PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL & TERRESTRIAL BIODIVERSITY COMPLIANCE STATEMENT

KTE ORANGE RIVER PIPELINE

Proposed Development of the KTE Water Pipeline and associated infrastructure and the expansion of the existing Kenhardt pipeline infrastructure from the Orange River to the Farm Uitkyk, No.889 within the Kai! Garib and Hantam Municipalities, Northern Cape.

KAI !GARIB & HANTAM MUNICIPALITIES, NORTHERN CAPE PROVINCE.

PREPARED FOR:
ENVIROAFRICA.

PREPARED BY:
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EXECUTIVE SUMMARY

Kutulo Tsatsi Energy Pty Ltd (KTE) proposed, the development of the KTE Water Pipeline and associated infrastructure and the expansion of the existing Kenhardt pipeline infrastructure from the Orange River to the Farm Uitkyk, No.889 within the Kai! Garib and Hantam Municipalities, Northern Cape.

Water for the project will be sourced from the Orange River near Keimoes (Neilersdrif), from where it will be pumped/gravitate to a reservoir on the farm Uitkyk 889/1 (a distance of just over 200 km). Water extraction will occur at the same location as the existing Kenhardt bulk water supply (BWS) pump station. The proposed pipeline will be located within the western road reserve of the R27 from Neilersdrif to Kenhardt with a water treatment works (WTW) just south of Neilersdrif (east of the R27) and a new reservoir about 30 km further south. At Kenhardt the pipeline will run to the west and south of town, crossing the Hartbees River, towards the east of the R27. It will then run in the eastern road reserve of the R27 to a booster pump station on the Farm De Bakke (±22km south of Kenhardt) from where it will gravitate (still in the eastern road reserve) to the Soafskolk gravel road (about 50 km further south). The proposed pipeline will then follow minor gravel roads (located within the road reserve of these roads) first to the Farm Styns Vley and then to the farm Uitkyk, about 60 km to the east-southeast of the Soafskolk turn-off.

VEGETATION TYPE & STATUS

According to the South African vegetation map (2018) (Mucina & Rutherford, 2006, updated), the proposed pipeline route will potentially impact on various vegetation types. Starting from the Orange River, moving south to Uitkyk Farm the following vegetation types are expected (Figure 3):

1. **Lower Gariep Alluvial Vegetation (LC)**, along the Orange River;
2. The northern half of the pipeline route will impact mostly on **Bushmanland Arid Grassland (LC)** for most of the way along the R27 to about 20km south of Kenhardt with intrusions of;
    - **Gordonia Duneveld (LC)** between Lennertsville and Kenhardt;
    - **Lower Gariep Broken Veld (LC)**, associated with the dolerite rocky outcrops along the R27;
3. The southern half of the pipeline route will impact mostly on **Bushmanland Basin Shrubland (LC)** from about 20km south of Kenhardt all the way to Farm Uitkyk, with intrusions of:
    - **Lower Gariep Broken Veld (LC)** (dolerite rocky outcrops);
    - **Bushmanland Vloere (LC)** just touching the road reserve in some areas;

All of these vegetation types are classified as of "**Least Concern**", in terms of the "*Revised National list of ecosystems that are threatened and in need of protection*" (GN. No. 2747 of 18 November 2022).

WATER COURSES AND WETLANDS

The pipeline route and associated infrastructure will cross numerous watercourses and even salt pans along its route. According to the **DFFE Screening Tool** report for the footprint area (Appendix 2), the relative Aquatic biodiversity theme sensitivity is considered of **Very High sensitivity**. As a result, a Freshwater Specialist has been appointed to evaluate the aquatic biodiversity theme (not discussed in this study).

LAND-USE

The pipeline route will be placed within road reserves, wherever possible, to minimise the impact on pristine vegetation. According to the 2020 (9-Class) National Land Cover Map of South Africa, most of the properties along the route still support natural veld, used for livestock grazing (which is consistent with the findings of the site visit).

CONSERVATION PRIORITY AREAS

The pipeline route and associated infrastructure will impact on a number of CBA and ESA areas as identified by the 2016, Northern Cape critical biodiversity areas maps (Refer to Figure 4 & Figure 5). This includes the CBA areas associated with the Orange River

corridor, which aim at the protection of remaining riparian vegetation and connectivity. Further south the CBA's likely aims at the protection of species of conservation concern (SoCC) associated with the rocky dolerite outcrops (Lower Gariep Broken Veld), and the deeper sandy soils of the Gordonia Duneveld intrusions and the river systems. The ESA areas are mostly associated with smaller episodic watercourses.

In Figure 5, the CBA areas seems to be associated with the protection of the Bushmanland Vloere and rocky outcrops (Lower Gariep Broken Veld) with its potential to contain SoCC.

The pipeline route has been specifically chosen to fall within the road reserve of existing roads wherever possible to minimise the impact on natural vegetation in good condition.

VEGETATION ENCOUNTERED

In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo (Mucina & Rutherford, 2006).

Orange River extraction point (Heading 5.1 & 7.1): Lower Gariep Alluvial Vegetation (Figure 6) was expected in this area, however, the riparian vegetation along the river in this area, had been transformed because of agricultural activities (vineyards) and the existing Kenhardt WTW. The plant species theme sensitivity = **Very-Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

Lennertsville WTW (Heading 5.2 & &.2): Two potential locations for the proposed WTW were evaluated, one to north of the existing Kenhardt WTW (the preferred location) and the other to the south of the Kenhardt WTW (Figure 7). Both are mostly disturbed and of low botanical significance. However, the southern option will impact on existing fenced-off and occupied dwellings as well as a few NCNCA protected species (all of them common and widespread species). Locating the proposed KTE WTW to the north of the existing Kenhardt WTW will result in the least or lowest overall additional environmental impact. The plant species theme sensitivity = **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

R27 Lennertsville to Kenhardt (Heading 5.3 & 7.3): In terms of botanical significance, this section of the pipeline route is considered the **most sensitive**. Even though the R27 road reserve is subject to regular brush-cutting (and other human related disturbances), this section of the road reserve supports a large number of individuals of two important NFA protected species, namely *Boscia albitrunca* (Shepards tree) and *Vachellia erioloba* (camel thorn) (Refer to Heading 5.3 & 5.5). Impact minimisation must include good environmental oversight, route planning and protecting all single stem *Boscia albitrunca* individuals over 1.5 m in height as well as all *Vachellia erioloba* trees more than 6 m in height, while the protection of the magnificent thick stem individuals over 8 m should be non-negotiable. The plant species theme sensitivity is rated as of **Medium Sensitivity**, BUT the impact can be reduced to **Low Sensitive** through mitigation. The terrestrial biodiversity theme sensitivity is considered to be **Medium Sensitivity** (even though it overlaps a CBA), mainly because of the SoCC. If the impact on these SoCC can be minimised (which should very feasible) the terrestrial sensitivity can be reduced to **Low Sensitivity.**

Piet Rooi's Puts Reservoir (Heading 5.4 & 7.4): The proposed reservoir will be located within the disturbance footprint of the old road camp (Photo 19 & 20) and does not support and significant SoCC. It does not fall within a CBA or ESA. The plant species theme sensitivity = **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

R27 Kenhardt to Soafskolk (Heading 5.6 & 7.5): Although this section supported a number of NCNCA protected species they were almost all weedy or pioneer species protected by default as part of the Aizoaceae family. No significant SoCC was observed. The plant species theme sensitivity =- **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

De Bakke Reservoir (Heading 5.7 & 7.6): The vegetation within the proposed site location

was sparse, dominated by a low grassy layer with the occasional shrub scattered in between (Photo 33 & Photo 34). Apart from the occasional weedy or pioneer NCNCA protected species no SoCC were observed within the footprint or its immediate vicinity. The plant species theme sensitivity =- **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

Road reserve Soafskolk to Farm Uitkyk (Heading 5.8 & 7.7): Apart from a number of weedy or pioneer *Mesembryanthemum* species (many of them regarded as disturbance indicator species) and a few larger indigenous trees, no SoCC were observed. However, all larger indigenous trees should be protected wherever possible. The plant species theme sensitivity =- **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity** (although it will impact on CBA and ESA areas and NCNCA protected species).

Styns Vley Reservoir (Heading 5.9 & 7.8): The vegetation is considered of low botanical significance (although the final location should aim to minimise the impact on larger indigenous trees). No significant SoCC were observed, and it will not impact on any CBA or ESA. The plant species theme sensitivity =- **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

Uitkyk Reservoir (Heading 5.10 & 7.9): The vegetation in this area of the farm was very dry and vegetation cover was sparse (Photo 49 & Photo 50). Overall, the vegetation is considered of low botanical significance. No species of conservation concern were observed, and it will not impact on any CBA or ESA. The plant species theme sensitivity =- **Low Sensitivity**. The terrestrial biodiversity theme sensitivity = **Low Sensitivity**.

SPECIES OF CONSERVATION CONCERN (SOCC)

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered Medium Sensitive**, because of the potential for or encountering the following species:

- ***Tridentea virescens* (Apocynaceae):** It is a widespread but rare succulent that occurs on stony ground, or hard loam in floodplains, in sporadic small subpopulations of up to six plants. It was not observed and the changes that this species will be impacted is considered low to very low.
- ***Sensitive species 144:*** Not observed within the development footprint.
- ***Dregeochloa calviniensis* (Poaceae):** This plant normally occurs on limestone outcrops in arid succulent karoo shrubland. Neither the plant nor prominent limestone outcrops were observed within the study area.
- Seventeen (17) NCNCA, protected species were observed (Refer to Table 10). However, almost all of these species, especially the Aizoaceae, are widespread species or hardy pioneer species. The only species of conservation concern (SoCC) observed were ***Sensitive Species 144*** (which will not be impacted), one ***Aloe*** species, two ***Boscia*** species and two ***Euphorbia*** species.
- No species protected in terms of NEM: BA were observed
- **Two (2) species** protected in terms of the NFA were observed, namely *Boscia albitrunca* (Sheppard's tree) & *Vachellia erioloba* (Camel thorn) (Refer to Appendix 3 for list their GPS locations). Refer to Table 10 for impact mitigation recommendations.

Because of the length of the pipeline and the differences in vegetation type the plant species sensitivity theme are discussed as part of the terrestrial sensitivity assessment for each section of the proposed route/infrastructure (Refer above).

MAIN CONCLUSION

According to the **DFFE Environmental Screening Tool** the relative Terrestrial Biodiversity theme sensitivity is considered of **Very High Sensitivity** because:

- The proposed project footprint overlaps CBA 1, CBA 2 and ESA areas.
- The proposed project footprint overlaps a FEPA (Freshwater Ecosystem Priority Area) Subcatchment.
- Portion of the footprint overlaps areas that has been included in the National Protected Area Expansion Strategy (NPAES).

Because of the variation in vegetation types and potential impacts over the length of the project, the Terrestrial Biodiversity Sensitivity was not done for the route as a whole, but for each significant section/area that will be impacted along its route (Refer Heading 7, summarised above).

- The impacts on terrestrial biodiversity are associated with impacts on CBA and ESA areas. However, the routes were chosen to fall within existing road reserves (which were often already disturbed). This is considered the best possible location for the proposed pipeline and should minimise the potential impacts on the CBA's and ESA's considerable.
- The main impacts on the plant species of conservation concern are related to the potential impacts on the two NFA protected species (*Boscia albitrunca* & *Vachellia erioloba*). Impact mitigation measures are discussed in Table 10 and Heading 8.

No fatal flaws or any other obstacles were found with respect to the flora, vegetation, fauna, and terrestrial biodiversity.

If the proposed mitigation recommendations are implemented it is considered highly unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g., migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened species.
- Loss of ecosystem connectivity.

Because of the placement and often disturbed nature of the proposed pipeline route & its associated infrastructure the findings of this assessment suggests that the relative overall **terrestrial biodiversity theme sensitivity** should be **Medium Sensitive** and can be reduced to **Low Sensitive** through mitigation (not Very High Sensitive as suggested in the DFFE screening report).

WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT THE PROJECT BE APPROVED WITH THE MITIGATION ACTIONS AS DESCRIBED UNDER HEADING 8.

INDEPENDENCE & CONDITIONS

PB Consult is an independent entity with no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and the company have no interest in secondary or downstream development because of the authorization of this project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. The author reserves the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Mr. Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTR and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity and environmental legal compliance audits.

During 2010 he joined EnviroAfrica to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes NEMA EIA applications, environmental management plans for various industries, environmental compliance audits, environmental control work as well as more than 70 biodiversity & botanical specialist studies.

Towards the end of 2017, Mr Botes started his own small environmental consulting business focusing on biodiversity & botanical assessments, biodiversity management plans and environmental compliance audits.

DECLARATION OF INDEPENDENCE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Petrus, Jacobus, Johannes Botes, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, as amended, and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and 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 NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 13 of GN No. R. 326.

Note: The terms of reference must be attached.

Signature of the specialist:

PB Consult (Sole Proprietor)

Name of company:

6 December 2024

Date:

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ABBREVIATIONS

BAR	Basic Assessment Report
BWS	Bulk Water Supply
CBA	Critical biodiversity area
DENC	Department of Environment and Nature Conservation
DFFE	Department of Fisheries, Forestry and Environment
EA	Environmental Authorization (=Record of Decision)
EAP	Environmental assessment practitioner
ECO	Environmental Control Officer
EIA	Environmental impact assessment
EMP	Environmental Management Plan or Program
EMS	Environmental management system
EN	Endangered
ESA	Ecological support area
KTE	Kutulo Tsatsi Energy Pty Ltd
LT	Least Threatened
NEMA	National Environmental Management Act, 1998 (Act no. 107 of 1998)
NFA	National Forest Act, Act 84 of 1998
SoCC	Species of Conservation Concern
VU	Vulnerable
WTW	Water Treatment Works

1. INTRODUCTION

Kutulo Tsatsi Energy Pty Ltd (KTE) proposed, the development of the KTE Water Pipeline and associated infrastructure and the expansion of the existing Kenhardt pipeline infrastructure from the Orange River to the Farm Uitkyk, No.889 within the Kai! Garib and Hantam Municipalities, Northern Cape Province. In addition to the pipeline, KTE intends to develop a large green hydrogen/ammonia production adjacent to the Sishen Saldana railway line.

Water for the project will be sourced from the Orange River near Keimoes (Neilersdrif), from where it will be pumped/gravitate to a reservoir on the farm Uitkyk 889/1 (a distance of just over 200 km). Water extraction will occur at the same location as the existing Kenhardt bulk water supply (BWS) pump station. The proposed pipeline will be located within the western road reserve of the R27 from Neilersdrif to Kenhardt with a water treatment works (WTW) just south of Neilersdrif (east of the R27) and a reservoir, about 30 km further south. At Kenhardt the pipeline will run to the west and south of town, crossing the Hartbees River, towards the east of the R27. It will then run in the eastern road reserve of the R27 to a booster pump station on the Farm De Bakke (±22km south of Kenhardt) from where it will gravitate (still in the eastern road reserve) to the Soafskolk gravel road (about 50 km further south). The proposed pipeline will then follow minor gravel roads (located within the road reserve of these roads) first to the Farm Styns Vley and then to the farm Uitkyk, about 60 km to the east-southeast of the Soafskolk turn-off.

Along its route, the pipeline will impact on several vegetation types (SA Vegetation map, 2018), mainly Bushmanland Arid Grassland and Gordonia Duneveld to the north and Bushmanland Basin Shrubland, Lower Gariep Broken Veld and Bushmanland Vloere vegetation to the south. Along the R27 the road reserve is subject to regular brush-cutting (to reduce the risk posed by larger animals and fire), which impacted on the vegetation composition, but it still supports species of conservation concern such as *Vachellia erioloba* (Camel thorn) and *Boscia albitrunca* (Sheppard's tree). The road reserves along the minor gravel roads were generally less disturbed but the presence of larger indigenous trees were relatively rare. The proposed footprint overlaps critical biodiversity area and ecological support areas as identified in the 2016 Northern Cape critical biodiversity areas maps (Holness & Oosthuysen, 2016).

The DFFE screening report for the proposed site, compiled by PB Consult on the 12th of June 2024, identified various areas of potential environmental sensitivity, of which the following will be discussed in this report:

- The relative Plant species theme sensitivity is considered of **Medium Sensitivity**;
- The relative Terrestrial Biodiversity theme sensitivity is considered of **Very High Sensitivity**.

The relative Animal species theme sensitivity (**High Sensitivity**) and the relative Aquatic Biodiversity Theme (**Very High Sensitivity**) will be discussed in separate specialist reports.

1.1. LEGISLATION GOVERNING THIS REPORT

EnviroAfrica was appointed by KTE to facilitate the NEMA EIA application for this project. PB Consult

was appointed by EnviroAfrica to conduct a botanical and terrestrial biodiversity assessment of the proposed footprint area. This report will form part of NEMA EIA environmental application.

This is a 'specialist report', compiled in terms of:

- The National Environmental Management Act, Act. 107 of 1998 (NEMA);
- The "Protocol for the Specialist Assessment and Minimum report content requirements for environmental impacts on terrestrial biodiversity" in terms of Sections 24(5)(a) and (h) and 44 of the NEMA (Government Notice No. 320 of 20 March 2020).

1.2. TERMS OF REFERENCE

The Terms of Reference for this study were to perform a site visit and to compile a specialist report that assesses the potential impacts on *Botanical* and *Terrestrial Biodiversity* features of the proposed development.

Study should address:

- Habitat sensitivity;
- Threatened ecosystems (including critical biodiversity areas and ecological support areas);
- Plant species of conservation concern (SoCC);
- Any significant botanical or other terrestrial biodiversity features that might be impacted because of the proposed development as identified in the DFFE Screening Report for the site.
- Potential direct and cumulative impacts resulting from the proposed development on the receiving environment.

2. STUDY AREA

2.1. LOCATION & LAYOUT

The proposed pipeline, about 200 km in length, will be located within the Bushmanland area of the Northern Cape Province (Kai !Garib and Hantam Local Municipalities) (Figure 1).

Water will be extracted from the Orange River, near Keimoes (Neilersdrif) from where it will be pumped to a Water Treatment Works, just south of Neilersdrif (next to the R27). From there the pipeline will fallow the R27 to Kenhardt, where it will pass to the east and south of town. It will then follow the R27 towards the Soafskolk turn-off (about halfway between Kenhardt and Brandvlei).

It will then follow minor roads towards a reservoir on Farm Styns Vley 280 and then on to the final reservoir on Farm Uitkyk (Portion 1 of Farm Uitkyk No. 889). From these final two reservoirs water will eventually be distributed to the various infrastructure of the project (in close proximity to these reservoirs).

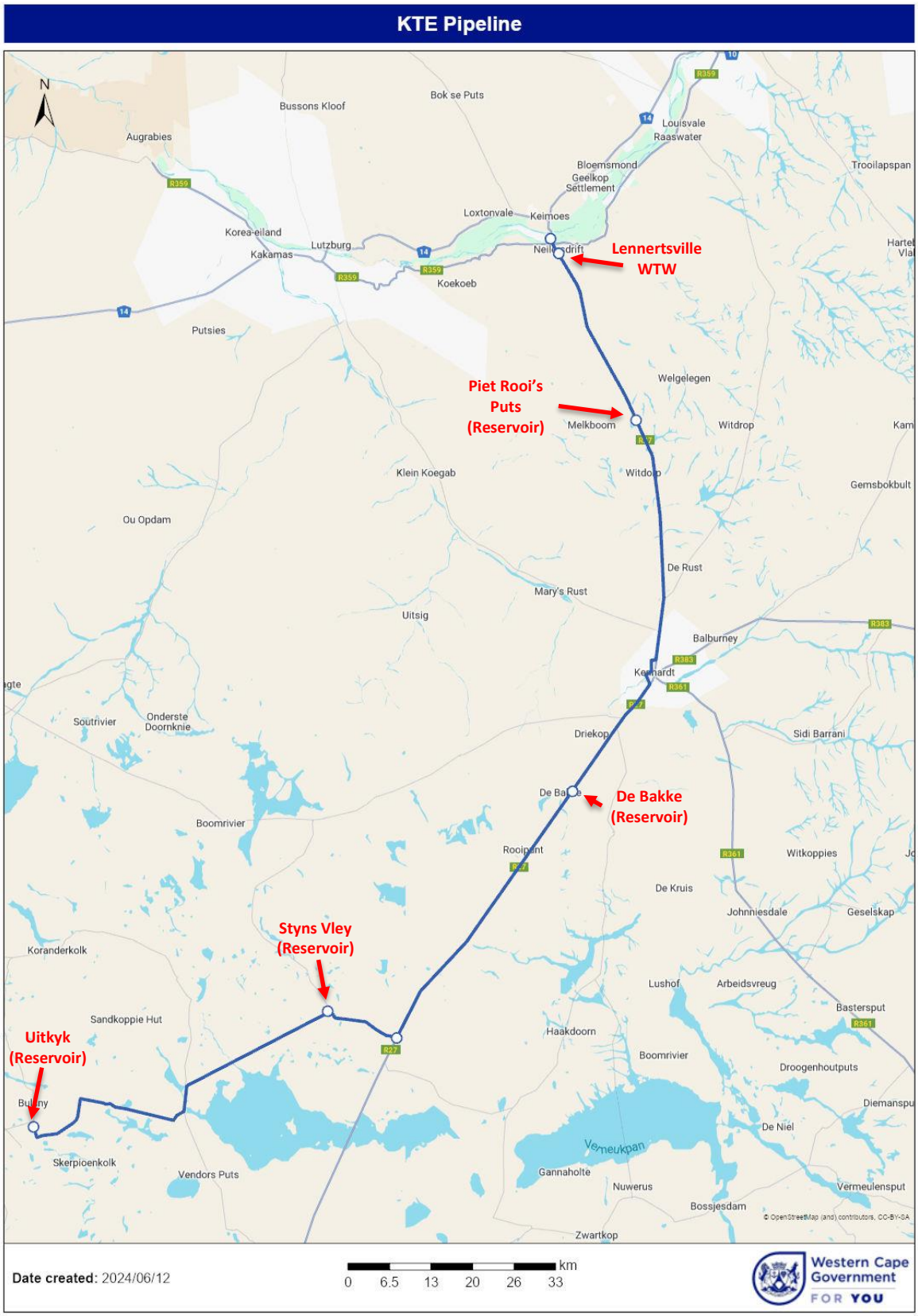

Figure 1: A map showing the proposed pipeline route (blue), from Neilersdrif to Uitkyk Farm. The red arrows show the locations of the main infrastructure along the way.

Table 1: Approximate co-ordinates for the locations of associated infrastructure along the pipeline route (WGS 84 format)

DESCRIPTION	CO-ORDINATE
Orange River Abstraction Point	S28° 44' 13.3" E20° 59' 01.7"
Water treatment works (Neilersdrif)	S28° 45' 28.6" E20° 59' 49.6"
3ML Reservoir (Piet Rooi's Puts)	S28° 59' 35.8" E21° 07' 18.8"
Booster pump station & 3ML Reservoir (De Bakke)	S29° 30' 50.4" E21° 01' 06.5"
Styns Vley Reservoir	S29° 49' 19.5" E20° 37' 29.3"
30 ML Uitkyk Reservoir	S29° 58' 59.8" E20° 09' 01.0"

2.2. PROJECT DESCRIPTION

Kutulo Tsatsi Energy Pty Ltd (KTE) proposed, the development of the KTE Water Pipeline and associated infrastructure and the expansion of the existing Kenhardt pipeline infrastructure from the Orange River to the Farm Uitkyk, No.889 within the Kai! Garib and Hantam Municipalities, Northern Cape Province. In addition to the pipeline, KTE intends to develop a large green hydrogen/ammonia production adjacent to the Sishen Saldana railway line.

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Water extraction will occur at the same location as the existing Kenhardt bulk water supply (BWS) pump station. The proposed pipeline will be located within the western road reserve of the R27 from Neilersdrif to Kenhardt with a water treatment works (WTW) just south of Neilersdrif (east of the R27). At Kenhardt the pipeline will run to the west and south of town, crossing the Hartbees River, towards the east of the R27. It will then run in the eastern road reserve of the R27 to a booster pump station on the Farm De Bakke (±22km south of Kenhardt) from where it will be pumped (still in the eastern road reserve) to the Soafskolk gravel road (about 50 km further south). The proposed pipeline will then follow minor gravel roads (located within the road reserve of these roads) to the farm Styns Vley and on the farm Uitkyk (about 60 km from the Soafskolk turn-off).

2.3. GEOLOGY AND SOILS

The Bushmanland is part of the Nama-Karoo, which is underlaid by a thick succession of sedimentary rocks. This includes the Cape Supergroup (marine origin), followed by Dwyka tillites and then as southern Africa drifted away from the south pole, by other fossil-rich sediments of the Karoo Supergroup (including Ecca and Beaufort Groups) deposited in a great inland sea (300 – 180 million years ago). Igneous activity after this period, resulted in voluminous outpourings of basaltic lava intrusions of dolerite sills and dykes into Karoo sediments. (Mucina *et al*., 2006) (Figure 2).

Mostly undisturbed by the intense folding in the south that formed the mountains and valleys of the Fynbos and Succulent Karoo Biome, the strata of the Nama-Karoo remained horizontal, giving rise to flat to gentle undulating rocky or sandy plains, interrupted by boulder outcrops of igneous origin and flat-topped mesas sculpted by wind and rain, with much of the northwest interspersed by with pans with no outlets. The soils are generally base-rich, weakly structured and skeletal. In the north from

Bushmanland to around Prieska the most common soils are red and yellow sand to non-swelling clays, generally freely drained with an orthic A-horizon, typical of arid areas in South Africa. In the interdune areas of the Bushmanland, shallow, coarse sand to sandy loam soils with high nutrient status are associated with dorbank and hardpan calcretes. Dolerite outcrops develop shallow to moderately deep, calcareous, sandy-clay loams with contain calcrete and calcareous horizons (Mucina *et al*., 2006).

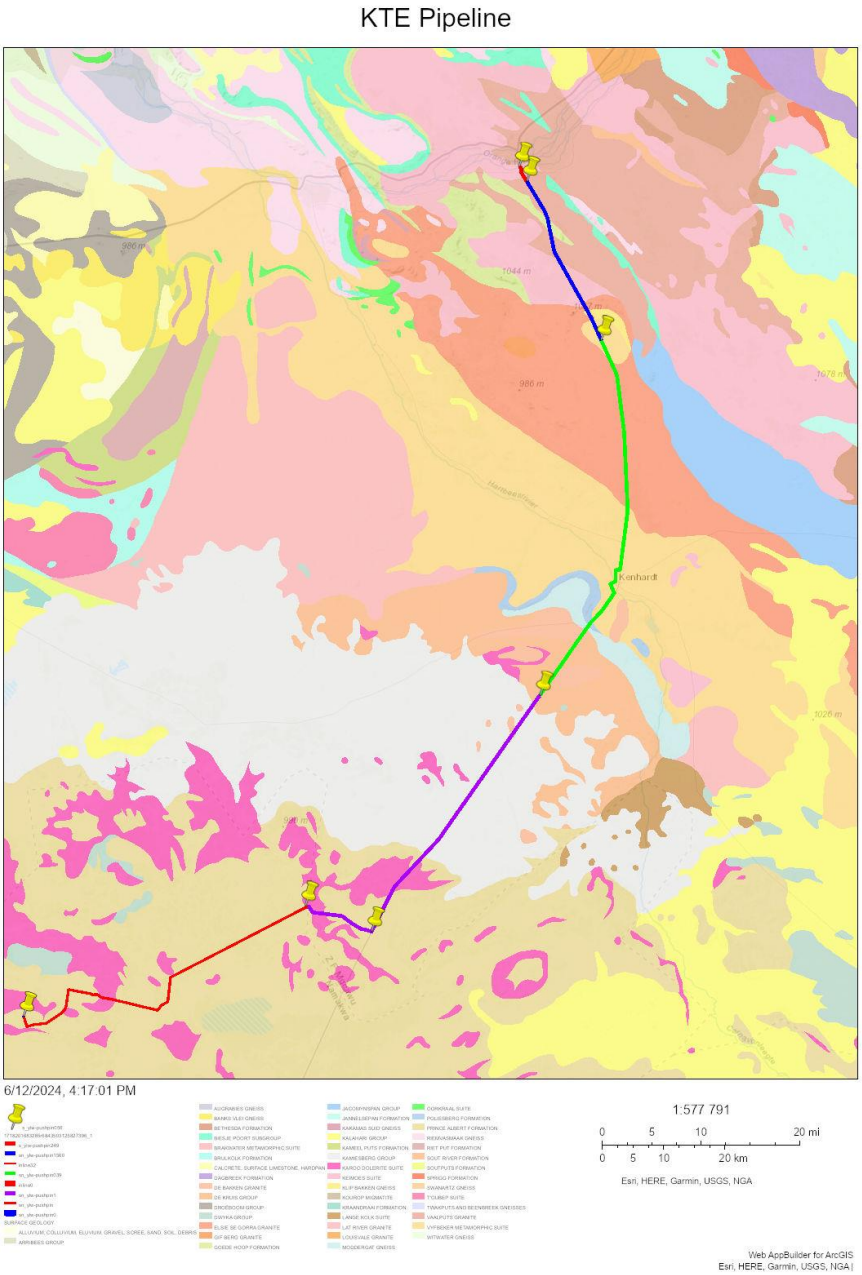


Figure 2: The Geology map of South Africa, showing the geology associated with the study area (Council for Geoscience).

Soils in most of the area associated with Bushmanland Arid Grassland are red-yellow apedal soils, freely drained, with a high base-status and less than 300 mm deep. Bushmanland Basin Shrubland is dominated by mudstones and shales of the Ecca Group and Dwyka tillites, both of early Karoo age with about 20% of rock outcrops formed by Jurassic intrusive dolerite sheets and dykes. Soils are

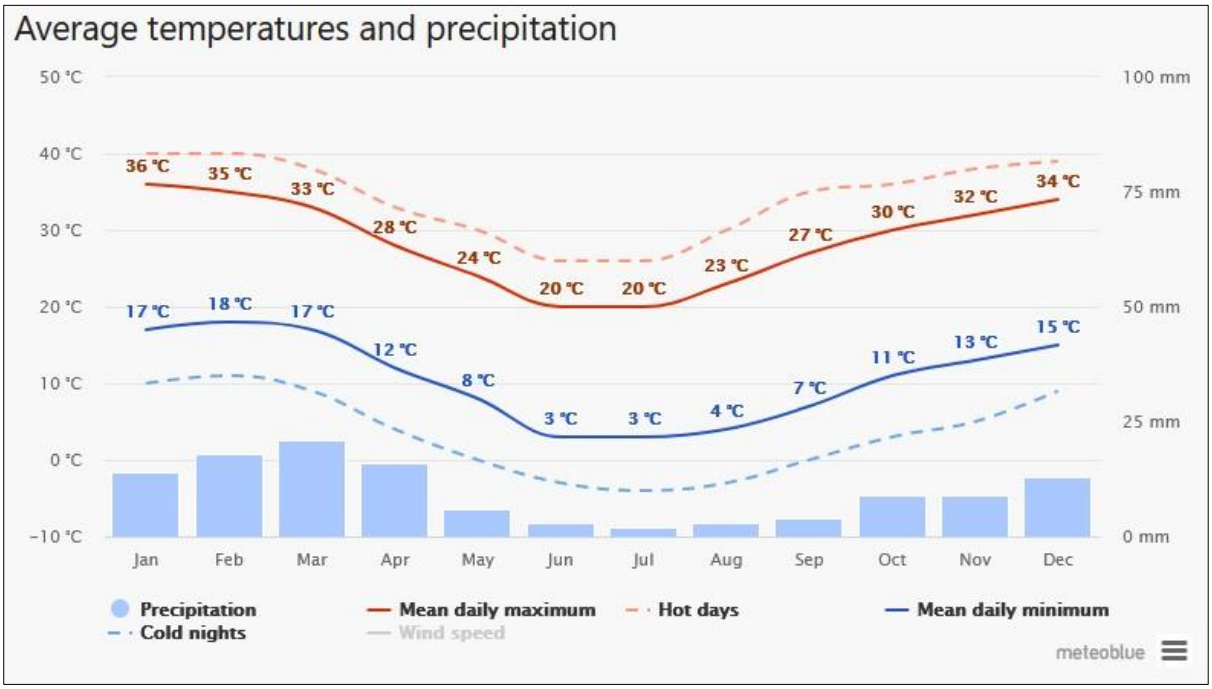
shallow Glenrosa and Mispah forms, with lime generally present in the entire landscape, and to a lesser degree red-yellow apedal, freely drained soils with a high base status (usually less than 15% clay). The salt content in these soils is very high.

2.4. CLIMATE

The climate of Nama-Karoo is essentially continental and is little affected by the ameliorating influences of the oceans. It is an arid biome where most of rivers are nonperennial (apart from the Orange River in this area). Shallow lakes (Bushmanland Vloere) may store water after heavy rainfall events, but this is unpredictable and will dry up during the dry season (Mucina *et. al.,* 2006).

Rainfall is unreliable and droughts are unpredictable and sometimes prolonged. In the southwest of the Nama-Karoo, rain comes in the form of unpredictable summer thunderstorms and occasional inland intrusions of winter high-pressure systems from the west. Summers are hot (mean January maximum >30°C) and winters are cold (with the mean July minimum close to zero). Temperature extremes ranges from -5°C in winter to 43°C in summer and winter frost occurs in all areas except in the extreme southeast of the biome (Albany Broken Veld). Dust devils and small whirlwinds are common in summer, but dust storms are uncommon (Mucina *et. al.,* 2006).

Table 2: : Average temperature and precipitation for Kenhardt (Source: www.meteoblue.com).



In all the vegetation types of the Nama-Karoo, rainfall peaks in March, while the onset of winter frost is soon afterwards, which means a very short growth season for frost sensitive species. This is further exacerbated in some years when the rains are later than usual or frost earlier than usual, or more seriously, when both occur in the same year (Mucina *et. al.,* 2006).

For this study the climate recorded for Kenhardt was taken as an example of the expected climate for the study are (being about halfway along the route). Table 2 shows the average temperatures and precipitation recorded for the last 30 years. The solid red line gives the maximum temperature of an average day, while the solid blue line shows the average minimum temperature per month. Hot days

and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years (Source: www.meteoblue.com).

3. APPROACH & METHODOLOGY

The protocol for specialist assessment and minimum report content and requirements for environmental impacts on terrestrial biodiversity was published in GN. No. 320 of 20 March 2020. It includes the requirements for a desktop analysis and site verification.

3.1. DESKTOP ANALYSIS

The first step of the study was to conduct a desktop analysis of the study area and its immediate surroundings. Using the DFFE screening tool report as basis, spatial information from online databases such as SANBI BGIS and Google Earth were used to evaluate the site in terms of vegetation, obvious differences in landscape (e.g., variations in soil type, rocky outcrops etc.) or vegetation densities , which might indicate differences in plant community or species composition, critical biodiversity areas and other terrestrial biodiversity features as identified in the screening tool.

This information was used to prepare a study area map, which is used as a reference during the physical site visit. Plant species lists were prepared, and species of special significance were flagged.

3.2. SITE SENSITIVITY VERIFICATION

The fieldwork for project was carried out over a 3 day period during October 2022 and a 3-day period during March 2024. The site survey was conducted, by driving the route, stopping at 10 km intervals (or where differenced in vegetation or SoCC were observed). At each stop the immediate area was walked and while sampling the vegetation, using a modified approach, based on the Braun-Blanquet vegetation survey method (Werger, 1974).

Protected or other special plants and any terrestrial feature of significance was, marked by waypoints and/or on the study map. A hand-held Garmin GPSMAP 62s was used to track the sampling route and for recording waypoints. During the survey notes, and photographic records were collected. All efforts were made to ensure that any variation in vegetation or soil condition, which might indicate special botanical features (e.g., rocky outcrops, watercourses or heuweltjies), were visited. Efforts was also made to ensure that the plant species list was as complete as possible.

3.3. LIMITATIONS, ASSUMPTIONS AND UNCERTAINTIES

The findings are based two 3-day site visits (covering two seasons), but does not constitute long-term repetitive sampling, which means that it is likely that some plant species might have been missed. In certain areas the veld was still very dry and probably still suffering from the recent long term drought period (experienced throughout the Northern Cape and Karoo). On the other hand, the author knows

this area and its vegetation relatively well, and the timing of the site visit was reasonable. Essentially all perennial plants were identifiable and a good understanding of the status of the vegetation and plant species along the route was obtained and confidence in the findings are high. There should be no limiting factors which could significantly alter the outcome of this study. It is unlikely that a full botanical assessment will result in any additional findings that would have a significant impact on the outcome.

3.4. IMPACT ASSESSMENT METHOD

The concept of environmental impact assessment in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA) and the Environmental Impact Assessment (EIA) was developed to identify and evaluate the nature of potential impact to determine whether an activity is likely to cause significant environmental impact on the environment. The concept of significance is at the core of impact identification, evaluation and decision making, but despite this the concept of significance and the method used for determining significance remains largely undefined and open to interpretation (DEAT, 2002).

The objective of this study was to evaluate the status of the veld within the study area to identify special or significant environmental features which might be impacted by the proposed development.

The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al*., 2005), were used to evaluate the botanical significance of the property with emphasis on:

- Significant ecosystems
    - Threatened or protected ecosystems
    - Special habitats
    - Corridors and or conservancy networks
- Significant species
    - Threatened or endangered species
    - Protected species.

3.4.1. DETERMINING SIGNIFICANCE

Determining impact significance from predictions of the nature of the impact has been a source of debate and will remain a source of debate. The author used a combination of scaling and weighting methods to determine significance based on a simple formula. The formula used is based on the method proposed by Edwards (2011). However, the criteria used were adjusted to suite its use for botanical assessment. In this document significance rating was evaluated using the following criteria.

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (Edwards 2011)

3.4.2. CRITERIA USED

***Conservation value*:** Conservation value refers to the intrinsic value of an attribute (e.g., an ecosystem, a vegetation type, a natural feature or a species) or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and fragmentation or its value in terms of the protection of habitat or species (Refer to Table 3 for categories used).

Likelihood refers to the probability of the specific impact occurring because of the proposed activity (Refer to Table 4, for categories used).

Duration refers to the length in time during which the activity is expected to impact on the environment (Refer to Table 5).

Extent refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur (Refer to Table 6).

Severity refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur (Refer to Table 7).

Table 3: Categories used for evaluating conservation status.

CONSERVATION VALUE	
Low (1)	The attribute is transformed, degraded not sensitive (e.g., Least threatened), with unlikely possibility of species loss.
Medium/low (2)	The attribute is in good condition but not sensitive (e.g., Least threatened), with unlikely possibility of species loss.
Medium (3)	The attribute is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with unlikely possibility of species loss.
Medium/high (4)	The attribute is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare & endangered species.
High (5)	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.

Table 4: Categories used for evaluating likelihood.

LIKELHOOD	
Highly Unlikely (1)	Under normal circumstances it is almost certain that the impact will not occur.
Unlikely (2)	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.
Possible (3)	The likelihood of the impact occurring, under normal circumstances is 50/50, it may, or it may not occur.
Probable (4)	It is very likely that the impact will occur under normal circumstances.
Certain (5)	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.

Table 5: Categories used for evaluating duration.

DURATION	
Short (1)	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).
Medium/short (2)	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).
Medium (3)	Impact is medium-term and reversible with mitigation but will last for some time after construction and may require ongoing mitigation. Rehabilitation time is expected to be longer (5-15 years).
Long (4)	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and is likely to require ongoing mitigation. Rehabilitation time is expected to be longer (15-50 years).
Permanent (5)	The impact is expected to be permanent.

Table 6: Categories used for evaluating extent.

EXTENT	
Site (1)	Under normal circumstances the impact will be contained within the construction footprint.
Property (2)	Under normal circumstances the impact might extent outside of the construction site (e.g., within a 2 km radius), but will not affect surrounding properties.

Surrounding properties (3)	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding landowners or –users, but still within the local area (e.g., within a 50 km radius).
Regional (4)	Under normal circumstances the impact might extent to the surrounding region (e.g., within a 200 km radius), and will impact on landowners in the larger region (not only surrounding the site).
Provincial (5)	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).

Table 7: Categories used for evaluating severity.

SEVERITY	
Low (1)	It is expected that the impact will have little or no affect (barely perceptible) on the integrity of the surrounding environment. Rehabilitation not needed or easily achieved.
Medium/low (2)	It is expected that the impact will have a perceptible impact on the surrounding environment, but it will maintain its function, even if slightly modified (overall integrity not compromised). Rehabilitation easily achieved.
Medium (3)	It is expected that the impact will have an impact on the surrounding environment, but it will maintain its function, even if moderately modified (overall integrity not compromised). Rehabilitation easily achieved.
Medium/high (4)	It is expected that the impact will have a severe impact on the surrounding environment. Functioning may be severely impaired and may temporarily cease. Rehabilitation will be needed to restore system integrity.
High (5)	It is expected that the impact will have a very severe to permanent impact on the surrounding environment. Functioning irreversibly impaired. Rehabilitation often impossible or unfeasible due to cost.

3.4.3. SIGNIFICANCE CATEGORIES

The formal NEMA EIA application process was developed to assess the significance of impacts on the surrounding environment (including socio-economic factors), associated with any specific development proposal to allow the competent authority to make informed decisions. Specialist studies must advise the environmental assessment practitioner (EAP) on the significance of impacts in his field of specialty. To do this, the specialist must identify all potentially significant environmental impacts, predict the nature of the impact, and evaluate the significance of that impact should it occur.

Potential significant impacts are evaluated, using the method described above, to determine its potential significance. The potential significance is then described in terms of the categories given in Table 8. Mitigation options are evaluated, and comparison is then made (using the same method) of potential significance before mitigation and potential significance after mitigation (to advise the EAP).

Table 8: Categories used to describe significance rating (adjusted from DEAT, 2002)

SIGNIFICANCE	DESCRIPTION
Insignificant or Positive (4-22)	There is no impact, or the impact is insignificant in scale or magnitude because of low sensitivity to change or low intrinsic value of the site, or the impact may be positive.
Low (23-36)	An impact barely noticeable in scale or magnitude because of low sensitivity to change or low intrinsic value of the site or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium Low (37-45)	Impact is of a low order and therefore likely to have little real effect. Mitigation is easily achieved. Social, cultural, and economic activities can continue unchanged, or impacts may have medium to short term effects on the social and/or natural environment within site boundaries.
Medium (46-55)	Impact is real, but not substantial. Mitigation is both feasible and easily possible but may require modification of the project design or layout. Social, cultural, and economic activities of communities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long term effect on the social and/or natural environment, within site boundary.
Medium high (56-63)	Impact is real, substantial, and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. Social, cultural, and economic activities may be impacted, but can continue (albeit in

	a different form). These impacts will usually result in medium to long-term effect on the social and/or natural environment, beyond site boundary within local area.
High (64-79)	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural, and economic activities of communities are disrupted and may come to a halt. These impacts will usually result in long-term change to the social and/or natural environment, beyond site boundaries, regional or widespread.
Unacceptable (80-100)	An impact of the highest order possible. There is no possible mitigation that could offset the impact. Social, cultural, and economic activities of communities are disrupted to such an extent that these come to a halt. The impact will result in permanent change. Very often these impacts are un-mitigatable and usually result in very severe effects, beyond site boundaries, national or international.

4. DESKTOP ASSESSMENT

This section discuss the results of the desktop analysis.

4.1. BROAD-SCALE VEGETATION EXPECTED

According to the South African vegetation map (2018) (Mucina & Rutherford, 2006, updated), the proposed pipeline route will potentially impact on various vegetation types. Starting from the Orange River, moving south to Uitkyk Farm the following vegetation types are expected (Figure 3):

4. **Lower Gariep Alluvial Vegetation (LC)**, along the Orange River;
5. The northern half of the pipeline route will impact mostly on **Bushmanland Arid Grassland (LC)** for most of the way along the R27 to about 20km south of Kenhardt with intrusions of;
    - **Gordonia Duneveld (LC)** between Lennertsville and Kenhardt;
    - **Lower Gariep Broken Veld (LC)**, associated with the dolerite rocky outcrops along the R27;
6. The southern half of the pipeline route will impact mostly on **Bushmanland Basin Shrubland (LC)** from about 20km south of Kenhardt all the way to Farm Uitkyk, with intrusions of:
    - **Lower Gariep Broken Veld (LC)** (dolerite rocky outcrops);
    - **Bushmanland Vloere (LC)** just touching the road reserve in some areas;

All of these vegetation types are classified as of "**Least Concern**", in terms of the "*Revised National list of ecosystems that are threatened and in need of protection*" (GN. No. 2747 of 18 November 2022).

Mucina *et al.* (2006), describe the various vegetation types as follows:

- **Lower Gariep Alluvial Vegetation** occurs on flat alluvial terraces and riverine islands supporting a complex of riparian thickets (dominated by *Ziziphus mucronata*, *Euclea pseudebenus* and *Tamarix usneoides*), reed beds with *Phragmites australis* as well as flooded grasslands and herblands populating sand banks and terraces within and along the river.
- **Bushmanland Arid Grassland** occurs on extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe'. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected.
- **Gordonia Duneveld** occurs on parallel dunes about 3–8 m above the plains, supporting open shrubland with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dune slopes, also with *A. mellifera* on lower slopes and *Rhigozum trichotomum* in the interdune straaten.
- **Lower Gariep Broken Veld** occurs on rocky hills and low mountains, slightly irregular plains but with some rugged terrain (e.g. downstream of the Augrabies Falls) with sparse vegetation dominated by shrubs and dwarf shrubs, with annuals conspicuous, especially in spring, and perennial grasses and herbs. Groups of widely scattered low trees such as *Aloe dichotoma* var. *dichotoma* and *Acacia mellifera* subsp*. detinens* occur on slopes of koppies and on sandy soils of foot slopes respectively.
- Bushmanland **Basin Shrubland** is described as occurring on slightly irregular plains covered by a dwarf shrubland, which are dominated by a mixture of low sturdy and spiny (and sometimes also succulent) shrubs such as *Rhigozum*, *Salsola*, *Pentzia*, *Eriocephalus* and 'white' grasses (*Stipagrostis*). In years of high rainfall annuals such as *Gazania* and *Leysera* can become abundant.
- **Bushmanland Vloere** occurs on flat and very even surfaces of pans and broad bottoms of intermittent rivers. The center of a pan (or the river drainage channel itself) is usually devoid of vegetation; loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of non-succulent dwarf shrubs of Nama-Karoo relationship. In places loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* can be found.

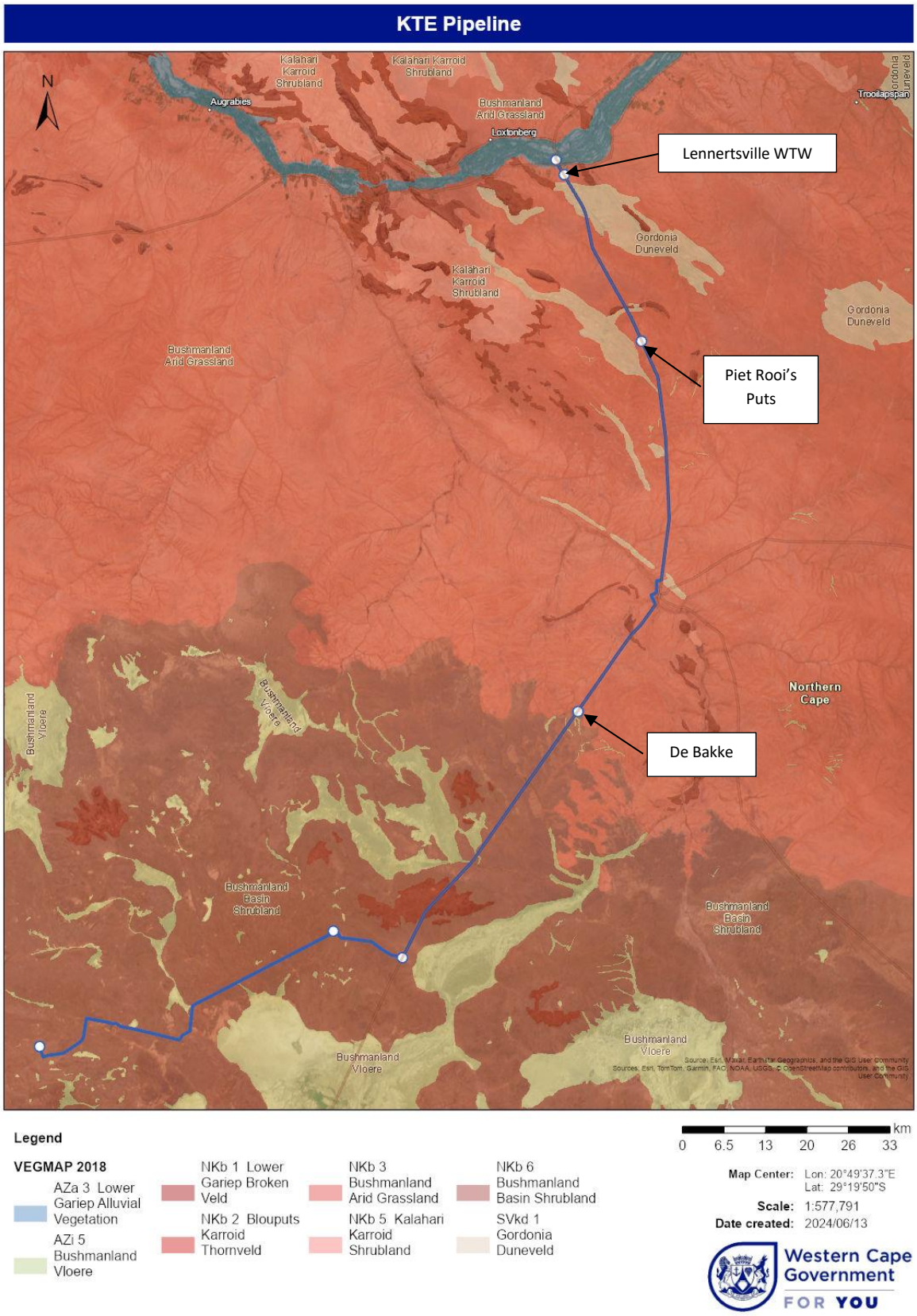


Figure 3: Vegetation map of South Africa (2018), showing the expected vegetation types along the pipeline route (CapeFarmMapper).

4.2. ECOLOGICAL DRIVERS & FUNCTIONING

Bushmanland Basin Shrubland is part of the Nama-Karoo Biome, which is a large arid landlocked region on the central plateau of the western half of South Africa, extending into Namibia. It is flanked by the Succulent Karoo to the west and south, desert to the northwest, arid Kalahari Savanna to the north, Grassland to the northeast, Albany Thicket to the southeast and small parts of Fynbos to the south. In South Africa, only the Desert Biome has a higher variability in annual rainfall and only the Kalahari Savanna greater extremes in temperature. The Nama-Karoo receives most of its rainfall in summer, especially in late summer (Mucina *et. al*., 2006).

Climate is essentially continental and with almost no effect of the ameliorating influences of the oceans. Rainfall is low and unreliable, peaking in March. Droughts are unpredictable and often prolonged. Summers are hot and winters cold with temperature extremes ranging from -5°C in winter to 43°C in summer. However, rainfall intensity can be high (e.g. episodic thunderstorm and hail storm events). This coupled with the generally low vegetation cover associated with aridity and grazing pressure by domestic stock over the last two centuries, raises the potential for soil erosion. In semi-arid environments such as the Nama-Karoo, nutrients are generally located near the soil surface, making it vulnerable to sheet erosion (Mucina *et. al*., 2006).

Because of its aridity and unpredictable rainfall patterns, the Nama-Karoo region would have favoured free moving herbivores such as gemsbok, ostrich and springbok, nomadic birds and invertebrates with variable dormancy cued by rain. Plant defence against herbivores and seed adaption for dispersal by mammals are relatively uncommon, except along rivers and seasonal pans, suggesting the transient nature of herbivores, except near water where they would have lingered longer. During the 19th century the vast herds of migratory ungulates indigenous to this biome have been replaced (almost completely) by domestic stock. Once farmers started fencing their properties into camps (following the Fencing Act of 1912), stock numbers were dramatically increased with dire consequences to plant diversity. Grazing during and immediately after droughts periods is regarded as a major cause of detrimental change in vegetation composition and were ultimately responsible for the decline of large numbers of palatable plants (Mucina *et. al*., 2006).

In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulent dominance (as in the Succulent Karoo). It is also too dry in summer for dominance by perennial grasses alone and the soils generally to shallow and rainfall too low for dominance by trees. But soil type, soil depth and local differences in moisture availability can cause abrupt changes in vegetation structure and composition (e.g. small drainage lines support more plant species than surrounding plains) (Mucina *et. al*., 2006).

In terms of status, very little of the Nama-Karoo has been transformed and the dominant land use is farming with small stock, cattle and game. Farms are fenced, but generally large (because of the low carrying capacity). The biggest threat to this vegetation remains domestic livestock grazing pressure. Grazing by livestock particularly during the summer growing season, reduces the perennial grass component, while prolonged droughts kill a high proportion of perennial plants, rapidly changing vegetation composition in favour of short-lived species with soil stored seed banks. Overgrazing after drought periods can delay vegetation recovery, which will worsen the effect of subsequent droughts.

4.3. CRITICAL BIODIVERSITY AREAS & ECOLOGICAL CORRIDORS

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (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 as well as the long-term ecological functioning of the landscape (Holness & Oosthuysen, 2016). The 2016 Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province (including the Namakwa District Biodiversity Sector Plan, 2008). 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. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

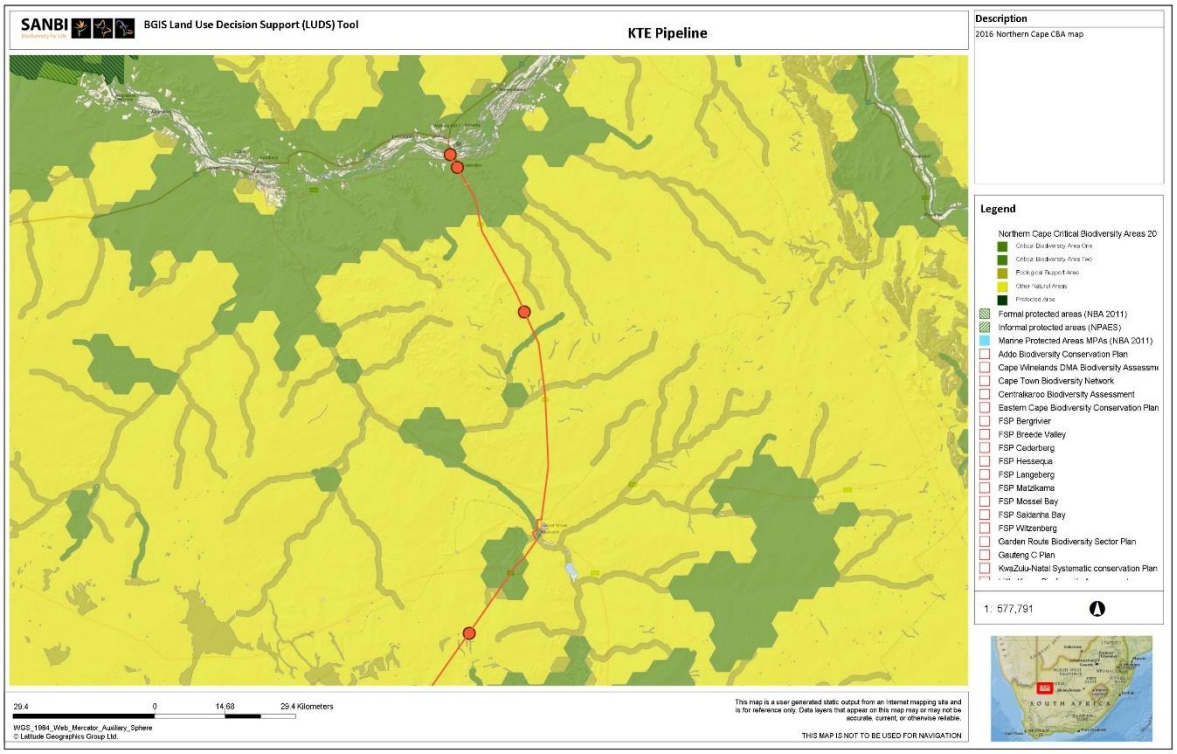


Figure 4: Northern Cape CBA map (2016) showing the northern section of the pipeline route.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning to promote sustainable development and protection of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are 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. In other words, if these areas are not

maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

- **<u>Ecological support areas (ESA's)</u>** are areas that are not essential for meeting biodiversity representation targets/thresholds, but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

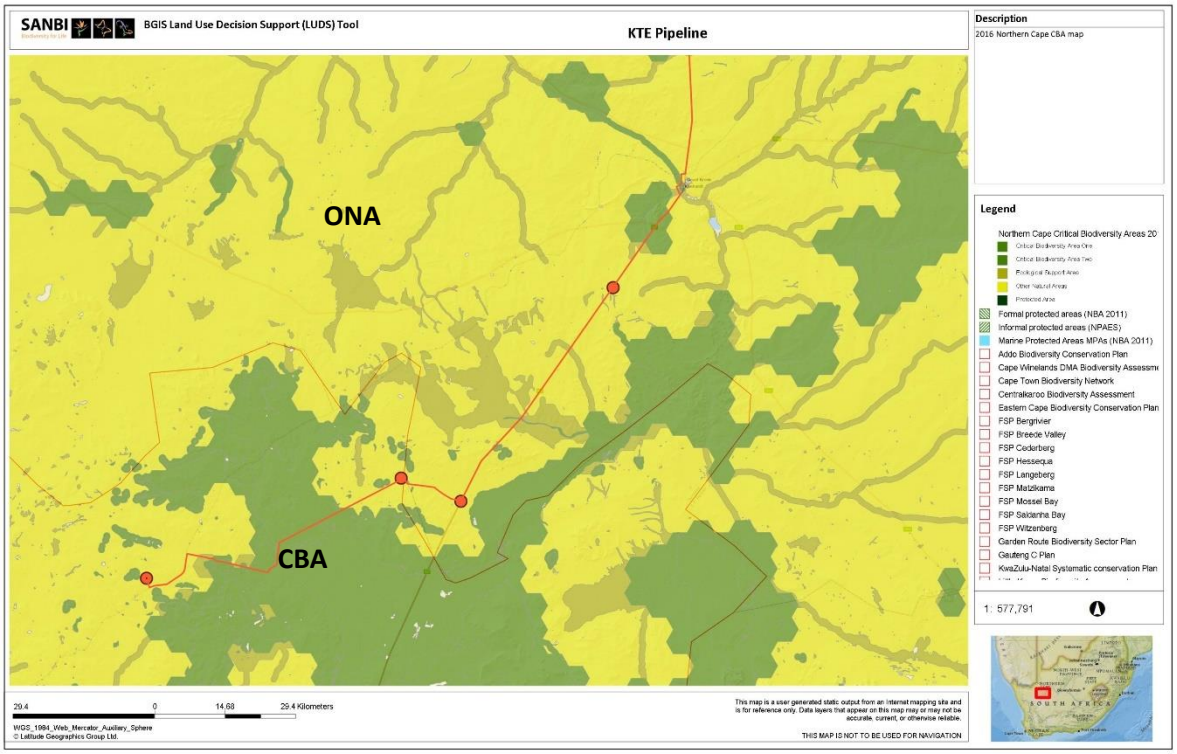


Figure 5: Northern Cape CBA map (2016) showing the southern section of the pipeline route.

According to the 2016, Northern Cape critical biodiversity areas maps (Figure 4), the proposed pipeline and its associated infrastructure is likely to impact on critical biodiversity areas (CBA's) and ecological support areas (ESA's). The reasons for assigning this <u>CBA</u>, and <u>ESA</u> are <u>not clearly explained</u> in the GIS layers, but according to information given in Critical Biodiversity Areas of the Northern Cape: Technical Report (Holness & Oosthuysen, 2016) all areas in close proximity of larger rivers were prioritized and all NFEPA (National Freshwater Ecosystem Priority Areas) rivers were given a minimum category of CBA as were areas of specific important bird areas (IBA). Areas of special habitats (e.g. rocky outcrops, koppies, dolerite dykes, boulder fields, woody vegetation on outwash plains etc.) were included with a 50% target and ESA status as minimum.

In Figure 4, the purpose of the CBA areas associated with the Orange River, aiming at the protection of any remaining riparian vegetation and connectivity. Further south the CBA's likely aims at the protection of species of conservation concern (SoCC) associated with the rocky dolerite outcrops

(Lower Gariep Broken Veld), deeper sandy soils of the sporadic river systems and the Gordonia Duneveld. The ESA areas is mostly associated with the smaller episodic watercourses.

In Figure 5, the CBA areas seems to be associated with the protection of the Bushmanland Vloere and rocky outcrops (Lower Gariep Broken Veld) with its potential to contain SoCC.

It should be noted that the pipeline route has been specifically chosen to fall within the road reserve of existing roads wherever possible to minimise the impact on natural vegetation in good condition.

4.4. WATERCOURSES AND WETLANDS

According to the **DFFE Screening Tool** report for the footprint area (Appendix 2), the relative Aquatic biodiversity theme sensitivity is considered of **Very High sensitivity**. The pipeline route and associated infrastructure will cross numerous watercourses and even salt pans along its route.

A Freshwater Specialist has been appointed to evaluate and discuss the aquatic biodiversity theme.

4.5. LANDUSE AND COVER

The pipeline route was had been located within existing road reserves wherever possible to minimise the impact on pristine vegetation. According to the 2020 (9-Class) National Land Cover Map of South Africa, most of the properties along the route still support natural veld, used for livestock grazing (which is consistent with the findings of the site visit).

4.6. POTENTIAL IMPACT ON CENTERS OF ENDEMISM

In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo (Mucina & Rutherford, 2006).

The proposed pipeline route will not impact directly on any recognised centre of endemism. The Gariep Centre is located to the north, north-west, associated with Augrabies, Pella and Onseepkans along the border of South Africa and Namibia, while the Griqualand West Centre of Endemism starts to the east of Upington in the Northern Cape Province (Van Wyk & Smith, 2001).

5. VEGETATION ASSESSMENT

The vegetation assessment follows the pipeline route from its extraction point at the Orange River southwards until it reaches the reservoir location on the Farm Uitkyk. It also discusses the areas that will be impacted by the associated infrastructure along the route.

5.1. ORANGE RIVER EXTRACTION POINT TO WTW

The proposed extraction point, and its associated pump station will be located just north of Neilersdrif (Keimoes), at the same location as the existing pump station for the Kenhardt pipeline (the footprint of the existing pump station will be enlarged). Lower Gariep Alluvial Vegetation (Figure 6) was expected in this area, however, the riparian vegetation along the river in this area, had been totally compromised as a result of past and present agricultural activities (vineyards) and associated anthropogenic activities. No natural veld remains in this area. The only plants remaining in this area were several planted Palm trees (Photo 1), a few weedy indigenous species such as *Convolvulus sagittatus* (bobbejaantou), *Salsola kali* and weedy invader species such as *Argemone ochroleuca* (white Mexican poppy), *Nicotiana glauca* (tabakboom), *Melia azedarach* (seringboom).

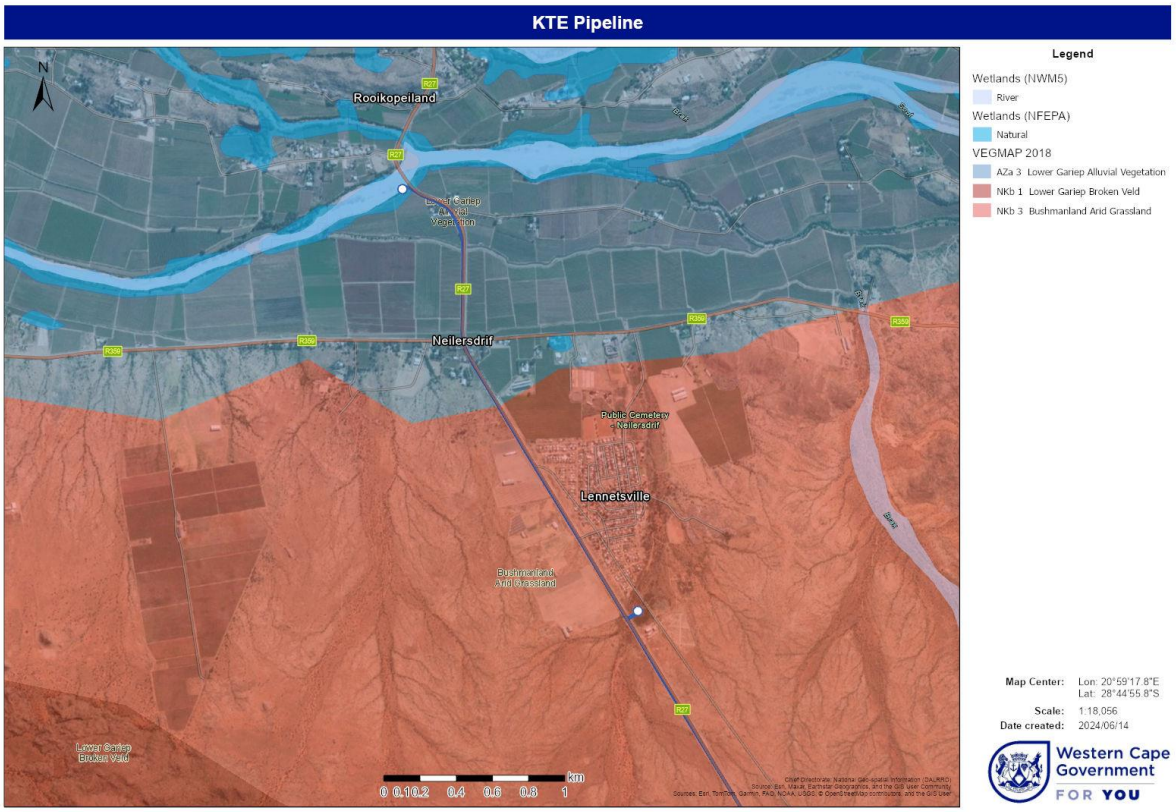


Figure 6: Vegetation map of South Africa (2018) showing the first section of the pipeline route (CapeFarmMapper).

Because of agricultural and urban development, the first section of the pipeline route up to the Lennertsville WTW can only be described as transformed with no natural veld remaining (Photo 1 to Photo 3). However, two *Vachellia erioloba* (camelthorn) trees are located within the road reserve within which the pipeline will be placed. One of these trees are a magnificent specimen of 10-12m in height. All efforts should be made to avoid impacting this tree.

Photo 1: Looking from east to west onto the existing pumphouse for the Kenhardt pipeline. Note the disturbed nature of the area and agricultural land to the left of picture.

Photo 2: The existing pumphouse, next to which the new pumphouse will be located. Note the existing disturbance footprint.

Photo 3: Looking from south to north along the R27 (towards Keimoes), where the pipeline will be placed (orange line). No natural veld remaining, but the pipeline construction might impact on agricultural land and two *Vachellia erioloba* trees between the Orange River extraction point and the Lennertsville WTW.

5.2. LENNERTSVILLE WTW

Raw water will be extracted from the Orange River and pumped to a Water Treatment Works (WTW) that will be located next to the existing Kenhardt WTW, just north of Lennertsville. Here, the raw water will be treated to potable water standards before being pumped to a balancing reservoir at Piet Rooi's Puts. The area that will be impacted by the new WTW & Reservoir at Lennertsville will be between 2 – 3 ha in size. Two potential locations for the proposed WTW were evaluated, one to north

of the existing Kenhardt WTW, next to Lennertsville (the preferred location) and the other to the south of the Kenhardt WTW (Figure 7).

Figure 7: Google image showing the study area (yellow) for the proposed WTW, the routes walked (light blue) and the locations of species of potential conservation concern (marked by waypoints). The waypoints refers to: Euphorbia = *Euphorbia braunsii*; Bfoet = *Boscia foetida* individuals.

A large portion of the area to the north of the existing Kenhardt WTW was characterized by dense stands of *Senegalia mellifera* and alien invasive *Prosopis* trees (Photo 4 & 5), in the wetter areas that seems to receive overflow water spilling from the evaporation ponds from the Kenhardt WTW. The site itself showed various signs of disturbance, which includes physical disturbances and illegal dumping. In general, this area was quite disturbed as a result of continual human impact and included many weedy species such as *Erigeron sumatrensis* (tall fleabane), *Tribulus zeyheri* and *Senecio* species. The occasional *Chascanum garipense*, *Tetraena decumbens*, *Phaeoptilum spinosum*, and *Aptosimum indivisum* were observed in between the grass dominated bottom layer (e.g. *Stipagrostis ciliata* and *Fingerhuthia africana*), but no species of conservation concern was observed in this area.

Photo 4: Dense stands of *Prosopis*, just north of the Kenhardt WTW evaporation ponds.

Photo 5: Dense stands of *Prosopis* and *Senegalia mellifera* to the north of Photo 4.

The area to the south of the Kenhardt WTW (Figure 7) includes several fenced-off local dwellings (which might be illegal settlement) (Photo 6), which had resulted in a disturbance footprint impacting about three quarters of this area.

Photo 6: Low – medium shrubs scattered observed in the area to the south of the Kenhardt WTW (*Tetraena* & *Phaeoptilum* visible in the foreground). Note the camped-off dwellings to the back of picture.

Photo 7: Looking from south to north over the area to the south of the Kenhardt WTW.

The remaining natural veld shows typical Bushmanland Arid Grassland dominated by a sparse to medium dense grass bottom stratum with scattered low shrubs in between (Photo 6 & 7). The most significant shrubs observed were six (6) *Boscia foetida* individuals, mostly in the southern part of the site, *Phaeoptilum spinosum*, *Tetraena decumbens*, *Tetraena microcarpa* (forming patches in disturbed

areas, Photo 9), *Kleinia longiflora* (occasionally), *Euphorbia braunsii*, *Justicia australis* (perdebos) and *Maerua gilgii* (single individuals). Lower shrubs and herbs observed included: *Amellus epaleaceus*, *Aptosimum indivisum*, *Chascanum garipense* (single individuals), *Dicoma capensis, Monsonia umbellata* and *Tribulus zeyheri* (dubbeltjie). One or two kraalaalwyne (*Aloe claviflora*) were also observed to the southwest of the study area.

Photo 8: Looking from southwest to northeast over the most southern part of the area to the south of the Kenhardt WTW. A few scattered *Boscia foetida* individuals can be observed in this photo.

Photo 9: Looking from east to west over the southern portion of the study area. Dwellings to the left, the Kenhardt WTW, just visible to the right, with a patch of *Tetraena microcarpa* (armoedsbossie) dominating a previously disturbed area in the foreground.

5.3. BUSHMANLAND ARID GRASSLAND SECTION OF THE R27

From the Lennertsville WTW the proposed BWS pipeline will be placed in the western road reserve of the R27, running south, towards the balancing reservoir at Piet Rooi's Puts, past Kenhardt and onto the De Bakke pump station and reservoir. The De Bakke pump station and reservoir is located almost at the point where Bushmanland Arid Grassland is replaced by Bushmanland Basin Shrubland vegetation (Figure 3). This section discusses the vegetation encountered along the R26 covered by Bushmanland Arid Grassland. The route past Kenhardt and the two reservoir sites (Piet Rooi's Puts and De Bakke) will be discussed separately.

The R27 road reserve (for its whole length) is purposely cleared of larger vegetation to improve visibility and in so doing lowering the risk of road accidents (e.g. larger animals sheltering and grazing within the road reserve) (Photo 10). As a result, all along the R27 the vegetation is generally short (Photo 11) and the only larger shrubs remaining are mainly protected *Boscia* species and the

occasional indigenous tree, including quite a number of protected *Vachellia erioloba* (camelthorn) trees, some of them magnificent individuals reaching up to 10 m as well as the occasional other indigenous tree such as *Ziziphus mucronata* (blinkblaar wag-'n-bietjie).

Photo 10: Looking north to south along the R27 road reserve within which the pipeline will be placed. Note the general low vegetation height and the Municipal workers busy brush-cutting the road reserve.

Photo 11: Looking from south to north back towards Lennertsville, showing the typical status of the road reserve. Note the low vegetation height and clear indications of brush cutting.

Photo 12: Looking south to north along the R27 road reserve. The photo shows the first patch of *Vachellia erioloba* trees within Gordonia Duneveld vegetation to the south of Lennertsville.

Whereas the *Boscia albitrunca* and *Boscia foetida* individuals are scattered all along the R27 road reserve in areas associated with Bushmanland Arid Grassland (Photo 13), the *Vachellia erioloba* trees are associated with deeper sandy soils of the Gordonia Duneveld (Photo 12) or larger watercourses (Photo 14). The first patch of these trees (Photo 12) are found about 7.5 km south of Lennertsville (Gordonia Duneveld), the second area (about 3 trees) about 33km further south. The greatest concentration of these trees are within the last 27 km going south towards Kenhardt (most of which were associated with the various watercourse in the N'Rougas North and South areas).

In total **just over 70 *Vachellia erioloba* trees** were counted within the road reserve of the R27, from the Orange River to just south of Kenhardt (only about 3 individuals were observed south of Kenhardt). This includes about 40 – 45 individuals over 6m in height of which about 17 are magnificent trees. However, it is important to note that in most areas, the pipeline can be placed to avoid these trees. One dead individual of *Sensitive Species 144* was observed, but apart from this dead individual, no other individuals were observed within the R27 road reserve.

Photo 13: Looking from north to south along the R27 road reserve. Note the low vegetation height and the remaining *Boscia* individuals.

Photo 14: Looking from south to north along the R27 road reserve. Note the *Vachellia erioloba* trees in the sandy areas associated with one of the watercourses.

Photo 15: Looking from north to south along the R27 from about 60km south of Keimoes. This is the typical vegetation encountered along most of the road section between Lennertsville and Kenhardt.

Because the road reserve is regularly brush-cut, most of the expected shrub layer had been compromised and the vegetation cover now favours a grassy and annual plants (often these annuals will be typical disturbance indicators). The following low shrubs and herbs were observed: the

occasional *Aizoon burchellii*, *Tetragonia species* (galsiekslaai) *Aptosimum indivisum, Aptosimum lineare*, *Aptosimum spinescens*, *Blepharis mitrata*, *Dicoma capensis*, *Justicia australis* (calcrete areas), *Kewa salsoloides, Kleinia longiflora, Lessertia frutescens, Mesembryanthemum crystallinum, Mesembryanthemum dinteri, Rogeria longiflora, Tetraena chrysopteron, T. simplex* and *Tribulus zeyheri.* Near watercourses or in protected areas the occasional larger shrub such as *Lycium cinereum*, *Senegalia mellifera* (swarthaak), *Phaeoptilum spinosum* and *Tetraena decumbens* might be encountered.

Photo 16: Looking from south to north onto one of the river crossing along the R27, showing one of the magnificent larger *Vachellia erioloba* trees encountered. Sociable weaver nests can be observed within the tree.

Photo 17: Many of the *Vachellia erioloba* trees were relatively young, such as this one observed to the north of Kenhardt. All trees within the road reserve were marked, although most (like this one) should be easy to protect.

Photo 18: One of the denser stands of *Vachellia erioloba* trees just north of Kenhardt.

5.4. RESERVOIR: PIET ROOI'S PUTS

A balancing reservoir will be placed at a high point about 30 km south of Lennertsville (on Farm Piet Rooi's Puts 56/3). Water will be pumped from the Lennertsville WTW to Piet Rooi's Puts Reservoir, from where it will gravitate to the De Bakke Reservoir & Pump station (south of Kenhardt). The chosen location for Piet Rooi's Reservoir (the red circle in Figure 8) will be next to the existing Kenhardt BWS Reservoir, within an area that was previously disturbed (an old R27 construction road camp). During the site visit a larger study area was investigated (yellow area in Figure 8).

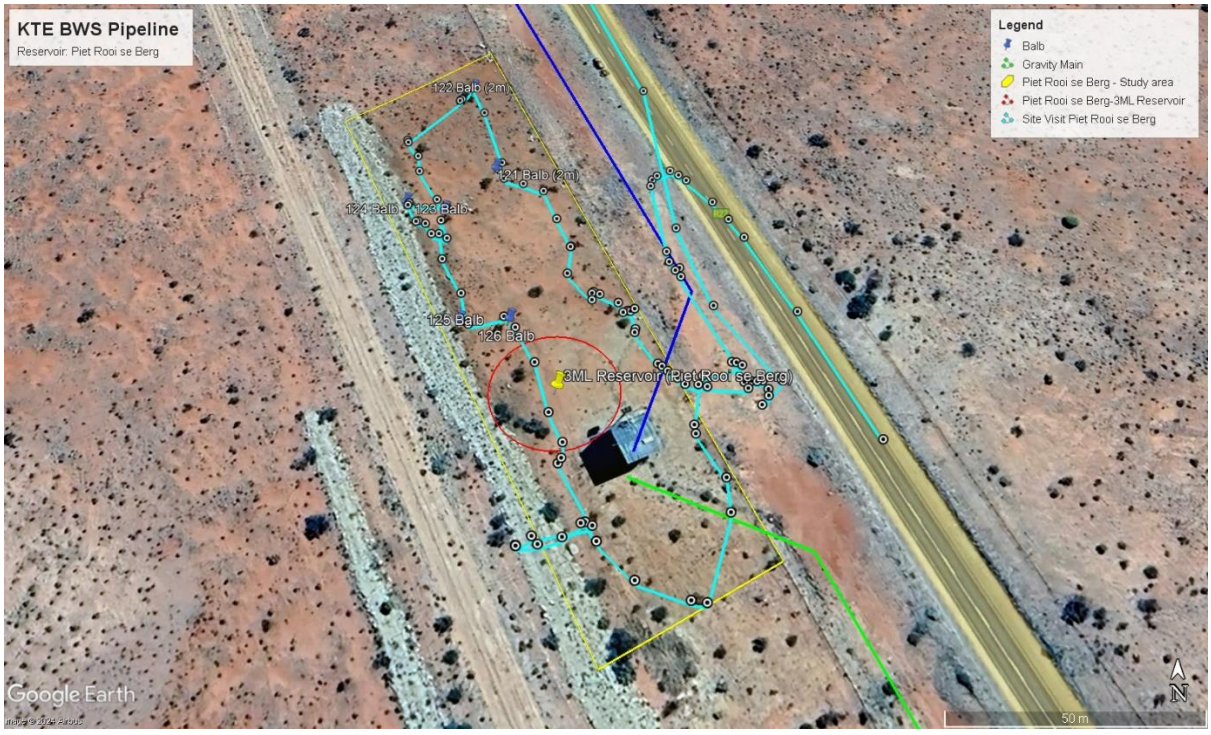


Figure 8: Google image showing the study area (yellow) for the proposed reservoir at Piet Rooi's Puts, the routes walked (light blue) and the locations of species of potential conservation concern (marked by waypoints). The waypoints marked as "Balb" refers to the locations of *Boscia albitrunca* individuals.

Photo 19: Looking from south to north over the proposed location for the new Reservoir at Piet Rooi's Puts. Note the disturbance footprint, and the occasional *Senegalia mellifera* and *Boscia albitrunca* individuals to the back.

The proposed new reservoir is not expected to impact on any remaining natural veld of any consequence, as it will be located within the disturbance footprint of the old road camp (Photo 19 &

20). Apart from a few grasses and weedy species, the disturbed area does not support any indigenous species of conservation concern. About five (5) *Boscia albitrunca* individuals were observed towards the northern edge of the study area of which only one is in close proximity to the proposed site location. However, with good environmental control there should be no reason why any of these plants should be impacted.

Photo 20: Looking from north to south over the proposed site location with the existing Kenhardt BWS reservoir in the back.

Along the outer edge of the site (outside of the disturbance footprint of the old road camp) the following indigenous shrubs were observed, namely a few individuals of *Senegalia mellifera*, *Aptosimum lineare*, *Dicoma capensis*, one *Euphorbia spinea*, weedy Asteraceae such as *Dimorphotheca*- & *Arctotis* species, *Pentzia incana*, *Tetraena chrysopteron* and the occasional *Justicia spartioides* (protected underneath *Senegalia mellifera*) and *Ruschia divaricata* underneath a *Boscia albitrunca*. To the west, but well away from the impact area, a beautiful individual of *Sensitive Species 144* was observed in the natural veld.

5.5. KENHARDT BY-PASS ROUTE

The proposed pipeline route will by-pass Kenhart to its west, following existing roads or tracks where possible (Figure 9). From the north it will cross underneath the Sishen-Saldana railway line, using an existing bridge (Photo 22). It will then cross a saline alluvial floodplain, between the Hartbees River and Kenhardt (Photo 23 & 24) running south towards the Hope Street gravel road. The pipeline route will then turn west-southwest to cross the Hartbees River at a right angle (Photo 25 & 26), and then south again, following existing gravel road (crossing tributaries to the Hartbees River) until it links up with the R27. It will then cross the R27 and runs south, in the eastern road reserve of the R27, towards the De Bakke Reservoir & Pump Station (Photo 28).

The vegetation to the north of Kenhardt is typical Bushmanland Arid Grassland (Photo 21), dominated by white grasses with the occasional shrub scattered throughout. The plant species was very similar to that described under Heading 5.3 above. Most of the larger shrubs were *Senegalia mellifera*, but the occasional *Boscia albitrunca* was observed, some of which might be impacted, but mostly they were well away from the proposed footprint. One *Vachellia erioloba* was observed, next to an intermittent stream, just north of the railway bridge (underneath which the pipeline will cross). This tree should be easy to protect and will not be within the proposed footprint area. Dense stands of *Prosopis* trees were often associated with these watercourses (Photo 22 & 24).

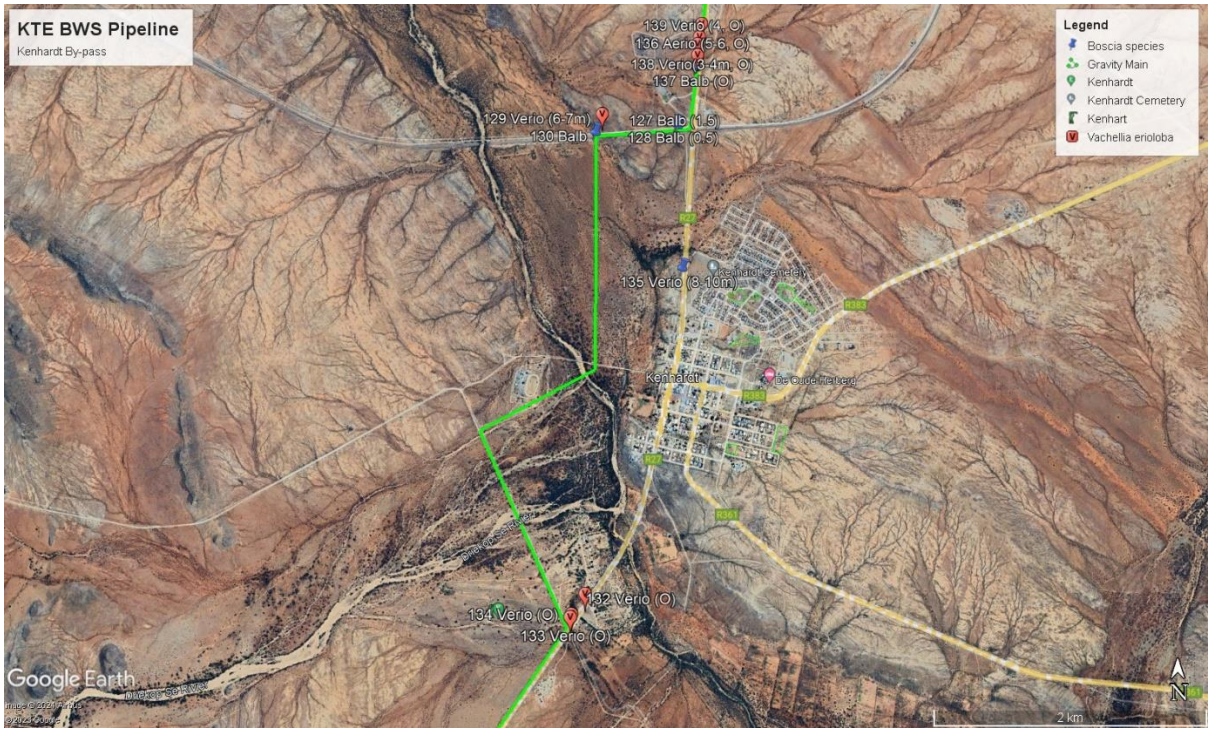


Figure 9: Google Image showing the town of Kenhardt and the proposed route for the pipeline (green). The red waypoints indicate the location of Vachellia erioloba trees, while the blue waypoints indicate Boscia albitrunca individuals.

Photo 21: Looking from east to west along the Sishen-Saldana railway line (R27 just to the back of this picture) showing the typical vegetation to the north of Kenhardt.

Photo 22: The Sishen-Saldana railway line just to north of Kenhardt showing the bridge underneath which the pipeline will cross. Note the dense *Prosopis* stands in the vicinity of the bridge.

Photo 23: *Salsola* dominated veld encountered south of the Sishen-Saldana railway line, within the saline alluvium soils of the floodplain to the east of the Hartbees River. The riparian vegetation of the Hartbees River can be seen to the back of picture.

Once the pipeline has crossed underneath the Sishen-Saldana railway bridge the vegetation changes dramatically as the pipeline enters a floodplain area with saline alluvial soils, which supports a vegetation composition very similar to the salt pans of the Bushmanland Vloere (Photo 24). In fact, the pans (vloere) and the intermittent streams and rivers of the Bushmanland are closely related in origin, geology and floristic composition of its vegetation (merging into one another in many locations) (Mucina *et. al*., 2006). The floodplain area was for the most part dominated by *Salsola* cf. *aphylla*, in combination with a number of salt tolerant species such as asbos, *Mesembryanthemum coriarium* (=*Psilocaulon*), *M. crystallinum* (Soutslaai), *M. noctiflorum* (vleisbos) *M. dinteri (=Psilocaulon), Galenia africana* and *Atriplex vestita* (vaalbrak).

Photo 24: One of the small drainage lines within the floodplain area. The drainage lines were typically dominated by *Prosopis* trees, but the occasional *Tamarix usneoides* and *Vachellia karroo* trees were also encountered.

Photo 25: The riparian vegetation next to the Hartbees River was typically dominated by dense *Prosopis* stands, but *Vachellia karroo* was also common.

Several intermittent drainage lines cross through this floodplain area, marked by a riparian border of larger trees. Unfortunately, most of these trees were alien invasive *Prosopis* trees, but *Tamarix usneoides* (wild tamarisk) the common *Vachellia karroo* (soetdoring) and *Ziziphus mucronata* (blinkblaar wag-'n-bietjie) were also observed (Photo 24 – 26).

Photo 26: Dense *Prosopis* stands, but in the area where the pipeline will cross the Hartbees River (looking from the east onto the river).

Photo 27: The floodplain area to the south of the Hartbees River. Looking from the R27 to the west over the site.

The riparian zone next to the Hartbees River was mostly associated with deeper sandy soils and characterized by a border of dense trees. Again, the vegetation was dominated by *Prosopis* trees but *Vachellia karroo* (sometimes forming patches), *Tamarix usneoides* and the occasional *Ziziphus mucronata* were also observed. On the edge or in open areas next to these trees' larger shrubs such as *Lycium cinereum*, *Phaeoptilum spinosum* and *Rhigozum trichotomum* were occasionally observed (Photo 26 & 27).

Photo 28: The eastern road reserve of the R27 just south of Kenhardt.

To the back of the river the vegetation was again typical Bushmanland Arid Grassland with the typical riparian vegetation next to the intermittent streams as described above.

Photo 28 shows the eastern road reserve of the R27 where the pipeline will cross the road. Two *Vachellia erioloba* trees were observed near this location but they slightly to the north and not within the proposed footprint area. However, they were marked for protection purposes.

Apart from larger indigenous trees, the vegetation associated with the Kenhardt by-pass route is considered of low botanical significance. However, the *Vachellia erioloba* individuals must be protected, while efforts should be made to minimize the impact on any other larger indigenous trees in this area.

5.6. BUSHMAN BASIN SHRUBLAND: R27

About 20 km south of Kenhardt, just about where the De Bakke Reservoir & Pump station will be located the vegetation changes from Bushmanland Arid Grassland to Bushmanland Basin Shrubland, which is also the main vegetation type that will be impacted all the way to the balancing Reservoir on Farm Uitkyk. Along the way, the pipeline route will cross intrusions of Lower Gariep Broken Veld (LC) (associated with rocky dolerite outcrops) and Bushmanland Vloere (associated with the salt pans). The soil in this area is generally slightly darker (mudstones and shales) and shallower, and the vegetation changes slightly, with drought resistant shrubs becoming more prominent, while the grassy component is less dominant. The terrain also becomes visibly drier as one moves southwards (Photo 29 to Photo 32). *Vachellia erioloba* (camel thorn) is now absent, but *Vachellia karroo* and *Ziziphus mucronata* can still be observed near watercourses.

Photo 29: Looking from north to south, at one of the culverts underneath the road. Note the *Vachellia karroo* to the left of picture.

Like the rest of the R27 between Kenhardt and Keimoes, the road reserve between Kenhardt and the Soafskolk turn-off is also brush-cut (Photo 29). Once one enters the Bushmanland Basin Shrubland the vegetation was generally much sparser and drier and probably require much less maintenance to maintain a low shrub layer. From the De Bakke pump station and reservoir southwards, the shrub layer remained sparse and was often dominated by the weedy *Galenia africana* (kraalbos) in combination with various other weedy or common *Mesembryanthemum* species (Photo 30). Other plant species observed, included *Aptosimum spinescens, Aizoon burchellii*, *Arctotis* species, *Augea*

capensis, *Cadaba aphylla*, *Dimorphotheca polyptera* (jakkalsblom) *Eriocephalus* cf. *microphyllus*, *Justicia divaricata (=Monechma), Lessertia frutescens (kankerbossie), Limeum aethiopicum, Lycium cinereum, Mesembryanthemum crystallinum, M. dinteri (=Psilocaulon), M. noctiflorum, M. tetragonum*, *Monsonia umbellata*, *Phaeoptilum spinosum*, occasionally *Pteronia* cf. *leucoclada* (bleekbossie), *Rhigozum trichotomum, Rogeria longiflora, Salsola tuberculata, Senegalia mellifera, Tetraena decumbens*, *Tetraena simplex* and the common dubbeltjie *Tribulus zeyheri*.

Photo 30: Looking from south to north, on the way to the De Bakke pump station and reservoir. In this area the weedy *Galenia africana* dominated the road reserve.

The road reserve runs through the occasional rocky outcrops (dolerite) where Lower Gariep Broken veld is expected (Photo 31). Because of constant road maintenance the vegetation did not show any marked difference from the vegetation to the north or south of these outcrops, but colonies of dassie were often observed near these areas.

Photo 31: One of the dolerite outcrops, just north of the Soafskolk turn-off. Colonies of dassies (rock hyrax) were often observed grazing near these rocky areas with shelters within the rocky outcrops.

Near watercourses or wetland areas, the occasional larger tree such as *Vachellia karroo*, *Searsia lancea* (karee) with the semi-parasitic mistletoe (*Tapinanthus oleifolius*) growing within, *Parkinsonia africana* and even the occasional *Royena lycioides*, may be observed with shrubs such as *Argyrolobium* cf. *argenteum, Berkheya annectens (disseldoring), Peliostomum virgatum, Stipagrostis namaquensis* (river bushman grass) and *Salsola aphylla* growing underneath or on the edges of these areas. Where the road cross salt pans associated with Bushmanland Vloere, the vegetation was usually dominated by dense stands of *Prosopis* trees.

Photo 32: Looking from north to south (near the Soafskolk turn-off). Note the increasing aridity of the landscape.

5.7. DE BAKKE RESERVOIR & PUMP STATION

The De Bakke reservoir & pump station will be located to the east of the R27 in an area of between 1 – 2 Ha in size. The vegetation within the proposed site location was sparse, dominated by a low grassy layer with the occasional shrub scattered in between (Photo 33 & Photo 34). Shrubs included *Galenia africana* patches, *Aptosimum spinescens*, *Augea capensis*, *Eriocephalus* cf. *microphyllus, Kleinia longiflora, Lycium cinereum, Monsonia umbellata*, *Phaeoptilum spinosum*, occasionally *Pteronia* cf. *leucoclada, Rhigozum trichotomum* and *Salsola tuberculata.*

Photo 33: Looking from south to north, over the proposed De Bakke pump station and reservoir (R27 to the left).

Photo 34: Looking from northeast to southwest over the proposed De Bakke study area (R27 to the back of picuture).

5.8. SOAFSKOLK TURN-OFF TO UITKYK RESERVOIR

From the Soafskolk turn-off the pipeline will follow secondary gravel roads to the Farm Styns Vley (about 11.5 km) (Photo 35 to Photo 37), before turning southwest to Dagab (Photo 38 & Photo 39), then turning west, following existing gravel roads to the farm Bysteek 423/0 (Photo 40 to Photo 42). Note that a short section of this pipeline will follow an internal farm road through farm Bysteek 423/0 (Photo 43). It will then cross underneath the Sishen-Saldana railway, using an existing culvert (Photo 44), before turning southwest, following the maintenance road (west of the railway line) towards the Farm Uitkyk (Photo 45 & Photo 46). The reservoir on Farm Uitkyk will be located on a high point in the landscape (Photo 46).

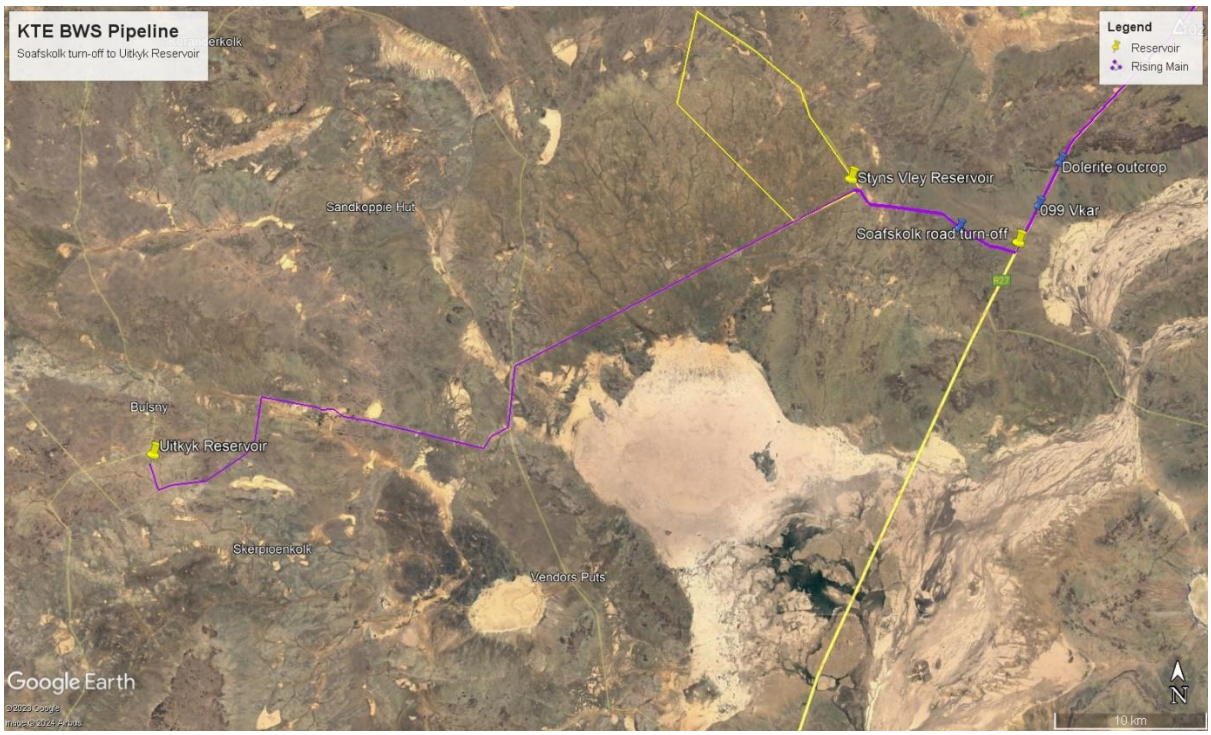


Figure 10: Google Image showing the proposed pipeline route (purple), following secondary farm roads from the Soafskolk turn-off, first to Farm Styns Vley (yellow polygon) and then on to the reservoir on Farm Uitkyk.

This section of the pipeline will impact almost exclusively on Bushmanland Basin Shrubland, only occasionally running past or through existing salt pan areas (following existing roads). The pipeline will again be located within the road reserve (mostly the southern road reserve) along these secondary gravel roads. The main difference between the vegetation along this section and that along the R27 is that this vegetation is not subject to regular brush cutting. Thus, although the plant species composition was very similar the shrub layer were often more pronounced. Between Styns Vley and Soafskolk (Photo 39) and near the Bysteek Farm house (Photo 42), the existing roads runs through (or touch) saltpan areas. The salt pan areas itself, were often heavily invaded by dense stands of alien invasive *Prosopis* trees.

For the most part the vegetation along these secondary farm roads can be described as dominated by "white" grasses (*Stipagrostis* species) with hardy (often spiny) shrubs scattered within the landscape (Photos 35, 37, 38 & 40). From Bysteek to Uitkyk the vegetation were a drier version and the grasses not as prominent (Photos 41, 43, 45 & 46).

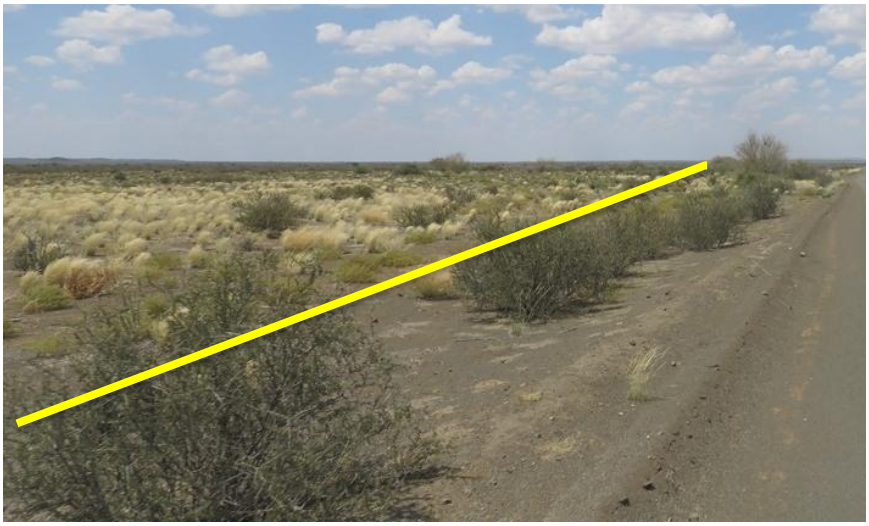


Photo 35: Looking from east to west, along the Soafskolk road, towards Styns Vley farm. *Rhigozum trichotomum* the dominant shrub in the foreground with *Parkinsonia africana showing towards the back*. The yellow line indicating the potential pipeline route.

Photo 36: One of the small watercourses crossing the pipeline route. The trees are *Parkinsonia africana* the left and *Royena lycioides* (one of only two individuals observed) in the middle.

Photo 37: Looking from east to west over the road reserve of the Soafskolk road. *Salsola tuberculata,* in this case, the dominant shrub in between the *Stipagrostis* grasses.

The larger hardy shrubs were usually *Rhigozum trichotomum* (driedoring), *Lyceum cinereum* (kriedoring) or *Phaeoptilum spinosum* (brosdoring). *Salsola tuberculata* patches were sometimes observed (e.g., Photo 37), while the slightly larger, *Parkinsonia africana* was the most dominant tree (apart from *Prosopis* individuals) observed. The intermittent drainage lines (watercourses) was almost always marked by *Parkinsonia africana* and/or a slightly denser cover of some of the larger shrubs mentioned above. *Cadaba aphylla* (swartstorm) and *Gomphocarpus filiformis* (lammerlat) were

almost always associated with these drainage lines, while the occasional *Searsia lancea* (karee) as well as one individual of the small tree *Royena lycioides* (Karoo-bloubos) were observed to the east, near the R27 (Photo 36).

Photo 38: Looking from Styns Vley southwest along the pipeline route. The larger trees being *Parkinsonia africana*, with *Lycium cinereum* in the foreground.

Apart from grasses, *Salsola tuberculata* and *Eriocephalus* cf. *microphylla* were observed on the edges of the salt pan between Styns Vley and Soafskolk, an area otherwise almost devoid of vegetation (Photo 39).

Photo 39: Looking southwest about hallway between the farms Styns Vley and Soafskolk, where the road touches on the edge of one of the salt pan areas.

Photo 40: Looking west towards the Farm Bysteek.

Scattered along the route various other smaller shrubs were observed, including: *Acanthopsis disperma*, *Amellus* cf. *tridactylus*, *Aptosimum spinescens* (common), *Augea capensis* (often in patches), *Berkheya annectens* (near watercourses), *Cynanchum viminale*, *Galenia africana*, *Geigeria ornativa*, *Helichrysum* cf. *argyrosphaerum*, *H. herniarioides* (prostrate herb), *Hirpicium* species, *Lessertia frutescens*, *Mesembryanthemum coriarium*, *M. crystallinum*, *M. noctiflora*, *Peliostomum virgatum*, *Pentzia incana*, *Pteronia* cf. *mucronata*, *P.* species, *Rosenia humilis*, *Salsola aphylla* (watercourses and wetlands), Sa*lsola tuberculata*, *Senecio niveus*, *Tetraena chrysopteron*, *T. simplex*, *Tetragonia* species and *Tribulus zeyheri* (dubbeltjie).

Photo 41: Looking west in the direction of the Farm Bysteek (a dolerite rocky outcrop showing in the background).

Photo 42: A dense stand of Prosopis trees, associated with the salt pans near Bysteek (probably associated with Vloerdam). *Salsola aphylla* was usually observed in the wetland area with *Salsola tuberculata* in the surrounding veld on the edges of the pan.

Photo 43: Typical vegetation along the twee spoor track between Bysteek and the Sishen-Saldana railway. Veld is dominated by *Prosopis* trees, with dried out remains of *Rhigozum trichotomum* visible.

Photo 44: Culvert underneath the Sishen-Saldana railway line, through which the pipeline will cross.

Photo 45: Typical vegetation along the last section of the route towards the Uitkyk Farm (the Sishen-Saldanha railway line to the left of picture)

Photo 46: Looking towards the proposed reservoir location on the farm Uitkyk

5.9. RESERVOIR ON FARM STYNS VLEY 280

The proposed location for the reservoir on farm Styns Vley is to the south of the farm, near the Soafskolk road. The disturbance footprint will be less than 1 ha in size, located in the lower part of the farm (the study area). Similar to the reservoir site on farm Uitkyk, the farm is still used for livestock grazing (mostly sheep). The vegetation was characterized by a fair grassy cover (e.g. *Stipagrostis obtusa*) with shrubs scattered in between. A number of *Parkinsonia africana* tees were observed together with larger shrubs like *Lycium cinereum, Phaeoptilum spinosum* and *Rhigozum trichotomum*. Smaller shrubs included *Cadaba aphylla*, *Salsola tuberculata*, *Tetraena chrysopteron* and *Aptosimum spinescens*.

Photo 47: Looking from south to north, over the proposed reservoir on Farm Styns Vley.

Photo 48: Looking from north to south over the proposed location for the reservoir on farm Styns Vley. Parkinsonia africana to the left, and back of picture.

5.10. RESERVOIR ON FARM UITKYK 899/1

The location of the reservoir on farm Uitkyk is quite a distance away of the proposed KTE plant location, but the site was chosen because it will allow gravity feed back to the KTE plant (being on higher ground), which will result in significant energy saving over the long term. The size of the disturbance footprint will be about 1 ha in size. The site is actively used as grazing by livestock (sheep).

Photo 49: Looking from south to north, over the proposed balancing reservoir on Farm Uitkyk

Photo 50: Looking from north to south over the proposed location for the reservoir on Farm Uitkyk.

At the time of the site visit the vegetation in this area of the farm was very dry and vegetation cover was sparse (Photo 49 & Photo 50). Apart from a low sparse grassy component (e.g. *Stipagrostis obtusa*) the only the occasional *Rhigozum trichotomum*, *Lycium cinereum* and *Tetraena chrysopteron* were observed.

6. FLORA ENCOUNTERED

Table 9 gives a list of the plant species encountered during this study. It is important to note that the species list is not based on long term repetitive sampling, and it is likely that species might have been missed. However, the author is confident that a good understanding of the vegetation was achieved and confidence in the findings is high.

Table 9: List of plant species observed within the proposed development footprint.

NO.	SPECIES NAME	FAMILY	STATUS	LOCATION
1.	*Acanthopsis disperma*	ACANTHACEAE	LC	Small, spiny shrub - occasional in granite slopes
2.	*Aizoon burchellii (=A asbestinum)*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	A widespread species, occasionally observed in the road reserve – Bushmanland Arid Grassland
3.	*Aloe claviflora*	ASPHODELACEAE	LC NCNCA, Schedule 2 Protected	Only observed in the Lennertsville WTW (southern portion).
4.	*Amellus* cf. *tridactylus*	ASSTERACEAE	LC	Occasionally in Bushmanland Basin Shrubland
5.	*Amellus epaleaceus*	ASSTERACEAE	LC	A small annual herb – occasionally observed.
6.	*Aptosimum indivisum*	SCROPHULARIACEAE	LC	Occasionally observed – Bushmanland Arid Grassland.
7.	*Aptosimum lineare*	SCROPHULARIACEAE	LC	Occasionally observed – Bushmanland Arid Grassland.
8.	*Aptosimum spinescens*	SCROPHULARIACEAE	LC	Doringviooltjie – a very hardy plant occasionally observed.
9.	*Argemone ochroleuca*	PAPAVERACEAE	**Alien invasive plant species.**	White Mexican poppy: Disturbed areas next to the Orange River
10.	*Argyrolobium* cf. *argenteum*	FABACEAE	LC	Only one patch observed, near a saltpan area along the R27.
11.	*Atriplex vestita*	AMARANTHACEAE	LC	Vaalbrak. Occasional in salt pans and floodplain areas.
12.	*Augea capensis*	ZYGPHYLLACEAE	LC	Occasionally observed, often forming patches.
13.	*Berkheya* cf. *annectens*	ASTERACEAE	LC	Disseldoring – occasionally observed (near water).
14.	*Blepharis mitrata*	ACANTHACEAE	LC	Occasionally throughout.
15.	*Boscia albitrunca*	BRASSICACEAE (CAPPARACEAE)	LC NFA protected species. NCNCA, Schedule 2 Protected	Shepperd's tree. Bushmanland Arid Grassland
16.	*Boscia foetida*	BRASSICACEAE (CAPPARACEAE)	LC NCNCA, Schedule 2 Protected	Small shrubby individuals occasionally observed.
17.	*Cadaba aphylla*	CAPPARACEAE	LC	Bloustorm – occasional near watercourses.
18.	*Chascanum garipense*	VERBENACEAE	LC	Lennertsville WTW (Bushmanland Arid Grassland)
19.	*Convolvulus sagittatus*	CONVOLULACEAE	LC	Bobbejaantou: On the fence next to the Orange River
20.	*Cynanchum viminale*	APOCYNACEAE	LC NCNCA, Schedule 2 Protected	Occasionally – Bushmanland Basin Shrubland.
21.	*Dicoma capensis*	ASTERACEAE	LC	Occasionally – Bushmanland Arid Grassland

NO.	SPECIES NAME	FAMILY	STATUS	LOCATION
22.	*Dimorphotheca polyptera*	ASTERACEAE	LC	Jakkalsblom – Occasional along the R27.
23.	*Erigeron sumatrensis (=Conyza albida)*	ASTERACEAE	Naturalized weed.	Tall fleabane: Weedy alien in disturbed areas near Lennertsville.
24.	*Eriocephalus* cf. *microphyllus*	ASTERACEAE	LC	Kapokbos: Observed in rocky area in Bushmanland Basin Shrubland
25.	*Euphorbia braunsii*	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected	A small succulent only observed near Lennertsville.
26.	*Euphorbia spinea*	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected	A small succulent only observed near Piet-Rooi-se reservoir.
27.	*Fingerhuthia africana*	POACEAE	LC	Fingerhoedgrass.
28.	*Galenia africana*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Kraalbos – common and often associated with disturbed areas.
29.	*Geigeria ornativa*	ASTERACEAE	LC	Vermeerbos: Occasionally in Bushmanland Basin Shrubland.
30.	*Gomphocarpus filiformis*	APOCYNACEAE	LC	Lammerlat – occasionally near watercourses.
31.	*Helichrysum cf. argyrosphaerum*	ASTERACEAE	LC	Rarely observed – Bushmanland Basin Shrubland
32.	*Helichrysum herniarioides*	ASTERACEAE	LC	Rarely observed – Bushmanland Basin Shrubland
33.	*Hirpicium* species	ASTERACEAE	LC	Small herb, occasionally observed in Bushmanland Basin Shrubland
34.	*Justicia austalis*	ACANTHACEAE	LC	Occasionally observed – Bushmanland Arid Grassland.
35.	*Justicia divaricata (=Monechma)*	ACANTHACEAE	LC	Occasionally observed along the R27.
36.	*Justicia spartioides*	ACANTHACEAE	LC	Occasionally observed at Piet Rooi's Puts Reservoir.
37.	*Kewa salsoloides*	KEWACEAE	LC	Small succulent occasionally observed.
38.	*Kleinia longiflora*	ASTERACEAE	LC	A medium succulent observed throughout.
39.	*Lessertia frutescens*	FABACEAE	LC NCNCA, Schedule 2 Protected	Kankerbossie; Occasionally throughout.
40.	*Limeum aethiopicum*	MOLLUGINACEAE	LC	Aarbossie – Low shrub, occasionally in Bushmanland Basin Shrubland
41.	*Limeum argute-carinatum*	MOLLUGINACEAE	LC	Koggelmandervoetkaroo – prostrate annual herb Bushmanland Arid Grassland
42.	*Lycium cinereum*	SOLANACEAE	LC	Kriedoring- Medium large shrub occasional throughout.
43.	*Maerua gilgii*	BRASSICACEAE (CAPPARACEAE)	LC	Single individuals – Lennertsville WTW
44.	*Melia azedarach*	MELIACEAE	**Alien invasive plant species.**	Seringboom: Disturbed areas next to the Orange River.
45.	*Mesembryanthemum coriarium (=Psilocaulon)*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Asbos: A widespread and hardy species relatively common throughout.
46.	*Mesembryanthemum crystallinum*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Soutslaai: A weedy species often observed in disturbed areas.

NO.	SPECIES NAME	FAMILY	STATUS	LOCATION
47.	*Mesembryanthemum dinteri (=Psilocaulon)*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	A widespread and hardy species occasionally observed along the R27.
48.	*Mesembryanthemum noctiflorum*	AICOACEAE	LC NCNCA, Schedule 2 Protected	Vleisbos: Occasional in Bushmanland Basin Shrubland
49.	*Mesembryanthemum tetragonum*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Succulent species occasionally observed in floodplain areas.
50.	*Monsonia umbellata*	GERANIACEAE	LC	Rhabas: Occasional throughout.
51.	*Nicotiana glauca*	SOLANACEAE	**Alien invasive plant species.**	Tabakboom: Disturbed areas next to the Orange River.
52.	*Parkinsonia africana*	FABACEAE	LC	Small tree, rarely observed next to drainage lines.
53.	*Peliostomum virgatum*	SCHROPHULARIACEAE	LC	Occasional near watercourses in Bushmanland Basin Shrubland
54.	*Pentzia incana*	ASTERACEAE	LC	Karoobossie – occasionally observed Bushmanland Basic Shrubland.
55.	*Phaeoptilum spinosum*	NYCTAGINACEAE	LC	Brosdoring – Relatively common throughout.
56.	*Prosopis* species	FABACEAE	**Alien invasive plant species.**	Common near watercourses or wetland areas.
57.	*Pteronia* cf. *leucoclada*	ASTERACEAE	LC	Bleekbossie: Small shrub – only just starting to flower.
58.	*Pteronia* species	ASTERACEAE		Medium shrub, no flowers.
59.	*Rhigozum trichotomum*	BIGNONIACEAE	LC	Driedoring – dominant throughout.
60.	*Rogeria longiflora*	PEDALIACEAE	LC	Only the dried out inflorescence observed.
61.	*Rosenia humilis*	ASTERACEAE	LC	Medium/small spiny shrub – Bushmanland Basin Shrubland
62.	*Royena lycioides (=Diospyros)*	EBENACEAE	LC	Karoo-boubos: Occasional next to larger watercourses.
63.	*Ruschia divaricata*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Occasional near Piet Rooi's Puts Reservoir.
64.	*Salsola* cf. *aphylla*	AMARANTHACEAE	LC	Ganna: medium shrub associated with salt panne and floodplain areas.
65.	*Salsola kali*	AMARANTHACEAE	**Alien invasive plant weed**	Tumbleweed: An annual unpalatable weed in disturbed areas.
66.	*Salsola* tuberculata	AMARANTHACEAE	LC	Blomkoolganna: Bushmanland Basin Shrubland.
67.	*Searsia lancea*	ANACARDIACEAE	LC	Karee – occasional along larger watercourses.
68.	*Senecio niveus*	ASTERACEAE	LC	Medium shrub with succulent stems – Bushmanland Basin Shrubland.
69.	*Senecio* species	ASTERACEAE	LC	Weedy indigenous species – disturbed areas.
70.	*Senegalia mellifera*	FABACEAE	LC	Swarthaak: Bushmanland Arid Grassland
71.	*Sensitive species 144*	ASPHODELACEAE	**VU** NCNCA, Schedule 1 Protected	One dead individual along the R27. Remainder well outside the footprint.
72.	*Stipagrostis ciliata*	POACEAE	LC	Langbeenboesmangrass.
73.	*Stipagrostis namaquensis*	POACEAE	LC	River bushman grass.
74.	*Stipagrostis* obtusa	POACEAE	LC	Kortbeenboesmangrass.

NO.	SPECIES NAME	FAMILY	STATUS	LOCATION
75.	*Tamarix usneoides*	TAMARICACEAE	LC	Wild tamarisk – Next to larger watercourses.
76.	*Tapinanthus oleifolius*	LORANTHACEAE	LC	Stem parasite – occasionally within larger shrubs.
77.	*Tetraena chrysopteros*	ZYGOPHYLACEAE	LC	Kleinskilpadbos – dwarf shrub occasionally observed.
78.	*Tetraena decumbens*	ZYGOPHYLACEAE	LC	Small succulent shrub in Bushmanland Arid Grassland
79.	*Tetraena microcarpa*	ZYGOPHYLACEAE	LC	Armoedsbossie. Small succulent shrub in Bushmanland Arid Grassland
80.	*Tetraena simplex*	ZYGOPHYLACEAE	LC	Vostruisdruiwe: Often on disturbed road verges.
81.	*Tetragonia* species	AIZOACEAE		A succulent species, Bushmanland Basin Shrubland
82.	*Tetragonia species*	AIZOACEAE	LC NCNCA, Schedule 2 Protected	Disturbed areas along the R27 – Bushmanland Arid Grassland
83.	*Tribulus zeyheri*	ZYGPHYLACEAE	LC	Dubbeltjie: Bushmanland Arid Grassland – R27 Road reserve.
84.	*Vachellia erioloba*	FABACEAE	LC NFA protected species	Camelthorn: Near watercourses and deeper sandy areas.
85.	*Vachellia karroo*	FABACEAE	LC	Soetdoring: Near watercourses.
86.	*Ziziphus mucronata*	RHAMNACEAE	LC	Blinkblaar wag-'n-bietjie: Occasionally near watercourses.

6.1. THREATENED AND PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora. Major threats to the South African flora are identified in terms of the number of plant taxa Red-Listed as threatened with extinction as a result of threats like, habitat loss (e.g. infrastructure development, urban expansion, crop cultivation and mines), invasive alien plant infestation (e.g. outcompeting indigenous plant species), habitat degradation (e.g. overgrazing, inappropriate fire management etc.), unsustainable harvesting, demographic factors, pollution, loss of pollinators or dispersers, climate change and natural disasters (e.g. such as droughts and floods). South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. However, due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. As a result, SANBI uses an amended system of categories to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

6.1.1. RED LIST OF SOUTH AFRICAN PLANT SPECIES

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa's indigenous plants (SANBI, 2020).

- One red-listed plant species, *Sensitive Species 144,* was observed within the R27 road reserve, but this individual was already dead. Other individuals observed were well away from the

footprint area. It is not expected that any of these plants will be impacted.

6.1.2. NEM:BA PROTECTED PLANT SPECIES

The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "Lists of critically endangered, endangered, vulnerable and protected species" (GN. R. 152 of 23 February 2007).

- No species protected in terms of NEM: BA were observed.

6.1.3. NFA PROTECTED PLANT SPECIES

The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (as updated).

- **Two (2) species** protected in terms of the NFA were observed, namely *Boscia albitrunca* (Sheppard's tree) & *Vachellia erioloba* (Camel thorn).
- Refer to Appendix 3 for list of all these plants observed with their GPS locations).
- Refer to Table 10 for impact mitigation recommendations.

6.1.4. NCNCA PROTECTED PLANT SPECIES

The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, and provides for the sustainable utilization of wild animals, aquatic biota, and plants. Schedule 1 and 2 of the Act gives extensive lists of specially protected and protected fauna and flora species in accordance with this act. NB. Please note that all indigenous plant species are protected in terms of Schedule 3 of this act (e.g., any work within a road reserve).

- **Seventeen (17)** species protected in terms of the NCNCA were observed, although most of them were widespread common species protected by default as part of a specific genus or family (Refer to Table 10).

6.2. PLANT SPECIES SENSITIVITY THEME

According to the **DFFE Environmental Screening Tool** report for this site (Appendix 2), the **plant species theme sensitivity is considered Medium Sensitive**, because of the potential for or encountering the following species:

- ***Tridentea virescens* (Apocynaceae):** It is a widespread but rare succulent that occurs on stony ground, or hard loam in floodplains, in sporadic small subpopulations of up to six plants. It might occur in the northern part (Keimoes area) of the study area, but it was not observed. Because of the disturbed nature of the R27 road reserve in this area, the changes that this species will be impacted is considered low to very low.
- ***Sensitive species 144:*** Refer to Table 10, above. This species is not expected to be impacted by the proposed development.
- ***Dregeochloa calviniensis* (Poaceae):** This plant normally occurs on limestone outcrops in arid succulent karoo shrubland. Neither the plant nor prominent limestone outcrops were observed

within the study area.

In addition, 17 NCNCA, protected species were observed, also including Sensitive Species 144 (Refer to Table 10). However, almost all of these species, especially the Aizoaceae, are widespread species or hardy pioneer species. The only species of conservation concern (SoCC) are:

- ***Sensitive Species 144***, which will not be impacted;
- One ***Aloe*** species;
- Two ***Boscia*** species; and
- Two ***Euphorbia*** species.

Table 10: An evaluation of the protected plant species with impact mitigation recommendations

NO.	SPECIES NAME	STATUS & COMMENTS	IMPACT MITIGATION RECOMMENDATIONS
1.	*Aizoon burchellii (=A asbestinum)* **Schedule 2 protected.** **(All plants in this Family)**	This plant was occasionally observed within the road reserve of the R27 between Lennertsville & the De Bakke Reservoir It is a widespread species not endemic to South Africa with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
2.	*Aloe claviflora* **Schedule 2 protected.** **(All plants in this Family)**	A few individuals were observed in the southern alternative for the Lennertsville WTW. This is a widespread species with a red-list status of Least Concern.	**Search & rescue** It is unlikely that these plants will be impacted, because the preferred location is to the north. However, all *Aloe* species that might be impacted by the proposed development must be transplanted outside of the footprint. **A NCNCA Permit application must be submitted.**
3.	*Boscia albitrunca* **Schedule 2 protected** **(All plants in this Genus)**	Just over 100 shrubs and small trees were observed within the R27 road reserve. But only about 11 were larger single stem individuals (most were multi-stemmed shrubs).	No search & rescue is proposed. *Boscia* species seldom transplant successfully, because of their extensive and deep root system. Efforts should be made to protect all the larger trees and as many of the shrubs as possible. **A NFA & a NCNCA Permit application must be submitted for the removal of these plant.**
4.	*Boscia foetida* **Schedule 2 protected** **(All plants in this Genus)**	A few individuals were observed in the southern alternative for the Lennertsville WTW. This is a widespread species with a red-list status of Least Concern	No search & rescue is proposed. Boscia species seldom transplant successfully, because of their extensive and deep root system. It is unlikely that these plants will be impacted, because the preferred location is to the north. **A NCNCA Permit application must be submitted for the removal of these plant.**
5.	*Cynanchum viminale* **Schedule 2 protected** **(All plants in this Family)**	A widespread plant with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
6.	*Euphorbia braunsii* **Schedule 2 protected** **(All plants in this Genus)**Error! Reference s ource not found.	A few individuals were observed in the southern alternative for the Lennertsville WTW. This is a widespread species with a red-list status of Least Concern.	**Search & rescue.** It is unlikely that these plants will be impacted, because the preferred location is to the north. However, all plants that might be impacted by the proposed development should be transplanted outside of the footprint. **A NCNCA Permit application must be submitted.**
7.	*Euphorbia spinea* **Schedule 1 protected** **(All plants in this Genus)**	A few individuals were observed within the R27 road reserve (Bushmanland Arid Grassland section). Although never common, this is a relatively widespread species with a red-list status of Least	**Search & rescue.** Any plants that might be impacted by the proposed development should be transplanted next to or within the study area.

NO.	SPECIES NAME	STATUS & COMMENTS	IMPACT MITIGATION RECOMMENDATIONS
		Concern.	**A NCNCA Permit application must be submitted.**
8.	*Galenia africana* **Schedule 2 protected (All plants in this family)**	A very widespread plant, often found in disturbed areas. It has a red-list status of Least Concern.	No Search & rescue proposed. This is a hardy pioneer species. **A NCNCA Permit application must be submitted.**
9.	*Lessertia frutescens* **Schedule 2 protected (All plants in this Genus)**	A widespread and hardy plant often associated with watercourses or disturbed roadsides. It has a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
10.	*Mesembryanthemum coriarium* **Schedule 2 protected (All plants in this Family)**	A widespread, hardy plant often associated with disturbed areas. It has a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
11.	*Mesembryanthemum crystallinum* **Schedule 2 protected (All plants in this Family)**	A widespread hardy plant, often found in disturbed areas. It has a red-list status of Least Concern.	No Search & rescue proposed. This is a hardy pioneer species. **A NCNCA Permit application must be submitted.**
12.	*Mesembryanthemum dinteri* **Schedule 2 protected (All plants in this Family)**	A widespread hardy plant with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
13.	*Mesembryanthemum noctiflorum* **Schedule 2 protected (All plants in this Family)**	A widespread hardy plant with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
14.	*Mesembryanthemum tetragonum* **Schedule 2 protected (All plants in this Family)**	A widespread species, not endemic to South Africa with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
15.	*Ruschia divaricata* **Schedule 2 protected (All plants in this Family)**	A widespread species, not endemic to South Africa with a red-list status of Least Concern.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
16.	*Tetragonia species* **Schedule 2 protected (All plants in this Family)**	A widespread pioneer species.	No Search & rescue proposed. Topsoil conservation and re-use during rehabilitation should result in seed store protection. **A NCNCA Permit application must be submitted.**
17.	*Vachellia erioloba* **NFA protected species**	About 70 trees were observed, mainly within the road reserve of the R27 in the deeper sands associated with Gordonia Duneveld and most particularly the first 27km north of Kenhardt. About 40 – 45 individuals are over 6m in height of which about 17 are magnificent trees. A list of these trees with their GPS co-ordinates are given in Appendix 3.	**Protect *in-situ*** Because of the size of the pipe, it is expected that some of these trees will be impacted during construction, but with care, most of them can be protected. All efforts should be made to avoid these trees when planning the pipeline route, especially all trees larger than 6m in height. **A NFA Permit application must be submitted (if any tree were to be impacted).**
18.	*Sensitive species 144* **Schedule 1 protected species**	This is a vulnerable plant with a with a broad distribution range, but showing a distinct population decline and is expected to be vulnerable to climate change. Only one dead individual was observed within the footprint area.	It is not expected that any of these plants will be impacted. **A NCNCA Permit application must be submitted** *(if any tree were to be impacted).*

From a botanical viewpoint the most significant impact on plant species is considered the potential impact on the two NFA protected species namely:

- ***Boscia albitrunca*** (Sheppard's tree):

- Most of the *Boscia albitrunca* individuals are multi-stemmed shrubs, but it also include several larger trees in good condition. Almost all of these occur from 10 km south of Lennertsville to Kenhardt (associated with Bushmanland Arid Grassland & Gordonia Duneveld vegetation types).

- ***Vachellia erioloba*** (camelthorn tree), especially in the following locations:
  - A patch of about 13 camelthorn trees, about 7-8km south of Lennertsville, associated with the intrusion of Gordonia Duneveld;
  - The patch of about 4 camelthorn trees (including one magnificent tree of about 10-12m in height) about 40km south of Lennertsville, associated with the intrusion of Gordonia Duneveld; and
  - The large number of camelthorn trees encountered within or along the R27 road reserve in the 27 km section just north of Kenhardt.

Because of the length of the pipeline and the difference in vegetation types of the plant species sensitivity theme are discussed as part of the terrestrial sensitivity assessment for each section of the proposed route/infrastructure (Refer to Heading 7).

7. TERRESTRIAL BIODIVERSITY SENSITIVITY ASSESSMENT

According to the **DFFE National Web Based Environmental Screening Tool** the relative Terrestrial Biodiversity theme sensitivity is considered of **Very High Sensitivity** because:

- The proposed project footprint overlaps CBA 1, CBA 2 and ESA areas.
- The proposed project footprint overlaps a FEPA (Freshwater Ecosystem Priority Area) Subcatchment.
- Portion of the footprint overlaps areas that has been included in the National Protected Area Expansion Strategy (NPAES).

Because of the variation in vegetation types and potential impacts over the length of the project, the Terrestrial Biodiversity Sensitivity was not done for the route as a whole, but for each significant section/area that will be impacted along its route. The different sections are discussed below.

7.1. IMPACT ASSESSMENT: ORANGE RIVER EXTRACTION POINT.

The new pump station will be located next to the existing Kenhardt BWS pumpstation in an area that is basically transformed, and on the edge of existing agricultural land (vineyards). The sensitivity assessment in Table 11 is based on the status of the site as described under Heading 5.1.

Table 11: Sensitivity assessment: Orange River Extraction point.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Special habitats: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	2	3	4	1	1	18	On the banks of the Orange River, a transformed section of Lower Gariep Alluvial Vegetation (LC), within a CBA. No natural veld remaining.
	With mitigation	2	2	4	1	1	16	The site should be located next to the existing pump station and should utilise the existing disturbance footprint as much as possible.
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	3	2	1	1	14	An existing pump station, with agricultural right up to the banks of the Orange River.
	With mitigation	2	2	2	1	1	12	The construction period might result in a temporary nuisance impact on agricultural activities.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	3	4	1	1	18	The vegetation type is not threatened but is located within a disturbed/transformed CBA.
	With mitigation	2	2	4	1	1	16	The site should be located next to the existing pump station and should utilise the existing disturbance footprint as much as possible.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	2	3	4	1	1	18	The site is located in an CBA, associated with the Orange River corridor. However, the site is disturbed/transformed with no natural veld remaining.
	With mitigation	2	2	4	1	1	16	The site should be located next to the existing pump station and should aim to utilise the existing disturbance footprint as much as possible.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	1	2	4	1	1	8	Connectivity had been severely compromised as a result of historical landuse.
	With mitigation	1	2	4	1	1	8	The site should be located next to the existing pump station and should aim to utilise the existing disturbance footprint as much as possible.
Plant SoCC: Potential impact on threatened or protected plant species.	Without mitigation	2	1	4	1	1	14	No species of conservation concern observed.
	With mitigation	2	1	4	1	1	14	N/a
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	2	3	4	1	1	18	The enlargement of an existing pump station footprint, in an area with no remaining natural veld or SoCC, but within a CBA.
	With mitigation	2	2	4	1	1	16	Refer to the impact minimisation recommendations.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	2	2	3	1	1	14	No additional impact on a CBA. However, the CBA overlaps an area already transformed with minimal connectivity and no SoCC.
	With mitigation							

No natural veld of any significance remains in the proposed footprint area and no significant species of conservation concern (SoCC) will be impacted. As a result, the site itself is considered of low botanical significance, as long as the development footprint remains within the proposed disturbed section of the Orange River bank next to the existing Kenhardt pump station. Although the site overlaps the CBA associated with the Orange River it is basically transformed because of the existing landuse (agriculture right up to the river bank and the existing pump station) and connectivity (in this area) had been compromised.

As a result, the impact assessment (Table 11) suggests that:

- The cumulative impact is rated as **Very-Low**.
- The plant species theme sensitivity is considered of **Very -Low Sensitivity** (no natural veld remaining and no SoCC observed).
- The terrestrial biodiversity theme sensitivity is also considered to be of **Low Sensitivity** (even though it overlaps a CBA), because of the transformed nature of the site.

7.2. IMPACT ASSESSMENT: LENNERTSVILLE WTW

The new KTE water treatment works (WTW) will be located to the south of Lennertsville, next to the existing Kenhardt WTW. Two potential locations were evaluated, the preferred location to the north off-, and a location to the south of the existing Kenhardt WTW. There are not special habitats or watercourses on the property (other than wastewater overflowing from the WTW), but the proposed location overlaps the CBA associated with the Orange River corridor. The sensitivity assessment in Table 12 is based on the status of the site as discussed under Heading 5.2.

Table 12: Sensitivity assessment: Lennertsville WTW.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	3	4	5	1	3	39	Municipal land - the southern option might impact on several fenced-off dwellings (potential illegal settlement).
	With mitigation	1	2	5	1	1	9	The preferred location (to the north of the existing WTW) will avoid the impact on the dwellings and NCNCA protected species.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	3	5	1	1	20	The vegetation type is Least Threatened, mostly disturbed or overgrown by Prosopis, but support a few (hardy) NCNCA protected species to the south.
	With mitigation	1	2	5	1	1	9	The preferred location (to the north) will minimise the impact on natural veld and SoCC.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	4	1	1	27	The site overlaps a mostly disturbed CBA; vegetation Least Threatened, but support a few (hardy) NCNCA protected species to the south.
	With mitigation	2	2	4	1	1	16	The preferred location (to the north of the existing WTW) will minimise impact on remaining natural veld.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	3	2	4	1	1	24	Although some connectivity remains, it had been largely compromised, because of existing infrastructure to the north, east and to a lesser degree south.
	With mitigation	2	2	4	1	1	16	The preferred location to the north will minimise the accumulative impact on connectivity slightly.
Plant SoCC: Potential impact on threatened or protected plant species.	Without mitigation	3	3	4	1	1	27	Three NCNCA protected plant species were observed (in small numbers) in the southern option.
	With mitigation	2	1	4	1	1	14	The northern option will avoid the impact on these species, otherwise implement the mitigation measures in Table 10.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	4	5	1	3	39	The potential impact on 2-3ha of natural veld, including the potential impact on SoCC within a CBA.
	With mitigation	2	2	5	1	1	18	Refer to the impact minimisation recommendations.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	2	2	3	1	1	14	No additional impact on a CBA. However, the CBA overlaps an area already disturbed with minimal connectivity.
	With mitigation							

Both the northern and the southern options are mostly disturbed and of low botanical significance. However, the southern option will impact on **existing fenced-off and occupied dwellings** (although they might be illegal settlement) as well as a few Northern Cape Nature Conservation Act (NCNCA) protected plants. Although only a few individuals were observed it includes: *Boscia foetida*, *Aloe claviflora* and *Euphorbia braunsii*. Even though these species are widespread and common, it raises the conservation value of the southern portion of the site slightly.

The impact assessment method (Refer to Table 12) suggests that:

- The cumulative impact is rated as **Medium-Low,** mainly because of the potential **impact on landuse** (the occupied dwellings to the south, even though they may be illegally erected) and to a lesser degree the potential impact on a disturbed CBA and SoCC (NCNCA protected species).
- The plant species theme sensitivity is considered of **Low Sensitivity**, even if the southern option is used, BUT the potential impact on SoCC can be avoided if the northern option is used.
- The terrestrial biodiversity theme sensitivity is considered to be of **Low Sensitivity** (even though it overlaps a CBA), because of the small impact on connectivity, but mainly because both the northern and southern options are already disturbed and subject to constant anthropogenic activity (urban creep and human activity). However, the northern option is the most disturbed, does not support any significant SoCC and is characterized by dense stands of the alien invasive *Prosopis* tree. Overall locating the proposed KTE WTW to the north of the existing Kenhardt WTW will result in the least or lowest overall additional environmental impact.

7.3. IMPACT ASSESSMENT: R27 LENNERTSVILLE TO KENHARDT

From Lennertsville to Kenhardt the pipeline will be located in the disturbed road reserve of the R27. It will impact on three (3) vegetation types (all three considered Least Threatened), but the northern portion of the route falls within a CBA (Figure 4), also crossing occasional CBA's associated with deeper sandy areas and rocky outcrops (potentially supporting SoCC).

In terms of botanical significance, this section of the pipeline route is considered the **most sensitive**. Even though the R27 road reserve is subject to regular brush-cutting (and other human related disturbances), this section of the road reserve supports a large number of individuals of two important NFA protected species, namely *Boscia albitrunca* (Shepards tree) and *Vachellia erioloba* (camel thorn) (Refer to Heading 5.3 & 5.5). Waypoints taken during the site visit (Refer to Appendix 3) showed that this section of the route supports almost all of the individuals of these two species observed within the road reserve of the R27 (within the study area). It is important to note, all individuals within the road reserve were marked (whether they will be impacted or not) and where in doubt all *Boscia* individuals were marked as *Boscia albitrunca* individuals (many of which might be *Boscia foetida*). Although it almost certain that some of these individuals will be impacted, it is also certain that, with good environmental oversight, most (more than 90%) of these individuals can be protected. But it will be important to understand the significance of the potential impact as the proposed pipeline will be large (up to 900mm in diameter) and micro route adjustments will not be possible. Impact minimisation must include good environmental oversight, route planning and protecting all single stem *Boscia albitrunca* individuals over 1.5 m in height as well as all *Vachellia erioloba* trees more than 6 m in height, while the protection of the magnificent thick stem individuals over 8 m should be non-negotiable.

Nature of the impact: Since the pipeline will be underground, the impact will be temporary of nature, but with a potential permanent impact on some of the *Boscia albitrunca* and *Vachellia erioloba* individuals.

Table 13: Sensitivity assessment: R27 Lennertsville to Kenhardt.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	2	3	1	1	14	R27 Road Reserve. Road reserves can be important ecological corridors, but in this case the road reserve is disturbed (adjoining natural veld to its west).
	With mitigation	2	2	3	1	1	14	Refer to the impact minimisation recommendations.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	3	2	3	1	2	24	The vegetation Least Threatened and disturbed, but sections overlaps CBA's or ESA's and support 2 NFA protected trees and hardy NCNCA protected species.
	With mitigation	3	1	3	1	1	18	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of NFA protected trees).
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	3	1	2	27	The vegetation Least Threatened and disturbed, but sections overlaps CBA's or ESA's and support 2 NFA protected trees and hardy NCNCA protected species.
	With mitigation	3	2	3	1	1	21	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of NFA protected trees).
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	2	1	3	1	1	12	The impact will be temporary (short - medium term) with little additional impact on connectivity.
	With mitigation	2	1	3	1	1	12	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of NFA protected trees).
Plant SoCC: Potential impact on threatened or protected plant species.	Without mitigation	4	3	4	2	3	48	The potential impact, mainly on a large number of two NFA protected trees and also on several hardy NCNCA protected species.
	With mitigation	4	2	3	1	2	32	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of NFA protected trees).
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	4	3	4	2	3	48	The main impact relates to the potential impact on a large number of NFA protected tree species (and several hardy NCNCA protected species).
	With mitigation	4	2	3	1	2	32	Refer to the impact minimisation recommendations.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	4	2	2	1	1	24	No additional impact on a CBA, or on SoCC. Maintenance (brush-cutting) of the road reserve will continue, but impact on SoCC is less likely.
	With mitigation							

The impact assessment method (Refer to Table 13) suggests that:

- The cumulative impact is rated as **Medium high** (which should be **unacceptable**), mainly because of the potential permanent impact on a large number of two NFA protected species and the potential temporary impact on NCNCA protected species and CBA's or ESA's.
- The plant species theme sensitivity is rated as of **Medium Sensitivity**, BUT the impact can be

reduced to **Low Sensitive** through mitigation.

- The terrestrial biodiversity theme sensitivity is considered to be **Medium Sensitivity** (even though it overlaps a CBA), because of the presence of SoCC. If the impact on these SoCC can be minimised (which should very feasible) the terrestrial sensitivity can be reduced to Low Sensitivity, because of the "Least Threatened" vegetation status, the temporary nature of the impact, and the low impact on connectivity.

In summary: From Lennertsville to Kenhardt the vegetation in general are of low botanical significance, **BUT** the presence of a high number of protected *Boscia albitrunca* and *Vachellia erioloba* trees (and *Boscia foetida* shrubs) raises the conservation value of this section significantly. This is especially true for the sandy Gordonia Duneveld areas and the sandy river crossings along the last 27 km towards Kenhardt.

7.4. IMPACT ASSESSMENT: PIET ROOI'S PUTS RESERVOIR

A 3 Megalitre Storage Reservoir will be located next to the existing Kenhardt Reservoir (Refer to Heading 5.4 & Figure 8). The proposed new reservoir is not expected to impact on any remaining natural veld of any consequence, as it will be located within the disturbance footprint of the old road camp (Photo 19 & 20). Apart from a few grasses and weedy species, the disturbed area does not support any indigenous species of conservation concern. About five (5) *Boscia albitrunca* individuals were observed towards the northern edge of the study area of which only one is in close proximity to the proposed site location. However, with good environmental control there should be no reason why any of these plants should be impacted.

The proposed reservoir location will not impact on any CBA or ESA or on any significant SoCC (apart from the occasional hardy or weedy NCNCA protected species). As a result:

- The cumulative impact is rated as **Low Sensitive**.
- The plant species theme sensitivity is considered of **Low Sensitivity**.
- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity**.

7.5. IMPACT ASSESSMENT: R27 KENHARDT TO SOAFSKOLK

From Kenhardt to Soafskolk, the pipeline will be located in the eastern road reserve of the R27. The vegetation will be Bushmanland Arid Shrubland (the first 20 km, about to the De Bakke Reservoir) and then mainly Bushmanland Basin Shrubland (Refer to Heading 5.6). The impacted vegetation types are all considered Least Threatened. Along the route it will impact on the occasional ecological support area (ESA) and one CBA (associated with the Bosduiflaagte River). The ESA's seems to be associated with the rocky outcrops supporting Lower Gariep Broken Veld and watercourses along the way.

As discussed above, the vegetation within the R27 road reserve is subject to regular brush-cutting disturbance and becomes progressively dryer as one moves south towards the Soafskolk turn-off. Only one *Vachellia erioloba* (Waypoint 110) and one *Boscia albitrunca* (Waypoint 109) were observed, just south of Kenhardt, but both will be easy to avoid. The only other larger trees observed in this section were *Vachellia karroo* (Soetdoring), *Searsia lancea* or *Ziziphus mucronata* (blinkblaar wag-'n-bietjie) individuals, all of them common and widespread species (although all larger indigenous trees

should be protected wherever possible). *Tamarix usneoides* was not observed but might also occur in sandy areas associated with watercourses.

Although this section supported a number of NCNCA protected species they were almost all weedy or pioneer species protected by default as part of the Aizoaceae family. No significant SoCC was observed. As a result:

- The cumulative impact is rated as **Low Sensitive**.
- The plant species theme sensitivity is considered of **Low Sensitivity**.
- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity**. Although the impacts on the ESA corridors may be rated as of Medium-Low Sensitivity, the pipe will be located within the already disturbed road reserve (as a result a Low Sensitivity rating is considered more appropriate).

7.6. IMPACT ASSESSMENT: DE BAKKE RESERVOIR

A second 3 Megaliter storage reservoir and a pump station will be located about 20 km south of Kenhart, just east of the R27 road reserve on the Farm De Bakke 186. The vegetation within the proposed site location was sparse, dominated by a low grassy layer with the occasional shrub scattered in between (Photo 33 & Photo 34). Apart from the occasional weedy or pioneer NCNCA protected species no SoCC were observed within the footprint or its immediate vicinity.

The site is considered of low botanical significance and does not impact on a CBA or ESA. As a result:

- The cumulative impact is rated to be of **Low Sensitivity**.
- The plant species theme sensitivity is considered of **Low Sensitivity**.
- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity**.

7.7. IMPACT ASSESSMENT: THE ROAD RESERVE FROM SOAFSKOLK TO FARM UITKYK

From the Soafskolk turn-off the pipeline will follow secondary gravel roads to the Farm Styns Vley (about 11.5 km), turning southwest to Dagab then west towards Bysteek, crossing the Saldanha-Sishen railway (*via* an existing culvert) then southwest towards the Farm Uitkyk (Refer to Heading 5.8).

Apart from a number of weedy or pioneer *Mesembryanthemum* species (many of them regarded as disturbance indicator species) and a few larger indigenous trees, no SoCC were observed. All *Mesembryanthemum* species are protected in terms of the NCNCA, but the species observed were all widespread and common species. As a result, the vegetation along this section of the route is considered of low botanical significance (but larger indigenous trees should be protected wherever possible).

However, the route will impact on CBA and the occasional ESA (Refer to Figure 5), which seems to be associated broadly with the watercourses and salt pans of the Bushmanland Vloere (the route itself only touch on these salt pans in two to three locations). The impact on these systems is considered to be temporary of nature (as the pipeline will be underground) and will be located within existing road reserves (thus minimizing the impact on more pristine areas).

Table 14: Sensitivity assessment: The road reserve from Soafskolk to Farm Uitkyk

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Watercourses & Wetlands: Potential impact on natural water resources and it's ecological support areas.	Without mitigation	3	3	3	1	2	27	The pipeline will be located in the road reserve but will touch/cross watercourses and salt pan areas associated with Bushmanland Vloere Vegetation (LT).
	With mitigation	3	3	3	1	2	27	There is no mitigation apart from staying next to the existing road corridor and minimising the construction footprint.
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	2	3	1	1	14	R27 Road Reserve. Road reserves can be important ecological corridors, but in this case all of the surrounding veld is still natural.
	With mitigation	2	2	3	1	1	14	Refer to the impact minimisation recommendations.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	3	2	3	1	1	21	The vegetation Least Threatened and disturbed, but sections overlaps CBA's or ESA's and supports hardy NCNCA protected species.
	With mitigation	3	1	3	1	1	18	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of larger indigenous trees).
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	3	1	2	27	The vegetation Least Threatened and disturbed, but sections overlaps CBA's or ESA's and supports hardy NCNCA protected species.
	With mitigation	3	3	3	1	2	27	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of larger indigenous trees).
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	2	1	3	1	1	12	The impact will be temporary (short - medium term) with little additional impact on connectivity.
	With mitigation	2	1	3	1	1	12	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of larger indigenous trees).
Plant SoCC: Potential impact on threatened or protected plant species.	Without mitigation	3	3	3	1	1	24	The potential impact, mainly on a large number of two NFA protected trees and also on several hardy NCNCA protected species.
	With mitigation	3	2	3	1	1	21	Refer to the impact minimisation recommendations (Environmental oversight during planning and construction, protection of NFA protected trees).
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	3	3	1	2	27	The main impact relates to the potential impact the CBA and ESA areas (and several hardy NCNCA protected species).
	With mitigation	3	3	3	1	2	27	Refer to the impact minimisation recommendations.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	2	2	1	2	21	No additional impact on a CBA, or on SoCC. The only potential impacts will be related to that associated with the surrounding land-use and the continual threat of alien invasive species on the wetland habitats (pans).
	With mitigation							

The impact assessment method (Refer to Table 14) suggests that:

- The cumulative impact will be **Low Sensitive** (although it will impact on CBA and ESA areas).
- The plant species theme sensitivity is considered of **Low Sensitivity**.

- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity** (although it will impact on CBA and ESA areas and NCNCA protected species). No significant SoCC were observed, and the impacts will be temporary of nature with almost no additional impact on connectivity.

7.8. IMPACT ASSESSMENT: STYNS VLEY RESERVOIR

A 10 Megaliter storage reservoir will be located on Farm Styns Vley 280/0. The footprint area is expected to be less than 1 ha. The property is still used for livestock grazing but will eventually house the KTE Renewable Energy Power Generation facilities (for which NEMA EIA approval had been obtained).

The vegetation is considered of low botanical significance (although the final location should aim to minimise the impact on larger indigenous trees). No significant SoCC were observed, and it will not impact on any CBA or ESA. As a result:

- The cumulative impact is rated **Low Sensitive**.
- The plant species theme sensitivity is considered of **Low Sensitivity**.
- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity**.

7.9. IMPACT ASSESSMENT: UITKYK RESERVOIR

The final storage tank will be a 30 Megaliter storage reservoir located on Farm Uitkyk 889/5 (on a high point). The footprint area is expected to be about 1 ha. The property is used for livestock grazing.

The vegetation in this area of the farm was very dry and vegetation cover was sparse (Photo 49 & Photo 50). Overall, the vegetation is considered of low botanical significance. No species of conservation concern were observed, and it will not impact on any CBA or ESA. As a result:

- The cumulative impact is rated to be of **Low Sensitivity**.
- The plant species theme sensitivity is considered of **Low Sensitivity**.
- The terrestrial biodiversity theme sensitivity is considered to be **Low Sensitivity**.

7.10. INDIRECT IMPACTS

Indirect impacts occur away from the 'action source' i.e., away from the development site. The impact assessed here is specifically how the proposed development would have an indirect impact on vegetation and flora away from the development site.

The indirect impact in this case will be a temporary impact on CBA and ESA areas, a potential impact on SoCC (with emphasis on the NFA protected species as discussed under Heading 7.3).

Because of the location of the pipeline (within road reserves) the potential for protecting most of the SoCC, the indirect impact is likely to be Low Sensitive in terms of botanical sensitivity.

With mitigation, it is considered highly unlikely that the development will contribute significantly

to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g., migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened species.
- Loss of ecosystem connectivity.

7.11. TERRESTRIAL SENSITIVITY MAP

The proposed mitigation recommendations focus on the protection of species of conservation concern, especially *Boscia albitrunca* and *Vachellia erioloba individuals*. The greatest concentration of these trees withing the R27 road reserve are between Lennertsville and Kenhardt as illustrated in the **Sensitivity map (Figure 11)**.

The specific waypoint locations as well as a short description are given in **Appendix 3**. Appendix 3 also highlights:

- *Boscia albitrunca* individuals of special significance in green, and
- *Vachellia erioloba* individuals of special significance in yellow.

Figure 11: The site sensitivity map focus on the protection of the National Forest Act protected tree species. The blue & white dots illustrates the distribution of these trees along the R27 road reserve (Also refer to Appendix 3).

8. MITIGATION RECOMMENDATIONS

Impact minimisation should focus on the protection of the National Forest Act, protected trees, especially the larger trees as described below. During construction the overriding goal should be careful planning of the pipeline route to minimise the impact on these trees.

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the mitigation recommendations pertaining to specialist studies.
- The route for each section of the pipeline must be clearly marked and approved by the ECO.
    - The aim must be to minimise the impact on all NFA protected trees, wherever possible.
    - Special care must be taken to protect as many as possible of the single stem Boscia albitrunca individuals over 1.5 m in height (marked in green in Appendix 3).
    - Special must be taken to protect as many as possible of the larger Vachellia erioloba trees over 6 m in height (marked in yellow in Appendix 3), and the protection of the magnificent thick stem individuals over 8 m should be non-negotiable.
- The pipeline route and disturbance footprint must stay within the road reserve (to control the construction footprint and minimise the impact on the adjacent natural vegetation).
- The "Search & Rescue" recommendations given in Table 10 must be implemented along the pipeline route as well as for the associated infrastructure footprints (reservoirs and pump station locations).
    - All ***Aloe*** species encountered within the footprint area, must be replanted outside the footprint area.
    - ***Euphorbia braunsii* & *E. spinea*** individuals encountered within the footprint area must be replanted outside the footprint area.
    - Search & Rescue must include an aftercare period, during which the plants are watered from time to time to give them the best possible chance of survival.
- A **NFA Permit application** must be obtained should any of the protected trees be impacted.
- A Northern Cape Nature Conservation Act permit must be obtained for the "Search & Rescue" and other impacts on the protected species listed in Table 10.
- All alien invasive species within the footprint and its immediate surroundings must be removed responsibly.
    - Care must be taken with the eradication method to ensure that the removal does not impact or lead to additional impacts (e.g., spreading of the AIP due to incorrect eradication methods);
    - Care must be taken to dispose of alien plant material responsibly.
- Indiscriminate clearing of any area outside of these footprints may not be allowed.
- An integrated waste management approach must be implemented during construction.
    - Construction related spoil, general- and hazardous waste must be disposed to approved waste disposal sites.

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APPENDIX 1: REQUIREMENTS FOR SPECIALIST REPORTS

Minimum Content Requirements for Botanical and Terrestrial Biodiversity Specialist Reports as per Protocol for the Specialist Assessment of Environmental Impacts on Terrestrial Biodiversity (GN 320 of 20 March 2020).

Protocol Ref	**Botanical and Terrestrial Biodiversity Specialist Assessment Report Content**	**Section / Page**
3.1.1.	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Page i
3.1.2.	a signed statement of independence by the specialist;	Page vii
3.1.3.	a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Heading 3.2 & 3.3
3.1.4.	a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Heading 3.1, 3.2 & 3.3.
3.1.5.	a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Heading 3.3
3.1.6.	a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Heading 7.11
3.1.7.	additional environmental impacts expected from the proposed development;	Heading 7
3.1.8.	any direct, indirect and cumulative impacts of the proposed development;	Heading 7
3.1.9.	the degree to which impacts and risks can be mitigated;	Heading 7
3.1.10.	the degree to which the impacts and risks can be reversed;	Heading 7
3.1.11.	the degree to which the impacts and risks can cause loss of irreplaceable resources;	Heading 7
3.1.12.	proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Heading 8
3.1.13.	a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	NA
3.1.14.	a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Page v
3.1.15.	any conditions to which this statement is subjected.	N/A

APPENDIX 2: DFFE SCREENING REPORT

APPENDIX 3: SPECIES OF CONSERVATION CONCERN

W-POINT	*SPECIES NAME*	DESCRIPTION	LATITUDE	LONGITUDE
109	*Boscia albitrunca*		-29.430421991273761	21.086203018203378
121	*Boscia albitrunca*	2m (outside)	-28.992504011839628	21.121535003185272
122	*Boscia albitrunca*	2m (outside)	-28.992239981889725	21.121455961838365
123	*Boscia albitrunca*		-28.992635020986199	21.121409023180604
124	*Boscia albitrunca*		-28.992611970752478	21.121307015419006
125	*Boscia albitrunca*		-28.992943977937102	21.121473982930183
126	*Boscia albitrunca*		-28.99293702095747	21.121597029268742
127	*Boscia albitrunca*	1.5m shrub	-29.32984996587038	21.152820037677884
128	*Boscia albitrunca*	0.5m shrub	-29.329759022220969	21.152703026309609
130	*Boscia albitrunca*		-29.330318011343479	21.146231023594737
137	*Boscia albitrunca*	Outside	-29.32568097487092	21.154332971200347
140	*Boscia albitrunca*	1.5m	-29.324034014716744	21.154584009200335
147	*Boscia albitrunca*	4m	-29.286933029070497	21.160094020888209
148	*Boscia albitrunca*	2m	-29.278741981834173	21.161181991919875
150	*Boscia albitrunca*	2m	-29.273677971214056	21.162110036239028
151	*Boscia albitrunca*	2 x shrubs	-29.27196797914803	21.162326037883759
153	*Boscia albitrunca*	4 x shrubs	-29.259380958974361	21.164184976369143
155	*Boscia albitrunca*	2 x shrubs	-29.258578978478909	21.164301987737417
160	*Boscia albitrunca*	2 x shrubs	-29.244383974000812	21.166392015293241
161	*Boscia albitrunca*	2 x shrubs	-29.243483003228903	21.166484970599413
170	*Boscia albitrunca*	1.5m	-29.217707980424166	21.16531896404922
171	*Boscia albitrunca*	5-6m	-29.205528991296887	21.164670959115028
172	*Boscia albitrunca*	6m	-29.195007020607591	21.164128985255957
173	*Boscia albitrunca*	4m	-29.171296041458845	21.16286801174283
174	*Boscia albitrunca*	5m	-29.159240014851093	21.162229981273413
177	*Boscia albitrunca*	2-3m	-29.154457971453667	21.161972992122173
178	*Boscia albitrunca*	3m	-29.15216501802206	21.161853969097137
179	*Boscia albitrunca*	1.5m	-29.15184298530221	21.161837037652731
180	*Boscia albitrunca*	3-4m	-29.144781986251473	21.161474017426372
182	*Boscia albitrunca*	2.5m	-29.129533963277936	21.160667007789016
183	*Boscia albitrunca*	3.5m	-29.125234968960285	21.160204997286201
184	*Boscia albitrunca*	1,5m	-29.124159989878535	21.160053033381701
190	*Boscia albitrunca*	1.5m	-29.119715988636017	21.159179974347353
199	*Boscia albitrunca*	1m shrub	-29.106913972645998	21.157569978386164
200	*Boscia albitrunca*	1m shrub	-29.101068014279008	21.156685017049313
205	*Boscia albitrunca*	1.5m shrub	-29.075332973152399	21.152935037389398
206	*Boscia albitrunca*	2-3m	-29.068174995481968	21.151871960610151
207	*Boscia albitrunca*	1.5m, outside	-29.066044986248016	21.15156602114439
208	*Boscia albitrunca*	1.5m, outside	-29.065459007397294	21.151473987847567
209	*Boscia albitrunca*	1.5m, outside	-29.061250034719706	21.150870993733406
210	*Boscia albitrunca*	2m shrub	-29.05975503847003	21.150661027058959

W-POINT	*SPECIES NAME*	DESCRIPTION	LATITUDE	LONGITUDE
211	*Boscia albitrunca*	2m shrub	-29.059126982465386	21.150560025125742
212	*Boscia albitrunca*	2-3m, outside	-29.055642038583755	21.150047974660993
213	*Boscia albitrunca*	2-3m, outside	-29.054324990138412	21.149862986057997
214	*Boscia albitrunca*	3 trees, 2-3m	-29.048984963446856	21.149083971977234
215	*Boscia albitrunca*	1.5m shrub	-29.047895986586809	21.148914992809296
216	*Boscia albitrunca*	1.5m, outside	-29.043931011110544	21.148102032020688
217	*Boscia albitrunca*	1m shrub	-29.035225985571742	21.143947038799524
218	*Boscia albitrunca*	2m shrub	-29.025125037878752	21.138745984062552
219	*Boscia albitrunca*	2 shrubs, 1.5m	-29.0234250202775	21.137903016060591
220	*Boscia albitrunca*	1m shrub	-29.019875032827258	21.136051034554839
221	*Boscia albitrunca*	2m shrub	-29.014172991737723	21.133109992370009
222	*Boscia albitrunca*	1.5m shrub	-29.009988997131586	21.130991969257593
223	*Boscia albitrunca*	1m shrub	-29.009334035217762	21.130638001486659
224	*Boscia albitrunca*	0.5m shrub	-29.003173001110554	21.127468971535563
225	*Boscia albitrunca*	0.5m shrub	-29.002702021971345	21.127242995426059
226	*Boscia albitrunca*	0.5m shrub	-29.000616017729044	21.126148989424109
227	*Boscia albitrunca*	0.5m shrub	-28.999564005061984	21.125610033050179
228	*Boscia albitrunca*	2 shrubs, 0.5m	-28.998150983825326	21.124913999810815
229	*Boscia albitrunca*	1m shrub	-28.995656026527286	21.123613966628909
230	*Boscia albitrunca*	0.5m shrub	-28.99012497626245	21.120793959125876
231	*Boscia albitrunca*	2m shrub	-28.98926499299705	21.12034996971488
232	*Boscia albitrunca*	0.5m shrub	-28.985093990340829	21.118176961317658
233	*Boscia albitrunca*	0.5m shrub	-28.982945960015059	21.117057977244258
234	*Boscia albitrunca*	0.5m shrub	-28.98195999674499	21.11656897701323
235	*Boscia albitrunca*	1m shrub	-28.979264963418245	21.115210019052029
236	*Boscia albitrunca*	0.5m shrub	-28.977671982720494	21.114379959180951
237	*Boscia albitrunca*	4 shrubs, 1-2m	-28.97289102897048	21.111921966075897
238	*Boscia albitrunca*	1.5m shrub	-28.970218040049076	21.110564013943076
239	*Boscia albitrunca*	0.5m shrub	-28.969723004847765	21.110295038670301
240	*Boscia albitrunca*	1m shrub	-28.968949019908905	21.109907040372491
241	*Boscia albitrunca*	2m	-28.96870200522244	21.109777959063649
242	*Boscia albitrunca*	2m	-28.968051988631487	21.109442012384534
243	*Boscia albitrunca*	2 shrubs, 1m, outside	-28.965999009087682	21.108388993889093
244	*Boscia albitrunca*	1.5m shrub	-28.965223012492061	21.107991021126509
245	*Boscia albitrunca*	1.5m shrub	-28.964724037796259	21.107721962034702
246	*Boscia albitrunca*	1.8m shrub	-28.961622985079885	21.106099979951978
247	*Boscia albitrunca*	1.5m shrub	-28.960022041574121	21.105314008891582
248	*Boscia albitrunca*	1.5m, outside	-28.957811985164881	21.104053035378456
249	*Boscia albitrunca*	1.5m shrub	-28.943670960143209	21.095031006261706
250	*Boscia albitrunca*	2 shrubs, 0.5m	-28.9416319783777	21.093714041635394
251	*Boscia albitrunca*	0.5m shrub	-28.897818010300398	21.065742960199714
252	*Boscia albitrunca*	1.5m	-28.895617006346583	21.0643379855901
253	*Boscia albitrunca*	1.8m shrub	-28.89524501748383	21.064128018915653

W-POINT	*SPECIES NAME*	DESCRIPTION	LATITUDE	LONGITUDE
255	*Boscia albitrunca*	1m shrub	-28.870611023157835	21.048442963510752
256	*Boscia albitrunca*	0.5m shrub	-28.835914973169565	21.036912985146046
115	*Boscia foetida*		-28.760766014456749	20.99910699762404
116	*Boscia foetida*		-28.760573985055089	20.999034997075796
117	*Boscia foetida*		-28.760480023920536	20.999157037585974
118	*Boscia foetida*		-28.76038103364408	20.999269019812346
119	*Boscia foetida*		-28.76038296148181	20.999181009829044
120	*Boscia foetida*		-28.759529013186693	20.998616991564631
114	*Euphorbia spinea*		-28.760675992816687	20.998599976301193
107	*Searsia lancea*	Patch	-29.472120031714439	21.052788980305195
166	*Searsia lancea*		-29.237650036811829	21.166422022506595
110	*Vachellia erioloba*	6m	-29.419980989769101	21.094561032950878
129	*Vachellia erioloba*	6-7m	-29.330183984711766	21.146691022440791
132	*Vachellia erioloba*	Outside	-29.363008020445704	21.145398030057549
133	*Vachellia erioloba*	Outside	-29.364322973415256	21.144362026825547
134	*Vachellia erioloba*	Outside	-29.364520031958818	21.144276028499007
135	*Vachellia erioloba*	8-10m	-29.339909004047513	21.153081972151995
136	*Vachellia erioloba*	5-6m, Outside	-29.325948022305965	21.154340011999011
138	*Vachellia erioloba*	3-4m, Outside	-29.325146041810513	21.154345041140914
139	*Vachellia erioloba*	4m, Outside	-29.324633991345763	21.154506979510188
141	*Vachellia erioloba*	3-4m, Outside	-29.323688009753823	21.154688028618693
142	*Vachellia erioloba*	3-4m, Outside	-29.309326959773898	21.15672399289906
143	*Vachellia erioloba*	8-10m	-29.30614996701479	21.157136969268322
144	*Vachellia erioloba*	8-10m	-29.306093975901604	21.157071003690362
145	*Vachellia erioloba*	3m, young tree	-29.305442031472921	21.157209975644946
146	*Vachellia erioloba*	5m, young tree	-29.305252013728023	21.157200001180172
149	*Vachellia erioloba*	Dead tree	-29.277632972225547	21.161389024928212
152	*Vachellia erioloba*	4-5m	-29.26004296168685	21.164124961942434
154	*Vachellia erioloba*	6-8m	-29.258908974006772	21.164248008280993
156	*Vachellia erioloba*	4m	-29.258304974064231	21.164334006607533
157	*Vachellia erioloba*	8-10m	-29.257155982777476	21.164531987160444
158	*Vachellia erioloba*	8-10m	-29.256910979747772	21.164557971060276
159	*Vachellia erioloba*	2 trees, 2m & 4m	-29.252075962722301	21.165258027613163
162	*Vachellia erioloba*	4 x trees, 6-10m	-29.239339996129274	21.166215995326638
163	*Vachellia erioloba*	6-10m	-29.239301020279527	21.166294030845165
164	*Vachellia erioloba*	6-10m	-29.23915701918304	21.16628497838974
165	*Vachellia erioloba*	6-10m	-29.239021986722946	21.166367959231138
167	*Vachellia erioloba*	8m	-29.237334039062262	21.166365025565028
168	*Vachellia erioloba*	6m	-29.236919973045588	21.166339041665196
169	*Vachellia erioloba*	4-5m	-29.226342011243105	21.165802013128996
175	*Vachellia erioloba*	5m	-29.158199988305569	21.162178013473749
176	*Vachellia erioloba*	8-10m	-29.156973967328668	21.162110036239028
181	*Vachellia erioloba*	8-10m	-29.13121797144413	21.160753006115556

W-POINT	*SPECIES NAME*	DESCRIPTION	LATITUDE	LONGITUDE
185	*Vachellia erioloba*	5-6m	-29.123238986358047	21.159927975386381
186	*Vachellia erioloba*	5 young trees, 4m	-29.122418984770775	21.15979696623981
187	*Vachellia erioloba*	5-6m	-29.121507033705711	21.159669980406761
188	*Vachellia erioloba*	8-10m	-29.120884006842971	21.159466970711946
189	*Vachellia erioloba*	8-10m	-29.120199037715793	21.159277958795428
191	*Vachellia erioloba*	Dead tree	-29.120141034945846	21.159507958218455
192	*Vachellia erioloba*	5-6m	-29.118429031223059	21.159235965460539
193	*Vachellia erioloba*	6-8m	-29.118066010996699	21.159173017367721
194	*Vachellia erioloba*	4-5m	-29.117626966908574	21.159118032082915
195	*Vachellia erioloba*	6-8m	-29.117176020517945	21.159041002392769
196	*Vachellia erioloba*	2 young trees	-29.116814006119967	21.159003032371402
197	*Vachellia erioloba*	8-10m	-29.116631029173732	21.158964978531003
198	*Vachellia erioloba*	8-10m, outside	-29.116371022537351	21.158933965489268
201	*Vachellia erioloba*	4m, young tree	-29.083192013204098	21.154075982049108
202	*Vachellia erioloba*	10-12m NB	-29.081570031121373	21.153787979856133
203	*Vachellia erioloba*	3-4m young tree	-29.079112960025668	21.153467036783695
204	*Vachellia erioloba*	2-4m, outside	-29.076810032129288	21.153140980750322
254	*Vachellia erioloba*	Dead tree	-28.872787971049547	21.049830000847578
257	*Vachellia erioloba*	6m tree	-28.819169020280242	21.03305496275425
258	*Vachellia erioloba*	3-4m young tree	-28.818939020857215	21.033013975247741
259	*Vachellia erioloba*	**11 magnificent trees**	-28.817806039005518	21.03275396861136
261	*Vachellia erioloba*	3 x Dead trees	-28.815562035888433	21.032247031107545
262	*Vachellia erioloba*	6-8m	-28.751622028648853	20.991837037727237
263	*Vachellia erioloba*	10-12m	-28.739402974024415	20.987238977104425
99	*Vachellia karroo*	Medium tree	-29.831792023032904	20.752372015267611
104	*Vachellia karroo*	Medium tree	-29.612344997003675	20.93985297717154
106	*Vachellia karroo*	Two young trees	-29.474031021818519	21.05110103264451
98	*Ziziphus mucronata*	Large tree	-29.845098964869976	20.698548965156078

APPENDIX 4: CURRICULUM VITAE – P.J.J. BOTES

Curriculum Vitae: Peet JJ Botes

Address: 22 Buitekant Street, Bredasdorp, 7280; **Cell**: 082 921 5949

Nationality:	South African
ID No.:	670329 5028 081
Language:	Afrikaans / English
Profession:	Environmental Consultant & Auditing
Specializations:	Botanical & Biodiversity Impact Assessments
	Environmental Compliance Audits
	Environmental Impact Assessment
	Environmental Management Systems
Qualifications:	**BSc** (Botany & Zoology), with Nature Conservation III & IV as extra subjects; Dept. of Natural Sciences, Stellenbosch University 1989.
	Hons. BSc (Plant Ecology), Stellenbosch University, 1989
	More than 20 years of experience in the Environmental Management Field (Since 1997 to present).
Professional affiliation:	Registered Professional Botanical, Environmental and Ecological Scientist at SACNASP (South African Council for Natural Scientific Professions) since 2005.
SACNAP Reg. No.:	400184/05

BRIEF RESUME OF RELEVANT EXPERIENCE

1997-2005: Employed by the Overberg Test Range (a Division of Denel), responsible for managing the environmental department of OTB, developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

2005-2010: Joined Enviroscientific, as an independent environmental consultant specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity and environmental legal compliance audits.

2010-2017: Joined EnviroAfrica, as an independent Environmental Assessment Practitioner and Biodiversity Specialist, responsible for Environmental Impact Assessments, Biodiversity & Botanical specialist reports and Environmental Compliance Audits. During this time Mr Botes compiled more than 70 specialist Biodiversity & Botanical impact assessment reports ranging from agricultural-, infrastructure pipelines- and solar developments.

2017-Present: Establish a small independent consultancy (PB Consult) specialising in Environmental Audits, Biodiversity and Botanical specialist studies as well as Environmental Impact Assessment.

LIST OF MOST RELEVANT BOTANICAL & BIODIVERSITY STUDIES

Botes. P. 2007:	Botanical assessment. Schaapkraal, Erf 644, Mitchell's Plain. A preliminary assessment of the vegetation in terms of the Fynbos Forum: Ecosystem guidelines. 13 November 2007.
Botes. P. 2008:	Botanical assessment. Schaapkraal Erf 1129, Cape Town. A preliminary assessment of the vegetation using the Fynbos Forum Terms of Reference: Ecosystem guidelines for environmental Assessment in the Northern Cape. 20 July 2008.
Botes, P. 2010(a):	Botanical assessment. Proposed subdivision of Erf 902, 34 Eskom Street, Napier. A Botanical scan and an assessment of the natural vegetation of the site to assess to what degree the site contributes towards conservation targets for the ecosystem. 15 September 2010.
Botes, P. 2010(b):	Botanical assessment. Proposed Loeriesfontein low cost housing project. A preliminary Botanical Assessment of the natural veld with regards to the proposed low cost housing project in/adjacent to Loeriesfontein, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 10 August 2010.
Botes, P. 2010(c):	Botanical assessment: Proposed Sparrenberg dam, on Sparrenberg Farm, Ceres. . A Botanical scan and an assessment of the natural vegetation of the site. 15 September 2010.
Botes, P. 2011:	Botanical scan. Proposed Cathbert development on the Farm Wolfe Kloof, Paarl (Revised). A botanical scan of Portion 2 of the Farm Wolfe Kloof No. 966 (Cathbert) with regards to the proposed Cathbert Development, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 28 September 2011.
Botes, P. 2012(a):	Proposed Danielskuil Keren Energy Holdings Solar Facility on Erf 753, Danielskuil. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 17 March 2012.
Botes, P. 2012(b):	Proposed Disselfontein Keren Energy Holdings Solar Facility on Farm Disselfontein no. 77, Hopetown. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
Botes, P. 2012(c):	Proposed Kakamas Keren Energy Holdings Solar Facility on Remainder of the Farm 666, Kakamas. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 March 2012.
Botes, P. 2012(d):	Proposed Keimoes Keren Energy Holdings Solar Facility at Keimoes. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 9 March 2012.
Botes, P. 2012(e):	Proposed Leeu-Gamka Keren Energy Holdings Solar Facility on Portion 40 of the Farm Kruidfontein no. 33, Prince Albert. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.
Botes, P. 2012(f):	Proposed Mount Roper Keren Energy Holdings Solar Facility on Farm 321, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
Botes, P. 2012(g):	Proposed Whitebank Keren Energy Holdings Solar Facility on Farm no. 379, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.

Botes, P. 2012(h): Proposed Vanrhynsdorp Keren Energy Holdings Solar Facility on Farm Duinen Farm no. 258, Vanrhynsdorp. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 April 2012.

Botes, P. 2012(i): Askham (Kameelduin) proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. 1 November 2012.

Botes, P. 2013(a): Groot Mier proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. January 2013.

Botes, P. 2013(b): Loubos proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. January 2013.

Botes, P. 2013(c): Noenieput proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. January 2013.

Botes, P. 2013(d): Paballelo proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. January 2013.

Botes, P. 2013(e): Welkom proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required. January 2013.

Botes, P. 2013(f): Zypherfontein Dam Biodiversity & Botanical Scan. Proposed construction of a new irrigation dam on Portions 1, 3, 5 & 6 of the Farm Zypherfontein No. 66, Vanrhynsdorp (Northern Cape) and a scan of the proposed associated agricultural enlargement. September 2013.

Botes, P. 2013(g): Onseepkans Canal: Repair and upgrade of the Onseepkans Water Supply and Flood Protection Infrastructure, Northern Cape. A Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). August 2013.

Botes, P. 2013(h): Biodiversity scoping assessment with regards to a Jetty Construction on Erf 327, Malagas (Matjiespoort). 24 October 2013.

Botes, P. 2013(i): Jacobsbaai pump station and rising main (Saldanha Bay Municipality). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 30 October 2013.

Botes, P. 2014(a): Brandvlei Bulk Water Supply: Proposed construction of a 51 km new bulk water supply pipeline (replacing the existing pipeline) from Romanskolk Reservoir to the Brandvlei Reservoir, Brandvlei (Northern Cape Province). A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). 24 February 2014.

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Botes, P. 2014(b): Kalahari-East Water Supply Scheme Extension: Phase 1. Proposed extension of the Kalahari-East Water Supply Scheme and associated infrastructure to the Mier Municipality, ZF Mgcawu District Municipality, Mier Local Municipality (Northern Cape Province). Biodiversity & Botanical scan of the proposed route to determine the possible impact on biodiversity with emphasis on vegetation and plant species. 1 July 2014.

Botes, P. 2014(c): The proposed Freudenberg Farm Homestead, Farm no. 419/0, Tulbagh (Wolseley Area). A Botanical scan of possible remaining natural veld on the property. 26 August 2014.

Botes, P. 2014(d): Postmasburg WWTW: Proposed relocation of the Postmasburg wastewater treatment works and associated infrastructure, ZF Mgcawu District Municipality, Tsantsabane Local Municipality (Northern Cape Province). Biodiversity and botanical scan of the proposed pipeline route and WWTW site. 30 October 2014.

Botes, P. 2015(a): Jacobsbaai pump station and rising main (Saldanha Bay Municipality) (Revision). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 21 January 2015.

Botes, P. 2015(b): Steenkampspan proving ground. Proposed establishment of a high speed proving (& associated infrastructure) on the farm Steenkampspan (No. 419/6), Upington, ZF Mgcawu (Siyanda) District

Municipality, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 20 February 2015.

Botes, P 2015(c): Proposed Bredasdorp Feedlot, Portion 10 of Farm 159, Bredasdorp, Cape Agulhas Municipality, Northern Cape Province. A Botanical scan of the area that will be impacted. 28 July 2015.

Botes, P. 2016(a): OWK Raisin processing facility, Upington, Erf 151, Kenhardt, Northern Cape Province. A Botanical scan of the proposed footprint. 26 May 2016.

Botes, P. 2016(b): Onseepkans Agricultural development. The proposed development of ±250 ha of new agricultural land at Onseepkans, Northern Cape Province. Biodiversity and Botanical Scan. January 2016.

Botes, P. 2016(c): Henkries Mega-Agripark development. The proposed development of ±150 ha of high potential agricultural land at Henkries, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 28 February 2016.

Botes, P. 2016(d): Proposed Namaqualand Regional Water Supply Scheme high priority bulk water supply infrastructure upgrades from Okiep to Concordia and Corolusberg. Biodiversity Assessment of the proposed footprint. March 2016.

Botes, P. 2017: The proposed new Namaqua N7 Truck Stop on Portion 62 of the Farm Biesjesfontein No. 218, Springbok, Northern Cape Province. Botanical scan of the proposed footprint. 10 July 2017.

Botes, P. 2018(a): Kamiesberg Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Kamiesberg, Northern Cape Province. Botanical scan of the proposed footprint. 20 February 2018

Botes, P. 2018(b): Rooifontein Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Rooifontein, Northern Cape Province. Botanical scan of the proposed footprint. 23 February 2018

Botes, P. 2018(c): Paulshoek Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Paulshoek, Northern Cape Province. Botanical scan of the proposed footprint. 27 March 2018.

Botes, P. 2018(d): Kakamas Wastewater Treatment Works Upgrade – Construction of a new WWTW and rising main, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 1 August 2018.

Botes, P. 2018(e): Kakamas Bulk Water Supply – New bulk water supply line for Kakamas, Lutzburg & Cillie, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 4 August 2018.

Botes, P. 2018(f): Wagenboom Weir & Pipeline – Construction of a new pipeline and weir with the Snel River, Breede River Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 7 August 2018.

Botes, P. 2018(g): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.

Botes, P. 2018(h): Tripple D farm agricultural development – Development of a further 60 ha of vineyards, Erf 1178, Kakamas, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.

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Botes, P. 2019(b): Verneujkpan Trust agricultural development – The proposed development of an additional ±250 ha of agricultural land on Farms 1763, 2372 & 2363, Kakamas, Northern Cape Province. 27 June 2019.

Botes, P. 2020(a): Gamakor & Noodkamp Low cost housing – Botanical Assessment of the proposed formalization of the Gamakor and Noodkamp housing development on the remainder and portion 128 of the Farm Kousas No. 459 and Ervin 1470, 1474 and 1480, Gordonia road, Keimoes. Kai !Gariep Local Municipality, Northern Cape Province. 6 February 2020.

Botes, P. 2020(b): Feldspar Prospecting & Mining, Farm Rozynen Bosch 104, Kakamas. Botanical assessment of the proposed prospecting and mining activities on Portion 5 of The Farm Rozynen Bosch No. 104, Kakamas, Khai !Garib Local Municipality, Northern Cape Province. 12 February 2020.

Botes, P. 2020(c): Boegoeberg housing project – Botanical assessment of the proposed formalization and development of 550 new erven on the remainders of farms 142 & 144 and Plot 1890, Boegoeberg settlement, !Kheis Local Municipality, Northern Cape Province. 1 July 2020.

Botes, P. 2020(d): Komaggas Bulk Water supply upgrade – Botanical assessment of the proposed upgrade of the existing Buffelsrivier to Komaggas BWS system, Rem. of Farm 200, Nama Khoi Local Municipality, Northern Cape Province. 8 July 2020.

Botes, P. 2020(e): Grootdrink housing project – Botanical assessment of the proposed formalization and development of 370 new erven on Erf 131, Grootdrink and Plot 2627, Boegoeberg Settlement, next to Grootdrink, !Kheis Local Municipality, Northern Cape Province. 14 July 2020.

Botes, P. 2020(f): Opwag housing project – Botanical assessment of the proposed formalization and development of 730 new erven on Plot 2642, Boegoeberg Settlement and Farm Boegoeberg Settlement NO.48/16, Opwag, !Kheis Local Municipality, Northern Cape Province. 16 July 2020.

Botes, P. 2020(g): Wegdraai housing project – Botanical assessment of the Proposed formalization and development of 360 new erven on Erven 1, 45 & 47, Wegdraai, !Kheis Local Municipality, Northern Cape Province. 17 July 2020.

Botes, P. 2020(h): Topline (Saalskop) housing project – Botanical assessment of the pproposed formalization and development of 248 new erven on Erven 1, 16, 87, Saalskop & Plot 2777, Boegoeberg Settlement, Topline, !Kheis Local Municipality, Northern Cape Province. 18 July 2020.

Botes, P. 2020(i): Gariep housing project – Botanical assessment of the proposed formalization and development of 135 new erven on Plot 113, Gariep Settlement, !Kheis Local Municipality, Northern Cape Province. 20 July 2020.