GROMIS-NAMA-AGGENEIS 400KV IPP INTEGRATION: ENVIRONMENTAL SCREENING

Botanical and Freshwater Surface Specialist Report

July 2020

Prepared for:

Eskom | Powering your world

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1. Document control

1.1. Quality and revision record

1.1.1. Quality approval

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This report has been prepared in accordance with Enviroworks Quality Management System.

1.1.2. Revision record

Revision Number	Objective	Change	Date
1	Draft Report	N/A	31 January 2020
2	Draft Report	General revision	14 February 2020
3	Draft Report	General revision	3 March 2020
4	Final Draft Report	Revision based on Eskom comments	10 July 2020

2. Executive summary

2.1. Background

Eskom proposes to develop a new power line from the Gromis substation via the Nama substation towards the Aggeneis substation in the Northern Cape Province.

In order to ensure that the Namaqualand electricity network is compliant and that there is sufficient line capacity to accommodate potential Independent Power Producers (IPPs) within the Namaqualand area, it is proposed to develop the new Gromis-Nama-Aggeneis 400 kV line and establishment of a 400/132 kV yard at the Nama substation. This Specialist Impact Assessment forms part of the Screening Assessment which aims to assess possible route alternatives for the proposed new power line.

2.1.1. Strategic Environmental Assessment for Strategic Electrical Grid Infrastructure Corridors

The 2016 Strategic Environmental Assessment (SEA) identified strategic Electricity Grid Infrastructure (EGI) Corridors to support electricity transmission up to 2040. The final EGI Corridors were gazetted for implementation on 16 February 2018 in Government Gazette No. 41445, Government Notice R. 113. The proposed new power line will be constructed within the SEA identified Northern Corridor.

2.1.2. Alternative Environmental Authorisation procedure to be followed

The above mentioned Gazette (GN R. 113 in Government Gazette No. 41445) provided an alternative procedure to be followed when applying for Environmental Authorisation (EA) for the development of large scale electricity transmission and distribution infrastructure (identified in terms of Section 24(2)(a) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA)) when these activities fall within the identified Strategic Transmission Corridors, such as the Northern Corridor.

The development of large scale electricity transmission infrastructure triggers Listed Activity 9 of Listing Notice 2 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), which usually would require a full Scoping and Environmental Impact Assessment. However, when such a development is to take place within a Strategic Transmission Corridor, a Basic Assessment (BA) Process in terms of the 2014 EIA Regulations (as amended) is to be followed. A pre-requisite for the BA process to be followed is however the obtaining of a servitude prior to application for environmental authorisation.

a) Screening of Alternative Routes

Enviroworks, a professional Environmental Compliance consultancy, was appointed by Eskom to conduct the Screening Assessment of the alternative route options. Several specialist studies were conducted as part of the screening process.

The purpose of the current Screening Assessment is to evaluate alternative routes within the Northern Corridor. As part of the Screening Assessment, a group of specialists evaluated a set of alternative routes according to potential sensitive environmental, social and economic issues. The findings of all the specialists will be integrated to make an informed decision on the best route alternative for the proposed power line.

The specialist findings will be used to produce a Screening Report that will recommend the best route alternative based upon NEMA Principles, the Best Available Technology principle and consultation with stakeholders such as Landowners, Organs of State , Non-Government Organisations (NGOs) and any other Interested and Affected Parties (I&APs). The Screening Report will then be used by Eskom to negotiate a servitude with landowners. After negotiations with landowners Eskom will proceed with the next stage which is to conduct a BA Process in order to obtain an Environmental Authorisation (EA) from the competent authority for the pre-negotiated route.

b) Locality and Description Alternatives

The proposed route alternatives were provided by Eskom based on existing infrastructure and feasibility (economic and engineering to name a few). These alternatives are situated within the Northern Corridor, as identified during the 2016 SEA. This study area lies within the Northern Cape Province, between the towns of Aggeneys in the east and Kleinsee in the West, with the town of Springbok in between them.

c) Need and Desirability

Electricity Grid Infrastructure (EGI) is required to provide grid access to electricity producers and distribute the electricity they generate to users. Independent Power Producers (IPPs) have rapidly become key electricity producers and this has increased the demand for grid access and hence the need to construct more EGI.

2.2. Introduction

The study area is situated in the Northern Cape Province, known for rich natural heritage, high levels of solar radiation on non-cloudy days and a semi-arid and arid climate. The natural wealth of the study area has received international recognition, with the Succulent Karoo recognized as the only arid biodiversity hotspot in the world. Nearly a third of the plant species found in the Northern Cape Province is endemic to the province (occurs in no other province) and an estimated 286 of the endemic species are classified as threatened. The natural environment not only has intrinsic biodiversity value (supporting and maintaining diverse communities and terrestrial flora and species dependent on watercourses and wetlands), the surface freshwater system plays a very important role in sustaining ecological and economic health. The study area is also largely dependent on the natural environmental for tourism (e.g. Namaqua and West Coast Flower Route) and related industries and livestock.

The proposed development will entail the construction of a 400 kV power line, between the substations of Aggeneis, Nama and Gromis. The direct footprint of a single pylon supporting a 400 kV powerline is about 1 ha. This area is needed for the foundation excavation, assembly and raising of the pylon. The overhead power line will be supported by various types of pylons (such as self-supporting lattice towers, guyed towers and monopole structures). Pylon towers will be spaced approximately 460 m apart, with the distance varying in mountainous terrain. Where the gradient of the terrain is <15%, Cross Rope Suspension and Guyed-Vee Towers will be used, and in the case where the gradient exceeds 15%, Self-Supporting Towers will be used.

The development footprint for where the substations expansion extends up to is unknown at this stage (including temporary construction camps, borrow pits, vehicle parking, stock piles, etc.). A 4m access road is needed for vehicles during construction. The access roads for accessing pylons/powerlines is usually widened to a two-track road of 8m. Servitudes of 55m is mandatory for the 400 kV line, with a maximum width of 90m at the pylon location. The servitude will require ongoing vegetation clearing to maintain an eight-metre strip wherein grass/herbaceous vegetation regrowth is cut to a height of 20 cm, and trees in most cases are removed. Considering the sparse and short vegetation growth forms in the study area, very little clearing and removal of trees will be needed.

2.3. Objectives of the study

Due to importance of the local terrestrial flora and surface freshwater features, and the potential negative impact that the proposed development could have on these features, it will firstly be necessary to identify important and sensitive features within the proposed alternative development corridors, compare alternative development corridors and recommend the best alternative with the least impact on sensitive or important features. Secondly it is necessary to identify and rate the significance of potential impacts of the proposed development and then compare the development alternative corridors to recommend the alternative with the least amount of impacts in terms of their significance. Lastly, it is important to recommend features to avoid at all cost during the proposed development, and make recommendations to reduce and mitigate potential negative impacts.

2.4. Study area description

The alternative corridors are characterized by a dry climate, especially when compared to the rest of South Arica. The terrestrial floral diversity is varied within the study area, with extremely high levels of biodiversity of international significance located to the west and decreasing in sensitivity and significance to the east of the study area. The aquatic ecosystems are overall characterized by ephemeral and non-perennial surface water systems due to the arid- to semi-arid climate.

Most of the land cover is natural, with varying degrees of degradation present, mostly from overgrazing, resulting in reduced vegetation cover, invasion by Invasive Alien Plants (IAPs) and erosion. A small proportion is transformed through urbanisation, agricultural and mining developments. Impacts on freshwater ecosystems from associated land use activities of the transformed landscape are relatively localised within the corridor context. More widespread impacts to freshwater systems tend to be linked to livestock farming practices and infestation of IAPs.

River systems are predominantly non-perennial/ephemeral in the area. Very few surface watercourses are present throughout the year and mostly include storage dams. The rivers of South Africa is commonly describe in terms of the 'Ecoregions' in which it occurs. The broad Level 1 Ecoregion delineation is based on shared attributed of river ecosystems based on attributed such as physiography, climate, rainfall, geology and potential natural vegetation. Most of the river ecosystems of this study area fall within the Namaqua Highland-, Nama Karoo- and Western Coastal Belt.

Wetlands, on the other hand are characterised by Bioregions, which is sub-division of biomes, based on the rainfall and climate. All wetlands of the study area are characterised by the Bushmanland Bioregion. Due to the xeric climatic conditions, wetlands occupy a very small portion of watercourses. The area supports wetland types dominated by floodplain wetland habitat along rivers, channelled-valley bottom wetlands and endorheic pans that are more unique to the region.

In terms of the terrestrial flora, the study area can be divided into two broad ecological regions, called biomes: Succulent- and Nama Karoo. The Succulent Karoo has an arid to semi-arid climate and is known for its exceptional floral richness and high levels of endemism, especially of succulent and bulbous species. The biome is recognised as one of three global biodiversity hotspots in southern Africa with unrivalled levels of diversity and endemism for an arid region. There are some drainage systems that originate from catchments outside the Succulent Karoo biome flowing through the biome. The watercourses are generally small and ephemeral in nature. Where the Succulent Karoo transitions into the Nama Karoo biome, on the inland borders to the east, the high levels of succulence and endemism transition to arid ecosystems typified by a much lower biodiversity and few species of conservation concern.

The second biome in this study area, Nama Karoo, occurs on the central plateau of the western half of South Africa. Floral richness and species endemism is not particularly high within the Nama Karoo, nor are there many rare or endangered species. This biome is considered the third largest in South Africa, with 1.6% being formally protected. Historically, the biome was home to large herds of game. The current landscape has been converted to fenced farms, used as rangeland for stock.

2.5. Method

Due to the scope of the work, timeframe constraints and the extent of the alternative corridors, appropriate existing data had to be sourced and used as far as possible for the screening analysis. The most recent freely available national and provincial data were sourced for biodiversity features for the study area. Investigations were limited to terrestrial flora and freshwater bodies (surface watercourses, as there is a separate study for groundwater).

A desktop assessment was done to identify and summarize terrestrial flora and freshwater features within the boundaries of the alternative development corridors. The features were then mapped and summarized. A brief site visit was done to get a broad sense of the condition of the proposed corridors, and to make general observations on the study area.

Potential impacts of the proposed development were identified from existing reports, done on similar developments. Appropriate mitigation measures are recommended to avoid, reduce or mitigate the identified impacts.

Impacts were rated to determine their significance, using an impact rating methodology, commonly used in Environmental Impact Assessments. The impact significance rating were determined for unmitigated scenarios, and then repeated assuming that recommended mitigation measures were implemented. A spatial representation of impact rating were mapped in a separate report (Appendix to the main Screening Report) that combines the results of all the Specialist investigations.

2.6. Results

From this study it is recommended that Alternative 5 is the preferred alternative. Alternative 1 (and the proportions of 4 and 5 where the routed converge with Alternative 1) offers the greatest opportunity to make use of existing infrastructure such as access roads and similar linear developments, despite crossing sensitive CBA1 areas. Alternative 1 (and the proportions of 4 and 5 where the routed converge with Alternative 1) has a larger area transformed (thus more developments), Alternative 4 in contrast has less transformed areas and access. The natural environment is in a more pristine condition in the western section of this alternative. Similarly, both the western section of Alternative 4 and the eastern section of Alternative 1 has wide sections of CBA 1s (and a Protected Area (PA) in the case of Alternative 1) going across the entire corridor width. The length of these section are also much larger (>460m) than the required distance between pylon placement. Using Alternative 5 as the preferred route could help limit the distance and size of new footprint clearing and further transformation, by limiting new disturbance as close as possible to existing or past disturbances. Alternative 5 is also mostly covered by less sensitive and more degraded ecological areas when compared to the corresponding section of Alternative 1 and 4. This alternative will also successfully navigate around the CBA 1 and PA areas in the eastern section of the study area that Alternative 1 & 4 passes through. If all mitigation measures are followed, both Alternative 1 & 5 could be viable and feasible options from the view point of terrestrial flora and freshwater aquatic perspective, but Alternative 5 is the preferred Alternative. Alternative 4 is considered not feasible due to the larger distance and area of disturbance that it would cause to an area in a relatively good ecological condition and also a larger portion of Succulent Karoo Biome will be impacted compared to Alternative 1 and 5, with limited access and infrastructure to make use of. Alternative 1 and 5 can make use of existing access and similar infrastructure, is the more direct distances of the three options and also has the lesser impact on the Succulent Karoo biome.

2.7. Identified impacts

Impacts were identified from the existing Generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity and impact assessments specifically focused on assessing impacts of energy generating and distribution infrastructure within Strategic Environmental Areas. Impacts associated with the proposed development range from those that are direct (e.g. pylon construction and clearing areas for servitudes) to those that are indirect and which occur over longer timeframes (e.g. habitat fragmentation, hydrological changes and alien plant infestation).

From a terrestrial flora and freshwater aquatic perspective, the dominating source of potential impacts that the proposed project will have during its life cycle will be directly and indirectly related to habitat loss and the transformation of habitats.

Other significant sources of impact include changes in surface hydrology and disturbance due to human presence and activities.

In terms of watercourses, service- and access roads and the power line itself will almost inevitably cross rivers, riparian zones, streams and wetlands. Crossing of watercourses, placement of infrastructure or construction can cause disturbance to watercourse bed and banks, and their buffers. The life cycle will however require very little water and impacts will not be consumptive.

The overall impacts of the proposed development and associated activities can be summarized as potentially causing a risk of habitat destruction, increased levels of disturbance and degradation (for terrestrial flora and freshwater ecosystems), establishment and spread of IAPs, increased soil erosion, as well as cumulative impacts on broad-scale ecological processes. The majority of impacts will be created during construction, with the effect carrying on in the operation phase for some of the impacts.

2.8. Mitigation measures for identified impacts

Mitigation measures were identified from the existing Generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity and impact assessments specifically focused on assessing impacts of energy generating and distribution infrastructure within Strategic Environmental Areas.

2.9. Impact rating results

The significance of the identified potential impacts were rated using standard methodology. The ratings were applied in the instance that no mitigation measures are implemented, and then repeated to assess the significance of the impacts, assuming recommended mitigation measures are implemented. Unmitigated, impacts ranged between medium to high in sensitive and natural vegetation remnants. If mitigation measures are implemented, and sensitive and natural areas are avoided, the significance of impacts are reduced to a low level.

2.10. Recommended ‘no-go areas’

- Avoid CBAs, Protected Areas and riparian and wetland bed and banks as far as possible (maps included for this study);
- Watercourses and their 32m buffers should be considered no-go areas for infrastructure placement as far as practically possible; and,
- Avoid impact to restricted and specialised habitats such as azonal vegetation types, cliffs, large rocky outcrops, quartz fields, bases of koppies, inselbergs, mountains or rocky outcrops, pebble patches and rock sheets and population of Species of Conservation Concern (not mapped at this scale of the study).

2.11. Recommendations for during the BA process

There are habitats and vegetation types within the study area which are considered rare or which contain an abundance of endemic species or species of conservation concern. Some vegetation types are restricted to specialised substrates which are limited in extent and impacts on these habitats cannot be effectively mitigated except through avoidance. Development within these areas should be limited as much as possible. It is not possible to map all of these fine-scale patterns during this study and their presence must be verified through site visits to the pylon footprint and route alignment during the appropriate season to the preferred alternative during the BA Process.

The presence of ephemeral watercourses (especially depression wetlands and pans is difficult to map at this level and watercourse presence should be verified through site visits of the preferred alternative pylon footprint and route alignment) during the BA Process. A site walk-through during the BA Process must identify and map cliffs, large rocky outcrops, quartz fields, pebble patches and rock sheets.

2.12. Final specialist recommendations

The Generic EMPr should be implemented during planning & design, construction, post-construction, operation and decommissioning phases of the project. Specialist findings and recommendations identified in this screening assessment-specialist report and upcoming BA-specialist site verifications should be incorporated into the project specific EMPr and implemented throughout the entire cycle of the project.

In order to reduce potential impacts of the proposed development on freshwater ecosystems watercourses classified with a very high or high sensitivity, and/or good ecological condition should be avoided as far as possible. Where avoidance of sensitive watercourses is not possible, detailed desktop investigations should be conducted, followed by specialist in-field verification. This will determine whether the fine-scale, micro-sited power line alignment and development footprints can avoid freshwater ecosystems and associated buffers. Following this verifiction, appropriate management actions may be determined and implemented as required.

2.13. Conclusion

Succulent Karoo and desert ecosystems occupy a large portion of the alternatives and the area is characterised by high level of endemism and sensitive features. These areas should be avoided at all cost. There are many opportunities for the power line routing to follow, and individual placement of pylons should be based on more detailed site verification once specialist visit the Preferred Alternative during the BA Process. The lesser sensitive areas located to the eastern sections Springbok (Nama Karoo Biome) should be more flexible to aligning the line and placing pylons. It is thus recommended that Alternative 5 be the Preferred Alternative from a Botanical and Freshwater perspective, as this alternative will give flexibility in avoiding sensitive habitats and ecosystems and provide flexibility in pylon placement.

Impacts on terrestrial flora and freshwater ecosystems are unfortunately unavoidable when developing large-scale projects such as strategic power transmission corridors such as this development. In particular, linear developments need to avoid urban areas and limit the impacts on other areas with anthropogenic significance to prevent socio-economic impacts. It is thus critical to strategically plan the placement of the line and development footprints to significantly reduce the impact on freshwater and terrestrial floral biodiversity.

The identified impacts are derived from existing studies conducted to identify possible impacts and their mitigation. The ratings were derived using a standard methodology, aimed at giving a defensible significance rating to impacts. The spatial representation of impact ratings are developed from best-available national and provincial data sets, through to be appropriate at this level of study.

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6. Background

Eskom proposes to develop a new power line from the Gromis substation via the Nama substation towards the Aggeneis substation in the Northern Cape Province.

In order to ensure that the Namaqualand electricity network is compliant and that there is sufficient line capacity to accommodate potential Independent Power Producers (IPPs) within the Namaqualand area, it is proposed to develop the new Gromis-Nama-Aggeneis 400 kV line and establishment of a 400/132 kV yard at the Nama substation. This Specialist Impact Assessment forms part of the Screening Assessment which aims to assess possible route alternatives for the proposed new power line.

6.1. Strategic Environmental Assessment for Strategic Electrical Grid Infrastructure Corridors

In 2016 a Strategic Environmental Assessment (SEA) was undertaken by the CSIR. The purpose of the SEA was to identify strategic Electricity Grid Infrastructure (EGI) Corridors to support electricity transmission up to 2040. The vision for the Strategic EGI was to expand in an environmentally responsible and efficient manner that effectively meets the country's economic and social development needs.

The final EGI Corridors assessed as part of the 2016 EGI SEA were gazetted for implementation on 16 February 2018 in Government Gazette No. 41445, Government Notice R. 113. One of these corridors, was the Northern Corridor – Please see Figure 1 for the Gazetted Corridors. The proposed new power line will be constructed within the SEA's identified Northern Corridor.

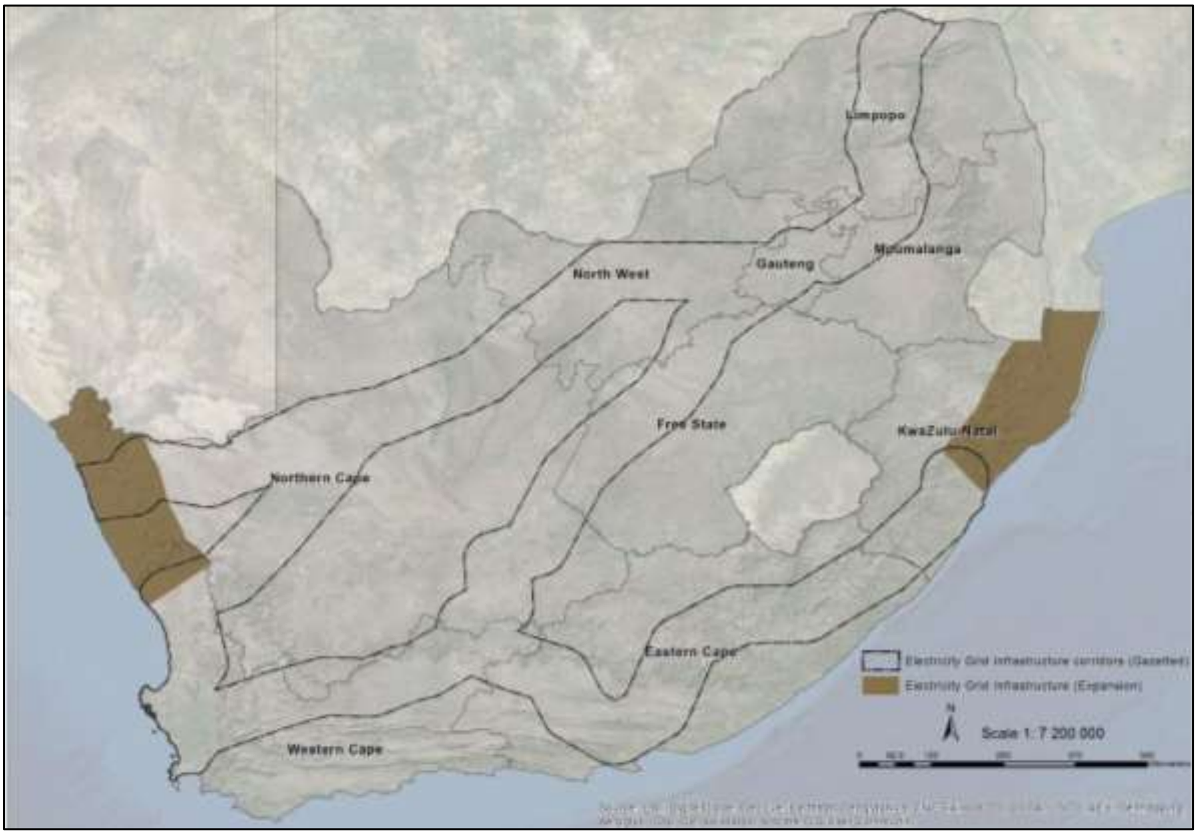

FIGURE 1 THE FINAL ELECTRICITY GRID INFRASTRUCTURE (EGI) POWER CORRIDORS ASSESSED AS PART OF THE 2016 EGI STRATEGIC ENVIRONMENTAL ASSESSMENT (TAKEN FROM DEPARTMENT OF ENVIRONMENTAL AFFAIRS, 2016)

6.2. Alternative Environmental Authorisation procedure to be followed

The above mentioned Gazette (GN R. 113 in Government Gazette No. 41445) provided an alternative procedure to be followed when applying for Environmental Authorisation (EA) for the development of large scale electricity transmission and distribution infrastructure (identified in terms of Section 24(2)(a) of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA)) when these activities fall within the identified Strategic Transmission Corridors, such as the Northern Corridor.

The development of large scale electricity transmission infrastructure triggers Listed Activity 9 of Listing Notice 2 of the 2014 Environmental Impact Assessment (EIA) Regulations (as amended), which usually would require a full Scoping and Environmental Impact Assessment. However, when such a development is to take place within a Strategic Transmission Corridor, a Basic Assessment (BA) Process in terms of the 2014 EIA Regulations (as amended) is to be followed. This speeds up the EA process for EGI developments within any of the five Strategic Transmission Corridors. A pre-requisite for the BA process to be followed is however the obtaining of a servitude prior to application for environmental authorisation.

One of the objectives of this SEA process was also to provide developers with the flexibility to consider a range of route alternatives within the strategic corridors to avoid land negotiation issues and to submit a pre-negotiated route to the Competent Authority.

As noted above, this has been achieved for the development of EGI within any of the five Strategic Transmission Corridors gazetted in February 2018 (GN R. 113 in Government Gazette No. 41445), for which:

(a) a pre-negotiated route must be submitted to the Department of Environmental Affairs (DEA); and,

(b) a BA procedure needs to be followed in compliance with the 2014 EIA Regulations (as amended) instead of a full Scoping and EIA process previously triggered by such activities.

6.2.1. Screening of Alternative Routes

The purpose of the current Screening Assessment is to evaluate alternative routes for the proposed development within the Northern Corridor. As part of the Screening Assessment, a group of specialists evaluated a set of alternative routes according to potential sensitive environmental, social and economic issues. The findings of all the specialists will be integrated to make an informed decision on the best route alternative for the proposed power line.

This study will thus be undertaken in terms of Regulation 15 of the Environmental Impact Assessment Regulations, 2014 (GN R. 982, in the Gazette No. 38282 of 4 December 2014), that provides for the procedure to be followed in applying for environmental authorisation for large scale electricity transmission and distribution development activities identified in terms of Section 24(2)(a) of the NEMA, 1998.

Enviroworks, a professional Environmental Compliance consultancy, was appointed by Eskom to conduct the Screening Assessment of the alternative route options. Several specialist studies were conducted as part of the screening process. These studies include:

- Heritage Impact Assessment
- Socio-Economic Impact Assessment
- Floral Impact Assessment
- Freshwater Impact Assessment (surface watercourses)
- Fauna Impact Assessment

- Avifaunal Impact Assessment
- Visual Impact Assessment
- Agricultural Impact Assessment
- Desktop Geo-hydrological Impact Assessment

The specialist findings will be used to produce a Screening Report that will provide the best route alternative based upon NEMA Principles, the Best Available Technology principle and consultation with stakeholders such as Landowners, Organs of State , Non-Government Organisations (NGOs) and any other Interested and Affected Parties (I&APs).

The Screening Report will then be used by Eskom to negotiate a servitude with landowners. These negotiations will take place after the Screening Assessment and will not form part of the current study. After negotiations with landowners Eskom will proceed with the next stage which is to conduct a BA Process in order to obtain an EA from the competent authority for the pre-negotiated route. Stakeholder consultation will be done again during this phase. Ample time will be provided for the public to comment. All information gathered during the Screening Assessment will be used in the BA Process for application for environmental authorisation.

6.2.2. Locality and Description Alternatives

The proposed route alternatives were provided by Eskom based on existing infrastructure and feasibility (economic and engineering to name a few). These alternatives being assessed are situated within the Northern Corridor, as identified during the 2016 SEA (Department of Environmental Affairs, 2016; RSA, 2019). The study area lies within the Northern Cape Province, between the towns of Aggeneys in the east and Kleinsee in the West, with the town of Springbok in between them (Figure 2).

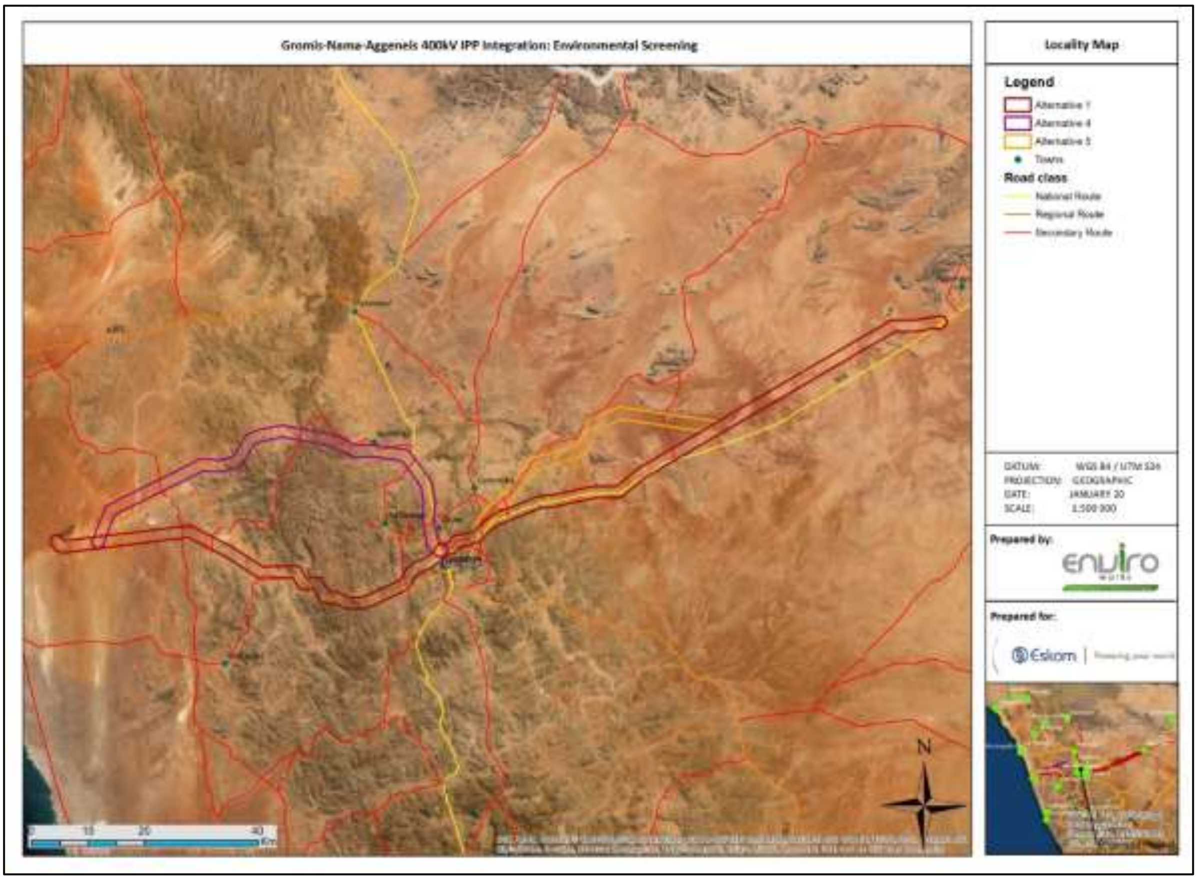

FIGURE 2 LOCATION OF ALTERNATIVE LINE CORRIDORS BETWEEN GROMIS-NAMA-AGGENEIS SUBSTATIONS, INDICATING TOWNS AND MAJOR ROADS

6.2.3. Need and Desirability

Electricity Grid Infrastructure (EGI) is required to provide grid access to electricity producers and distribute the electricity they generate to users. Independent Power Producers (IPPs) have rapidly become key electricity producers and this has increased the demand for grid access and hence the need to construct more EGI.

7. Introduction

The study area is situated in the Northern Cape Province, known for rich natural heritage, high levels of solar radiation on non-cloudy days and a semi-arid and arid climate.

The natural wealth of the study area has received international recognition, with the Succulent Karoo recognized as the only arid biodiversity hotspot in the world (Rundel and Cowling, 2013). Nearly a third of the plant species found in the Northern Cape Province is endemic to the province (occurs in no other province) and an estimated 286 of the endemic species are classified as threatened (SANBI, 2017; Northern Cape Province, 2019). The natural environment not only has intrinsic biodiversity value (supporting and maintaining diverse communities, terrestrial flora and species dependent on watercourses and wetlands), the surface freshwater system plays a very important role in sustaining ecological and economic health. The study area is also largely dependent on the natural environmental for tourism (e.g. Namaqua and West Coast Flower Route) and related industries and livestock.

The proposed development will entail the construction of a 400 kV power line, between the substations of Aggeneis, Nama and Gromis. The direct footprint of a single pylon supporting a 400 kV powerline is about 1 ha. This area is needed for the foundation excavation, assembly and raising of the pylon. The overhead power line will be supported by various types of pylons (such as self-supporting lattice towers, guyed towers and monopole structures). Pylon towers will be spaced approximately 460 m apart, with the distance varying in mountainous terrain. Where the gradient of the terrain is <15%, Cross Rope Suspension and Guyed-Vee Towers will be used, and in the case where the gradient exceeds 15%, Self-Supporting Towers will be used.

The development footprint for where the substation’s expansion extends up to is unknown at this stage (including temporary construction camps, borrow pits, vehicle parking, stock piles, etc.). A 4m access road is needed for vehicles during construction. The access roads for accessing pylons/powerlines is usually widened to a two-track road of 8m. Servitudes of 55m is mandatory for the 400 kV line, with a maximum width of 90m at the pylon location. The servitude will require ongoing vegetation clearing to maintain an eight-metre strip wherein grass/herbaceous vegetation regrowth is cut to a height of 20 cm, and trees in most cases are removed. Considering the sparse and short vegetation growth forms in the study area, very little clearing and removal of trees will be needed.

Due to importance of the local terrestrial flora and freshwater features (surface water), and the potential negative impact that the proposed development could have on these features, it will firstly be necessary to identify important and sensitive features within the proposed alternative development corridors, compare alternative development corridors and recommend the best alternative with the least impact on sensitive or important features. Secondly it is necessary to identify and rate the significance of potential impacts of the proposed development and then compare the development alternative corridors to recommend the alternative with the least amount of impacts in terms of their significance. Lastly, it is important to recommend features to avoid at all cost during the proposed development, and make recommendations to reduce and mitigate potential negative impacts.

8. Objective of specialist study

- Identify important freshwater (surface) and terrestrial floral features within the provided alternative location corridors.
- Identify and assess the significance of potential ecological impacts/threats that the proposed development of the power line and substation expansion might have that are linked to watercourses (rivers, streams, drainage lines and wetlands) and terrestrial floral biodiversity.
- Compare the significance of the potential impacts of the potential location alternatives (corridors) for the proposed development and make recommendations on the preferred alternative.
- Focus the assessment primarily on the interpretation of existing data and base it on defensible and, if available, standardised and recognised methodologies.
- Provide management and mitigation measures for the identified potential impacts.

9. Study area description

The alternative corridors are characterized by a dry climate, especially when compared to the rest of South Arica. The terrestrial floral diversity is varied within the study area, with extremely high levels of biodiversity of international significance located to the west and decreasing in sensitivity and significance to the east of the study area. The aquatic ecosystems are overall characterized by ephemeral and non-perennial surface water systems due to the arid- to semi-arid climate.

Most of the land cover is natural, with varying degrees of degradation present, mostly from overgrazing, resulting in reduced vegetation cover, invasion by Invasive Alien Plants (IAPs) and erosion. A small proportion is transformed through urbanisation, agricultural and mining developments. Impacts on freshwater ecosystems from associated land use activities of the transformed landscape are relatively localised within the corridor context. More widespread impacts to freshwater systems tend to be linked to livestock farming practices and infestation of IAPs (Department of Environmental Affairs, 2016).

River systems are predominantly non-perennial/ephemeral in the area. Very few surface watercourses are present throughout the year and mostly include storage dams. The rivers of South Africa are commonly described in terms of the 'Ecoregions' in which it occurs. The broad Level 1 Ecoregion delineation is based on shared attributes of river ecosystems and based on attributes such as physiography, climate, rainfall, geology and potential natural vegetation (Kleynhans et al., 2005). Most of the river ecosystems of this study area fall within the Namaqua Highland-, Nama Karoo- and Western Coastal Belt Ecoregion (Figure 3); which is each briefly explained in the next paragraphs.

The Western Coastal Belt Ecoregion (no. 25, Figure 3) is situated in the winter rainfall region, with the dominant vegetation types being Succulent Karoo, and the terrain dominated by plains with low and moderate relief. The Olifants-, Doring-, Sout-, Groen- and Buffalo Rivers traverse this region while the Orange River flows through the northern part. Mean annual precipitation (MAP) is very low, drainage density is low and the stream frequency is low-medium (Kleynhans et al., 2005).

The Nama Karoo Ecoregion (no. 26, Figure 3) has a diverse topography but plains with a moderate to high relief and lowlands, hills and mountains with moderate to high relief are dominant. Vegetation consists almost exclusively of Nama Karoo types. Perennial rivers that traverse this region are the Riet and Orange. Rivers draining extensive parts of the region, such as the Hartbees, are seasonal. The MAP is moderate-low in the east, decreasing to arid in the west. Drainage density is generally low, but medium to high in some parts. The stream frequency is low-medium but also has significant areas with low-high and high frequencies (Kleynhans et al., 2005).

Lastly, the Namaqua Highland Ecoregion (no. 27, Figure 3) has closed hills and mountains with moderate to high relief that are distinctive in this region. Dominant vegetation types consist of Succulent Karoo types and Renosterveld. The Buffalo- and Groen Rivers have their sources in the region while the Orange River flows through the northern part. The MAP is predominantly arid. Drainage density is medium and the stream frequency is medium-high (Kleynhans et al., 2005).

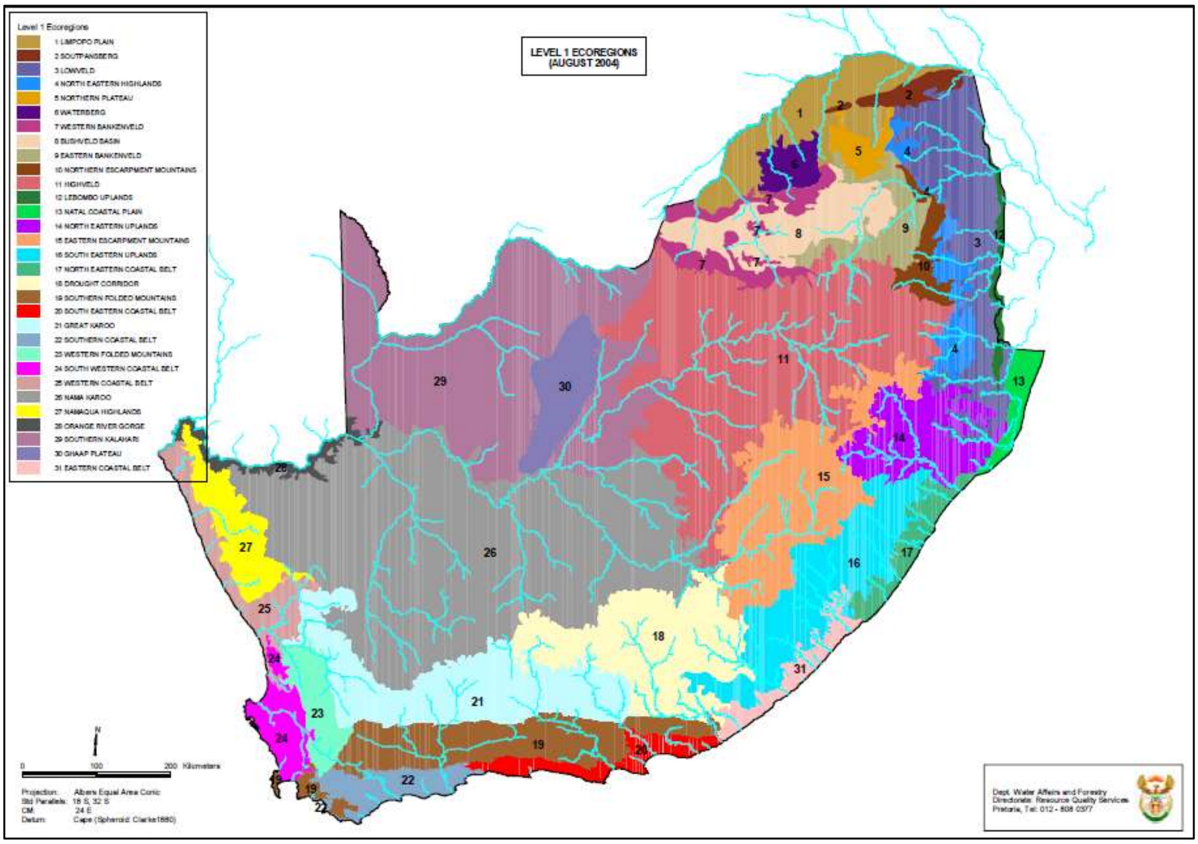

FIGURE 3 LEVEL I RIVER ECOREGIONS FOR SOUTH AFRICA, LESOTHO AND SWAZILAND (TAKEN FROM KLEYNHANS ET AL., 2005)

Wetlands, on the other hand are characterised by Bioregions, which is a sub-division of biomes, based on the rainfall and climate (Rutherford et al., 2006). The Bushmanland Bioregion occurs from the north eastern part of the Namaqualand area in the west to around Prieska in the east and from around Upington in the north to the Brandvlei/Sak River vicinity in the south. All wetlands of the study area are characterised by this Bioregion, which is dominated by arid shrublands and arid grasslands (Mucina et al., 2006b). Due to the xeric climatic conditions, wetlands occupy a very small portion of watercourses. The area supports wetland types dominated by floodplain wetland habitat along rivers, channelled-valley bottom wetlands and endorheic pans that are more unique to the region.

In terms of the terrestrial flora, the study area can be divided into two broad ecological regions, called biomes: Succulent- and Nama Karoo (Figure 4). Each will be briefly described below to give a broad description of the terrestrial flora.

The Succulent Karoo has an arid to semi-arid climate and is known for its exceptional floral richness and high levels of endemism, especially of succulent and bulbous species (Rundel and Cowling, 2013). The biome is recognised as one of three global biodiversity hotspots in southern Africa with unrivalled levels of diversity and endemism for an arid region (Cowling et al., 1999; Desmet, 2007). The Succulent Karoo biome extends from the coastal regions of southern Namibia through the western parts of the Northern Cape and Western Cape provinces of South Africa, as well as inland of the Fynbos biome to the Little Karoo in the south (Mucina et al., 2006a; Rundel and Cowling, 2013). This semi-desert biome has a winter rainfall with a MAP between 100 and 200 mm. Extreme weather includes very high summer maxima, frequent fog along the coast and very dry and hot berg wind throughout the year (Desmet and Cowling, 1999; Mucina et al., 2006a; Department of Environmental Affairs, 2016). An unusual soil feature occurs frequently in this biome, consisting of low circular mounds called 'heuweltjies'. Their rich soils support an entirely different vegetation from the surrounding land cover.

There are some drainage systems that originate from catchments outside the Succulent Karoo biome flowing through the biome. The watercourses are generally small and ephemeral in nature (Mucina et al., 2006a; Department of Environmental Affairs, 2016). Where the Succulent Karoo transitions into the Nama Karoo biome, on the inland borders to the east, the high levels of succulence and endemism transition to arid ecosystems typified by a much lower biodiversity and few species of conservation concern (Department of Environmental Affairs, 2016). The vegetation structure is dominated by dwarf leaf-succulent shrublands mixed with succulent shrubs and few grasses, except in some sandy areas. The landscape varies between rock strewn plains, rocky areas supporting solitary trees and valleys and drainage lines with tall bush clumps. High altitude areas, on the rain shadow of mountains represent the daisy-type vegetation resembling fynbos (Mucina et al., 2006a). Species of the *Aizoaceae* (formerly the *Mesembryanthemaceae*), *Crassulaceae* and *Euphorbiaceae*, as well as succulent members of the *Asteraceae*, *Iridaceae* and *Hyacinthaceae* are particularly prominent plant families. Mass flowering displays of annuals (mainly *Asteraceae* species), often on degraded or fallow agricultural lands are a characteristic occurrence in spring (in Department of Environmental Affairs, 2016).

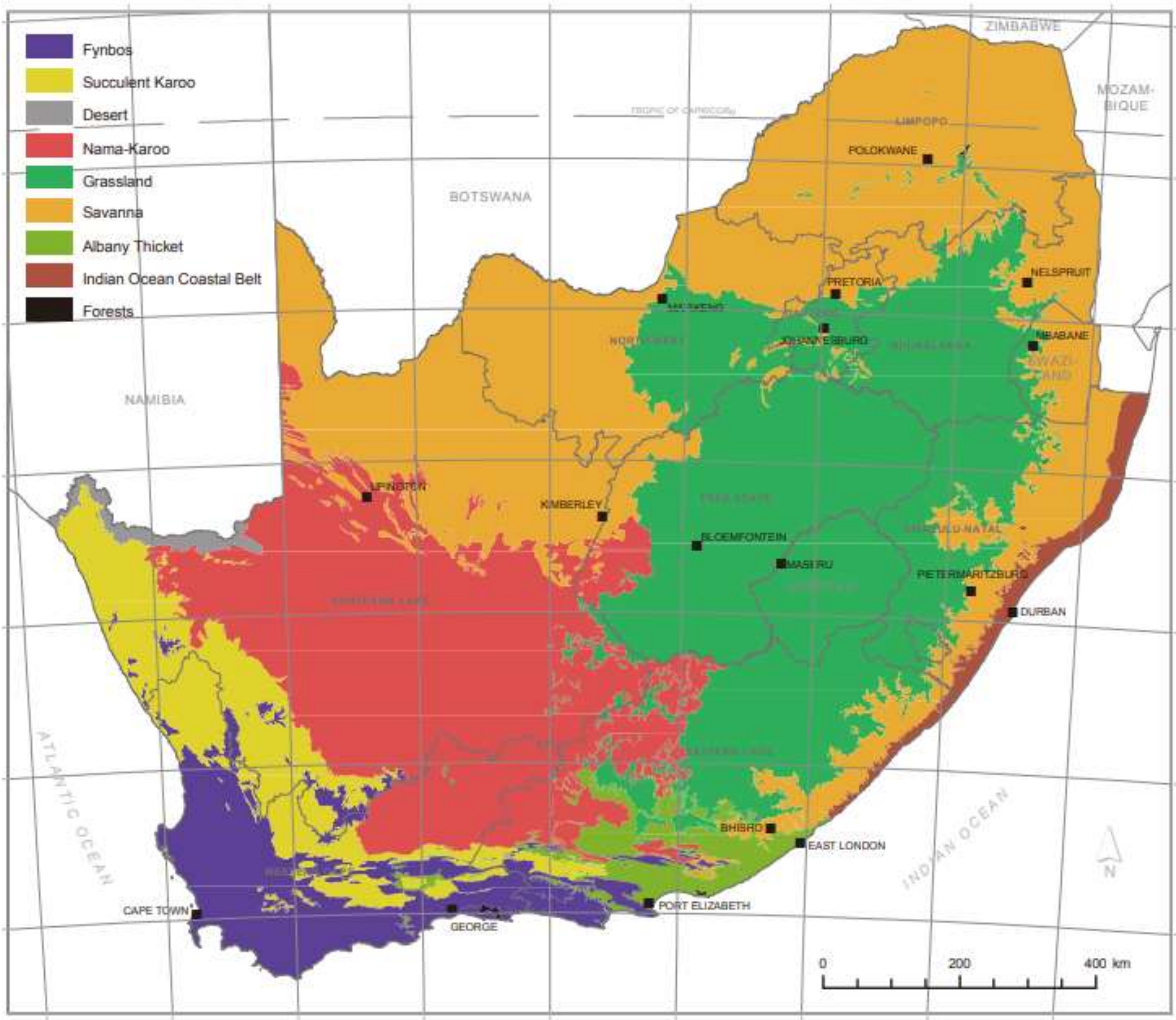

FIGURE 4 BIOMES OF SOUTH AFRICA, LESOTHO AND SWAZILAND (RUTHERFORD ET AL., 2006)

Only about 8% of the Succulent Karoo biome is formally protected, despite its' unique and exceptional biodiversity (Mucina et al., 2006a; Hoffman et al., 2018). Land is mostly used for agriculture and almost the entire area is subject to livestock grazing. Irrigation is limited and the soils are nutrient-poor, so cultivation potential is low. A combination of high levels of overgrazing and unsustainable cultivation practices have contributed to the loss of topsoil through sheet erosion and the degradation of veld condition, placing strain on species diversity (Mucina et al., 2006a; Le Maitre et al., 2009; Department of Environmental Affairs, 2016; Walker et al., 2018). Additional threats to biodiversity include climate change (increasing temperature and decrease in rainfall), mining, renewable energy developments, growing urban populations, over harvesting of fuel wood, illegal harvesting of plants and the spread of IAPs. Spread of IAPs is exacerbated by disturbances caused by mining, cropping, linear structures and eutrophication of water. Invasion by the *Cactaceae* family is a particular concern in this arid environment (as in Department of Environmental Affairs, 2016). Despite mounting threats to the Succulent Karoo, it is estimated that only 4% of the area is completely transformed (Mucina et al., 2006a).

The 2016 SEA Specialist Report on the Nama Karoo, Succulent Karoo and Desert Biomes (Department of Environment Affairs) provides a summary of the biodiversity significance of the Succulent Karoo. Here it is repeated and highlighted that the biome has a floral diversity exceeding 6 356 plant species. Of this number about 450 taxa are considered threatened i.e. species that are facing a high risk of extinction; 816 species are of conservation concern i.e. species that have a high conservation importance in terms of preserving South Africa's rich floristic diversity (SANBI, 2017) and nearly 40% of the species are considered endemic to the Succulent Karoo vegetation (Mucina et al., 2006a). The Succulent Karoo also host five centres of plant endemism (Van Wyk and Smith, 2001).

The second biome in this study area, Nama Karoo, occurs on the central plateau of the western half of South Africa (Mucina et al., 2006b). The harsh climate fluctuates substantially in seasonal and daily temperatures and droughts and frost occurrence is frequent. The seasonal rainfall peaks in summer with a MAP ranging from 100 mm in the west to 500 mm in the east, decreasing from east to west and from north to south (Desmet and Cowling, 1999; Mucina et al., 2006b).

The landscape consists of extensive, flat to undulating gravel plains dominated by grassy, dwarf shrubland vegetation. The vegetation composition and structure is mainly determined by rainfall and soil type (Cowling et al., 1986; Mucina et al., 2006b; Department of Environmental Affairs, 2016). Plains are interrupted by isolated hills, koppies, butts, mesas, low mountain ridges and dolerite dykes supporting sparse dwarf Karoo scrub and small trees, toward the Great Escarpment (Dean and Milton, 1999; Mucina et al., 2006b; Department of Environmental Affairs, 2016). The dominant dwarf shrubs (generally <1 m tall) and grasses are interspersed with succulents, geophytes and annual forbs. Some trees occur occasionally in the landscape, being mostly restricted along drainage lines and on rocky outcrops (Mucina et al., 2006b; Department of Environmental Affairs, 2016). *Asteraceae* (daisies), *Fabaceae* (legumes) and *Poaceae* (grasses) families dominate the vegetation. The presence of succulent taxa representative of the *Aizoaceae*, *Crassulaceae* and *Euphorbiaceae* plant families adds to the species richness of Nama Karoo vegetation (Mucina et al., 2006b; Department of Environmental Affairs, 2016).

Floral richness and species endemism is not particularly high within the Nama Karoo, nor are there many rare or endangered species (Van Wyk and Smith, 2001; Department of Environmental Affairs, 2016). This biome is considered the third largest in South Africa, with 1.6% being formally protected. Despite the relatively low level of protection, all vegetation types within the biome are considered least threatened (South African Government Department of Environmental Affairs, 2011) the biome is mostly considered 'natural' as only 5% has been transformed (Hoffman et al., 2018). Most of the vegetation type is now impacted to some extent by erosion, soil degradation, overgrazing and reduced vegetation cover (Hoffman and Ashwell, 2001; Mucina et al., 2006b; Department of Environmental Affairs, 2016). Historically, the biome was home to large herds of game. The current landscape has been converted to fenced farms, used as rangeland for stock (Hoffman et al., 1999).

The complexities regarding land use change, livestock grazing and the interactions with the climate will not be discussed here, but the interactions have led to the gradual degradation of the vegetation and ecosystems over time (in Department of Environmental Affairs, 2016). Existing environmental pressures in the study area, amongst others, include primarily (Department of Environmental Affairs, 2016):

- Pollution from agricultural activities (fertilizers, herbicides and pesticides) and point-source discharges from urban centres;
- Grazing by livestock in high and/or concentrated levels, causing overgrazing and trampling, within and adjacent to, river and wetland systems, which in turn leads to increased erosion and changes in vegetation structure;
- Increases in woody vegetation along rivers, in particular by *Vachelia karoo*, as well as infestations of invasive alien species (e.g. *Tamarix* spp. and *Prosopis glandulosa*). These deep-rooted species are able to readily consume groundwater. Heavily infested areas have a significant impact on the hydrology of catchments, as well as outcompeting indigenous species;
- Localised impacts of sand mining and other mining activities;
- Construction of weirs and dams along river systems, which alters the natural hydrological flows;
- Illegal collection of rare and endangered species; and,
- Road crossings, which cause concentration of surface runoff and localised sheet and gulley erosion in proximity to rivers and wetlands.

10. Methodology

Due to the scope of the work, timeframe constraints and the extent of the alternative corridors, appropriate existing data had to be sourced and used as far as possible for the screening analysis.

The most recent freely available national and provincial data were sourced for biodiversity features for the study area. Investigations were limited to terrestrial flora and freshwater bodies (surface watercourses, as there is a separate study for groundwater). The list of data sources are listed and briefly discussed below in Table 1, Section 10.1.

A desktop assessment was done to identify and summarize terrestrial flora and freshwater features within the boundaries of the alternative development corridors. The features were then mapped and summarized as in Section 12.1 and 12.2 respectively below.

A brief site visit was done to get a broad sense of the condition of the proposed corridors, and to make general observations on the study area. These are discussed in Section 12.3.

Potential impacts of the proposed development were identified from existing reports, done on similar developments and is described in Section 12.4. Appropriate mitigation measures are recommended to avoid, reduce or mitigate the identified impacts (Section 12.5).

Impacts were rated to determine their significance, using an impact rating methodology, commonly used in Environmental Impact Assessments (Section 12.6). The impact significance rating were determined for unmitigated scenarios, and then repeated assuming that recommended mitigation measures were implemented. A spatial representation of impact rating were presented in this report in order to recommend the Preferred Alternative from a botanical and freshwater perspective.

10.1. Data sources

TABLE 1 SOURCES AND DESCRITPION OF SPATIAL DATA SOURCES USED TO IDENTIFY TERRESTRIAL FLORA AND SUFACE FRESHWATER FEATURES IN THIS SPECIALIST SCREENING ASSESSMENT.

Data title	Source and date of publication	Data Description
2018 National Wetland Map 5 Ecosystem threat status and protection level	• Council for Scientific and Industrial Research. 2018 South African Inventory of Inland Aquatic Ecosystems (File Geodatabase) [Vector] 2018. Available from the Biodiversity GIS website. • Council for Scientific and Industrial Research. 2018 National Wetland Map 5 Ecosystem threat status and protection level [Vector] 2018. Available from the Biodiversity GIS website.	• The 2018 South African Inventory of Inland Aquatic Ecosystems (SAIIAE) geodatabase is a collection of data layers pertaining to ecosystem types and pressures for both rivers and inland wetlands. These data layers were developed and used for the 2018 National Biodiversity Assessment (NBA 2018). • The National Wetland Map version 5 (NWM5) shows the distribution of inland wetland ecosystem types across South Africa and includes estuaries and the extent of some rivers.
2018 River ecosystem threat status and protection level	Council for Scientific and Industrial Research. 2018 River ecosystem threat status and protection level [Vector] 2018. Available from the Biodiversity GIS website.	This data set is part of the first version of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018 released in July 2018. A second update of the SAIIAE 2018 was issued with the launch of the NBA 2018, and includes the condition, Ecosystem Threat Status (ETS) and Ecosystem Protection Level (EPL) information for the rivers. The river lines data set is associated with the National Wetland Map 5 (NWM5) issued with the SAIIAE version 1 and 2.
2010 National Protected Area Expansion Strategy (NPAES)	South African National Parks. NPAES Focus Areas 2010 [vector geospatial dataset] 2010. Available from the Biodiversity GIS website	Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities.
2018 Terrestrial ecosystem threat status and protection	South African National Biodiversity Institute. 2018 Terrestrial ecosystem threat status and protection level - remaining extent [Vector] 2018. Available from the Biodiversity GIS website.	'NBA2018_Terrestrial Ecosystem Threat Status and Protection level remaining extent' layer is associated with the 'NBA2018_Terrestrial Ecosystem Threat

Data title	Source and date of publication	Data Description
level - remaining extent		Status and Protection level' data set. While the a 'NBA2018_Terrestrial Ecosystem Threat Status and Protection level remaining extent' provides the data for Protection level and threat status for the historical (pre 1750AD) extent of the terrestrial ecosystems, this layer shows the protection level and threat status of the current remaining extent of terrestrial ecosystems. More detail can be found in NBA 2018 Technical Report Volume 1: Terrestrial Realm, http://hdl.handle.net/20.500.12143/6370 Note: the National List of Threatened Terrestrial Ecosystems published in terms of the Biodiversity Act in 2011 remains in legal force. The data contained in NBA 2018 represents an update of the assessment of threat status for terrestrial ecosystems, but the National List of Threatened Terrestrial Ecosystems has not yet been revised.
2018 Wetland Probability Map	Collins, N. 2017. National Biodiversity Assessment (NBA) 2018 Wetland Probability Map. https://csir.maps.arcgis.com/apps/MapJournal/index.html?appid=8832bd2cbc0d4a5486a52c843daebcba#	Mapping of wetland areas based on a concept of water accumulation in the lowest position of the landscape, which is likely to support wetlands assuming sufficient availability of water to allow for the development of the indicators and criteria used for identifying and delineating wetlands. This method of predicting wetlands in a landscape setting is more suitable for certain regions of the country than in others.
2011 National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection	DEA (2011). National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection. Government Gazette, 558(34809): 1 – 544, December 9.	The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is also to preserve witness sites of exceptionally high conservation value.
2016 Critical Biodiversity Areas (CBAs) of the Northern Cape	Northern Cape Department of Nature and Conservation (DENC). (2016). Critical Biodiversity Areas (CBAs) of the Northern Cape. http://bgis.sanbi.org/.	The Northern Cape CBA Map identifies biodiversity priority 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 as a whole.
2014 South African National Roads	Source unknown	National roads layer, showing major road across South Africa. The layer is dated but still gives a relatively good indication of the existing access routes in the area, as

Data title	Source and date of publication	Data Description
		vehicular access can be a major constraint in the area.
2019 Existing lines	Eskom Holdings SOC Ltd. 2019. Personnel communication.	This layer indicates existing power lines in the areas.
2015 Parent Farm	Chief Surveyor. Rural Development & Land Reform. 2015. Parent Farm, Northern Cape Province.	This layer indicates the spatial boundaries of parent farms within the Northern Cape Province. Even though the layer will not contain sub-divisions and portions of the farms, major cadastral boundaries are captured in this layer. Assuming access along parent farm boundaries is a potential underestimate of access roads, as it does not take into account additional farm roads, or smaller farm portion (subdivision) fencing and tracks.

10.2. Assessment methodology

10.2.1. Desktop

The desktop-based screening approach adopted in this study is in line with the approach used during the 2016 Electricity Grid Infrastructure SEA (Department of Environmental Affairs, 2016).

As a starting point, Protected Areas (PAs) and Critical Biodiversity Areas (CBAs) were identified as these are areas of high sensitivity and is undesirable for degradation and further transformation. The study area has been subject to recent fine-scale conservation planning and this represents an important biodiversity input layer for the mapping (Holness and Oosthuysen, 2016). This fine-scale conservation planning identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Therefore, development in such areas is not considered desirable as this may compromise the ability to meet conservation targets or impact on biodiversity patterns or processes within the CBA. These areas have been derived in an efficient manner and take into account competing land uses. To compensate for habitat loss within CBAs even greater areas are required to meet the same targets. Both PAs and CBAs are considered to represent very highly sensitive areas (Department of Environmental Affairs, 2016; Holness and Oosthuysen, 2016).

Vegetation types were added from the 2018 Terrestrial ecosystem threat status and protection level - remaining extent data layer (Slingsby et al., 2019). This layer takes into account the remaining extent of existing vegetation, and was used to calculate the amount of transformation in the study area. The following vegetation types are highly rated in terms of environmental impact and should be avoided, based on the fact that they are sensitive habitats (Mucina et al., 2006c; Department of Environmental Affairs, 2015): Namaqualand Sand Fynbos, Namaqualand Klipkoppe Shrubland, Namaqualand Riviere, Aggeneys Gravel Vygieveld and Bushmanland Inselberg Shrubland (which is characterised by the presence of a high proportion of listed and endemic species) (Department of Environmental Affairs, 2015).

Freshwater courses were added as an additional sensitive ecosystems and habitat types. Wetlands and rivers were added from the new National Biodiversity Assessment's (2018) Inland Aquatic Ecosystem Inventory and its associated data layers (Van Deventer et al., 2018). A 32m no-go buffer (regulated distance in NEMA Regulations, 2014, as amended) was identified around all watercourses, to protect the physical watercourse beds and banks. This buffer in no way speaks to the impact that development can have on the regulated zone of watercourses.

Additional data were also used to inform the mapping, with the presence of threatened ecosystems and National Protected Area Expansion Strategy (NPAES) Focus Areas being used to further identify sensitive habitats that should be avoided in terms of development transformation and further degradation (Government of South Africa, 2008; South African Government Department of Environmental Affairs, 2011).

Despite the fact that there are a variety of sensitive habitats and ecosystems, warranting protection and where development should be avoided and minimized at all cost, there are opportunities for development where there are existing infrastructure, transformation or disturbances. Using this principle to 'piggy-back' new developments on existing infrastructure footprints, disturbances or access routes, it will limit new disturbances away from more intact or pristine locations, restrict disturbance to existing disturbances and can play a role to cumulatively reduce the overall level of transformation and fragmentation of habitats, especially where development opportunities are limited in sensitive ecosystems.

Certain features were identified as criteria for existing access, disturbance and transformation. As mentioned previously, the level of vegetation transformation was derived from the 2018 Terrestrial ecosystem threat status and protection level - remaining extent data layer (Slingsby et al., 2019). Current access routes were derived from the 2014 National Road Network. It was assumed that cadastral farm boundaries will also present an opportunity for access to sites, as most farm boundaries are fenced and fenced boundaries usually have dirt tracks (informal roads) running on either side of the fence. Existing power line data was used as a proxy for existing developments, and the proposed new development can make use of existing servitudes and maintenance roads, as well as restrict new development as close as possible to existing disturbances. Existing access roads is an important aspect to limit the amount of crossings over watercourses.

10.3. Site visit

Due to scale of the study and limited access routes in the rugged terrain, opportunistic observations of the general ecosystem condition and watercourse condition were made (i.e. signs of disturbance, vegetation clearing, soil disturbance, land use and erosion) during a site visit between 13 – 17 October 2019 to get an overall impression of the study area and alternative corridors.

The ideal vegetation surveying should would have been between July through to mid-September for winter rainfall areas and February to April for summer rainfall areas. Limited quantitative information could thus be retrieved regarding the terrestrial flora and ephemeral watercourses during the site visit.

10.4. Impacts

10.4.1. Impact identification

Impacts were identified from the existing generic EMPr for the development and expansion of substation infrastructure and overhead electricity for the transmission and distribution of electricity, that was Gazetted (RSA, 2019). Impacts were supplemented and expanded upon, by the two National SEAs conducted for similar developments, within the same zone (Department of Environmental Affairs, 2015, 2016).

10.5.2. Impact rating

For each potential impact, the DURATION (time scale), EXTENT (spatial scale), IRREPLACEABLE loss of resources, REVERSIBILITY of the potential impacts, MAGNITUDE of negative or positive impacts, and the PROBABILITY of occurrence of potential impacts were assessed. The assessment of the above criteria were used to determine the significance of each impact, with and without the implementation of the proposed mitigation measures. The scales used to assess these variables and to define the rating categories are tabulated in Table 2 and Table 3 below.

TABLE 2 EVALUATION COMPONENTS, RANKING SCALES AND DESCRIPTIONS (CRITERIA).

Evaluation component	Ranking scale and description (criteria)
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity (> 20 years). **3 - Medium term**: Impact might occur during the operational phase/life of the activity (5 to 20 years). **2 - Short term**: Impact might occur during the construction phase (< 5 years). **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0** - None
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be severely altered. **8 - High**: Bio-physical and/or social functions and/or processes might be considerably altered. **6 - Medium**: Bio-physical and/or social functions and/or processes might be notably altered. **4 - Low** : Bio-physical and/or social functions and/or processes might be slightly altered. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be negligibly altered. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain unaltered.
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be substantially enhanced. **8 - High (positive)**: Bio-physical and/or social functions and/or processes might be considerably enhanced. **6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be notably enhanced. **4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be slightly enhanced. **2 - Very Low (positive)**: Bio-physical and/or social functions and/or processes might be negligibly enhanced. **0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain unaltered.
PROBABILITY (of occurrence)	**5 - Definite**: >95% chance of the potential impact occurring. **4 - High probability**: 75% - 95% chance of the potential impact occurring. **3 - Medium probability**: 25% - 75% chance of the potential impact occurring **2 - Low probability**: 5% - 25% chance of the potential impact occurring. **1 - Improbable**: <5% chance of the potential impact occurring.

Evaluation component	Ranking scale and description (criteria)
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Medium**: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. **Low**: The activity is localised and might have a negligible cumulative impact. **None**: No cumulative impact on the environment.

Once the evaluation components have been ranked for each potential impact, the significance of each potential impact will be assessed (or calculated) using the following formula:

SP (significance points) = (duration + extent + irreplaceable + reversibility + magnitude) x probability

The maximum value is 150 SP (significance points). The unmitigated and mitigated scenarios for each potential environmental impact should be rated as per Table 3 below.

TABLE 3 DEFINITION OF SIGNIFICANCE RATINGS (POSITIVE AND NEGATIVE).

Significance Points	Environmental Significance	Description
100 – 150	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
40 – 99	**Moderate (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

Impacts that may result from the planning, design and construction phase, operation and decommissioning phases, significance rating of impacts, proposed mitigation and significance rating of impacts after mitigation that are likely to occur as a result of each phase were calculated.

(**Note:** Evaluation components: M – Magnitude; D – Duration; E – Extent; R - Reversibility; I - Irreplaceable; P – Probability; S - Significance)

Refer to **Table 2:** Evaluation components, ranking scales and descriptions (criteria) and to **Table 3:** Definition of Significance Ratings.

11. Assumptions and limitations of the study

- The Karoo study area is generally poorly sampled and sparsely distributed with the result that extensive areas will have no records for flora or wetlands in the existing biodiversity databases. Some areas are well sampled, and are usually national parks, along the main access roads and near to towns and other popular tourist destinations. It is thus highly recommended that all areas should receive more detailed biodiversity data collection in the appropriate season to inform the final power line route placement.

- No spatial consideration was given to species protected under the Northern Cape Provincial legislation regarding Protected Species (Northern Cape Nature Conservation Act (Act 9 of 2009)), since the species observations are sparsely and unevenly sampled across the study areas. It should be noted that no protected species may be damaged, pruned, removed or translocated without the necessary permits. During the BA phase, detailed on the ground verification should identify the location of protected species, recommend areas to avoid placing the development footprint where there is high concentration and numbers of the these protected species, and in the case where it cannot be avoided, recommend suitable mitigation measures and apply for the necessary permits.

- The new National Biodiversity Assessment (2018), including the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018, gives the latest best available data on freshwater courses: the study area has a low level of mapping of ephemeral wetlands (depressions) and pans, but the level of drainage line mapping is relatively good.
- It is well recognized that the Succulent Karoo and desert ecosystems have exceptional levels of floral diversity but there is a lack in adequate knowledge of most species’ responses to power transmission infrastructure construction and operation. This means there is some level of uncertainty relating to significance rating of impacts of large scale linear developments in the area. The effectiveness of the proposed mitigation also is difficult to predict at this stage. In order to address this uncertainty, impacts and their mitigation measures are in line with the current best available information on similar developments and strategic level assessments and Environmental Management Programmes (EMPrs) (Department of Environmental Affairs, 2015, 2016; RSA, 2019).
- Data should be interpreted keeping in mind the scale and date at which the data that is used was developed.

12. Results

12.1. Mapping of spatial data

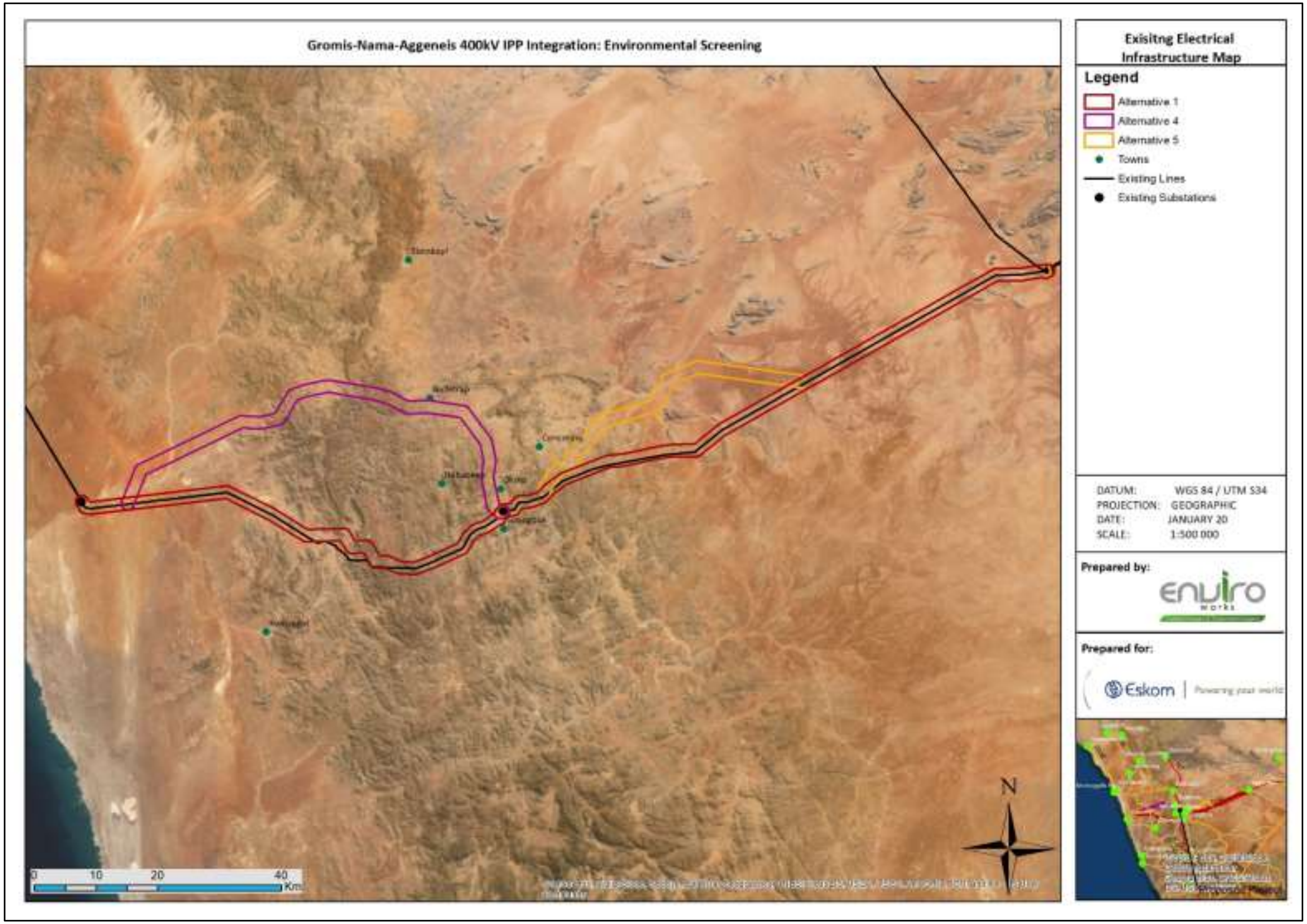

FIGURE 5 EXISTING ESKOM POWER LINES CROSSING THE STUDY AREA

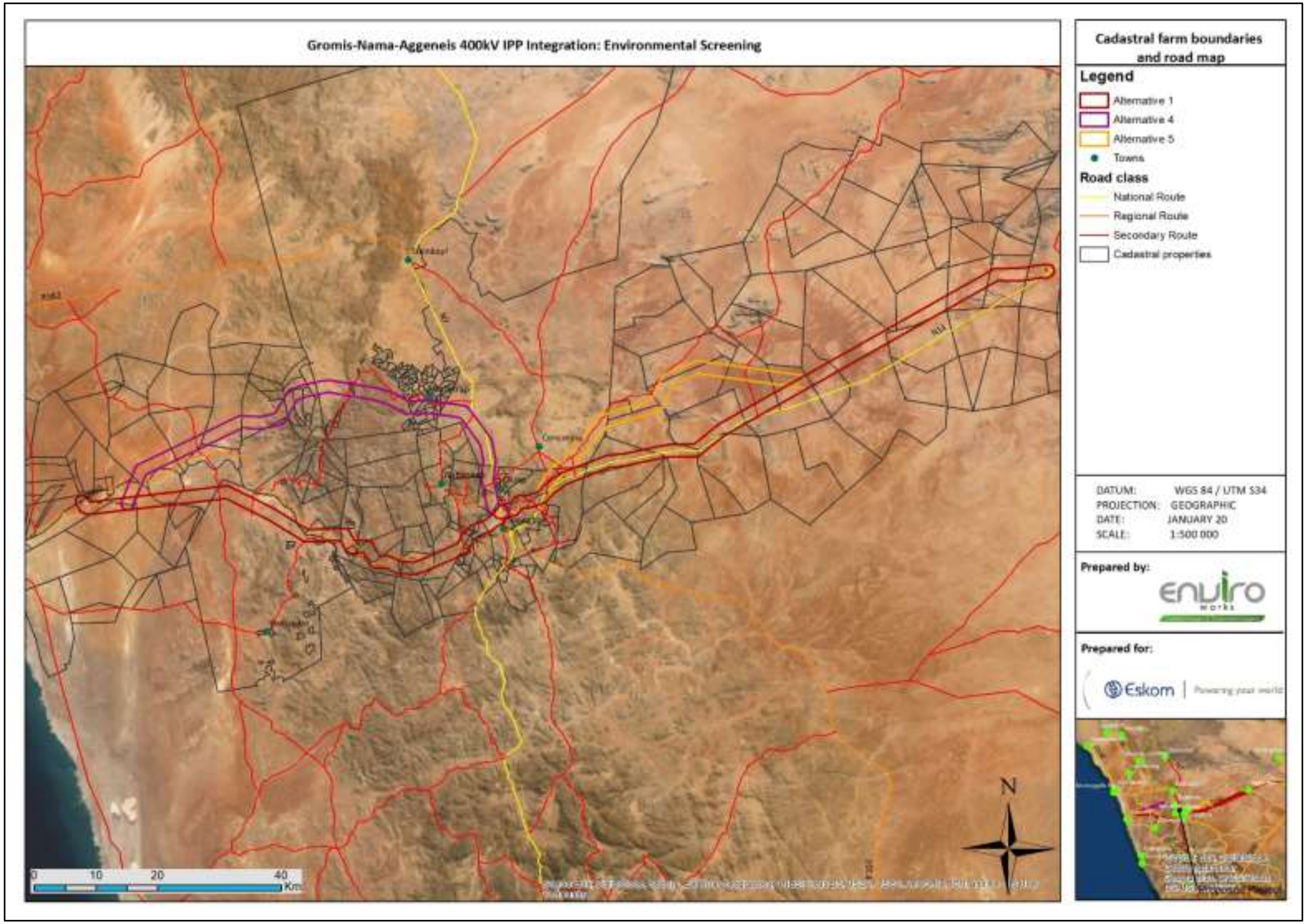

FIGURE 6 CADASTRAL PROPERTY BOUNDARIES FOR FARMS INTERSECTING WITH THE CORRIDOR ALTERNATIVES

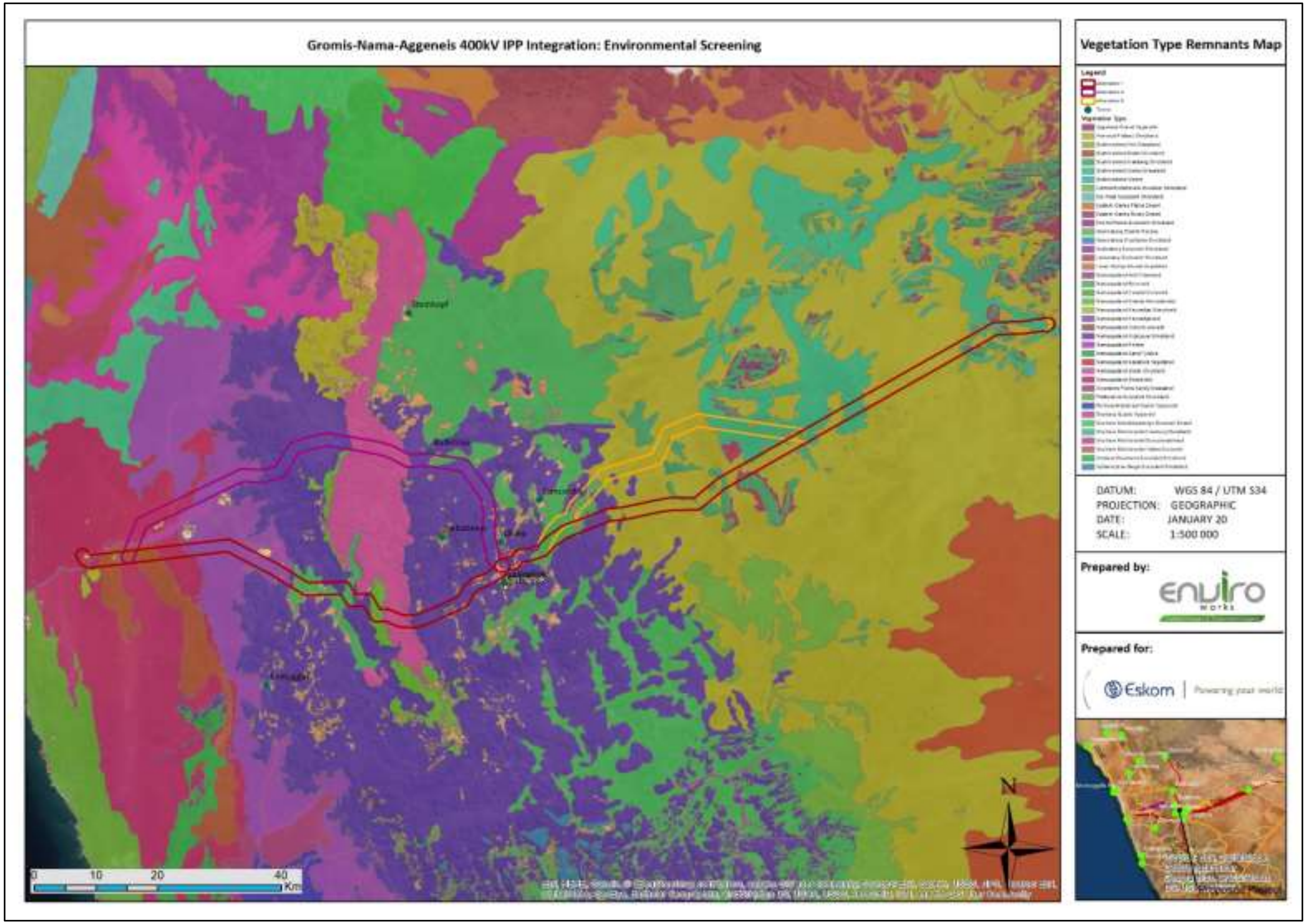

FIGURE 7 DISTRIBUTION OF VEGETATION TYPES ACCROSS THE STUDY AREA

FIGURE 8 REDLIST CATEGORY OF ECOSYSTEMS, SHOWING EXISTING REMNANTS OF VEGETATION

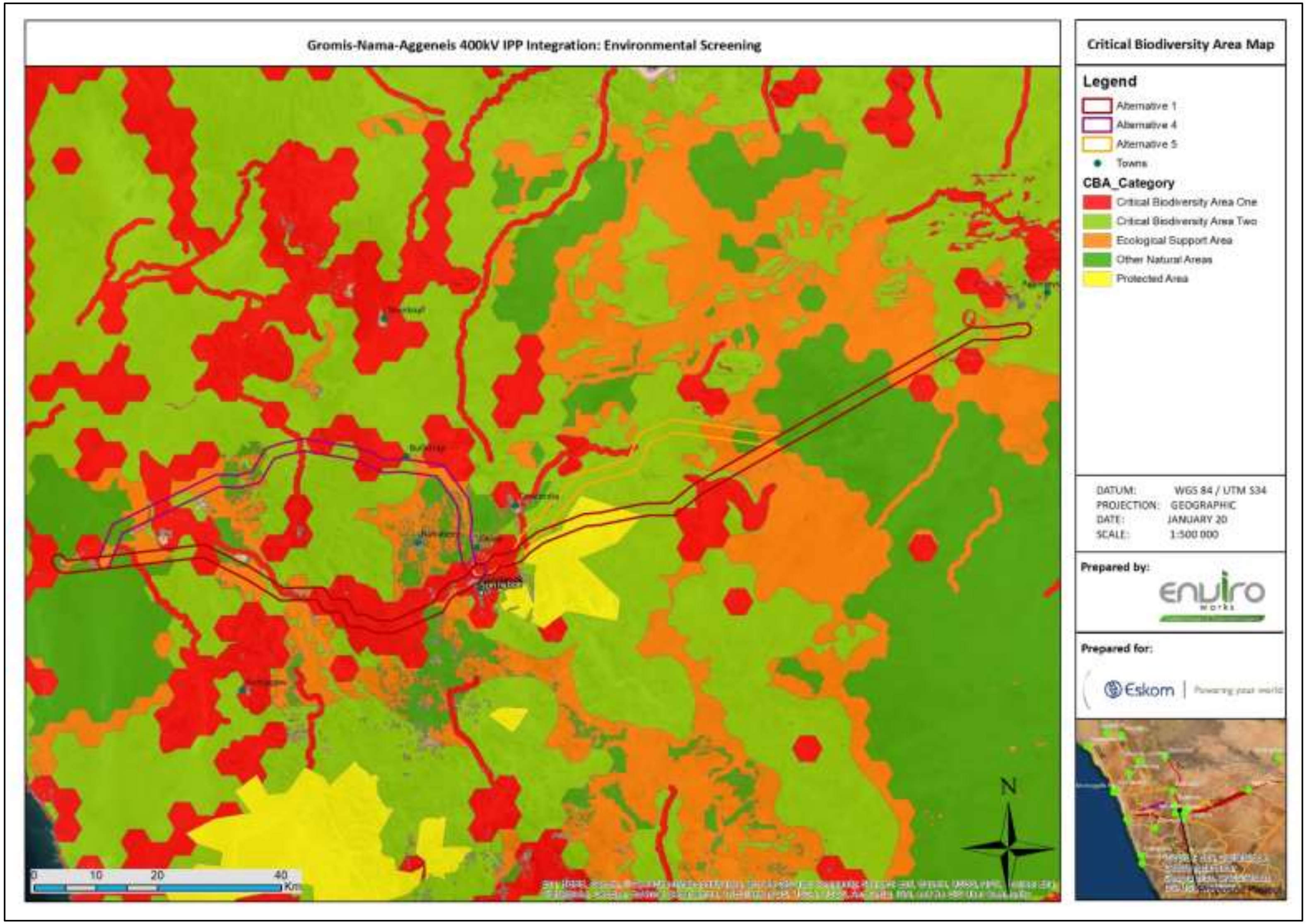

FIGURE 9 CRITICAL BIODIVERSITY AREAS (CBAS) MAP OF NORTHERN CAPE PROVINCE, INDICATING THE CBA CATEGORY

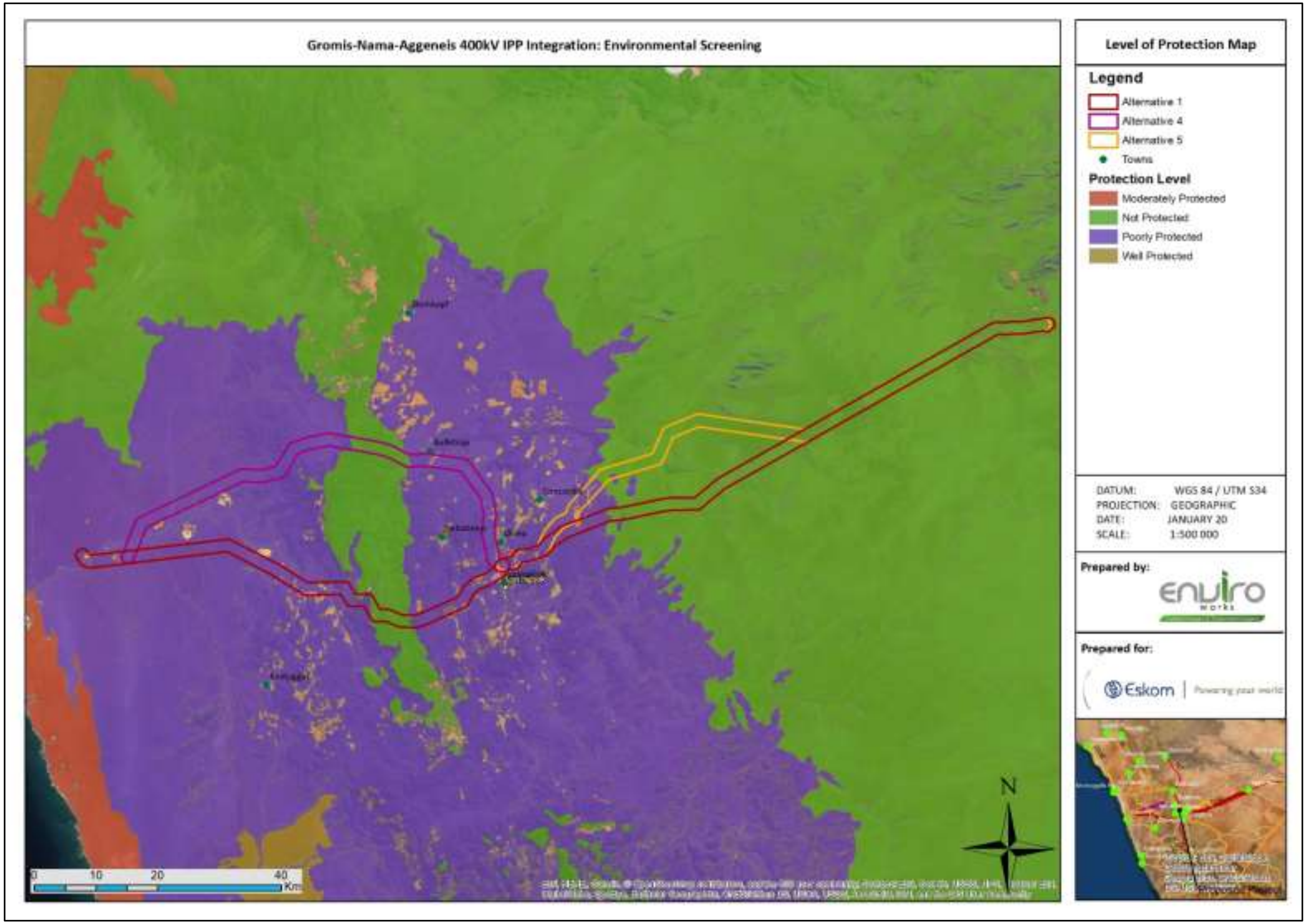

FIGURE 10 LEVEL OF PROTECTION OF ECOSYSTEMS IN SOUTH AFRICA

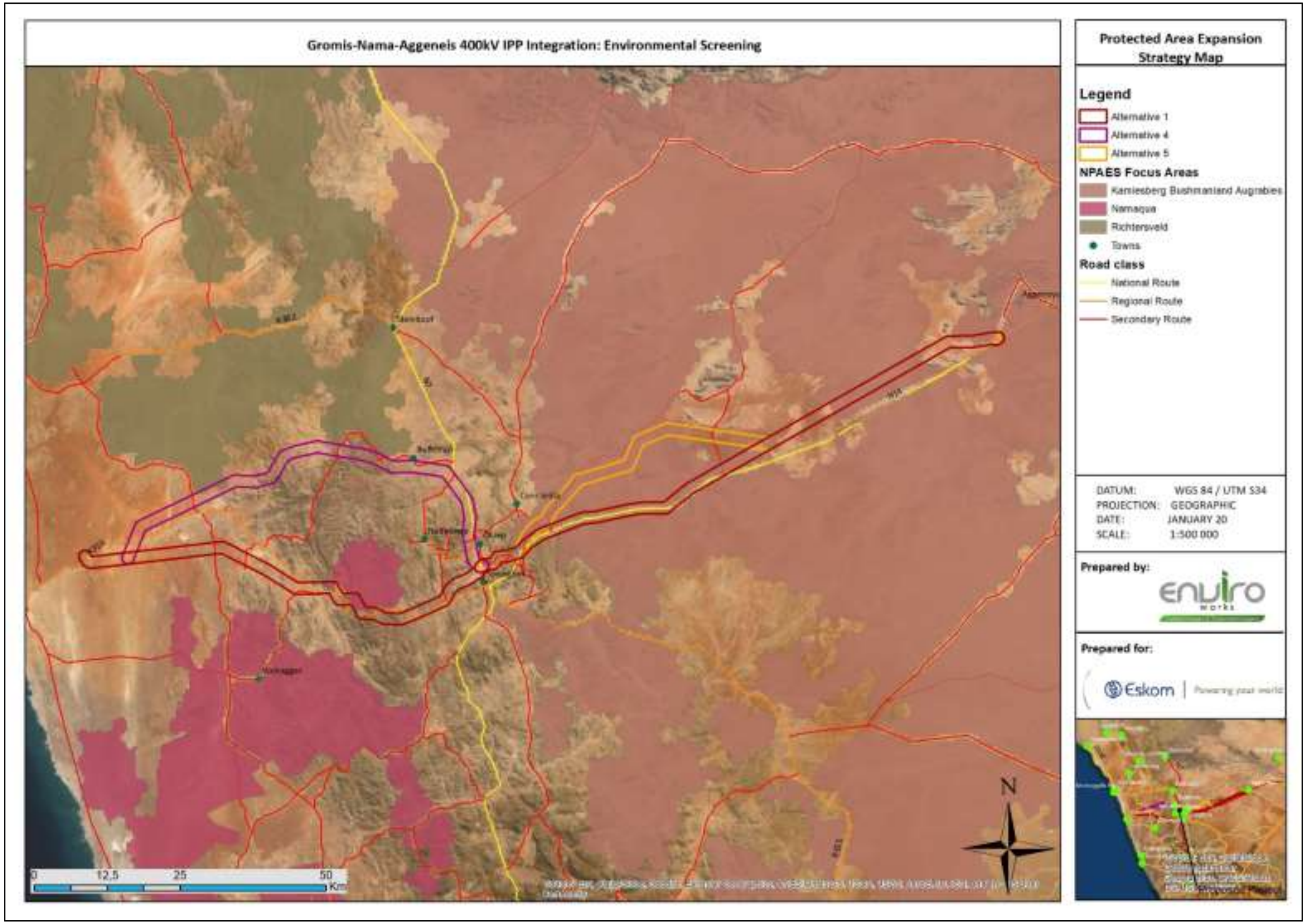

FIGURE 11 FOCUS AREAS IDENTIFIED AS PART OF THE NATIONAL PROTECTED AREAS EXPANSION STRATEGY

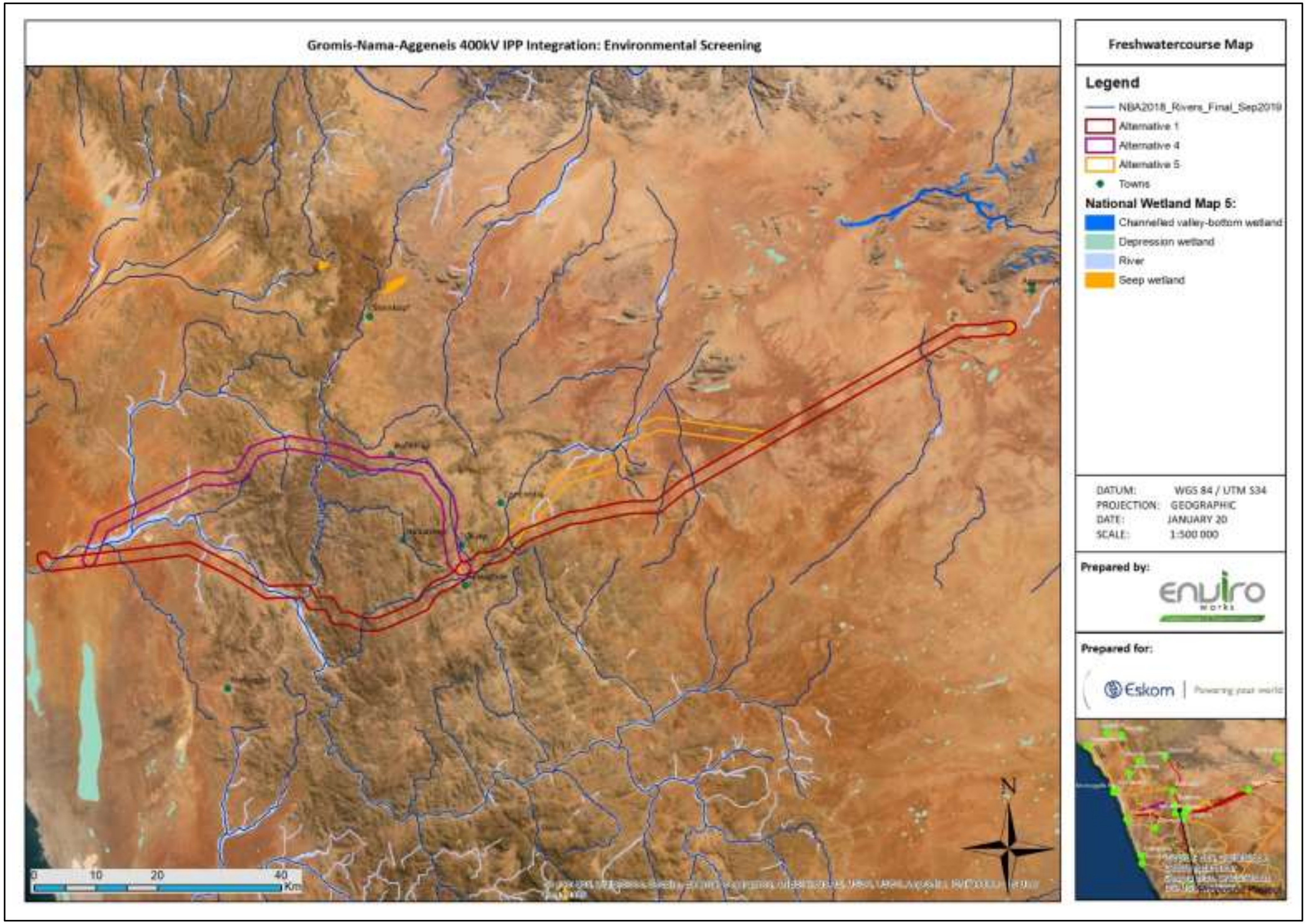

FIGURE 12 WATERCOURSE MAP OF THE ALTERNATIVE CORRIDORS AND SURROUNDS, INDICATING RIVERS AND NATURAL WETLANDS

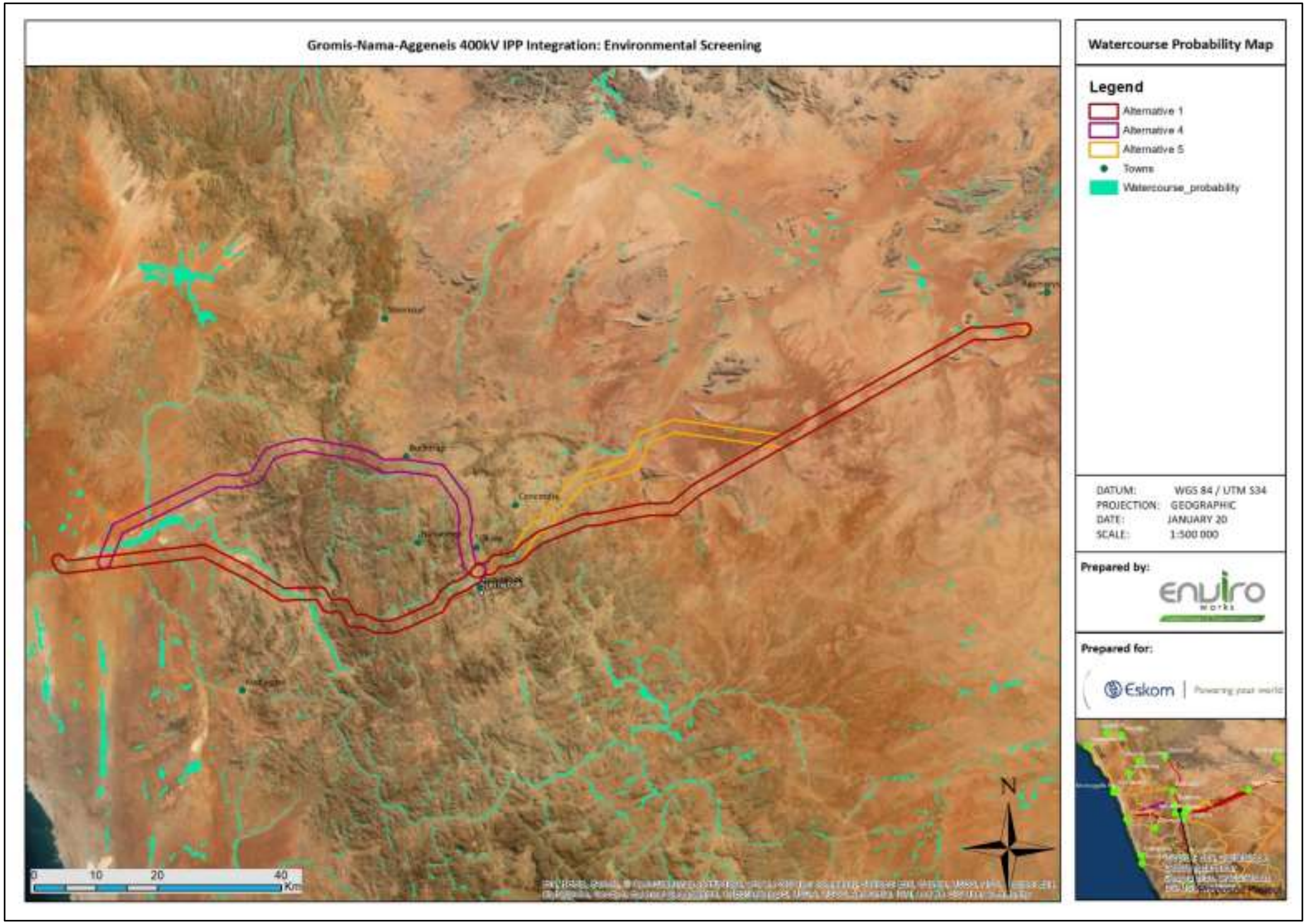

FIGURE 13 AREAS THAT HAVE A HIGH PROBABILITY OF BEING WATERCOURSES, INDICATING VALLEY BOTTOMS (LIKELY DRAINAGE LINES OR AREAS OF WATER ACCUMULATION AND FLOW IN CASES OF HIGH ENOUGH WATER AVAILABILITY

12.2. Comparison of spatial data per alternative corridor

From the sub-station near Springbok, Alternative 1 follows the N14 east almost parallel towards the substation of Aggeneis, outside the town of Aggeneys. Just over halfway along the N14, the corridor deviates further away from the road, but still remains relatively parallel to the N14 to move between inselbergs. From the substation of Nama, Alternative 1 follows the R355 down the mountain pass towards Kleinsee, just after the pass, the line deviates from the R355, and makes a more direct path to the Gromis substation (Figure 2).

From Nama- to Gromis substation, Alternative 4 follows the N7 towards Bulletrap, after which it passes over mountainous terrain towards the Gromis substation (Figure 2). Between the Nama- and Aggeneis substations, Alternative 1 and 4 follows the same path. Alternative 5 follows the same path as Alternative 1 between the Nama- and Gromis substations. In the east, between Nama- and Aggeneis substations, the corridor moves more sharply north-east from the Nama substation to pass the Goegaap Nature Reserve on its northern boundary, after which it joins the same path as Alternative 1 towards Aggeneis substation.

Alternative 1 follows the same path as an existing 200 kV power line and follows the main road transportation network for most of the route (Figure 5 & 6), whereas Alternative 4 & 5 only follows the existing 200 kV line for one particular section each and joins Alternative 1. Alternative 1 has larger distances of existing linear infrastructure based on roads and existing power lines – and their servitudes. This leaves Alternative 1 with the advantage above Alternative 4 & 5 in having more existing linear developments and access roads to 'piggy-back' on during the proposed development construction and maintenance. Using Alternative 1 as the preferred route could help limit the distance and size of new footprint clearing and further transformation, by limiting new disturbance as close as possible to existing or past disturbances.

12.2.1. Terrestrial flora

All three alternatives seem to be in a relatively 'natural' condition, as very little transformed areas can be seen at the scale of the map (Figure 8). The transformed areas seem to correspond to urban centres and human settlements in the centre of the study area. There is almost no transformation visible to the eastern sections of the alternatives. To the west, transformed areas correspond to mining footprints.

The study area traverses a diversity of vegetation types (Figure 7) which are all classified as Least Threatened despite certain ecosystems' higher sensitivity or importance regarding endemic indigenous species richness. (Figure 8). A large section of Alternatives 1 and 5 are covered by CBA 1s around Springbok, and going west down the Pass to Kleinsee (Figure 9). The eastern portion of Alternative 4 has three CBA 1s traversing the corridor. In the eastern part of the study area, Alternative 1 and 4 are crossed by a PA and CBA1, while the corresponding section of Alternative 5 has no CBA 1 areas across its width. This particular section Alternative 5 is dominated by a large section of degraded CBA 2.

When comparing the levels of protection of ecosystems (i.e. are ecosystems adequately protected or not), all three alternatives have similar levels of protection (Figure 10). Not Protected ecosystems mean ecosystems are under-protected, but it should also be kept in mind that the ecosystems are still considered Least Threatened, and the threat level is thus considered relatively low. The Not Protected ecosystems are largely ecosystems to the east of the study area and proportion of the mountainous terrain in the west, corresponding to the Nama Karoo Biome. The Poorly Protected ecosystems correspond to the more sensitive Succulent Karoo that has more areas protected under Protected and Conservation Areas status. The more protected ecosystems are situated on the west of Springbok, closer to the coast.

The Focus Areas for expansion of the National Protected Areas (NPAES), are almost equally distributed amongst alternatives. Most of these areas are comprised of the Kamiesberg Bushmanland Augrabies Focus Area to the east of Springbok, with Alternative 1 and 5 having a small portion of the Namaqua Focus Area and Alternative 4 an even smaller portion of Richtersveld Focus Area.

12.2.2. Watercourses (surface freshwater)

There are many streams and rivers crossing the study area but wetlands have been poorly mapped in this study area and may increase the sensitivity of the alternatives, especially the western section that have pans and depressions present.

The study site has a very low watercourse density, and this is confirmed when looking at the mapped rivers and watercourses (Figure 12). The drainage network increases in density in the west of the study area, with very low incidence of mapped watercourses in the east (Figure 12 & 13).

Wetland status and condition of the wetlands found in the alternatives are all considered Critical according to the Ecosystem Threat Status determined in 2018. These are inland wetland ecosystems where the extent (area) of each inland wetland modelled in a natural or near-natural ecological condition is ≤20% of the total extent for that ecosystem type. The threat status, correlates with the protection level of ecosystems, where none of the wetland ecosystems found in the alternatives are protected according to the 2018 NBA. Nationally, inland wetland ecosystems are under-protected and in the Northern Cape Province, threatened ecosystem are commonly under-protected (Van Deventer et al., 2019). The majority of wetlands found in the alternatives are still in a natural to near-natural state, indicating overall good ecological conditions of these ecosystems, despite the low level of protection in the area.

In terms of the Present Ecological State (PES) of rivers, the study area's rivers are mostly in 'Moderately Modified' and 'Near-Natural' state. A proportion of the rivers are not classified into a PES category, due to data deficiencies, meaning there is uncertainty of the PES some river reaches. The PES patterns follows the general national trend that tributaries are generally less heavily impacted than mainstream rivers (Van Deventer et al., 2019); Alternative 1 and 5 traverses the large Buffels River riparian area (and many of its' tributaries) which are impacted by population pressure, agriculture and linear disturbances.

12.3. Observations from the site visit

Going along the N14, from Springbok to Aggeneys, Alternative 1 (and Alternative 4, as it follow the same route as 1 for this section) and 5 mostly follows the direction of this road. This area seems heavily degraded and overgrazed. The eastern section of Alternative 1, 4 and 5 traverses the open landscape of Bushmanland Arid Grassland (Figure 14). This vegetation type dominates the area between Springbok and Aggeneis substation (Figure 15). The landscape has solitary mountains and koppies throughout the sparsely vegetated plains. Koppies support Busgmanland Inselberg Shrubland, and examples can be seen in the background of Figure 14. These inselbergs are sensitive ecological features in the landscape, as it represents elements of Succulent Karoo Biome embedded in the Nama Karoo Biome. The inselbergs support a high level of local endemics (Mucina et al., 2006a) and should be avoided at all cost during the proposed development.

Excavations are a common site, visible all along the main road (Figure 16).The watercourses in this section have almost no riparian vegetation, and watercourses are identified mostly by topography and alluvial banks. The area in vicinity of the N14 shows signs of degradation from livestock grazing (reducing vegetation cover) and trampling of watercourses (Figure 17).

The potential impacts of the proposed development can be observed from the existing power line. In the eastern section between the Nama- and Aggeneis substations, the footprint on the sandy plains are relatively small. Maintenance roads are confined to double vehicle tracks, and the vegetation around the pylons mostly resemble the adjacent vegetation type. There is a small radius around pylons with lower vegetation cover than the surrounds, but overall the area seems relatively well rehabilitated (Figure 18).

It was noted that most fence lines had tracks or dirt roads on both sides and this was the main motivation for using cadastral farm boundaries as proxy for existing access roads (Figure 19).

Overall, the area (Alternative 1, 4 and 5) is sparsely populated. Most of the development and disturbance is concentrated around the urban centers, such as Springbok, the main roads, farm houses, small holdings, non-perennial watercourses, livestock watering points and mines/borrow pits. It is around these disturbed areas where non-indigenous and alien invasive plants are most abundant. Often around houses and livestock watering points, alien or non-indigenous trees and cacti are planted for shade, wind shelter and aesthetic reasons (Figure 20 a & b).

As Alternative 5 approaches the Nama substation outside Springbok, it passes a relatively wide river valley that passes between two inselbergs. The valley floor takes up most of the space between the inselbergs and placing the pylons and lines will have difficulty avoiding the river banks and recommended buffers. The area also displays signs of erosion on edges of the watercourse banks and plain edges (Figure 21). Access roads and pylon placement will have a relatively high risk of causing erosions in this area if not strictly following contours and implementing erosion prevention measures.

Just before the Nama substation (Figure 22) Alternative 1, 4 and 5 converge in their routes. The area directly surrounding the substation does not contain sensitive floral or watercourse features. It is recommended that development be confined to the smallest practical size and contain development as close as possible to existing development and disturbances, preferably between the substation and road. From the point where Alternative 5 diverges away from Alternative 1 and 4 (towards the Springbok) the terrain sees a change from the desert-like plains of the Nama Karoo biome and becomes more mountainous and vegetated as it transitions to the Succulent Karoo Biome. The vegetation types of the last mentioned Biome harbor higher levels of endemism than the adjacent Nama Karoo, and features beautiful flower displays in the summer. There is an existing access road going through the mountains (Figure 23) leading to the Nama substation, with the exiting 200 kV power line falling within the same corridor as Alternative 1 and 4 in the east of the study area.

From the existing access road – dirt and tarred road - one can clearly observed the preferential pathways for run-off water and subsequent erosion that is formed within the tracks (Figure 24). It is therefore strongly advised to make use of existing infrastructure and access as far as possible, to avoid creating new pathways through vegetation remnants. Erosion was also observed around the base of some existing pylons (Figure 25). It seems that a drainage line flows around the base and is the main cause for erosion. This highlights the importance of not placing pylons within watercourse beds or banks, preferably keeping at least a 32m buffer from the edge of the active stream bank.

FIGURE 14 TYPICAL LANDSCAPE OF THE EASTERN SECTION OF ALTERNATIVE 1, 4 AND 5, FROM THE NAMA- TO AGGENEIS SUBSTATION

FIGURE 15 AGGENEIS SUBSTATION

FIGURE 16 EXCAVATIONS THAT ARE A TYPICAL FEATURE ALONG THE N14

FIGURE 17 TRAMPLED ALLUVIUM BOTTOM OF A WATERCPURSE NEXT TO N14

FIGURE 18 MAINTENACE ROAD VISIBLE AS DOUBLE TRACKS BENEATH EXISITNG LINE

FIGURE 19 ACCESS ROADS IN THE FORM OF DIRT TRACKS ON BOTH SIDES OF FARM FENCES

FIGURE 20 A (ABOVE) AND B (BELOW) NON-INDIGENOUS AND ALIEN INVASIVE PLANTS ARE MORE ABUNDANT IN CLOSE VICINITY TO DISTURBED AREAS, AND ARE INTENTIONALLY PLANTED NEXT TO HOMESTEADS AND WATERING POINTS TO ACT AS WIND SHELTER, PROVIDE SHADE AND SOMETIMES FOR AESTHETIC REASONS

FIGURE 21 EROSION FEATURES IN THE VALLEY OF ALTERNATIVE 5

FIGURE 22 NAMA SUBSTATION OUTSIDE OF SPRINGBOK

FIGURE 23 NAMAQUALAND BLOMMEVELD VALLEYS, IN BETWEEN NAMAQUALAND KLIPKOPPE SHRUBLAND DOMES AND KOPPIES

FIGURE 24 PREFERENTIAL FLOW PATHWAYS AND EROSION IN EXISTING ACCESS ROAD

FIGURE 25 EROSION AROUND THE BASE OF AN EXISTING PYLON

The topography is increasingly hilly, going from the Nama substation west towards the Gromis substation, situated outside Kleinsee. The corridors pass through a dramatic landscape of granite and gneiss domes, smooth glacis and disintegrating boulder koppies (Figure 26). The striking rock formations support beautiful flower displays in spring and the shrubland has many succulents, biogeographically important - and some endemic taxa. This vegetation type (Namaqualand Klipkoppe Shrubland) is a popular tourist attraction (many to see the famous kokerboom, *Aloe dichotoma var. dichotoma*), and there are abundant 4x4 access routes and flower viewing routes in this area. The striking granite and gneiss landscape is broken up by a wedge of smooth shale hills of the Namaqualand Shale Shrubland (Figure 27). The shale substrate support a dens shrubland with a high level of endemic species. The section between Springbok and Kleinsee has many quarries and borrow pits, abandoned and active mines (Figure 28), interspersed with some small holdings, agriculture and livestock grazing (Figure 29).

The western section of Alternative 4, leaves the substation of Nama outside of Springbok, roughly following the N7 north towards Bulletrap, going past O'kiep. Close to the road, there is a concentration of human impact that includes small towns, settlements, houses and homesteads visible from the road (Figure 30). Alternative 1 and 5 passes through a very similar landscape than Alternative 4, but mostly follows the R355 route, and the existing 200 kV line.

The route of Alternative 4 continues in a north western direction past Bulletrap, before turning south west towards the Gromis substation. The route passes over a narrow section of heuweltjieveld (Namaqualand Heuweltjieveld) that is uniquely known for the old termite mounds that are scattered over the undulating plains. These mounds support a different floral composition than the surrounding matrix, and also houses borrowing animals. The last section of Alternative 4 ends in the relatively flat and slightly undulating landscape characterizing the area around Kleinsee. The route crosses the Buffels River riparian area, and a section of duneveld (where it joins the same path as Alternative 1 and 5).

Alternative 1 and 5 follows the general path of the R355 down a pass, where it then deviates south west away from the R355 across a relatively open landscape towards the Gromis substation. The alternatives crosses two small tributaries of the Buffels River (Figure 31), as well as crossing the Buffels River riparian area at two places. These watercourses are non-perennial with sandy beds (Figure 32). Sections of the Buffels River that were observed seemed heavily impacted by soil disturbance. Very few surface water features were observed during the site visit, and included was a pan of water – possible seasonal or a spring – and then in stream dams next to the R355 (Figure 33 & 34)

There are three large scale existing linear development within most of Alternative 1's corridor (and to a lesser extent Alternative 4 and 5): the R355 and 200 kV power line, both mentioned before, and a pipeline adjacent to the R355 main road going to Kleinsee. While the pipeline seems to be placed close to the road (Figure 35), and possibly within the road reserve, no major impacts could be observed on the terrestrial flora or watercourses. As seen in the section between Nama- and Aggeneis substation, roads seem to have more visible impacts like soil erosion, especially where cut and fill was needed in uneven terrain with steep slopes (Figure 36). Erosion next to the road is prominent in Namaqualand Klipkoppe Shrubland. When looking at the existing 200 kV line between the Gromis- and Nama substation the surrounding vegetation recovered well post construction, to a state that resembles its natural state, as the vegetation is homogenous in terms of its qualities (colour, texture, height, cover) (pers. obs.; Figures 37). Similar observations concerning rehabilitation and vegetation recovery around pylon bases were also made in the other vegetation types that the existing line passes through and thus also Alternative 1 (and proportion of Alternative 4 and 5) are planned, like Namaqualand Shale Shrubland (Figure 38). On a smaller scale, fencing and telephone lines are also existing linear developments (both within Alternative 1, 4 and 5) – but very little signs of degradation could be seen at this scale of assessment (Figure 39).

Alternative 1 and 5 also crosses the Namaqualand Heuweltjieveld (Figure 40) before it crosses over to Namaqualand Strandveld (Figure 41) and Namaqualand Duneveld. Hereafter the corridors cross the Buffels River and associated Namaqualnd Riviere (before joining the Gromis substation).

All alternatives cross the Buffels River. This river is nestled in the sensitive vegetation type of the Namaqualand Riviere on the western side of the study area. This vegetation type is characterized by alluvium soils, with shrubland and patches of grass within the river bed and banks of the non-perennial and intermittent rivers. There are also area of low thickets within the vegetation type. In some places, the existing line crosses watercourses, and pylons are placed directly within the riparian zone as in Figure 42. This should be avoided as much as practically and financially possible, in order to prevent further impacts on watercourses in the area and prevent riparian and wetland habitat loss, fragmentation of habitats and disruption of ecosystem services.

The direct area surrounding the Gromis substation does not seems to contain sensitive surface water features (Figure 43). The substation is situated next to a mine and a road separates the substation from the Buffels River and Namaqualand Riviere vegetation type. The substation is situated within the species rich Namaqualand Strandveld. It is recommended to develop in existing degraded or impacted areas, keep development into natural vegetation as small as practically possible and aim to extend the development in the direction of the mine and road as far as possible.

An additional feature that was observed regarding watercourses, is evidence of water running down granite koppies (Figure 44), and water being directed down slopes of koppies, inselbergs of mountains, and that some of these features had water accumulating and running around the base into drainage lines. It is thus highly recommended to avoid placing infrastructure within the direct area around bases of mountains, koppies or inselbergs.

FIGURE 26 BOULDER KOPPIES TYPICAL OF THE NAMAQUALAND KLIPKOPPE SHRUBLAND

FIGURE 27 SHALE HILLS IN THE BACKDROP

FIGURE 28 ONE OF THE LARGER ABANDONED MINES OBSERVED BETWEEN ALTERNATIVE 1, 4 AND 5

FIGURE 29 EXAMPLE OF SMALL HOLDING WITH SMALL SCALE AGRCICULTURAL ACTIVITIES

FIGURE 30 ROOIWINKEL, WEST OF THE N7

FIGURE 31 NON-PERENNIAL TRIBUTARY OF THE BUFFELS RIVER THAT ALTERNATIVE 1 AND 5 CROSSES

FIGURE 32 CROSSING OF BUFFELSBANK RIVER, SOUTH OF R355

FIGURE 33 ONE OF THE FEW SURFACE WATER FEATURES OBSERVED DURING THE SITE VISIT, POSSIBLY A SEASONAL PAN OR SPRING

FIGURE 34 A (ABOVE) AND B (BELOW) COUPLE OF THE FEW SURFACE WATER FEATURES, IN STREAM DAMS, NEXT TO THE R355, WITHIN ALTERNATIVE 1 AND 5 ROUTE

FIGURE 35 LINEAR DEVELOPMENT - PIPELINE RUNNING NEXT TO THE R355

FIGURE 36 EROSION NEXT TO ROAD, IN NAMAQUALAND KLIPKOPPE SHRUBLAND

FIGURE 37 VERY LITTLE DISTURBANCE SEEN SURROUNDING THE EXISTING 200 KV LINE

FIGURE 38 EXISTING 200KV LINE PASING THROUGH NAMAQUALAND SHALE SHRUBLAND HILLLS

FIGURE 39 FENCE AND TELEPHONE POLES NEXT TO THE R355 IN ALTERNATIVE 1 AND 5

FIGURE 40 EXISTING LINE, WITHIN ALTERNATIVE 1 AND 5, TRAVERSING NAMAQUALAND HEUWELTJIEVELD

FIGURE 41 SUCCULENT SHRUBS AND VEGETATION ESTABLISHED WELL AFTER PYLON CONSTRUCITON IN NAMAQUALAND STRANDVELD

FIGURE 42 PYLON OF THE EXISTING LINE WITHIN THE WATERCOURSE, AND SHOULD BE AVOIDED AS MUCH AS PRACTICALLY AND FINANCIALLY POSSIBLE

FIGURE 43 VIEW OF A PORTION OF THE GROMIS SUBSTATION

FIGURE 44 MARKS OF WATER RUNNING DOWN GRANITE KOPPIES

12.4. Identified impacts

Impacts were identified from the existing Generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity (RSA, 2019) and impact assessments specifically focused on assessing impacts of energy generating and distribution infrastructure within Strategic Environmental Areas (Department of Environmental Affairs, 2015, 2016).

Impacts associated with the proposed development range from those that are direct (e.g. pylon construction and clearing areas for servitudes) to those that are indirect and which occur over longer timeframes (e.g. habitat fragmentation, hydrological changes and alien plant infestation) (Department of Environmental Affairs, 2016).

From a terrestrial flora and freshwater perspective, the dominating source of potential impacts that the proposed project will have during its life cycle will be directly and indirectly related to habitat loss and the transformation of habitats. Other significant sources of impact include changes in surface hydrology and disturbance due to human presence and activities.

In terms of watercourses, service- and access roads and the power line itself will almost inevitably cross rivers, riparian zones, streams and wetlands. Crossing of watercourses, placement of infrastructure or construction itself can cause disturbance to watercourse bed and banks, and their buffers. The life cycle will however require very little water and impacts will not be consumptive (Department of Environmental Affairs, 2015).

The main potential impacts relate to the following aspects (Department of Environmental Affairs, 2016):

- Vegetation destruction, habitat loss and impact on plant species of conservation concern as a result of servitude clearance and construction of access routes, pylons and substations expansion;
- Loss of riparian- and wetland habitat and vegetation;
- Soil disturbance, soil compaction and increased erosion;
- Impact on protected areas or areas earmarked for protection, CBAs and broad-scale ecological processes;
- Cumulative impacts on habitat loss (protected and CBAs) and broad-scale ecological processes, which includes the disruptions of ecosystems and hydrological flow;
- Pollution of aquatic ecosystems; and,
- Increased opportunity for alien invasive plant establishment and spread.

The table below summarizes potential impacts that have been identified (Table 4).

TABLE 4 SUMMARY OF POTENTIAL IMPACTS THAT HAVE BEEN IDENTIFIED.

Phase	Impact	Activity	Impact management outcome
Planning & Construction	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Access roads: Direct loss and clearing of terrestrial vegetation.	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • No habitat loss and impact on sensitive vegetation and habitat types. • No loss of Species of Conservation Concern (SCC) from development footprints.
		Expansion of substation: The direct clearing and/or removal of vegetation to allow for the construction of substation expansion.	• Minimise impact to the environment through the planned and restricted expansion and construction on site. • Vegetation clearing is restricted to the authorised development footprint of the proposed infrastructure. • No loss of SCC from development footprints.
		Construction of pylons and creating of servitudes: The direct clearing and/or removal of vegetation to allow for the construction of pylons, as well as to establish servitudes to access the pylons and powerlines during construction and for on-going maintenance.	• Minimise impact to the environment through the planned and restricted expansion and construction on site. • Vegetation clearing is restricted to the authorised development footprint of the proposed infrastructure. • No loss of SCC from development footprints.
Planning & Construction	Loss of riparian- and wetland habitat and vegetation	Finalising tower positions	No environmental degradation occurs as a result of the survey and pegging operations.
		Assembly and erecting towers	No environmental degradation occurs as a result of assembly and erecting of towers.
		Stringing	No environmental degradation occurs as a result of stringing.
		Access roads: Direct loss of riparian and wetland vegetation (and associated buffers, including potentially sensitive/threatened/important freshwater ecosystems and/or habitat supporting SCC.	Minimise impact to the environment through the planned and restricted movement of vehicles on site.
Planning & Construction	Disruption of broad-scale ecological processes and hydrological flow	Access roads: Fragmentation of freshwater ecosystems and flow patterns, resulting in an indirect loss of ecological patterns and processes such as species movement and dispersal, habitat	• Minimise impact to the environment through the planned and restricted movement of vehicles on site.

		connectivity, increased edge effects and disturbance, establishment of invasive alien vegetation, etc.	• No transformation, loss or fragmentation of rivers and wetlands.
		River crossings (temporary during construction): Linear developments biggest impact is fragmenting habitats (terrestrial- and freshwater ecosystems and their buffers). If fragmentation is permanent it can isolate populations and cause a cascade of ecological impacts for the population. Habitat fragmentation also has the potential to exacerbate impacts, such as through altering micro-climatic conditions. These alterations in turn affect the perimeter of ecosystems resulting in edge effects and development of transitional habitats. This presents a favourable situation for invasive alien plants (IAPs) to establish, with knock-on effects for ecosystems.	• Protection of watercourse. • Pollution and contamination or loss and fragmentation of the watercourse environment and erosion are prevented. • No transformation, loss or fragmentation of rivers and wetlands.
Planning & Construction	Compaction of soils and creation of preferential flow paths within and adjacent to wetland and river habitat	Access roads: Stormwater runoff resulting in increased flows (hydrological alteration) within receiving aquatic environments, particularly in relation to runoff discharge points, which in turn has a number of indirect issues such as bank erosion and collapse, scouring and channel incision, headcut erosion, desiccation of wetland/riparian soils and vegetation, increased turbidity, sedimentation and smothering of benthos. The combined effects can negatively affect the ecological integrity and ability of the freshwater ecosystems to function properly.	Minimise impact to the environment through the planned and restricted movement of vehicles on site.
Planning & Construction	Soil disturbance, soil compaction and increased erosion	Stockpiling and stockpile areas	Reduce erosion and sedimentation as a result of stockpiling.
		Site Establishment Development	Impacts on the environment are minimised during site establishment and the development footprint are kept to demarcated development area.
Planning & Construction	Pollution of aquatic ecosystems	Access roads: Waste pollution and contamination of aquatic environments from foreign materials (e.g. fuels/hydrocarbons, cement, and building materials) being dumped and/or carried into aquatic environments.	Minimise impact to the environment through the planned and restricted movement of vehicles on site.
		Storm- and wastewater management: Lack of proper storm water management can lead to excessive run-off and erosion, contamination of surrounding environment and watercourses with sediments and spills from cement, oil or hydrolics.	Impacts to the environment caused by stormwater and wastewater discharges during construction are avoided.
		Sanitation	Clean and well maintained toilet facilities are available to all staff in an effort to minimise the risk of disease and impact to the environment.
		Workshop, equipment maintenance and storage	Soil and surface water contamination is minimised.

<table>
<tr><td></td><td></td><td><u>Batching plants</u></td><td>Minimise spillages and contamination of soil and surface water.</td></tr>
<tr><td>Planning & Construction</td><td>Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and broad-scale ecological processes</td><td><u>Access restricted areas - Construction of pylons and creating of servitudes</u></td><td>Access to restricted areas prevented and the development footprints are kept to demarcated development area.
No effect on ability to meet conservation targets for unprotected vegetation types.</td></tr>
<tr><td rowspan="4">Planning & Construction</td><td rowspan="4">Increased opportunity for alien invasive plant establishment and spread</td><td><u>Finalising tower positions</u></td><td>No environmental degradation occurs as a result of the survey and pegging operations.</td></tr>
<tr><td><u>Assembly and erecting towers</u></td><td>No environmental degradation occurs as a result of assembly and erecting of towers.</td></tr>
<tr><td><u>Stringing</u></td><td>No environmental degradation occurs as a result of stringing.</td></tr>
<tr><td><u>Landscaping and rehabilitation:</u>
IAPs that already occur in the area are likely to invade newly disturbed areas, by encroachment into disturbed areas (e.g. temporary construction camps, borrow pits, vehicle parking, stock pile areas, etc.), transitional habitats, as well as around pylons/substations and along access roads. The spread of existing, and the introduction of new problem plant species may be facilitated by movement of people and construction vehicles.
IAP infestation within freshwater ecosystems will further degrade habitats and habitat availability for associated biota.
Secondary impacts (or caused by IAPs) include, but are not limited to:
Competition with native plant species
Shading of banks and instream habitats, altering habitat suitability;
Bank instability, erosion and collapse, with exacerbated deposition of sediments and debris
In more severe cases, reduced water availability due to excessive water consumption from most IAPs</td><td>Areas disturbed during the development phase are returned to a state that approximates the original condition.</td></tr>
<tr><td>Operation</td><td>Disruption of broad-scale ecological processes and hydrological flow</td><td><u>River crossings (permanent during operation):</u>
Linear developments’ biggest impact is fragmenting habitats (terrestrial- and freshwater ecosystems and their buffers). If fragmentation is permanent it can isolate populations and cause a cascade of ecological impacts for the population.
Habitat fragmentation also has the potential to exacerbate impacts, such as through altering micro-climatic conditions. These alterations in turn affect the perimeter of ecosystems resulting in edge effects and development of transitional habitats. This presents a favourable situation for IAPs to establish, with knock-on effects for ecosystems.</td><td>Protection of watercourse. Pollution and contamination or loss and fragmentation of the watercourse environment and erosion are prevented.
No transformation, loss or fragmentation of rivers and wetlands.</td></tr>
</table>

Operation	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Continuous clearing of vegetation to maintain the servitude/maintenance roads	• Minimise impact to the environment through the planned and restricted vegetation clearing for servitudes/maintenance roads. • Vegetation clearing is restricted to the authorised development footprint of the proposed infrastructure.
Operation	Soil disturbance, soil compaction and increased erosion	Pylons & access roads	Minimise loss of soil and erosion.
Decommission	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Disassembly of towers, substation and maintenance roads	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • No habitat loss and impact on sensitive vegetation and habitat types. • No loss of SCC from decommission infrastructure. • Vegetation clearing is restricted to the authorised development footprint of the proposed infrastructure.
Decommission	Loss of riparian- and wetland habitat and vegetation	Disassembly of towers, substation and maintenance roads	No environmental degradation occurs as a result of disassembly of infrastructure.
Decommission	Soil disturbance, soil compaction and increased erosion	Stockpiling and stockpile areas	Reduce erosion and sedimentation as a result of stockpiling.
		Site Establishment Development	Impacts on the environment are minimised during site establishment and the decommission footprints are kept to demarcated development area.
Decommission	Pollution of aquatic ecosystems	Disassembly of towers, substation and maintenance roads	Minimise impact to the environment through the planned and restricted movement of vehicles on site, and decommissioning of infrastructure.
		Storm- and wastewater management: Lack of proper storm water management can lead to excessive run-off and erosion, contamination of surrounding environment and watercourses with sediments and spills from cement, oil or hydrolics.	Impacts to the environment caused by stormwater and wastewater discharges during decommission are avoided.
		Sanitation	Clean and well maintained toilet facilities are available to all staff in an effort to minimise the risk of disease and impact to the environment.

<table>
<tr><td></td><td></td><td><u>Workshop, equipment maintenance and storage</u></td><td>Soil and surface water contamination is minimised.</td></tr>
<tr><td>Decommission</td><td>Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and broad-scale ecological processes</td><td><u>Access restricted areas - Decommission of pylons and creating of servitudes</u></td><td>Access to restricted areas prevented and the decommission footprint are kept to demarcated development area.
No effect on ability to meet conservation targets for unprotected vegetation types.</td></tr>
<tr><td rowspan="2">Decommission</td><td rowspan="2">Increased opportunity for alien invasive plant establishment and spread</td><td><u>Disassembly of towers, substation and maintenance roads</u></td><td>No environmental degradation occurs as a result of disassembly of infrastructure.</td></tr>
<tr><td><u>Landscaping and rehabilitation:</u>
IAPs that already occur in the area are likely to invade newly disturbed areas, by encroachment into disturbed areas (e.g. temporary decommissioning camps, vehicle parking, stock pile areas, etc.), transitional habitats, as well as around pylons/substations footprints and along access roads. The spread of existing, and the introduction of new problem plant species may be facilitated by movement of people and decommission vehicles.
IAP infestation within freshwater ecosystems will further degrade habitats and habitat availability for associated biota.
Secondary impacts (or caused by IAPs) include, but are not limited to:
Competition with native plant species
Shading of banks and instream habitats, altering habitat suitability;
Bank instability, erosion and collapse, with exacerbated deposition of sediments and debris
In more severe cases, reduced water availability due to excessive water consumption from most IAPs</td><td>Areas disturbed during the decommissioning phase are returned to a state that approximates the original condition.</td></tr>
</table>

The overall impacts of the proposed development and associated activities can be summarized as potentially causing a risk of habitat destruction, increased levels of disturbance and degradation (for terrestrial flora and freshwater ecosystems), establishment and spread of IAPs, increased soil erosion, as well as cumulative impacts on broad-scale ecological processes (Department of Environmental Affairs, 2016). The majority of impacts will be created during construction, with the effect carrying on in the operation phase for some of the impacts. The section below provides possible suitable mitigation measures to avoid, reduce or mitigate the significance of identified impacts.

12.5. Mitigation measures for identified impacts

Mitigation measures were identified from the existing Generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity (RSA, 2019) and impact assessments specifically focused on assessing impacts of energy generating and distribution infrastructure within Strategic Environmental Areas (Department of Environmental Affairs, 2015, 2016).

The table below summarizes mitigation measures that could be implemented to avoid, reduce or mitigate the significance of potential impacts (Table 5).

TABLE 5 MITIGATION MEASURES TO AVOID, REDUCE OR MITIGATE THE SIGNIFICANCE OF IDENTIFIED IMPACTS OF THE PROPOSED DEVELOPMENT.

Phase	Impact	Activity	Mitigation measures
Planning & Construction	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Access roads: Direct loss and clearing of terrestrial vegetation.	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • Avoid habitat loss and impact on sensitive vegetation and habitat types. • Avoid loss of Species of Conservation Concern (SCC) from development footprints. • It is advised to use existing access roads as far as possible or to limit the distance and width of new access roads as much a practically possible. Existing roads (from National road network) and existing service roads from Eskom lines and farm roads (most farm boundaries/fences have tracks on either side) are preferred. • Areas where there are still remnants of untransformed vegetation are seen as undesirable. • Development footprint placing should avoid natural vegetation remnants as far as possible. • Vegetation clearing is restricted to the authorised development footprint of the proposed infrastructure. • The development alternatives/pylon placements with the highest incidence of Redlist status species should be avoided and clearing should be avoided in ecosystems with a threatened status. If constructed in a sensitive manner, the impact of such power lines can be kept to a fairly low level and consists of a temporary construction track (that may be used as service roads occasionally during operation) and some disturbance around the foundations of the pylons. In most instances it is not necessary to establish a corridor of cleared vegetation for the power line within this study area.
		Expansion of substation: The direct clearing and/or removal of vegetation to allow for the construction of substation expansion.	
		Construction of pylons and creating of servitudes: The direct clearing and/or removal of vegetation to allow for the construction of pylons, as well as to establish servitudes to access the pylons and powerlines during construction and for on-going maintenance.	
Planning & Construction	Loss of riparian- and wetland habitat and vegetation	Finalising tower positions	• Limit environmental degradation as a result of the survey and pegging operations. • Limit environmental degradation as a result of assembly and erecting of towers. • Limit environmental degradation as a result of stringing. • Limit placement to existing degraded/disturbed areas and avoid placing towers within watercourses.
		Assembly and erecting towers	
		Stringing	
		Access roads: Direct loss of riparian and wetland vegetation (and associated buffers), including potentially sensitive/threatened/important freshwater ecosystems and/or habitat supporting SCC.	

			• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • It is advised to use existing access roads as far as possible or to limit the distance and width of new access roads as much a practically possible. Existing roads (from National road network) and existing service roads from Eskom lines and farm roads (most farm boundaries/fences have tracks on either side) are preferred. • Watercourses and their 32m buffers and vegetation remnants should be avoided where practically possible. • Areas where there are still remnants of untransformed vegetation are seen as undesirable. • Development footprint placing should avoid natural vegetation remnants as far as possible. • Vegetation clearing should be restricted to the authorised development footprint of the proposed infrastructure. • Clearing should be avoided in ecosystems with a threatened status. If constructed in a sensitive manner, the impact of such power lines can be kept to a fairly low level and consists of a temporary construction track (that may be used as service roads occasionally during operation) and some disturbance around the foundations of the pylons. In most instances it is not necessary to establish a corridor of cleared vegetation for the power line in the study area.
Planning & Construction	Disruption of broad-scale ecological processes and hydrological flow	<u>Access roads:</u> Fragmentation of freshwater ecosystems and flow patterns, resulting in an indirect loss of ecological patterns and processes such as species movement and dispersal, habitat connectivity, increased edge effects and disturbance, establishment of invasive alien vegetation, etc.	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • Limit transformation, loss or fragmentation of rivers and wetlands. • It is advised to use existing access roads as far as possible or to limit the distance and width of new access roads as much a practically possible. Existing roads (from National road network) and existing service roads from Eskom lines and farm roads (most farm boundaries/fences have tracks on either side) are preferred. • Areas where there are still remnants of untransformed vegetation are seen as undesirable. • Critical Biodiversity areas (CBA1, CBA2, ESA) & watercourses and their 32m buffers and vegetation remnants should be avoided where practically possible.
		<u>River crossings (temporary during construction):</u> Linear developments' biggest impact is fragmenting habitats (terrestrial- and freshwater ecosystems and their buffers). If	• Protect watercourses.

		fragmentation is permanent it can isolate populations and cause a cascade of ecological impacts for the population. Habitat fragmentation also has the potential to exacerbate impacts, such as through altering micro-climatic conditions. These alterations in turn affect the perimeter of ecosystems resulting in edge effects and development of transitional habitats. This presents a favourable situation for IAPs to establish, with knock-on effects for ecosystems.	• Pollution and contamination or loss and fragmentation of the watercourse environment and erosion should be prevented and avoided. • Limit transformation, loss or fragmentation of rivers and wetlands. • Run-off water, from the construction and development footprint, should avoid as far as practically possible watercourses (rivers, streams and wetlands), and limit impacts on watercourses of ecological importance or that are ecologically sensitive. • A minimum buffer of 32 meter is recommended as no-go areas around watercourses (legislative distance for triggering activities according to listing notices). • Development of permanent watercourse crossings must only be undertaken where no alternative access to tower position is available. • Crossing should be designed and constructed to allow migration and movement of fish.
Planning & Construction	Compaction of soils and creation of preferential flow paths within and adjacent to wetland and river habitat	Access roads: Stormwater runoff resulting in increased flows (hydrological alteration) within receiving aquatic environments, particularly in relation to runoff discharge points, which in turn has a number of indirect issues such as bank erosion and collapse, scouring and channel incision, headcut erosion, desiccation of wetland/riparian soils and vegetation, increased turbidity, sedimentation and smothering of benthos. The combined effects can negatively affect the ecological integrity and ability of the freshwater ecosystems to function properly.	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • Avoid steep slopes or uneven terrain, as these areas will have a larger impact such as increased risk of soil erosion due to the cut and fill that is usually required. • Special provision will have to be made in areas with deep, loose sand to ensure that the tracks do not grow wider or become multiple tracks as drivers seek to find easier routes. • It is important that any disturbed areas and roads that will not be used for maintenance during the operational phase should be rehabilitated and monitored.
Planning & Construction	Soil disturbance, soil compaction and increased erosion	Stockpiling and stockpile areas Site Establishment Development	• Reduce erosion and sedimentation as a result of stockpiling. • Impacts on the environment should be minimised during site establishment and the development footprint should be kept to demarcated development area. • Sensitive areas should be avoided where practically possible for stockpiling and stockpile areas. Critical Biodiversity areas (CBA1, CBA2, ESA) & watercourses and their 32m buffers and vegetation remnants should be avoided where practically possible for stockpiling and site establishment. • Location of camps must be within approved area to ensure that the site does not impact on sensitive areas identified in the environmental assessment or site walk through.

			• Sites must be located where possible on previously disturbed areas. • Areas outside development footprint should be considered no-go areas.
Planning & Construction	Pollution of aquatic ecosystems	<u>Access roads:</u> Waste pollution and contamination of aquatic environments from foreign materials (e.g. fuels/hydrocarbons, cement, and building materials) being dumped and/or carried into aquatic environments.	• Minimise impact to the environment through the planned and restricted movement of vehicles on site. • It is advised to use existing access roads as far as possible or to limit the distance and width of new access roads as much a practically possible. Existing roads (from National road network) and existing service roads from Eskom lines and farm roads (most farm boundaries/fences have tracks on either side) are preferred. • Areas where there are still remnants of untransformed vegetation are seen as undesirable.
		<u>Storm- and wastewater management:</u> Lack of proper storm water management can lead to excessive run-off and erosion, contamination of surrounding environment and watercourses with sediments and spills from cement, oil or hydrolics.	• Impacts to the environment caused by stormwater and wastewater discharges during construction should be avoided. • No untreated storm- and wastewater should be released into the environment. • Run-off water, from the construction and development footprint, should avoid as far as practically possible watercourses (rivers, streams and wetlands), and limit impacts on watercourses of ecological importance or that are ecologically sensitive. • A minimum buffer of 32 meter is recommended as no-go areas around watercourses (legislative distance for triggering activities according to listing notices).
		<u>Sanitation</u> <u>Workshop, equipment maintenance and storage</u> <u>Batching plants</u>	• Clean, secure and well maintained toilet facilities should available to all staff in an effort to minimise the risk of disease and impact to the environment. • Soil and surface water contamination should be avoided. • Minimise spillages and contamination of soil and surface water. • Sensitive areas should be avoided. A general minimum buffer of 100m for rivers and streams are recommended, as well as a 500m buffer for wetlands. • Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains.
Planning & Construction	Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and	<u>Access restricted areas - Construction of pylons and creating of servitudes</u>	• Access to restricted areas should be prevented and the development footprint should be kept to demarcated development area. • No effect on ability to meet conservation targets for unprotected vegetation types.

	broad-scale ecological processes		• Vegetation clearing should be restricted to the authorised development footprint of the proposed infrastructure. • The development alternative with the highest incidence of Redlist status species should be avoided and clearing should be avoided in ecosystems with a threatened status. If constructed in a sensitive manner, the impact of such power lines can be kept to a fairly low level and consists of a temporary construction track (that may be used as service roads occasionally during operation) and some disturbance around the foundations of the pylons. In most instances it is not necessary to establish a corridor of cleared vegetation for the power line in the study area. • Critical Biodiversity areas (CBA1, CBA2, ESA) & watercourses and their 32m buffers should be seen as area requiring restricted access. • Areas outside development footprint should be considered no-go areas.

Planning & Construction	Increased opportunity for alien invasive plant establishment and spread	<u>Finalising tower positions</u>
		<u>Assembly and erecting towers</u>
		<u>Stringing</u>
		<u>Landscaping and rehabilitation:</u>
		• IAPs that already occur in the area are likely to invade newly disturbed areas, by encroachment into disturbed areas (e.g. temporary construction camps, borrow pits, vehicle parking, stock pile areas, etc.), transitional habitats, as well as around pylons/substations and along access roads. The spread of existing, and the introduction of new problem plant species may be facilitated by movement of people and construction vehicles.
		• IAP infestation within freshwater ecosystems will further degrade habitats and habitat availability for associated biota.
		• Secondary impacts (or caused by IAPs) include, but are not limited to:
		  ○ Competition with native plant species
		  ○ Shading of banks and instream habitats, altering habitat suitability;
		  ○ Bank instability, erosion and collapse, with exacerbated deposition of sediments and debris
		  ○ In more severe cases, reduced water availability due to excessive water consumption from most IAPs
			• Limit environmental degradation as a result of the survey and pegging operations.
			• Limit environmental degradation as a result of assembly and erecting of towers.
			• Limit environmental degradation as a result of stringing.
			• Areas disturbed during the development phase should be returned to a state that approximates the original condition.
			• Indigenous species must be used for rehabilitation planting where it compliments or approximates the original condition.
			• Areas where there are still remnants of untransformed vegetation are seen as undesirable.
			• Development footprint placing should avoid natural vegetation remnants as far as possible.
			• Vegetation clearing should be restricted to the authorised development footprint of the proposed infrastructure.
			• Limit placement within existing degraded/disturbed areas and avoid placing towers within watercourses or ecosystems with threatened status (protected areas, areas earmarked for protection or CBA1, CBA 2 or ESA areas).
			• In sensitive areas, tower assembly must take place off-site or away from sensitive positions.

Operation	Disruption of broad-scale ecological processes and hydrological flow	River crossings (permanent during operation): Linear developments' biggest impact is fragmenting habitats (terrestrial- and freshwater ecosystems and their buffers). If fragmentation is permanent it can isolate populations and cause a cascade of ecological impacts for the population. Habitat fragmentation also has the potential to exacerbate impacts, such as through altering micro-climatic conditions. These alterations in turn affect the perimeter of ecosystems resulting in edge effects and development of transitional habitats. This presents a favourable situation for invasive alien plants (IAPs) to establish, with knock-on effects for ecosystems.	• Protection of watercourses. • Pollution and contamination or loss and fragmentation of the watercourse environment and erosion should be prevented. • Limit transformation, loss or fragmentation of rivers and wetlands. • Special provision will have to be made in areas with deep, loose sand to ensure that the tracks do not grow wider or become multiple tracks as drivers seek to find easier routes. • A minimum buffer around watercourses of 32 meter is recommended as no-go areas (legislative distance for triggering activities according to listing notices). • Development of permanent watercourse crossings must only be undertaken where no alternative access to tower position is available. • Crossing should be designed and constructed to allow migration and movement of fish.
Operation	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Continuous clearing of vegetation to maintain the servitude/maintenance roads	• Minimise impact to the environment through the planned and restricted vegetation clearing for servitudes/maintenance roads. • Vegetation clearing should be restricted to the authorised development footprint of the proposed infrastructure. • Only absolute necessary area and amount of vegetation should be cleared to ensure the safe and proper functioning of infrastructure during maintenance activities.
Operation	Soil disturbance, soil compaction and increased erosion	Pylons & Access Roads	• Sensitive areas should be avoided where practically possible. Critical Biodiversity areas (CBA1, CBA2, ESA) & watercourses and their 32m buffers and vegetation remnants should be avoided where practically possible. • Sites must be located where possible on previously disturbed areas or as close as possible to existing disturbances. • Monitor infrastructure during operation for signs of erosions, and implement remediation measures immediately.
Decommission	Vegetation destruction, habitat loss and impact on plant species of conservation concern	Disassembly of towers, substation and maintenance roads	Corresponding measures as during the construction phase
Decommission	Loss of riparian- and wetland habitat and vegetation	Disassembly of towers, substation and maintenance roads Stockpiling and stockpile areas Site Establishment Development	
Decommission	Pollution of aquatic ecosystems	Disassembly of towers, substation and maintenance roads Storm- and wastewater management:	

		Lack of proper storm water management can lead to excessive run-off and erosion, contamination of surrounding environment and watercourses with sediments and spills from cement, oil or hydrolics.	
		<u>Sanitation</u>	
		<u>Workshop, equipment maintenance and storage</u>	
Decommission	Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and broad-scale ecological processes	<u>Access restricted areas - Decommission of pylons and creating of servitudes</u>	
Decommission	Increased opportunity for alien invasive plant establishment and spread	<u>Disassembly of towers, substation and maintenance roads</u>	
		<u>Landscaping and rehabilitation:</u> • IAPs that already occur in the area are likely to invade newly disturbed areas, by encroachment into disturbed areas (e.g. temporary decommissioning camps, vehicle parking, stock pile areas, etc.), transitional habitats, as well as around pylons/substations footprints and along access roads. The spread of existing, and the introduction of new problem plant species may be facilitated by movement of people and decommission vehicles. • IAP infestation within freshwater ecosystems will further degrade habitats and habitat availability for associated biota. • Secondary impacts (or caused by IAPs) include, but are not limited to: o Competition with native plant species o Shading of banks and instream habitats, altering habitat suitability; o Bank instability, erosion and collapse, with exacerbated deposition of sediments and debris o In more severe cases, reduced water availability due to excessive water consumption from most IAPs	

12.6. Impact rating results

The table below (Table 6) rates the significance of the identified potential impact (as per Section 12.4). The ratings are applied in the instance that no mitigation measures are implemented, and then repeated to assess the significance of the impacts, assuming recommended mitigation measures (as per Section 12.5) are implemented. The table also explains the rationale for how impacts and their subsequent ratings have been assigned to spatial features in order to spatially represent impacts. The spatial representation of impact was also mapped for the study and the details of the mapping procedure and the resulting maps can be viewed in Appendix 2 and 5 respectively of the main Screening Report.

TABLE 6 IMPACT RATING FOR IDENTIFIED POTENTIAL IMPACTS[1]

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																				Features included in grouping/location in corridor
		BEFORE MITIGATION										AFTER MITIGATION										
		Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	
Project activity:	**Planning & Construction**																					
#1	Vegetation destruction, habitat loss and impact on plant species of conservation concern	3	2	4	3	8	4		80	M	M	2	1	2	2	4	2		18	L	L	**Sensitive Vegetation Types**
#2		2	1	2	2	4	3		33	L		2	1	1	1	2	2		14	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#4	Loss of riparian- and wetland habitat and vegetation	4	2	3	3	8	5		100	H	M	3	2	2	2	6	4		60	M	L	**Watercourses, with 32m buffer**
#2b		2	1	2	2	4	3		33	L		1	1	1	1	2	2		12	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#12	Disruption of broad-scale ecological processes and hydrological flow	4	3	3	4	6	4		80	M	L	3	2	2	3	4	3		42	M	L	**Watercourses, with 32m buffer and ESAs**
#2c		3	1	2	2	4	2		24	L		2	1	1	1	2	1		7	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**

[1] The alternative corridors were divided into homogenous units based on certain shared characteristic based on each impact. Each unit was rated separately in terms of impacts. 'Features included in grouping/location in corridor' specifies the units for which impact ratings were calculated.

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																				Features included in grouping/location in corridor
		BEFORE MITIGATION										AFTER MITIGATION										
		Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	
#6	Compaction of soils and creation of preferential flow paths within and adjacent to wetland and river habitat	4	2	4	3	6	4		76	M	M	2	1	2	1	4	3		30	L	L	**Slopes > 1:1.5, Bushman Arid Grassland & Namaqua Inland Duneveld and watercourses & 32m buffer**
#7		2	1	2	2	2	3		27	L		1	0	0	0	0	1		1	L		**Rest of the area not included in #6 & #3**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#5	Soil disturbance, soil compaction and increased erosion	4	2	4	3	6	4		76	M	M	2	1	2	1	4	3		30	L	L	**CBA1, CBA2, ESA, Protected areas, Areas earmarked for protection & watercourses and their 32m buffers**
#2d		2	1	2	2	2	3		27	L		1	0	0	0	0	1		1	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#4a	Pollution of aquatic ecosystems	2	3	3	3	6	3		51	M	L	1	1	1	0	0	1		3	L	L	**Watercourses, with 32m buffer**
#8		2	2	2	2	4	2		24	L		1	0	0	0	0	1		1	L		**100m Buffer around rivers and 500m around wetlands**
#9		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Other areas not included in #4 & #8**
#5	Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and broad-scale ecological processes	4	3	3	4	6	4		80	M	L	3	2	2	3	4	3		42	M	L	**CBA1, CBA2, ESA, Protected areas, Areas earmarked for protection & watercourses and their 32m buffers**
#2d		3	1	2	2	4	2		24	L		2	1	1	1	2	1		7	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#2a	Increased opportunity for alien invasive plant establishment and spread	5	3	3	3	6	4		80	M	M	2	1	1	1	2	3		21	L	L	**Vegetation Remnants**
#3		2	1	1	1	2	3		21	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																				Features included in grouping/location in corridor
		BEFORE MITIGATION										AFTER MITIGATION										
		Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	
Project activity:	**Operation**																					
#1	Vegetation destruction, habitat loss and impact on plant species of conservation concern	3	2	4	3	8	4		80	M	L	2	1	2	2	4	2		18	L	L	**Sensitive Vegetation Types**
#2		2	1	2	2	4	3		33	L		2	1	1	1	2	2		14	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#12	Disruption of broad-scale ecological processes and hydrological flow	4	3	3	4	6	4		80	M	L	3	2	2	3	4	3		42	M	L	**Watercourses, with 32m buffer and ESAs**
#2c		3	1	2	2	4	2		24	L		2	1	1	1	2	1		7	L		**Vegetation remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#5	Soil disturbance, soil compaction and increased erosion	4	2	4	3	6	4		76	M	M	2	1	2	1	4	3		30	L	L	**CBA1, CBA2, ESA, Protected areas, Areas earmarked for protection & watercourses and their 32m buffers**
#2d		2	1	2	2	2	3		27	L		1	0	0	0	0	1		1	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
Project activity:	**Decommission**																					
#1	Vegetation destruction, habitat loss and impact on plant species of conservation concern	3	2	4	3	8	4		80	M	L	2	1	2	2	4	2		18	L	L	**Sensitive Vegetation Types**
#2		2	1	2	2	4	3		33	L		2	1	1	1	2	2		14	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#4	Loss of riparian- and wetland habitat and vegetation	4	2	3	3	8	5		100	H	M	3	2	2	2	6	4		60	M	L	**Watercourses, with 32m buffer**
#2b		2	1	2	2	4	3		33	L		1	1	1	1	2	2		12	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#4a		2	3	3	3	6	3		51	M	L	1	1	1	0	0	1		3	L	L	**Watercourses, with 32m buffer**

PROJECT ALTERNATIVE	POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT	ENVIRONMENTAL SIGNIFICANCE																				Features included in grouping/location in corridor
		BEFORE MITIGATION										AFTER MITIGATION										
		Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	Duration	Extent	Irreplaceable	Reversibility	Magnitude	Probability		TOTAL (SP)	Significance	CUMULATIVE	
#8	Pollution of aquatic ecosystems	2	2	2	2	4	2		24	L		1	0	0	0	0	1		1	L		**100m Buffer around rivers and 500m around wetlands**
#9		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Other areas not included in #4 & #8**
#5	Impact on protected areas or areas earmarked for protection, Critical Biodiversity Areas and broad-scale ecological processes	4	3	3	4	6	4		80	M	L	3	2	2	3	4	3		42	L	L	**CBA1, CBA2, ESA, Protected areas, Areas earmarked for protection & watercourses and their 32m buffers**
#2d		3	1	2	2	4	2		24	L		2	1	1	1	2	1		7	L		**Vegetation Remnants**
#3		1	0	0	0	0	1		1	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**
#2a	Increased opportunity for alien invasive plant establishment and spread	5	3	3	3	6	4		80	M	M	2	1	1	1	2	3		21	L	L	**Vegetation Remnants**
#3		2	1	1	1	2	3		21	L		1	0	0	0	0	1		1	L		**Transformed areas, existing roads & power lines**

12. Preferred alternative recommendation

The Succulent Karoo Biome should be approached as potentially sensitive as the abundance of rare, endemic and specialised species in this area is very high. The eastern Nama Karoo is potentially more suitable for electricity transmission infrastructure and development. With the exception of the inselbergs and quartz fields, the areas which fall with the Bushmanland Arid Grassland vegetation type are singled out as havening generally the lowest sensitivity (Department of Environmental Affairs, 2015).

From this study it is recommended that Alternative 5 is the preferred alternative. Alternative 1 (and the proportions of 4 and 5 where the routed converge with Alternative 1) offers the greatest opportunity to make use of existing infrastructure such as access roads and similar linear developments, despite crossing sensitive CBA1 areas. Alternative 1 (and the proportions of 4 and 5 where the routed converge with Alternative 1) has a larger area transformed (thus more developments), Alternative 4 in contrast has less transformed areas and access. The natural environment is in a more pristine condition in the western section of this alternative. Similarly, both the western section of Alternative 4 and the eastern section of Alternative 1 has wide sections of CBA 1s (and a Protected Area (PA) in the case of Alternative 1) going across the entire corridor width. The length of these section are also much larger (>460m) than the required distance between pylon placement. Using Alternative 5 as the preferred route could help limit the distance and size of new footprint clearing and further transformation, by limiting new disturbance as close as possible to existing or past disturbances. Alternative 5 is also mostly covered by less sensitive and more degraded ecological areas when compared to the corresponding section of Alternative 1 and 4. This alternative will also successfully navigate around the CBA 1 and PA areas in the eastern section of the study area that Alternative 1 & 4 passes through. If all mitigation measures are followed, both Alternative 1 & 5 could be viable and feasible options from the view point of terrestrial flora perspective, but Alternative 5 is the preferred Alternative. Alternative 4 is considered not feasible due to the larger distance and area of disturbance that it would cause to an area in a relatively good ecological condition and also a larger portion of Succulent Karoo Biome will be impacted compared to Alternative 1 and 5, with limited access and infrastructure to make use of. Alternative 1 and 5 can make use of existing access and similar infrastructure, is the more direct distances of the three options and also has the lesser impact on the Succulent Karoo biome.

It is anticipated that construction directly within watercourses can be avoided in all three alternative by the sensitive alignment of the route and pylon placement, thus limiting disturbance and habitat destruction within aquatic ecosystems. Crossing of watercourses will be inevitable in all three Alternatives, but it is still anticipated that impacts will be minimal if mitigation measures are applied and it is refrained from placing infrastructure directly within watercourse. Alternative 1 and 5 are the preferred alternative from a freshwater perspective as the most use can be made of exiting watercourse crossings and few if any) new crossings will be necessary.

13. Recommended ‘no-go areas’

- Avoid CBAs, Protected Areas and riparian and wetland bed and banks as far as possible (maps included for this study);
- Watercourses and their 32m buffers should be considered no-go areas for infrastructure placement as far as practically possible; and,
- Avoid impact to restricted and specialised habitats such as azonal vegetation types, cliffs, large rocky outcrops, quartz fields, bases of koppies, inselbergs, mountains or rocky outcrops, pebble patches and rock sheets and SCC (not mapped at this scale of the study).

14. Recommendations for during the BA process

There are habitats and vegetation types within the study area which are considered rare or which contain an abundance of endemic species or species of conservation concern. Some vegetation types are restricted to specialised substrates which are limited in extent and impacts on these habitats cannot be effectively mitigated except through avoidance (Department of Environmental Affairs, 2015). Development within these areas should be limited as much as possible. It was not possible to map all of these fine-scale patterns during this study and their presence must be verified through site visits during the appropriate season to the preferred alternative during the BA Process.

The presence of ephemeral watercourses (especially depression wetlands and pans was difficult to map at this level and watercourse presence should be verified through site visits of the Preferred Alternative during the BA Process. A site walk-through or finer scale verification during the BA Process must ensure route alignment and pylon placement avoid cliffs, large rocky outcrops, quartz fields, pebble patches, rock sheets and populations of SCC.

15. Alignment of recommendations with existing and future spatial planning frameworks

This study ties into the results from the National Screening Tool in that it identifies that further detailed Aquatic-, Botanical- and Terrestrial Biodiversity Specialist site verification are needed at the BA level. The screening tool also recognises the fact that the alternatives are situated in a Renewable Energy Development Zone and a Strategic Transmission Corridor.

The approach taken in this study is consistent with the key strategies and interventions recommended in the Northern Cape Spatial Development Framework [SDF] (Northern Cape Province, 2019). The Provincial SDF aims that spatial planning categories A & B: Core and Buffer Areas of the Natural Environment conserve existing ecological corridors and consolidate and rehabilitate any remnants of corridors that link ecosystems, secure additional potential areas that will aid in conservation targets and establish a system of protected areas. These principles are captured mostly in the Provincial CBA data used to compare alternatives, identify potential impacts and rate their significance.

16. Summary of recommended mitigation measures

- Use should be made of the most recent and up to date environmental sensitivity maps and least cost path when planning the final placement of the power line route and pylons;
- Design infrastructure (substation expansion, pylon placement and route alignments) should avoid highly sensitivity areas;
- Pre-construction walk-through by specialists should be done to verfify the route alignment and pylon placement to reduce impacts on sensitive habitats and protected species (SCC) through micro-siting of the development footprint;
- Placement of infrastructure should be done in such a way that no threatened or rare, or species of conservation concern are affected;
- Design to use as much common/shared infrastructure as possible with development in nodes, rather than spread out;
- Avoid construction of substations on steep slopes (>25 degrees).
- Do not place infrastructure within the beds and bank of watercourses, and avoid their regulated area as far as possible;
- Limit the amount of watercourse crossings; and,
- Use existing watercourse crossings to avoid creating new temporary or permanent crossing of access roads.

17. Recommended monitoring requirements

The following monitoring guidelines are from the Electricity Grid Infrastructure were taken from the 2016 SEA (Department of Environmental Affairs, 2016), as they were developed for the study area and specific development type:

- Planning stage: avoid high-threat status ecosystems, as well as flora species of conservation (SCC). This should be done by conducting more detailed field verification and site walkthroughs to determine distribution range or known occurrences of these species. The route alignment should allow for flexibility in determining the final route and pylon placement to avoid locally sensitive features and populations. Should sections of the planned route transect the known locations or distribution of an SCC, a taxon-specific specialist should be appointed to confirm the sensitivity and assess the significance of potential impacts on that SCC. The impact assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on SCC populations, both locally and regionally. Any identified impacts should be avoided or mitigated. All mitigation measures from the specialist study to be incorporated into the EMPr. A South African Council for Natural Scientific Professions (SACNASP) accredited botanist must conduct the site verification in accordance with the NEMA regulations.
- Pre-construction: A walk-through and on-site verification, by a SACNASP accredited in the appropriate field, of the final power line route is mandatory to identify any watercourses and features that should be avoided or buffered from impact, and to identify and locate any plant SCC that should be subject to search and rescue prior to construction.
- Pre-construction: The final power line route and pylon placement should be verified in the field by the appropriate accredited specialists and at the appropriate time of year. In the winter rainfall areas, all fieldwork for flora should take place from late July through to mid-September depending on the exact timing of rainfall. In the summer rainfall areas, fieldwork should take place following good rainfall and growth of the vegetation. In most areas this is usually late summer to early autumn (February to April).
- Pre-construction: Where high sensitivity areas cannot be avoided and there is significant habitat loss in these areas, an offset study should be conducted to ascertain whether an offset is an appropriate mechanism to offset the impact on the high sensitivity area. This should include an identification of offset receiving areas as well as an estimate of the required extent of the offset and the degree to which the offset would be able to compensate for the assessed impacts.
- Construction & Operation: The successful establishment and persistence of plant species of high conservation concern translocated during the search and rescue should be monitored for at least five years after construction is completed. An appropriate frequency would be a year after translocation and every second year thereafter.
- Operation: Management of alien invasive species within the powerline corridor during operation requires chemical stump treatment and germination control or with methods appropriate to the invasive species.

18. Final specialist recommendations

The Generic EMPr (RSA, 2019) should be implemented during planning & design, construction, post-construction, operation and decommissioning phases of the project. Specialist findings and recommendations identified in this screening assessment-specialist report and upcoming BA-specialist site verification should be incorporated into the project specific EMPr and implemented throughout the entire cycle of the project.

In order to reduce potential impacts of the proposed development on freshwater ecosystems watercourses classified with a very high or high sensitivity, and/or good ecological condition should be avoided as far as possible. Where avoidance of sensitive watercourses is not possible, detailed desktop investigations should be conducted, followed by specialist in-field verification. This will determine whether the fine-scale, micro-sited power line alignment and development footprints can avoid freshwater ecosystems and associated buffers. Following this verification, appropriate management actions may be determined and implemented as required (Department of Environmental Affairs, 2016).

19. Conclusion

Succulent Karoo and desert ecosystems occupy a large portion of the alternatives and the area is characterised by high level of endemism and sensitive features. These areas should be avoided at all cost. There are many opportunities for the power line routing to follow, and individual placement of pylons should be based on more detailed verification by an appropriate specialist of the Preferred Alternative during the BA Process. The lower sensitive areas located to the eastern sections Springbok (Nama Karoo Biome) should be more flexible to aligning the line and placing pylons. It is thus recommended that Alternative 5 be the Preferred Alternative from a Botanical and Freshwater perspective, as this alternative will give flexibility in avoiding sensitive habitats and ecosystems and provide flexibility in pylon placement. Alternative 1 is very similar to 5 and will also be a feasible option from a terrestrial flora and freshwater perspective.

Impacts on terrestrial flora and freshwater ecosystems are unfortunately unavoidable when developing large-scale projects such as strategic power transmission corridors such as this development. In particular, linear developments need to avoid urban areas and limit the impacts on other areas with anthropogenic significance to prevent socio-economic impacts. It is thus critical to strategically plan the placement of the line and development footprints to significantly reduce the impact on freshwater and terrestrial floral biodiversity.

The identified impacts are derived from existing studies conducted to identify possible impacts and their mitigation. The ratings were derived using a standard methodology, aimed at giving a defensible significance rating to impacts. The spatial representation of impact ratings are developed from best-available national and provincial data sets, through to be appropriate at this level of study.

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