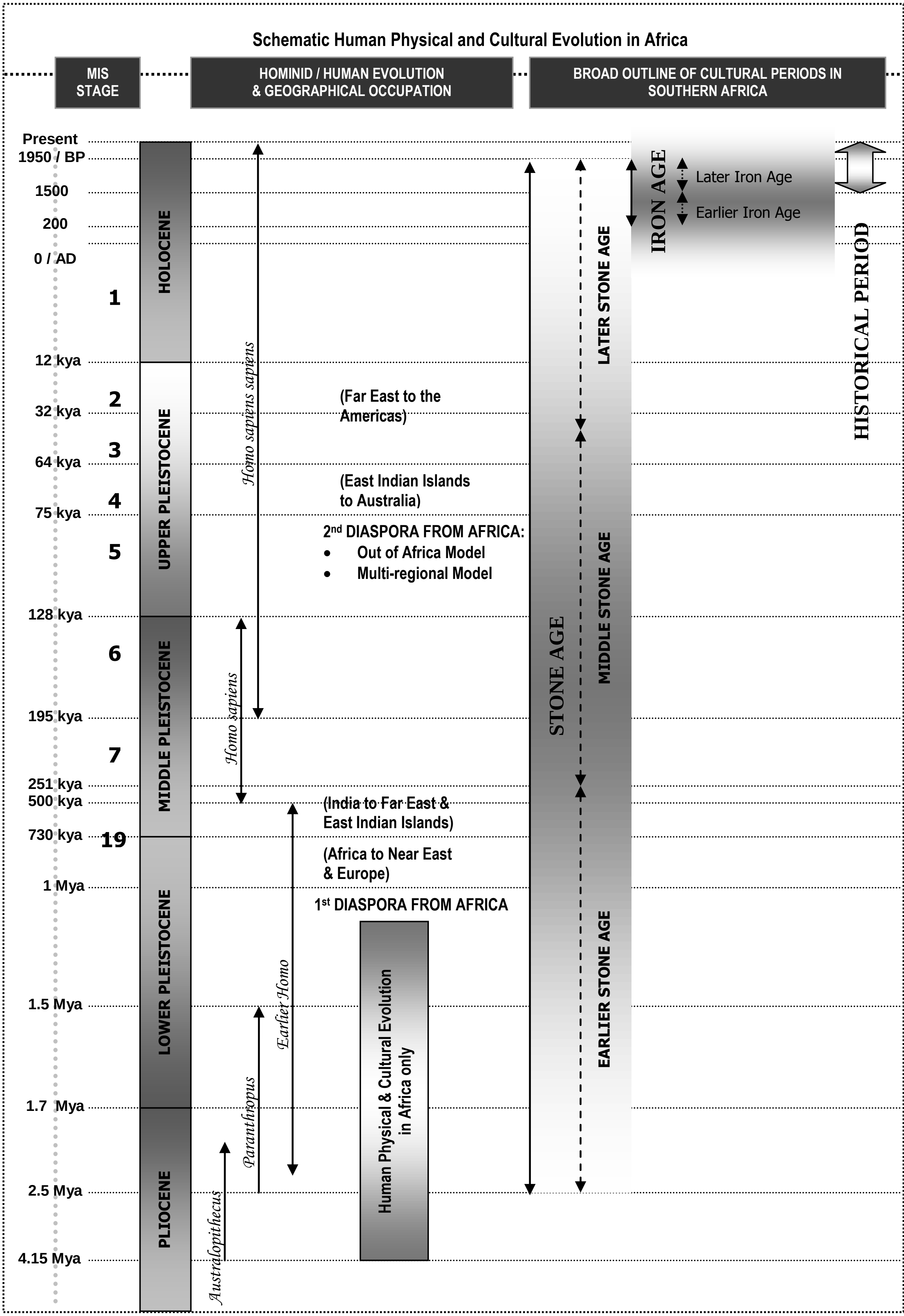

Schematic Human Physical and Cultural Evolution in Africa
MIS STAGE
HOMINID / HUMAN EVOLUTION & GEOGRAPHICAL OCCUPATION
BROAD OUTLINE OF CULTURAL PERIODS IN SOUTHERN AFRICA
Present
1950 / BP
1500
200
0 / AD
12 kya
32 kya
64 kya
75 kya
128 kya
195 kya
251 kya
500 kya
730 kya
1 Mya
1.5 Mya
1.7 Mya
2.5 Mya
4.15 Mya
1
2
3
4
5
6
7
19
HOLOCENE
UPPER PLEISTOCENE
MIDDLE PLEISTOCENE
LOWER PLEISTOCENE
PLIOCENE
Homo sapiens sapiens
Homo sapiens
Earlier Homo
Paranthropus
Australopithecus
(Far East to the Americas)
(East Indian Islands to Australia)
2nd DIASPORA FROM AFRICA:
Out of Africa Model
Multi-regional Model
(India to Far East & East Indian Islands)
(Africa to Near East & Europe)
1st DIASPORA FROM AFRICA
Human Physical & Cultural Evolution in Africa only
STONE AGE
LATER STONE AGE
MIDDLE STONE AGE
EARLIER STONE AGE
IRON AGE
Later Iron Age
Earlier Iron Age
HISTORICAL PERIOD

# Extracts from the

# National Heritage Resources Act (No 25 of 1999)

**DEFINITIONS**
**Section 2**

In this Act, unless the context requires otherwise:

ii. "*Archaeological*" means –
   a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
   b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10 m of such representation;
   c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic,… and any cargo, debris, or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation.

viii. "*Development*" means any physical intervention, excavation or action, other than those caused by natural forces, which may in the opinion of a heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being, including –
   a) construction, alteration, demolition, removal or change of use of a place or structure at a place;
   b) carrying out any works on or over or under a place;
   c) subdivision or consolidation of land comprising, a place, including the structures or airspace of a place;
   d) constructing or putting up for display signs or hoardings;
   e) any change to the natural or existing condition or topography of land; and
   f) any removal or destruction of trees, or removal of vegetation or topsoil;

xiii. "*Grave*" means a place of interment and includes the contents, headstone or other marker of such a place, and any other structure on or associated with such place;

xxi. "*Living heritage*" means the intangible aspects of inherited culture, and may include –
   a) cultural tradition;
   b) oral history;
   c) performance;
   d) ritual;
   e) popular memory;
   f) skills and techniques;
   g) indigenous knowledge systems; and
   h) the holistic approach to nature, society and social relationships.

xxxi. "*Palaeontological*" means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trance;

xli. "*Site*" means any area of land, including land covered by water, and including any structures or objects thereon;

xliv. "*Structure*" means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith;

**NATIONAL ESTATE**
**Section 3**

1) For the purposes of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
2) Without limiting the generality of subsection 1), the national estate may include –
   a) places, buildings, structures and equipment of cultural significance;
   b) places to which oral traditions are attached or which are associated with living heritage;
   c) historical settlements and townscapes;
   d) landscapes and natural features of cultural significance;
   e) geological sites of scientific or cultural importance
   f) archaeological and palaeontological sites;
   g) graves and burial grounds, including –
      i. ancestral graves;
      ii. royal graves and graves of traditional leaders;
      iii. graves of victims of conflict

   iv. graves of individuals designated by the Minister by notice in the Gazette;
   v. historical graves and cemeteries; and
   vi. other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No 65 of 1983)

h) sites of significance relating to the history of slavery in South Africa;

i) movable objects, including –
   i. objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
   ii. objects to which oral traditions are attached or which are associated with living heritage;
   iii. ethnographic art and objects;
   iv. military objects;
   v. objects of decorative or fine art;
   vi. objects of scientific or technological interest; and
   vii. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1 xiv) of the National Archives of South Africa Act, 1996 (Act No 43 of 1996).

**STRUCTURES**
**Section 34**

1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

**ARCHAEOLOGY, PALAEONTOLOGY AND METEORITES**
**Section 35**

3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

4) No person may, without a permit issued by the responsible heritage resources authority –
   a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
   b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
   c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
   d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may –
   a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
   b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
   c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph a) to apply for a permit as required in subsection 4); and
   d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

**BURIAL GROUNDS AND GRAVES**
**Section 36**

3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority –
   a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

c) bring onto or use at a burial ground or grave referred to in paragraph a) or b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction of any burial ground or grave referred to in subsection 3a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection 3b) unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority –

a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and

b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in co-operation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority –

a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and

b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-internment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.

**HERITAGE RESOURCES MANAGEMENT**
**Section 38**

1) Subject to the provisions of subsections 7), 8) and 9), any person who intends to undertake a development categorised as –

a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

b) the construction of a bridge or similar structure exceeding 50 m in length;

c) any development or other activity which will change the character of a site –

i. exceeding 5 000 $m^2$ in extent; or

ii. involving three or more existing erven or subdivisions thereof; or

iii. involving three or more erven or subdivisions thereof which have been consolidated within the past five years; or

iv. the costs which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

d) the rezoning of a site exceeding 10 000 $m^2$ in extent; or

e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

2) The responsible heritage resources authority must, within 14 days of receipt of a notification in terms of subsection 1) –

a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report. Such report must be compiled at the cost of the person proposing the development, by a person or persons approved by the responsible heritage resources authority with relevant qualifications and experience and professional standing in heritage resources management; or

b) notify the person concerned that this section does not apply.

3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection 2a) …

4) The report must be considered timeously by the responsible heritage resources authority which must, after consultation with the person proposing the development decide –

a) whether or not the development may proceed;

b) any limitations or conditions to be applied to the development;

c) what general protections in terms of this Act apply, and what formal protections may be applied, to such heritage resources;

d) whether compensatory action is required in respect of any heritage resources damaged or destroyed as a result of the development; and

e) whether the appointment of specialists is required as a condition of approval of the proposal.

**APPOINTMENT AND POWERS OF HERITAGE INSPECTORS**
**Section 50**

7) Subject to the provision of any other law, a heritage inspector or any other person authorised by a heritage resources authority in writing, may at all reasonable times enter upon any land or premises for the purpose of inspecting any heritage resource protected in terms of the provisions of this Act, or any other property in respect of which the heritage resources authority is exercising its functions and powers in terms of this Act, and may take photographs, make measurements and sketches and use any other means of recording information necessary for the purposes of this Act.
8) A heritage inspector may at any time inspect work being done under a permit issued in terms of this Act and may for that purpose at all reasonable times enter any place protected in terms of this Act.
9) Where a heritage inspector has reasonable grounds to suspect that an offence in terms of this Act has been, is being, or is about to be committed, the heritage inspector may with such assistance as he or she thinks necessary –
    a) enter and search any place, premises, vehicle, vessel or craft, and for that purpose stop and detain any vehicle, vessel or craft, in or on which the heritage inspector believes, on reasonable grounds, there is evidence related to that offence;
    b) confiscate and detain any heritage resource or evidence concerned with the commission of the offence pending any further order from the responsible heritage resources authority; and
    c) take such action as is reasonably necessary to prevent the commission of an offence in terms of this Act.

A heritage inspector may, if there is reason to believe that any work is being done or any action is being taken in contravention of this Act or the conditions of a permit issued in terms of this Act, order the immediate cessation of such work or action pending any further order from the responsible heritage resources authority.

# APPENDIX G4

PALAEONTOLOGICAL IMPACT ASSESSMENT

# PALAEONTOLOGICAL PHASE 1 IMPACT ASSESSMENT OF THE PROPOSED UPGRADE OF THE VAAL GAMAGARA REGIONAL WATER SUPPLY SCHEME: PHASE 2 AND GROUNDWATER ABSTRACTION

**Compiled for:**

**NEMAI CONSULTING**

PO BOX 1673 Sunninghill

2157

**2 November 2019**

**Prepared by:**

**BANZAI ENVIRONMENTAL (PTY) LTD**

**Declaration of Independence**

General declaration:

- I, Elize Butler, declare that –
- I act as the independent Palaeontologist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

**Disclosure of Vested Interest**

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;


**PALAEONTOLOGICAL CONSULTANT:** Banzai Environmental (Pty) Ltd

**CONTACT PERSON:** Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com


SIGNATURE: 

The Palaeontological Impact Assessment report has been compiled taking into account the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

*Table 1:Nema Requirements*

| **NEMA Regs (2014) - Appendix 6** | **Relevant section in report** |
|---|---|
| 1. (1) A specialist report prepared in terms of these Regulations must contain-<br>a) details of-<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | Page ii of Report – Contact details and company and Appendix 1 |
| b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Page ii-iii |
| c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 4 – Objective |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 5 – Geological and Palaeontological history |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 10 – Impacts |
| d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 9 – Site Visiy |
| e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 7 Methodology |
| f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Section 1, Section 5 |
| g) an identification of any areas to be avoided, including buffers; | N/A |
| h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section 5 |
| i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 7.1.– Assumptions and Limitation |
| j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities; | Section 11-12 |

| | |
|---|---|
| k) any mitigation measures for inclusion in the EMPr; | Section 11-12 |
| l) any conditions for inclusion in the environmental authorisation; | N/A |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 11 |
| n) a reasoned opinion-<br>i. as to whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Saction1, Section 11 |
| o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | Not applicable. |
| p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | Not applicable. To date not comments regarding heritage resources that require input from a specialist have been raised. |
| q) any other information requested by the competent authority. | Not applicable. |
| 2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | Refer to section 2 and 3 compliance with SAHRA guidelines |

**EXECUTIVE SUMMARY**

Nemai Consulting has appointed Banzai Environmental to undertake the Palaeontological Phase 1 Field Assessment assessing the palaeontological impact of the upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 (VGRWSS-II). The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to detect the occurrence of fossil material within the planned development footprint. This Assesment is thus necessary to evaluate the potential effect of the construction on the palaeontological resources.

The proposed Vaal Gamagara Regional Water Supply Scheme upgrading is completely underlain by the following sediments:

- Kalahari Group
- Dwyka Group, Karoo Supergroup.
- Matsap Subgroup, Volop Group, Olifantshoek Supergroup
- Gamagara Fm, Olifantshoek Supergroup
- Ongeluk Fm, Postmasburg Group Transvaal Supergroup
- Asbestos Hills, and Campbell Rand Subgroup, Ghaap Group, Transvaal Supergroup
- Vryburg Fm, Transvaal Supergroup (Moderate to high Sensitivity)

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is High; Dwyka Group is Low; Gamagara Fm is Low, Ongeluks Fm is Moderate, the Campbel Rand and Asbestos Hills is Moderate while the Vryburg Fm has a Moderate to high Sensitivity.

A 2-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 26 and 27 October 2019. No visible evidence of fossiliferous outcrops was found. For this reason, an overall medium palaeontological sensitivity is allocated to the development footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of VGRWSS-II will be of a medium significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction of the development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by new excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (*in situ* if possible) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that suitable mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

Recommendations:

- The EAP and ECO for this project must be informed that High Palaeontological Sensitivity is allocated to the Kalahari Formation and a moderate to High to the Vryburg Formation.
- If fossil remains are discovered during any phase of construction, either on the surface or exposed by new excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (if possible, *in situ*) and the ECO ought to alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a palaeontologist.
- These recommendations must be incorporated in the EMPr of this project.

**CONTENTS**



**LIST OF FIGURES**

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# 1 INTRODUCTION

The Vaal Gamagara Scheme is a Water Supply Scheme (VGRWSS-II ) situated in the Northern Cape. This project was completed in 1968. Sedibeng Water has been in charge of the VGRWSS-II since 2007. The Scheme entails the transfer of water from Delportshoop on the Vaal River (60 km north west of Kimberley) through Postmasburg to the Kathu iron ore mines. A pipeline continues from Kathu to the manganese mines at Hotazel and terminates at Black Rock. The VGRWSS-II comprise of water treatment works (WTW) (capable of treating 13.27 million $m^3$/a water), 11 reservoirs, pumps and 370 km of pipes that distribute clean water to users.

The scheme removes water from the groundwater table, thus ensuring safe mining conditions at the following mines: Kolomela, Beeshoek and Sishen. The existing scheme is currently functioning at full capacity and is not able to supply the growing future water demands, or deal with the increasing water supply interruptions.

The iron ore and manganese mining operations are the driving force behind the increased water demand. The Northern Cape mines produces 84% of South Africa's iron ore and 92% of the world's high-grade manganese deposits. Diamond and lime mining operations in the area also contributes to the water demand, but to a lesser degree. The aging infrastructure is approximately 50 years old and is expected to increased water demand as water supply interruptions will be bigger.

The Upgrading of the VGRWSS-II entails the construction of new pipelines from Delportshoop to Olifantshoek, upgrading of four pump stations, upgrading of the Delportshoop Water Treatment Works as well as the development of two well fields in the Northern Cape. The existing system will continue fully operational during the implementation of VGRWSS-II, to safeguard reliable water supply to the various municipalities, farmers and mines in the area.

**The project comprises of the following:**

- Upgrading of the existing VGRWSS-2
- SD1 and SD2 groundwater abstraction

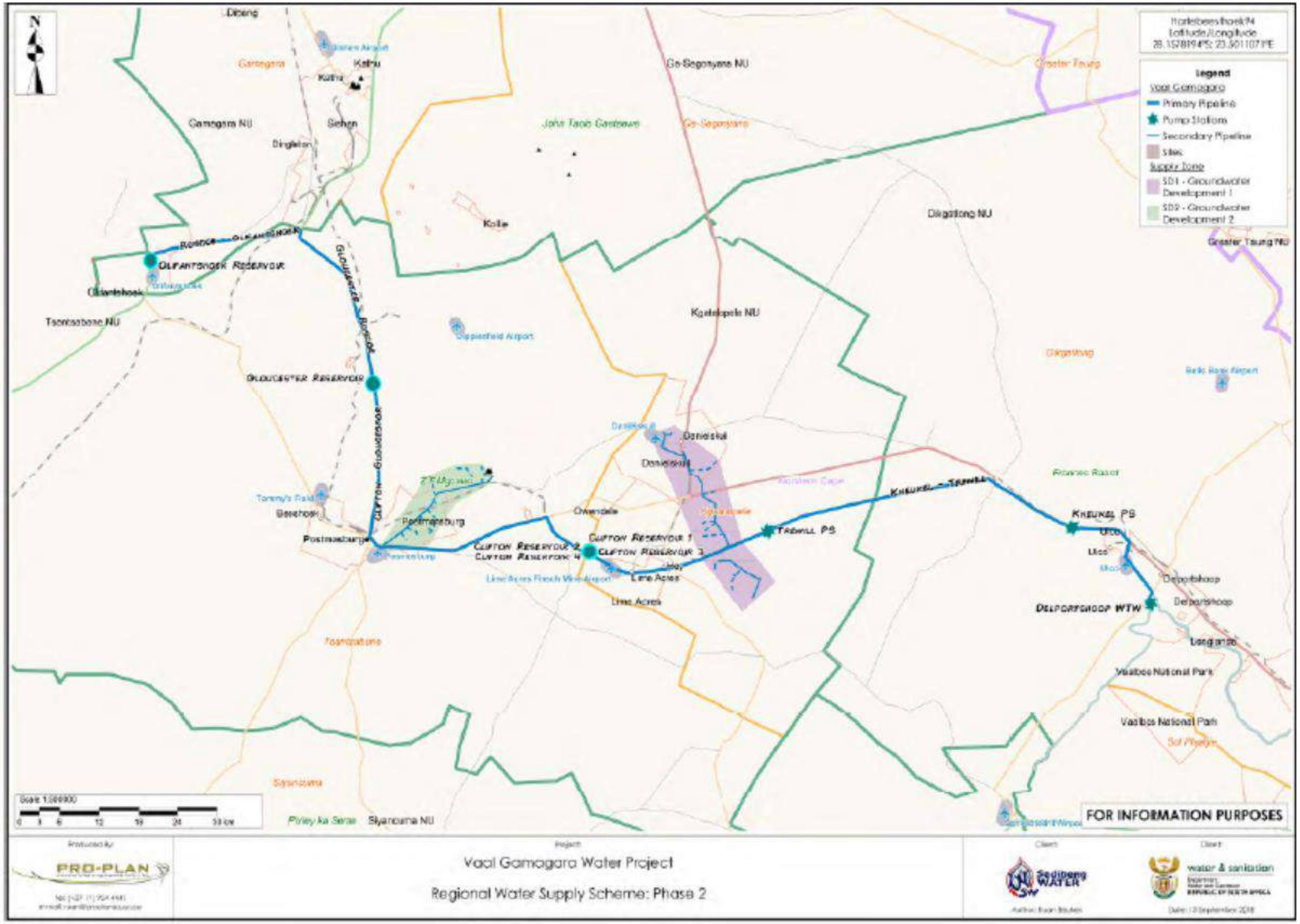

*Figure 1: Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2, near Postmasburg, Northern Cape Province..*

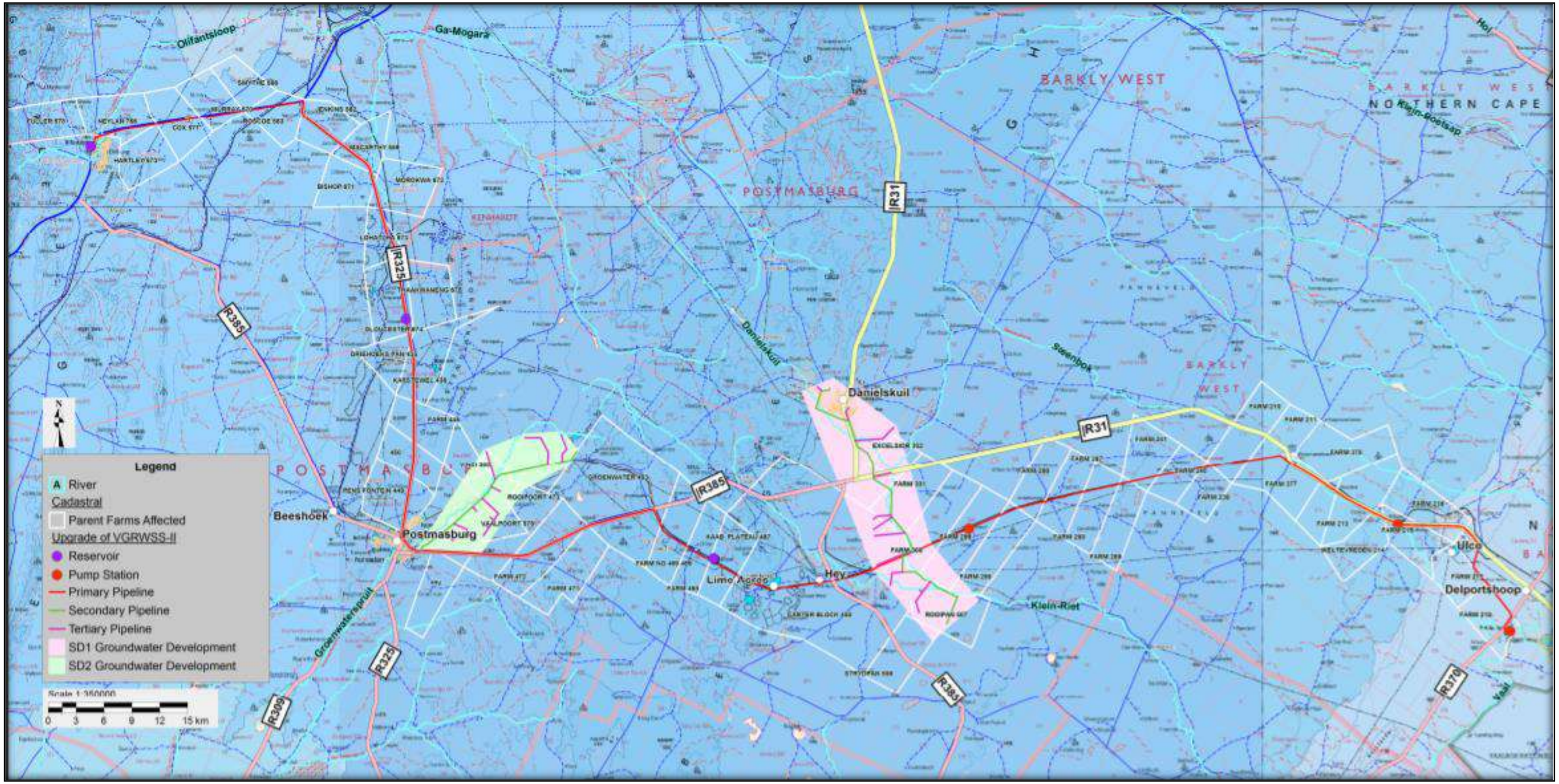


*Figure 2: Topographical map of the proposed Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2, near Postmasburg, Northern Cape Province.*

## 2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 13 years. She has been conducting PIAs since 2014.

## 3 LEGISLATION

### 3.1 NATIONAL HERITAGE RESOURCES ACT (25 OF 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This DIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 $m^2$ in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 $m^2$ in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

## 4 OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

**General Requirements:**

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed dvelopment;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
    **c. Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

## 5 GEOLOGICAL AND PALAEONTOLOGICAL HERITAGE

The upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 is completely underlain by the following (from youngest to oldest sediments) (Table 2; Figure 3-8).

Kalahari Group (High Sensitivity)
Dwyka Group, Karoo Supergroup. (Low Sensitivity)
Matsap Subgroup, Volop Group, Olifantshoek Supergroup (Low Sensitivity)
Gamagara Fm, Olifantshoek Supergroup (Low Sensitivity)
Ongeluk Fm, Postmasburg Group Transvaal Supergroup (Moderate Sensitivity)
Asbestos Hills Subgroup, Ghaap Group, Transvaal Supergroup (Moderate Sensitivity)
Campbell Rand Subgroup, Ghaap Group, Transvaal Supergroup (Moderate Sensitivity)
Vryburg Fm, Transvaal Supergroup (Moderate to high Sensitivity)

The proposed development is divided into three areas (Figure 4). Each of these areas represent a different geological map. Maps are provided by the Council of Geoscience, Pretoria.
Section A: 1: 250 000 2724 Kuruman Geological map. (Figure 5)
Section A: 1: 250 000 2822 Postmasburg Geological Map (Figure 6)
Section A: 1: 250 000 2824 Cristiana Geological Map (Figure 7)

**Kalahari Group**

The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in southern Africa and its deposits is approximately 65 – 2.5 million years old. The Cenozoic sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge et al., 2006). The youngest formation of the Kalahari group is the Gordonia Formation which is generally termed Kalahari sand and comprises of red aeolian sands that covers most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contains white to brown fine grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters. Quaternary alluvium, aolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent 1980).

The fossil assemblages of the Kalahari are generally very low in diversity, and occur over a wide range and thus the palaeontological diversity of this Group is low. These fossils represent terrestrial plants and animals with a close resemblance to living forms .Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. Fossils can be expected in ancient rivers and pans.

Almond & Pether 2008, allocated a low significance to the Kalahari Group because fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. In the past palaeontologists did not focus on Cenozoic superficial deposits although they sometimes comprise of significant fossil biotas. **But,** Groenewald and Groenewald (2014) allocated a high palaeontological significance due to the significant fossil remains of Cenozoic aged terrestrial organisms that have been recorded from the sedimentary rocks. These fossils are important indicators of palaeo-environmental conditions.

**Dwyka Group**

The Permo-Carboniferous Dwyka Group is the oldest deposit in the Karoo Supergroup and spans the Late Carboniferous to Early Permian. The Dwyka Group overlies the glaciated Precambrian bedrocks in the north and unconformably and paraconfoformably the Cape Supergroup in the south and in the east it overlies the Natal Group and Msikaba Formation unconformably. Glacial pavements underlaying the Dwyka Group has well-developed striations (specifically in the north) (Johnson et al, 2006) . The Dwyka Group is believed to be deposited in a marine basin (Visser, 1989).

South Africa was covered by an ice sheet during the Dwyka. These deposits were thus deposited in a cold, glacially-dominated environment. This Group consists mainly of gravelly sediments with subordinate vorved shales and mudstones with scraped and facetted pebbles. The retreating glaciers deposited dark-grey tillite (Visser et al, 1987). The Dwyka is known for its rich assemblage of dropstones of various sizes.

The Permo-Carboniferous Dwyka Group is known for its track ways (trace fossils) which is also known as iIchnofacies that was formed by fish and arthropods, while fossilized faeces or coprolites have also been recovered. Body fossils consists of gastropods, invertebrates and marine fish. Fossil plants from this group include a rich diversity of conifers, cordaitaleans, glossopterids, ginkgoaleans, horsetails, lycopods, pollens and spores ferns (Almond and Pether, 2008).

**Olifansthoek Supergroup**

This Supergroup consists of arenaceous sediments and forms a characteristic north-trending mountain range from the Boegoeberg Dam area norhwards to Korannaberg (Moen, 2006). These sediments in the north are increasingly covered by the Kalhari Group. This Supergroup is thicker than 5000m$^2$. The Olifantshoek Supergroup comprise of basic lava that is overlain by by a thick sequence of coarse grey and red quartzite and minor shale as well as interbedded shale (Cornell et al., 1998). These “red beds” consists of fluvial sediments, carbonates, subordinate near surface marine siliciclastic metasediments which is a low grade and lavas. These sediments are Mid Proterozoic (Mokolian) in age (approximately. 1.9 Ga).

The Olifantshoek Supergroup, Volop Group is divided into two Subgroups namely the Brulsand and Matsap Subgroups. The Matsap Subgroup has three Formations namely Glen Lyon, Ellies’s Rust and Fuller formation. The Gamgara and Mapedi Formations are present along the eroded crest of the Maremanr Aticline. The ferruginised Gamagara Fm contains coarsening-upward cycles of quartzite and shale overlying a basal haematite-pebble conglomerate (Moen, 2006). To date only micro-fosils have been recorded and possibly stromatolites (Almond and Pether, 2008).

**Transvaal Supergroup**

The Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton of South Africa namely the Griqualand West Basin, Transvaal Basin, as well as the Kanye Basin in Botswana. The Griqualand West Basin can be subdivided into the Ghaap Plateau and Prieska sub-basins. The geometry of the three basins is mostly stratiform with the exception of the volcanic precursor of the Kanye Basin and parts of the Griqualand West Basin. Extensive deformation has taken place in the south-western portion of the Griqualand West Basin. The development footprint is located in the Griqualand West Basin, which consists of clastic sediments as well as volcanic rocks, diamictites and banded iron formations (BIF)

Rocks of the Transvaal Supergroup in the Transvaal Basin were intruded by the Bushveld Complex approximately 2060 million years ago. The Transvaal Supergroup overlays the Archaean basement as well as the Witwatersrand and Ventersdorp Supergroups. The Transvaal Supergroup overlays rocks of the far western Transvaal and Kanye Basin rocks belonging to the Kanye Formation and Gaborone Granite Suite (Walraven et al, 1194; Hartzer, 1995).

Manganese deposits is present in the Hotazel Formation, upper Postmasburg Group (approximately 2222 Ma). The Vryburg Formation is the basal unit and overlies unconformably the granite and rocks of the Ventersdorp Supergroup. The Campbell Subgroup sediments were deposited on the shallow submerged Kaapvaal Craton, approximately 2.6 to 2.5 Ga (billion years ago). This Subgroup is a very thick (1.6-2.5 km) carbonate platform succession of cherts with some subordinated ironstone and lenses of siltstone or shale dolomites and dolomitic limestones.  A variety of shallow water facies, often developed depositional cycles reflecting sea level changes, including stromatolitic limestones and dolomites, oolites, oncolites, laminated calcilutites, cherts and marls, with subordinate siliclastics (shales, siltstones) and minor tuffs (Eriksson *et al.* 2006) are recorded. The Campbell Group overlies the Vryburg Formation and consists of the Schmidtsdrif Formation and the upper Ghaap Plateau Formation. The Griquatown Group is divided into two formations namely the Asbestos Hills and Koegas Formations. The Gamagara Formation follows and is positioned on the Maremane Anticline, and is overlain by the Makganyene Formation. The Cox Group comprises of the lower Ongeluk Formation and the upper Voëlwater Formation. The Ongeluk Formation was deposited under water and is approximately 400 to 900 m thick. This Formation is basal and is mainly volcanic (Visser 1989). Manganese is present in the upper Voëlwater Formation (Snyman 1996). According to Kent (1980) and Snyman (1996) Griqualand West Basin attains a maximum thickness of 4500 m.

Fossils known from the Transvaal Supergroup are algal structures which are also known as stromatolites. Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

*Figure 3: Example of a well preserved stromatolite from the Archaean Era.*

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998) (Figure 3). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Schopf, 2006). Literature on the Malmani stromatolites, includes articles by Button (1973), Truswell and Eriksson (1972), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

The lower parts of the thick successions are represented by the predominately dolomitic sediments and associated iron formations of the Ghaap group. The geology of the area is partly attributed to high stream velocities and rapid deposition. Clasts of Ventersdorp lava predominate, with significant (if variable) amounts of banded iron formation (BIF), chert, quartzite and quartz also present. .

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*Table 2: Geological and Palaeontological Summary*

| Geological Information | Lithology | Palaeontological Sensitivity | Fossil Heritage |
|---|---|---|---|
| Kalahari Group | Superficial deposits comprising of calcrete and aeolian sand clays, gravels, sandstone, silcrete, | High<br>Groenewald, 2014 | Late Cretaceous to Recent (<90 Ma to Recent)<br>This Group has been neglected in the past and is poorly studied. Fossils are associated with lakes, pans and river systems of the past.<br>Fossils include termite burrows, palynomorphs and root casts. The vertebrate remains include ostrich eggs, mammals and fish. Diatome-rich limestones, freshwater and terrestrial shells (bivalves and gastropods, ostracods and charophytes and freshwater stromatolites) |
| Dwyka Group, Karoo Supergroup | Diamictite, mudstone with dropstones and fluvioglacial gravel common in the north and varved shale | Low<br>Almond and Pether, 2008 | Late Carboniferous to Early Permian (320Ma-290 Ma)<br>Vascular plants, marine vertebrates including molluscs and fish, organic walled-microfossils and trace fossils.<br>Sediments include glacial, interglacial and post-glacial siliclastic sediments (tilites) |
| Matsap Subgroup, Volop Group, Olifantshoek Supergroup | Brown and subordinate grey quartzites | Low<br>Moen 2006;<br>Almond and Pether, 2008 | Microfossils and possible stromatolites<br>Mid Proterozoic approximately 1.9 G (Mokolian)<br>Lavas and carbonates. The mainly “redbeds” is fluvial sediments; subordinate shallow marine siliciclastic metasediments of a low grade The “red beds” suggests an early oxygen-rich atmosphere, and laterites implies possible life on land |

| | | | |
|---|---|---|---|
| Gamagara Fm, Olifantshoek Supergroup | Basaltic lava, conglomerate, quartzite, and shale, | Low<br>Moen 2006;<br>SAHRIS: Almond and Pether, 2008 | Microfossils and possible stromatolites<br>Mid Proterozoic approximately 1.9 G (Mokolian)<br>Lavas and carbonates. The mainly "redbeds" is fluvial sediments; subordinate shallow marine siliciclastic metasediments of a low grade The "red beds" suggests an early oxygen-rich atmosphere, and laterites implies possible life on land |
| Ongeluk Fm, Postmasburg Group Transvaal Supergroup | Andesitic and basaltic lava, minor jasper with abundant pillows | Moderate<br>SAHRIS: Almond and Pether, 2008 | Record of 2.2 Ga is contentious and looks like trace fossils<br>Cherts and carbonates, cyanobacteria (organic walled microfossils) in siliclastics, shallow lacustrine and marine stromatolites in carbonates; |
| Campbell Rand Subgroup, Ghaap Group, Transvaal Supergroup<br><br>Asbestos Hills Subgroup, Ghaap Group, Transvaal Supergroup | Dolomite/limestone (commonly stromatolitic), subordinate chert, minor quartzite and shale<br><br>Banded iron-formation, jaspilite, riebeckite-amphibolite banded iron-formation | Moderate<br>SAHRIS: Almond and Pether, 2008<br><br>Moderate | Cherts and carbonates, cyanobacteria (organic walled microfossils) in siliclastics, shallow lacustrine and marine stromatolites in carbonates;<br><br>Record of 2.2 Ga is contentious and looks like trace fossils<br>Cherts and carbonates, cyanobacteria (organic walled microfossils) in siliclastics, shallow lacustrine and marine stromatolites in carbonates; |

| | | | |
|---|---|---|---|
| Vryburg Fm, Transvaal Supergroup | Andesitic/basaltic lava, chert, clastic minor conglomerate, dolomite/limestone, mudrock, quartzitic sandstone, siltstone, tuff | Moderate SAHRIS: Almond and Pether, 2008 | Cherts and carbonates, cyanobacteria (organic walled microfossils) in siliclastics, shallow lacustrine and marine stromatolites in carbonates |

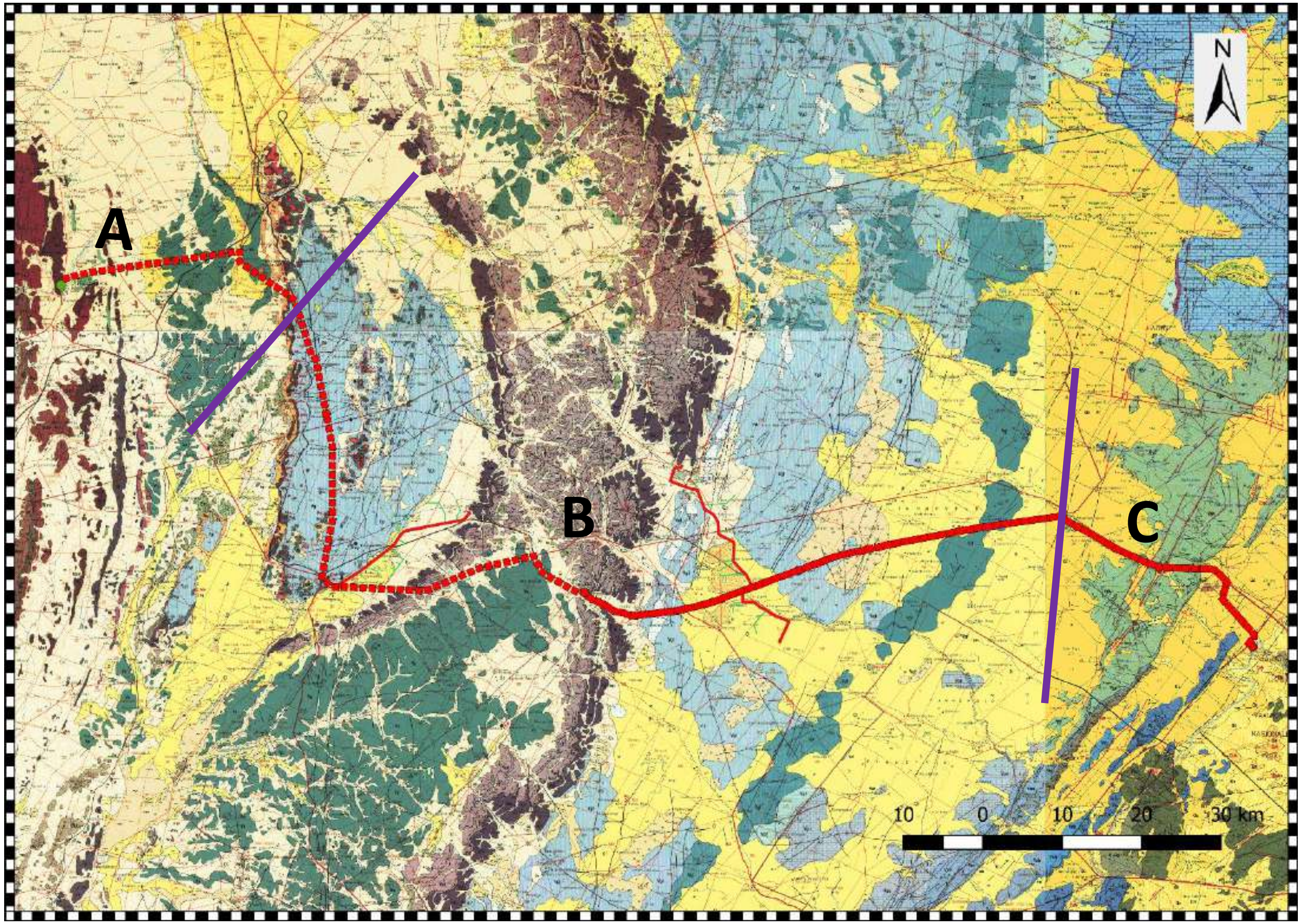



Figure 4: Surface geology of the *proposed Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2, near Postmasburg, Northern Cape Province.. Note that the development area has been divided into 3 sections , namely Section A, B and C.* Map drawn QGIS Desktop 2.28.18.

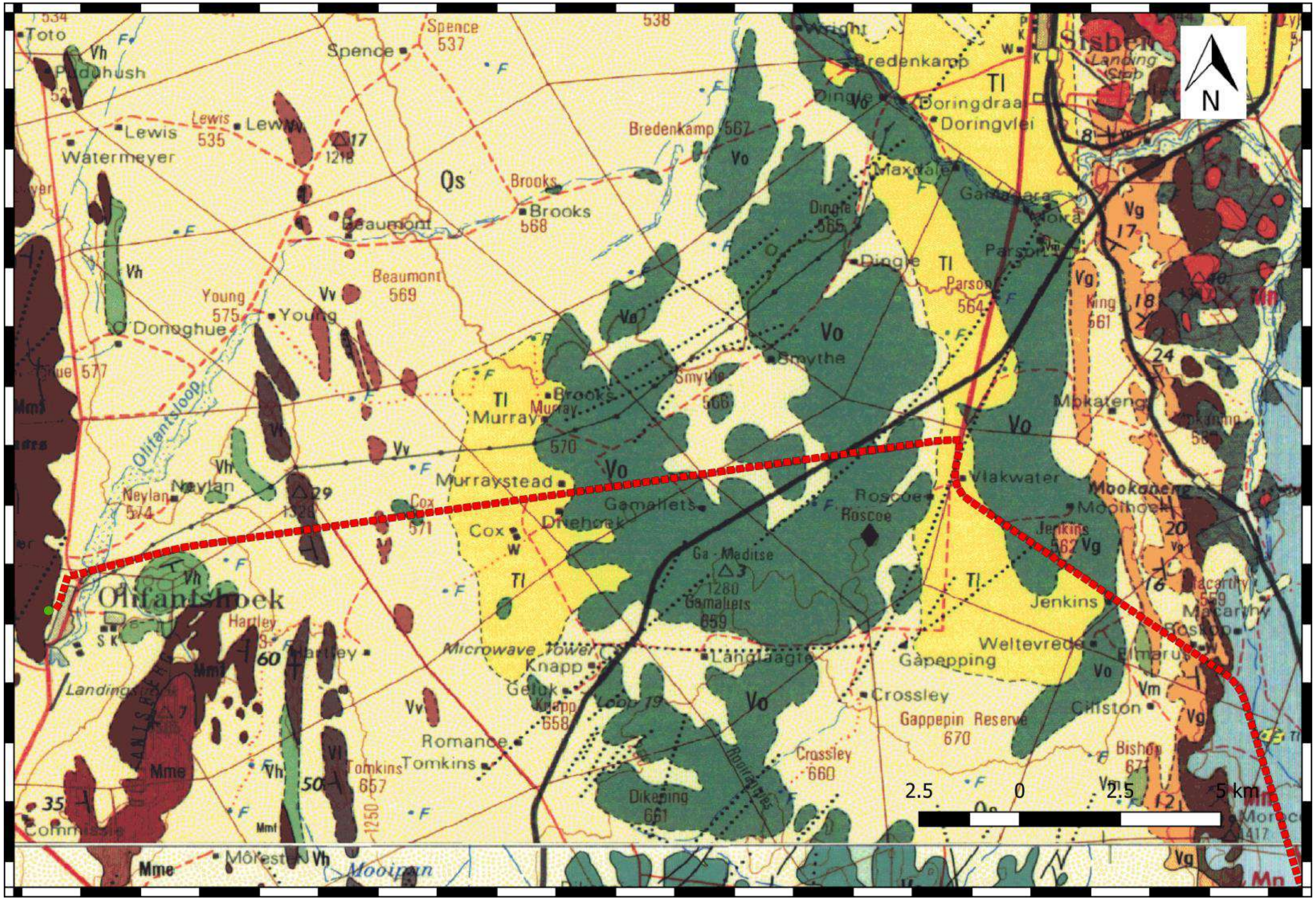


Figure 5: Extract of the 2724 Christiana Geological Map of the *proposed Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2-Section A, near Postmasburg, Northern Cape Province.* Map drawn QGIS Desktop 2.28.18.

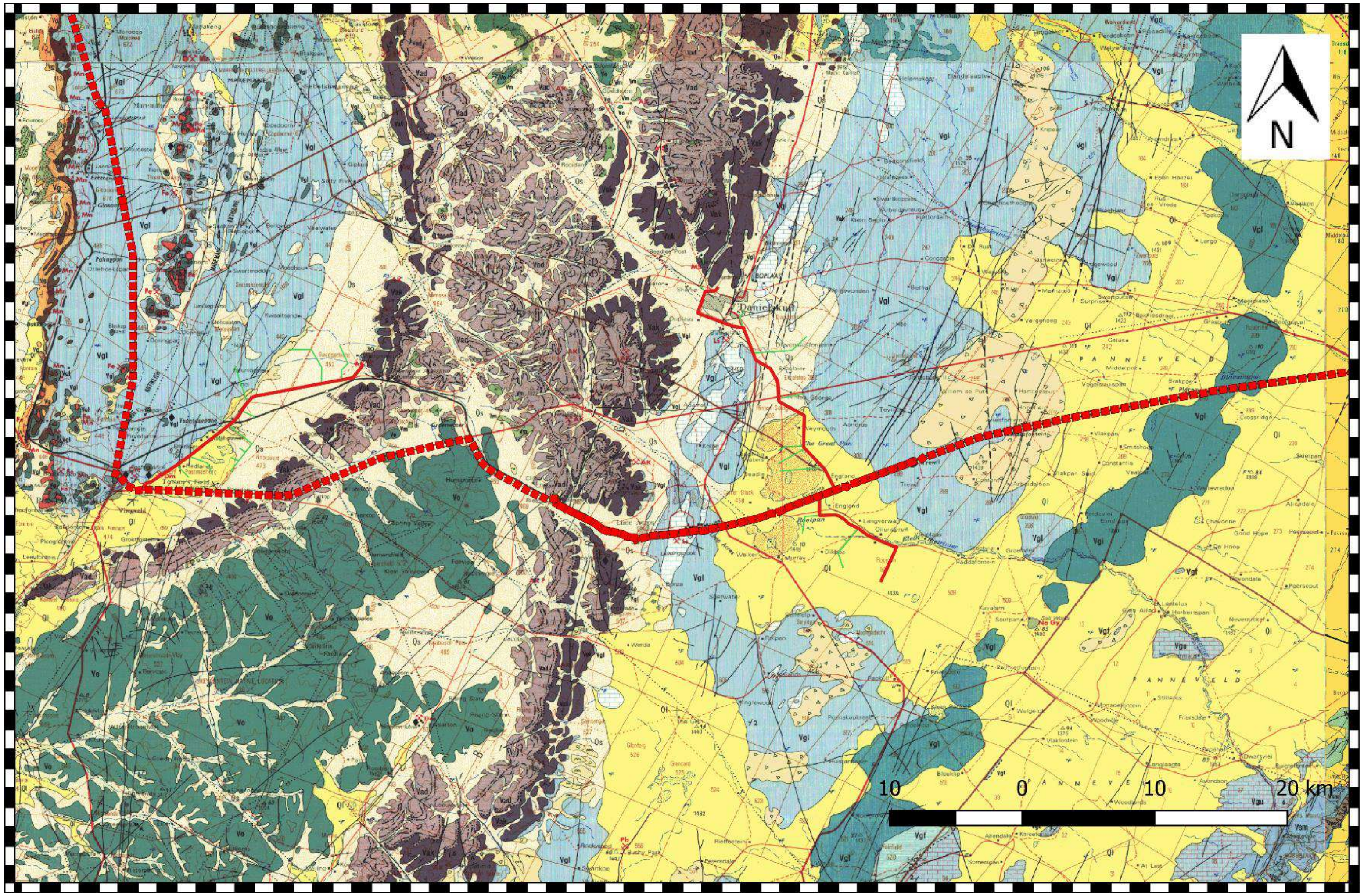



Figure 6: Surface geology of the *proposed Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2-Section B, near Postmasburg, Northern Cape Province.* Map drawn QGIS Desktop 2.28.18.

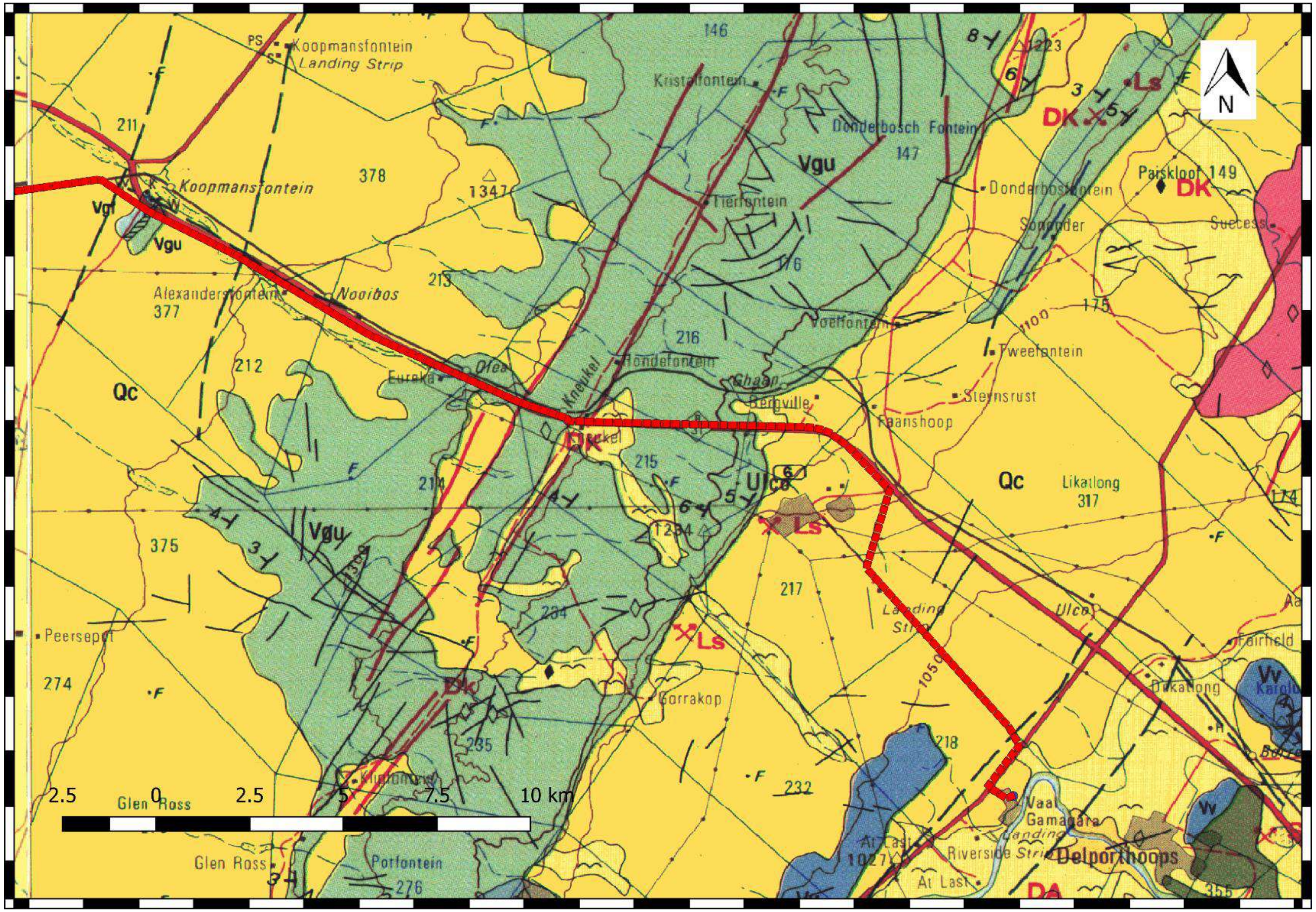
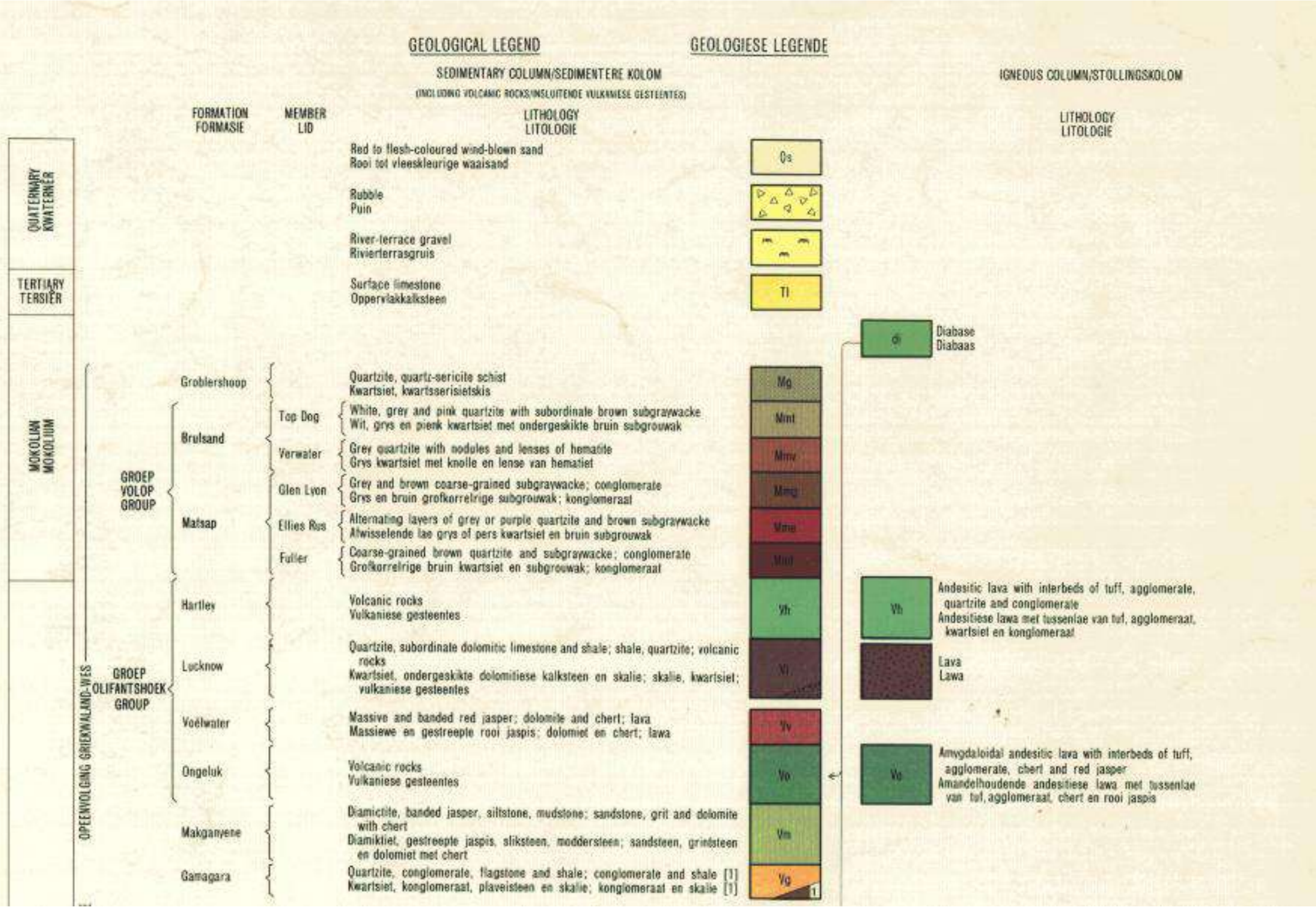
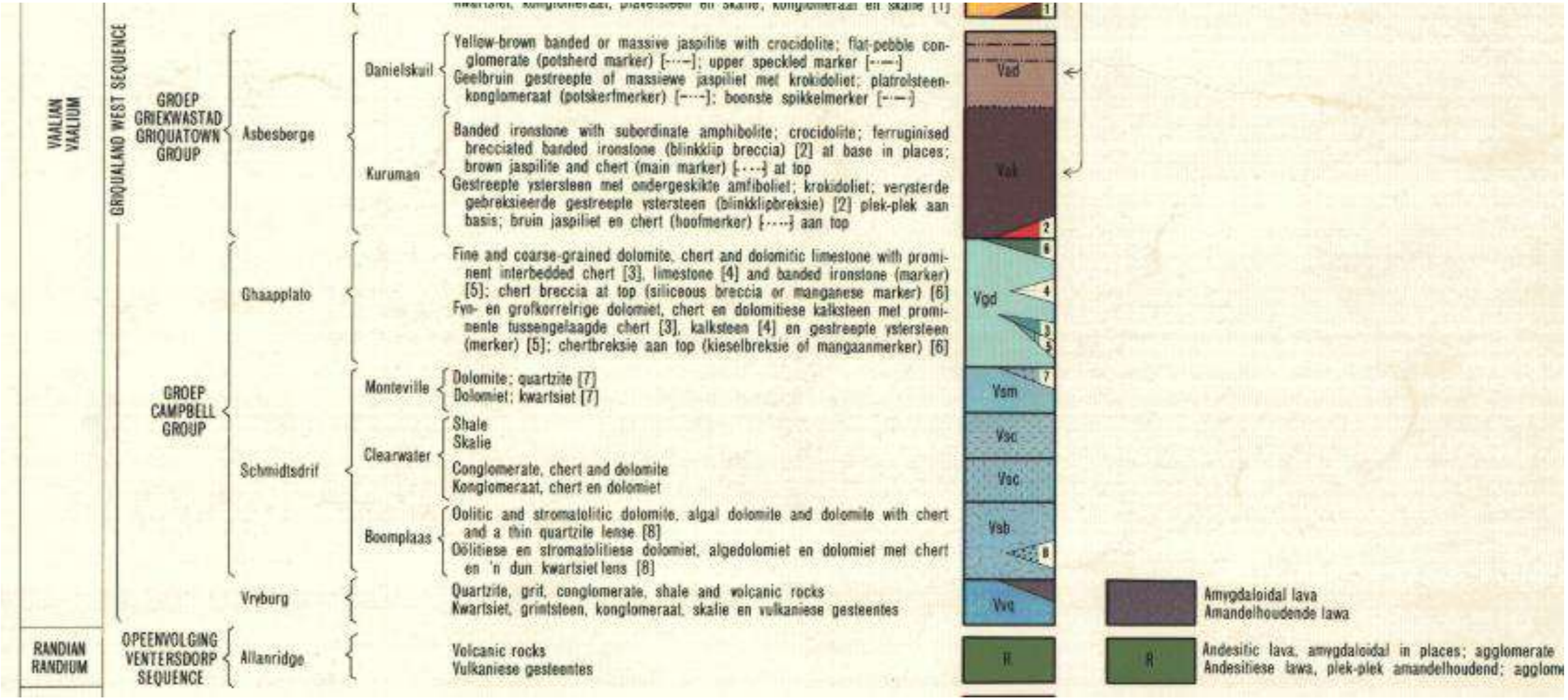



Figure 7: Surface geology of the *proposed Vaal Gamagara Water Project-Regional Water Supply Scheme: Phase 2-Section C, near Postmasburg, Northern Cape Province.* Map drawn QGIS Desktop 2.28.18.

Map Clarification





| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | kwartsiet, konglomeraat, plaveisteen en skalie, konglomeraat en skalie [1] | 1 |
| VAALIAN VAALIUM | GRIQUALAND WEST SEQUENCE | GROEP GRIEKWASTAD GRIQUATOWN GROUP | Asbesberge | Danielskuil | Yellow-brown banded or massive jaspilite with crocidolite; flat-pebble conglomerate (potsherd marker) [-···-]; upper speckled marker [-·-·-] Geelbruin gestreepte of massiewe jaspiliet met krokidoliet; platrolsteen-konglomeraat (potskerfmerker) [-···-]; boonste spikkelmerker [-·-·-] | Vad |
| | | | | Kuruman | Banded ironstone with subordinate amphibolite; crocidolite; ferruginised brecciated banded ironstone (blinkklip breccia) [2] at base in places; brown jaspilite and chert (main marker) [-···-] at top Gestreepte ystersteen met ondergeskikte amfiboliet; krokidoliet; verysterde gebreksieerde gestreepte ystersteen (blinkklipbreksie) [2] plek-plek aan basis; bruin jaspiliet en chert (hoofmerker) [-···-] aan top | Vak, 2 |
| | | GROEP CAMPBELL GROUP | Ghaapplato | | Fine and coarse-grained dolomite, chert and dolomitic limestone with prominent interbedded chert [3], limestone [4] and banded ironstone (marker) [5]; chert breccia at top (siliceous breccia or manganese marker) [6] Fyn- en grofkorrelrige dolomiet, chert en dolomitiese kalksteen met prominente tussengelaagde chert [3], kalksteen [4] en gestreepte ystersteen (merker) [5]; chertbreksie aan top (kieselbreksie of mangaanmerker) [6] | Vgd, 6, 4, 3, 5 |
| | | | Schmidtsdrif | Monteville | Dolomite; quartzite [7] Dolomiet; kwartsiet [7] | Vsm, 7 |
| | | | | Clearwater | Shale Skalie | Vsc |
| | | | | | Conglomerate, chert and dolomite Konglomeraat, chert en dolomiet | Vsc |
| | | | | Boomplaas | Oolitic and stromatolitic dolomite, algal dolomite and dolomite with chert and a thin quartzite lense [8] Öölitiese en stromatolitiese dolomiet, algedolomiet en dolomiet met chert en 'n dun kwartsiet lens [8] | Vsb, 8 |
| | | | Vryburg | | Quartzite, grit, conglomerate, shale and volcanic rocks Kwartsiet, grintsteen, konglomeraat, skalie en vulkaniese gesteentes | Vvq |
| RANDIAN RANDIUM | OPEENVOLGING VENTERSDORP SEQUENCE | | Allanridge | | Volcanic rocks Vulkaniese gesteentes | R |

| | |
|---|---|
| | Amygdaloidal lava Amandelhoudende lawa |
| R | Andesitic lava, amygdaloidal in places; agglomerate Andesitiese lawa, plek-plek amandelhoudend; agglom |

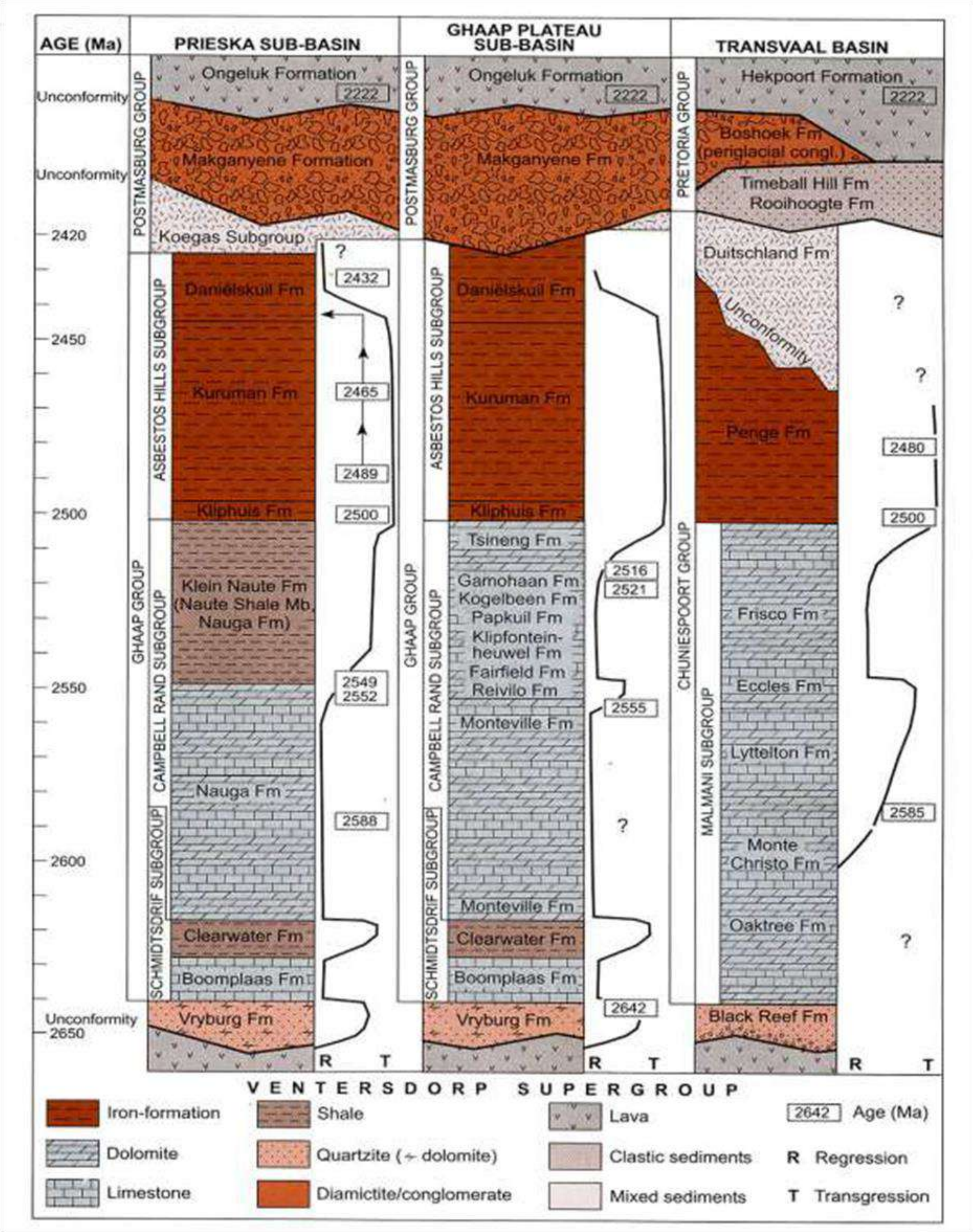



*Figure 8: Stratigraphy of the Transvaal Supergroup of the Ghaap Plateau Basin. The middle column (Ghaap Plateau Subbasin) shows the rock units represented in the proposed site (Eriksson,* et al. *2006).*

## 6 GEOGRAPHICAL LOCATION OF THE SITE

The VGRWSS Phase 2 starts at the Delportshoop WTW and runs past the towns of Ulco, Lime Acres and Postmasburg before ending at Olifantshoek, in the Northern Cape.

*Table 3: Affected municipalities.*

| District Municipality (DM) District ( | Local Municipality (LM) |
|---|---|
| Frances Baard DM | Dikgatlong LM |
| ZF Mgcawu DM | Kgatelopele LM & Tsantsabane LM |
| John Taolo Gaetsewe DM | Gamagara LM |

## 7 METHODS

A desktop study evaluate the possible risk to palaeontological heritage (this includes fossils as well as trace fossils) in the proposed development area. In compiling the desktop report aerial photos, Google Earth 2018, topographical and geological maps and other reports from the same area as well as the author's experience were used to assess the proposed development footprint. int. No consultations were undertaken for this Impact Assessment.

### 7.1 Assumptions and limitations

The accuracy of Desktop Palaeontological Assessment is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information were not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentre on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas is used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally **assume** that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

## 8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- The Palaeosensitivity Map from the SAHRIS website.
- A Google Earth map with polygons of the proposed development was obtained from Nemai Consulting
- The VGRWSS Phase 2- BID
- Geological Map 1: 250 000 2822 Postmastburg (Counsil for Geoscience).
- Geological Map 1: 250 000 2722 Kuruman (Counsil for Geoscience).

- Geological Map 1: 250 000 2824 Christiana (Counsil for Geoscience).
- Palaeontological Impact Assessments of developments in the same area found on the internet include Almond, 2013, 2015; Bamford 2017; Butler 2018, 2019; Fourie 2018. See reference list.

## 9 SITE VISIT

A 2-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 26 and 27 October 2019. The following photographs were taken during the site visit to the proposed development. No visible fossiliferous outcrop was identified during the site investigation although the author identified numerous well-preserved stromatolites near Ulco (See Butler, 2018). Well-preserved fossils may thus be found during excavations and due care must be taken to preserve them- see protocol for finds.

*Figure 9: Start of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 (VGRWSS-II) in Delportshoop*

*GPS coordinates 28°24'29"S 24°15'60"E*

*Figure 10: Low vegetation along the R370. GPS coordinates 28°24'16''S  24°15'42''E*

*Figure 11: Roadworks next to the R31. GPS coordinates 28°19'05"S  24°12'49"E*

*Figure 12: Road running northwesternly in Danielskuil. GPS coordinates 28°12' 18"S  23°33'02"E*

*Figure 13: SD1 area along the Park Road roadside in Danielskuil. GPS coordinates 28°10'36.67"S 23°31'39.46"E*

Figure 14: Roadside along R385. GPS coordinates 28°15' 57"S  23°32'48"E

Figure 15: Roadside along the R325 near Olifanshoek. GPS coordinates 28°04' 07"S  23°03'58"E

Figure 16: Roadside along the N14 near Olifanshoek. GPS coordinates 27°55' 01"S  22°49'39"E

Figure 17: Roadside in Olifanshoek near resiorvoir. GPS coordinates 27°56' 01"S  22°44'11"E

## 10 IMPACT ASSESSMENT METHODOLOGY

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

• Construction
• Operation
• Decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact the following criteria is used:

*Table 4:* The rating system

| | | |
|---|---|---|
| **NATURE** | | |
| Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.<br>The Nature of the Impact is the possible descruction of fossil heritage | | |
| **GEOGRAPHICAL EXTENT** | | |
| This is defined as the area over which the impact will be experienced. | | |
| 1 | Site | The impact will only affect the site. |
| 2 | Local/district | Will affect the local area or district. |
| 3 | Province/region | Will affect the entire province or region. |
| 4 | International and National | Will affect the entire country. |
| **PROBABILITY** | | |
| This describes the chance of occurrence of an impact. | | |
| 1 | Unlikely | The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence). |
| 2 | Possible | The impact may occur (Between a 25% to 50% chance of occurrence). |
| 3 | Probable | The impact will likely occur (Between a 50% to 75% chance of occurrence). |
| 4 | Definite | Impact will certainly occur (Greater than a 75% chance of occurrence). |
| **DURATION** | | |
| This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity. | | |
| 1 | Short term | The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years). |
| 2 | Medium term | The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years). |

| | | |
|---|---|---|
| 3 | Long term | The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years). |
| 4 | Permanent | The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite. |
| **INTENSITY/ MAGNITUDE** | | |
| Describes the severity of an impact. | | |
| 1 | Low | Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible. |
| 2 | Medium | Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity). |
| 3 | High | Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation. |
| 4 | Very high | Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation. |
| **REVERSIBILITY** | | |
| This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity. | | |
| 1 | Completely reversible | The impact is reversible with implementation of minor mitigation measures. |
| 2 | Partly reversible | The impact is partly reversible but more intense mitigation measures are required. |
| 3 | Barely reversible | The impact is unlikely to be reversed even with intense mitigation measures. |
| 4 | Irreversible | The impact is irreversible and no mitigation measures exist. |
| **IRREPLACEABLE LOSS OF RESOURCES** | | |

| | | |
|---|---|---|
| This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity. | | |
| 1 | No loss of resource | The impact will not result in the loss of any resources. |
| 2 | Marginal loss of resource | The impact will result in marginal loss of resources. |
| 3 | Significant loss of resources | The impact will result in significant loss of resources. |
| 4 | Complete loss of resources | The impact is result in a complete loss of all resources. |
| **CUMULATIVE EFFECT** | | |
| This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question. | | |
| 1 | Negligible cumulative impact | The impact would result in negligible to no cumulative effects. |
| 2 | Low cumulative impact | The impact would result in insignificant cumulative effects. |
| 3 | Medium cumulative impact | The impact would result in minor cumulative effects. |
| 4 | High cumulative impact | The impact would result in significant cumulative effects |
| **SIGNIFICANCE** | | |
| Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:<br>(**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.**<br>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating. | | |
| Points | Impact significance rating | Description |
| 6 to 28 | Negative low impact | The anticipated impact will have negligible negative effects and will require little to no mitigation. |
| 6 to 28 | Positive low impact | The anticipated impact will have minor positive effects. |
| 29 to 50 | Negative medium impact | The anticipated impact will have moderate negative effects and will require moderate mitigation measures. |
| 29 to 50 | Positive medium impact | The anticipated impact will have moderate positive effects. |
| 51 to 73 | Negative high impact | The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact. |
| 51 to 73 | Positive high impact | The anticipated impact will have significant positive effects. |

| | | |
|---|---|---|
| 74 to 96 | Negative very high impact | The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws". |
| 74 to 96 | Positive very high impact | The anticipated impact will have highly significant positive |

### 10.1 SUMMARY OF IMPACT TABLES

Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. The impact will most likely happen (moderate to high sensitivity). The magnitude of the impact occurring is medium. There will be a irriversable and irriplacable loss of fossilssil Heritage. The significance of the impact ill be a negative medium impact.

## 11 FINDINGS AND RECOMMENDATIONS

The proposed Vaal Gamagara Regional Water Supply Scheme upgrading is completely underlain by the following sedimentations:
Kalahari Group (High Sensitivity)
Dwyka Group, Karoo Supergroup. (Low Sensitivity)
Matsap Subgroup, Volop Group, Olifantshoek Supergroup (Low Sensitivity)
Gamagara Fm, Olifantshoek Supergroup (Low Sensitivity)
Ongeluk Fm, Postmasburg Group Transvaal Supergroup (Moderate Sensitivity)
Asbestos Hills Subgroup, Ghaap Group, Transvaal Supergroup (Moderate Sensitivity)
Campbell Rand Subgroup, Ghaap Group, Transvaal Supergroup (Moderate Sensitivity)
Vryburg Fm, Transvaal Supergroup (Moderate to high Sensitivity)

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is High; Dwyka Group is Low; Gamagara Fm is Low, Ongeluks FM is Moderate, the Campbel Rand is Moderate and Asbestos Hills also has a Moderate Sensitivity while the Vryburg Fm has a (Moderate to high Sensitivity).

A 2-day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 26 and 27 October 2019. No visible evidence of fossiliferous outcrops was found. For this reason, an overall medium palaeontological sensitivity is allocated to the development footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of VGRWSS-II will be of a medium significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction of the development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by new excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (*in situ* if possible) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that suitable mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

Recommendations:

- The EAP and ECO for this project must be informed that High Palaeontological Sensitivity is allocated to the Kalahari Formation and a moderate to High to the Vryburg Formation.
- If fossil remains are discovered during any phase of construction, either on the surface or exposed by new excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (if possible, *in situ*) and the ECO ought to alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a palaeontologist.
- These recommendations must be incorporated in the EMPr of this project.

## 12 CHANCE FINdS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

### 12.1 LEGISLATION

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **“all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**”.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

### 12.2 BACKGROUND

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

### 12.3 INTRODUCTION

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Control Officer (ECO) of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ECO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

### 12.4 CHANCE FIND PROCEDURE

- If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or site manager. The ECO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (as many as you can) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development.

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**Appendix: 1: CV**

**ELIZE BUTLER**

**PROFESSION:** Palaeontologist

**YEARS' EXPERIENCE**: 25 years in Palaeontology

**EDUCATION:** B.Sc Botany and Zoology, 1988
University of the Orange Free State

B.Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

**Dissertation title:** The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS
2013 to current

**Dissertation title:** A new gorgonopsian from the uppermost D*aptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

**MEMBERSHIP**

Palaeontological Society of South Africa (PSSA) 2006-currently

**EMPLOYMENT HISTORY**

| | |
|---|---|
| Part time Laboratory assistant | Department of Zoology & Entomology University of the Free State Zoology 1989-1992 |
| Part time laboratory assistant | Department of Virology University of the Free State Zoology 1992 |
| Research Assistant | National Museum, Bloemfontein 1993 – 1997 |
| Principal Research Assistant and Collection Manager | National Museum, Bloemfontein 1998–currently |

**TECHNICAL REPORTS**

**Butler, E. 2014.** Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

**Butler, E. 2014.** Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

**Butler, E. 2015.** Palaeontological impact assessment of the proposed consolidation, re-division and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2015.** Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

**Butler, E. 2015.** Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. Bloemfontein.

**Butler, E. 2015.** Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province. Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.

**Butler, E. 2015.** Palaeontological Heritage Impact Assessment report on the establishment of the 65 MW Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

**Butler, E. 2015.**Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.

**Butler, E. 2015.** Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

**Butler, E. 2016.** Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Recommendation from further Palaeontological Studies: Proposed Construction of the Modderfontein Filling Station on Erf 28 Portion 30, Founders Hill, City Of Johannesburg, Gauteng Province. Bloemfontein.

**Butler, E. 2016.** Recommendation from further Palaeontological Studies: Proposed Construction of the Modikwa Filling Station on a Portion of Portion 2 of Mooihoek 255 Kt, Greater Tubatse Local Municipality, Limpopo Province. Bloemfontein.

**Butler, E. 2016.** Recommendation from further Palaeontological Studies: Proposed Construction of the Heidedal filling station on Erf 16603, Heidedal Extension 24, Mangaung Local Municipality, Bloemfontein, Free State Province. Bloemfontein.

**Butler, E. 2016.** Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single Or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Savannaha South Africa. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from the Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday’s river valley Local Municipality, Eastern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape province.. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment of the proposed development of two burrow pits (DR02625 and DR02614) in the Enoch Mgijima Municipality, Chris Hani District, Eastern Cape

**Butler, E. 2016.** Ezibeleni waste Buy-Back Centre (near Queenstown), Enoch Mgijima Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2016.** Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

**Butler, E. 2016.**Palaeontological Impact Assessment for the proposed development of four Leeuwberg Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological impact assessment for the proposed Aggeneys south prospecting right project, Northern Cape Province. Bloemfontein.

**Butler, E. 2016.** Palaeontological impact assessment of the proposed Motuoane Ladysmith Exploration right application, KwaZulu Natal. Bloemfontein.

**Butler, E. 2016.** Palaeontological impact assessment for the proposed construction of two 5 MW solar photovoltaic power plants on farm Wildebeestkuil 59 and farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

**Butler, E. 2016.**: Palaeontological desktop assessment of the establishment of the proposed residential and mixed use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 IR, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamagara local municipality and John Taolo Gaetsewe district municipality, Northern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment Of The Proposed Development Of The New Open Cast Mining Operations On The Remaining Portions Of 6, 7, 8 And 10 Of The Farm Kwaggafontein 8 In The Carolina Magisterial District, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Scoping Report for the Proposed Construction of a Warehouse and Associated Infrastructure at Perseverance in Port Elizabeth, Eastern Cape Province.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the Proposed Establishment of a Diesel Farm and a Haul Road for the Tshipi Borwa mine Near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the Proposed Changes to Operations at the UMK Mine near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment for the Development of the Proposed Ventersburg Project-An Underground Mining Operation near Ventersburg and Henneman, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological desktop assessment of the proposed development of a 3000 MW combined cycle gas turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment for the Development of the Proposed Revalidation of the lapsed General Plans for Elliotdale, Mbhashe Local Municipality. Bloemfontein.

**Butler, E. 2017.** Palaeontological assessment of the proposed development of a 3000 MW Combined Cycle Gas Turbine (CCGT) in Richards Bay, Kwazulu-Natal. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed development of the new open cast mining operations on the remaining portions of 6, 7, 8 and 10 of the farm Kwaggafontein 8 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed mining of the farm Zandvoort 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of open pit mining at Pit 36W (New Pit) and 62E (Dishaba) Amandelbult Mine Complex, Thabazimbi, Limpopo Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological impact assessment of the proposed development of the sport precinct and associated infrastructure at Merrifield Preparatory school and college, Amathole Municipality, East London. Bloemfontein.

**Butler, E. 2017.** Palaeontological impact assessment of the proposed construction of the Lehae training and fire station, Lenasia, Gauteng Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the new open cast mining operations of the Impunzi mine in the Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the Lephalale coal and power project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelberg, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

**Butler, E. 2017** Palaeontological Desktop Assessment of the proposed development of a railway siding on a portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed of the Lephalale Coal and Power Project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed development of the H2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2018.** Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment for the proposed re-alignment and de-commisioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

**Butler, E. 2018** Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein

**E. Butler.** 2019. Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.

**E. Butler**. 2019. Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**E. Butler.** 2019. Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**E. Butler**. 2019. Palaeontological Field Assessement for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.

**E. Butler**. 2019. Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.

**E. Butler.** 2019. Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019.** Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality

**E. Butler. 2019.** Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

**E. Butler. 2019**. Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

**E. Butler. 2019.** Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo

E. **Butler. 2019.** Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province

**E. Butler.** 2019. Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.

**E. Butler. 2019**. Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.

**E. Butler. 2019**. Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019.** Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019**. Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.

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# APPENDIX H5

TERRESTRIAL ECOLOGICAL IMPACT ASSESSMENT

# PROPOSED UPGRADING OF THE VAAL GAMAGARA REGIONAL WATER SUPPLY SCHEME: PHASE 2 IN NORTHERN CAPE PROVINCE

DEA REFERENCE NO:

## Terrestrial Ecological Impact Assessment Report

November 2019

Draft

Prepared for: Pro-Plan Consulting Engineers


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Environmental, Social and OHS Consultants

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# Title and Approval Page

| | |
|---|---|
| Project Name: | Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province |
| Report Title: | Terrestrial Ecological Impact Assessment Report |
| Authority Reference: | |
| Report Status | Draft |

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| Applicant: | Pro-Plan Consulting Engineers |



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| **Author's Affiliations** | **Professional Natural Scientist**: South African Council for Natural Scientific Professions Ecological Science (400349/2) |
| | **Professional Member** of South African Institute of Ecologists and Environmental Scientists |
| | **Professional Member**: South African Association of Botanists. |
| **External Reviewer:** | |

# Executive Summary

**Introduction and Background**

Nemai Consulting has been appointed by Pro-Plan Consulting Engineers, on behalf of Sedibeng Water, as the Independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province.

The Vaal Gamagara Scheme is a water supply scheme located in the Northern Cape Province that was completed in 1968 by the Department of Water Affairs, now Department of Water and Sanitation (DWS), and transferred to Sedibeng Water in 2008. The Scheme currently supplies approximately 22 million $m^3/a$ to domestic consumers, mines and farmers. The Scheme transfers water from Delportshoop on the Vaal River (60km to the north west of Kimberley) via Postmasburg to the iron ore mines at Kathu. From Kathu, the pipeline continues to the manganese mines at Hotazel and finally terminates at Black Rock.

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Secondary to the expected increased water demand are water supply interruptions that are amplified due to the aging infrastructure. The infrastructure, being almost 50 years old, is nearing the end of its useful life. Due to the condition of the pipelines, the full design capacity can no longer be supplied through this infrastructure. Total collapse in water supply estimated at 2023.

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The proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 (VGRWSS-II) entails the following:

- Construction of new pipelines from Delportshoop to Olifantshoek, approximately 210km in length;
- Upgrading four existing pump stations;
- Upgrading of the existing Delportshoop WTW; and
- Sourcing of bedding material from borrow pits areas.

A Terrestrial Ecological Assessment was undertaken as part of the EIA process in order to assess the impacts that the proposed upgrade of the VGRWSS-II will have on the receiving environment

**Study Area**

The proposed upgrade of the VGRWSS-II is located in the Northern Cape Province. The proposed upgrade falls within three District Municipalities, namely the John Taolo Gaetsewe District Municipality (DM), the Frances Baard DM, and the Z F Mgcawu DM.

The proposed pipeline starts at the Delportshoop WTW (28°24'26.05"S/24°16'5.98"E) and runs through Lime Acres and Postmasburg, ending at Olifantshoek (27°56'30.17"S/ 22°43'54.24"E). The total length of the proposed pipeline from Delportshoop to Olifantshoek is approximately 210km. The proposed pipeline is mostly located inside the existing VGRWSS servitude, which traverses rivers, game farms, farming areas, human settlements, mining areas, and is situated along existing linear infrastructure, including roads and a railway line

**Regional Vegetation**

The proposed upgrade of the VGRWSS-II study area falls within the Azonal vegetation and Savanna biomes.

Azonal vegetation responds more readily to localized edaphic factors such as the amount and periodicity of water and salts, rather than to macroclimatic and geological patterns across the landscape that dictates vegetation formation elsewhere. The stresses and problems that vegetation encounter in the azonal vegetation environment are so peculiar and in some cases so extreme that only highly specialized species that are sufficiently equipped to deal with those stresses and problems can be found there, forming their own typical vegetation composition.

The Savanna Biome is the largest Biome in South Africa and occupies over one third of the whole area. It is characterized by a grassy ground layers and distinct upper layers of woody plants.

The study area is classified as falling within the following vegetation types, namely: Southern Kalahari Mekgacha; Schmidtsdrif Thornveld; Postmasburg Thornveld; Olifantshoek Plains Thornveld; Kuruman Thornveld; Kuruman Mountain Bushveld; Koranna-Langeberg Mountain Bushveld; Kathu Bushveld and Ghaap Plateau Vaalbosveld.

**Terrestrial Threatened Ecosystems**

No threatened terrestrial ecosystems are located in the vicinity of the project area with the nearest, the Schweizer-Reneke Bushveld ecosystem, situated approximately 110 km to the east of the project area.

**Northern Cape Critical Biodiversity Areas**

The Northern Cape Critical Biodiversity Areas (CBA) map identifies biodiversity priority areas, called CBAs and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species to ensure the long-term ecological functioning of the landscape as a whole.

The Northern Cape CBA map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. These include the following:

- Namakwa District Biodiversity Sector Plan
- Cape Fine-Scale Plan (only the extent of the areas in the Northern Cape i.e. Bokkeveld and Nieuwoudtville)
- Richtersveld Municipality Biodiversity Assessment

The identification of CBAs and ESAs for the Northern Cape was undertaken using a Systematic Conservation Planning approach. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated.

The proposed upgrade traverses CBA One regions, CBA Two regions, ESA regions, and Other Natural Areas. Although sections of the study area fall within CBA1 and CBA 2 regions, it must be noted that based on the findings from the site visits and the fact that the proposed project infrastructure is mostly located inside the existing VGRWSS pipeline servitude, the CBA and ESA regions within the servitude have been previously disturbed and transformed, and thus no longer retain the ecosystem functioning nor meet the national biodiversity objectives of these regions.

**Methodology**

Survey methodology included a comprehensive desktop review, utilising available provincial and national ecological data, relevant literature, GIS databases, topographical maps and aerial photography. This was then supplemented through a ground-truthing phase, where pertinent areas associated with the project area were visited during field surveys undertaken from 15 to 19 April 2019. The survey focused on flora (vegetation) and fauna (mammals, avifauna, reptiles and amphibians). Several Orange/Red Listed floral and Red Data faunal species pertaining to the project area were identified during the desktop review and their habitat suitability were assessed through the ground-truthing phase of the surveys.

**Results and Discussion – Flora**

During the field survey, no threatened plant species were observed within the study area, however only two (2) species of conservation concern were noted, namely *Vachellia erioloba* (= *Acacia erioloba*) (Camel thorn) and *Boophone disticha* (Century plant), listed as *Declining.* These plant species were recorded within the study area.

In terms of the National Forests Act (Act No. 84 of 1998), certain tree species are declared as protected. Protected trees occurring in the study area are *Boscia albitrunca* (Shepherd's tree) and *Vachellia (Acacia) erioloba* (Camel thorn)***.*** According to Section 51(1) of the National Forests Act (Act No. 84 of 1998), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister of Department of Agriculture, Forestry and Fisheries (DAFF).

The following plant species are listed as “protected plants” in terms of Schedule 2 of Northern Cape Nature Conservation Act (Act 9 of 2009): *Boscia albitrunca* (Shepherd's tree); *Olea europaea* subsp*. africana*; all species of families Amaryllidaceae (*Ammocharis coranica*, *Boophone disticha* and *Nerine laticoma*; Asphodelaceae (*Aloe grandidentata*, *Aloe hereroensis*, *Bulbine narcissifolia*, and *Kniphofia cf. ensifolia*; Hyacinthaceae (*Ornithogalum* sp.; Iridaceae (*Babiana* sp, were recorded within the study area. In terms of restricted activities involving protected plants, no person may, without a permit—(a) pick; (b) import; (c) export; (d) transport; (e) cultivate; or (f) trade in, a specimen of a protected plant. Data supplied by DAFF indicates that protected plant species such as *Lithops* spp*., Vachellia haematoxylon* (Grey Camel thorn) and *Nymania capensis* (Chinese lanterns) have been recorded in the study area.

The major concerns on site are alien invasives, weeds and potential invasives. Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring programme to control and/or eradicate newly emerging invasives. The rehabilitation of disturbed areas should receive high priority and must be included in the Environmental Management Program (EMPr) and recommendations regarding the specific plant species used during rehabilitation should be site specific and based on the surrounding vegetation composition.

## Results and Discussion – Fauna

The agricultural fields were largely devoid of mammal species; however meerkat dens were present on the edges of agricultural fields. Large mammal species were mostly found within the game farms. According to the information provided by the local farm owners, two Red Data mammal species have been sighted within the region, namely Black-footed cat and Southern African Hedgehog.

Most bird species found in Northern Cape are either classified by the Northern Cape Nature Conservation Act (Act 9 of 2009as *Schedule 1 Specially Protected species* or *Schedule 2 Protected species* or *Schedule 3 Common indigenous species*. Anecdotal evidence from local land-users indicate that Red Data bird species such as Lanner falcon, Lesser kestrel (even though this species has been downlisted from Vulnerable to Least concern) and Kori Bustard have been observed along the project area and also bird species such as Flamingos and Storks are said to be found in very wet years but for short periods.

Reptile species found within the project area such as Mole snake, Rock Monitor, Leopard Tortoise and Cape Cobra are classified as *protected species* under Schedule 1 of Northern Cape Nature Conservation Act (Act 9 of 2009). All land tortoises and all lizards are listed as *Protected species* under Schedule 2 of the Northern Cape Nature Conservation Act (Act 9 of 2009) whereas *all species of Chamaeleon* are classified as *Schedule 1 Specially Protected species* of Northern Cape Nature Conservation Act (Act 9 of 2009). Prior to construction and vegetation clearance a suitably qualified environmental officer/herpetologist should undertake a walk-through and relocate any affected animals to appropriate habitat away from the servitude. Any lizards, geckoes, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.

The watercourses within the study area hold water on a permanent and temporary basis and are important breeding habitat for most of the frog species which occur within the study area. Only Five frog species were recorded within the study area. Anecdotal evidence from local land-users indicate the presence Bullfrog species. The Bullfrogs are listed as *specially protected species* under Schedule 1 of the Northern Cape Nature Conservation Act (Act 9 of 2009). A Permit is required from Northern Cape Nature Conservation in order to hunt, import, export, transport, keep, possess, breed or trade a specimen of a specially protected animal. All frogs are listed as *protected wild animals* under Schedule 2 of the Northern Cape Nature Conservation Act (Act 9 of 2009).

## Environmental Impact Assessment

An impact significance rating was assessed and all impacts were found to be significantly reduced through the implementation of mitigation measures. Impacts were noted to be rated between “medium to low” prior to mitigation, and as “low” after mitigation.

## Terrestrial Sensitivity

A map of the sensitivity and conservation value of the different parts of the study area was developed showing the distribution of areas in different sensitiviity classes. It is possible from this map to identify areas where there are possible conflicts between the alignment of the pipeline and areas of high sensitivity.

## Conclusion and Recommendations

Biodiversity offsets are not deemed to be necessary, however, it is recommended that a suitably qualified Ecologist (or a similarly qualified individual) should be appointed prior to the start of the construction activities to undertake a pre-construction walk-down to identify plant species of conservation concern and protected species (such as *Boophone disticha)* and oversee the rescue and relocation of these species. The walk-down survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of special concern. This is relevant in the areas that have been labelled as ecologically sensitive. In order to conserve the faunal species community structures within the region, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the required footprint only. During the field surveys, it was found that the impacts of the proposed development on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur.

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| | |
|---|---|
| ADU | Animal Demography Unit |
| CBA | Critical Biodiversity Area |
| CARA | Conservation of Agricultural Resources Act |
| CAR | Coordinated Avifaunal Road-count |
| CPE | Centre of Plant Endemism |
| CR | Critically Endangered |
| CWAC | Coordinated Waterbird Count |
| DAFF | Department of Agriculture, Forestry and Fisheries |
| DDD | Data Deficient - Insufficient Information |
| DEA | Department of Environmental Affairs |
| DENC | Northern Cape Department of Environment and Nature Conservation |
| DM | District Municipality |
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| EMF | Environmental Management Framework |
| EMPr | Environmental Management Programme |
| EN | Endangered |
| ESA | Ecological Support Area |
| EW | Extinct in the Wild |
| GPS | Global Positioning System |
| GIS | Geographic information system |
| QDS | Quarter degree Squares |
| GWC | Griqualand West Centre of Endemism |
| IAPs | Alien and Invasive Plant species |
| IBA | Important Bird and Biodiversity Area |
| IUCN | International Union for Conservation of Nature |
| LM | Local Municipality |
| NBA | National Biodiversity Assessment, 2018 |
| NEMA | National Environmental Management Act |
| NT | Near Threatened |
| ONA | Other Natural Areas |
| RE | Regionally Extinct |
| SABS | South African Bureau of Standards |
| SANBI | South African National Biodiversity Institute |
| SARCA | Southern African Reptile Conservation Assessment |
| SEAs | Strategic Environmental Assessments |
| SAFAP | South African Frog Atlas Project |
| SCC | Species of Conservation Concern |
| VGRWSS | Vaal Gamagara Regional Water Supply Scheme |

| | |
|---|---|
| VU | Vulnerable |
| WTW | Water Treatment Works |

# 1 INTRODUCTION AND BACKGROUND

Nemai Consulting has been appointed by Pro-Plan Consulting Engineers, on behalf of Sedibeng Water, as the Independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province.

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- Sourcing of bedding material from borrow pits areas.

A Terrestrial Ecological Assessment was undertaken as part of the EIA process in order to assess the impacts that the proposed upgrade of the VGRWSS-II will have on the receiving environment. The objectives of this study is listed below:

## 1.1 Objectives of the Study

- To consult relevant literature to determine which species (plants, mammals, birds, reptiles and amphibians) could potentially be present in the area;
- A desktop assessment to identify all sensitive terrestrial ecosystems (i.e. vegetation, CBA, ESA, NPAES, IBA, NFEPA, rivers etc.) along the pipeline route;
- A desktop assessment to determine which Red Listed and protected fauna and flora species were previously recorded from this study area;
- To conduct fieldwork in order to compile lists of flora and fauna species found in the study areas, and assess their conservation status;
- To assess the potential impacts of the proposed project on these taxa and/or habitats;
- To provide monitoring, guidelines and management recommendations to mitigate negative impacts and enhance positive impacts within the study area.
- To assess the habitat suitability and condition of the Red Listed fauna and flora species that could potentially be present as identified during the desktop assessment.

## 1.2 Declaration

I, Avhafarei Phamphe, declare that I –

- act as an independent specialist consultant in the fields of Biodiversity (Fauna and Flora) for the Terrestrial Impact Assessment Report for the Vaal Gamagara Regional Water Supply Scheme Project;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- have and will not have any vested interest in the proposed activity;
- have no, and will not engage in conflicting interests in the undertaking of the activity;

- undertake to disclose to the competent authority any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014;
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not and
- The attached peer review comments have been adequately addressed in this report.

Avhafarei Phamphe
Senior Biodiversity Specialist
Nemai Consulting (PTY) Ltd

# 2 RELEVANT LEGISLATION AND GUIDELINES

The following legislation are relevant to this project:

- The Constitution, 1996 (Act No. 108 of 1996) – Section 24;
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- National Forests Act, 1998 (Act No. 84 of 1998);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Threatened or Protected Species regulations;
- Northern Cape Conservation Act (Act No. 9 of 2009), specifically concerning Specially Protected and Protected flora and fauna species as listed under Schedule 1 and 2 of Chapter 12;
- The National Environmental Management Act (NEMA) No. 107 of 1198): Environmental Impact Assessment Regulations, 2014 as amended. Specifically, the requirements of the specialist report as per the requirements of Appendix 6;
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) - Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.

# 3 STUDY AREA

The proposed upgrade of the VGRWSS-II is located in the Northern Cape Province (**Figures 1** and **2**). The proposed upgrade falls within three District Municipalities, namely the John Taolo Gaetsewe District Municipality (DM), the Frances Baard DM, and the Z F Mgcawu DM.

The proposed pipeline starts at the Delportshoop WTW (28°24'26.05"S/24°16'5.98"E) and runs through Lime Acres and Postmasburg, ending at Olifantshoek (27°56'30.17"S/ 22°43'54.24"E). The total length of the proposed pipeline from Delportshoop to Olifantshoek is approximately 210km. The proposed pipeline is mostly located inside the existing VGRWSS servitude, which traverses rivers, game farms, farming areas, human settlements, mining areas, and is situated along existing linear infrastructure, including roads and a railway line (**Figure 3**).

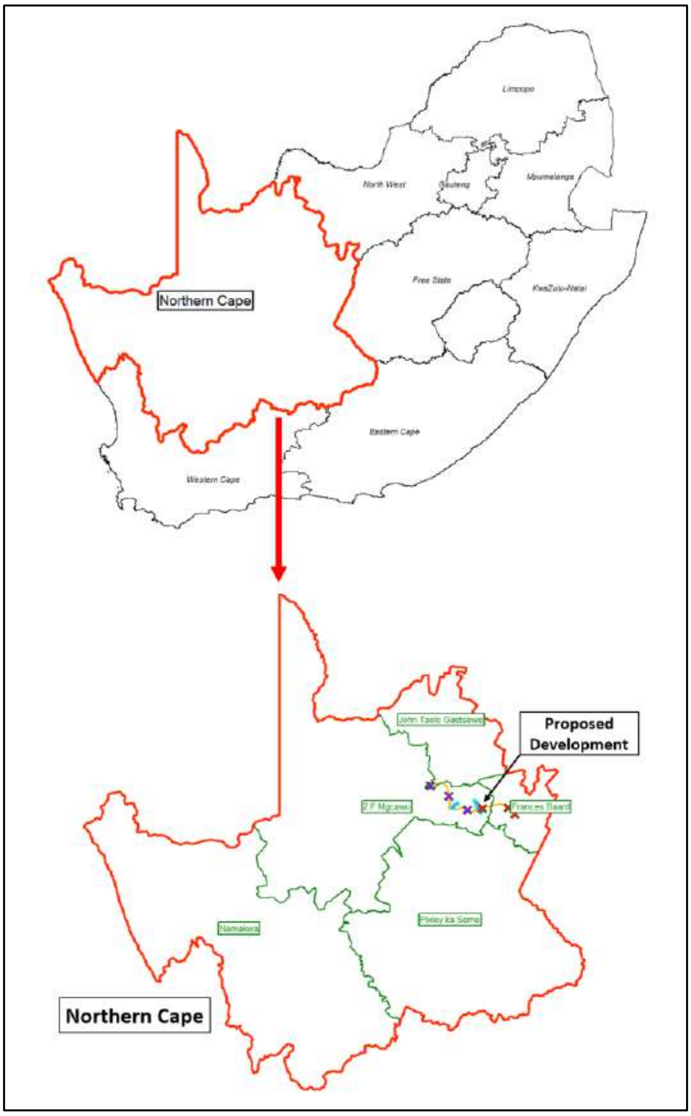


**Figure 1: Regional locality map**

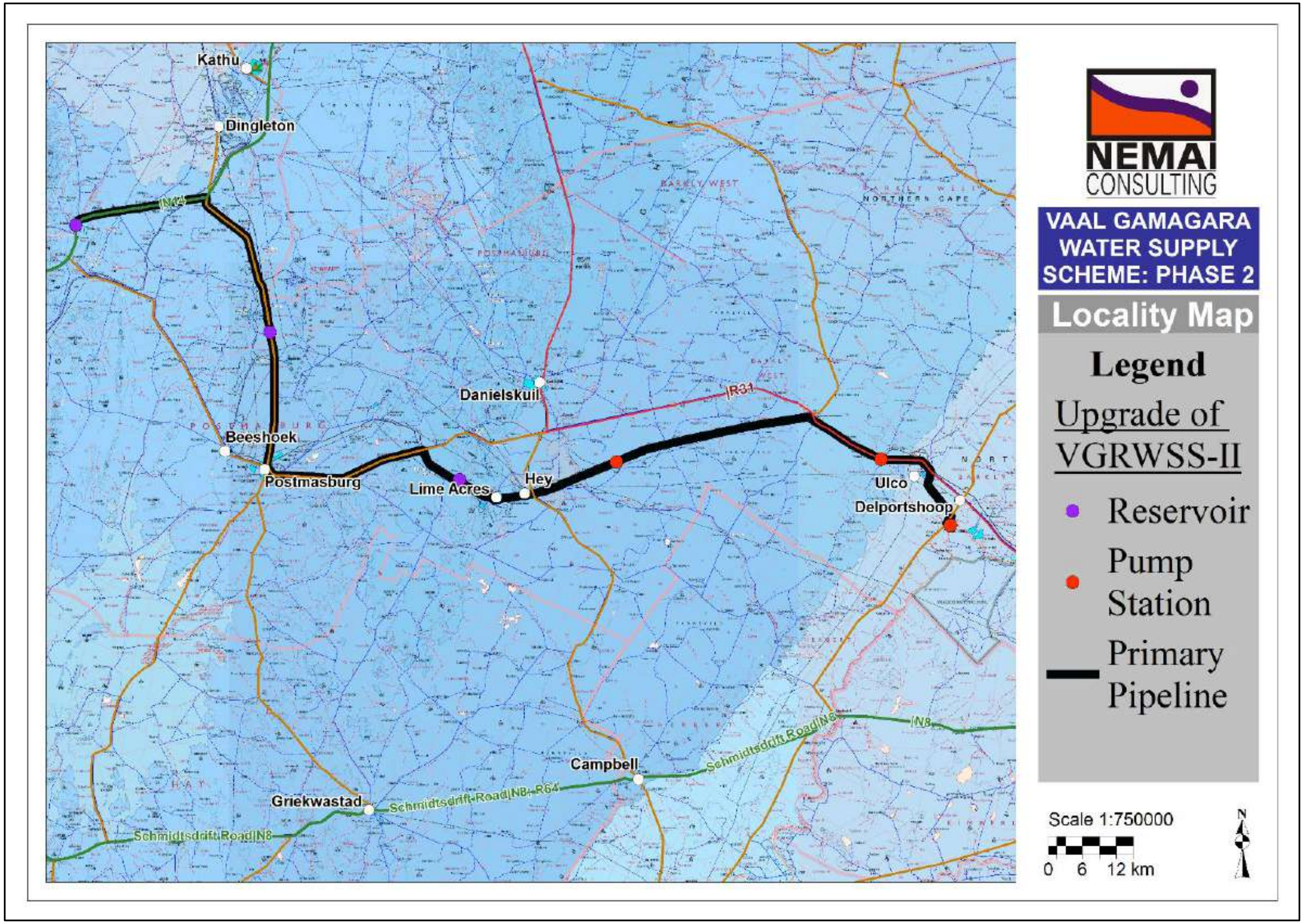


**Figure 2. 1 in 250 000 Topographical map of the study area**


**Figure 3. Photographs taken along the study area**

# 4 LIMITATIONS AND GAPS

The constraints or limitations to the study include:

- Surveys were undertaken from 15-19 April 2019, which fall within an optimal time of the season to find sensitive plant and animal species of high conservation priority. Weather conditions during the surveys were favourable for recording both fauna and flora. The timing and duration of the site visit are not seen to pose a significant constraint on the results of the study and it is unlikely that any significant features or species would be revealed by additional site visits. Northern Cape Province normally received the most rains in January, February and March so end of March/April is seen as a good time for biodiversity surveys.
- This report has been prepared on the strengths of the information available at the time of the assessment; and
- Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based on information gathered or databases consulted at the time of the investigation.

# 5 METHODOLOGY

## 5.1 Flora

The flora assessment consisted of two complementary approaches:

- A desktop analysis, which included a literature review, local knowledge, topographical maps, and Google Earth imagery; and
- Site visits were conducted from 15 to 19 April 2019.

Satellite imagery of the study area (Google Earth) was studied in order to acquire a three-dimensional view of the topography and land use and to identify potential "hot-spots" or specialized habitats such as natural habitats, and rivers on or near the study area.

The Pretoria Computerised Information System (PRECIS) list of Red Data plants recorded in the 2824AD, 2824AC, 2824AA, 2823BB, 2823BD, 2823BC, 2823AD, 2823AC, 2823AA, 2723CC, 2722DD and 2722DC Quarter Degree Grid Squares (QDGS) was obtained from South African Biodiversity Institute (SANBI) (http://posa.sanbi.org/searchspp.php) and were consulted to verify the record of occurrence of the plant species seen in the vicinity of the study area. SANBI uses this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. The list was consulted to verify the record of occurrence of the plant species previously recorded in the vicinity of the study area. This can be used to determine the Red data list plant species which could potentially occur within an area. The site sampled is also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS lists may not be present at the area sampled.

The vegetation map published in SANBI (2018) was consulted to identify vegetation types that are found in the study area.

The study area included at least an 80 m corridor (i.e. 40 m on either side of the centre line) for the pipeline, which was traversed by foot and species listed as they were encountered. Attention was also paid to the occurrence of medicinal, plant species of conservation concern, protected trees, threatened species, alien and declared weed species. Field guides such as van Wyk *et al.* (1997), Pooley (1998), van Oudshoorn (1999) and Manning (2009) were utilised during the field work for identification of plant species.

Invasive plant species are regulated by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) - Alien and Invasive Species (AIS) List, 2016 (and the latest revised edition of 2019-02-13) was consulted. The AIS Regulations list four different categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

Invasive plant species categories:

- Category 1a: Invasive species which must be eradicated. Any form of trade or planting is strictly prohibited.
- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form or trade or planting is strictly prohibited.
- Category 2: Invasive species, or species deemed to be potentially invasive, in which a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited.

## 5.2 Mammals

The Animal Demographic Unit website and Skinner & Chimimba (2005) were consulted in order to draw up list of potential occurrences of mammal species within the study area. A site visit was then conducted, from 15 – 19 April 2019, where all the mammal species observed on site were documented. The potential habitat for Red Listed mammal species previously recorded in the area were then identified, and the habitat quality and quantity for Red Listed species potentially present were then evaluated. This was then further augmented with anecdotal information provided by local residents. Adjoining properties situated within the corridor were also scanned for important mammal species. During the site visit, mammals were identified by spoor, burrow and visual sightings through random transect walks.

## 5.3 Avifauna

In order to determine any Red data bird which could potential occur within the study area, Southern African Bird Atlas Project (SABAP) 1 & 2 were consulted. An avifauna survey site visit was conducted to record the bird species on the studied site and also to identify possible sensitive areas. The entire study site was surveyed on foot and in the process sightings were recorded through random transects walks. Adjoining properties situated within the corridor were also scanned for important bird species and/or habitats. Birds were identified visually using 10X42 Bushnell Waterproof binoculars where necessary, by call and from feathers. Where necessary, identifications were verified using Sasol Birds of Southern Africa (Sinclair et al. 2002) and the Chamberlain Guide to Birding Gauteng (Marais and Peacock, 2008).

## 5.4 Reptiles

The Animal Demographic Unit website and historic distributions of reptile species were consulted in order to draw up lists of potential occurrences. Site visits were then conducted where all the reptile species observed on study area were documented. The potential habitat for RED Listed reptile species previously recorded in the area were then identified. The habitat quality and quantity for Red Listed species potentially present were evaluated. This was then augmented with anecdotal information provided by locals. Adjoining properties situated within the corridor were also scanned for important reptile species. During the site visits, reptiles were identified by burrow and visual sightings through random transect walks. Possible burrows and reptile retreats were inspected for any inhabitants.

## 5.5 Amphibians

ADU (2019), data from the South African Frog Atlas Project (SAFAP) (1999-2003) and du Preez & Carruthers (2009) were consulted in order to draw up a list of potential occurrences. Field visits were then undertaken/conducted in order to document all observed frog species. Potential habitat for Red Listed frog species which were previously recorded in the study area were then identified. Habitat quality and quantity for Red Listed species potentially present were then evaluated. This was then augmented with anecdotal information provided by locals. Adjoining properties situated within the corridor were also scanned for important frog species. Samplings were conducted on the moist to semi-aquatic areas. Suitable habitats such as ephemeral wetlands where amphibian species of conservation such as Bullfrogs occur were also investigated. Frog calls were compared with pre-recorded calls from du Preez and Carruthers (2009)'s CD and identified from this comparison.

# 6 REGIONAL VEGETATION

The proposed upgrade of the VGRWSS-II study area falls within the Azonal vegetation and Savanna biomes (SANBI, 2012) (**Figure 4**).

Azonal vegetation responds more readily to localized edaphic factors such as the amount and periodicity of water and salts, rather than to macroclimatic and geological patterns across the landscape that dictates vegetation formation elsewhere. The stresses and problems that vegetation encounter in the azonal vegetation environment are so peculiar and in some cases so extreme that only highly specialized species that are sufficiently equipped to deal with those stresses and problems can be found there, forming their own typical vegetation composition (Keddy, 2004).

The Savanna Biome is the largest Biome in South Africa and occupies over one third of the whole area. It is characterized by a grassy ground layers and distinct upper layers of woody plants (Low and Rebelo, 1996).

SANBI (2012) classified the study area as falling within the following vegetation types: Southern Kalahari Mekgacha (Azonal vegetation), Southern Kalahari Salt Pans (Azonal vegetation), Kuruman Mountain Bushveld (Savanna biome), Kathu Bushveld (Savanna biome), Olifantshoek Plains Thornveld (Savanna biome), Postmasburg Thornveld (Savanna biome), Koranna-Langeberg Mountain Bushveld (Savanna biome), Schmidtsdrif Thornveld (Savanna biome), Ghaap Plateau Vaalbosveld (Savanna biome) and Kuruman Thornveld (Savanna biome).

However, according to SANBI (2018) and National Biodiversity Assessment (2018), the following vegetation types were recorded within the study area, namely: Southern Kalahari Mekgacha; Schmidtsdrif Thornveld; Postmasburg Thornveld; Olifantshoek Plains Thornveld; Kuruman Thornveld; Kuruman Mountain Bushveld; Koranna-Langeberg Mountain Bushveld; Kathu Bushveld and Ghaap Plateau Vaalbosveld (**Figure 5**).

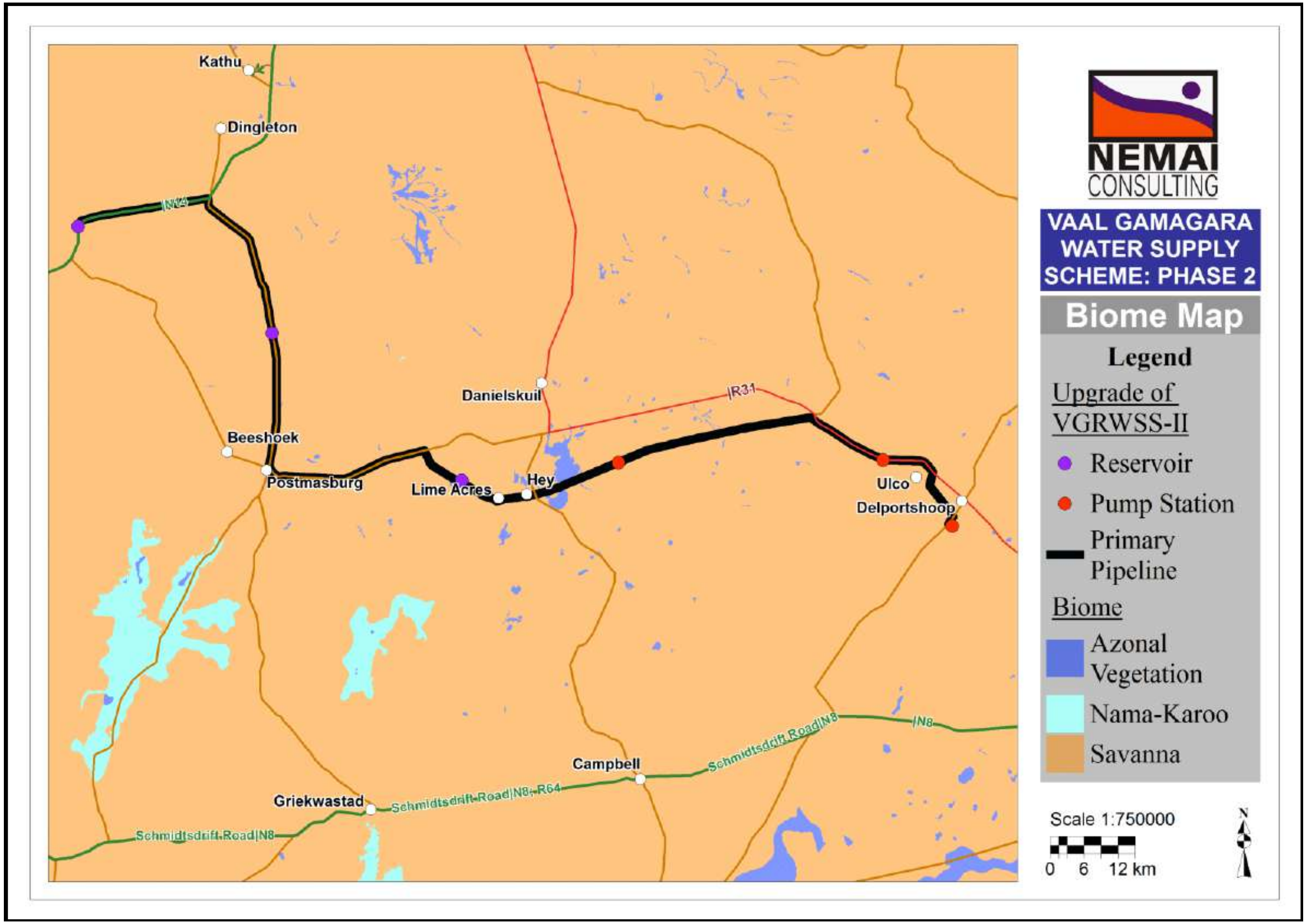


**Figure 4. Biomes in relation to the project area**

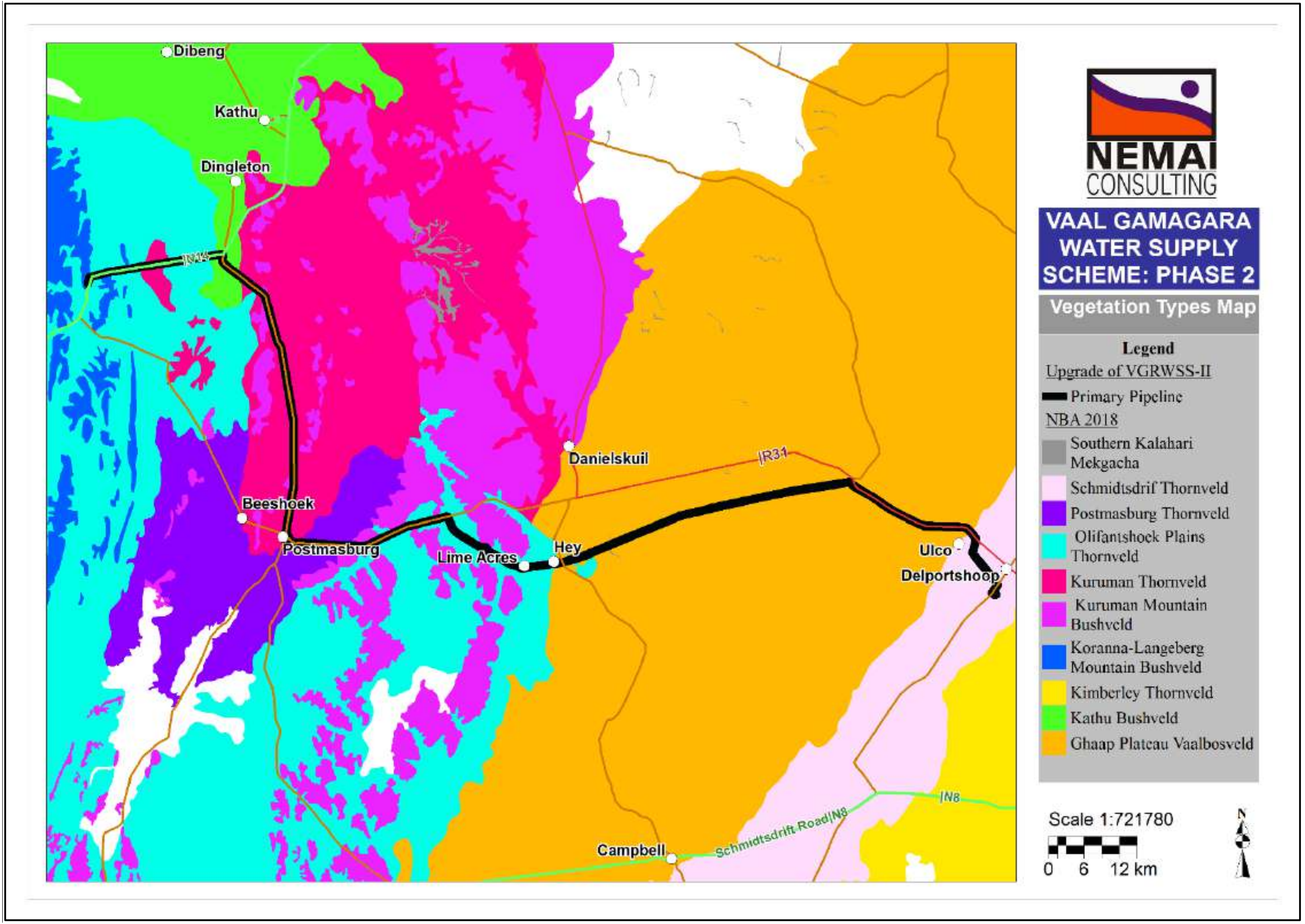


**Figure 5. Vegetation types in relation to the project area (SANBI, 2018)**

The description of the reference vegetation types follows below:

## 6.1 Southern Kalahari Mekgacha

This vegetation type is found in Northern Cape and North-West Provinces. It occurs in valleys (including beds and adjacent slopes) of the intermittent rivers draining the dry savanna south of the Bakalahari Schwelle (broad interfluve at 1 000–1 100 m altitude) in the South African part of the Kalahari region. The major mekgacha of the region include the Nossob, Auob, Molopo and Kuruman Rivers. A more extensive (endorheic) system of mekgacha is found north of the Bakalahari Schwelle in central Botswana (Mucina and Rutherford, 2006).

The vegetation type is considered *Least threatened* with a national conservation target of 24%. Already 18% is statutorily conserved in the Kgalagadi Transfrontier Park and Molopo Nature Reserve. About 2% has been transformed by road building. The mekgacha are under strong utilisation pressure, both from wildlife (to graze and for salt licks) and domestic animals (grazing, browsing and animal penning). Alien woody *Prosopis* species occur as invasive plants in places (Mucina and Rutherford, 2006).

## 6.2 Kuruman Mountain Bushveld

This vegetation type is distributed in Northern Cape and North-West Provinces. It occurs from the Asbestos Mountains southwest and northwest of Griekwastad, along the Kuruman Hills north of Danielskuil, passing west of Kuruman town and re-emerging as isolated hills, i.e. Makhubung and the hills around Pomfret in the north (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None is conserved in statutory conservation areas. Very little is transformed. Erosion varies from low to very low. Some parts in the north are heavily utilised for grazing (Mucina and Rutherford, 2006).

## 6.3 Kathu Bushveld

This vegetation type is mainly distributed in Northern Cape Province. It occurs in plains from Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinckspan to the Botswana border roughly between Van Zylsrus and McCarthysrus (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None is conserved in statutory conservation areas. More than 1% is already transformed, including the iron ore mining locality at Sishen, one of the biggest open-cast mines in the world (Mucina and Rutherford, 2006).

## 6.4 Olifantshoek Plains Thornveld

This vegetation type is mainly distributed in Northern Cape Province. It occurs in plains including most of the pediment areas of the Korannaberg, Langeberg and Asbestos Mountains as well as those of some ridges to the west of the Langeberg. From the vicinity of Sonstraal in the north, past Olifantshoek to areas north of Niekerkshoop between Volop and Griekwastad in the south. Also from Griekwastad northwards to the flats west of the Lime Acres area (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. Only 0.3% is statutorily conserved in the Witsand Nature Reserve. Only about 1% of the area has been transformed and erosion is very low (Mucina and Rutherford, 2006).

## 6.5 Postmasburg Thornveld

This vegetation type is restricted to the Northern Cape Province. It is found in limited area around Postmasburg along the short valley of the Groenwaterspruit to the northeast and southwest, west to Bermolli and around Heuningkrans (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None of this vegetation type is conserved in statutory conservation areas but very little has been transformed (Mucina and Rutherford, 2006).

## 6.6 Koranna-Langeberg Mountain Bushveld

This vegetation type is restricted to Northern Cape Province. From the Tswalu Kalahari Reserve at the northern tip of the Korannaberg southwards in the form of multiple ridges to the Langeberg west of Olifantshoek and southwards along the Langeberg and some parallel ridges, to ridges in the vicinity of Volop. Also some ridges to the west of the Langeberg (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None of this unit is conserved in statutory conservation areas but partly conserved in private reserves such as the Tswalu Kalahari Reserve. Virtually none of the area is transformed (Mucina and Rutherford, 2006).

## 6.7 Schmidtsdrif Thornveld

This vegetation type is found in Northern Cape, Free State and North-West Provinces. It occurs on footslopes and midslopes to the southeast and below the Ghaap Plateau, from around Douglas in the southwest via Schmidtsdrif towards Taung in the northeast. A small, less typical section is found east of the Ghaap Plateau from Warrenton towards Hertzogville (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. Only 0.2% is statutorily conserved in the Vaalbos National Park. Some 13% of this unit is already transformed, mainly by cultivation. Of alien plant taxa, *Prosopis* deserves attention (Mucina and Rutherford, 2006).

### 6.8 Ghaap Plateau Vaalbosveld

This vegetation type is found in Northern Cape and North-West Provinces. It occurs in flat plateaus from around Campbell in the south, east of Danielskuil through Reivilo to around Vryburg in the north (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None of this vegetation type is conserved in statutory conservation areas. Only about 1% is already transformed (Mucina and Rutherford, 2006).

### 6.9 Kuruman Thornveld

This vegetation type is found in North-West and Northern Cape Provinces. It occurs on flats from the vicinity of Postmasburg and Danielskuil (here west of the Kuruman Hills) in the south, extending via Kuruman to Tsineng and Dewar in the north (Mucina and Rutherford, 2006).

The vegetation type is considered as *Least threatened* with a national conservation target of 16%. None of this vegetation type is conserved in statutory conservation areas. Only 2% is already transformed (Mucina and Rutherford, 2006).

# 7 THREATENED TERRESTRIAL ECOSYSTEMS

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (Government Notice 1002) (Driver *et al.* 2004). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems.

It is estimated that Threatened Ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management

Frameworks (EMFs), EIAs and other environmental applications (Mucina and Rutherford, 2006).

The Vaal Gamagara Regional Water Supply Scheme does not fall within any of the threatened terrestrial ecosystems (**Figure 6**).

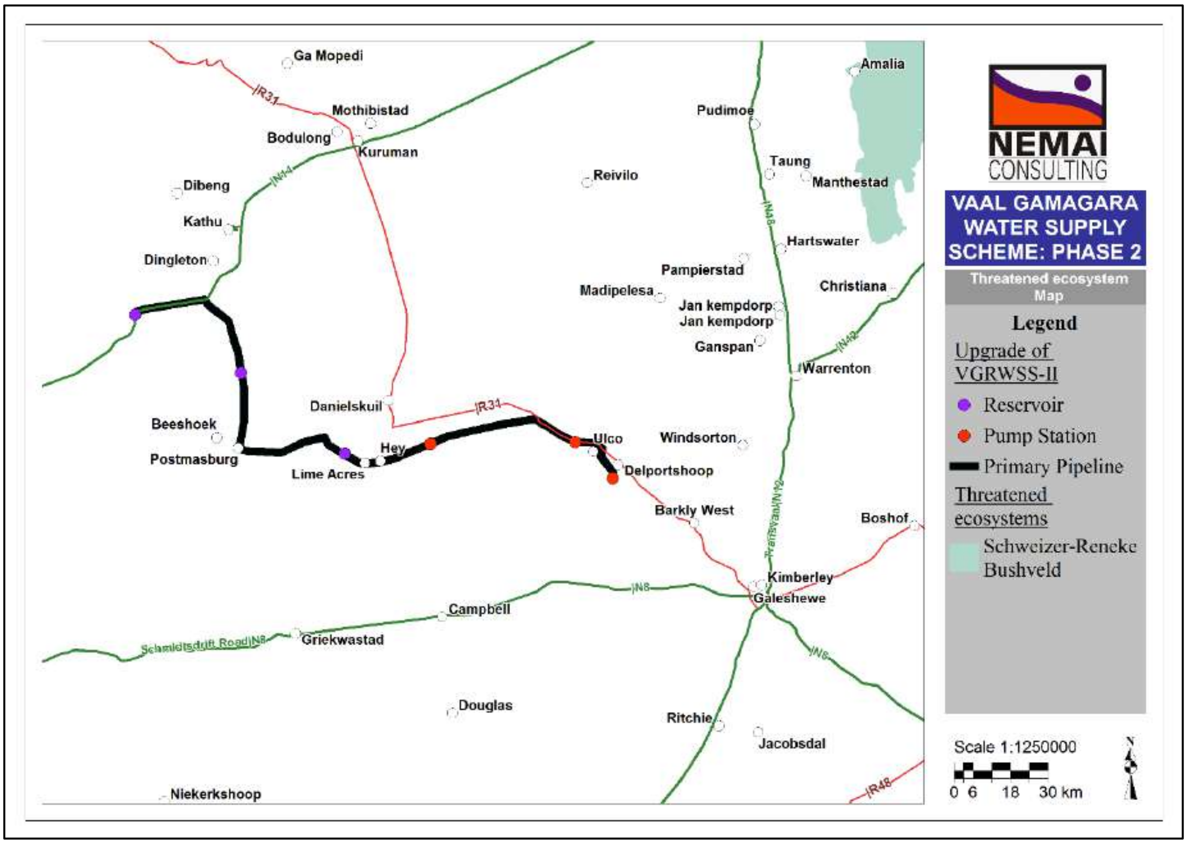


**Figure 6. Threatened terrestrial ecosystems in relation to the project area**

# 8 CRITICAL BIODIVERSITY AREAS OF THE NORTHERN CAPE

The Northern Cape Critical Biodiversity Areas (CBA) map (Oosthuysen and Holness, 2016) identifies biodiversity priority areas, called CBAs and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species to ensure the long-term ecological functioning of the landscape as a whole.

The Northern Cape CBA map updates, revises and replaces all older systematic biodiversity plans and associated products for the province. These include the following:

- Namakwa District Biodiversity Sector Plan
- Cape Fine-Scale Plan (only the extent of the areas in the Northern Cape i.e. Bokkeveld and Nieuwoudtville)
- Richtersveld Municipality Biodiversity Assessment

The identification of CBAs and ESAs for the Northern Cape was undertaken using a Systematic Conservation Planning approach. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated.

The proposed upgrade traverses CBA One regions, CBA Two regions, ESA regions, and Other Natural Areas (**Figure 7**).

Although sections of the study area fall within CBA1 and CBA 2 regions, it must be noted that based on the findings from the site visits and the fact that the proposed project infrastructure is mostly located inside the existing VGRWSS pipeline servitude, the CBA and ESA regions within the servitude have been previously disturbed and transformed, and thus no longer retain the ecosystem functioning nor meet the national biodiversity objectives of these regions.

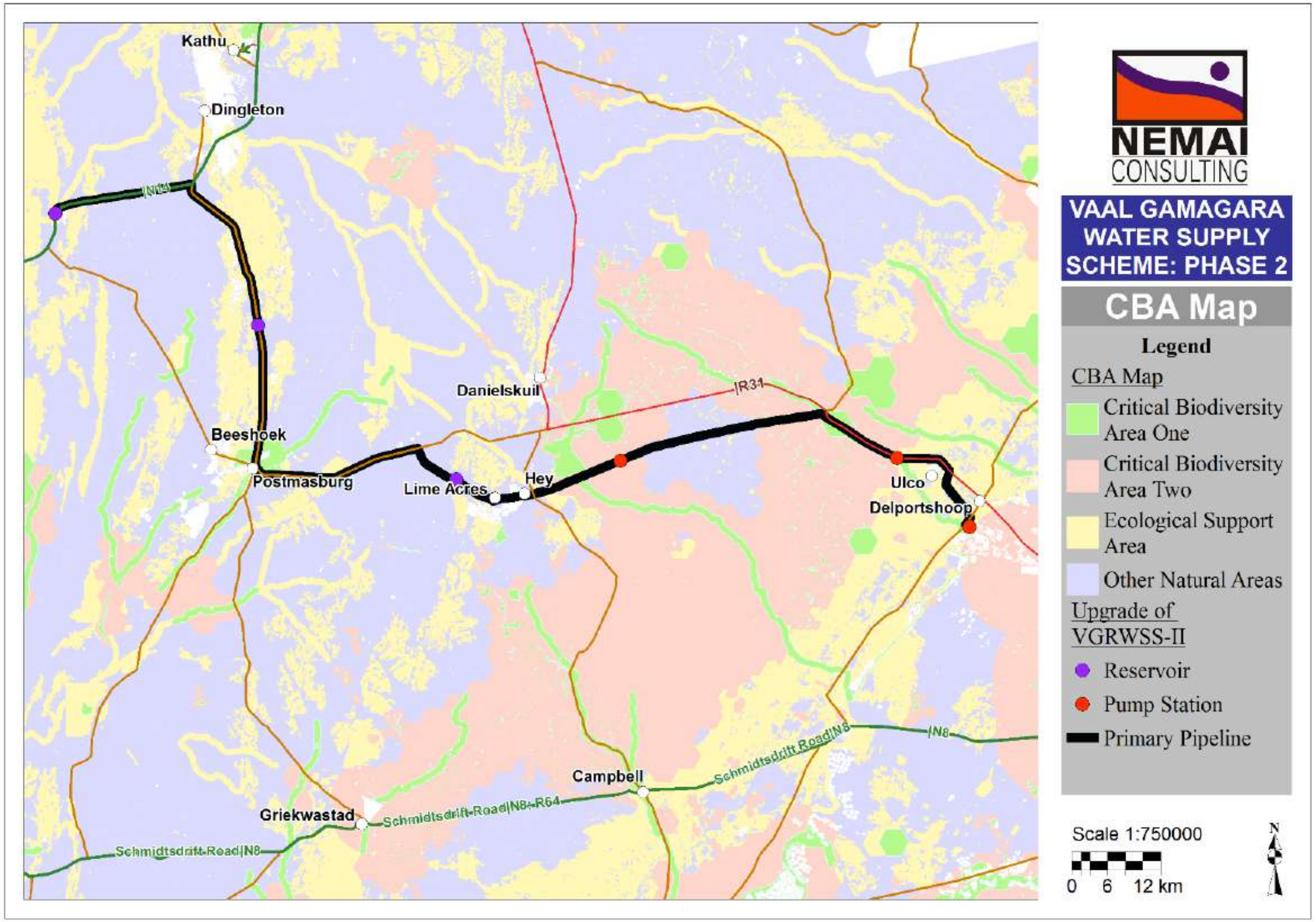


**Figure 7. CBAs in relation to the project area**

# 9 GRIQUALAND WEST CENTRE OF ENDEMISM

According to White (1983), a Centre of Plant Endemism (CPE) is considered to be an area of relatively small size which harbours a unique assemblage of species and intraspecific taxa, some of which are endemic species or near-endemics (a species with a restricted range also marginally present in an adjacent area of smaller size than the area in which it is most numerous).

The Griqualand West Centre of Endemism (GWC) (**Figure 8**) was identified as one of 18 centres of endemism in southern Africa (Van Wyk and Smith, 2001) and it supports approximately 18000 species of plants (40 regarded as endemic or near endemic). Kalahari Plateau bushveld and Kalahari Mountain Bushveld are endemic to GWC. GWC endemic species includes *Blepharis marginata, Chorchorus pinnatipartitus, Digitaria polyphylla, Gnaphalium englerianum, Amphiglossa tecta, Calobota cuspidosa, Justicia puberula, Putterlickia saxatilis, Sutera griquensis* and *Tarchonanthus obovatus.*

The proposed pipeline upgrade falls within the Griqualand West Centre of Endemism. The GWC is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood (Van Wyk and Smith, 2001). Although the study area fall within GWC, it must be noted that based on the findings from the site visits and the fact that the proposed project infrastructure is mostly located within the existing VGRWSS pipeline servitude, the GWC within the servitude have been previously disturbed and transformed.

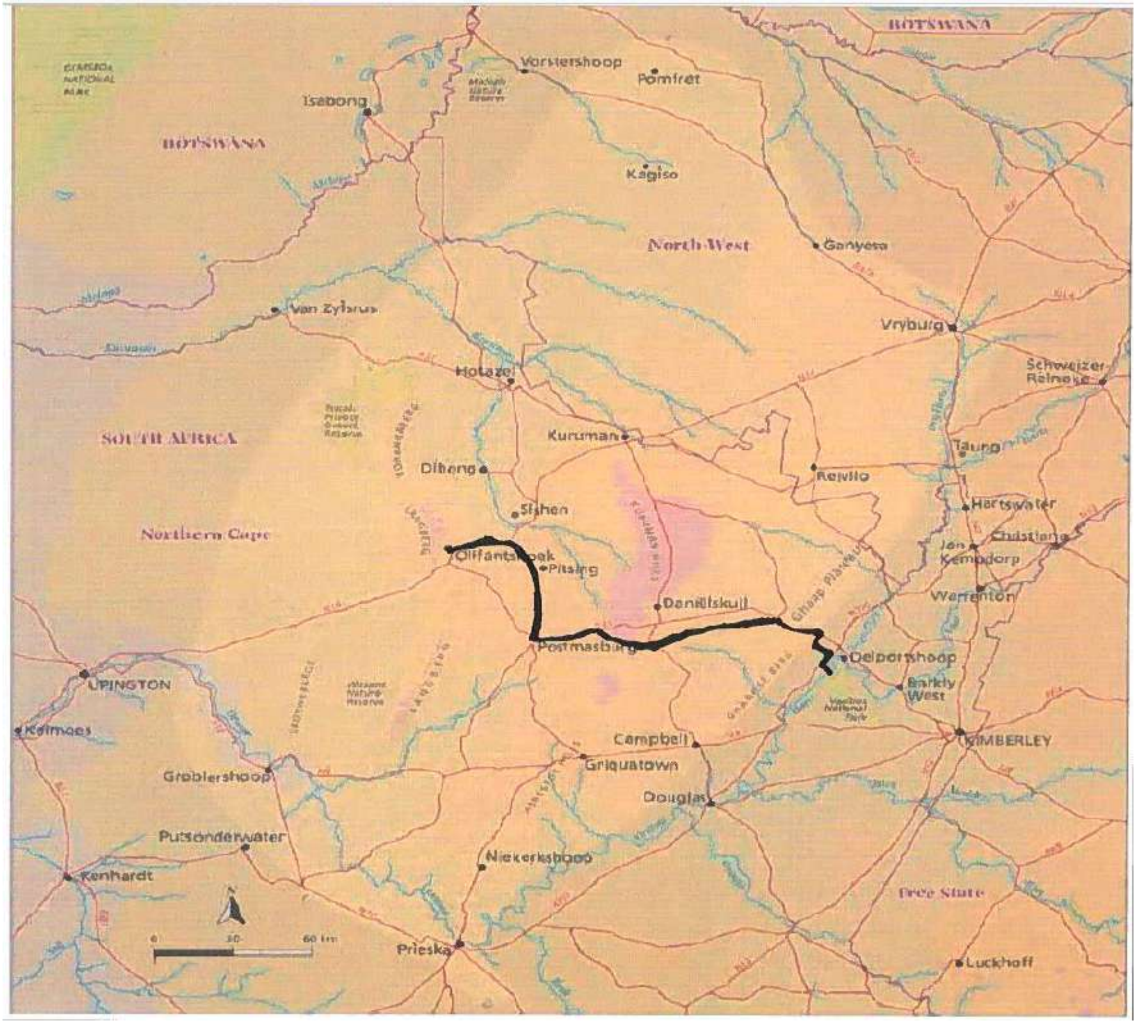


**Figure 8. The GWC (light shaded area) as proposed by van Wyk & Smith (2001). The study area is shown in black**

# 10 RESULTS AND DISCUSSION

## 10.1 Flora

### 10.1.1 Desktop study results

**Table 1** indicates the plants that are known to occur on or around the study area recorded in 2824AD, 2824AC, 2824AA, 2823BB, 2823BD, 2823BC, 2823AD, 2823AC, 2823AA, 2723CC, 2722DD and 2722DC QDS. The definitions of the conservation status are provided in **Table 2**.

**Table 1. Red Data Plant species which could potentially occur in the study area (SANBI data)**

| Family | Species | Conservation Status |
|---|---|---|
| Amaryllidaceae | *Boophone disticha* | Declining |
| Asparagaceae | *Asparagus stipulaceus* | Near Threatened |
| Asteraceae | *Gnaphalium declinatum* | Near Threatened |
| Asteraceae | *Pentzia stellata* | Near Threatened |
| Fabaceae | *Acacia erioloba* | Declining |
| Mesembryanthemaceae | *Antimima lawsonii* | Rare |

**Table 2. Definitions of Red Data status (Raimondo *et al*. 1999)**

| Symbol | Status | Description |
|---|---|---|
| NT | Near Threatened | A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five International Union for Conservation of Nature (IUCN) criteria for Vulnerable and it is therefore likely to qualify for a threatened category in the near future. |
| | Declining | A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population. |
| N/A | Rare | A taxon is rare when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN. |

### 10.1.2 Plant species recorded in the study area

A list of plant species recorded along the study area are listed in **Table 3** below. Red Data listed plant species and protected trees are indicated in **BOLD**.

**Table 3. Plant species recorded within the study area**

| Scientific Name | Common Name | Ecological/Conservation status | Form |
|---|---|---|---|
| ***Vachellia (Acacia) erioloba*** | **Camel thorn** | **Declining** | **Tree** |
| *Acacia karroo* (*Vachellia karroo*) | Sweet thorn | Least Concern | Tree |
| *Senegalia (Acacia) mellifera* subsp. *detinens* | Black Thorn | Least Concern | Tree |
| *Vachellia hebeclada (Acacia hebeclada)* | Candle thorn | Least Concern | Tree |
| *Vachellia (Acacia) karroo* | Sweet Thorn | Least Concern | Tree |
| *Vachellia (Acacia) tortilis* | Umbrella thorn | Least Concern | Tree |
| *Agave sisalana* | Sisal | Invader 2 | Succulent shrub |
| *Albuca* sp |  | Least Concern | Herb |
| *Aloe grandidentata* | Bontaalwee | Least Concern | Succulent |
| *Aloe hereroensis* | Sand Aloe | Least Concern | Succulent |
| *Alternanthera pungens* | Khakhiweed | Weed | Herb |
| *Ammocharis coranica* | Karoo Lily | Least Concern | Herb |
| *Argemone mexicana* | Mexican prickly poppy | Category 1b | Herb |
| *Argemone ochroleuca* | White-Flowered Poppy | Category 1b | Herb |
| *Aristida adscensionis* | Common needle grass | Least Concern | Grass |
| *Aristida canescens* | Pale Three Awn | Least Concern | Grass |
| *Aristida congesta* subsp. *congesta* | Buffalo Grass | Least Concern | Grass |
| *Aristida congesta* subsp. *barbicollis* | Buffalo Grass | Least Concern | Grass |
| *Aristida diffusa* | Iron grass | Least Concern | Grass |
| *Aristida adscensionis* | Common Needle grass | Least Concern | Grass |
| *Arundo donax* | Spanish Reed | Category 1b | Reed |
| *Asparagus laricinus* | Bergkatbos | Least Concern | Herb |
| *Atriplex semibaccata* | Australian saltbush | Exotic | Shrub |
| *Babiana* sp. |  | Least Concern | Herb |
| ***Boophane disticha*** | **Century plant** | **Declining** | **Herb** |
| ***Boscia albitrunca*** | **Shepherd tree** | **Protected** | **Tree** |
| *Bidens bipinnata* | Spanish needles | Weed | Herb |
| *Bulbine narcissifolia* | Strap-leaved Bulbine | Medicinal | Herb |
| *Buddleja saligna* | False olive | Least Concern | Shrub |
| *Calobota cuspidosa* |  | Least Concern | Succulent |
| *Cenchrus ciliaris* | Foxtail buffalo grass | Least Concern | Grass |
| *Cirsium vulgare* | Scotch Thistle | Category 1b | Herb |
| *Chenopodium album* | White goosefoot | Weed | Herb |
| *Chloris virgata* | Feather-top chloris | Increaser 2 | Grass |
| *Chrysocoma ciliata* | Bitter bush | Least Concern | Shrub |
| *Erigeron* (*Conyza*) *bonariensis* | Flax-Leaved Fleabane | Weed | Herb |
| *Cynodon dactylon* | Couch Grass | Least Concern | Grass |

| Scientific Name | Common Name | Ecological/Conservation status | Form |
|---|---|---|---|
| *Datura ferox* | Large thorn apple | Category 1b | Herb |
| *Datura stramonium* | Jimson weed | Category 1b | Herb |
| *Dipcadi glaucum* | Poison Onion | Least Concern | Herb |
| *Dipcadi viride* | Dainty Green Bells | Least Concern | Herb |
| *Diospyros lycioides* subsp. *lycioides* | Blue bush | Least Concern | Shrub |
| *Echinopsis spachiana* | Golden Torch | Category 1b | Succulent |
| *Echinopsis schickendantzii* | Torch cactus | Category 1b | Succulent |
| *Ehretia alba* | Puzzle bush | Least Concern | Shrub |
| *Elephantorrhiza elephantina* | Elephant's root | Least Concern | Shrub |
| *Enneapogon desvauxii* | Nine-awned Pappus Grass | Least Concern | Grass |
| *Enneapogon scoparius* | Bottlebrush Grass | Least Concern | Grass |
| *Eucalyptus camaldulensis* | River Red Gum | Invader 2 | Tree |
| *Euclea crispa* subsp *crispa* | Blue guarri | Least Concern | Shrub |
| *Euclea undulata* | Common guarri | Least Concern | Shrub |
| *Eustachys paspaloides* | Brown Rhodes Grass | Least Concern | Grass |
| *Euphorbia sp* | | Least Concern | Succulent |
| *Euphorbia tirucalli* | Fire Sticks | Least Concern | Succulent |
| *Eragrostis lehmanniana* var. *lehmanniana* | Lehmann love grass | Least Concern | Grass |
| *Eragrostis trichophora* | Atherstone's Grass | Least Concern | Grass |
| *Eriocephalus merxmuelleri* | Kapokbos | Least Concern | Shrub |
| *Felicia muricata* | Wild Aster | Least Concern | Herb |
| *Flaveria bidentis* | Smelter's bush | Category 1b | Herb |
| *Lasiosiphon (Gnidia) polycephala* | Karoo broom | Least Concern | Shrub |
| *Ledebouria* sp | | Least Concern | Herb |
| *Gomphocarpus physocarpus* | Balloon milkweed | Medicinal/ Least Concern | Shrub |
| *Grewia flava* | Brandy bush | Least Concern | Shrub |
| *Heteropogon contortus* | Spear Grass | Least Concern | Grass |
| *Hirpicium* sp. | | Least Concern | Herb |
| *Hyparrhenia hirta* | Common Thatching Grass | Least Concern | Grass |
| *Indigofera alternans* | Skaap-ertjie | Least Concern | Herb |
| *Imperata cylindrica* | Cogon grass | Least Concern | Grass |
| *Lycium cinereum* | Kareebos | Least Concern | Shrub |
| *Lycium villosum* | Hairy Honeythorn | Least Concern | Shrub |
| *Melhania* sp. | | Least Concern | Herb |
| *Melia azedarach* | Persian Lilac/Syringa | Invader 3 | Tree |
| *Melinis repens* | Natal Red Top | Least Concern | Grass |
| *Mirabilis jalapa* | Four o`clock | Category 1b | Herb |
| *Monechma incanum* | Boegoe-ankerkarooskaapbos | Least Concern | Shrub |

| Scientific Name | Common Name | Ecological/Conservation status | Form |
|---|---|---|---|
| *Nerine laticoma* | Vleilelie | Least Concern | Herb |
| *Nicotiana glauca* | Wild tobacco | Category 1b | Shrub |
| *Olea europaea* subsp. *africana* | Wild olive | Least Concern | Tree |
| *Opuntia ficus-indica* | Sweet prickly pear | Category 1b | Succulent |
| *Opuntia humifusa* | Eastern Prickly Pear | Category 1b | Succulent |
| *Opuntia microdasys* | Bunny Ears | Least Concern | Succulent |
| *Ornithogalum (Albuca) seineri* | Bushveld Chincherinchee | Least Concern | Herb |
| *Oropetium capense* | Haasgras | Least Concern | Grass |
| *Pegolettia retrofracta* | Bergdraaibos | Least Concern | Shrub |
| *Pennisetum setaceum* | Fountain Grass | Least Concern | Grass |
| *Pennisetum cf. alopecuroides* | Chinese fountain grass | Alien | Grass |
| *Pentzia sphaerocephala* | Pentzia sphaerocephala | Least Concern | Shrub |
| *Phragmites australis* | Common reed | Least Concern | Reed |
| *Prosopis glandulosa* | Honey mesquite | Invader 2 | Tree |
| *Rhigozum trichotomum* | Three-thorn Rhigozum | Least Concern | Shrub |
| *Schinus molle* | Pepper tree | Invader 3 | Tree |
| *Searsia burchellii* | Karoo kunibush | Least Concern | Tree |
| *Searsia lancea* | Karee | Least Concern | Tree |
| *Searsia pendulina* | White Karee | Least Concern | Tree |
| *Searsia tridactyla* | | Least Concern | Tree |
| *Sesamum triphyllum.* | Wild sesame | Least Concern | Herb |
| *Stipagrostis uniplumis* | Bushman Grass | Least Concern | Grass |
| *Tarchonanthus camphoratus* | Camphor bush | Least Concern | Shrub |
| *Tagetes minuta* | Tall Khaki Weed | Weed | Herb |
| *Themeda triandra* | Red grass | Least Concern | Grass |
| *Tridax procumbens* | Coat buttons | Weed | Herb |
| *Typha capensis* | Bulrush | Least Concern | Aquatic Herb |
| *Verbesina encelioides* | Wild Sunflower | Weed | Herb |
| *Viscum rotundifolium* | Red Berry Mistletoe | Least Concern | Shrub |
| *Ziziphus mucronata* | Buffalo thorn | Least Concern | Shrub |

### 10.1.3 Threatened Species, Species of Conservation Concern and Medicinal Plants recorded within the study area

According to the South African Red Data list categories done by SANBI (**Figure 9**), **threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species. **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

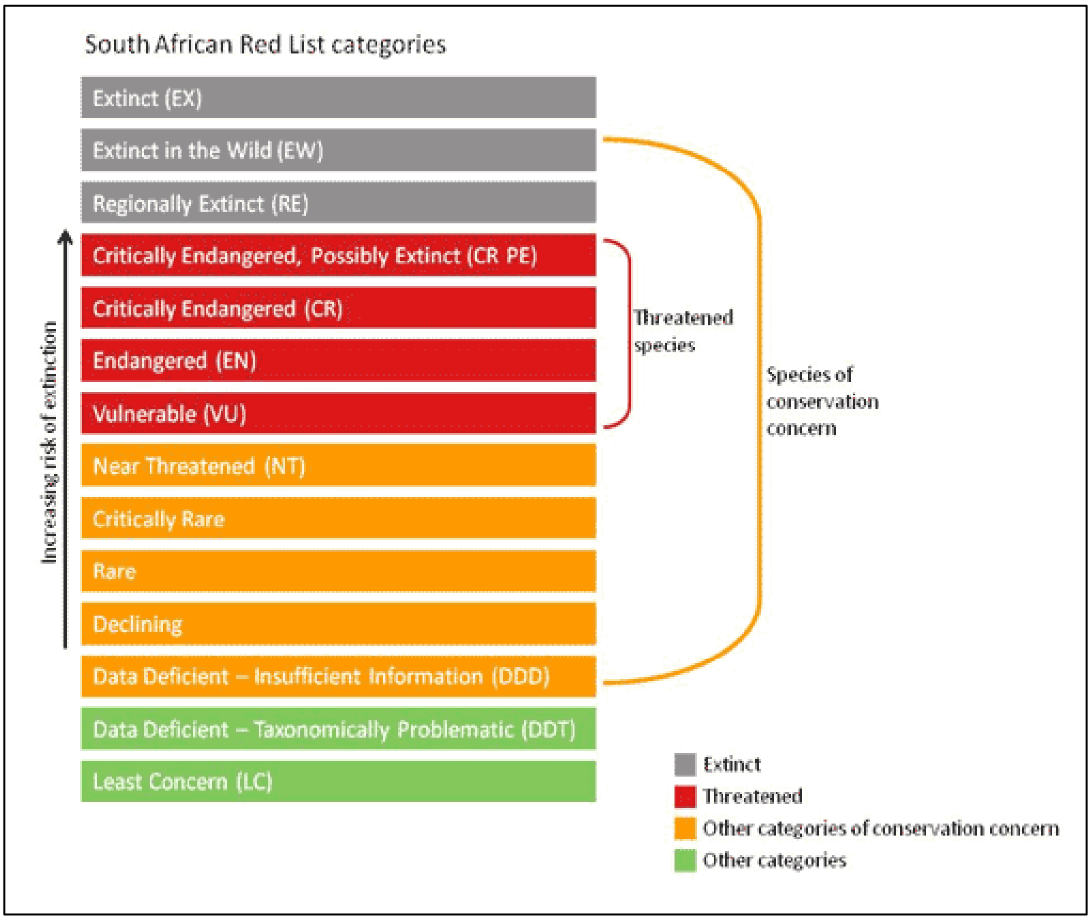


**Figure 9. South African Red Data list categories (SANBI)**

Within the study area, there are a number of medicinal plant species (**Table 3**). In some cases there is merit in protecting or translocating them before the proposed development commences.

During the field survey, no threatened plant species were observed within the study area, however only two (2) species of conservation concern were noted, namely *Vachellia erioloba* (= *Acacia erioloba*) (Camel thorn) and *Boophone disticha* (Century plant). Raimondo *et al.* (2009) has listed these species as *Declining.* These plant species were recorded within the study area.

*Vachellia erioloba* (**Figure 10**) is widely distributed inland in the western half of the country, from the Northern Cape through to Limpopo Province. It also extends to Namibia, Botswana, Zimbabwe and to central Africa. It is a competitive species that can displace preferred vegetation. The timber is strong and is highly prized for firewood (Coates Palgrave, 2002).

The distribution of *Vachellia erioloba* plant species within the study area is shown in **Figure 11**.

**Figure 10. *Vachellia erioloba* (Camel thorn tree) recorded within the study area**

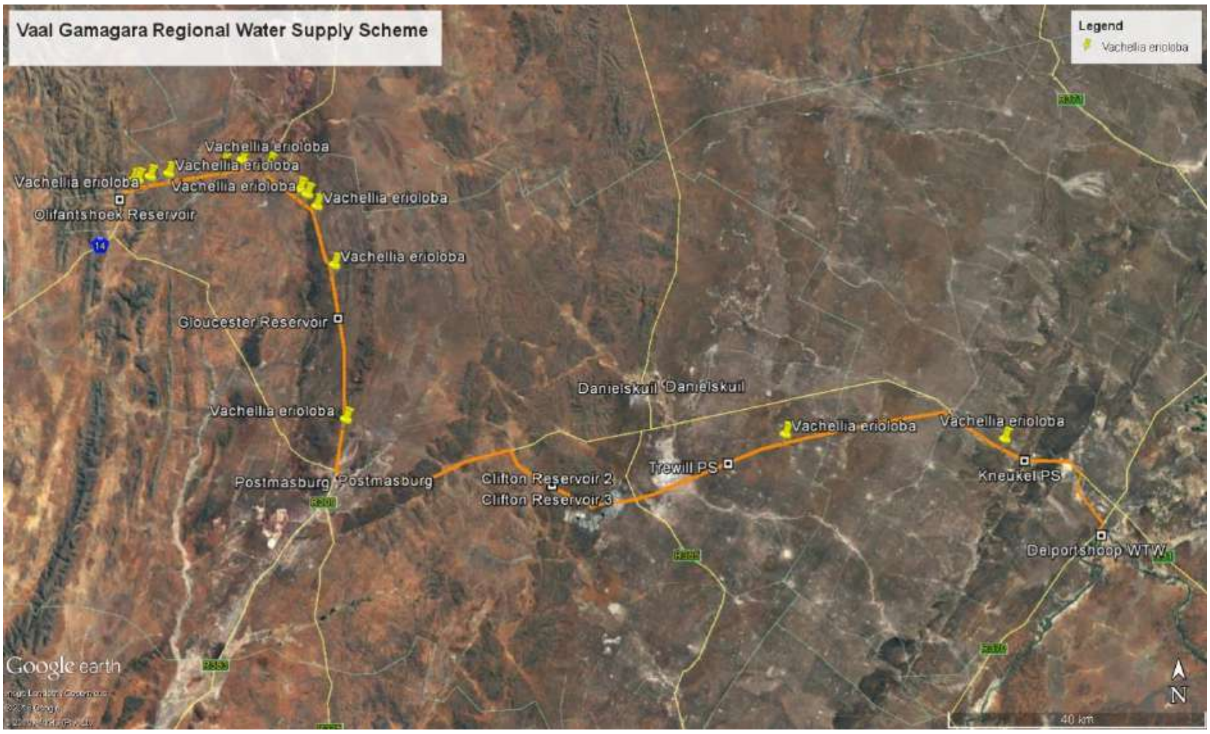


**Figure 11. The distribution of *Vachellia erioloba* (Camel thorn tree) within the study area**

According to Williams *et al.* (2016), *Boophone disticha* (**Figure 12**) is found in the Northern Cape, Eastern Cape, KwaZulu-Natal, Free State, Gauteng, Limpopo, Mpumalanga, and North West Provinces, and north up to Uganda, in Albany Thicket, Fynbos, Grassland, Indian Ocean Coastal Belt, Nama Karoo, Savanna and Succulent Karoo habitats, in dry grassland and rocky areas. The distribution of this species within the study area is indicated in **Figure 13**.

**Figure 12. *Boophone disticha* recorded within the study area**

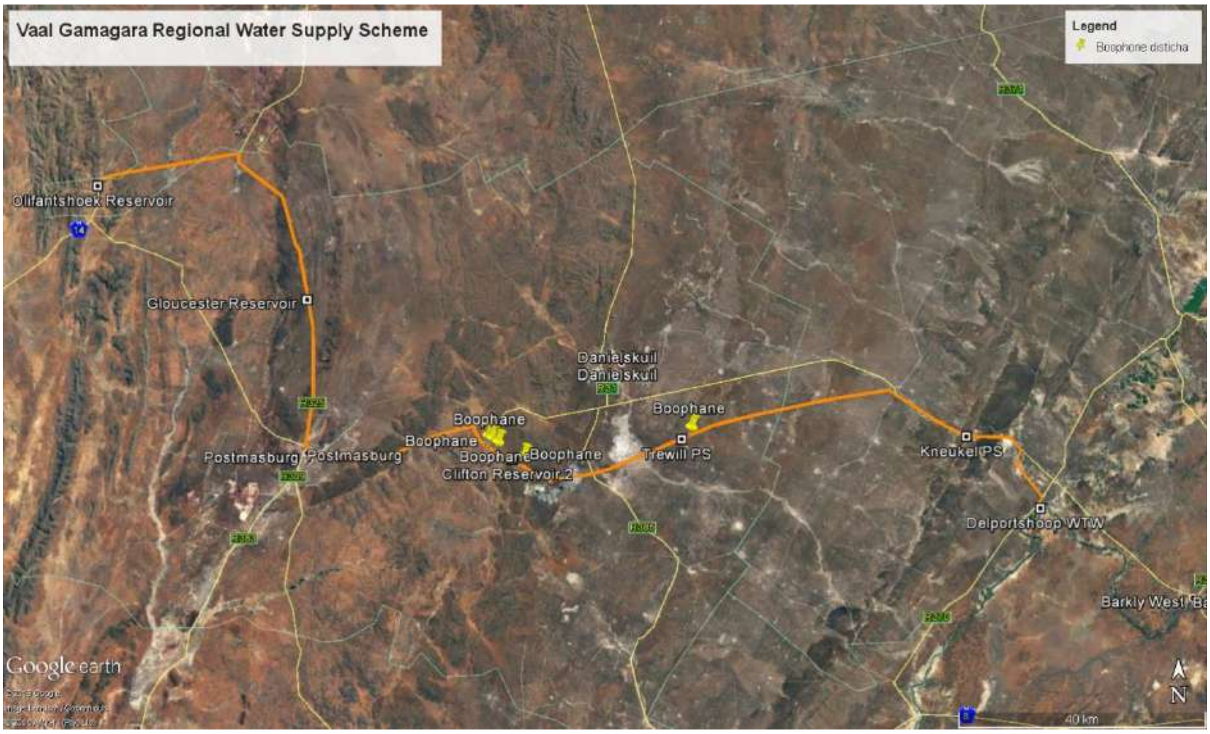


**Figure 13. The distribution of *Boophone disticha* within the study area**

It is therefore recommended that a walk-down survey of the study area be undertaken prior to the start of the construction activities in order to survey the area in detail for any plant species of conservation concern. This is relevant in the areas that have been labelled as ecologically sensitive.

### 10.1.4 Protected plant species

In terms of the National Forests Act (Act No. 84 of 1998), certain tree species are declared as protected. Protected trees occurring in the study area are *Boscia albitrunca* (Shepherd's tree) (**Figure 14**) and *Vachellia (Acacia) erioloba* (Camel thorn)***.*** According to Section 51(1) of the National Forests Act (Act No. 84 of 1998), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister of Department of Agriculture, Forestry and Fisheries (DAFF).

The following plant species are listed as "protected plants" in terms of Schedule 2 of Northern Cape Nature Conservation Act (Act 9 of 2009): *Boscia albitrunca* (Shepherd's tree); *Olea europaea* subsp*. africana* (**Figure 15**); all species of families Amaryllidaceae (*Ammocharis coranica* (**Figure 16**), *Boophone disticha* and *Nerine laticoma* (**Figure 17**); Asphodelaceae (*Aloe grandidentata* (**Figure 18**), *Aloe hereroensis* (**Figure 19**), *Bulbine narcissifolia* (**Figure 20**), and *Kniphofia cf. ensifolia* (**Figure 21**); Hyacinthaceae (*Ornithogalum* sp. (**Figure 22**); Iridaceae (*Babiana* sp, (**Figure 23**) were recorded within the study area. In terms of restricted activities involving protected plants, no person may, without a permit—(a) pick; (b) import; (c) export; (d) transport; (e) cultivate; or (f) trade in, a specimen of a protected plant. Data supplied by DAFF indicates that protected plant species such as *Lithops* spp*., Vachellia haematoxylon* (Grey Camel thorn) and *Nymania capensis* (Chinese lanterns) have been recorded in the study area.

The distribution of all the protected trees and provincially protected plants species recorded within the study area are indicated in **Figure 24** below.

The *Olea europaea* subsp*. africana* tree species is found in a variety of habitats, often near water, on rocky hillsides, on stream banks and in woodland (where it can reach 12 m). This tree is an asset on farms and game farms, especially in very dry areas because it is extremely hardy and is an excellent fodder tree. Its leaves are browsed by game and stock. It can be propagated from seed or from hardwood cuttings. The root consists of a sturdy tap root with many lateral roots (Coates-Palgrave, 1988). According to DAFF (2010), the root system is generally shallow and widespread and approximately 80 % of the roots occur within the top 60 cm of soil. The soil characteristics will determine the depth of the root system.

**Figure 14. *Boscia albitrunca* (Shepherd's tree) recorded within the study area**

**Figure 15. *Olea europaea subsp. africana* within the study area**

**Figure 16. *Ammocharis coranica* recorded within the study area**

**Figure 17. *Nerine laticoma* recorded within the study area**

**Figure 18. *Aloe grandidentata* within the study area**

**Figure 19. *Aloe hereroensis* within the study area**

**Figure 20. *Bulbine narcissifolia* within the study area**

**Figure 21. *Kniphofia cf. ensifolia* recorded within the study area**

**Figure 22. *Ornithogalum seineri* recorded within the study area**

**Figure 23. *Babiana sp,* recorded within the study area**

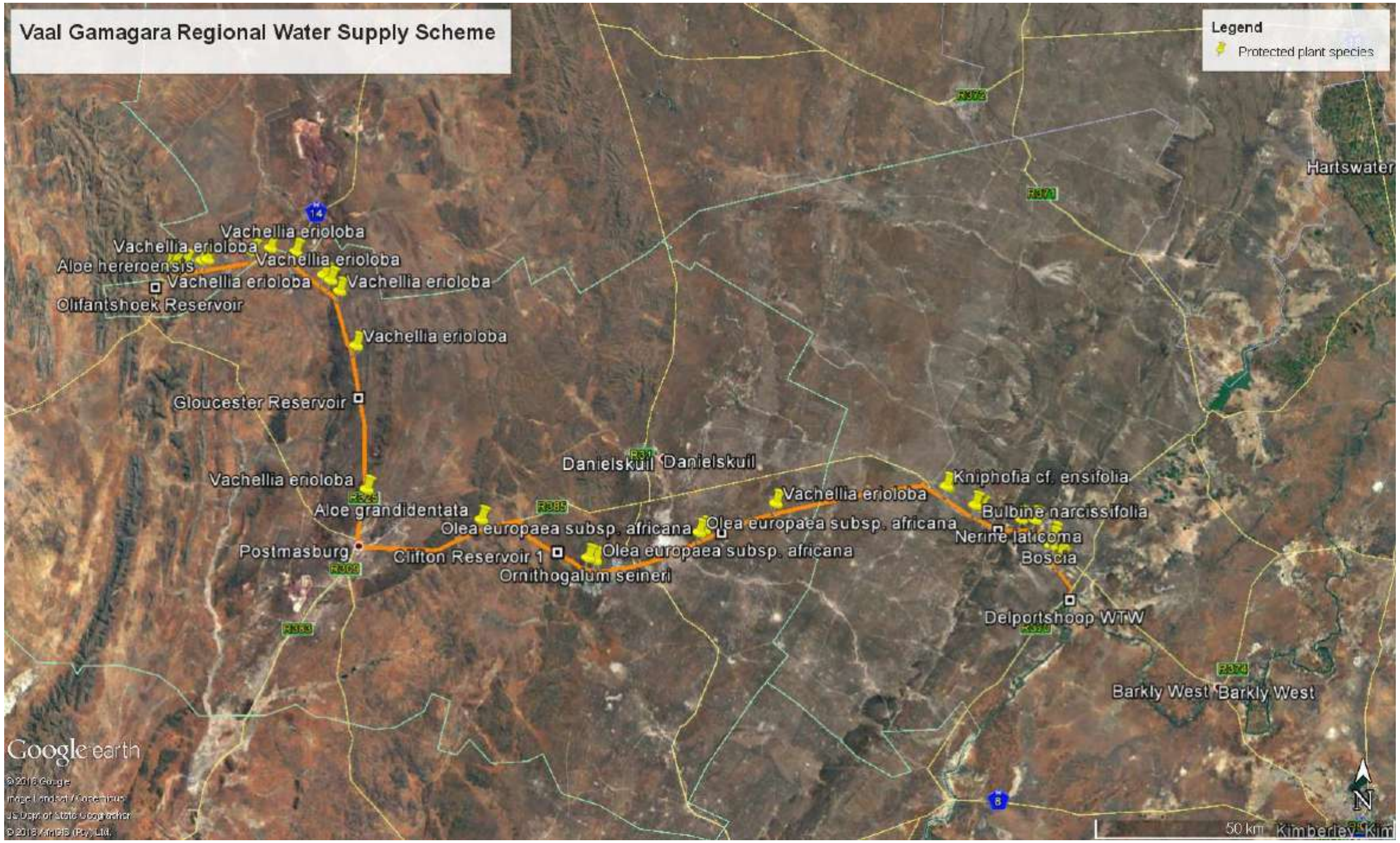


**Figure 24. Distribution of all the protected trees and provincially protected plants species recorded within the study area**

### 10.1.5 Alien invasive species recorded in the study area

Alien and Invasive Plants (IAPs) are species of exotic origin that typically invade undeveloped or disturbed areas (Bromilow, 2010). IAPs pose a threat to ecosystems because by nature they grow fast, reproduce quickly and have a high dispersal ability (Henderson, 2001), resulting in a decline of indigenous fauna and flora species richness and diversity.

Alien invasive plant species within the study area (**Table 3**) were observed to occur in clumps, scattered distributions or as single individuals. Invader and weed species on site must be controlled to prevent further infestation and it is recommended that all individuals of invader and weeds species (especially Category 1b) must be removed and eradicated.

Alien plant species which were found to be dominant in the study area, were namely *Flaveria bidentis* (**Figure 25**), *Opuntia ficus-indica* (**Figure 26**), *Datura ferox* (**Figure 27**), and *Cirsium vulgare* (**Figure 28**) (All Category 1b).

**Figure 25. *Flaveria bidentis* recorded within the study area**

**Figure 26. *Opuntia ficus-indica* recorded within the study area**

**Figure 27. *Datura ferox* recorded within the study area**

**Figure 28.** ***Cirsium vulgare*** **recorded within both the study area**

The Environmental Management Programme (EMPr) must ensure that the Applicant/Contractor implements suitable methods during the construction phase to limit the introduction and spread of alien invasive plant species.

### 10.1.6 Potential occurrence of Red Data plant species

Data sourced from SANBI website indicates there are plant species on the Red Data List that are known to occur in or on surrounding the study area. The probability of occurrence is based on the soils, rainfall, abundance, habitat availability, habitat quality and quantity, known distribution and suitable habitats. These plant species and their probability of occurrence are indicated in **Table 4**.

**Table 4. Red listed plant species potentially occurring within the study area and probability of occurrence within the study area**

| Species | Status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|
| *Boophone disticha* | Declining | Occurs in dry grassland and rocky areas | **PRESENT** |
| *Asparagus stipulaceus* | Near Threatened | Coastal dunes. Fynbos | Very Low |
| *Gnaphalium declinatum* | Near Threatened | Seasonal pans on flats or lower slopes. | Very Low. Restricted to Western Cape |
| *Pentzia stellata* | Near Threatened | Seasonally waterlogged calcrete pans. | High. Abundance of calcrete pans on site |
| *Acacia erioloba* | Declining | Savanna, semi-desert and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops. | **PRESENT** |
| *Antimima lawsonii* | Rare | Limestone soils. | Low. No Limestone soils along the pipeline route |

## 10.2 Fauna

### 10.2.1 Mammals

10.2.1.1 Desktop survey results

The potential Red Data mammal species that could be found within the study area are those which have been recorded in the grid cells (ADU, 2019) Child *et al*. (2016), habitat preference, habitat availability, as well as the presence of sufficient food sources and also historical distribution based on Skinner and Chimimba (2005) (**Table 5**).

**Table 5. Red List mammal species potentially occurring within the study area.**

| Family | Scientific name | Common name | Red list category |
|---|---|---|---|
| Bovidae | *Hippotragus equinus* | Roan Antelope | Endangered |
| Bovidae | *Hippotragus niger niger* | Sable Antelope | Vulnerable |
| Bovidae | *Damaliscus pygargus pygargus* | Bontebok | Vulnerable |
| Canidae | *Lycaon pictus* | African wild dog | Endangered |
| Erinaceidae | *Atelerix frontalis* | Southern African Hedgehog | Near Threatened |
| Felidae | *Felis nigripes* | Black-footed Cat | Vulnerable |
| Felidae | *Panthera pardus* | Leopard | Vulnerable |
| Hyaenidae | *Hyaena brunnea* | Brown Hyena | Near Threatened |
| Manidae | *Smutsia temminckii* | Ground Pangolin | Vulnerable |
| Mustelidae | *Aonyx capensis* | African Clawless Otter | Near Threatened |
| Rhinolophidae | *Rhinolophus denti* | Dent's Horseshoe Bat | Near Threatened |

10.2.1.2 Mammals recorded within the study area

The agricultural fields were largely devoid of mammal species; however meerkat dens were present on the edges of agricultural fields. Domestic animals such as cattle, sheep, donkeys and horses were noted in abundance within the study area. Significantly the bushveld, riparian vegetation and natural grasslands between agricultural fields are utilised as a movement and linkage corridor within the study area. These areas also provide ideal foraging and breeding habitat for a number of mammal species. Stone boulders are important habitat for fauna, which rely on such areas for habitat or shelter for a number of small mammals such as rodents and dassies. Mammal species such as Gemsbok (**Figure 29**), Cape Ground Squirrel (**Figure 30**), and Cape Rock Hyrax (**Figure 31**) were seen within the study area. **Table 6** lists mammal species recorded during the surveys. Most of the mammal species were observed within the game farms. The mammal species lists provided by the local farm owners are indicated in **BOLD** and includes three Red Data mammal species. Most mammals found in Northern Cape are either classified as *Schedule 1 specially protected species* and *Schedule 2 protected species* of Northern Cape Nature Conservation Act (Act 9 of 2009) (**Table 6**).

**Figure 29. Gemsbok horn recorded within the study area**

**Figure 30. A dead Cape Ground Squirrel recorded within the study area**

**Figure 31. Cape Rock Hyrax recorded within the study area**

**Table 6. Mammals recorded within the study area**

| Scientific name | English name | Conservation Status | NEMBA Threatened or Protected Species (TOPS) Regulations (2015) and species list (2015) | Northern Cape – Protected Species (2009) |
|---|---|---|---|---|
| *Sylvicapra grimmia* | Grey/Common Duiker | Least concern | | Schedule 2 Protected |
| *Antidorcas marsupialis* | Springbok | Least Concern | | Schedule 2 Protected |
| *Canis mesomelas* | Black-backed Jackal | Least concern | | Schedule 4 Damage causing animal species |
| *Cryptomys hottentotus* | African Mole Rat | Least concern | | Schedule 2 Protected |
| *Aepyceros melampus* | Impala | Least concern | | Schedule 2 Protected |
| *Rhabdomys pumilio* | Four-striped Grass Mouse | Least concern | | Schedule 2 Protected |
| *Cynictis penicillata* | Yellow mongoose | Least concern | | Schedule 2 Protected |
| *Galerella sanguinea* | Slender Mongoose | Least concern | | Schedule 2 Protected |
| *Papio cynocephalus ursinus* | Chacma baboon | Least concern | | Schedule 4 Damage causing animal species |
| *Procovia capensis* | Cape Rock hyrax | Least concern | | Schedule 2 Protected |
| *Suricata suricatta* | Meerkat (Suricate) | Least concern | | Schedule 2 Protected |
| ***Hystrix africaeaustralis*** | **Cape Porcupine** | **Least concern** | | **Schedule 2 Protected** |
| *Rattus rattus* | House rat | Least concern | | Schedule 6 Invasive species |
| *Xerus inauris* | Cape Ground Squirrel | Least concern | | Schedule 2 Protected |
| ***Orycteropus afer*** | **Aardvark** | **Least concern** | | **Schedule 1 Specially protected species** |
| ***Damaliscus pygargus phillipsi*** | **Blesbok** | **Least concern** | **Protected** | **Schedule 2 Protected** |
| *Tragelaphus strepsiceros* | Greater Kudu | Least concern | | Schedule 2 Protected |
| ***Phacochoerus africanus*** | **Common Warthog** | **Least concern** | | **Schedule 2 Protected** |

| Scientific name | English name | Conservation Status | NEMBA Threatened or Protected Species (TOPS) Regulations (2015) and species list (2015) | Northern Cape – Protected Species (2009) |
|---|---|---|---|---|
| *Taurotragus oryx* | Common Eland | Least concern | | Schedule 2 Protected |
| ***Thallomys nigricauda*** | **Black tailed tree rat** | **Least Concern** | | **Schedule 2 Protected** |
| ***Alcelaphus buselaphus caama*** | **Red hartebeest** | **Least Concern** | **Protected** | **Schedule 2 Protected** |
| ***Oryx gazella*** | **Gemsbok** | **Least Concern** | | **Schedule 2 Protected** |
| ***Felis nigripes*** | **Black-footed cat** | **Vulnerable** | **Protected** | **Schedule 1 Specially protected species** |
| *Pedetes capensis* | South African Spring Hare | Least Concern | | Schedule 2 Protected |
| *Connochaetes taurinus* | Blue Wildebeest | Least Concern | | Schedule 2 Protected |
| ***Raphicerus campestris*** | **Steenbok** | **Least Concern** | | **Schedule 2 Protected** |
| ***Caracal caracal*** | **Caracal** | **Least Concern** | | **Schedule 4 Damage causing animal species** |
| ***Otocyon megalotis*** | **Bat-eared Fox** | **Least Concern** | **Protected** | **Schedule 1 Specially protected species** |
| ***Genetta genetta*** | **Small Spotted Genet** | **Least Concern** | | **Schedule 2 Protected** |
| ***Felis silvestris lybica*** | **African Wildcat** | **Least Concern** | | **Schedule 1 Specially protected species** |

#### 10.2.1.3 Mammal species of conservation concern within the study area

According to the information gathered from the farm owners, 2 Red Data mammal species have been sighted within the area, namely Black-footed cat and Southern African Hedgehog.

According to Wilson *et al.,* (2016), Black-footed cats are nocturnal, extremely secretive in nature, predominantly ground-dwellers and will not readily take to trees. These species prefer hollowed out abandoned termite mounds and also will use dens dug by other animals such as Springhares, Cape Ground Squirrels and Aardvark. They inhabit dry, open savannah, grasslands and Karoo semi-desert with sparse shrub and tree cover.

The distribution of Southern African Hedgehog mainly falls within savannah and grassland vegetation types, within which it is found in a wide variety of semi-arid and sub-temperate habitats, including scrub brush, western Karoo, grassland and suburban gardens. The species appear to prefer dense vegetation habitats and rocky outcrops that may provide food, cover and nesting materials (Skinner and Chimimba 2005).

#### 10.2.1.4 Potential occurrence of Red Data mammal species

Data sourced from Virtual Museum of African Mammals (ADU, 2019) and historical distribution (Skinner and Chimimba, 2005) indicate that there are mammal species which are known to occur in the general vicinity of the study area. **Table 7** below indicates the suitable habitat together with the probability of occurrence. The probability of occurrence is based on the presence of suitable habit where the species is likely to occur, known distribution, overall abundance, disturbance factors, anthropogenic change and the habitats of the species.

**Table 7. Red Data Listed mammal species which could potentially occur within the study area, their suitable habitats and also the probability of occurrence (Friedmann & Daly (2004), Skinner & Chimimba (2005) and Child et al. (2017)).**

| Common name | Red list category | Suitable habitat | Probability of occurrence |
|---|---|---|---|
| Roan Antelope | Endangered (2016) | Inhabit savannah woodlands and grasslands within the bushveld and Lowveld of southern Africa and prefer habitats with a cover of high grasses and total woody plants, which play an important role for both grazing and calving. | Low |
| Sable Antelope | Vulnerable | Species that frequents the woodland/grassland ecotone. They are selective feeders with a preference for fresh growth grasses. | Low |
| Bontebok | Vulnerable (2016) | Bontebok are almost exclusively grazers, with a preference for short grass and recently burnt veld. | Low |
| African wild dog | Endangered (2016) | Wild dogs prefer woodlands or broken woodlands although they are also found on open plains and savannas. They are independent of water | Very Low |
| Southern African Hedgehog | Near Threatened (2016) | The distribution mainly falls within savannah and grassland vegetation types, within which it is found in a wide variety of semi-arid and sub-temperate habitats, including scrub brush, western Karoo, grassland and suburban gardens | High |
| Black-footed Cat | Vulnerable (2016) | The species prefers hollowed out abandoned termite mounds when available (especially for the kittens), but will use dens dug by other animals such as Springhares, Cape Ground Squirrels (*Xerus inauris*) and Aardvark (*Orycteropus afer*). It is a specialist of open, short grass areas with an abundance of small rodents and ground roosting birds. It inhabits dry, open savannah, grasslands and Karoo semi-desert with sparse shrub and tree cover and a mean annual rainfall of between 100 and 500 mm at altitudes up to 2,000 m asl. | High |
| Leopard | Vulnerable (2016) | The Leopard has a wide habitat tolerance, including woodland, grassland savannah and mountain habitats but also occur widely in coastal scrub, shrubland and semi desert. Densely wooded and rocky areas are preferred as choice habitat types. | Very Low |

| Common name | Red list category | Suitable habitat | Probability of occurrence |
|---|---|---|---|
| Brown Hyena | Near Threatened (2015) | The Brown Hyaena is widespread across southern Africa and is found in the desert areas with annual rainfall less than 100 m, semi-desert, open scrub and open woodland savannah with a maximum rainfall up to about 700 mm. It shows an ability to survive close to urban areas. It requires some type of cover in which to lie up during the day. For this it favours rocky, mountainous areas with bush cover in the bushveld areas of South Africa. | Very Low |
| Ground Pangolin | Vulnerable (2016) | This species is predominantly nocturnal and it is widely distributed in savannas and woodlands habitats, preferring arid and mesic savannah and semi-arid environments at lower altitudes, often with thick undergrowth. | High |
| African Clawless Otter | Near Threatened (2016) | Cape Clawless Otters are predominantly aquatic and seldom found far from permanent water. Fresh water is an essential habitat requirement, not only for drinking but also for rinsing their fur. | Low |
| Dent's Horseshoe Bat | Near Threatened (2016) | This species is associated with arid savannah habitats where suitable roosting sites occur; typically restricting it to broken country with rocky outcrops or suitable caves | Medium |

### 10.2.2 Avifauna

#### 10.2.2.1 Desktop survey results

The Important Bird and Biodiversity Areas (IBA) Programme is a BirdLife International initiative to conserve important bird species and their habitats. It also identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types.

It is therefore important to manage a network of South African IBAs to conserve threatened, endemic, biome restricted and congregatory birds. As shown in **Figure 32** below, the study area does not fall within any of the IBAs. The Coordinated Avifaunal Road-count (CAR) and Coordinated Waterbird Count (CWAC) areas data was reviewed and revealed that there are no CAR routes or (CWAC) areas through the study area.

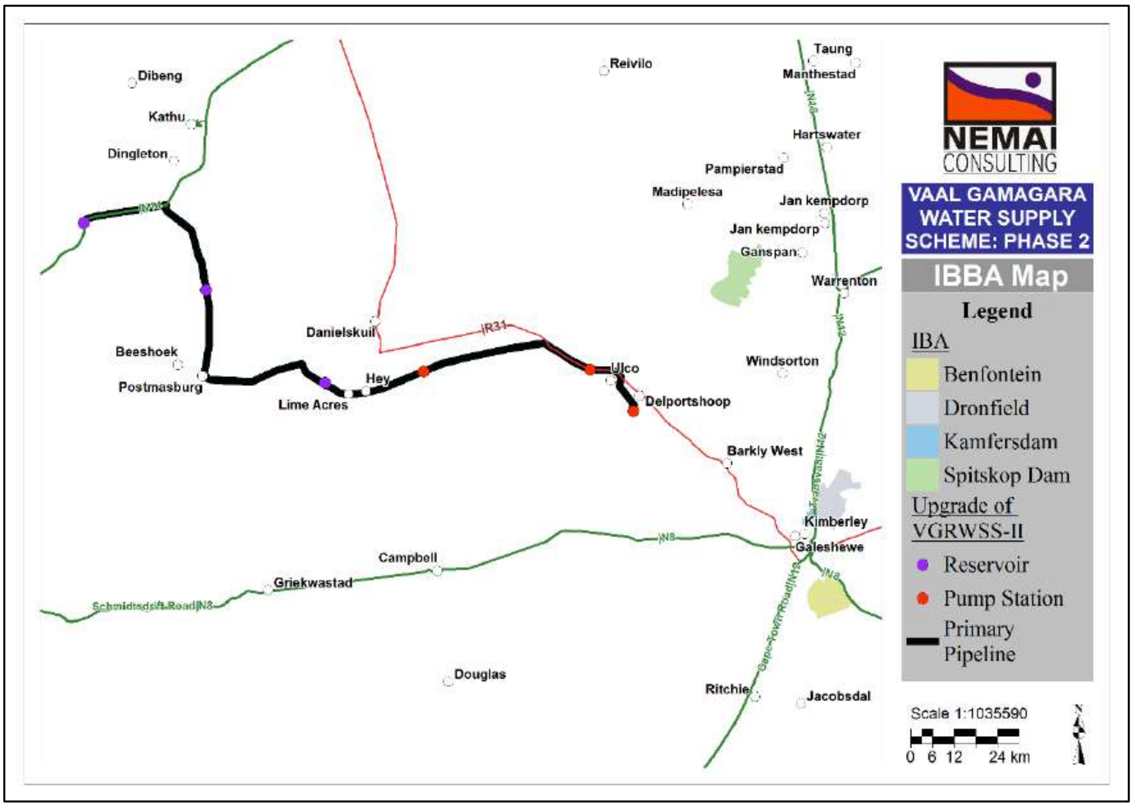


**Figure 32. IBAs in relation to the study area**

According to the Southern African Bird Atlas Project 2 (SABAP 2), threatened bird species occur in the grid cells 2824AD, 2824AC, 2824AA, 2823BB, 2823BD, 2823BC, 2823AD, 2823AC, 2823AA, 2723CC, 2722DD and 2722DC (**Table 8**).

**Table 8. Red Data bird species potentially occurring within the study area.**

| Species | Scientific name | Conservation status |
|---|---|---|
| Tawny Eagle | *Aquila rapax* | Endangered |
| Martial Eagle | *Polemaetus bellicosus* | Endangered |
| Kori Bustard | *Ardeotis kori* | Near Threatened |
| Ludwig's Bustard | *Neotis ludwigii* | Endangered |
| Blue Crane | *Anthropoides paradiseus* | Near Threatened |
| African Marsh Harrier | *Circus ranivorus* | Endangered |
| Black Harrier | *Circus maurus* | Endangered |
| African White-backed Vulture | *Gyps africanus* | Critically endangered |
| Lappet-faced vulture | *Torgos tracheliotos* | Endangered |
| Lanner Falcon | *Falco biarmicus* | Vulnerable |
| Black Stork | *Ciconia nigra* | Vulnerable |
| Abdim's Stork | *Ciconia abdimii* | Near Threatened |
| Yellow-billed Stork | *Mycteria ibis* | Endangered |
| Marabou Stork | *Leptoptilos crumenife* | Near Threatened |
| Secretarybird | *Sagittarius serpentarius* | Vulnerable |
| Greater Flamingo | *Phoenicopterus roseus* | Near Threatened |
| Lesser Flamingo | *Phoeniconaias minor* | Near Threatened |
| Chestnut-banded Plover | *Charadrius pallidus* | Near Threatened |
| Greater painted snipe | *Rostratula benghalensis* | Near Threatened |
| European Roller | *Coracias garrulus* | Near Threatened |
| Burchell's Courser | *Cursorius rufus* | Vulnerable |

### 10.2.2.2 Field work results

A number of bird species in South Africa have declined mainly due to massive habitat transformation and degradation as well as increased levels of human disturbances, extensive habitat transformation due to mining, industrial and commercial and agricultural activities (Low and Rebelo, 1996). Factors such as land-use alteration (urbanisation) contribute in the decline of species. Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al*. 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000). The study area has limited suitable habitat for any larger terrestrial birds as well as certain smaller raptor species. Investigation of the study area revealed the following important avian micro-habitats:

Bird species such as herons, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks along the streams (**Figure 33**) and will also feed on insects that live within the reeds. Many of these bird species make use of the thorny nature of these trees to build their nests. Water bodies represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna.

**Figure 33. Common reeds provide nesting sites for bird species such as weavers and bishops**

**Grassland vegetation unit**: patches of grasslands (**Figure 34**) on site represent a significant feeding area for many bird species such as Secretarybird (listed as Vulnerable), Kori bustard (Near Threatened). The grassland patches are also a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as small mammals. This in turn may attract raptors because of both the presence and accessibility of prey. Red Data Listed bird species such as Lanner Falcon, Lesser Kestrel, and Martial Eagle, may often hunt in open grassland areas.

**Figure 34. Grasslands provide a favourite foraging area for birds such as Helmeted Guineafowl, as well as being hunting habitat for small raptors such as Lesser Kestrel and Black-shouldered kite**

**Exotic trees** often provide roosting and nesting habitat for various bird species, and as such their importance for avifauna should not be underestimated. Exotic trees provide perching, roosting and nesting habitat for various raptor species, as well as larger birds such as francolins, Guineafowl, Herons and Hadeda Ibises.

Although stands of *Eucalyptus* (**Figure 35**) are invader species, these stands have become important refuges for certain species of raptors including Long Crested Eagle and Steppe Buzzard. Birds such as Lesser Kestrel and Amur and Red-footed Falcons, make use of large *Eucalyptus* trees, where they roost in large numbers. No roosts were identified on the study area.

**Figure 35. *Eucalyptus* trees could be used by the migratory Lesser Kestrels for roosting purposes.**

**Bushveld**: This habitat consists of bushes, woody plants, small trees and patches of grasslands (**Figure 36**). The bushes are frequented by smaller bird species such as Prinias, Tit-babblers, and Robin-chats, while larks and pipits are found on the ground. Weavers and Sparrow weavers use the tree as structures for nesting and raptors such as the Southern Pale Chanting Goshawk may use these areas for perching.

Figure 36. Bushveld on site

**Dam(s):** Dams (**Figure 37**) are considered important attractants to various bird species with numerous waterfowl frequenting these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas.

Figure 37. Dam on site

Bird species recorded during the field survey are shown in **Figures 38-44**. Most bird species found in Northern Cape are either classified by the Northern Cape Nature Conservation Act (Act 9 of 2009) as *Schedule 1 specially protected species* or *Schedule 2 protected species* or *Schedule 3 common indigenous species.* Anecdotal evidence from local land-users indicate that Red Data bird species such as Lanner falcon, Lesser kestrel (even though this species has been downlisted from Vulnerable to Least concern) and Kori Bustard have been observed along the project area and also bird species such as Flamingos and Storks are said to be found in very wet years but for short periods. **Table 9** indicates bird species recorded within the study area.

**Table 9. Bird species recorded within the study area**

| Common name | Scientific name | Conservation status |
|---|---|---|
| Common Ostrich | *Struthio camelus* | Least Concern |
| Black-headed Heron | *Ardea melanocephala* | Least Concern |
| Cattle Egret | *Bubulcus ibis* | Least Concern |
| Hamerkop | *Scopus umbretta* | Least Concern |
| African Sacred Ibis | *Threskiornis aethiopicus* | Least Concern |
| Hadeda Ibis | *Bostrychia hagedash* | Least Concern |
| Egyptian Goose | *Alopochen aegyptiaca* | Least Concern |
| Black-shouldered Kite | *Elanus caeruleus* | Least Concern |
| Southern Pale Chanting Goshawk | *Melierax canorus* | Least Concern |
| **Lanner falcon** | ***Falco biarmicus*** | **Vulnerable** |
| Lesser Kestrel | *Falco naumanni* | Least Concern |
| Common Quail | *Coturnix coturnix* | Least Concern |
| Helmeted Guineafowl | *Numida meleagris* | Least Concern |
| **Kori Bustard** | ***Ardeotis kori*** | **Near Threatened** |
| African Jacana | *Actophilornis africanus* | Least Concern |
| Three-banded Plover | *Charadrius tricollaris* | Least Concern |
| Crowned Lapwing (Plover) | *Vanellus coronatus* | Least Concern |
| Blacksmith Lapwing (Plover) | *Vanellus armatus* | Least Concern |
| European Roller | *Coracias garrulus* | Least Concern |
| Black-winged Stilt | *Himantopus himantopus* | Least Concern |
| Spotted Thick-knee (Dikkop) | *Burhinus capensis* | Least Concern |
| Speckled Pigeon | *Columbia guinea* | Least Concern |
| Cape turtle-Dove | *Streptopelia capicola* | Least Concern |
| Laughing Dove | *Streptopelia senegalensis* | Least Concern |
| Barn Owl | *Tyto alba* | Least Concern |
| Spotted eagle-Owl | *Bubo africanus* | Least Concern |
| White-backed Mousebird | *Colius colius* | Least Concern |
| European Bee-Eater | *Merops apiaster* | Least Concern |
| African Hoopoe | *Upupa africana* | Least Concern |
| African GreyHhornbill | *Tockus nasutus* | Least Concern |
| Crested Barbet | *Trachyphonus vaillantii* | Least Concern |
| Red-capped Lark | *Calandrella cinerea* | Least Concern |
| Barn Swallow | *Hirundo rustica* | Least Concern |
| Greater Striped Swallow | *Hirundo cucullata* | Least Concern |
| Rock Martin | *Ptyonoprogne fuligula* | Least Concern |
| Pied Crow | *Corvus albus* | Least Concern |
| Red-eyed Bulbul | *Pycnonotus nigricans* | Least Concern |
| Zitting Cisticola | *Cisticola juncidis* | Least Concern |
| Rufous-eared Warbler | *Malcorus pectoralis* | Least Concern |
| Black-chested Prinia | *Prinia flavicans* | Least Concern |
| Pririt Batis | *Batis pririt* | Least Concern |
| Common Fiscal (Fiscal Shrike) | *Lanius collaris* | Least Concern |

| Common name | Scientific name | Conservation status |
|---|---|---|
| African Pipit | *Anthus cinnamomeus* | Least Concern |
| Crimson-breasted Shrike | *Laniarius atrococcineus* | Least Concern |
| Red-billed Oxpecker | *Buphagus erythrorhynchus* | Least Concern |
| Sociable Weaver | *Philetairus socius* | Least Concern |
| House Sparrow | *Passer domesticus* | Least Concern |
| Cape Sparrow | *Passer melanurus* | Least Concern |
| Southern Grey-headed Sparrow | *Passer diffusus* | Least Concern |
| Southern Masked-Weaver | *Ploceus velatus* | Least Concern |
| Southern Red Bishop | *Euplectes orix* | Least Concern |
| Common Waxbill | *Estrilda astrild* | Least Concern |
| Yellow Canary | *Serinus flaviventris* | Least Concern |

**Figure 38. Blacksmith Lapwing (Plover) recorded within study area**

**Figure 39. African Sacred Ibis recorded within study area**

**Figure 40. Crowned Lapwing (Plover) recorded within study area**

**Figure 41. Helmeted Guineafowl recorded within study area**

**Figure 42. Pied Crow recorded within study area**

**Figure 43. African Grey hornbill recorded within study area**

**Figure 44. Sociable weaver nest recorded within the study area**

#### 10.2.2.3 Potential occurrence of Red Data bird species

Data sourced from SABAP 1, Harrison et al. (1997), Barnes (2000), SABAP2 and Tarboton *et al.* (1987) indicated bird species on the Red Data List that are known to occur on grid cells; as well as their probability of occurrence (**Table 10**). The probability of occurrence is based on the availability of suitable habitat, known distribution, overall abundance, disturbance factors, anthropogenic change and the habitats of the species.

**Table 10. Red Data bird species potentially occurring and the probability of occurrence within the study area**

| Species | Scientific name | Conservation status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|---|
| Tawny Eagle | *Aquila rapax* | Endangered | Tawny Eagles are found in lightly wooded savannah, thornveld, and semi-desert, but avoid dense forest and highlands. They have large home ranges of (±70km$^2$), but also respond temporarily to favourable environmental conditions or prey outbreaks. | High |
| Martial Eagle | *Polemaetus bellicosus* | Endangered | The Martial Eagle is to be found in the savannah and thornbush areas of Africa south of the Sahara, from Senegal to Somalia and south to the Cape. It is also found in open plains and semi-desert country, but not frequenting forest, although it occasionally breeds in forests on the edge of open country | High |
| Kori Bustard | *Ardeotis kori* | Near Threatened | The Kori Bustard inhabits fairly open and dry savanna, where it usually occurs alone or in small group. | High |
| Ludwig's Bustard | *Neotis ludwigii* | Endangered | Semi-arid dwarf shrubland, also in arid savanna and fynbos | Medium |
| Blue Crane | *Anthropoides paradiseus* | Near Threatened | This crane breeds in dry grasslands at high elevations where there is less disturbance. They may roost and breed in wetlands if available and some individuals prefer to nest in arable and pastureland. | Medium |
| African Marsh Harrier | *Circus ranivorus* | Endangered | This species breeds and forages in wetland habitats including marshes, floodplains, reed beds and lake margins | Medium |
| Black Harrier | *Circus maurus* | Endangered | Fynbos, shrubland, dry grassland and croplands | Medium |
| African White-backed Vulture | *Gyps africanus* | Critically endangered | Inhabits the woodland regions of southern Africa. It relies primarily on large mammalian carcasses. | High |

| Species | Scientific name | Conservation status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|---|
| Lappet-faced vulture | *Torgos tracheliotos* | Endangered | Inhabits woodland regions of South Africa and Swaziland, with an apparent preference for drier woodlands, although it is likely extended into other biomes. | Medium |
| Lanner Falcon | *Falco biarmicus* | Vulnerable | Usually inhabiting open country, the Lanner Falcon can be found in a wide range of habitats ranging from extreme desert to wet, forested mountains up to elevations of 5,000 metres. The species can be found in *Eucalyptus* stands in southern Africa and even in urban areas, as long as there are open or lightly wooded areas nearby for hunting, though it tends to avoid heavily forested or very wet areas | High |
| Black Stork | *Ciconia nigra* | Vulnerable | It can occupy almost any type of wetland, such as pans, rivers, flood plains, ponds, lagoons, dams, swamp forests, mangrove swamps, estuaries, tidal mudflats and patches of short grass close to water. | Medium |
| Abdim’s Stork | *Ciconia abdimii* | Near Threatened | It is normally found in grasslands, sparsely wooded savanna, near pans and in agricultural fields. | Low |
| Yellow-billed Stork | *Mycteria ibis* | Endangered | Associated with water – dams, wetlands, rivers, marshes, even small pools. | Low |
| Marabou Stork | *Leptoptilos crumenife* | Near Threatened | It generally prefers open semi-arid habitats and wetlands, such as pans, dams and rivers. | Low |
| Secretarybird | *Sagittarius serpentarius* | Vulnerable | Prefers open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savannah. Avoids densely wooded areas, rocky hills and mountainous areas. | High |
| Greater Flamingo | *Phoenicopterus roseus* | Near Threatened | It generally prefers coastal mudflats, inland dams, sewage treatment works, small temporary pans and river mouths, while it | Low |

| Species | Scientific name | Conservation status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|---|
| | | | exclusively breeds at recently flooded, large eutrophic shallow salt pans. | |
| Lesser Flamingo | *Phoeniconaias minor* | Near Threatened | It generally favours open, eutrophic and shallow wetlands, coastal mudflats, salt works and sewage treatment plants; it exclusively breeds on salt pans and saline lakes | Low |
| Chestnut-banded Plover | *Charadrius pallidus* | Near Threatened | It is strongly associated with hyper-saline or hyper-alkaline wetlands, including natural and man-made salt pans and commercial saltworks. | Low |
| Greater painted snipe | *Rostratula benghalensis* | Near Threatened | It generally prefers dams, pans and marshy river flood plains, or any waterside habitat with mud and vegetation. | Medium |
| European Roller | *Coracias garrulus* | Near Threatened | European Rollers are hole-nesters, making use of natural cavities or abandoned excavated burrows of other species. | Medium |
| Burchell's Courser | *Cursorius rufus* | Vulnerable | Prefers open, desert and semi-deserts habitats often occurring in the most sparsely vegetated areas available. Typical habitat include heavily grazed or burnt grassland, stony or gravelly plains, stubbly sandveld, dry riverbeds and edges of saline pans. | High |

### 10.2.3 Reptiles

#### 10.2.3.1 Desktop survey results

According to South African Reptile Conservation Assessment (SARCA) (ADU, 2019) and historic distribution (Bates *et al.* 2014), no reptile species of conservation importance are known to occur in the vicinity of the study area.

#### 10.2.3.2 Reptiles recorded within the study area

Areas such as rocky outcrops (**Figure 45**), bushveld, grasslands and riparian vegetation within the project area are of high importance to reptiles. Rocky outcrops are important habitat or shelter for a variety of skinks, geckos and snakes.

**Figure 45. Rocky outcrops within the project area**

Riverine habitats are usually rich in reptile diversity and concentrations due to the habitat supporting a high number of prey species, such as frogs, birds and small mammals (Branch, 2001). The majority of reptile species are sensitive to severe habitat alteration and fragmentation. Species are also very often “expelled” into riparian zones due to transformation of lands for anthropogenic disturbances such as human settlements and agricultural purposes.

Termite mounds were present within the project area (**Figure 46**) and the old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous lizards and snakes (Jacobsen, 2005). Large number of species of reptiles feed on the emerging alates (winged termites). No termite mounds were destroyed during the brief field survey. All overturned rock material was carefully replaced in its original position. **Table 11** indicates reptile species observed within the project area and this was then augmented with anecdotal information provided by local residents and are indicated in **BOLD**. Species such as Ground Agama (**Figure 47**) and Leopard Tortoise (**Figure 48**) were recorded in abundance within the study area.

**Figure 46. Termite mound recorded within the project area**

**Table 11. Reptiles recorded within the study area**

| Genus | Species | Subspecies | Common name | Conservation Status |
|---|---|---|---|---|
| *Agama* | *aculeata* | | Distant's Ground Agama | Least Concern |
| *Agama* | *aculeata* | *aculeata* | Western Ground Agama | Least Concern |
| *Acanthocercus* | *atricollis* | | Southern Tree Agama | Least Concern |
| *Lamprophis* | *capensis* | | Brown House Snake | Least Concern |
| *Lygodactylus* | *capensis* | *capensis* | Common Dwarf Gecko | Least Concern |
| *Agama* | *atra* | | Southern Rock Agama | Least Concern |
| ***Bitis*** | ***arietans*** | | **Puff Adder** | **Least Concern** |
| ***Dispholidus*** | ***typus*** | ***typus*** | **Boomslang** | **Least Concern** |
| ***Pedioplanis*** | ***namaquensis*** | | **Namaqua Sand Lizard** | **Least Concern** |
| ***Pseudaspis*** | ***cana*** | | **Mole snake** | **Least Concern** |
| *Stigmochelis* | *pardalis* | | Leopard Tortoise | Least Concern |
| *Pedioplanis* | *lineoocellata* | *lineoocellata* | Spotted Sand Lizard | Least Concern |

| Genus | Species | Subspecies | Common name | Conservation Status |
|---|---|---|---|---|
| *Varanus* | *albigularis* | *albigulari* | Southern Rock Monitor | Least Concern |
| *Varanus* | *niloticus* | | Water Monitor | Least Concern |
| *Trachylepis* | *capensis* | | Cape Skink | Least Concern |
| *Naja* | *nivea* | | Cape Cobra | Least Concern |
| *Pachydactylus* | *capensis* | | Cape thick-toed gecko | Least Concern |

**Figure 47. Ground Agama recorded within the study area**

**Figure 48. Leopard Tortoise recorded within the study area**

10.2.3.3 Protected Species

These are indigenous species of high conservation value or national importance that require protection. Reptile species such as Mole snake, Rock Monitor, Leopard Tortoise and Cape Cobra are classified as *protected species* under Schedule 1 of Northern Cape Nature Conservation Act (Act 9 of 2009). All land tortoises and all lizards are listed as *protected species* under Schedule 2 of the Northern Cape Nature Conservation Act (Act 9 of 2009). All species of Chamaeleon are classified as *Schedule 1 specially protected species* of Northern Cape Nature Conservation Act (Act 9 of 2009).

### 10.2.4 Amphibians

Amphibians are an essential part of South Africa's exceptional biodiversity and are such worthy of both research and conservation.

10.2.4.1 Desktop survey results

Frogs and tadpoles are good species indicator of water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles and frogs are aquatic and greatly exposed to aquatic pollutants (Blaustein, 2003).

ADU (2019), data from the South African Frog Atlas Project (SAFAP) (1999-2003) and du Preez & Carruthers (2009) were consulted in order to draw up a list of potential occurrences and no frog species of conservation concern are likely to be found within the study area.

#### 10.2.4.2 Field work results

The watercourses (**Figure 49**) within the study area hold water on a permanent and temporary basis and are important breeding habitat for most of the frog species which occur within the study area. Only five frog species were recorded within the study area (**Table 12**).

**Figure 49. Watercourses within the study area**

**Table 12. Amphibian species recorded within the study area**

| Genus | Species | Common name | Conservation status |
|---|---|---|---|
| *Amietophrynus* | *gutturalis* | Guttural Toad | Least Concern |
| *Cacosternum* | *boettgeri* | Common Caco | Least Concern |
| *Kassina* | *senegalensis* | Bubbling Kassina | Least Concern |
| *Tomopterna* | *cryptotis* | Tremolo Sand Frog | Least Concern |
| *Xenopus* | *laevis* | Common Platanna | Least Concern |

#### 10.2.4.3 Protected Species

Anecdotal evidence from local land-users indicate the presence Bullfrog species. The Bullfrogs are listed as *specially protected species* under Schedule 1 of the Northern Cape Nature Conservation Act (Act 9 of 2009). A Permit is required from Northern Cape Nature Conservation in order to hunt, import, export, transport, keep, possess, breed or trade a specimen of a specially protected animal. All frogs are listed as *protected wild animals* under Schedule 2 of the Northern Cape Nature Conservation Act (Act 9 of 2009).

# 11 TERRSTRIAL ECOLOGICAL SENSITIVITY ANALYSIS

**Figure 50** below illustrates the terrestrial ecological sensitivity within the study area. The sensitivity assessment approach entails identifying zones of high, moderate and low sensitivity. The method predominantly involves identifying sensitive vegetation or habitat types, topography and land transformation, biodiversity patterns (hotspots), Species of conservation concern and biodiversity process areas (ecological infrastructure and corridors).

The sensitivity map (**Figure 50**) was based on the presence of the following features:

- Critical Biodiversity Area 1 (High);
- Critical Biodiversity Area 2 (High);
- Ecological Support Area (Medium);
- Rivers (High);
- Wetlands; and
- Protected plant species (Medium).

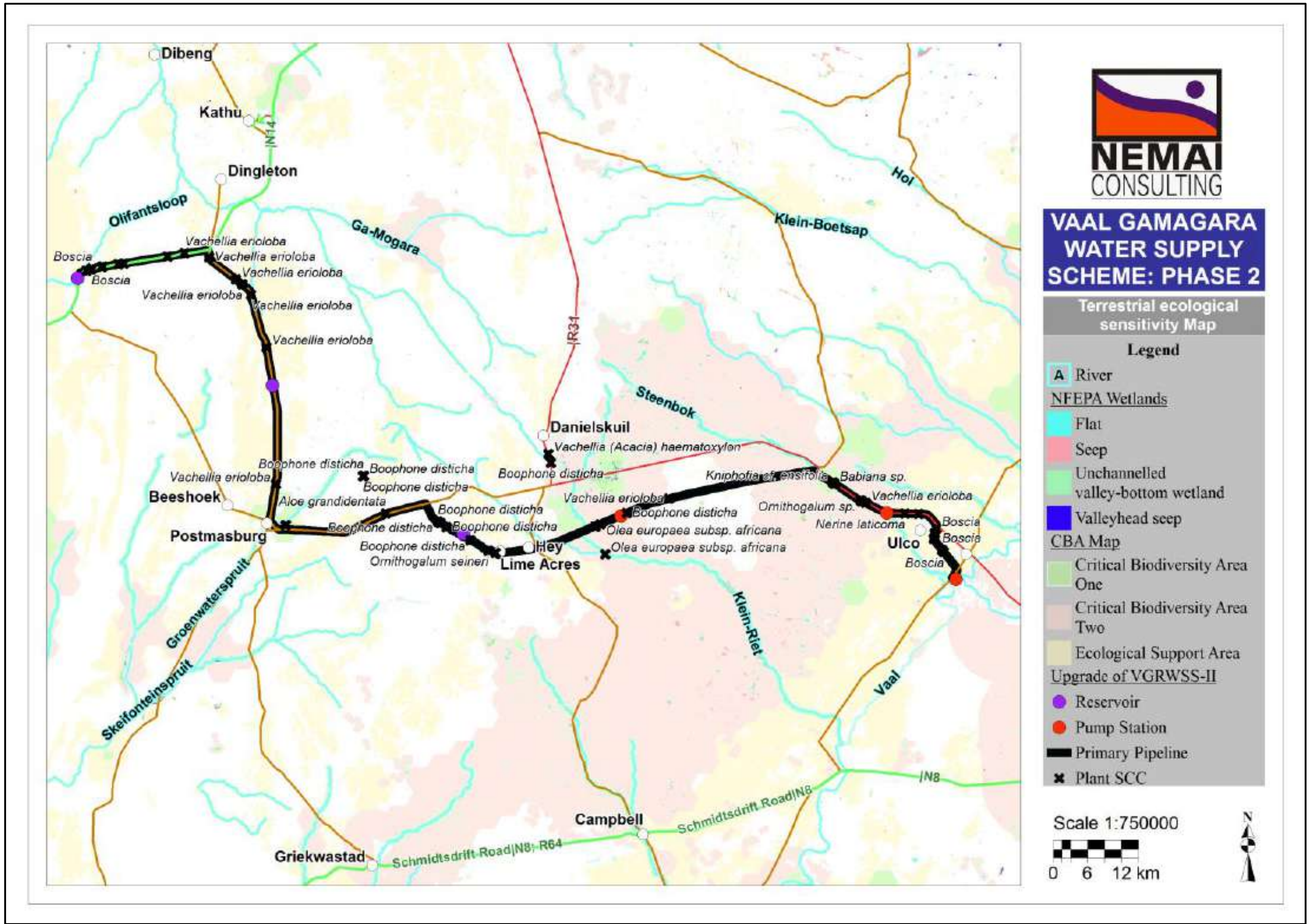


Figure 50. Terrestrial ecological sensitivity map of the study area

# 12 ENVIRONMENTAL IMPACT ASSESSMENT

## 12.1 Methodology

All impacts were analysed in the section to follow (**Table 13**) with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions apply:

**Status**
The project could have a positive, negative or neutral impact on the environment.

**Extent**

- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

**Magnitude**

Degree to which impact may cause irreplaceable loss of resources.

- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

**Duration**

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

**Probability**

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

**Significance**

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

- 0 – Impact will not affect the environment. No mitigation necessary.
- 1 – No impact after mitigation.
- 2 – Residual impact after mitigation.
- 3 – Impact cannot be mitigated.

## 12.2 Assessment of Environmental Impacts and Suggested Mitigation Measures

Only the environmental issues identified during the appraisal of the receiving environment and potential impacts are assessed (**Table 13**). Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

### 12.2.1 Pre-construction / Construction Phases

Activities associated with the pre-construction and construction phases, include the following:

- Clearance of vegetation;
- Site establishment and preparation (placement of construction material, construction camp, Laydown areas, etc.);
- Removal of topsoil will impact on the rehabilitation of the project area;
- Storage of non-hazardous construction material;
- Storage of hazardous/dangerous material e.g. fuel; and
- Storage of general and hazardous waste.

Potential impacts associated with the pre-construction and construction phases, include the following:

- Loss of plant Species of Conservation Concern (SCC) from vegetation clearance;
- Potential loss of topsoil from site preparation. Loss of topsoil on areas that will be compacted and/or covered with hardened surfaces (e.g. cement);
- Loss of vegetation from vegetation clearance during pre-construction and construction phases;
- Increased erosion due to clearance of vegetation and exposure of bare soil and incorrect storm water management measures;
- Ecosystem disruption may occur where clearing is undertaken to allow for the construction of the project infrastructure;

- Proliferation of alien invasive species on account of site disturbance. Introduction and spread of weeds and invasive alien plants in and around the site due to imported soil used during construction;
- Loss of vegetation due to fuel and chemical spills from the use of equipment (e.g. generators) and storage and use of hazardous substances;
- Temporary loss of functioning of CBAs and ESAs habitats, which are important in terms of biodiversity, ecosystem functionality and ecological processes; and
- Permanent loss of tree cover within the servitude since the establishment of trees within the pipeline servitude will not be allowed as roots may compromise the stability of the pipeline.

The construction phase of the proposed development is anticipated to have direct impacts on remaining floral habitat within the servitude and potential loss of plant SCC. Several plant SCC and provincially/national protected flora/trees were recorded on site. The potential loss of plant SCC is site specific and the search, rescue and relocation of these species before construction will result in the significance of the impact after mitigation to be considered low.

Based on the results of the field survey, it is evident that the project site provides habitat to a number of fauna species. Although it is assumed that the majority of fauna species will move to different areas as a result of disturbance, many animal SCC fauna species have a specific habitat requirements and the destruction of their habitats will result in displacement to less optimal habitats, or ultimately may result in their complete demise.

The upgrade of the pipeline is unlikely to significantly alter the overall functioning of the CBA and ESA, given that the physical extent of the disturbance footprint will be extremely small relative to the full extent of the CBA along the pipeline route.

Topsoil will be required during the rehabilitation of the proposed development area and should there be a loss of topsoil and proliferation of alien species on stored topsoil or during rehabilitation, this could ultimately lead to loss and/or degradation of floral habitat.

Soils on site are considered to be predisposed to potential contamination, as contamination sources are generally unpredictable for construction developments and often occur as incidental spills or leaks. The significance of soil contamination is considered to be low, largely dependent on the nature, volume and/or concentration of the contaminant of concern.

### 12.2.2 Operational Phase

Activities associated with the operational phase, include the following:

- Vegetation management activities e.g. removal of plants from the servitude;
- Repairs and maintenance of the pipeline, fencing, roads etc.; and
- Site inspections by personnel.

Potential impacts associated with the operational phase, include the following:

- Loss of vegetation type, important species and ecological processes resulting from vegetation management measures e.g. manual vegetation removal along the road, brush cutting or application of herbicide within the servitude;
- Introduction and spread of weeds and invasive alien plants in and around the servitude due to disturbance caused during servitude or pipeline maintenance;
- Loss of topsoil due to erosion caused by inadequate/failing stormwater management measures/designs;
- Disturbance to ecological processes due to altered habitat and disturbance to natural movements/processes;
- Soil contamination from hazardous substance spillages outside their primary and secondary containment during maintenance work;
- Loss of vegetation type, important species and ecological processes from soil contamination or spillage onto vegetation from hazardous substance spillages outside their primary and secondary containment during maintenance work; and
- Loss of habitat due to operational activities.

**Table 13. Potential impacts and the recommended mitigation measures for the Vaal Gamagara Regional Water Supply Scheme**

<table>
<tr><th colspan="7">PRE-CONSTRUCTION PHASE</th></tr>
<tr><th colspan="3">Potential Impact</th><th colspan="4">Mitigation</th></tr>
<tr><td colspan="3">Loss of plant species of conservation concern and protected trees due to clearing for the construction of associated infrastructures (e.g. site camps etc.).</td><td colspan="4"><ul><li>As far as possible, avoid disturbance to the Olea europea subsp. africana plant species along the pipeline servitude.</li><li>Permits from DAFF and Northern Cape Department of Environment and Nature Conservation (DENC) are required before construction commences in order to cut, disturb, destroy or remove the several protected trees (noted within the project area), namely Boscia albitrunca and Vachellia (Acacia) erioloba</li><li>It is recommended that a suitably qualified Ecologist (or a similarly qualified individual) should be appointed to undertake a pre-construction walk-down to identify plant species of conservation concern and protected species (such as Boophone disticha, Lithops spp. and Nymania capensis etc) and oversee the rescue and relocation of these species. For flora species, the following factors need to be considered amongst others) as part of this process:<ul><li>Detailed plan of action (including timeframes, methodology and costs);</li><li>Site investigations;</li><li>Consultation with authorities and stakeholders;</li><li>Marking of species to be relocated;</li><li>Applying for permits (Northern Cape DENC);</li><li>Identification of suitable areas for relocation;</li><li>Aftercare; and</li><li>Monitoring (including targets and indicators to measure success).</li></ul></li></ul></td></tr>
<tr><td>Without Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Moderate</td><td>1</td></tr>
</table>

| PRE-CONSTRUCTION & CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | Mitigation | | | |
| Loss of fauna under Schedule 1 *specially protected species* and Schedule 2 *protected species* of Northern Cape Nature Conservation Act (Act 9 of 2009). | | | • In order to protect animal species on or around the site, prior construction, these species should be removed and relocated to natural areas in the vicinity. This remedial action requires the engagement of a herpetologist/ ecologist or a suitably qualified environmental officer to oversee the removal of any fauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment).<br>• Any lizards, geckoes, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.<br>• Vegetation clearance should, ideally, start during the non-breeding season of fauna populations (i.e. winter).<br>• Prior and during vegetation clearance, any larger fauna species noted should be given the opportunity to move away from the construction machinery. | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Regional | Medium | Short-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Regional | Low | Short-term | Unlikely | 1 |

| PRE-CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | Mitigation | | | |
| Loss of animal species of conservation concern (Black-footed cat and Southern African Hedgehog) | | | • A walk down survey needs to be conducted prior to construction in order to identify possible burrowing animals.<br>• All personnel working on the project must participate in an environmental awareness program and this program must include appropriate wildlife avoidance methodologies, such as impact minimisation procedures. Information about the importance and purpose of protecting wildlife mist be described in the program.<br>• No animals should be intentionally killed or destroyed. Poaching and hunting should not be permitted in the project site or surrounding areas.<br>• Vegetation clearance should, ideally, start during the non-breeding season of fauna populations (i.e. winter).<br>• Any animals found within excavations must not be harmed, and a suitably qualified person should be called to assist in safely removing the animal from the excavation.<br>• Any animals found on the servitude should be allowed to leave freely, or a suitably qualified person should be called to assist in moving the animal off-site safely. | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

| PRE-CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Loss of CBA and ESAs habitats | | • No stockpiling of topsoil, soil, construction material, or establishment of construction camps must be allowed within the sensitive ecological areas.<br>• The most significant way to mitigate the loss of habitat is to limit the construction footprint within the natural habitat areas remaining. Disturbance of vegetation must be limited to the servitude area acquired for the project.<br>• Where possible, sensitive habitats must not be cleared and encouraged to grow.<br>• Disturbance of vegetation must be limited only to areas of construction.<br>• Areas cleared of vegetation must be re-vegetated and re-established prior to contractor leaving the site.<br>• Removal of alien and alien invasive plants must be continuous. Removal of plants must be undertaken before they flower or set seed.<br>• All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.<br>• Prevent contamination of natural areas by any pollution.<br>• The presence and location of all CBAs and ESAs must be clearly communicated to all employees and visitors to the project site.<br>• Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project.<br>• Topsoil stripped must be stored in such a way that it can be replaced at the same location to limit the mixing of plant species between habitats. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

<table>
<tr><th colspan="7">PRE-CONSTRUCTION PHASE</th></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Mitigation</td></tr>
<tr><td colspan="2">Loss of topsoil</td><td colspan="5"><ul><li>During site preparation, topsoil and subsoil are to be stripped separately from each other.</li><li>Topsoil should be stripped to at least 150mm depth, and stockpiles should not exceed 1.5m in height.</li><li>Topsoil must be stored separately from subsoil and spoil material for use in the rehabilitation phase.</li><li>Stockpiles should be protected from wind and rain related erosion, compaction, as well as contamination from diesel, cement, concrete, wastewater, or any other waste or hazardous substance.</li><li>Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.</li><li>Topsoil stripped must be stored in such a way that it can be replaced at the same location to limit the mixing of plant species between habitats.</li></ul></td></tr>
<tr><td>Without Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Unlikely</td><td>1</td></tr>
</table>

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Destruction of indigenous flora during site establishment | | • Indigenous plants naturally growing within the project area, but that would be otherwise destroyed during clearing for development purposes, such similar plant species should be incorporated into landscaped areas.<br>• Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment.<br>• Where possible, natural vegetation must not be cleared and encouraged to grow.<br>• Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm and this can be achieved through provision of appropriate awareness to all personnel.<br>• Disturbance of vegetation must be limited only to areas of construction.<br>• Prevent contamination of natural vegetation by any pollution.<br>• Areas cleared of vegetation must be re-vegetated and re-established prior to contractor leaving the site.<br>• Any fauna (mammal and reptile) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed rescued and relocated by an experienced person.<br>• Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent further spread.<br>• No storage of building materials or rubble is allowed in the sensitive areas.<br>• Areas showing dense natural vegetation can be avoided in order to reduce vegetation loss.<br>• Avoid translocating stockpiles of topsoil from one place to another in order to avoid translocating soil seed banks of alien species.<br>• Rehabilitation of all disturbed areas should be an ongoing process and areas should be rehabilitated as soon as construction is completed in that area (i.e. that rehabilitation of the whole pipeline route is not only undertaken once all construction is completed, but rather in incremental sections as construction progresses. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

| PRE/CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Loss of faunal habitat | | • Vegetation outside of the footprints is not to be cleared. Construction activities to be limited to the construction servitude only.<br>• As far as possible, the existing road network should be utilised to access the construction sites.<br>• Revegetation of disturbed areas should be carried out in order to restore habitat availability and minimise soil erosion and surface water runoff whilst re-instating faunal habitat.<br>• A suitable rescue and relocation plan should be developed and overseen by a suitably qualified specialist in order to ensure that species loss during pre-construction activities is kept to a minimum.<br>• Spills and /or leaks from construction equipment must be immediately remedied and cleaned up so as to ensure that these chemicals/hydrocarbons do not contaminate the soils.<br>• Should any smaller animals which are less mobile be observed in the construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Construction personnel are to be educated about these species and the need for their conservation.<br>• No hunting/trapping or collecting of faunal species is allowed.<br>• No fires are allowed.<br>• Reptiles and amphibians that are exposed during the clearing operations should be captured for later release or translocation by a qualified expert.<br>• Any person found deliberately harassing any animal in any way should face disciplinary measures, following the possible dismissal from the site. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Regional | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Loss and displacement of animals on site | | • Regular training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.<br>• The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase.<br>• All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited.<br>• Strict adherence to speed limits by construction vehicles on the public and private access roads. Appropriate speed limits need to be posted on all access roads according to the geometric design and limitations of heavy vehicles.<br>• No fires should be allowed at the site.<br>• No dogs or other domestic pets should be allowed at the site.<br>• Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint by a suitable qualified personnel trained in the handling and relocation of animals.<br>• It is recommended that, while trenches are open during the construction phase, an appropriately sloping section is made available to allow any trapped animals to escape.<br>• Any fauna (mammal, reptile and amphibian) that becomes trapped in the trenches or in any construction related activity may not be harmed and must be rescued and relocated by an experienced person.<br>• Inspect open trenches at least daily to ensure that animals have not become trapped. Such animals will be safely removed and released, where possible. Special equipment for handling of venomous snakes should be available on site to ensure safe removal. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

<table>
<tr><th colspan="7">CONSTRUCTION PHASE</th></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Mitigation</td></tr>
<tr><td colspan="2">Loss of habitat and habitat fragmentation</td><td colspan="5"><ul>
<li>The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining.</li>
<li>No structures should be built outside the area demarcated for the development.</li>
<li>Although it is unavoidable that sections of the project infrastructure development will need to traverse areas of potential high sensitivity, the clearing of vegetation must be limited to the servitude area acquired for the project.</li>
<li>Where possible, the proposed linear infrastructure should be aligned with existing linear infrastructure or routed through already transformed/degraded areas.</li>
<li>Any protected plants close to the site that will remain in place must be clearly marked and may not be defaced, disturbed, destroyed or removed. They must be cordoned off with construction tape or similar barriers and marked as a no-go areas.</li>
<li>During construction, the ECO must monitor vegetation clearing on site. Any deviations from the approved plans which will result in the removal of vegetation from additional areas should first be checked for protected species by the ECO. Any protected species present which are able to survive translocation should be translocated to a safe site.</li>
<li>The ECO must translocate any listed species observed within the development footprint which were missed during the pre-construction vegetation walk-through.</li>
<li>The timing between clearing of an area and subsequent development is to be minimised.</li>
</ul></td></tr>
<tr><td>Without Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Unlikely</td><td>1</td></tr>
</table>

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Loss of vegetation due to soil contamination | | • Appropriate measures should be implemented in order to prevent potential soil pollution through fuel, oil leaks and spills and then compliance monitored by an appropriate person.<br>• Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks.<br>• An emergency response contingency plan will be implemented to address clean-up measures should a spill and/or a leak occur.<br>• All plant and machinery should be inspected every day, serviced and maintained regularly, and any leaking plant/machinery should be removed from site for repair.<br>• Measures to avoid leakages and spillages on to bare ground and leakages must be undertaken.<br>• Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Safe disposal certificate must always be obtained from the registered waste disposal site, and proof of disposal kept on site. Drip-trays must be placed under vehicles and equipment when not in use.<br>• Washing and cleaning of equipment should also be done within bunds, in order to trap any cement and prevent excessive soil erosion and these sites must be re-vegetated after construction has been completed.<br>• Spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans will be implemented during the construction phase.<br>• Spill kits will be made available on site for clean-up of spills and leaks of contaminants.<br>• The site must have a suitable area for the safe cleaning of cement contaminated tools and equipment. Cleaning such tools/equipment results in water contaminated with cement, which is hazardous to the environment. Cement contaminated water must not be released or otherwise disposed of into the environment, including stormwater drains. The contaminated water should be kept in a bund, drum, or other suitable containment (which will be used to wash contaminated tools, and can be re-used to mix cement) and allowed to evaporate. The remaining residue can be disposed of as building rubble once dry.<br>• Every plant and all machinery should be issued with a drip tray on site. The drip tray should be placed underneath the plant/machine when it has shutdown. Drip trays should be in good working order with no holes or cracks, and should be able to hold liquid adequately if/when needed.<br>• The contents of drip trays, including rainwater, must not be disposed of into the environment, but decanted into suitable, sealable, containers. These containers should be labelled and the contents disposed of as hazardous waste. Proof of disposal at a licenced waste disposal site must be obtained. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Encroachment and proliferation of weeds and alien invasive plant species | | • Invasive plants (listed in this study) can be removed manually or with the help of simple tools. This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ring-barking or bark stripping. These control options are only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. It would be preferable to uproot alien vegetation to limit regrowth after cutting.<br>• Topsoil stockpiles, in particular, should be kept free of alien and alien invasive vegetation.<br>• Seedlings of many invasive plants appear all the time during construction and when they appear, they must be pulled out as soon as possible to eliminate costly removal at a later stage. It is easier to remove seedlings when the soil is moist.<br>• A 'Tree Popper' can be used to remove shrubs and smaller trees or alternatively, the top growth can be cut off and then the stem and roots can be removed from the soil.<br>• For large stands of trees on site should they are too large for physical removal, ring-barking the tree should be considered<br>• To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication programme needs to be developed by a suitable person with a botanical expertise of the region.<br>• Promote awareness of all personnel.<br>• Chemical control should only be used as a last resort, since it is hazardous for natural vegetation. It should not be necessary if regular monitoring is undertaken, which should be effective for controlling invasive alien plants. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Regional | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Unlikely | 1 |

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | Mitigation | | | | | |
| Increased soil erosion | • Program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example during the summer when intense rainstorms are common.<br>• Site-specific plans for soil erosion and sediment control should be developed and implemented. This should include a determination of site erosion potential and the identification of water bodies at risk.<br>• Sediment barriers or sediment traps such as silt fences, sandbags etc must be established to curb erosion and sedimentation where necessary.<br>• An ecologically-sound stormwater management plan must be implemented during construction and appropriate water diversion systems put in place.<br>• Sediment barriers should be regularly maintained and cleaned to ensure effective drainage.<br>• Stockpiles are not be used as stormwater control features.<br>• Sediment control measures such as silt fences, concrete blocks and/or sandbags must be placed around stockpiles to limit runoff, where erosion of stockpiles is severe. | | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Damage to plant and animal life outside of the study area | | • Construction activities should be limited to the authorised construction servitude only.<br>• No trapping or any other method of catching of any animal may be performed.<br>• Illegal hunting is prohibited.<br>• No dumping of any form is permitted.<br>• No damage and/or removal/trapping/snaring of indigenous plant or animal species for cooking and other purposes will be allowed.<br>• All areas to be affected by the project activities will be rehabilitated by indigenous vegetation. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Disturbance to animals | | • Animals residing within the designated area shall not be unnecessarily disturbed.<br>• During construction, refresher training should be conducted to construction workers with regards to littering and poaching.<br>• The Contractor and his/her employees shall not bring any domestic animals onto site.<br>• Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding dangerous animals such as snakes. Information regarding snake handlers in the region should be displaced on construction camp walls. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| POST CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | Mitigation | | | | | |
| Loss of habitat due to construction activities | • Indigenous plants naturally growing within the project area, but that would be otherwise destroyed during clearing for development purposes, should be incorporated into rehabilitation areas.<br>• All areas to be affected by the project will be rehabilitated after construction and all waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at an approved landfill site. All waste and construction material must be removed post construction prior to rehabilitation.<br>• When rehabilitating the construction footprint site, it is imperative that as far as possible the habitat that was present prior to disturbances is recreated or improved, so that faunal species that were displaced by vegetation clearing and construction activities are able to recolonize the rehabilitated area.<br>• As much vegetation growth as possible should be promoted within the servitude in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use same species of indigenous plant species which were destroyed (in the same densities) during construction activities as the first choice during landscaping. In terms of the percentage of coverage required during rehab and also the grass mix to be used for rehab, the EMPr will be consulted for guidance. However, the plant material to be used for rehabilitation should be similar to what is found in the surrounding area.<br>• Replace topsoil to the same location it was removed. Do not mix topsoil between different areas with different species composition.<br>• Clear the area of all waste (including inert waste) and contaminated soil in preparation for rehabilitation.<br>• Scarify to loosen compacted soil. | | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| OPERATIONAL PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | Mitigation | | | | |
| Disturbance of faunal species | | • Animals residing within the designated area shall not be unnecessarily disturbed.<br>• When accessing the pipeline servitude, vehicles are to utilise the existing roads.<br>• Ensure that no unnecessary clearing of faunal habitat occurs.<br>• No hunting/trapping/snaring or collecting of faunal species is allowed.<br>• No fires by maintenance personnel are allowed.<br>• Following heavy rains, access roads and areas of disturbance are to be inspected for signs of erosion, which, if found, must be immediately rectified through appropriate erosion control measures. | | | | |
| Without Mitigation | Status | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

<table>
<tr><th colspan="7">OPERATIONAL PHASE</th></tr>
<tr><th colspan="2">Potential Impact</th><th colspan="5">Mitigation</th></tr>
<tr><td colspan="2">Loss and/or degradation of floral habitat</td><td colspan="5">
• All alien seedlings and saplings must be removed as they become evident for the duration of operational phase.<br>
• Manual / mechanical removal is preferred to chemical control.<br>
• Prevent contamination of natural vegetation by any pollution.<br>
• All waste generated will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site.<br>
• No waste may be left on site after maintenance visits have been completed.<br>
• During maintenance works where excavations are made, the following must be undertaken:<br>
o Topsoil must be stripped to depth of 150mm and stored separately to subsoil and spoil;<br>
o Maintenance work footprint must be kept to a minimum;<br>
o Soil should be returned in the same order it was removed, ending with topsoil;<br>
o The affected areas must be monitored and alien vegetation removed and erosion remediated.<br>
• As much vegetation growth as possible should be promoted post construction activities within the project area in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during rehabilitation. The plant material to be used for rehabilitation should be similar to what is found in the surrounding area.<br>
• Entire footprint of area affected by operation and maintenance activities to be reinstated and rehabilitated.<br>
• Incorporate findings of specialists from walk-down survey (if applicable).<br>
• Seedling of many invasive plants appear all the time after construction and when they appear, they must be pulled out as soon as possible to eliminate costly tree felling at a later stage. It is easier to remove seedlings when the soil is moist.<br>
• Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
</td></tr>
<tr><td>Without Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

## 12.3 Cumulative Impacts

Cumulative impacts can be identified by combining the potential environmental implications of the proposed project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

The following are the cumulative impacts that are assessed as being a likely consequence of the upgrade pipeline. These are assessed in context of the extent of the current site, other developments in the area as well as general habitat loss and transformation resulting from mining and other activities in the area.

The Terrestrial Ecological Impact Assessment Study identified species of conservation concern that could be adversely affected by the project activities. The study took into consideration the existing local impacts to the biodiversity and the incremental loss of conservation-worthy species of the project within the context of the provincial conservation goals and targets.

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. Due to the presence of a number of mining developments in the area, this is a potential cumulative impact of the development that is assessed.

The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the country’s ability to meet its conservation targets. Although the receiving vegetation types in the study area are classified as *Least Threatened* and Kathu Bushveld, Olifantshoek Plains Thornveld, Postmasburg Thornveld and Koranna-Langeberg Mountain Bushveld vegetation types are relatively restricted vegetation types in Nothern Cape and are therefore vulnerable to cumulative impacts. This impact is therefore assessed in light of the current development as well as any other developments in the surrounding area which would also contribute to cumulative impacts.

During construction activities, the potential loss of untransformed habitat may result in the loss of protected plant species and the subsequent displacement of fauna. It is evident that most of the large-bodied fauna species will vacate the construction area and take refuge at nearby similar habitat. However, small-bodied and less mobile fauna could become trapped in excavations and trenches and these should be relocated.

Exotic vegetation is encountered in the project area and is mostly associated with grazing and disturbances linked to subsistence livelihoods. Large areas will be cleared during the construction phase of the project and all disturbed areas outside of the project area will need to be appropriately rehabilitated to ensure that a cumulative impact is not caused in this regard.

Through the search, rescue and relocation, a concerted effort will be made to prevent the loss of SCC that will be affected by the project. With the relocation of these species to suitable habitat the cumulative impact to biodiversity could be adequately managed.

# 13 CONCLUSION AND RECOMMENDATIONS

The proposed upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 falls within the Azonal vegetation and Savanna biomes. The vegetation types found within the study are all listed as *Least threatened*. No terrestrial threatened ecosystem exists on site.

During the field survey, no threatened plant species were observed within the project area; however, only two plant species of conservation concern (listed as *Declining)* were found, namely *Vachellia erioloba* (= *Acacia erioloba***)** (Camel thorn) and *Boophone disticha.*

Protected trees occurring within the study area are *Boscia albitrunca* (Shepherd's tree), and *Vachellia (Acacia) erioloba* (Camel thorn)*.* According to Section 51(1) of the National Forests Act (Act No. 84 of 1998), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister of DAFF.

The following plant species are listed as "protected plants" in terms of Schedule 2 of Northern Cape Nature Conservation Act (Act 9 of 2009): *Boscia albitrunca* (Shepherd's tree); *Olea europaea* subsp*. africana*; all species of families Amaryllidaceae (*Ammocharis coranica*, *Boophone disticha* and *Nerine laticoma*; Asphodelaceae (*Aloe grandidentata*, *Aloe hereroensis*, *Bulbine narcissifolia*, and *Kniphofia cf. ensifolia*; Hyacinthaceae (*Ornithogalum* sp.; Iridaceae (*Babiana* sp, were recorded within the study area. In terms of restricted activities involving protected plants, no person may, without a permit—(a) pick; (b) import; (c) export; (d) transport; (e) cultivate; or (f) trade in, a specimen of a protected plant. Data supplied by DAFF indicates that protected plant species such as *Lithops* spp*., Vachellia haematoxylon* (Grey Camel thorn) and *Nymania capensis* (Chinese lanterns) have been recorded in the study area.

The major concerns on site are alien invasives, weeds and potential invasives. All areas affected by construction should be rehabilitated upon completion of the construction phase of the development to its pre-construction state where possible, in agreement with the ECO. Mitigation measures provided will ensure that any available ecological linkages between sensitive areas are not affected negatively. Mitigation measures included within this report are feasible and will be easy to achieve. Several of the mitigation measures included here have been implemented successfully on several different construction sites.

In order to alleviate the loss of habitat within the study area, it is recommended that a clear, concise and well formulated rehabilitation plan be implemented after the construction activities, focussing on fauna species relocation, as well as the concurrent reinstatement of faunal habitat post construction activities.

Prior to construction and vegetation clearance a suitably qualified environmental officer/herpetologist should undertake a walk-through and relocate any affected animals to appropriate habitat away from the servitude. Any lizards, geckoes, agamids, monitors or snakes encountered should be allowed to escape to suitable habitat away from the disturbance. No reptile should be intentionally killed, caught or collected during any phase of the project.

The watercourses within the study area hold water on a permanent and temporary basis and are probably important breeding habitat for most of the frog species which occur within the study area. Anecdotal evidence from local land-users indicate the presence Bullfrog species. The Bullfrogs are listed as *specially protected species* under Schedule 1 of the Northern Cape Nature Conservation Act (Act 9 of 2009). A Permit is required from Northern Cape Nature Conservation in order to hunt, import, export, transport, keep, possess, breed or trade a specimen of a specially protected animal. All frogs are listed as *protected wild animals* under Schedule 2 of the Northern Cape Nature Conservation Act (Act 9 of 2009).

Biodiversity offsets are not deemed to be necessary, however, it is recommended that a suitably qualified Ecologist (or a similarly qualified individual) should be appointed prior to the start of the construction activities to undertake a pre-construction walk-down to identify plant species of conservation concern and protected species (such as *Boophone disticha)* and oversee the rescue and relocation of these species. The walk-down survey should preferably be undertaken during summer season in order to have a higher probability of detecting species of special concern. This is relevant in the areas that have been labelled as ecologically sensitive. In order to conserve the faunal species community structures within the region, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the required footprint only. During the field surveys, it was found that the impacts of the proposed development on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur.

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### Review report of the

# Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province Terrestrial Ecological Impact Assessment Report

**(Report Reference: 10689; dated September 2019)**

**Prepared by:**

Rautenbach Biodiversity Consulting


**Please direct any queries to:**

Anita Rautenbach

Cell: 083 305 1516

Email: rabiodiversity@gmail.com

## CONTENTS



## REVIEWER DETAILS AND DECLARATION OF INDEPENDENCE

| | |
|---|---|
| **Document title** | Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province. Terrestrial Ecological Impact Assessment Report (September 2019) |
| **Report reviewer** | Anita Rautenbach |
| **Qualifications** | MSc. Biological Science |
| **Professional affiliations** | Professional Natural Scientist (400725/15) |
| **Email address** | rabiodiversity@gmail.com |
| **Cell** | +27 83 305 1516 |

I, **Anita Rautenbach** *Pr. Sci. Nat*. declare that I:

- act as an independent reviewer of this report;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity;
- have performed the review of this report in an objective manner, even had this resulted in views and findings that are not favourable to the EAP/applicant;
- declare that there were no circumstances that compromised my objectivity in performing this work;
- have expertise in conducting the specialist report relevant to this review, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity; and that I
- have no, and will not engage in, conflicting interests in the undertaking of the activity.

Rautenbach

A. Rautenbach　　　　　　Date: 10 October 2019

# 1. INTRODUCTION

Rautenbach Biodiversity Consulting was appointed by The Biodiversity Company to conduct an independent peer review of the report titled the "Proposed Upgrading of the Vaal Gamagara Regional Water Supply Scheme: Phase 2 in Northern Cape Province Terrestrial Ecological Impact Assessment Report (September 2019) as prepared by Nemai Consulting (Pty) Ltd.

Below follows a summary of the various components that was taken into consideration during the review process (adapted from DEAT, 2004; DEAT, 2002; Brownlie, 2005).

Summary appraisal of the terrestrial ecological assessment report:

| | JUDGEMENT | | |
|---|---|---|---|
| **COMPONENT** | **COMPLETE (C)** | **ACCEPTABLE (A)** | **INADEQUATE (I)** |
| 1. Non-technical summary | | | ✓ |
| 2. Project description | | | ✓ |
| 3. Legal compliance and guidelines | | | ✓ |
| 4. Limitations, assumptions and gaps in knowledge | | | ✓ |
| 5. Establishment of baseline environmental conditions | | | ✓ |
| 6. Field surveys and data collection | | | ✓ |
| **7**. Impact identification | | | ✓ |
| **8**. Development of mitigation measures | | | ✓ |
| **9**. General approach | | | ✓ |

**Complete** - all information required for decision-making is available. No additional information is required even though more information might exist.

**Acceptable** - the information presented is incomplete, but the omissions do not prevent the decision-making process from proceeding.

**Inadequate** - the information presented contains major omissions. Additional information is necessary before the decision-making process can proceed.

The overall report is therefore graded as follows:

| | |
|---|---|
| **EXCELLENT:** The EIA report contains everything required for decision-making on the project. There are no gaps. | |
| **GOOD:** The EIA report contains most of the information required as far as it is relevant in the particular circumstances of the project; any gaps are relatively minor. | |
| **SATISFACTORY:** The information presented is not complete; there are significant omissions but in the context of the proposed project, these are not so great as to prevent a decision being made on whether the project should be allowed to proceed. | |
| **INADEQUATE:** Some of the information has been provided, but there are major omissions; in the context of the proposed project these must be addressed before a decision on whether the project should be allowed to proceed can be taken. | |
| **POOR:** The information required has not been provided or is far from complete and, in the context of the proposed project, the omissions must be addressed before a decision on whether the project should be allowed to proceed can be taken. | ✓ |

**TABLE 1:** Technical summary

| | JUDGEMENT (C/A/I) | COMMENTS |
|---|---|---|
| **1. NON-TECHNICAL SUMMARY** | | To be completed once all ommisions has been addressed. |
| • Does the report contain a brief but concise non-technical summary that clearly explains the project and the environment, the main issues and mitigation measures to be undertaken, and any remaining or residual impacts? | I | |
| • Does the summary include a brief explanation of the overall approach to the assessment? | I | |
| • Does the summary provide an indication of the confidence which can be placed in the results? | I | |
| • Does the summary indicate whether the project is or is not environmentally acceptable**?** | I | |
| **2. PROJECT DESCRIPTION** | | |
| • Scope of the project | I | Insufficient information with regards to the upgrading of pumpstations, WTW and borrow pit areas. |
| • Background and history of the project. | A | |
| • Has the land required for the project and any associated services, been described and clearly shown on a scaled map? | I | Location of borrow pit areas not indicated on map (Fig. 2). |
| • For a linear project, has the land corridor and need for earthworks been described and shown on a scaled map? | I | Corridor width not presented. |
| • Has the re-instatement after use of temporary landtake been described? | I | Not considered. |
| **3. LEGAL COMPLIANCE AND GUIDELINES** | | |
| • Revelevant environmental legislation | A | |
| • Relevant environmental guidelines | A | |
| **4. LIMITATIONS, ASSUMPTIONS, GAPS IN KNOWLEDGE** | I | Limitations and assumptions not clearly articulated and incomplete. Gaps in knowledge not identified. |
| **5. ESTABLISHMENTOF BASELINE ENVIRONMENTAL CONDITIONS** | | |
| • Consideration of all available documentary records, research papers and other relevant information. | I | Literature review inadequate and incomplete. No reference to specific research/specialist studies and none cited. |
| • Use of recognized survey and analysis techniques. | I | Poor articulation of methodology. Failure to use recognized and repeatable survey methods for field surveys. |
| • Identification and provision of appropriate descriptions of the baseline environmental conditions | I | Failure to include aquatic habitats. Descriptions for Centre of Endemism and relevance to proposed development unclear. |
| • Identification of key environmental features that may enhance, constrain or limit the direction and rate of environmental change. | I | Aquatic habitat, important for many conservation sensitive fauna and flora species was not considered. |
| • Explanation of links, interactions and dependencies between environmental components. | I | None identified. |

| | JUDGEMENT (C/A/I) | COMMENTS |
|---|---|---|
| • Verification of desktop and other information by systematic field surveys. | I | CBA & ESA areas not ground-truthed. Current condition of these areas not indicated. Aquatic habitats not assessed. Current condition and location of these areas not indicated. |
| • Acknowledgement of the implications of gaps and limitations in information and data. | I | Given the duration of the survey, coupled to the length of the pipeline route (~210 km) it is highly unlikely that all areas could be surveyed equally by one person. Seasonal variations were also not considered. Therefore potential and substantial gaps and limitations in information and data may exist. However, this was not recognised as significant constraints which seem highly unlikely. |
| **6. FIELD SURVEYS AND DATA COLLECTION** | | |
| • Temporal considerations, particularly survey timing and duration | I | Given the extent of the area duration is considered inadequate. Temporal considerations were not taken into account. |
| • The use of standard methods and techniques for information recording and surveying. | I | None applied. |
| • The degree of sampling effort and the intensity of the survey applied. | I | Not indicated. |
| • Indication of the levels of precision and measures of confidence or uncertainty associated with the data presented | I | Not indicated. |
| **7. IMPACT IDENTIFICATION** | | |
| • Identification of indirect, cumulative, secondary, short-, medium and long-term, permant or temporary and positive or negative effects. | I | This entire section needs extensive revision since not all impacts associated with the proposed development were identified. For example, but not limited to, aquatic environments and borrow pit areas.<br><br>Pre-construction, construction, operational and decommission phase impacts should be presented in separate sections.<br><br>Potential impacts are merely listed, with no description of what causes the effect, what will be affected and how it will be affected.<br><br>Mitigation measures proposed are insufficient, irrelevant or unpractical, vague, with no clear guidelines as to the implementation and/or monitoring requirements. |
| • Description and quantification of potential impacts for all phases of the proposed project (construction, operation, decommissioning). | I | |
| • Assessment of the significance of impacts likely to arise from the project against the reference condition, rather than against the present state revealed by the field surveys. | I | |
| • Evaluation of impacts according to prescribed impact assessment and evaluation techniques and criteria. | I | |
| • Provision of information on impact reversibility and the potential for mitigating the identified impacts. | I | |
| • Provision of details on how uncertainties and limitations in predicting potential impacts were dealth with. | I | |
| • Statement of all assumptions made for assessing potential impacts. | I | |
| • Statement of the predicted post-mitigation significance of impacts, i.e. the significance of residual impacts after all proposed mitigation measures have been taken into account. | I | |
| • Are cumulative impacts considered? | I | |
| **8. DEVELOPMENT OF MITIGATION MEASURES** | | |
| • Has the mitigation of negative impacts been considered and, where | I | Generic mitigation measures, incomplete, in many cases not feasible or |

| | JUDGEMENT (C/A/I) | COMMENTS |
|---|---|---|
| feasible, have specific measures been proposed to address each impact? | | achievable or inappropriate. |
| • Are the mitigation measures proposed affordable, feasible and achievable with defined criteria for success? | I | |
| • Are significance ratings with and without mitigation measures provided? | I | |
| • Provision of precise descriptions for each recommended mitigation action to be implemented and the time span for which they are necessary | I | |
| • Is it clear to what extent the mitigation methods are likely to be effective? | I | |
| • Provision of quantifiable standards (performance criteria) for reviewing or tracking the effectiveness of proposed mitigation actions. | I | |
| **9. GENERAL APPROACH** | | |
| **Organisation of the information** | | |
| • Is the information logically arranged in sections? | I | Refer to the report for a number of comments and suggestions. |
| • Is the location of the information identified in an index or table of contents? | A | |
| • When information from external sources has been introduced, has a full reference to the source been included? | A | |
| **Presentation of the information** | | |
| Has information and analysis been offered to support all conclusions drawn? | I | |
| • Has information and analysis been presented so as to be comprehensible to the non-specialist, using maps, tables and graphical material as appropriate? | I | |
| • Has superfluous information (i.e. information not needed for the decision) been avoided? | I | |
| • Have prominence and emphasis been given to severe adverse impacts, to substantial environmental benefits, and to controversial issues? | I | |
| • Is the information objective? | I | |

## 2. CONCLUSIONS AND RECOMMENDATIONS

The information provided in this report is far from complete, poorly articulated with numerous contradictions and incorrect interpretations, incorrect/inconsistent use of terminology etc. Both the desktop assessment and field surveys are incomplete and does not provide all required information.

The impact assessment is incomplete and insufficient and failed to identify potential significant environmental impacts on fauna, vegetation and ecosystems, particularly with regards to aquatic environments. Another significant omission is the potential impacts related to borrow pit areas. Proposed mitigation measures are generic, vague, in some cases inappropriate and unfeasible and lack sufficient details with regards to implementation and monitoring requirements.

As a means to assist the report author in the update and completion of this (and future) assessment, a number of suggestions and comments were attached to the report. It is however of critical importance that the report author has a thorough understanding of the requirements for biodiversity specialist studies. A list of useful resources was therefore compiled that the report author should thoroughly investigate prior to the update and completion of this report. Although some of the documents refer to specialist requirements within provinces other than the Northern Cape, all the information presented within these documents draws on best practice in EIA in general, and within specialist fields of expertise, to address issues related to the timing, scope and quality of specialist input.

**Recommended reading list:**

- Integraded Environmental Management Information Series (IEM) Information series 0-23. Department of Environmental Affairs and Tourism (DEAT) https://www.environment.gov.za/documents/strategies/integrated_environmentalmanagement_eim
- Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
- Guidelines for Biodiversity Impact Assessments in KwaZulu-Natal (Version 2) http://www.kznwildlife.com/Documents/ekznw_handbookbiodiversityassess_130213_ab.pdf
- GDARD requirements for biodiversity assessments Version 3 (2014). This document also includes general mitigation measures with regards to pipeline developments which may be usefull for this document.
- Department of Water Affairs and Forestry, February 2005 Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria. http://www.dwa.gov.za/documents/IEM/BestPracticeGuidelines/ConstructionSpecsMar06.pdf
- NEMA 24(5)(a) and (h): General requirements, site sensitivity verification, protocols and minimum reporting requirements of identified environmental themes (available from iaiasa.co.za).
- Guidance document on Biodiversity, Impact Assessment and Decision making in southern Africa. https://www.environment.gov.za/sites/default/files/docs/guidancedoconbiodiversity.pdf

## 3. REFERENCES

DEAT (2004) Review in Environmental Impact Assessment, Integrated Environmental Management, Information Series 13, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2002) Specialist Studies, Information Series 4, Department of Environmental Affairs and Tourism (DEAT), Pretoria

Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

# ANITA RAUTENBACH (Pr.Sci.Nat)


| | |
|---|---|
| Gender | Female |
| Date of Birth | 18 March 1971 |
| Languages | Afrikaans and English |
| Driver's license | Code 08 |
| Mobile number | (+27) 83 305 1516 |
| Email | rabiodiversity@gmail.com & akkedis1@gmail.com |
| Physical/Postal address | 13 Killarney Valley View road, Cato Ridge, 0132 |


**BACKGROUND**

Anita graduated with a Master's degree in Biological Science from the School of Life Sciences, University of KwaZulu-Natal Durban. Her Master's dissertation investigated patterns and processes of rodent and shrew assemblages in the Savanna Biome of KwaZulu-Natal. Her main interest involves fauna taxonomy, distribution patterns and ecology. She has been involved in various research projects and ecological assessments in southern Africa. Anita has approximately 12 years of in the environmental field and is currently registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP).

**ACADEMIC QUALIFICATIONS**

University of KwaZulu Natal – MSc. Biological Science, Durban.
University of KwaZulu Natal - Bachelor of Science Honours (Biological Science)
University of South Africa – Bachelor of Science (Zoology & Geography)

**SKILLS**

- Fauna, flora and vegetation assessments;
- Threatened species assessments;
- Small mammal assessments, trapping and identification;
- Desk-based assessments;
- Training – small mammal trapping, handling of live specimens, processing and identification;
- Sample design set-up;
- Data collection and analyses;
- Radiotracking;
- GIS Mapping.

**PROJECT EXPERIENCE (Selected projects)**

**2019**

- Retrospective assessment for the unauthorized construction of an irrigation dam on farm Neederland 202 HT
  Ecological assessment – Mpumalanga
- Retrospective assessment for the unauthorized enlargement of an irrigation dam on the Farm Witklip 4/207 HT
  Ecological assessment -Mpumalanga
- Proposed housing development on Erf 2082, Shelley Beach
  Terrestrial ecological assessment – KwaZulu-Natal
- Specialist input to the wetland offset plan for the proposed Richcards Bay Combined Cycle Gas Turbine Power Plant
  Threatened species assessment – KwaZulu-Natal
- Proposed development of a business park on Erf 947, Port Edward
  Botanical assessment – KwaZulu-Natal
- Proposed mining development on the farm 'The Corner RE/11328, Umzumbe
  Botanical assessment – KwaZulu-Natal
- Proposed housing development, Kwamathukuza, Newcastle
  Ecological opinion – KwaZulu-Natal

**2018**

- Proposed development of an opencast pit and underground decline shaft, ZAC Colliery
  Ecological assessment – KwaZulu-Natal
- Proposed development of a hospital, Newcastle
  Vegetation and flora assessment, KwaZulu-Natal
- Proposed closed-cycle gas plant development
  Ecological assessment – KwaZulu-Natal
- Proposed development of a new abattoir, Inkosi Langibalele municipality
  Biodiversity assessment – KwaZulu-Natal
- Retrospective assessment for the unauthorized construction of a dam on Portion 5 of the Farm Tweefontein 3344
  Biodiversity assessment – Newcastle

**2017**

- Proposed Craigside Housing Development
  Ecological assessment – KwaZulu-Natal
- Proposed development of a housing Estate, Coral Lagoon (Pty) Ltd
  Threatened species assessment – Black headed dwarf chameleon - KwaZulu-Natal
- Proposed open-cast mining development – Mdzonyane
  Ecological assessment – Limpopo Province
- Proposed Umzimkhulu Housing development
  Ecological assessment – KwaZulu-Natal
- Proposed development of the Pavua Dam Hydropower facility
  Terrestrial fauna assessment – Mozambique
- Proposed development of the Maphumulo Integrated Energy Centre (IEC), Glendale
  Vegetation assessment – KwaZulu-Natal
- Proposed development of Portion 1 of Erf 286, Forest Hills
  Botanical assessment – KwaZulu-Natal
- Proposed development of macadamia orchards on the Farm Witkloof 456 HU
  Ecological opinion – KwaZulu-Natal
- Proposed housing development – Amaoti
  Ecological assessment – KwaZulu-Natal
- Proposed Thukela-Goedertrou pipeline development
  Ecological assessment – KwaZulu-Natal
  Retrospective assessment on Farm Stefco 4/428 for the unauthorized construction of a dam
  Ecological assessment – KwaZulu-Natal

**2016**

- Proposed development of the Shixini 3 Macadamia Orchard
  Ecological Assessment – Eastern Cape
- Proposed construction of Ilanga Secondary School, Nkomazi Municipality
  Ecological assessment - Mpumalanga
- Illovo Sugar Cane Estate, Iove Sugar Ltd.
  Biodiversity assessment – KwaZulu-Natal
- Buffelsdraai Landfill site, University of KwaZulu-Natal
  Small mammal assessment – KwaZulu-Natal
- Proposed development of the Mkhuhlu Quarry
  Ecological survey - Mpumalanga
- Proposed bridge construction – Standerton
  Development of construction work method statements for in-stream works across water courses – Mpumalanga Province
- Proposed upgrade of road infrastructure
  Avian assessment - Ladysmith
- Proposed housing Development – Kingsburg housing Development
  Ecological assessment – KwaZulu-Natal
- Proposed Ingogo Dams Development
  Ecological assessment – KwaZulu-Natal

**2015 - 2007**

- University of KwaZulu-Natal
  Small mammal assessment – KwaZulu-Natal
- Proposed development of a township on the Farm Impala, Nkomazi Municipality
  Ecological assessment – Mpumalanga Province
- Proposed development of Mapulaneng hospital, Bushbuckridge Municipality
  Ecological assessment – Mpumalanga Province
- Proposed development of an Eco-housing Estate
  Ecological assessment – Mpumalanga Province
- Proposed construction of a bridge, Umjindi Municipality
  Ecological assessment – Mpumalanga Province
- Proposed construction of the Frank Maghinyane School, Bushbuckridge Municipality
  Ecological assessment – Mpumalanga Province
- Upgrade of Queen Nandi, Kwamashu and Inanda Interchanges, SANRAL
  Fauna assessment – KwaZulu-Natal
- Proposed development of a new dig-out Port in Durban, Transnet Capital Projects
  Mammal assessment – KwaZulu-Natal
- Proposed development of a new mine, Base Titatium
  Mammal assessment – Kenya
- Bioblitz, Operation Wallacea
  Small mammal assessment, Mkhuze Game Reserve – KwaZulu-Natal
- University of KwaZulu-Natal
  Small mammal assessment – KwaZulu-Natal
- University of Swaziland - Swaziland
  Radio tracking of Wahlberg's epauletted fruit bat - Swaziland
- Durban Natural Science Museum
  Bat assessment Paradise Valley – KwaZulu-Natal
- Durban Natural Science Museum
  Small mammal assessment – Madagascar
- &Beyond
  Small mammal assessments - Phinda Private Game Reserve – KwaZulu-Natal
- Phelindaba – Gauteng
  Rodent assessment - Gauteng
- Durban Natural Science Museum
  Small mammal assessment - Albert Falls Dam – KwaZulu-Natal
- Durban Natural Science Museum
  Small mammal assessments – Ecorat - Swaziland

**EMPLOYMENT HISTORY**

**Rautenbach Biodiversity Consulting – Durban** *(Independent Specialist Consultant)*
March 2015 – present (full-time)

- Fauna and Flora Assessments;
- Ecological Assessments;
- Biodiversity Assessments;
- Threatened Species Assessments;
- GIS mapping;
- Small mammal assessments;
- Desktop assessments;
- Sample design set-up;
- Data collection and analyses;
- Report writing.

**Rautenbach Biodiversity Consulting – Durban** *(Independent Specialist Consultant)*
2012 March – March 2015 (part-time)

- Fauna, flora and vegetation assessments;
- Sample design, data collection, data analyses;
- GIS mapping;
- Report writing;
- Desk-based assessments;
- Training;
- ISO 14001 compliance monitoring and auditing (construction).

**GVK Siya Zama Building and Renovations – Durban** *(Regional Safety Manager)*
March 2013 – March 2015

- Development of HSE Plans;
- Hazard identification and risk assessments;
- Data analyses;
- Report writing;
- Training;
- Quarterly safety meetings;
- Monthly OHSAS 18001 and ISO 14001 compliance audits.

**GVK Siya Zama Building and Renovations - Durban** *(Roaming Safety Officer)*
March 2012 – February 2013

- Ensure on-site subcontractor compliance,
- Conduct risk assessments;
- Monthly safety meetings;
- Induction training;
- Incident investigation and report writing;
- Training

**Durban Natural Science Museum (Mammal technician)**
April 2007 – August 2011

- Acceptance, accessioning, care and loan of mammal specimens;
- Preparation of specimens for addition to museum collections;
- Data entry;
- Biological sampling;
- Co-ordination, organizing and conducting field surveys;
- Assistance with research;
- Mammal identification.
- Training

**Dr D Storm** *(Receptionist)*
1997 - 2007

- Setting up appointments;
- Ordering;
- Accounts;
- Filing, typing of medical reports.

**Drs Smith, Snyman and Partners Diagnostic Radiologists – Pretoria** *(Medical typist)*

1992 - 1997

- Making of appointments;
- Typing

**Drs Brits and Griessel Pathologists – Pretoria** (Medical typist)
1990 - 1991

- Typing of pathology reports.

**Professional Affiliations**

South African Council for Natural Scientific Professions (400725/15).

**Publications**

- Solano, E., Taylor, P,J., Rautenbach, A., Ropiquet, A., Castiglia, R. 2014. Cryptic speciation and chromosomal repatterning in the African climbing mice Dendromus (Rodentia, Nesomyidae). PloS One (DOI:10.1371/journal.phone.0088799).
- Rautenbach, A., Dickerson, T., Schoeman, M.C. 2013. Diversity of rodents and shrew assemblages in different vegetation types of the savannah biome in South Africa: no support for nested subset or competition hypotheses. African Journal of Ecology 5(1) pp. 30-40.
- Taylor, P.J., Rautenbach, A., Schoeman, M.C., Combrink, X. 2007. A winter survey of the smaller mammals of the uMkhuze section of the iSimangaliso Wetland Park, KwaZulu-Natal Province, South Africa. (https://www.researchgate.net/228787004).

**REFERENCES:**

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SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

**Anita Rautenbach**

Registration number: 400725/15

is registered as a

**Professional Natural Scientist**

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule I of the Act)

| | |
|---|---|
| **Zoological Science** | **18 November 2015** |



| 18 November 2015 | | |
|---|---|---|
| Pretoria | President | Executive Director |

# UNIVERSITY OF KWAZULU-NATAL™

# INYUVESI YAKWAZULU-NATALI

This is to certify that

**Anita Rautenbach**

was admitted this day
at a congregation of the University
to the degree of

**Master of Science**
(Biological Sciences)

having satisfied the conditions prescribed for the degree.

M W Makgoba
Vice-Chancellor

J J Meyerowitz
Registrar

S Mukaratirwa
Dean

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17 April 2013

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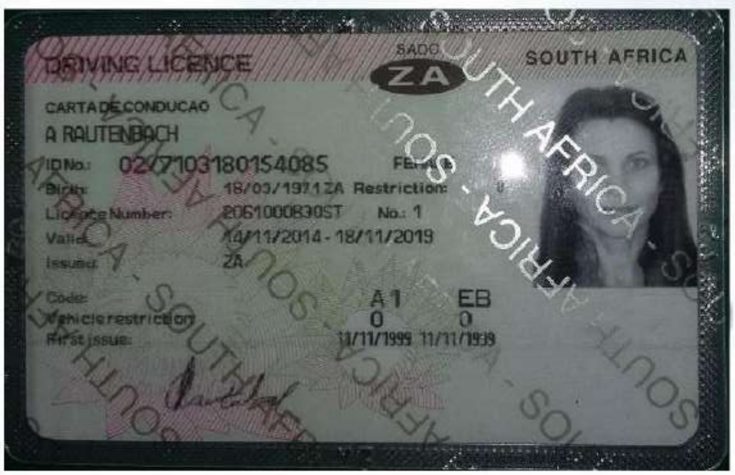
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Valid: 14/11/2014 - 18/11/2019
Issued: ZA
Code: A1 EB
Vehicle restriction: 0 0
First issue: 11/11/1999 11/11/1999

# APPENDIX H6

SOCIO-ECONOMIC IMPACT ASSESSMENT

# PROPOSED UPGRADE OF THE VAAL GAMAGARA REGIONAL WATER SUPPLY SCHEME PHASE 2

## SOCIO-ECONOMIC IMPACT ASSESSMENT

AUTHORITY REFERENCE NO: N/A

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FINAL

PREPARED FOR: PRO – PLAN ENGINEERING CONSULTANTS


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# Title and Approval Page

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# DECLARATION

I, Ciaran Chidley, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Ciaran Chidley

Nemai Consulting (PTY) Ltd

30th November 2019

Mr Chidley has wide experience in the field having trained as an engineer, economist and business practitioner. He has conducted socio-economic studies for clients including in the fields of mining, infrastructure development, water and housing. These studies include economic impact assessments, status quo reports and modelling the regional economic impacts of project based stimulae.

He holds a B.Sc (Eng) Civil, a B.A (Economics and Philosophy) and an MBA. He has been practising since 1996 and his CV is attached to Appendix A of this report.

# Amendments Page

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# Executive Summary

The Vaal Gamagara Regional Water Supply Scheme (VGRWSS) is located in the Northern Cape Province and was completed in 1968 by the Department of Water Affairs, now Department of Water and Sanitation (DWS), and transferred to Sedibeng Water in 2017. The existing scheme transfers water from Delportshoop on the Vaal River (60km to the north west of Kimberly) via Postmasburg. The current scheme is operating at capacity and is not able to supply the increasing future water demands, and deal with the increasing water supply interruptions.

Nemai Consulting was appointed to carry out the Socio-Economic impact Assessment (SEIA) a specialist study which forms part of the Environmental Impact Assessment (EIA).

The project area is situated in the North Eastern Region of the Northern Cape Province. The project is spread across three District Municipalities: Francis Baard, Siyanda and John Taolo Gaetsewe District Municipalities.

This report will assess the impacts of the construction and operation of a new proposed water pipeline which makes its way from Delportshoop Water Treatment Plant to Olifantshoek, a distance of some 210 kilometres.

**Methodology**

The following activities were conducted as part of the SEIA: defining the study area; detailing the project scope; a situational analysis describing the socio-economic status of the study area, engagement with stakeholders through a public engagement process; and developing impacts and recommended mitigation measures to reduce the identified impacts. The report concludes with an alternative analysis from a socio-economic perspective.

**Situational Analysis**

The predominant land use is agricultural: either commercial or subsistence farming. In the towns and settlements along the route, residential and commercial land uses are found. The pipeline travels along existing infrastructure in a design effort to reduce social-economic impacts.

The study area has a population of 25 874, with education and income levels typical for rural South Africa. The majority of population in the study area have piped water supplied inside homes and flush toilets. There are areas where there are no sanitation services, notably the rural areas of Postdene and Postmasburg.

**Stakeholder Engagement**

Stakeholder engagement was carried out using two approaches. First using public participation process during the EIA and later as part of this SEA during site visits to the affected locations. The primary data was collected directly from the community members, community leaders, Ward Councillors and private landowners. During this engagement the following socio-economic issues were identified: dust; land acquisition; security issues; traffic; land use and direct economic benefits from the project.

**<u>Identification of Activities, Aspects and Impacts</u>**

The impact assessment started with the identification of the high risk project activities and the socio-economic aspect of the project which create impacts.

The socio-economic impacts of the project were divided into categories and were identified as follows:

High Risk Activities:

- Land and Servitude Rights Acquisition (where necessary, having regard to existing structures located in the pipeline servitude);
    - Structures located in the existing servitude (including the dwelling in Postmasburg, The Ranch and Langeberg Stene);
    - Olifantshoek Community Health Care Centre;
    - Olifantshoek Cemetery.
- Construction Works
    - abstraction arrangements at the Delportshoop water treatment works;
    - approximately 210km of the existing pipeline from Delportshoop to Olifantshoek;
    - Access roads and upgrading/maintaining existing roads.

Lower Risk Activities:

- Upgrading of the Clifton and Gloucester Reservoirs, as well as the Trewill and Kneukel Sumps;
- Mechanical and electrical upgrading of the pup station at Delportshoop, Kneukel and Trewill;
- Scheme Operations:
    - Operation and maintenance of the Delportshoop WTP;
    - Operation and maintenance of the newly upgraded reservoirs and pump stations;
    - Road maintenance.

**<u>Mitigation Measures</u>**

Relevant and appropriate mitigation measures are proposed in the report and the implementation of these mitigation is expected to reduce the socio-economic impacts of the project to lower levels.

The project has the potential to create employment opportunities for the local communities' opportunities for existing and new local SMMEs. These range from site clearing, to construction, as well as the supply of materials. There are also opportunities existing for community members to provide catering, accommodation and other services to the new workers. Active participation of the local community is encouraged as a mitigation measure.

The re-routing of the main pipeline is the primary mitigation measure for the Olifantshoek Health Care Centre. Legally erected structures impinging on the pipeline route should be compensated for. In addition, disturbances that may occur during the construction phase cn be successfully mitigated through contractor agreements and discussions with the directly affected parties who are in close proximity to the project.

**Summary and Conclusion**

The study assessed the social and economic impacts of the proposed project. As expected of any construction project, there were several positive and negative socio-economic impacts identified.

No socio-economic fatal flaws were identified for the project mainly owing to the fact that the existing pipeline follows existing infrastructure to achieve this.

The identified negative impacts can be successfully mitigated and the positive impacts will bring economic and social benefit to the area.

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# List of Abbreviations

| | |
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| EIA | Environmental Impact Assessment |
| VGRWSS | Vaal Gamagara Regional Water Supply Scheme |
| DWS | Department of Water and Sanitation |
| WTW | Water Treatment Works |
| SEIA | Socio-Economic Impact Assessment |
| SD | Source Development |
| BID | Background Information Document |
| GIS | Geographic Information System |
| PPP | Public Participation Process |
| IAP | Interested and Affected Parties |
| SMME | Small Medium and Micro-sized Enterprises |

# 1 INTRODUCTION

Sedibeng Water has proposed Upgrade of the Vaal Gamagara Regional Water Supply Scheme Phase 2 (VGRWSS) Phase 2, located in the Northern Cape Province. The current scheme is operating at capacity and is not able to supply the increasing future water demands, and deal with the increasing water supply interruptions.

The proposed pipeline will follow existing infrastructure (railways, roads and the existing pipeline) to reduce the overall impacts of the upgrade. The existing pipeline and project area is located in the north eastern region of the Northern Cape Province. The approximate length of the pipeline is 210 kilometres.

Nemai Consulting was appointed as the independent Environmental Impact Assessment Practitioner (EAP) by Pro-Plan Engineering Consultants to undertake the Environmental Impact Assessment (EIA) for the development of the proposed VGRWSS Phase 2.

One of the specialist studies required by the EIA is a Socio-Economic Impact Assessment (SEIA). This report fulfils the requirements of the SEIA and its recommendations will be included into the SEIA.

## 1.1 Terms of Reference

The Terms of Reference for the study were as follows:

- Determine the specific social, land utilisation and acquisition implications of the project;
- Collect baseline data on the current social environment;
- Develop an understanding of the social and economic landscape of the project area;
- Conduct a public engagement campaign in the project area to determine perceptions and impacts with regards the project;
- Assess the social impacts of the project, both positive and negative; and
- Suggest suitable mitigation measures to address the identified impacts; and

## 1.2 Structure of the Report

The remainder of the report structured as follows:

**Section 2:** ***Legislation*** – A description of the statutory and regulatory requirements that inform this report.

**Section 3:** ***Project Description*** – This section provides an introduction and motivation to the project.

**Section 4:** ***Methodology*** – Outline on the methodology used to determine the socio-economic impacts of the proposed project.

**Section 5:** ***Situational Analysis***– A desktop analysis into the baseline context on the study area. A discussion on the finding that result from community engagement, site visits and stakeholder participation.

**Section 6:** ***Identification of Activities, Aspects and Impacts*** – The identification of the project activities and an investigation into what aspects of these activities will result in socio-economic impacts.

**Section 7: Analysis of Alternatives** – Decision making with regards the preferred alternatives from a socio-economic perspective.

# 2 LEGISLATION

Legislation, policy, plans and strategy provide an important framework and governance of the SEIA. This section provides a summary of the acts, policy, plans and strategy which were considered by this study.

## 2.1 Constitution of the Republic of South Africa (Act 108 of 1996)

As contained in the Constitution the rights of all South Africans are protected as outlined in Chapter 2: The Bill of Rights. These rights form the basis of democracy in South Africa. The Constitution (including the Bill of Rights) binds the Legislature, the Executive, the Judiciary and all organs of state and is the overriding legislation of South Africa.

While all items in the Bill of Rights are considered to be of equal importance, key items in the Bill of Rights that have a bearing on social rights and issues in this project include (but are not necessarily limited to):

- Life: Everyone has the right to life;
- Human Dignity: Everyone has inherent dignity and the right to have their dignity respected and protected;
- Equality: Everyone is equal before the law and has the right to equal protection and benefit from the law;
- Freedom of religion, belief and opinion: Everyone has the right of freedom of conscience, religion, thought, belief and opinion;
- Environment: Everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development;
- Property: No person may be deprived of property except in terms of the law of general application, and no law may permit arbitrary deprivation of property. Property may be expropriated only in terms of the law of general application for a public purpose or in the public interest. The public interest includes South Africa's commitment to land reform and to reforms to bring about equitable access to all South Africa's natural resources. Property is not limited to land;
- Health care, food, water and social security: Everyone has the right to have access to health care services, including reproductive health care, sufficient food and water and

social security, including, if they are unable to support themselves and their dependents, appropriate social assistance;

- Language and culture: Everyone has the right to use the language and participate in the cultural life of their choice, but no one exercising these rights may do so in a manner inconsistent with any provision of the Bill of Rights;
- Cultural, religious and linguistic communities: Persons belonging to cultural, religious or linguistic communities may not be denied the right, with other members of the that community to enjoy their culture, practice their religion and use their language, and to form, join and maintain cultural, religious and linguistic associations and other organs of civil society. These rights must be exercised in a manner that is consistent with any provision in the Bill of Rights;
- Access to information: Everyone has the right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights; and,
- Just administrative action: Everyone has the right to administrative action that is lawful, reasonable and procedurally fair. Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons. This right has been given effect via the Promotion of Administrative Justice Act ((PAJA) Act 3 of 2000).

## 2.2 National Environmental Management (Act 107 of 1998)

The National Environmental Management Act (NEMA) and the principles contained therein have a significant influence on the need to identify and assess socio-economic impacts. The NEMA principles are based on the basic rights as set out in Chapter 2 (Bill of Rights) of the Constitution.

According to Barber (2007:16) the following NEMA principles have an important impact on social issues:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably;
- Development must be socially, environmentally and economically sustainable;
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option;
- Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons;

- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination;
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured;
- Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge;
- Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in light of such consideration and assessment;
- The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected;
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law;
- The environment is held in public trust for the people. The beneficial use of environmental resources must serve the public interest and the environment must be protected as the peoples' common heritage; and
- The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.

## 2.3 Development Facilitation Act (Act 67 of 1995)

The Development Facilitation Act (DFA) outlines various principles concerning land development in Section 3 of the Act. Some of the relevant principles are briefly highlighted below (Babour, 2007). These principles include (but are not limited to:

- Promoting the integration of the social, economic, institutional and physical aspects of land development;
- Promoting integrated land development in rural and urban areas in support of each other;
- Promoting the availability of residential and employment opportunities in close proximity to or integrated with each other;

- Optimising the use of existing resources including such resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation and social facilities;
- Promoting a diverse combination of land uses, also at the level of individual erven or subdivisions of land;
- Discouraging the phenomenon of "urban sprawl" in urban areas and contributing to the development of more compact towns and cities;
- Contributing to the correction of the historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure in excess of current needs;
- Encouraging environmentally sustainable land development practices and processes;
- Promoting land development which is within the fiscal, institutional and administrative means of the Republic;
- Promoting the establishment of viable communities; and,
- Promoting sustained protection of the environment.

## 2.4 Restitution of Land Rights Act 22 Of 1994

The aim of the Restitution of Land Rights Act 22 of 1994 is as follows:

- To provide for the restitution of rights in land in respect of which persons or communities were dispossessed under or for the purpose of furthering the objects of any racially based discriminatory law;
- To establish a Commission on Restitution of Land Rights and a Land Claims Court; and
- To provide for matters connected therewith.

## 2.5 National Development Plan (2011)

The National Development Plan (NDP) of 2010 proposes to “invigorate and expand economic opportunity through infrastructure, more innovation, private investment and entrepreneurialism.

The Plan aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and reduction of inequality. The core elements of a decent standard of living identified in the Plan are:

- Housing, water, electricity and sanitation;
- Safe and reliable public transport;
- Quality education and skills development;
- Safety and security;
- Quality health care;

- Social protection;
- Employment;
- Recreation and leisure;
- Clean environment; and
- Adequate nutrition.

## 2.6 National Water Resources Strategy (June 2013)

This strategy provides a national framework against which water resources across the country will be managed and in this sense aims to;

"…ensure that national water resources are protected, used, developed, conserved, managed and controlled in an efficient and sustainable manner towards achieving South Africa's development priorities in an equitable manner over the next five to 10 years. This Strategy responds to priorities set by Government within the National Development Plan (NDP) and National Water Act (NWA) imperatives that support sustainable development. The NWRS2 acknowledges that South Africa is a water-stressed country and is facing a number of water challenges and concerns, which include security of supply, environmental degradation and resource pollution, and the inefficient use of water" (Department of Water Affairs, 2013a, p. iii).

## 2.7 Northern Cape Provincial Growth Strategy (PGDS)

The Northern Cape Office of the Premier has aligned itself to support the PDGS objectives, which include:

- To work towards an increased and sustained economic growth and development in the province;
- To ensure human resource development management and corporate governance;
- To enhance Information and Communication Technology (ICT) for development;
- To ensure maximum impact of special programmes on all government programmes; and
- To maximise policy formulation, integration, co-ordination, monitoring and evaluation.

## 2.8 International Organisation for Standardization, ISO 14001:2004

The International Organisation for Standardization (ISO) is used for identifying impacts. The ISO 14001: 2004 – Environmental Management Systems definitions for aspect, activity and impact are used in keeping with best practice.

ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence.

# 3 PROJECT DESCRIPTION

The VGRWSS Phase 2 is a sub-section of the greater Vaal Gamagara Water Supply Scheme (VGWSS) in the Northern Cape Province that was launched in 2016 by the Minister of Water and Sanitation, Mrs Nomvula Mokonyane.

According to the Department of Water and Sanitation (DWS), the Water Supply Scheme is expected to meet the Northern Cape Province increasing water demands up to the year 2030. The scheme includes the following infrastructure:

- Refurbishment of the existing Vaal Gamagara Water Treatment Plant near Delportshoop; and
- The upgrade of the pump stations and the construction of a 430 km long pipeline to run from Delportshoop to Black Rock.

The upgrade of the water scheme was necessitated by the need to address the ageing infrastructure and to secure the supply for the mining in the surrounding locality.

The VGRWSS Phase 2 is the subject of this study. In Phase 2 of the Water Supply Scheme, Sedibeng Water is proposing the upgrade of the VGRWSS which consists of the following:

- Mechanical and electrical upgrading of the abstraction works at Delportshoop;
- Refurbishment on pipework and repairs to buildings at the Delportshoop water treatment works;
- Replacing / refurbishing approximately 210 km of the existing pipeline from Delporsthoop to Olifantshoek:
- Mechanical and electrical upgrading of the pump stations at Delportshoop, Kneukel and Trewill; and
- Upgrading of the Clifton and Gloucester Reservoir's, as well as the Trewill and Kneukel Sumps.

The upgrades will require construction material to be sourced from approximately 20 borrow pits that will be located at ten kilometre intervals along the pipeline.

In addition, it is also proposed to abstract groundwater at the following well sites to augment the existing VGRWSS;

- Source Development Area 1 in the Danielskuil area; and
- Source Development Area 2 in the Postmasburg area.

These two source development areas have been considered in a separate specialist socio-economic report, since their impacts are distinct from those of the rest of the pipeline.

**Figure 1** below shows a locality map of the overall project and the areas it transverses.

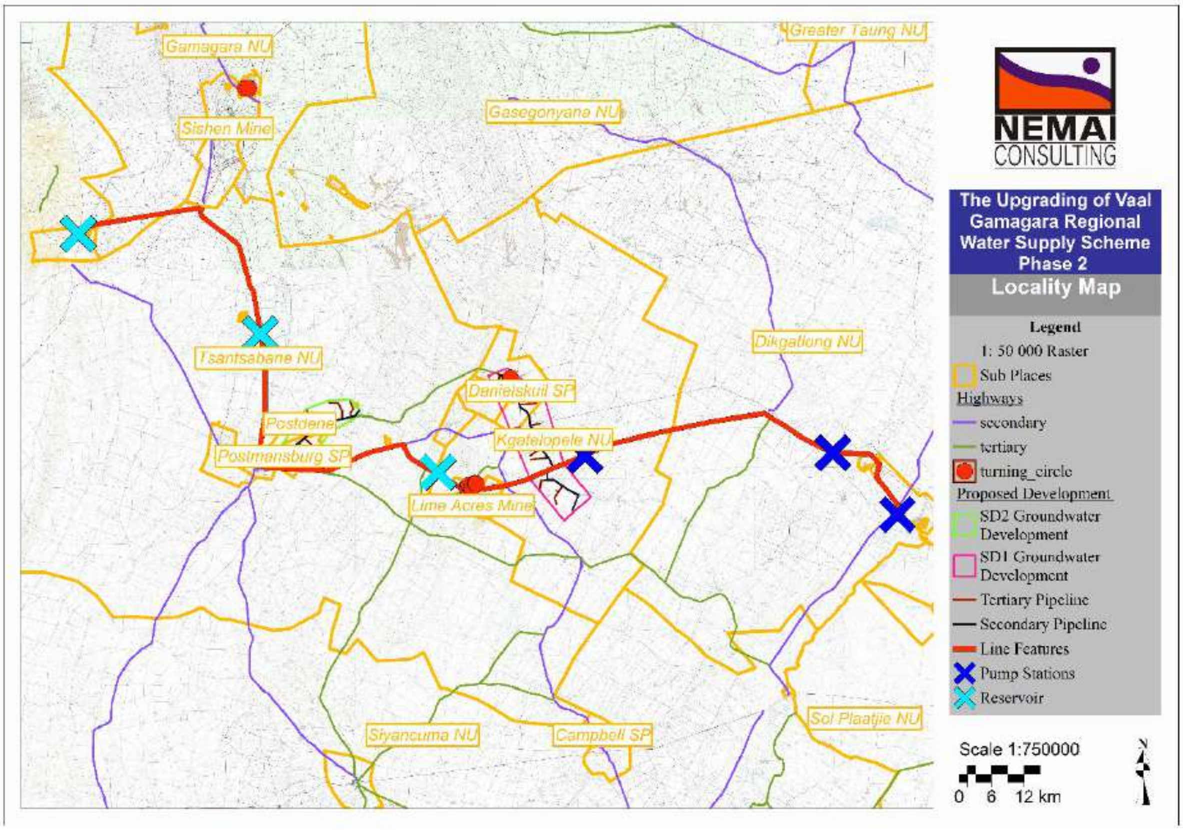



*Figure 1: Locality Map*

The directly affected Main Places within the Wards and Local Municipalities for the proposed water pipeline upgrade are listed in the table below. Main Places are the major subdivisions of municipalities used by Statistics South Africa in their Census 2011.

*Table 1: Affected Local Municipalities, Wards and Places*

| Local Municipality | Wards | Main Place |
|---|---|---|
| Gamagara | 4 and 6 | Olifantshoek |
| Tsantsabane | 1, 3 and 7 | Postmasburg, Postdene |
| Kgatelopele | 2 and 4 | Kgatelopele, Danielskuil, Lime Acres |
| Dikgatlong | 6 | Delportshoop, Dikgatlong and Ulco |

The Main Places listed in **Table 1** above are those taken from Census 2011. Their boundaries do not necessarily coincide with the ward boundaries, but the names have been used in this report to identify local features within the project study area.

## 3.1 Rationale for the Project

The upgrade of the existing VGRWSS Phase 2, is to augment water supply to the existing VGRWSS.

The current scheme is operating at capacity and is not able to supply the increasing future water demands, and deal with the increasing water supply interruptions. The major driving force of the increased water demand is iron ore and manganese mining operations. These mines of the Northern Cape produce 84% of South Africa's iron ore and 92% of the world's high-grade manganese deposits are in the Kalahari basin. Diamond and lime mining operations also contribute to the water demand, but to lesser degree.

The VGRWSS Phase 2 is critical to ensure the continued sustainability of iron ore and manganese mining operations in the project study area, while also ensuring water supply to the surrounding villages. The upgrading of VGRWSS Phase 2 will address the ageing infrastructure while also securing the supply for mining activities in the area, especially in the John Taolo Gaetsewe District Municipality (Gamagara Local Municipality).

The municipalities of Dikgatlong, Kgatelopele, Tsantsabane and Gamagara will also benefit from the bulk water supply. Agriculture is a common practice in the project study area, as a result, the growing agricultural water demands will also be addressed by the proposed upgrades in the future.

## 3.2 No-Go Alternative

The alternative considered during the EIA and thus also considered during this SEIA, is the No-Go alternative. In this alternative, the socio-economic impacts of not going ahead with the proposed development have been considered.

The 'No-go' alternative would mean that the proposed upgrading of VGRWSS Phase 2 would not be implemented and the area where the upgrade would be built would not change in any way, the environment and the socio-economic conditions would generally stay the same within the site.

This would mean that the anticipated increase in future water demands within the Northern Cape, particularly the project study area, resulting in the need for further enhancement of the water supply in the area would not be met. There would be no further expansion and upgrades if the VGRWSS Phase 2 is not implemented. The projected impacts on the society and communities would not prevail as the conditions would still remain the same.

## 3.3 Description of the Study Area

The study area for this SEIA are defined by the impact area of the project. As the distance from the pipelines increases, the social impacts decrease. This can be seen in examples such as the direct impact on people who live in close vicinity to the pipeline, rather than those who live further away from the pipeline.

The project study area is defined as the footprint of the impact resulting from the project. In this case, the existing pipeline has a registered servitude, and the study area is a zone extending 200m on both sides from the centreline of the pipeline.

Table 2 below provides a list of the affected main places in the study area. These main places are a geographical sub-unit defined during Statistics South Africa's Census 2011.

*Table 2: Affected Main Places in the Study Area*

| Main Place |
|---|
| Olifantshoek |
| Postmasburg |
| Kgatelopele |
| Delportshoop |
| Postdene |
| Danielskuil |
| Lime Acres |
| Dikgatlong |
| Ulco |
| Tsantsabane NU |

## 3.4 Description of the Regional Area

In addition to the study area, the project is defined by using regions. The regions are made up of the four local municipalities in which the pipeline transverses. Table 3 below provides a list of the affected regions which will be discussed in the report in detail.

*Table 3: Definition of the Regional Study Area*

| Local Municipality |
|---|
| Gamagara |
| Tsantsabane |
| Kgatelopele |
| Dikgatlong |

# 4 METHODOLOGY

Socio-Economic Impact Assessment is an interactive process by its nature which relies on both desktop research as well site visits, and input from the community stakeholders. This tool assists the community to be part of the environmental decision-making process, and empower communities to participate in decisions that will affect their livelihoods (DEAT, 2005).

The Australian Government Department of the Environment and heritage (2005:5) states that Socio-Economic Impact Assessment is a useful tool to help understand the potential range of impacts of a proposed change, and the likely responses of those impacted on if the change occurs.

An SEIA is used during the EIA process to identify and evaluate potential social, economic or cultural impacts of a proposed development. The SEIA recognises the important relationship between economics, social and biophysical environment.

The SEIA is aimed at minimising the adverse impacts of the proposed development while also aiming to maximise the beneficial impacts. The SEIA sets out the socio-economic baseline, predicts impacts and makes recommendations for mitigations. In addition, the Department of Monitoring and Evaluation Republic of South Africa (PM&E SA, 2015:5), states that the core aims/ roles of the SEIA are:

- To minimise the unintended consequences from policy initiatives, regulations and legislation, including unnecessary costs from implementation and compliance as well as from unanticipated outcomes; and
- To anticipate implementation risks and encourage measures to mitigate them.

Furthermore (DP&ME SA, 2015:6) states that the SEIA’s help in measuring the following impacts:

- Social cohesion and security (safety, food, financial, energy and etc.);
- Economic inclusion;
- Economic growth; and
- Environmental sustainability.

## 4.1 Sourcing of Information and Data Analysis

The SEIA sets out the socio-economic baseline of the study area, predicts social impacts on the project and makes recommendations for mitigation. The socio-economic baseline level is based on both primary and secondary data. The primary data was collected directly from the community members, community leaders, and private farmers. Secondary data was accessed through South African databases, available reports and articles, internet searches and are referenced in the text and in the reference section of this report.

The profile of the baseline conditions includes describing the current status quo of the community, including information on a number of social and economic issues such as:

- Demographic factors;
- Socio-economic factors such as income and population data;
- Access to services;
- Institutional environment;
- Social Organisation (Institutional Context); and
- Statutory Regulatory Environment.

### 4.1.1 Primary Data

#### 4.1.1.1 Public Participation

Affected landowners and members of the public were afforded the opportunity to comment on the project during the public participation process carried out during the scoping and EIA phases of the project. Comments and responses used during this process have been included into this report and were one of the bases of the analysis of the socio-economic impacts considered in this report.

In addition to the public participation process information gathering, primary data was also collected for the purposes of the study using the following approaches:

- **Rapid Rural Assessment:** A survey was conducted to capture visual observations on the social dynamics, community proceedings, community resources and infrastructure.
- **Stakeholder Consultants:** consultation with the affected village/ local community and municipal representatives along each project component to discuss the proposed project and to gather their concerns and feedback on the project.
- **Focus Group Discussions:** focus group discussions with the affected farmers who reside in close proximity and/ or within the range or servitude of the project were conducted.
- **Key Informant Interviews:** Informal discussions with the Interested and Affected Parties (IAP's) to help inform the baseline were conducted during site visits and as well as during the public participation process and site visit. These included community members and ward councillors.

### 4.1.2 Secondary Data

An assessment and consultation of existing similar reports, public participation material, internet searches, the Background Information Document (BID), was conducted to provide an understanding of the project details, location and possible impacts.

The required information was collected using different sources as mentioned above, these also included Statistics South Africa Census data and a thorough review of relevant municipal, district and other literature.

The discussion of the demographics and the development profile of the municipality is carried out using Census 2011 data produced by Statistics South Africa. This data is updated, where possible, using the results of the Community Survey 2016.

#### 4.1.3 Geographic Information System

A Geographic Information System (GIS) was used to conduct an analysis of the area. The use of GIS brings together the demographic and socio-economic data to enable a thorough analysis of the project area.

## 4.2 Impact Assessment

An impact assessment allows for an estimate of the identified social and economic impacts to those who will be affected. In addition, the response of the affected parties to such impacts also needs to be clarified (Centre for Good Governance, 2006). All impacts will be analysed with regards to their nature, extent, magnitude, duration, probability and significance (Barbour, 2007). Section 7 lists definitions that apply to the impact assessment.

The determined impacts are clustered around a common issue and are assessed before and after mitigation. The identification of the socio-economic impacts associated with the project is issues-based, with the main headings referring to a common theme addressing several related impacts. Under each of these issues the specific impacts and potential mitigation strategies are discussed for pre-discussion, construction, operation and decommissioning phases.

## 4.3 Assumptions and Limitations

The following assumptions and limitations underlie this Socio-economic Impact Assessment:

- It is assumed that information obtained during the public participation phase provides a comprehensive account of the community structure and community concerns for the project;
- The study was done with information available to the specialist at the time of executing the study, within the available time frames and budget. The sources consulted are not exhaustive and additional information which might strengthen arguments, contradict information in this report and/ or identify additional information which might exist. However, the specialist did take an evidence-based approach in the compilation of this report and did not intentionally exclude information relevant to the assessment;

- The study was completed using the Statistics South Africa Census 2011 data and Statistics South Africa Community Survey 2016. The data might be somewhat outdated, however it is the most comprehensive primary data available;
- It is assumed that no relocation of families or people will take place for this project; and
- This project presents a single route which consists of the existing pipeline, the upgrade will be along this route and. follow existing infrastructure to reduce the impacts and effects on the locality. The assumed impacts and effects may later change during the detailed design phase of the project.

# 5 SITUATIONAL ANALYSIS

The socio-economic status quo of the project study area is an important study of the proposed upgrade/project. In this section, the status quo is described using data obtained from Statistics South Africa's Census 2011 and Community Survey 2016, as well as by observations made during site visits to the project area.

## 5.1 Land Use and Infrastructure

The pipeline runs through areas of different land use. The predominant land use is agricultural: either commercial or subsistence farming. In the towns and settlements along the route, residential and commercial land uses are found

For the purposes of analysing land use on this project, the study area is divided into two sections; the southern and central sections of the project study area are characterised by agriculture (commercial and subsistence farming) and densely populated commercial and mining land use towards the central section. The northern section of the project study area passes through areas that include populated areas (high and low density), commercial and mining land uses.

### 5.1.1 Southern and Central Section

The southern section of the project study area consists of a number of settlements which are in the vicinity of the project. Most of the settlements are along R31, R385 and R370.

The table below provides detail on the settlements which will be directly affected by the pipeline route.

*Table 4: Villages Directly Impacted by the Project*

| Local Municipality | Settlement / Town Name | Route | Co-ordinates in the Vicinity of Impact |
|---|---|---|---|
| Dikgatlong | Delportshoop | Main Route | 28°24'26.80"S 24°15'56.55"E |
| Dikgatlong | Ulco | Main Route | 28°19'43.82"S 24°13'14.96"E |
| Dikgatlong | Koopmansfontein | Main Route | 28°14'39.99"S 24° 1'51.16"E |
| Kgatelopele | Shaleje | Main Route | 28°21'27.94"S 23°31'13.52"E |
| Kgatelopele | Lime Acres | Main Route | 28°21'56.24"S 23°28'8.47"E |
| Kgatelopele | Norfin | Main Route | 28°22'16.21"S |

| Local Municipality | Settlement / Town Name | Route | Co-ordinates in the Vicinity of Impact |
|---|---|---|---|
| | | | 23°28'10.10"E |
| Tsantsabane | Metsimatala / Groen Water | Main Route | 28°17'16.81"S 23°18'43.46"E |
| Tsantsabane | Postmasburg | Main Route | 28°19'4.11"S 23° 4'3.76"E |
| Tsantsabane | Maremane | Main Route | 28° 3'1.22"S 23° 3'7.53"E |
| Gamagara | Olifantshoek | Main Route | 27°56'1.35"S 22°44'11.27"E |

The settlements in the southern section of the project area are mostly high density and clustered. The upgrading of the VGRWSS will be along the existing pipeline in these settlements, as such the pipeline should be able to pass through the area without introducing new and severe impacts upon the individual dwellings.

The southern section of the pipeline mostly consists of subsistence and commercial farming. The bulk of the land on these farms is used for grazing of cattle and sheep.

#### 5.1.1.1 Delpoortshoop

The existing Delportshoop Water Treatment Plant is located in this section, south east of the pipeline. There is an existing gravel road which is utilised as an access road for the local farmers, residents and employees of Sedibeng Water. The existing road and entrance to the treatment plant is shown in Figure 2 below.


*Figure 2: Entrance to Delpoortshoop WTW*

Approximately three kilometres away from the Delportshoop WTP, there are the densely populated settlements of Delportshoop. The rapid growth of the settlements and the rate of informal dwellings emerging, suggest that the dwellings could eventually move closer to the WTP. This is shown in Figure 3 below.

*Figure 3: Settlement in the Vicinity of the WTP*

Figure 3 above shows some of the houses in the vicinity of the Deelportshoop Water Treatment Plan, the types of dwellings (Informal and clustered), suggest that these are recently erected and are spreading rapidly. The settlements are without piped water, electricity and proper sanitation.


*Figure 4: Cattle grazing nar Delpootshoop*


*Figure 5: Grazing of Sheep in Delportshoop*


*Figure 6: Land Use in Delportshoop*

*Figure 7: Donkeys in Delportshoop*


*Figure 8: Delportshoop WTP Location*

Images of the typical land uses in Delportshoop are shown in Figure 3, Figure 4, Figure 5, Figure 6, Figure 7 and Figure 8. Agriculture in this section includes livestock grazing, animal farming outweighs crop production in this section.

The southern section of the project which has dwellings around the existing pipeline located at the Delportshoop Water Treatment Plant, is shown in Figure 8 above.

#### 5.1.1.2 Koopmansfontein

Figures 9 - 15 show the types of land use found in Koopmansfontein and in the farms located within its vicinity. The types of land use are pre-dominantly agricultural with animal farming being prevalent.


*Figure 9: Cattle Grazing and Watering in Koopmansfontein*


***Figure 10: Commercial Centre in Koopmansfontein***


***Figure 11: Goat Production in Koopmansfontein***

*Figure 12: Cattle Watering in Koopmansfontein*

*Figure 13: Sheep Farming in Koopmansfontein*


*Figure 14: Farm Dwellings near Koopmansfontein*


*Figure 15: Filling Station near the Proposed Pipeline near Koopmansfontein*

At Koopmansfontein, the pipeline makes its way through open fields and is located approximately 150m away from a Filling Station and a few scattered farm dwellings, see Figure 15 above. It should be noted that the ULCO Aerodrome is located to the east of Koopmansfontein, approximately 200m from the pipeline. This aerodrome is a sensitive receptor to dust.

#### 5.1.1.3 Shaleje

The Shaleje settlements are located along the R385 in to the east of Lime Acres. The settlements consist of a large open grazing area, existing boreholes, a few scattered farm dwellings and old abandoned buildings which extend to the SD1 area. In this section of the project, the pipeline runs along the railway line and does not have any social impacts.

#### 5.1.1.4 Lime Acres / Norfin

Lime Acres and Norfin to the south of Lime Acres are two small towns to the east of the R385 which support the mining carried out at Petra Diamonds and at PPC Lime. This is a formal town with residential and commercial areas.

*Figure 16: PPC Lime in Lime Acres, adjacent to Railway Line*

The pipeline in this section makes its way across the PPC Lime property, approximately 3km east to the east Lime Acres, the mine is located along the existing railway as shown in Figure 16 above.

*Figure 17: Houses in Lime Acres*

Figure 17 above shows some of the houses in the vicinity of the railway and existing pipeline.


*Figure 18: Land Use in Norfin*

*Figure 19: Houses in Norfin*


*Figure 20: Dwellings Impacted in Lime Acres*

Figures 18 and 19 show the land use and houses in the vicinity of the pipeline which may be impacted by the upgrades. The town's roads are predominantly tarred roads. The existing roads are will endure higher use than normal during the construction phase, mitigation measures will be provided in this report. Figure 20 provides an overview image of the impacted dwellings.

*Figure 21: Animal Shelter to the west of Lime Acres*

Figure 21 above shows the Lime Acres animal shelter situated on the outskirts of Lime Acres. This figure also provides an image of the existing gravel road used as a main access road into the project area.

*Figure 22: Farm dwelling to the west of Lime Acres*

It should be noted that the Lime Acres Aerodrome is located to the west of Lime Acres, approximately fifty metres from the pipeline. This aerodrome is a sensitive receptor to dust.

Scattered settlements found to the west of Lime Acres and around the project study area in general, have a low level of infrastructure provision. They mostly consist of poorly maintained gravel roads, with no storm water drainage. Agricultural activities in this section of the project are subsistence based with cattle, sheep and goats being the main source of income.

The kraals are kept close to the homesteads for security reasons. The concern around an influx of workers is a security threat to the residents, their livestock and property. Figure 33 above shows a typical view of the farm's dwellings in the project study area. The dwelling shown in Figure 22 is in the vicinity of the three Clifton Reservoirs.


*Figure 23: Land Use to the West of Lime Acres*

Lesedi Power Project, a 64MW Solar PV Plant was identified along the project study area on to the west of Lime Acres see Figure 23 above. The land use in the area is a mixture of grazing along with the Solar Photovoltaic Power Plant.

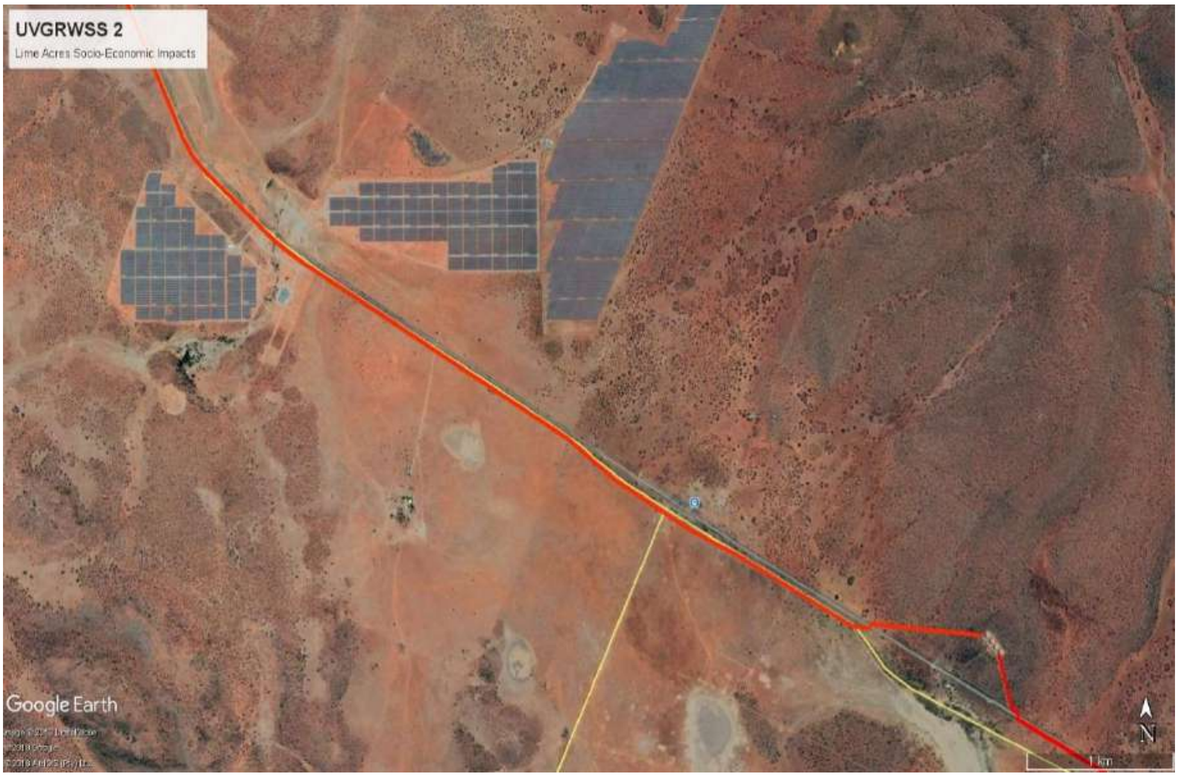



*Figure 24: Lesedi Power Project and grazing to the west of Lime Acres*

Figure 24 above provides an overview of the dwellings in the vicinity of the project study area.

#### 5.1.1.5 Groenwater

Groenwater, also known locally as Metsimatala (the Tshwana translation of Groenwater), is a growing, formal, low density settlement located along the R385. The settlement is characterised by gravel roads, subsistence cattle raising and general has a low level of service provision.


*Figure 25: Entrance to Groenwater*


*Figure 26: Affected Dwellings in Groenwater*

Figure 25 above shows the typical land use at which the pipeline transverses the Groenwater settlement. The project pipeline will pass the entrance of Groenwater and will not directly impact any buildings.

Access to Groenwater settlement may be limited during construction as the pipeline will be making its way through the main access route as seen in Figure 26. A poultry farm was identified to the south of Groenwater, see Figure 26 above. The entrance to this farm should not be affected by the construction of the pipeline. Poultry farms are sensitive to dust and mitigation measure in this regard are provided in the report.


*Figure 27: Typical Dwelling in Groenwater*

Figure 27 provides an image of a dwelling located between Groenwater and Postmasburg. This dwelling will experience restricted access during construction. In addition, Figure 37 also serves as example to the type of mixed agricultural land use with windmill driven boreholes and water storage tanks.

### 5.1.2 Northern Section

In the northern section of the project there is a lot more commercial and mining activities than in the southern and central portions. The farming in this area remains generally the same to that found in the south and central portion, this includes; a mixture of grazing, non-irrigated crops and there are a few crops irrigated using centre pivots. It is important to note that the majority of land in the overall project study area is largely overgrazed.

As observed in the southern and central portions of the project, the pipeline impact upon dwellings, farm lands and water infrastructure such as windmills, reservoirs, storage dams/tanks and centre pivots.

Water infrastructure has great significance to the social and economic wellbeing of communities. Disruptions of water infrastructure could leave the communities vulnerable to increased water shortages and eventually resulting in ill-health and poor economic production.

#### 5.1.2.1 Postmasburg

Postmasburg is the nearest town for the surrounding communities such as Jenn-Haven and Groenwater. The town is fairly developed with tarred and paved roads. Postmasburg is the most economically active hub in the project study area. The town provides various goods and services to the residents in and around Postmasburg.


*Figure 28: Affected Dwelling in Postmasburg (erected over the servitude)*

The entrance to this dwelling has been constructed over the pipeline servitude and will have to be removed during construction. The legality of this structure will have to be determined during the detailed design phase of the project and should the structure have been erected legally, the landowner would have to be compensated for the loss of the structure.


*Figure 29: Affected Dwellings in Postmasburg*


*Figure 30: Sibilo Shopping Centre in Postmasburg*

Commercial and residential holdings shown in Figures 28, 29 and 30 are impacted by the pipeline as it makes its way along the boundary of these holdings – access may be affected. Figure 30 shows Sibilo Shopping Centre, a busy hub with retailers such as Shoprite, KFC and Spur. Reduced access to the centre could result in increased traffic congestion during construction, since the hub is located at the main entrance of Postmasburg, at the intersection of the R358 and R325.


*Figure 31 Dwellings Impacted in Postmasburg*

Figure 31 above provides an overview of the impacted dwellings and dwellings in the vicinity of the pipeline such as; Postdene, a newly developed settlement north east of Postmasburg.

The route through Postmasburg following existing roads and should not impact unduly upon residents during the construction phase, if access considerations are well managed.


*Figure 32: Mining to the North of Postmasburg*


*Figure 33: Mining to the North of Postmasburg*

Mining has a large footprint in the northern section of the pipeline. Figures 32 and 33 above shows the Manganese mining activities identified approximately nine kilometres of Postmasburg along the R325.

#### 5.1.2.2 Maremane

Maremane is an informal settlement located 30km north east of Postmasburg along the R325. The settlement is said to have emerged in 2014, it is a low-density settlement with subsistence livestock farming and grazing being practiced.

The Maremane settlement has poor infrastructure, the main access road is gravel and there is no formal sanitation, electricity and piped water. Figures 34 35 provide images of the conditions in Maremane.


***Figure 34: Land Use in Maremane***

***Figure 35: Affected Dwellings in Maremane***

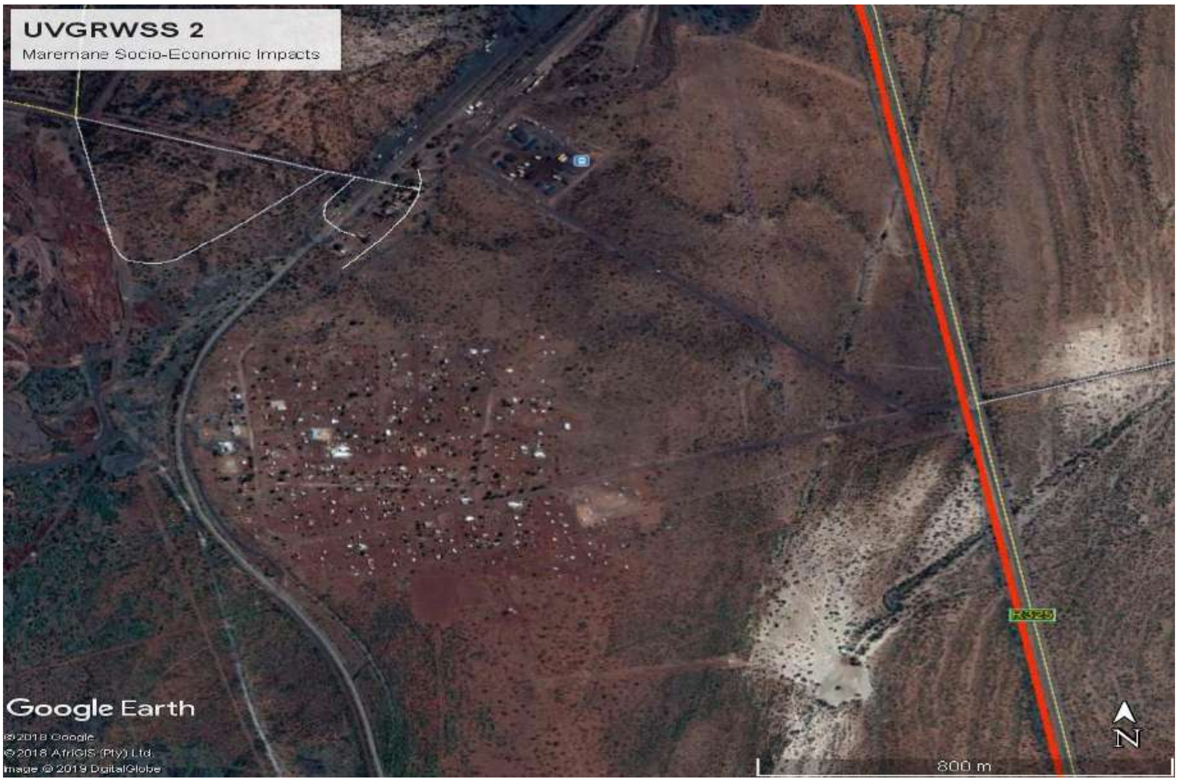



*Figure 36: Impacted Dwellings in Maremane*

Figure 36 above shows the location of the pipeline in relation to Maremane settlement. The image above does not accurately show the current size of the settlement, at the time of writing, dwellings in the settlement have extended to the east, and are adjacent to the R325. They do not, however, reach into the pipeline servitude.

#### 5.1.2.3 Olifantshoek

The type of land use on the scattered dwellings found to the east of Olifantshoek is generally the same. This land use consists of kraals situated near the dwellings and the open space is used for cattle and sheep grazing.


*Figure 37: Land Use to the South East of Olifantshoek*


*Figure 38: Land Use to the South East of Olfantshoek*


*Figure 39: Impacted Dwellings to the South East of Olifantshoek*

Water infrastructures such as windmills are largely used throughout the project for supplying water to the livestock. Figures 37 and 38 provide an image of the types of land uses found on the dwellings scattered along the R325. Figure 39 above shows an overview of the dwellings within the vicinity of the pipeline.


*Figure 40: Blue Sky Couriers to the South East of Olifantshoek*

Figure 40 above shows a depot owned by Blue Sky Couriers, the depot is not directly affected by the pipeline since the pipeline is located on the opposite side of the road. Security concerns were raised regarding the cargo at the depot as there might be an influx of workers in the adjacent property during construction.


*Figure 41: Accommodation to the east of Olifentshoek*

The Ranch is a located along the N14 approximately thirteen kilometres to the east of Olifantshoek. The Ranch is a tourist destination which offers overnight stays, the pipeline makes its way through the property. Impacts during construction will affect this business which depends on tourism for its success. The entrance to the destination is shown in Figure 41 above. This entrance has been constructed over the pipeline servitude and will have to be removed during construction. The legality of this structure will have to be determined during the detailed design phase of the project and should the structure have been erected legally, the landowner would have to be compensated for the loss of the structure.


*Figure 42: Land Use on the outskirts of Olifantshoek*

Langeberg Stene is located seven kilometres outside Olifansthoek along the N14. This brickmaker will be affected during construction as the pipeline makes its way through the holding’s entrance. Entrance to Langeberg Stene is shown in Figure 42 above. During construction, access to the facility may be restricted and this needs to be carefully handled to avoid an impact on the productivity of the facility.


*Figure 43: Accommodation to the East of Olifantshoek*


*Figure 44: Langeberg Stene to the East of Olifantshoek*

Figures 43 and 44 above show an overview of the land uses and affected dwelling on the outskirt of Olifantshoek.

*Figure 45: Affected Dwellings in Olifantshoek*

*Figure 46: Olifantshoek Community Health Centre*

Olifantshoek is a high density town with commercial, residential and smallholdings all impacted by the proposed upgrade. Figures 45 and 46 shows images of the some of the affected dwellings and other buildings.

The town has good infrastructure: piped running water; tarred and paved roads; electricity and formal dwellings. Olifantshoek has been experiencing challenges with the water supply for the past 7 years, the periodically town experiences interruptions in the water supply which last for several weeks.

The impacts on most dwellings include limited access to dwellings during construction as the pipeline passes on the entrances of most dwellings. The pipeline is planned to run through the Olifantshoek Community Health Centre, as shown in Figure 46 above. It is suggested that the route be amended to avoid this impact. The pipeline is also planned to along the boundary of the Olifantshoek Cemetery, and the route should also be adjusted to reduce this impact.


*Figure 47: Impacted Dwellings and Buildings in Olifantshoek*

The pipeline in this section makes its way through the existing dwellings and infrastructure in Olifantshoek see Figure 47 above.

### 5.1.3 Summary of Impacts of the proposed Upgrades

The proposed pipeline upgrade project does not have any route alternatives, as a result the existing pipelines follows existing infrastructure such as roads and railways to reduce the overall impacts. Impacted communities along the main and existing pipeline are; Delportshoop, Koopmansfontein, Lime Acres, Groenwater (Metsimatala), Postmasburg, Maremane and Olifantshoek.

The table below provides a breakdown of the number of impacts for the proposed VGRWSS Phase 2 upgrade.

*Table 5: Summary of Impacts along the Proposed Upgrades*

| Nature of Impacts | Main Pipeline |
|---|---|
| Farm Buildings/ Dwellings | 0 |
| Irrigation Pivots | 1 |
| Smallholdings (dwellings) | 23 |
| Commercial/Institutional | 5 |
| Other – Tourism, hatchery and Rail | 4 |

## 5.2 Study Area Overview

The section below provides a more detailed description of the social and economic environment of the study area and further illustrates the livelihoods of the study area. See Figure 48 for a map of the municipalities in which the pipeline passes through.

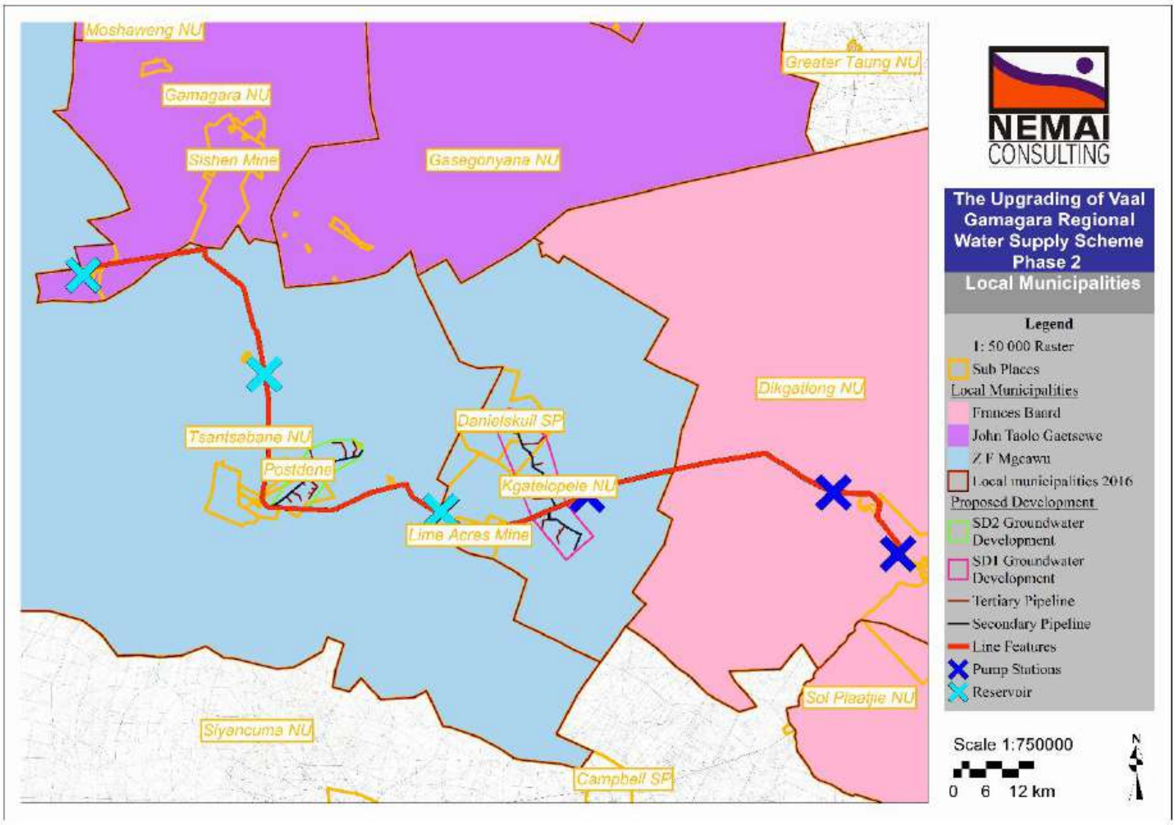



*Figure 48: Map of the Affected Municipalities*

The project is spread across three District Municipalities: Francis Baard, Siyanda (ZF Ngcawu) and John Taolo Gaetsewe District Municipalities. The District municipalities mentioned above are home to four Local Municipalities in which the project is located; Gamagara, Tsantsabane, Kgatelopele and Dikgatlong.

### 5.2.1 Population Data

The population of the study area, as determined during Statistics South Africa's Census 2011, is presented in the pie chart below.

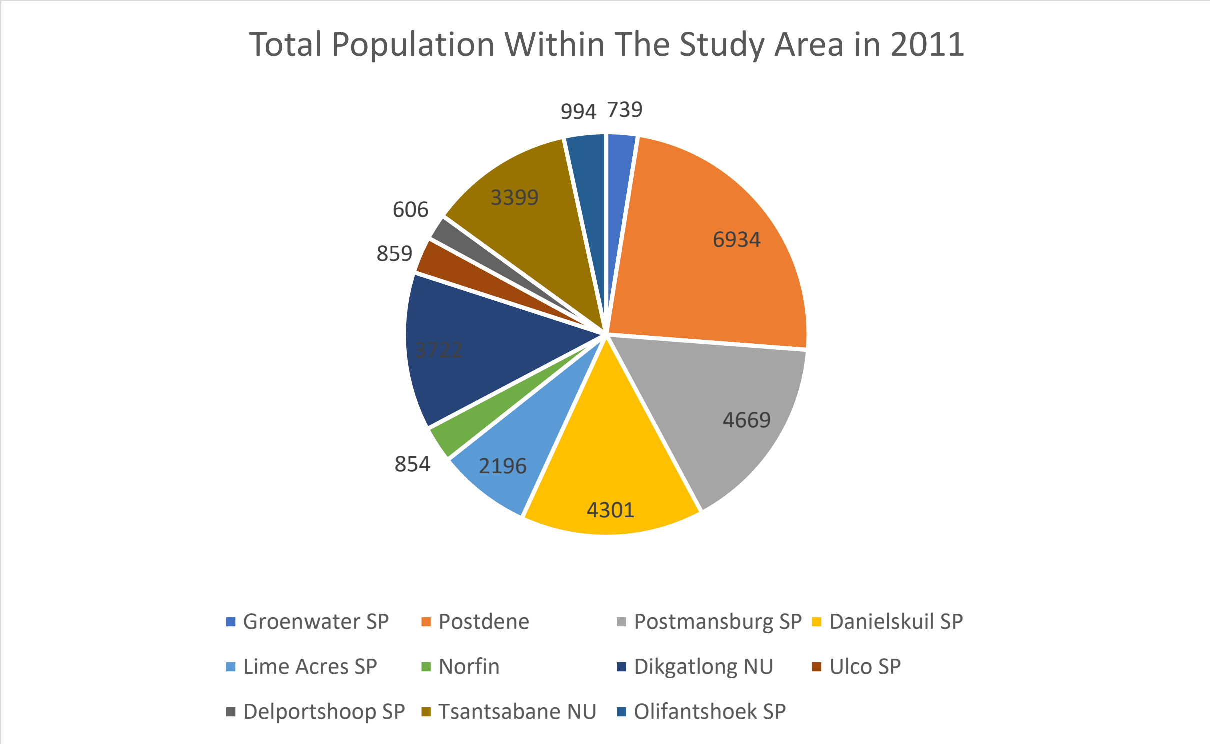



***Figure 49: Population Data in the Study Area***

Postdene, located outside Postmasburg, has the highest population, at 6 934, Postmasburg SP, is the next most populated, at 4 669 people. The Delpoortshoop Sub place is the least populated, at 606 people.

Note that Danielskuil SP cover the Source Development area, but has been included in the discussion for the sake of completeness.

The change in population of the regional area as determined from Statistics South Africa's Community Survey 2016 is presented in the table below.

***Table 6: Population data in the Regional Area (2011-2016)***

| Region | Census 2011 | CS 2016 |
|---|---|---|
| Gamagara | 41 617 | 30 299 |
| Tsantsabane | 35 093 | 21 086 |
| Kgatelopele | 18 687 | 10 475 |
| Dikgatlong | 46 841 | 24 293 |
| **Grand Total** | **142 238** | **162 164** |

During the community survey of the region in 2016, the total population was recorded to be at 162 164. The total population of the region in 2011 was 142 238, the number has increased by 19 926 (12.3%) in a period of 5 years, equivalent to an annual growth rate of 2.65%.

### 5.2.2 Dwelling Type

The characteristics of the dwellings in which households live and their access to various services and facilities provide an important indication of the well-being of household members. It is widely recognised that shelter satisfies a basic human need for physical security and comfort

According to the Statistics South Africa household classification the following definitions apply to formal and informal housing (Figure 51):

- **Formal dwelling** refers to a structure built according to approved plans, i.e. house on a separate stand, flat or apartment, townhouse, room in backyard, rooms or flatlet elsewhere. Contrasted with informal dwelling and traditional dwelling; and
- **Informal dwelling** is a makeshift structure not erected according to approved architectural plans, for example shacks or shanties in informal settlements or in backyards.

The chart below shows the dwelling types located within the study area.

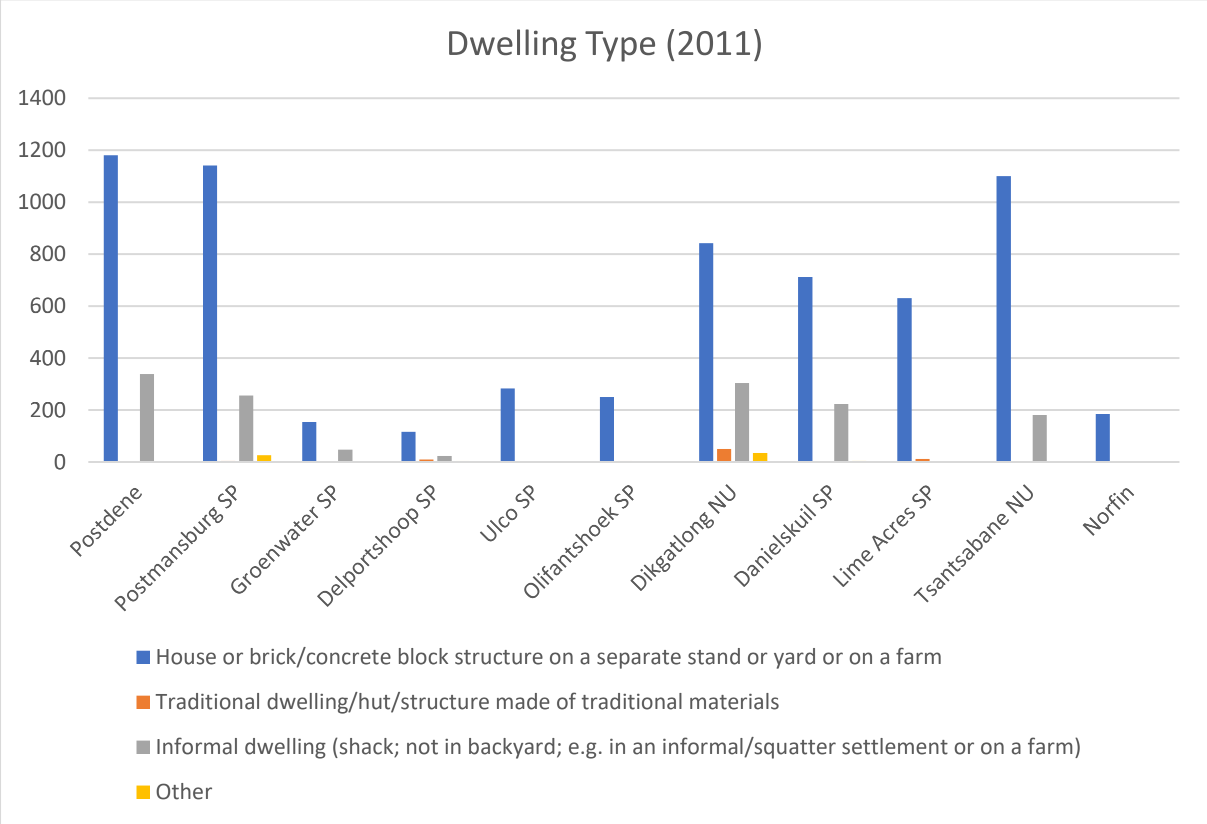



*Figure 50: Type of Dwelling (2011)*

The vast majority of the inhabitants of the study area live in formal, brick dwellings. There are areas where informal dwellings exist, notably Postdene, where there are 339 informal dwellings in the sub-place. The standards of living are high and the relative lack of informal dwellings indicate a population that is not transient.

### 5.2.3 Access to Piped Water

Understanding the water supply at a household level provides insight into the municipal level of service of a community as well on the standard of living. The graph below, which summarises Statistics South Africa's Census 2011 data, shows the use of various water supply standards within each of the sub-places.

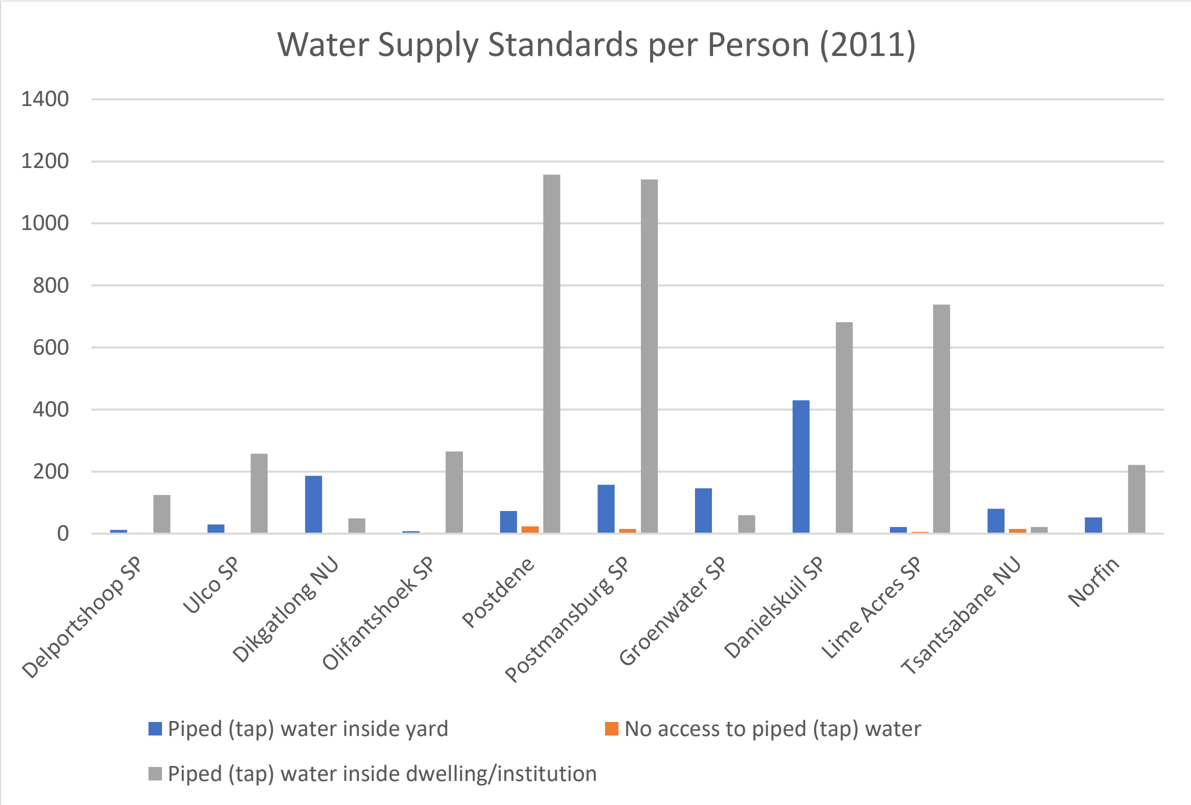



*Figure 51: Access to Piped Water (2011)*

The majority of the study area is dominated by a piped water supplied inside homes. The exception to this rule is Groenwater SP and Dikgatlong NU, where informal settlements are most common and thus there are households with a water supply point outside the house, in the yard.

### 5.2.4 Sanitation

Access to sanitation services is also an indicator of the standard of living amongst the population in the sub-places. The graph below, which summarises Statistics South Africa's Census 2011 data, shows the use of the various sanitation standards within each of the sub-places.

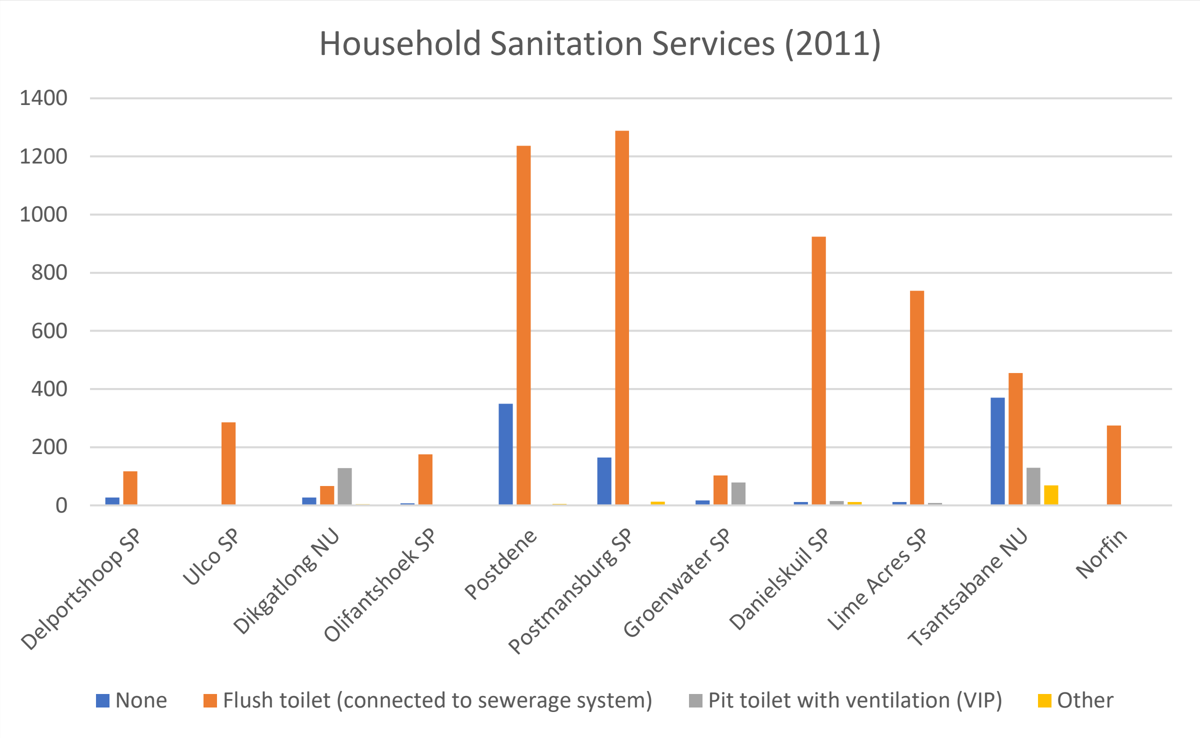



*Figure 52: Access to Sanitation Services in (2011)*

Majority of the households in the sub-places use flush toilets. There are areas where there are no sanitation services, notably the rural areas of Tsantsabane and Postdene where there are up to 370 people living without any toilet facilities.

### 5.2.5 Education

Education levels are assessed in order to understand the potential grade or level of employment as well as livelihood of the community. Furthermore, it indicates the functional literacy and skill level of a community. The graph below provides detail on the education levels within the study area. The figures are taken from Statistics South Africa's Census 2011.

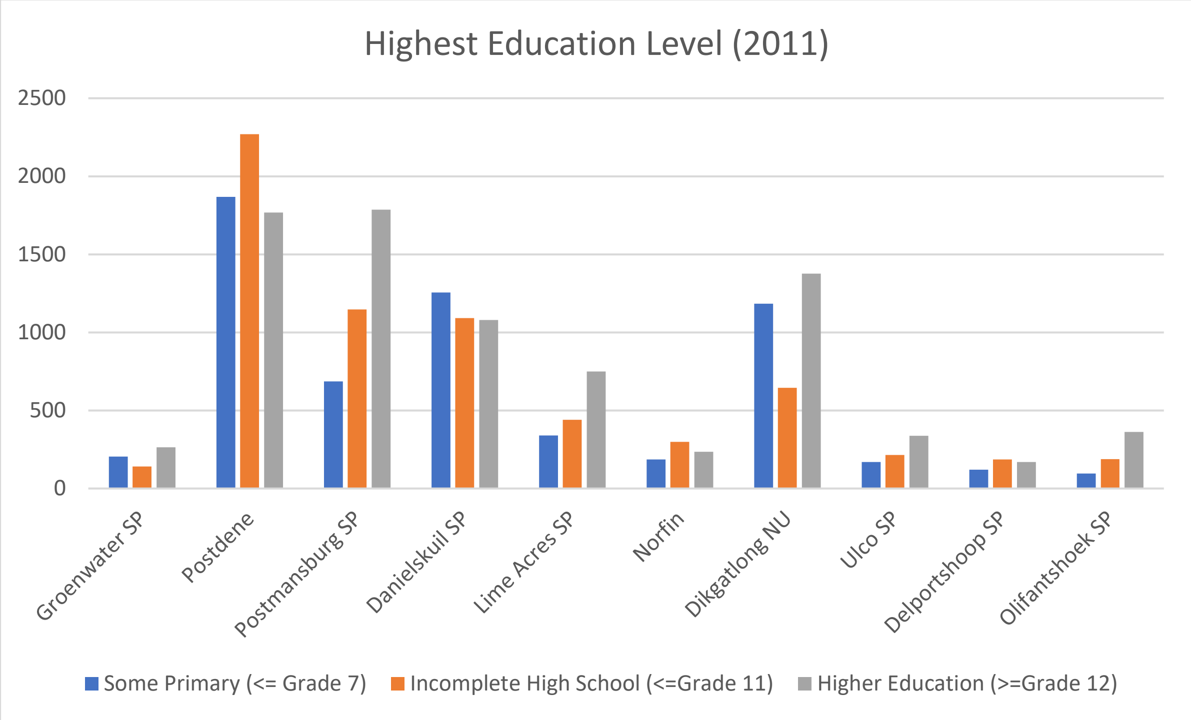



***Figure 53: Highest Education Level in 2011***

The graph shows that sixty one percent of the inhabitants of the study area have not achieved matric. The remaining thirty-nine percent have achieved matric or a post matric qualification. Table 7 below provides more detail on the levels of education within the study area.

***Table 7: Education Levels within the Study Area***

| | **Some Primary (<=Grade 7)** | **Incomplete High School (<=Grade 11)** | **Higher Education (>=Grade 12)** |
|---|---|---|---|
| Groenwater | 34% | 23% | 43% |
| Postdene | 32% | 38% | 30% |
| Postmasburg | 19% | 32% | 49% |
| Danielskuil | 37% | 32% | 31% |
| Lime Acres | 22% | 29% | 49% |
| Norfin | 26% | 41% | 33% |
| Dikgatlong NU | 37% | 20% | 43% |
| Ulco | 23% | 30% | 47% |
| Delportshoop | 25% | 39% | 36% |
| Olifantshoek | 15% | 29% | 56% |

Postmasburg and Lime Acres are the two sub-places with the highest levels of education within the study area, where 49% of the population have achieved a matric pass or higher level of education. Ulco, Dikgatlong NU and Groenwater follow with 47% and 43% of the population above 20 years old achieving matric or higher, Postdene and Danielskuil have the least educated population with matric and higher being at 30% and 31% respectively.

The data is consistent with the living standards measures presented above.

Economic theory proves that education improves the level and quality of human capital, in turn increasing the productivity of individuals. Thus, increasing the output generated per worker. Education facilitates long term growth and is critical to escape the poverty gap.

Economic theory proves is proven in practice in a study conducted by Altbeker and Storme (2013). The study shows that while number of graduates in South Africa has more than doubled in the past fifteen years; the unemployment rate amongst graduates has declined to around five percent.

The statistics presented in the figures above, suggest that the communities are dependent on the thirty-nine percent of the population who have completed high school or received a higher education.

In Postdene and Danielskuil, 70% and 69% of the population have incomplete high school education and some primary education. The structural problem in these two areas requires intervention of an external entity to improve current education levels. A generation of youth with some form of higher education is required to break the poverty cycle in this area.

### 5.2.6 Annual Household Income

Annual household income is important to assess as it provides information on the poverty level of a community. Development of unskilled rural households is much slower than that of a skilled households, this is due to the unskilled communities tending to generate low incomes per household than higher skilled communities.

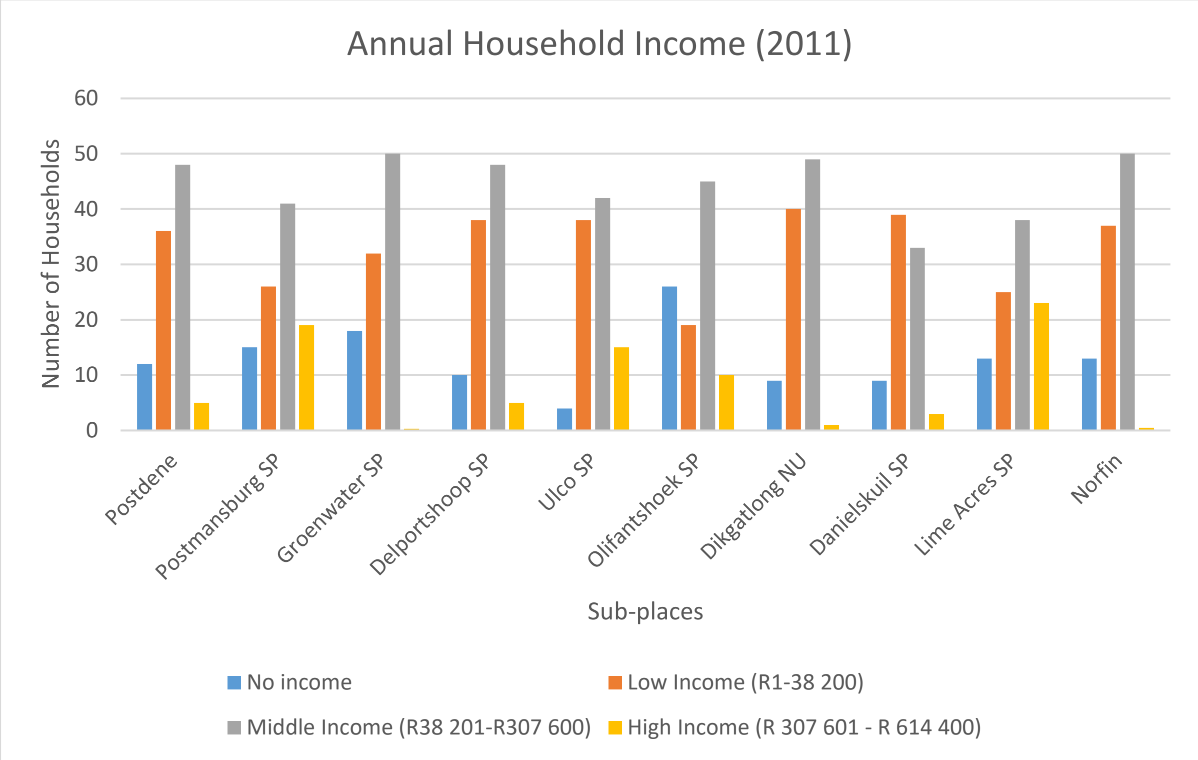



*Figure 54: Annual Household Income (2011)*

The graph demonstrates that a substantial percentages of the population of Groenwater, Postdene, Delpoortshoop, Olifantshoek, Dikgatlong and Danielskuil have no or low income. This is combined with relatively fewer higher income individuals, which indicates that these communities are most vulnerable to economic shocks with little buffer against dips in income levels,

The table below provides additional detail on the household incomes of the sub-places

*Table 8: Household Income within the Study area*

| Sub-Place | No income | Low Income (R1-38 200) | Middle Income (R38 201-R307 600) | High Income (R307 601 – R614 400) |
|---|---|---|---|---|
| Postdene | 12% | 36% | 48% | 5% |
| Postmansburg SP | 15% | 26% | 41% | 19% |
| Groenwater SP | 18% | 32% | 50% | 0.3% |
| Delportshoop SP | 10% | 38% | 48% | 5% |
| Ulco SP | 4% | 38% | 42% | 15% |
| Olifantshoek SP | 26% | 19% | 45% | 10% |
| Dikgatlong NU | 9% | 40% | 79% | 1% |
| Danielskuil SP | 9% | 39% | 33% | 3% |
| Lime Acres SP | 13% | 25% | 38% | 23% |
| Norfin | 13% | 37% | 50% | 0.5% |

A cluster of communities: Postdene, Groenwater, Delpoortshoop, Dikgatlong, Lime Acres and Norfin have no or low-income levels at 48-50% of the communities. Lime Acres and Norfin has a higher percentage than the other communities of higher income individuals, which buffers against economic shocks and provides in-built resilience to period of low income.

The poverty levels in the remaining areas: Postdene, Groenwater, Delpoortshoop and Dikgatlong are the most severe in the study area. These communities would most benefit from additional employment opportunities and skills development programmes for both short and long term durations.

Of particular note in Figure 59, are the figures for households with "No income". Statistics SA in their publication "Income Dynamics and Poverty Status in Households in South Africa, Census 2011", (Statistics SA:2015) define income as being ""…all money received from salary, wages or own business; plus money benefits from employer, such as contributions to medical aid and pension funds; plus all money from other sources, such as additional work activities, remittances from family members living elsewhere, state pension or grant, other pensions or grants, income from investments, etc. The census question asks for the total before tax."

According to this definition, a total of 193 households in Postdene receive no income. To justify and rationalize this level of income there are four possibilities: the households have either unreported their income; rely on charity donations of goods and or social grants; due to the study area being predominately used for agriculture, the third possibility is that the household use subsistence farming to sustain the household's food and water needs. In this study area, it is most likely that subsistence agriculture supports household livelihoods and the communities which make the most use of this form of sustenance are: Olifantshoek, Groenwater and Postmasburg.

### 5.2.7 Employment

Census 2011 uses the following definitions applicable to employment that are useful for reference purposes:

- "**Employed** - Those who performed work for pay, profit or family gain for at least one hour in the seven days prior to the interview or who were absent from work during these seven days, but did have some form of paid work to return to";
- "**Economically Active Person** - A person of working age who is available for work, and is either employed, or is unemployed but has taken active steps to find work in the reference period". These are the sum of the employed and unemployed persons;
- "**Unemployed –** Those people within the economically active population who: (a) did not work during the seven days preceding the census; (b) want to work and are available to start work within two weeks of the interview; and (c) have taken active steps to look for work or start some form of self-employment in the four weeks preceding the census night."; and
- "**Other Not Economically Active –** People who are not available for work such as fulltime scholars and students, full-time homemakers, those who are retired and those who are unable or unwilling to work"; and

The statistics of employed and unemployed persons in the study area is reported in the graph below by using the Statistics South Africa's Census 2011 data. These figures use the official definition for unemployment. The sum of the employed persons and the unemployed persons is the actual labour force at the time of the census.

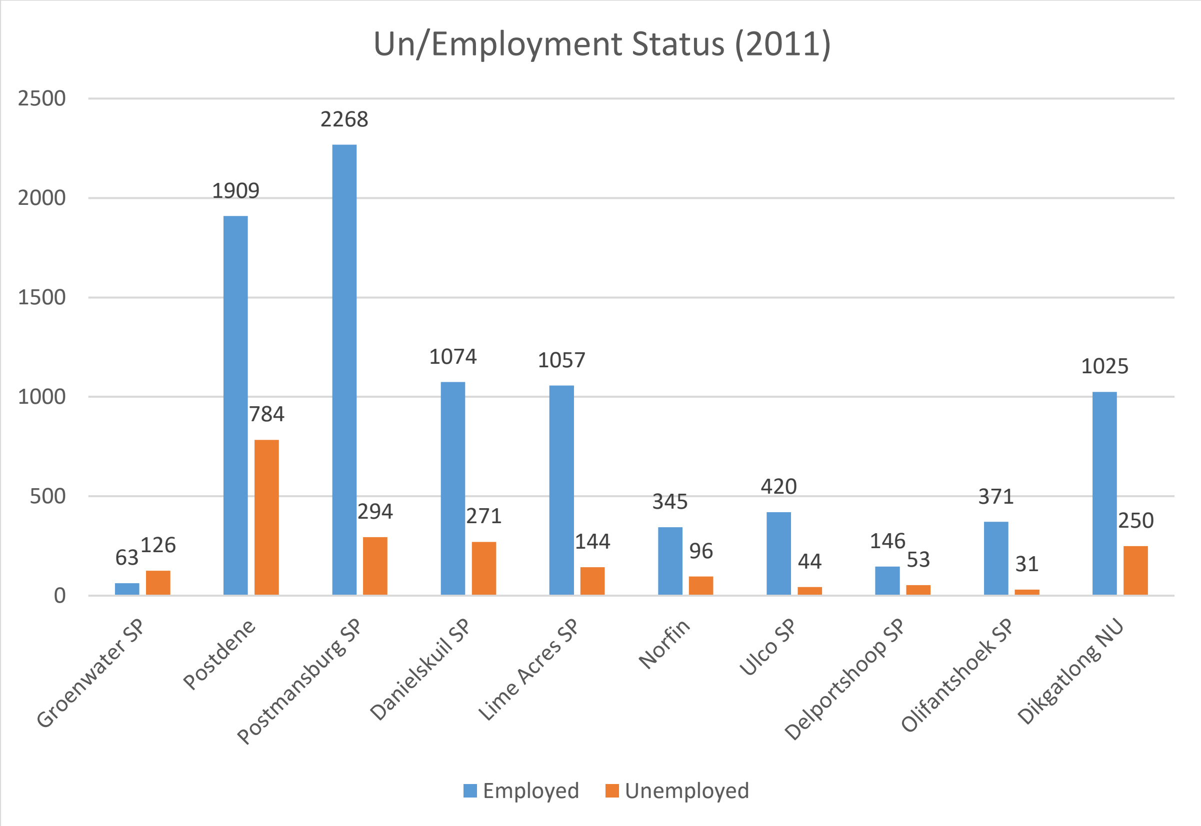



*Figure 55: 2011 Employment Status (2011)*

The graph shows that unemployment in the study area is lowest in Olifantshoek (at 8%) and highest in Groenwater (at 67%) and Postdene at (29%). The data corresponds with that on education levels, for example in Olifantshoek, 56% of the population have achieved a matric pass or higher level of education, and the highest level in the study area.

This conclusion reinforces the estimate of the communities which would most benefit from job opportunities and skills development as including Groenwater and Postdene.

### 5.2.8 Child Headed Households

An understanding of child headed households in the project area is crucial as it may assist in identifying challenges facing these households. The KwaZulu Natal Human Settlements (2010:04), defines a Child-headed Household as a household wherein the head child is younger than 18 years old i.e. a household consisting only of children.

Figure 61 below provides statistics of the Child-headed Households within the study area. The figures are taken from Statistics South Africa's Census 2011.

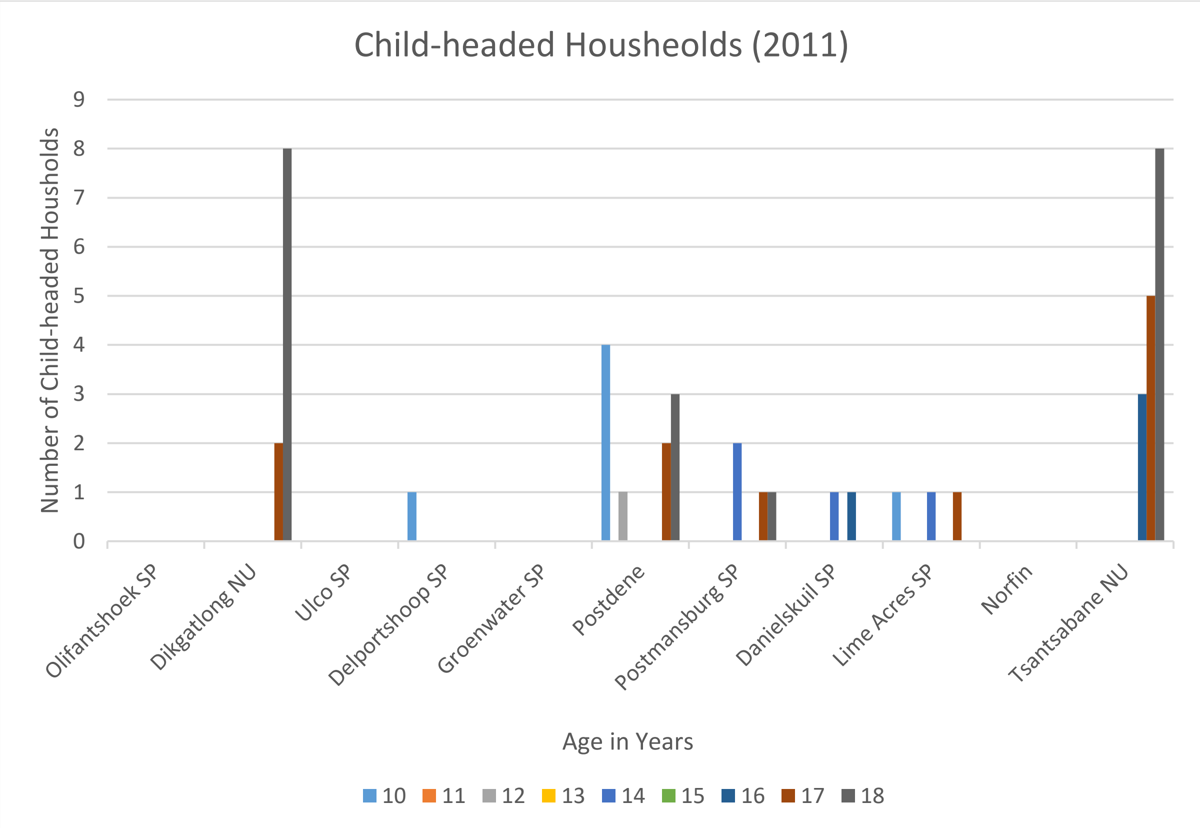



*Figure 56: Child Headed Households (2011)*

Tsantsabane NU and Dikgatlong NU have the highest number of chid-headed households at sixteen households, followed by Postmasburg with four child-headed households. The vast majority of the households in the project area are not child-headed however, most child-headed households tend to be of informal dwellings with lack of access to adequate sanitation and water. Existing child-headed households in the project area should be considered as primary beneficiaries when identifying beneficiaries of the project.

Due to the high increase of population in the project area and the decline in education levels, it may be of importance to emphasise the need to educate and develop HIV/AIDS awareness initiatives in the project area, particularly to the youth.

It is recommended that should the project come into contact with child-headed households they be brought to the attention of the Northern Cape Department: Social Development in Kimberley.

## 5.3 Stakeholder Engagement

The following stakeholder engagement was carried out during Public Participation Process (PPP) as part of the EIA and as part of the SEIA studies.

### 5.3.1 Contact with Directly Affected Landowners

The directly affected landowners/parties were contacted, this was carried out as part of the PPP of the EIA and in addition some interactions with the IAP's took place during the site visits. This process included individual meetings with the IAP's, focus group meetings, public meetings, authority meetings, formal and informal interviews. During the meetings, there were socio-economic issues that were raised as resulting from the proposed project. The overall responses include the following:

- Many landowners were concerned about the **reduction of access to their farmlands,** the concern was mostly centred on the possibility of the access to their farmlands being reduced during construction phase. In addition it was noted that the construction phase of the project will interfere with the agricultural activities and if the proposed upgrades will include pipelines running above the surface cutting the properties in half, would have a negative impact on the property value;
- **Security issues** were raised by the affected parties. The concerns were with regards to the impact upon security of contractors being present in the area for the entire duration of the project, concerns that the project would increase public access as in the historic events contractors did not close/ lock the access gates after working. Related to this issue were concerns with regards to trespassing on private land as well as construction after working hours;
- **Damage to private property** as a result of the contractor action were raised as a concern, such damage resulting from introduction of heavy machinery and heavy vehicles could affect the operational efficiencies on farms, residential and commercial dwellings;
- The ability of the project to create **direct economic benefits** in the form of local expenditure, local employment, Small, Medium and Micro-sized Enterprises (SMME) was raided. Participants preferred to see as much as possible of the project budget to be spent locally;
- **Reduction of access to amenities** a concern was raised that, as a result of the project, some access to amenities such as shopping centres and other facilities where the pipeline makes its way through, would be prohibited;

- **Reduced access to land** whereby, if certain camps on a farm can no longer be used, the farm can no longer be managed as an economic entity, which will result in the suspension of the farming on that entire farm.

#### 5.3.1.1 Contact with Dikgatlong Local Municipality Councillors

The affected areas in this municipality are Delpoortshoop, Koopmansfontein, and Ulco. The concerns noted by the Councillors are as follows:

- **Socio-economic benefits:** The Councillors noted that the community members in the area are largely unemployed. Companies such as Afrisam employs a small amount of people from the surrounding communities. It was pointed out that the project should try to employ locally-based labour, possibly using the Expanded Public Works Programme model as well as using local companies. As far as possible, importing labour from outside the outside the affected communities should be avoided. In addition, skills development programmes and certifications to create long term skills within the community was noted as an expectation from the project;
- **Security Concerns:** The areas in this municipality experiences a lot of theft in livestock as the unemployment rate is very high. Since the project will allow additional people to access private properties, theft and other criminal activities in the area might increase. This was a sensitive issue across all communities, project-wide;
- **Project Awareness:** Councillors were concerned that landowners did not have enough knowledge of the project. It was pointed out that generally the EIA process includes a great deal of public participation and that directly affected landowners have been informed individually of the proposed project;
- **Duration of the project:** as the councillors wanted to know the duration of the employment contracts which will be issued to the community.

#### 5.3.1.2 Contact with Gamagara Local Municipality Councillors

The affected area in this municipality is Olifantshoek. The concerns noted by the two Councillors in this section of the project are as follows:

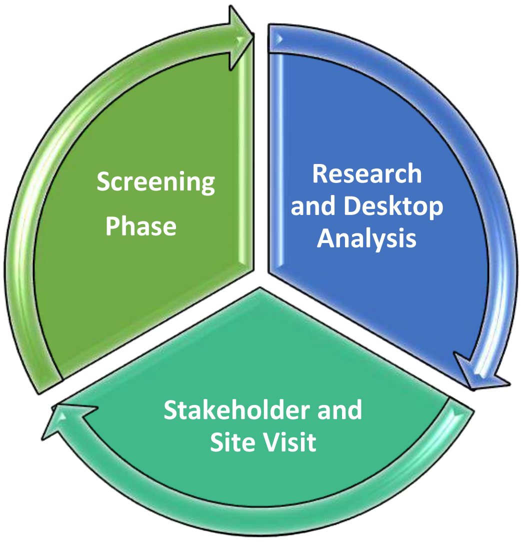
- **Social Benefits of the project:** It was noted that the area experiences a lot of interruptions in the supply of water, the communities experience up to seven weeks without water in their taps. It would be beneficial for the project to supply sufficient water for the growing population in the area;
- **Socio-economic benefits:** the Councillors were interested and excited about the socio-economic benefits that the project might have to offer to the community members. They mentioned that there is a lot of substance abuse in the area due to the high unemployment rates. They noted that the project should introduce job creations through the Expanded Public Works Programme model, and encouraging the use of small local companies;

- **Economic Implications:** some concerns were based around the economic implications of the pipelines on local businesses. The councillors noted that during construction the businesses will experience restricted access to their properties, and this might cripple the economy of the area.
- **Security Issues:** as the project will be making its way through the residential area, a concern regarding third parties having access to private properties was raised;
- **Damage to Private Property:** again with the project making its way through some dwellings in the area, a concern was raised with regard to the damage to private property as a result of the project construction.

# 6 Identification of Activities, Aspects and Impacts

The methodology for the identification of impacts was threefold. Firstly, an assessment of the screening phase took place. This was followed by a research and desktop analysis. Finally, a stakeholder and site visit was conducted.

The assessment of the screening report and the Background Information Document was important to understand the project background details, location and possible impacts. In this section GIS was used to conduct a thorough analysis of the project study area. As a result, the project details were understood and located.




The second aspect to identification of impacts was a research and desktop study. Data on the community such as population statistics, health, education and services were analysed using Census 2011 data. Consultation of relevant studies was conducted to provide an insight and supplement the already acquired knowledge where deemed necessary. A brief analysis of the economic aspect of the community was also assessed. It also allows for the identification of the challenges faced by the community. Not only does the desktop study facilitate site visits, it also directs the discussion during interviews.

Finally, stakeholder engagements were conducted in the form of interviews and public meetings with directly affected landowners and relevant authorise. The consultations provided valuable insight on IAP's views on the projects. Using this methodology, aspects were identified from activities that proposed. These aspects have triggered impacts which will be discussed in Section 7. In order to contextualise the impacts, the activity and aspects have been outlined and discussed below.

According to ISO 14001-2004 4.3.1 Environmental Aspects; the Organization shall establish, Implement and maintain a procedure(s)

- To identify the environmental aspects of its activities, products and services within the defined scope of the environm4ental management system that it can control and those it can influence taking into account planned new developments or new or modified activities, products and services, and
- To determine those aspects that have or can have significant impact(s) on the environment (i.e. significant environmental aspects) (International Organization for Standardization, 2011).

## 6.1 Identification of Activities and Aspects

An "activity" is defined as a distinct or risk undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardisation, 2011).

The activities identified for the projects are listed below as either high risk or lower risk to the social environment.

High Risk Activities:

- Land and Servitude Rights Acquisition (where necessary, having regard to existing structures located in the pipeline servitude);
  - Structures located in the existing servitude (including the dwelling in Postmasburg, The Ranch and Langeberg Stene);
  - Olifantshoek Community Health Care Centre;
  - Olifantshoek Cemetery.
- Construction Works
  - abstraction arrangements at the Delportshoop water treatment works;
  - approximately 210km of the existing pipeline from Delportshoop to Olifantshoek;
  - access roads and upgrading/maintaining existing roads.

Lower Risk Activities:

- Upgrading of the Clifton and Gloucester Reservoirs, as well as the Trewill and Kneukel Sumps;
- Mechanical and electrical upgrading of the pup station at Delportshoop, Kneukel and Trewill;
- Scheme Operations:
  - Operation and maintenance of the Delportshoop WTP;
  - Operation and maintenance of the newly upgraded reservoirs and pump stations;
  - Road maintenance.

An aspect is defined as elements of an organisation's activities of products or services that can interact with the environment. In order to capture the high risk impacts associated with the proposed infrastructure, an activity – aspect – impact table was created (**Table 9**).

The table presents an overview of the impacts associated with aspects during the various stages of the project. Some impacts, including their mitigation measures, are thereafter discussed in detail while the remaining impacts not discussed in this report are addressed in separate specialist studies as part of the EIA study. If the impact is not significant then no further investigation is recommended.

*Table 9: Table Outlining Activity, Aspects and Impacts of the project*

| Activity | Aspect | Potential Impact |
|---|---|---|
| Land Acquisition and Servitude Rights Acquisition | Land Acquisition | Partial loss of livelihood on the part of landowners<br>Reduced access to healthcare services in Olifantshoek |
| | Servitude Rights | Reduced access to land/structures – all structures located in the servitude. Structures identified as part of this study are: Postmasburg dwelling, The Ranch, Langeberg Stene and Olifantshoek Cemetery |
| Construction Phase | Access into properties | Damage to property or equipment |
| | | Damage or wear to access roads |
| | | Improvement of access in the project area |
| | | Security concerns |
| | Trenching and pipe laying | Proximity to construction work and associated |
| | | Employment of local people and SMME's |
| | | Sourcing of equipment, machinery and services locally |
| | Earthworks and roadworks | Noise |
| | | Dust |
| | Concrete and civil works | Noise |
| | | Influx of workers |
| | | Employment of local labour and SMME's |
| | | Sourcing of equipment, machinery and services locally |
| | | Temporary road closures |
| | | Increased traffic |
| | | Temporary closures to affected some properties |
| | Transport of goods to site and employment of staff | Increased traffic |
| | | Security concerns |
| | | Improved access to amenities |
| | Mechanical and Electrical works | Noise |
| | | Employment of local people |
| | | Sourcing of equipment, machinery and services locally |
| | Rehabilitation | Damage or wear to access roads |
| | | Security concerns |

## 6.2 Impacts Mitigation Framework

ISO 14001-2004 defines impacts as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s environmental aspects”.

When considering an assessment of the impacts, the following definitions apply.

| | |
|---|---|
| Nature | The project could have a positive, negative or neutral impact on the environment. |
| Extent | **Local** – extend to the site and is immediate surroundings.<br>**Regional** – impact on the region but within the province.<br>**National** – impact on an international scale.<br>**International** – impact outside of South Africa. |
| Magnitude | Degree to which impact may cause irreplaceable loss of resources:<br>**Low** – natural and social functions and processes are not affected or minimally affected.<br>**Medium** – affected environment is notably altered, natural and social functions and processes continue albeit in a modified way.<br>**High** – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease. |
| Duration | **Short term** – 0-5 years<br>**Medium term** -5-11 years<br>**Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.<br>**Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient. |
| Probability | **Almost certain** – the event is expected to occur in most circumstances.<br>**Likely** – the event will probably occur in most circumstances.<br>**Moderate** – the event should occur at some time.<br>**Unlikely** – the event could occur at some time.<br>**Rare/ Remote** – the event may occur only in exceptional circumstances. |
| Significance | Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance rating is as follows:<br>0 – impact will not affect the environment. No mitigation necessary.<br>1 – No impact after mitigation.<br>2 - Residual impact after mitigation.<br>3 – Impact cannot be mitigated. |
| Mitigation | Information on the impacts together with literature from social science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased and positive benefits are enhanced. |
| Monitoring | Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures. |

A well designed, well implemented, well managed, well maintained pipeline network expansion and upgrade can bring significant benefits to the communities that it serves. If configures or operated in a way that ignores significant socio-economic needs or potential impacts, the pipeline may have socio-economic costs or liabilities for the stakeholders and affected communities.

Therefore assessing socio-economic impacts is a complex process due to the multi-dimensional nature of the human interactions. This occurs in situations where a particular impact affects a group of stakeholders differently. An inter-connection of impacts can also be encountered whereby a number of impacts are related and when assessed cumulatively their impacts may be of significance.

The impact assessment scores both before and after mitigation were arrived at by the specialist team engaging in a modified version of the Delphi technique, where the team discussed the scores, and through a process of iteration arrived at a consensus for each of the values. Where additional information was needed to make a determination, the technique would be halted, the necessary information would be uncovered and included in the report, and the technique would be recommenced.

## 6.3 Impact of Providing Additional, Secured Water Supply

The upgrading of the VGRWSS Phase 2 through the construction of a new pipeline has socio-economic implications. The socio-economic benefits of a secure water supply are fundamental to the project and the communities. These benefits will also increase to the residents in the supply areas.

The United Nations Educational Scientific and Cultural Organisation highlight socio-economic development process depend on the human’s use of water since water is a basic essential biological element to humanity.

Serious water shortages may be accompanied by chronic illnesses; thus putting pressure on the hospitals and clinics. Sufficient water supply minimises the spread of diseases within the economy and increases the livelihood status of the individuals. Further, water supplies the individual with the opportunity to do every day activities such as drinking water, cooking, bathing and cleaning. The ability to prepare healthy food ensures sustenance and strengthens the immune system.

A secure water supply is a basic human need and is an economic good. It contributes substantially to economic growth, thus the service and management of it should be constantly reviewed. Without water, the human system and economic productivity will decline dramatically, because of the positive relation between populations an economic growth. A growing economy is most likely to attract other infrastructure investments and result in better education, which uplifts the social status of the economy.

A secure water supply reduces expenditure on health-related costs in a society. In most developing countries people spend a third of their income on medical costs mostly from water related diseases such as malaria and diarrhoea. Thus secured water helps the population in redistributing their incomes to other sectors such as education, it increases productivity since time spent on health care matters can be spent on other activities such as harvesting and education (Bloom and Sachs; 1998). On average, economies with safe access to water enjoy a positive growth.

Agricultural production, even on a subsistence level, thrives with a secured water supply. Thus, increased water supply reduces food security pressure. These benefits are all realised through an increases and secure water supply.

| Environmental Feature | Impacts Created by Providing a Secure, Sufficient Water Supply | | | | | |
|---|---|---|---|---|---|---|
| Project life-cycle | Operational Phase | | | | | |
| Potential Impact | Proposed Management Objectives / Mitigation Measures | | | | | |
| Economic | • Increased productivity;<br>• Increased education levels;<br>• More flexible economy. | | | | | |
| Social Benefits | • Reduces disease burden;<br>• Reduced food security challenges in affected community;<br>• Reduced drought stress. | | | | | |
| | Nature | Extent | Magnitude | Duration | Probability | Significance |
| Before Mitigation | Positive | Regional | High | Long Term | Likely | 3 |
| After Mitigation | Positive | Regional | High | Long Term | Likely | 3 |
| Significance of Impact and Preferred Alternatives | Mitigation is not necessary for this positive impact.<br><br>This mitigation measure does not influence the alternatives considered in the study. | | | | | |

## 6.4 Impacts Owing to Land Acquisition and Servitude Rights Acquisition

The implementation of the proposed project could have an impact on landowners in that existing structures have been erected in some places along the servitude. Places that have been identified are:

- Postmasburg dwelling;
- The Ranch;
- Langeberg Stene; and
- possibly the Olifantshoek Cemetery

The Olifantshoek Health Care Centre is located along the pipeline route. This is a significant community resource and as such the pipeline should be routed around the facility, rather than relocating the facility.

Existing servitude conditions restrict the erection of structures inside the servitude and where this has been done, the legality of this should be investigated as part of the detailed design phase. Where the structure has been erected legally, the landowner should be compensated in accordance with the law for the removal of the structure.

The main pipeline has an existing servitude and thus no negotiations are required between with the landowners regarding land acquisition and compensation.

| Environmental Feature | | Impact owing to Land and Rights Acquisition | | | | |
|---|---|---|---|---|---|---|
| Relevant Alternatives & Activities | | Assertion of servitude rights | | | | |
| Project life-cycle | | Pre-construction | | | | |
| Potential Impact | | Proposed Management Objectives / Mitigation Measures | | | | |
| Loss of value owing to assertion of servitude rights | | • Where structures have been legally erected and are on the route of the pipeline, all negotiations and payments relating to compensating affected landowners should be conducted and concluded before construction begins. Structures so affected and identified in this report are:<br>o Postmasburg dwelling;<br>o The Ranch;<br>o Langeberg Stene; and<br>o possibly the Olifantshoek Cemetery | | | | |
| Loss of Olifantshoek Health Care Centre | | • The pipeline should be routed around this community facility | | | | |
| | Nature | Extent | Magnitude | Duration | Probability | Significance |
| Before Mitigation | Negative | Regional | Medium | Medium term | Likely | 3 |
| After Mitigation | Negative | Local | Medium | Medium term | Likely | 1 |
| Significance of Impact and Preferred Alternatives | The routing of the main pipeline is the primary mitigation measure for the Olifantshoek Health Care Centre. Legally erected structures impinging on the pipeline route should be compensated for. | | | | | |

## 6.5 Impacts during the Construction Phase

The construction activity will impact the social environment both positively and negatively. Given the nature of the project area, construction activity is likely to cause a number of social nuisances as well as possible economic implications on the communities and commercial activities.

Construction impacts of the VGRWSS Phase 2 developments are briefly listed below and explained in depth in section **6.5.1.1 – 6.5.1.6** of this report**.**

The following construction impacts will be considered as part of the EIA:

- Economic opportunities generated by the project are highly anticipated and will improve the socio-economic livelihood of receiving environments throughout the project area.
- The construction phase and period may lead to increased traffic and other traffic-related impacts. The use of heavy vehicles for the delivery of construction material and

the delivery of construction workers may lead to increased damage to the local existing roads.

- Site clearing activities and other construction related activities could lead to an instability in grazing area for the livestock and may lead to a temporarily restricted farming space.
- The pipeline travels alongside and even through existing structures particularly in Postmasburg and Olifantshoek, this will increase visual impacts during and after construction. This may also cause disturbances to the residents and commuters using surrounding services which will be affected by the development. In Olifantshoek, the alignment of the pipeline to avoid the existing cemetery and Community Health Care Centre is recommended.
- Possible damage to property after access has been granted to the contractor may be experienced during construction. This accompanied by an influx of workers, poses a security concern on the receiving communities particularly on their livestock and properties.
- Possible future network expansions to the existing VGWRSS will result in increased water supply and will reduce stress on the current scheme. Associated activities will include noise and dust to the receiving environment.

### 6.5.1 Economic Opportunity

The high number of impoverished households show that there are vulnerable communities in the study area. It is recommended that the appointed contractor use local labour and SMME's as far as possible during construction phase to enhance any local economic impact. In so doing business owners in the vicinity of the project will have the opportunity to expand their enterprises by offering goods and services to the project. This will have local multiplier effects.

Profits generated will stay in the area raising the economic activity and increasing welfare resulting in induced economic opportunity. In South Africa, most employment is generated through small and medium businesses. Given the size of the proposed project, should contracts between local SMMEs occur, it is likely that there will be an increase employment by SMMEs for the duration of the contracts.

The project has the potential to create a number of opportunities for existing and new local SMMEs. These range from site clearing, to construction, as well as the supply of materials. There are also opportunities existing for community members to provide catering, accommodation and other services to the new workers.

Where possible, Sedibeng water should support and encourage the development of SMMEs and local or regional suppliers in line with government policy. In addition, Sedibeng Water should encourage existing SMMEs to be involved in the proposed project.

Education levels provide an indication to the level of skill in the community and the degree to which one can be skilled. From the sub area statistics of the study, it is not likely that many people are skilled and highly skilled.

Attempts to break the poverty cycle in the study area require more than secondary school education. Higher education or further skills training is required. Thus, it is important that the community members under-go skills development. Thus, it is recommended that Sedibeng Water institute a skills development programme during construction.

Sedibeng water must monitor the employment process at all times. Employment audits should be conducted and there should be full transparency of the process. It is important that women are also provided employment opportunities. Audits should pay attention to the employment process of women to ensure that exploitation does not take place.

### 6.5.2 Noise and Dust

During construction phase communities may be exposed to increased dust, noise and visual and other nuisance disturbances.

The generation of dust stems from activities such as earthworks and trenching, as well as vehicular movement during construction phase. This situation will be worst during the dry season and during windy seasons. Airborne particulates may pose a hazard to residents in the vicinity or downwind of the construction sites that suffer from respiratory tract problems. Areas of particular concern are the Maremane settlement, the poultry farm south west of

Groenwater, the ULCO Aerodrome east of Koopmansfontein and the Lime Acres Aerodrome west of Lime Acres. Mitigation through dust suppression methods will allow for this impact to be effectively managed.

During construction, heavy equipment will be required for the site clearance, pipelines excavations and backfilling and general transport, noise generation will be unavoidable. The degree of noise, frequency of noise and individual perception are all important considerations when determining the impact on noise. Drilling; blasting and construction activities will also create noise pollution. Adequate warning of high noise events such as drilling and blasting should be communicated to the affected communities.

#### 6.5.3 Worker Health and Safety

The impacts of constructing can affect the health and safety of those working on the construction site; disturbance, health and income of the host communities; and disturbance to the environment and animals. These impacts can be mitigated in the Environmental Management Programme (EMPr) and through adherence to the Occupational Health and Safety Act 85 of 1993.

An influx of worker is often characterised by higher health risks, particularly if the influx is male dominated. These include a higher disease burden and rise in HIV/AIDS rates. There should also be awareness and education campaigns on health and social risks such as HIV/AIDA and crime prevention.

#### 6.5.4 Security

There are safety concerns related to the construction activity. Landowners have expressed a number of security concerns including increased access to the farms and crime. Trespassing was cited as a concern as well as of damage property once access is granted.

Mitigation measures include Sedibeng Water, prior to construction, must agree with farmers on appropriate access points to ensure the safety of the businesses, livestock and residents. A security policy must be drafted and strictly enforced by the contractors this would include requirement to obtain landowner permission prior to any property.

Contractor staff should be identifiable as such through the use of common work uniforms.

#### 6.5.5 Damage to Property Once Access is granted

Once access is granted, mitigation measures should be taken to ensure that any damage that is caused as a result of this access is mage good. This includes damage to infrastructure such as fences, gates, pipelines, electrical connections or roads.

Property damage includes the destruction of crops that may be required at the time of site clearance.

Where there is a risk of damage occurring, the contractor is to document to the condition prior to the start of work. If the condition has deteriorated after completion of the work, any such damage should be made good. Landowner signed off that the damage has indeed been rectified should be obtained.

### 6.5.6 Local Road Condition and Traffic Impact

Local road access will be used during the project, and as a result these roads may be subject to damage. The project is to maintain the local roads for the duration of the contract and should leave them in a state the same or better than they were prior to the start of the construction phase.

Heavy duty trucks and construction vehicles cause damage to the current road conditions as well as contribute to increased dust and congestion on the roads.

The greater the number of trucks on the road, the greater the risk of road accidents occurring. It is important that the contractors are sensitive to the road conditions and ensure that throughout the construction process that these roads are maintained and suitable for small vehicles.

| Environmental Feature | Economic opportunities arising from the construction phase | | | | | |
|---|---|---|---|---|---|---|
| Project life-cycle | Construction phase | | | | | |
| Potential Impact | Proposed Management Objectives / Mitigation Measures | | | | | |
| SMME Creation | • Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment. | | | | | |
| Job Creation and Skills Development | • The main contractor should employ non-core labour from the sub-places as far as possible during the construction phase.<br>• The principles of Expanded Public Works Programme can be used during construction. | | | | | |
| Indirect Employment Impacts | • Spaza shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the Local Municipality – Informal Trading By-Laws, are complied with. | | | | | |
| | Nature | Extent | Magnitude | Duration | Probability | Significance |
| Before Mitigation | Positive | Local | Medium | Short Term | Likely | 1 |
| After Mitigation | Positive | Local | Low | Short Term | Likely | 3 |
| Significance of Impact and Preferred Alternatives | Those who will benefit during the construction is limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. | | | | | |

| Environmental Feature | Short-term disturbance arising from the construction phase |
|---|---|
| Project life-cycle | Construction phase |
| Potential Impact | Proposed Management Objectives / Mitigation Measures |
| Traffic | • Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site. |

| Environmental Feature | Short-term disturbance arising from the construction phase |
|---|---|
| Project life-cycle | Construction phase |
| Potential Impact | Proposed Management Objectives / Mitigation Measures |
| | • The EMPr must include restrictions on the Contractor and its sub-contractors related to minimising impacts on the safety of road users. Restrictions should include appropriate speed limitations, restricting travel times to daylight hours, communication measures and the establishment of haul routes.<br>• Measures must be put in place to prevent construction vehicles from entraining dirt onto public roads. |
| Local Road Condition | • A condition survey of the local roads to be used during the construction phase should be made prior to construction<br>• Haul and delivery routes should be defined and adhered to during the construction phase.<br>• Maintenance of local roads should take place during the construction phase to ensure that the local roads used by the contractor are left in the same or better condition than they were prior to the start of construction. |
| Increase in Dust | • Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms. This is especially the case when working near the Maremane settlement, the poultry farm south west of Groenwater, the ULCO and Lime Acres Aerodromes<br>• Mitigation measures management should be adhered to according to the relevant specialist studies. |
| Influx of workers | • All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors.<br>• People in search of work may move into the area, however, the project will create a limited number of job opportunities. Locally based people should be given an opportunity.<br>• No staff accommodation should be allowed on site. |
| Worker Health and Safety | • The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites.<br>• Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the pipelines.<br>• Contractors should establish HIV/AIDs awareness programmes at their site camps. |
| Security | • During construction, the working faces should be fenced to prevent trespassing and expansion of the working footprint.<br>• In preparation for the operations phase, each landowner should be given the choice between having the stretch of pipeline within his/her property fenced.<br>• All contractors' staff should be easily identifiable through their uniforms.<br>• A security policy should be developed which amongst others requires that permission be obtained prior to entering any property and provisions controlling trespassing by contractor staff.<br>• No staff, apart from security staff, should be allowed to reside at contractor camps.<br>• Contractors should establish a crime awareness programmes at their site camps. |

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Short-term disturbance arising from the construction phase</td></tr>
<tr><td colspan="2">Project life-cycle</td><td colspan="5">Construction phase</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2">Noise impacts</td><td colspan="5">• Prior notice should be given to surrounding communities of blasting events;<br>• Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.</td></tr>
<tr><td colspan="2">Damage to property</td><td colspan="5">• If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction<br>• The contractor is to make good any damage that occurs on any property as a result of construction work<br>• Where livestock are lost/stolen and there is a reasonable apprehension that the contractor was responsible, compensation is to be paid to the farmer for the loss.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Local</td><td>Medium</td><td>Short Term</td><td>Likely</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Local</td><td>Low</td><td>Short Term</td><td>Moderate</td><td>1</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">Disturbances during the construction phase can be successfully mitigated through contractor specifications issued at tender stage and through monitoring of contractor performance during the construction phase.<br><br>Negative impacts owing to the construction will be experienced irrespective of the site.</td></tr>
</table>

### 6.5.7 Cumulative Impacts

Cumulative impacts refer to the impacts that are incremental on the environment that results from the impacts of the proposed action when added to the existing foreseeable future actions. Cumulative impacts can be both positive and negative.

Cumulative impacts can be identified by combining the potential environmental implications of the proposed VGRWSS Phase 2 development with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

In this case, the study area has not been the recipient of large-scale projects in the recent past, nor are there any future projects of this magnitude being considered along this servitude. With this background, the authors do not consider it likely that the project will contribute to cumulative impacts in the study area.

# 7 ANALYSIS OF ALTERNATIVES

The benefits from the project doing ahead, from a socio-economic perspective, will be larger than the project not proceeding.

With regards to the project route selection, the table below describes the reason for the selections.

*Table 10: Table of Project Components and Alternatives*

| Component | Routes | Order of Preference (1: most preferred, 3: least preferred) | Comments |
|---|---|---|---|
| Go/No Go | To not carry out the proposed project | Not Supported | Water supply to the area will be less secure if the project did not go ahead. A secure water supply is a fundamental input to the social and economic activities of the area. |
| VGRWSS Phase 2 | Existing pipeline servitude | 1 | The pipeline traverses largely empty land while following existing infrastructure such as roads and railways to minimise the social and economic impacts. It is important to note that this route makes its way through some towns, commercial enterprises and a health care facility. However it does not affect residential buildings which may result in relocation. |

# 8 CONCLUSION

The study assessed the social and economic impacts of the proposed project. As expected of any construction project, there were several positive and negative socio-economic impacts identified.

No socio-economic fatal flaws were identified for the project mainly owing to the fact that the existing pipeline follows existing infrastructure to achieve this.

The identified negative impacts can be successfully mitigated and the positive impacts will bring economic and social benefit to the area.

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# ANNEXURE A - CENSUS OF VGRWSS PHASE 2 DIRECT SOCIO-ECONOMIC IMPACTS

***Table 1: Property Directly Impacted by the Pipeline***

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Residential Area | 28°24'26.18" S<br>24°15'55.57" E | Delpoortshoop<br><br>Pipeline |   |
| Gravel Road Crossing | 28°23'22.14" S<br>24°16'04.04" E | Delpoortshoop<br><br>Pipeline |   |
| Ulco Airport Building | 28°21'00.51" S<br>24°13'47.80" E | Delpoortshoop |   |
| Agricultural Building | 28°20'44.69" S<br>24°13'45.71" E | Delpoortshoop |   |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Irrigation Pivot, 300m distant | 28°20'00.44" S 24°13'33.57" E | Delpoortshoop |  |
| Rail Crossing | 28°19'52.72" S 24°13'56.65" E | Delpoortshoop / ULCO-Afrisam |  |
| ULCO-Afrisam Entrance Crossing | 28°19'22.04" S 24°14'01.16" E | Delpoortshoop / ULCO-Afrisam |  |
| ULCO-Afrisam Northern Encroachment | 28°18'33.33" S 24°13'10.52" E | Delpoortshoop / ULCO-Afrisam |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Minor Entrance Road Crossing | 28°18'20.56" S<br>24°10'19.58" E | ULCO-Afrisam |  |
| Kneukel Pump Station – not an impact | 28°18'17.87" S<br>24°08'49.39" E | ULCO-Afrisam |  |
| Cultivated Field | 28°17'53.13" S<br>24°07'44.93" E | ULCO-Afrisam |  |
| Minor Road Crossing and Agricultural Building | 28°17'21.87" S<br>24°06'36.81" E | ULCO-Afrisam |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Cultivated Field | 28°17'15.48" S<br>24°06'30.57" E | ULCO-Afrisam |  |
| Abandoned Agricultural Building, very low impact | 28°17'13.34" S<br>24°06'15.31" E | ULCO-Afrisam |  |
| Minor Entrance Road Crossing | 28°16'05.67" S<br>24°04'13.47" E | ULCO-Afrisam |  |
| Dwellings | 28°14'41.02" S<br>24°01'50.18" E | Koomansfontein |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Electrical Sub-Station | 28°14'48.52" S 23°57'44.47" E | Koopmansfontein |  |
| Plateau Railway Station | 28°15'19.07" S 23°54'17.41" E | Koopmansfontein |  |
| Electrical Sub-Station | 28°15'58.71" S 23°50'56.64" E | Koopmansfontein |  |
| Minor Road Crossing | 28°16'27.09" S 23°48'23.43" E | Koopmansfontein |  |
| Road Junctions | 28°16'53.96" S 23°46'15.16" E | Ariesfontein |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Dwellings | 28°16'59.79" S 23°45'38.00" E | Ariesfontein |  |
| Railway Sub-Station | 28°17'18.64" S 23°44'14.39" E | Ariesfontein |  |
| Trewil Pump Station – not an impact | 28°18'32.51" S 23°40'56.33" E | Ariesfontein |  |
| Railway Sub-Station | 28°19'38.77" S 23°37'51.63" E | Ariesfontein |  |
| Eskom Sub-Station | 28°19'54.84" S 23°37'23.85" E | Shaleje |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Road over Rail | 28°21'31.67" S 23°32'07.56" E | Shaleje |   |
| Rail Sub-Station | 28°21'31.79" S 23°32'00.96" E | Shaleje |   |
| Railway Dwellings | 28°21'40.66" S 23°31'24.15" E | Shaleje |   |
| PPC Lime | 28°21'38.22" S 23°30'23.47" E | Lime Acres |   |
| Residential Area, Lime Acres | 28°21'53.77" S 23°28'03.65" E | Lime Acres |   |

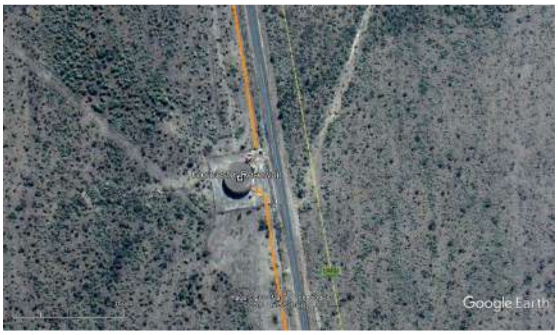
| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Lime Acres Aerodrome | 28°21'40.86" S 23°26'29.63" E | Lime Acres |  |
| Hostel Housing | 28°21'15.59" S 23°25'50.79" E | Lime Acres |  |
| Agricultural Building | 28°21'06.96" S 23°25'47.99" E | Lime Acres |  |
| Rail Sub-Station | 28°20'44.13" S 23°24'57.65" E | Lime Acres |  |
| Rail Crossing | 28°20'29.01" S 23°24'29.66" E | Lime Acres |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Clifton Reservoir – not an impact | 28°20'15.32" S 23°24'25.06" E | Lime Acres |  |
| Rail Crossing | 28°20'11.21" S 23°23'53.02" E | Lime Acres |  |
| Clifton Railway Station | 28°19'47.67" S 23°23'01.89" E | Lime Acres |  |
| Solar Farm | 28°18'55.16" S 23°21'14.29" E | Lime Acres |  |
| R31 Road Crossing | 28°17'28.43" S 23°20'15.48" E | Lime Acres |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Entrance to Metsimatala | 28°17'45.96" S<br>23°18'54.72" E | Groenwater / Metsimatala |  |
| Metsimatala Housing | 28°17'38.43" S<br>23°18'52.71" E | Groenwater / Metsimatala |  |
| Farm Entrance | 28°19'58.17" S<br>23°08'58.24" E | Postmasburg |  |
| Minor Road Crossing | 28°19'57.25" S<br>23°08'41.11" E | Postmasburg |  |
| Road Crossing | 28°19'49.47" S<br>23°05'21.96" E | Postmasburg |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Residential Area | 28°19'44.53" S 23°04'51.47" E | Posmasburg |  |
| Dwelling | 28°19'35.33" S 23°04'37.68" E | Postmasburg |  |
| Cultivated Field | 28°19'28.90" S 23°04'30.07" E | Postmasburg |  |
| Residential Area | 28°19'23.53" S 23°04'26.23" E | Postmasburg |  |
| Residential Area | 28°19'13.11" S 23°04'17.73" E | Postmasburg |  |

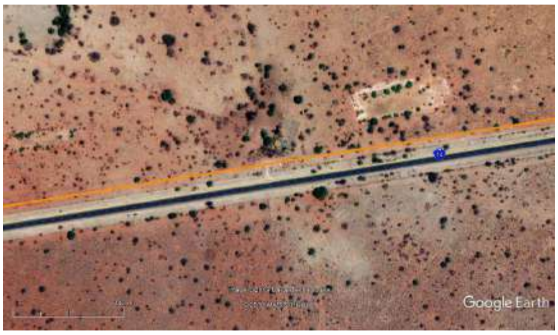
| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Commercial Centre | 28°19'03.42" S 23°04'03.17" E | Postmasburg |   |
| Residential Area | 28°18'23.08" S 23°04'15.03" E | Postmasburg |   |
| Quarry Entrance | 28°14'50.46" S 23°04'51.10" E | Postmasburg |   |
| Informal Settlement | 28°10'05.74" S 23°04'51.99" E | Postmasburg |   |
| Rail Crossing | 28°09'09.23" S 23°04'52.26" E | |   |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Gloucester Reservoir | 28°06'26.48" S 23°04'23.82" E | |   |
| Dwellings | 28°05'57.16" S 23°04'19.14" E | |   |
| Dwelling | 28°05'21.46" S 23°04'15.93" E | |   |
| Minor Road Crossing | 28°04'15.10" S 23°03'55.18" E | |   |
| Minor Road Crossing | 28°02'52.83" S 23°03'43.14" E | |   |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Informal Settlement | 28°03'00.46" S<br>23°03'10.94" E | Maremane |  |
| Rail Crossing, Assamang | 28°02'00.85" S<br>23°03'24.17" E | Maremane |  |
| Mine Entrance | 27°59'46.09" S<br>23°02'36.92" E | Maremane |  |
| Mine Entrance | 27°58'22.90" S<br>23°02'11.21" E | PMG Mine |  |
| Mine Entrance | 27°57'38.93" S<br>23°01'56.52" E | Olifantshoek |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Dwellings | 27°57'05.22" S<br>23°01'18.58" E | Olifantshoek |  |
| Dwellings - | 27°56'23.18" S<br>23°00'00.07" E | Olifantshoek |  |
| Transport Facility | 27°55'24.38" S<br>22°58'47.04" E | Olifantshoek |  |
| Commercial Facility | 27°54'31.69" S<br>22°57'40.19" E | Olifantshoek |  |
| N14 Road Crossing | 27°53'55.56" S<br>22°57'42.91" E | Olifantshoek |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Rail Crossing | 27°54'07.93" S<br>22°56'01.90" E | Olifantshoek |  |
| Minor Road Crossing | 27°54'25.26" S<br>22°53'52.29" E | Olifantshoek |  |
| Hostel Dwellings | 27°54'25.84" S<br>22°53'33.80" E | Olifantshoek |  |
| Dwelling | 27°54'30.44" S<br>22°53'20.57" E | Olifantshoek |  |
| Tourism Accomodation | 27°54'40.94" S<br>22°51'45.79" E | Olifantshoek |  |

| Name | Co-Ordinates | Nearest Town/ Project Component | Image |
|---|---|---|---|
| Entrance Crossing – Langeberg Stene | 27°55'09.13" S<br>22°48'43.23" E | Olifantshoek |  |
| Farm Reservoir | 27°55'22.70" S<br>22°47'00.74" E | Olifantshoek |  |
| Residential Area | 27°55'59.27" S<br>22°44'12.03" E | Olifantshoek |  |
| Olifantshoek Main Cemetery | 27°56'11.67" S<br>22°44'05.99" E | Olifantshoek |  |
| Olifantshoek Commnity Health Centre | 27°56'19.56" S<br>22°44'06.95" E | Olifantshoek |  |

# ANNEXURE B – SPECIALIST CV

**PERSONAL DATA** | **CIARAN CHIDLEY**

| | |
|---|---|
| Education | Pr Eng, BSc (Eng) (Civil) B.A. (Econ), MBA |
| Nationality | South African |
| Languages | English and Afrikaans |

## EDUCATION AND PROFESSIONAL QUALIFICATIONS

- Registered Professional Engineer with the Engineering Council of South Africa – Reg. no. 980360
- B.Sc (Eng) Civil Engineering – University of the Witwatersrand
- B.A. Economics, Philosophy – University of South Africa
- Master of Business Administration – University of the Witwatersrand

## EXPERIENCE OVERVIEW

Mr Chidley has gained experience in a range of different socio-economic projects during the 15 years of his professional career. They have revealed him as a researcher sympathetic to the needs for development and growth, whilst at the same time maintaining an environmental balance that will ensure that any growth is sustainable into the future.

Projects in this field include the implementation of an Expanded Public Works Programme in Soweto, Socio-Economic studies for the heavy infrastructure and mining industries in Mpumlanga and Limpopo, business planning for waste and waste related projects, economic assessments for local municipalities to allow the identification of core areas of economic advantage.

He has conducted social assessments in informal settlements with the aim of understanding living arrangements, sources of income, education levels and the condition of infrastructure items around dwellings. He has contributed to the development of educational programmes for informal settlements dwellers as well as to stakeholder engagements carried out in the settlements.

## EXPERIENCE AND KEY QUALIFICATIONS

### A) Facilitation of Mining Projects

1) Facilitation between stakeholders, Government Departments including Dept of Minerals and Energy, mines along the East Rand the public on all surface holings as a result of mining activities on the East Rand.
2) Facilitation and relocation strategy of illegal dwellers on the Arbour Mine.
3) Facilitation between stakeholders, Government Departments, mining houses and the public, social impact assessment, perception analysis of defunct mines in the Loskopdam catchment.
4) Public participation and license application as part of the amended EMPR for Baken Mine in the Northern Cape.
5) Facilitation of low cost housing projects on mining property.
6) Facilitation, detailed socio-economic study and social development strategy for Ticor on the new proposed Fairbreeze Mine.

## B) Socio-Economic Studies

1) Economic impact assessment of the environment affected by a proposed new 456kVA 375-kilometre-long transmission line from East London to Somerset East, Eastern Cape Province;
2) Nkomati Anthracite Mine Social Impact Assessment. The study covered the full extent of the mine footprint and the recommendations included measures to improve social relations between the mine and the surrounding communities;
3) Social impact and socio-economic studies for Rand Water for the provision of funds for poverty alleviation projects.
4) Cost benefit assessment, using an Input/Output model, of the proposed transmission network strengthening project between Middleburg and Groblersdal, Mpumalanga Province;
5) Socio-Economic Impact Assessment (SEIA) for an expansion of the operations of the Universal Coal New Clydesdale Coal Mine, south of Witbank;
6) Socio-economic study of the impact of the expansion of the Tweefontein Mining Complex, Mpumalanga
7) Socio-economic study of the impact of the expansion of the Vandyksdrift Mine, Mpumalanga
8) Socio-economic study of the impact of the expansion of the Landau Colliery, Mpumalanga
9) Socio economic study for the new Ticor Mtunzini Mine
10) Socio-Economic Impact Assessment for the Leslie 2 Underground Mine. The socio-economic study determined the local socio-economic, land utilisation and acquisition implications of the project
11) Economic assessment and development recommendations for the nodal development and rejuvenation of Verulam CBD, KwaZulu Natal Province;
12) Strategic Local Economic Development framework for the Mthonjaneni Local Municipality, centred on Melmoth, Kwa Zulu Natal Province;
13) Economic Status Quo Assessment of the Namakwa District Municipality in the Northern Cape, to identify opportunities and constraints to development in the region. Part of the district municipality's Environmental Management Framework;
14) Socio economic study for the Eskom Transmission Lines, 320 kilometres long, in Mpumalanga
15) Socio economic study for defunct asbestos mines in the Northern Cap Province
16) Socio economic study for the Sasol Clean fuels project

## C) Institutional and Social Development

1) Project Manager for a social and economic assessment of the informal settlements in Marikana, Rustenburg, more than 2 000 informal settlement households were enumerated during this survey;
2) Carried out an awareness and skills survey in Ivory Park, Johannesburg and then carried out an awareness and training programme to address the needs identified in the survey.
3) Completed a social survey for DWAF, on the impact of defunct mines in the Loskop Dam area on the social environment.
4) Undertook investigation of social facilitation aspect of four housing developments in Metsweding, namely Ekangala F1, F2 and F3, Rethabiseng Proper, Zithobeni Ext 8 and Onbekend, as well as numerous housing developments in Tshwane.
5) Performed a needs assessment for the Bekkersdal Township in the West Rand, and prepared Business Plans for combined school sports facilities and a water ring feed.

6) Undertook water and sanitation needs assessment for seven of the fourteen Southern African Development Community (SADC) member states.

## D) ENVIRONMENTAL AUDITING

1) Completed environmental auditing for the Jukskei EMF.
2) Completed environmental auditing for the Klipspruit EMF.
3) Currently undertaking environmental compliance monitoring of an EMP for the Leeukop Relief Outfall Sewer.
4) Currently undertaking environmental compliance monitoring of an EMP for the Modderfontein Outfall Sewer.

## E) GIS DEVELOPMENT

1) Designed, developed and implemented the GIS for the Jukskei River Course.
2) Designed, developed and implemented the GIS for the Klipspruit River Course.
3) Designed, developed and implemented the GIS for the Greater Ellis Park Area.

Declaration:

I confirm that the above CV is an accurate description of my experience and qualifications.

| | |
|---|---|
| Signature of Staff Member | Date |
| Ciaran Chidley | 20 August 2016 |

# Dr Neville Bews & Associates

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07 October, 2019

**Attention: Christian van der Hoven**

**Nemai Consulting**

147 Bram Fischer Drive,

Ferndale,

Randburg

**Re: Peer review of the Social Impact Specialists Report for the Proposed Upgrade of the Vaal Gamagara Regional Water Supply Scheme Phase 2**

Having reviewed the above report I find that it provides a good description of the project and the social environment within which the project will unfold. It also provides a good indication of the social impacts that are likely to arise as a result of the proposed project and suggests appropriate optimisation and mitigation measure. The review was concluded on 07 October, 2019 and the following comments are made:

1. The terms of reference are acceptable.
2. The methodology is clearly explained and acceptable.
3. The findings are based on acceptable evidence.
4. The mitigation measures and recommendations are appropriate.
5. Consideration needs to be given to the issues raised in the attached schedule. See the comment column of the attached schedule.
6. The reference literature is appropriate.
7. No site-inspection was carried out as part of this peer review.
8. The report is well-written and easy to understand.

Attached is a schedule, in accordance with Appendix 6 of the National Environmental Management Act, 1998 (ACT NO. 107 OF 1998). Environmental Impact Assessment Regulations, 2014, indicating the level of compliance of the report in respect of this regulation.

**DECLARATION OF INDEPENDENCE**

I, Neville Bews, as authorised representative of Dr Neville Bews & Associates hereby confirm my independence as a specialist and declare that neither I nor Dr Neville Bews & Associates have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Dr Neville Bews & Associates was appointed as social impact assessment specialists in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed. This declaration is specifically in connection with the review of the Social Impact Report for Proposed Upgrade of The Vaal Gamagara Regional Water Supply Scheme Phase 2.

Signed: Date: 07 October, 2019

## Proposed Upgrade of The Vaal Gamagara Regional Water Supply Scheme Phase 2

| **Appendix 6: Specialist reports** | **Section** | **Comment** |
|---|---|---|
| A specialist report prepared in terms of these Regulations must contain- | | |
| (a) details of-<br>(i) the specialist who prepared the report; and<br>(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae; | Not provided | To be inserted into the report. |
| (b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Not provided | To be inserted into the report. |
| (c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1 P1-2 | |
| cA) An indication of the quality and age of base data used for the specialist report. | Not indicated | Could easily be addressed under Section 4.3 |
| cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change. | Section 6 | Cumulative impacts were not considered |
| (d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Not applicable | |
| (e) a description of the methodology adopted in preparing the report or carrying out the specialised process; | Section 4 | |
| (f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure; | Sections 5 & 6 | |
| (g) an identification of any areas to be avoided, including buffers; | Page 47 | Olifantshoek CHC |
| (h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Not applicable | |
| (i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 4.3 | See comment cA) above |
| (j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment; | Section 5, 7 & Annexure A | |
| (k) any mitigation measures for inclusion in the EMPr; | Section 6 | |
| (l) any conditions for inclusion in the environmental authorisation; | None | |
| (m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | None | |
| (n) a reasoned opinion-<br>(i) as to whether the proposed activity or portions thereof should be authorised; and<br>(ii)if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Sections 6, 7 & 8 | |
| (o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | Section 5.3 | |
| (p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto | Not included | |
| (q) any other information requested by the competent authority. | Not applicable | |
| 2. Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | Not applicable | |

Reviewer: Neville Bews

Date: 07 October, 2019

Dr Neville Bews & Associates
SOCIAL IMPACT ASSESSORS

# Curriculum Vitae Neville Bews

## Dr. Neville Bews & Associates – Johannesburg, South Africa

**EDUCATION**

- *B.A. (Soc), University of South Africa, 1980*
- *B.A. (Soc) (Hons), University of South Africa, 1984*
- *The Henley Post Graduate Certificate in Management, Henley Management College, United Kingdom*
- *M.A. (Cum Laude), Rand Afrikaans University, 1999*
- *D. Litt. et Phil., Rand Afrikaans University, 2000*

Dr Neville Bews is a senior social scientist and human resource professional with 38 years' experience. He consults in the fields of Social Impact Assessments and research, and human resource management. He has worked on a number of large infrastructure, mining and water resource projects. He at times lectures on social impact assessment for the Department of Sociology, University of Johannesburg.

## EXPERIENCE – EXAMPLES

### Water resources and regional planning Social Impact Assessments

**Department of Water Affairs and Forestry** **South Africa**

Social impact assessment for the Mokolo and Crocodile River (West) Water Augmentation Project for increased and assurance of water supply. Research socio-economic circumstances, data analysis, assessment, authored report.

Mzimvubu Water Project Eastern Cape. Research socio-economic circumstances, data analysis, assessment, authored report. Umkhomazi Water Project Phase 1 – Raw Water Component Smithfield Dam - 14/12/16/3/3/3/94; Water Conveyance Infrastructure - 14/12/16/3/3/3/94/1; Balancing Dam - 14/12/16/3/3/3/94/2.

Umkhomazi Water Project Phases 1 – Raw Water Components
Smithfield Dam – 14/12/16/3/3/3/94/
Water Conveyance Infrastructure – 14/12/16/3/3/3/94/1
Balancing Dam – 14/12/16/3/3/3/94/2

Umkhomazi Water Project Phases 2 – Potable Water Component – 14/12/16/3/3/3/95.

**The Aveng (Africa) Group Limited (Grinaker LTA)** **South Africa**

Assisting the construction company with the social management of the Mokolo and Crocodile River (West) Water Augmentation Project. Consult and mediate between contractors and affected parties advise on strategies to reduce tensions between contractors and the public.

**Sedibeng District Municipality** **South Africa**

Social impact assessment for the Environmental Management Plan for the Sedibeng District, on behalf of Felehetsa Environmental (Pty) Ltd. Research socio-economic circumstances, data analysis, assessment, authored report.

**Felehetsa Environmental (Pty) Ltd** **South Africa**

Social Impact Assessment for Waterfall Wedge housing and business development situated in Midrand Gauteng. Research socio-economic circumstances, data analysis, assessment, authored report.

**NEMAI Consulting Environmental & Social Consultants** **South Africa**

Ncwabeni: Off-Channel Storage Dam, KwaZulu-Natal. Research socio-economic circumstances, data analysis, assessment, authored report.

## Social Assessments for mining clients

**Vale** **Mozambique**

Socio-economic impact assessment of proposed Moatize power plant, Tete. Research socio-economic circumstances, data analysis, assessment, authored report.

**Exxaro Resources Limited** **South Africa**

Social impact assessment for the social and labour plan for Leeuwpan Coal Mine, Delmas. Research socio-economic circumstances, data analysis, assessment, authored report.

Social impact assessment for the social and labour plan for Glen Douglas Dolomite Mine, Henley-on-Klip. Research socio-economic circumstances, data analysis, assessment, authored report.

Social impact assessment for the social and labour plan for Grootegeluk Open Cast Coal Mine, Lephalale. Research socio-economic circumstances, data analysis, assessment, authored report.

Social and labour plan for the Paardekraal Project, Belfast. Research socio-economic circumstances, data analysis, assessment, authored report.

Social impact assessment for the Paardekraal Belfast Project Belfast. Research socio-economic circumstances, data analysis, assessment, authored report.

**Kumba Resources Ltd** **South Africa**

Social Impact Assessments for the Sishen Iron Ore Mine in Kathu Northern Cape. Research socio-economic circumstances, data analysis, assessment, authored report.

Social Impact Assessments for the Sishen South Project in Postmasburg, Northern Cape. Research socio-economic circumstances, data analysis, assessment, authored report.

Social Impact Assessments for the Dingleton resettlement project at Sishen Iron Ore Mine Kathu, Northern Cape. Research socio-economic circumstances, data analysis, assessment, authored report.

**Gold Fields** **South Africa**

Social Impact Assessment for the Gold Fields West Wits Project. Research socio-economic circumstances, data analysis, assessment, authored report.

**Anglo Coal** **South Africa**

Review of social impact assessment for the proposed Waterberg Gas 37-spot coalbed methane (CBM) bulk yield test project.

**Sekoko Mining** **South Africa**

Sekoko Wayland Iron Ore, Molemole Local Municipalities in Limpopo Province. Research socio-economic circumstances, data analysis, assessment, authored report.

**Memor Mining (Pty) Ltd** **South Africa**

Langpan Chrome Mine, Thabazimbi, Limpopo. Research socio-economic circumstances, data analysis, assessment, authored report.

**Prescali Environmental Consultants (Pty) Ltd** **South Africa**

Vlakpoort Open Cast Mine – Thabazimbi, Limpopo. Research socio-economic circumstances, data analysis, assessment, authored report.

**Afrimat Ltd** **South Africa**

1. Marble Hall Lime Burning Project: Social Impact Assessment – Limpopo.
2. Glen Douglas Lime Burning Project: Social Impact Assessment - Henley-on Klip, Midvaal

## Social assessments for regional and linear projects

**Gautrans** **South Africa**

Social impact for the Gautrain Rapid Rail Link, Pretoria to Johannesburg and Kempton Park. Managed a team of 10 field workers, research socio-economic circumstances, data analysis, assessment, and co-authored report.

**South African National Road Agency Limited** **South Africa**

Social Impact of tolling the Gauteng Freeway Improvement Project. Research socio-economic circumstances, data analysis, assessment, authored report.

Social Impact of the N2 Wild Coast Toll Highway. Managed a team of three specialists. Research socio-economic circumstances, data analysis, assessment, co-authored report.

SIA for the N3 Keeversfontein to Warden (De Beers Pass Section). Research socio-economic circumstances, data analysis, assessment, authored report.

**Transnet** **South Africa**

Social impact assessment for the Transnet New Multi-Product Pipeline Project (555 km) (Commercial Farmers). Research socio-economic circumstances, data analysis, assessment, authored report.

Expansion of Railway Loops at Arthursview; Paul; Phokeng and Rooiheuwel Sidings in the Bojanala Platinum District Municipality in the North West Province for Transnet Soc Ltd.

**Eskom Holdings Limited** **South Africa**

Social Impact Assessment for the Ubertas 88/11kV Substation in Sandton, Johannesburg. Research socio-economic circumstances, data analysis, assessment, authored report.

Nuclear 1 Power Plant. Assisted with the social impact assessment consulting to Arcus GIBB Engineering & Science. Peer review and adjusted the report and assisted at the public participation feedback meetings.

Social impact assessment for Eskom Holdings Limited, Transmission Division's Neptune-Poseidon 400kV Power Line in the Eastern Cape. Research socio-economic circumstances, data analysis, assessment, authored report.

Social Impact assessment for Eskom Holdings Limited, Transmission Division, Forskor-Mernsky 275kV±130km Powerline and Associated Substation Works in Limpopo Province. Research socio-economic circumstances, data analysis, assessment, authored report.

**Eskom Holdings Limited, Transmission Division** **South Africa**

Social Impact assessment for Eskom Holdings Limited, Transmission Division, Tubatse Strengthening Phase 1 – Senakangwedi B Integration in Limpopo Province. Research socio-economic circumstances, data analysis, assessment, authored report.

Basic SIA study for Proposed 1 X 400 kV Eskom Maphutha - Witkop 170 km Powerline.

Social Impact Assessment for the Mulalo Main Transmission Substation and Power Line Integration Project, Secunda

**MGTD Environmental** **South Africa**

Social impact assessment for a 150MW Photovoltaic Power Plant and Associated Infrastructure in Mpumalanga. Research socio-economic circumstances, data analysis, assessment, authored report.

10MWp Photovoltaic Power Plant & Associated Infrastructure, North West Province. Research socio-economic circumstances, data analysis, assessment, authored report.

**eThekwini Municipality** **South Africa**

Social impact assessment for the proposed infilling of the Model Yacht Pond at Blue Lagoon, Stiebel Place, Durban. Research socio-economic circumstances, data analysis, assessment, authored report.

Kennedy Road Housing Project, Ward 25 situated on 316 Kennedy Road, Clare Hills (Erf 301, Portion 5).

**Afzelia Environmental Consultants and Environmental Planning & Design** **South Africa**

Proposed Cato Ridge Crematorium In Kwazulu-Natal Province

**MGTD Environmental** **South Africa**

ABC Prieska Solar Project; Proposed 75 MWp Photovoltaic Power Plant and its associated infrastructure on a portion of the remaining extent of ERF 1 Prieska, Northern Cape. Research socio-economic circumstances, data analysis, assessment, authored report.

ABC Prieska Solar Project; Proposed 75 MWp Photovoltaic Power Plant and its associated infrastructure on a portion of the remaining extent of ERF 1 Prieska, Northern Cape.

## Assessments for social projects and social research

**Australia – Africa 2006 Sport Development Program** **South Africa**

To establish and assess the impact of the Active Community Clubs Initiative on the communities of NU2 (in the township of Mdantsane)*and Tshabo (a rural village). Lead researcher social, data collection and analysis, assessment.

**United Nations Office on Drugs and Crime** **South Africa**
Evaluation of a Centre for Violence Against Women in Upington. Research socio-economic circumstances, data analysis, assessment, co-authored report.

**University of Johannesburg** **South Africa**
Research into research outputs of academics working in the various departments of the university. Research socio-economic circumstances, data analysis, assessment, authored report.

## Human Resource and management training

**Various national companied** **South Africa**
Developed and run various management courses such as, recruitment selection & placement; industrial relations / disciplinary hearings; team building workshops; multiculturalism workshop. 1986-2007

**University of South Africa, Department of Industrial Psychology** **South Africa**
Developed the performance development study guide for industrial psychology 3. 2000

**Authored Chapters in HR books** **South Africa**
In Slabbert J.A. de Villiers, A.S. & Parker A (eds.). Managing employment relations in South Africa. Teamwork within the world-class organisation. 2005

In Muchinsky, P. M. Kriek, H. J. & Schreuder, A. M. G. Personnel Psychology 3rd Edition
Chapter 9 – Human resource planning.
Chapter 10 – The changing nature of work. 2005

In Rossouw, G. J. and van Vuuren, L. Business Ethics - Made in Africa 4th Edition.
Chapter 11 – Building Trust with Ethics. 2010

**South African Management Development Institute (SAMDI)** **Democratic Republic of the Congo**
Developed a course on Strategic Human Resource Planning for SAMDI and the Democratic Republic of the Congo as well as trainer's manuals for this course. 2006.

**Competition Tribunal** **South Africa**
Developed a Performance Management System and Policy for the Competition Tribunal South Africa. 2006

## PUBLICATIONS

Bews, N. & Martins, N. 2002. An evaluation of the facilitators of trustworthiness. SA Journal of Industrial Psychology. 28(4), 14-19.

Bews, N. Martins, N. & von der Ohe, H. 2002. Editorial. SA Journal of Industrial Psychology. 28(4), 1.

Bews, N. & Rossouw, D. 2002. Contemporary organisational change and the importance of trust. SA Journal of Industrial Psychology. 28(4), 2-6.

Bews, N. & Uys, T. 2002. The impact of organisational restructuring on perceptions of trustworthiness. SA Journal of Industrial Psychology. 28(4), 21-28.

Bews, N & Rossouw, D. 2002. A role for business ethics in facilitating trustworthiness. Journal of Business Ethics. 39: 377-390.

Bews, N. 2009. A matter of trust – Gaining the confidence of the public and client. IAIA Newsletter Forthcoming (Spring 2009).

Bews, N. 2009. Does he who pays the bill call the shots? Sitting astride client and public interest – the dilemma of maintaining credibility in impact assessments. IAIA Newsletter Winter – 2009.

Bews, N. 2002. Reducing your company's risk of sexual harassment claims. HR Future. (2) 2 10-11.

Bews, N. & Martins, N. von der Ohe, H. 2002. Organisational change and trust: Experiences here and abroad. Management Today, (18) 8 34-35.

Martins, N. Bews, N. & von der Ohe, H. 2002. Organisational change and trust. Lessons from Europe and South African organisations. HR Future, (2)9 46-47.

Rossouw, D. & Bews, N. 2002. The importance of trust within a changing business environment. Management Today. 18(2) 26-27.

Bews, N. 2001. You can put a value to trust in the new economy. HR Future, (1)1 48-49.

Bews, N. 2001. Maintaining trust during organisational change. Management Today, (17) 2 36-39.

Bews, N. 2001. Business ethics, trust and leadership: how does Africa fare? Management Today, (17) 7 14-15.

Rossouw, D & Bews, N. 2001. Trust is on the decline in the workplace, yet it's vital for modern organisational success. People Dynamics. (18) 6 28-30.

Bews, N. & Uys, T. 2001. The effects of restructuring on organisational trust. HR Future, (1)8 50-52.

Rossouw, G. J. & Bews. N. F. 2010. Building Trust with Ethics. In Rossouw, G. J. and van Vuuren, L. Business Ethics - Made in Africa 4th Edition. Cape Town: Oxford University Press.

Bews N. 2005. Teamwork within the world-class organisation. In Slabbert J.A. de Villiers, A.S. & Parker A (eds.). Managing employment relations in South Africa. Durban : Butterworths.

Bews, N. F. 2005. Human resource planning. In Muchinsky, P. M. Kriek, H. J. & Schreuder, A. M. G. 2005. Personnel Psychology 3rd Edition. Cape Town; Oxford University Press.

Bews, N. F. 2005. The changing nature of work. In Muchinsky, P. M. Kriek, H. J. & Schreuder, A. M. G. 2005. Personnel Psychology 3rd Edition. Cape Town; Oxford University Press.

Bews, N. F. 2005. Chapter 9 & 13. In Muchinsky, P. M. Kriek, H. J. & Schreuder, A. M. G. 2005. Instructor's Manual. Personnel Psychology 3rd Edition. Cape Town; Oxford University Press.

Bews, N. F., Schreuder, A. M. G. & Vosloo, S. E. 2000. Performance Development. Study guide for Industrial Psychology 3. Pretoria: University of South Africa.

Uys, T. and Bews, N. 2003. ''Not in my Backyard'': Challenges in the Social Impact Assessment of the Gautrain. Department of Sociology Seminar, RAU. 23 May 2003.

Bews, N. 2002. The value of trust in the new economy. Industrial Relations Association of South Africa (Irasa). Morning seminar 21 August 2002.

Bews. N, 2002. The issue of trust considered. Knowledge Recourses seminar on Absenteeism. The Gordon Institute of Business. 27 August 2002.

Bews, N. & Uys, T. 2001. The impact of organisational trust on perceptions of trustworthiness. South African Sociological Association Conference. Pretoria.

Bews, N. 2001. Business Trust, Ethics & Leadership:- Made in Africa. International Management Today/Productivity Development Conference. Hosted by Productivity Development (Pty) Ltd & Management Today. Best Knowledge in Leadership Practice Conference 23-24 July 2001.

Bews, N. 2001. Charting new directions in leading organisational culture and climate change. Workplace Transformation and Organisational Renewal. Hosted by The Renaissance Network. November 2001.

Bews, N. 2000. Towards a model for trust. South African Sociological Association Conference. Saldanha.

Bews, N. 2003. 'Social Impact Assessments, theory and practice juxtaposed – Experience from a South African rapid rail project.' New Directions in Impact Assessment for Development: Methods and Practice Conference. University of Manchester, Manchester, England.

## MEMBERSHIP OF PROFESSIONAL BODIES

Member of South African Affiliate of the International Association for Impact Assessment (IAIAsa). Membership Number: 2399

Registered on database for scientific peer review of iSimangaliso GEF project outputs

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

Vaal Gamagara Regional Water Supply Scheme Phase 2: Upgrading of Existing Scheme

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | | |
|---|---|---|---|---|---|
| Specialist Company Name: | Index | | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | NA | | Percentage Procurement recognition | NA |
| Specialist name: | Andries Gouws | | | | |
| Specialist Qualifications: | BSc Agric (Hons), PhD | | | | |
| Professional affiliation/registration: | Soil Science Society of South Africa, SASNAP | | | | |
| Physical address: | 277 Eridanus Street, Waterkloof Ridge, Pretoria | | | | |
| Postal address: | P O Box 26275, Monument Park | | | | |
| Postal code: | 0108 | | Cell: | 0828076717 | |
| Telephone: | | | Fax: | | |
| E-mail: | index@iafrica.com | | | | |

## 2. DECLARATION BY THE SPECIALIST

I, **Johan Andries Gouws**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

**INDEX**

Name of Company:

**1 August 2019**

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Johan Andries Gouws, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

**INDEX**

Name of Company

1 August 2019

Date

Signature of the Commissioner of Oaths

1 August 2019

Date

FRANCOIS GOUWS
COMMISSIONER OF OATHS
PRACTISING ATTORNEY (RSA)
414 SUSSEX AVENUE
LYNNWOOD, PRETORIA

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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**PROJECT TITLE**

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3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1.

**SPECIALIST INFORMATION**

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | The Biodiversity Company | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | 4 | Percentage Procurement recognition | |
| Specialist name: | Tyron Clark | | | |
| Specialist Qualifications: | Master of Science | | | |
| Professional affiliation/registration: | | | | |
| Physical address: | 77 Peridot Street, Jukskei Park, 2188 | | | |
| Postal address: | info@thebiodiversitycompany.com | | | |
| Postal code: | | Cell: | 0836229224 | |
| Telephone: | | Fax: | | |
| E-mail: | tyron@thebiodiversitycompany.co m | | | |

## 2. DECLARATION BY THE SPECIALIST

I, ___Tyron Clark______________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

The Biodiversity Company

Name of Company:

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Tyron Clark, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

05 August 2019

Date

M A Senna    Mueti David Senna

Signature of the Commissioner of Oaths

05 August

Date

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
2019 -08- 05
DOUGLASDALE
SOUTH AFRICAN POLICE SERVICE

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

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0001

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Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | McGregor Museum Archaeology Department , DSAC, NCPG | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | N/A [Provincial Public Entity] | Percentage Procurement recognition | N/A [Provincial Public Entity] |
| Specialist name: | Prof David Roger Neacalbánn McIntyre Morris – supervising Ms Abenicia Henderson | | | |
| Specialist Qualifications: | PhD | | | |
| Professional affiliation/registration: | Association of Southern African Professional Archaeologists Member #91 | | | |
| Physical address: | McGregor Museum 7 Atlas Street Kimberley | | | |
| Postal address: | P.O. Box 316, Kimberley | | | |
| Postal code: | 8300 | Cell: | 082 2224777 | |
| Telephone: | 053 8392707 | Fax: | 053 8421433 | |
| E-mail: | dmorriskby@gmail.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, ___David Roger Neacalbánn McIntyre Morris______________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

McGregor Museum (Archaeology Department)

Name of Company:

12/8/19

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, David Roger Neacalbánn McIntyre Morris ___________ swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

McGregor Museum (Archaeology Department)

Name of Company

12 / 8 / 19.

Date

Bothma.

Signature of the Commissioner of Oaths

12/8/2019

Date

AMANDA BOTHMA
Kommissaris van Ede / Commissioner of Oaths
Akte Sekretaresse/ Deeds Secretary
DUNCAN & ROTHMAN
Office 69, Suite 1, 1st Floor, North Cape Mall
31 Jacobus Smit Street, KIMBERLEY 8301
Ref/Verw. 9/1/8/2 Kimberley (9/3/07)

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

Vaal Gamagara Regional Water Supply Scheme Phase 2: Upgrading of Existing Scheme

**Kindly note the following:**

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**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address:**
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Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Banzai Environmental Pty Ltd | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | | Percentage Procurement recognition | |
| Specialist name: | Elize Butler | | | |
| Specialist Qualifications: | MSc | | | |
| Professional affiliation/registration: | PSSA | | | |
| Physical address: | 14 Eddie De Beer Street, Dan Pienaar, Bloemfontein, 9301 | | | |
| Postal address: | di | | | |
| Postal code: | 9301 | Cell: | 084 4478 759 | |
| Telephone: | | Fax: | | |
| E-mail: | Elizebutler002@gmail.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, _______Elize Butler________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
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- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

______________________________

Signature of the Specialist

Banzai Environmental Pty Ltd

Name of Company:

5/8/ 2019.

Date

### 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ________Elize Butler________________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Banzai Environmental Pty Ltd

Name of Company

5/08/2019.

Date

8167196

Signature of the Commissioner of Oaths

2019-08-05.

Date

COM. VICE CENTRE

2019 -08- 0 5

2019-08-05 at 08:41

8167196

(HANDTEKENING) KOMMISSARIS VAN EDE
(SIGNATURE) COMMISSIONER OF OATHS

Rachel Dirache

VOLLE VOORNAME EN VAN IN DRUKSKRIF
FULL FIRST NAMES AND SURNAME IN BLOCK LETTERS

SA POLISIEDIENS
SA POLICE SERVICE

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

Vaal Gamagara Regional Water Supply Scheme Phase 2: Upgrading of Existing Scheme

**Kindly note the following:**

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**Departmental Details**

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Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address:**
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Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Dr Neville Bews & Associates | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | N/A | Percentage Procurement recognition | N/A |
| Specialist name: | Neville Bews | | | |
| Specialist Qualifications: | D Litt. et Phil | | | |
| Professional affiliation/registration: | AIAIsa | | | |
| Physical address: | 84 Hennie Alberts Street Brackenhurst | | | |
| Postal address: | PO Box 145412 Bracken Gardens | | | |
| Postal code: | 1452 | Cell: | 0825573489 | |
| Telephone: | 011 867-0462 | Fax: | 086621-8345 | |
| E-mail: | bewsco@netactive.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Neville Bews ______________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Dr Neville Bews & Associates

Name of Company:

29 January, 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, ___Neville Bews______________________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Dr Neville Bews & Associates

Name of Company

29 January, 2020

Date

TSELANE 3
CONSTABLE
SAPS

Signature of the Commissioner of Oaths

2020-01-29

Date

SOUTH AFRICAN POLICE SERVICE
SUPPORT SERVICES
COMMANDER
2020 -01- 29
BRACKENDOWNS
EAST RAND
SOUTH AFRICAN POLICE SERVICE

**environmental affairs**

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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**PROJECT TITLE**

| |
|---|
| Vaal Gamagara Regional Water Supply Scheme Phase 2: Upgrading of Existing Scheme |

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Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
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Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | | Percentage Procurement recognition | |
| Specialist name: | Ciaran Chidley | | | |
| Specialist Qualifications: | B.A. (Economic), MBA | | | |
| Professional affiliation/registration: | | | | |
| Physical address: | 147 Bram Fischer Drive, Ferndale | | | |
| Postal address: | P.O.Box 1673, Sunnighill | | | |
| Postal code: | 2157 | Cell: | 082 788 1298 | |
| Telephone: | 011 781 1730 | Fax: | 011 781 1731 | |
| E-mail: | CiaranC@nemai.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, ___Ciaran Chidley________________________, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
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- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Name of Company:

2019-08-15

Date

### 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, __Ciaran Chidley______________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company

2019-08-15

Date

0484399 W/O Sarite

Signature of the Commissioner of Oaths

2019/08/15

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -08- 15
C.S.C
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SUID-AFRIKAANSE POLISIEDIENS

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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Arcadia

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Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | | Percentage Procurement recognition | |
| Specialist name: | Avhafarei Ronald Phamphe | | | |
| Specialist Qualifications: | M.Sc (Botany) | | | |
| Professional affiliation/registration: | Professional Natural Scientist: South African Council for Natural Scientific Professions Ecological Science (400349/2)<br>Professional Member of South African Institute of Ecologists and Environmental Scientists<br>Professional Member: South African Association of Botanists. | | | |
| Physical address: | 147 Bram Fischer Drive, Ferndale | | | |
| Postal address: | P.O.Box 1673, Sunninhhill | | | |
| Postal code: | 2157 | Cell: | 0827836724 | |
| Telephone: | 011 781 1730 | Fax: | 011 781 1731 | |
| E-mail: | AvhafareiP@nemai.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, AVHAFAREI PHAMPHE, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
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- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

NEMAI CONSULTING

Name of Company:

06/08/2019

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Avhafarei Phamphe, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Nemai Consulting

Name of Company

06/08/2019

Date

Malesa

Signature of the Commissioner of Oaths

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -08- 06
C.S.C
LINDEN
SUID-AFRIKAANSE POLISIEDIENS

Date

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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Arcadia

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Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Rautenbach Biodiversity Consulting | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | | Percentage Procurement recognition | |
| Specialist name: | Anita Rautenbach | | | |
| Specialist Qualifications: | MSc. Biological Science | | | |
| Professional affiliation/registration: | SACNASP 400725/15 | | | |
| Physical address: | 13 Killarney Valley Road, Cato Ridge, Durban | | | |
| Postal address: | As above | | | |
| Postal code: | 0132 | Cell: | 083 305 1516 | |
| Telephone: | 083 305 1516 | Fax: | | |
| E-mail: | rabiodiversity@gmail.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Anita Rautenbach, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
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Signature of the Specialist

Rautenbach Biodiversity Consulting

Name of Company:

29/01/2020

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Anita Rautenbach, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Rautenbach

Signature of the Specialist

Rautenbach Biodiversity Consulting

Name of Company

29/01/2020

Date

T.A Vezi

Signature of the Commissioner of Oaths

COMMISSIONER OF OATHS EX OFFICIO
CHIEF LEGAL ADVISOR
SOUTH AFRICAN POST OFFICE LIMITED
SAVEWAY BUILDING CNR LINKWANDA ROAD,
WATERFALL 3652

LINK HILLS 44541
2020 -01- 29
1

2020 -01-29

Date