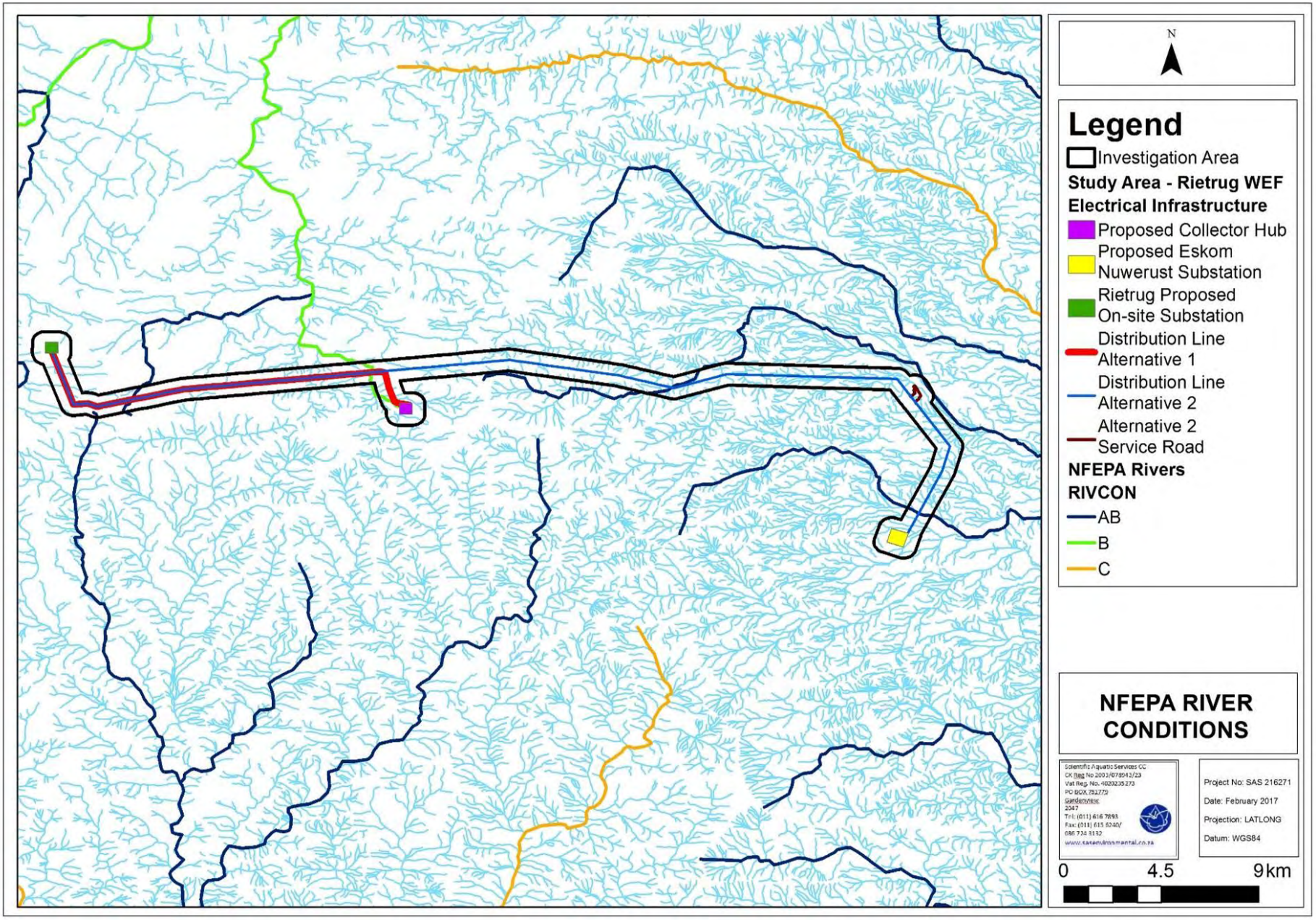


Figure 9: Ecological condition of the rivers associated with the study area according to the NFEPA database (2011).

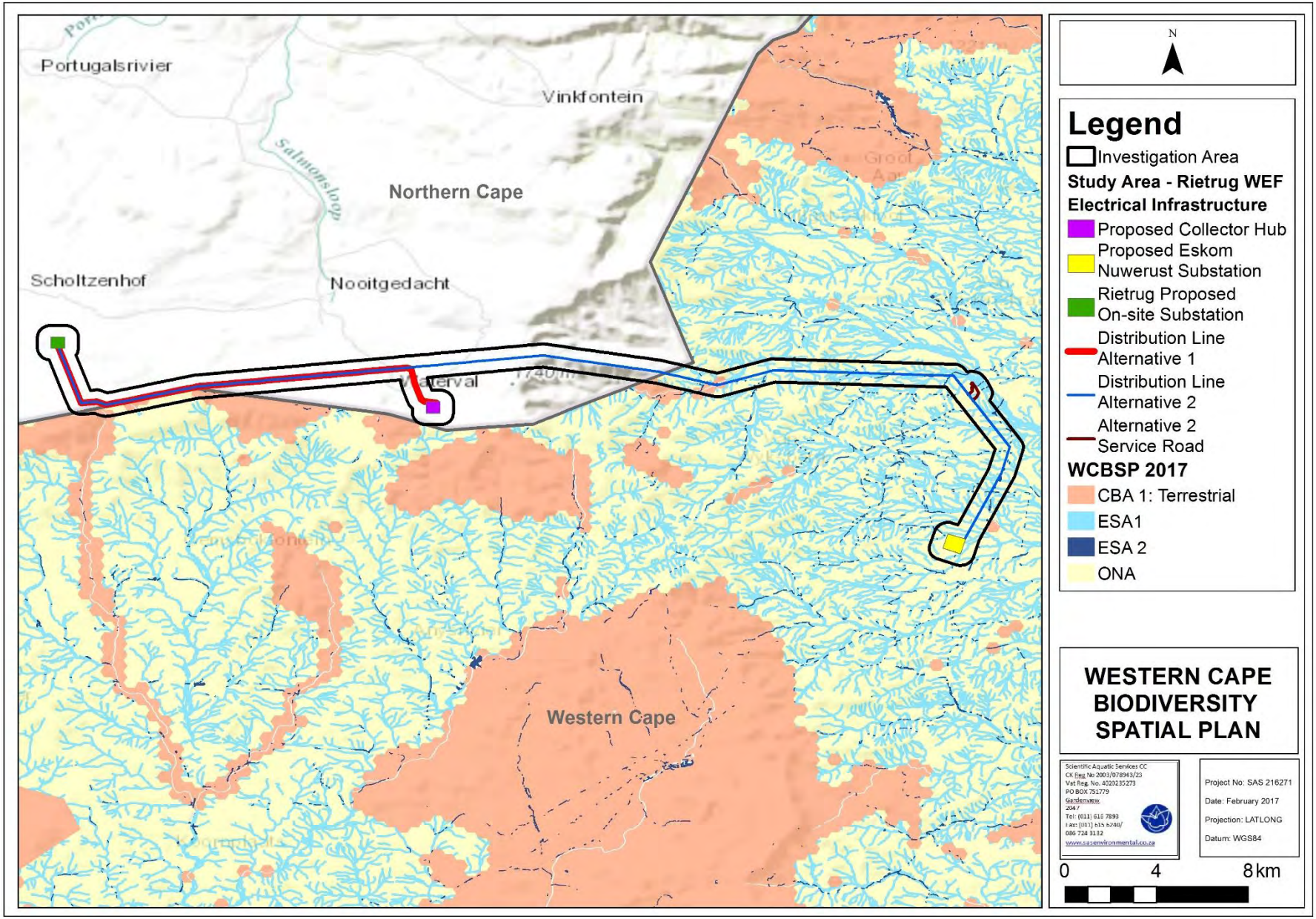


Figure 10: CBA and ESA associated with the study area and investigation area (WCBSP, 2017).

4.2 Ecological Status of Sub-quaternary Catchments [DWS Resource Quality Services (RQS) PES/EIS database, 2014.]

The PES/EIS database, as developed by the DWS RQS department and made available to consultants since mid-August 2014, was utilised to obtain additional background information pertaining to the relevant rivers applicable to the study area. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQS department from all reliable sources of reliable information such as the South African River Health Program (SA RHP) sites, Ecological Water Resource (EWR) sites and Hydro Water Management System (WMS) sites.

In this regard, information for the following sub-quaternary catchment reaches (SQRs) within the Nama Karoo and Great Karoo Ecoregions are applicable (Figure 14):

Nama Karoo (Orange Catchment):
D56B – 07731 (Riet River Tributary)
D56B – 07733 (Riet River)
D56A – 07650 (Portugal's River Tributary)

Great Karoo (Gourits Catchment):
J11B – 07772 (Beerfontein se Laagte River)
J24A – 07720 (Vanwyks River)
J24A – 07778 (Juk River)

Key information on background conditions associated with the study area, as contained in this database and pertaining to the PES, ecological importance and ecological sensitivity for the various systems are tabulated in Appendix D and summarised in Sections 4.2.1 to 4.2.6 following Figure 11.

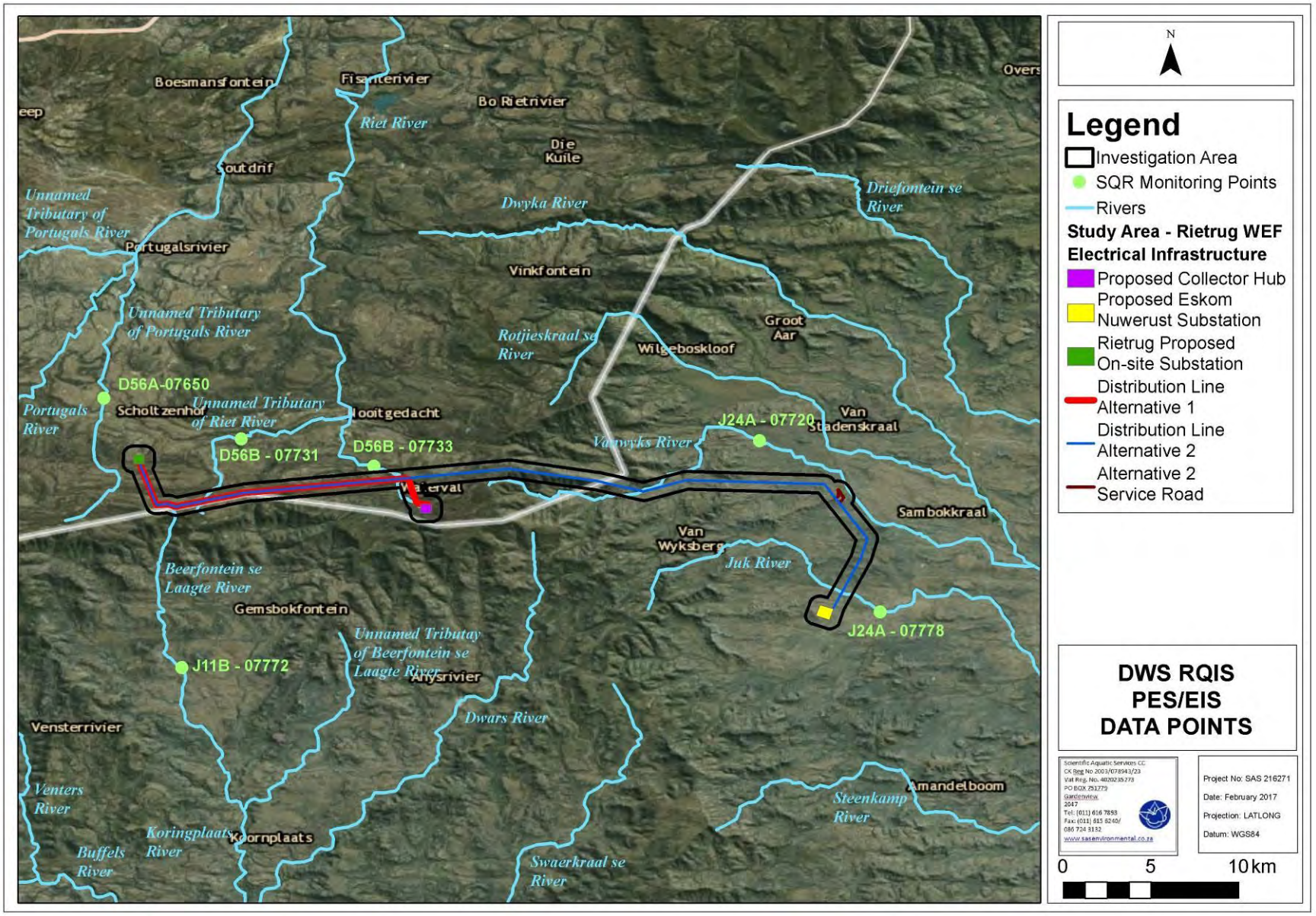


Figure 11: Applicable sub-quaternary catchment reaches and the relevant DWS RQS PES/EIS monitoring points associated with the rivers located within the study area.

4.2.1 D56B- 07731 (Riet River Tributary)

Since this is considered an ephemeral stream, no fish or invertebrate species are recorded for the SQR D56B- 07731 (Riet River Tributary) monitoring point.

4.2.2 D56B- 07733 (Riet River)

The EI data for SQR D56B- 07733 (Riet River) indicates that the following fish species are expected to occur at this site:

Barbus anoplus (Weber, 1897)

According to the EI data for this SQR, the following macro-invertebrate species are expected to occur in the area:

Ceratopogonidae
Chironomidae
Culicidae
Muscidae

4.2.3 D56A – 07650 (Portugal's River Tributary)

The EI data for D56A-07650 (Portugal's River Tributary) indicates that the following fish species are expected to occur at these sites:

Barbus anoplus (Weber, 1897)

The EI data for these threes SQRs indicates that the following macro-invertebrate species are expected to occur in the area:

Ceratopogonidae
Chironomidae
Culicidae
Muscidae

4.2.4 J11B – 07772 (Beerfontein se Laagte River)

The EI data for SQR J11B – 07772 (Beerfontein se Laagte River) indicates that there are no fish species recorded for this SQR monitoring point. The data does however indicate that the following macro-invertebrate species are expected to occur in the area during periods of surface flow. It is notable that all these taxa are considered tolerant of reduced water quality and low flow:

Baetidae 2 spp.
Caenidae
Ceratopogonidae
Chironomidae
Coenagrionidae
Corixidae
Culicidae
Dytiscidae
Gerridae
Gomphidae
Gyrinidae
Libellulidae
Muscidae
Naucoridae
Notonectidae
Pleidae
Simuliidae
Tabanidae
Veliidae/Mesoveliidae

4.2.5 J24A – 07720 (Vanwyks River)

The EI data for SQR J24A – 07720 (Vanwyks River) indicates that there are no fish species recorded for this SQR monitoring point. The data does however indicate that the following macro-invertebrate species are expected to occur in the area:

Aeshnidae	Culicidae	Oligochaeta
Baetidae 2 spp.	Gyrinidae	Pleidae
Ceratopogonidae	Libellulidae	Potamonautidae
Chironomidae	Naucoridae	Simuliidae
Coenagrionidae	Notonectidae	Veliidae/Mesoveliidae

4.2.6 J24A – 07778 (Juk River)

The EI) data for SQR J24A – 07778 (Juk River) indicates that there are no fish species recorded for this SQR monitoring point. The data does however indicate that the following macro-invertebrate species are expected to occur in the area:

Aeshnidae	Culicidae	Oligochaeta
Baetidae 2 spp.	Gyrinidae	Pleidae
Ceratopogonidae	Libellulidae	Potamonautidae
Chironomidae	Naucoridae	Simuliidae
Coenagrionidae	Notonectidae	Veliidae/Mesoveliidae

4.3 Identification of Environmental Sensitivities

The following sections contain information pertaining to the characterisation, PES, EIS (i.e. the sensitivity of the freshwater resources), mapping of the freshwater resources and discussion pertaining to legal requirements in terms of zones of regulation around the identified freshwater resources.

4.3.1 Riparian and wetland system characterisation

In preparation for the field survey, aerial photographs, digital satellite imagery as well as provincial and national wetland databases (as outlined in Section 4.1 of this report) were used to identify areas of interest on a desktop level. Thereafter, the identified points of interest and any additional potential wetland areas / watercourses noted during the field survey were also assessed. Although all possible measures were undertaken to ensure all wetland features and riparian zones were identified, assessed and delineated, some smaller features may have been overlooked within the study area. It should also be noted that the artificial farm dams occurring throughout the study area were not assessed since these are considered to be man-made structures which would not persist under normal circumstances, do not contribute significantly to provincial wetland conservation targets, nor to the ecological service provision of freshwater ecosystems within the study area.

The emphasis of this report is on those systems which are perceived to have an increased likelihood of being impacted to varying degrees by the proposed 132 kV distribution line and its associated infrastructure. Features located outside of these key focus areas, i.e. those within the perceived zone of influence (within the 500m zone of regulation in terms of GN509) of the proposed 132 kV distribution line and its associated infrastructure were delineated using digital satellite imagery, with limited field verification. However, when field verification of features which were delineated using desktop techniques took place, delineations proved to be sufficiently accurate in most instances. Nonetheless, the potential impacts of activities such as agriculture, erosion and clearing of natural vegetation within the greater catchment were taken into consideration during the assessment.

Three true river systems with associated riparian features (as evidenced by a distinct change from the adjacent terrestrial areas to dense riparian vegetation cover on the banks and deposition of alluvial soils within the non-perennial river bed) were identified within the study area and surrounding investigation area. These were the Riet River, Vanwyk's River and the Juk River and their associated unnamed tributaries. Several unnamed tributaries of the Portugal's River are associated with the western-most portion of the study area, although the Portugal's River itself is not associated with the Rietrug study area. Numerous smaller ephemeral drainage features, preferential surface flow paths and erosion gullies associated with these rivers and their respective tributaries were also identified. However, these features were not assessed as they do not have any true riparian characteristics (i.e. vegetation of terrestrial zone does not differ from that of the vegetation found within the adjacent terrestrial areas) and thus from an ecological point of view cannot be defined as watercourses as defined by the NWA. It must however be noted that, should any of these ephemeral drainage lines have a floodline applicable to them they would be defined as a watercourse and require protection as such. This should be verified by a suitably qualified hydrologist. It is recommended that a surface water baseline study should be undertaken as part of the WULA process in consultation with the DWS, and should be used to guide the layout of the proposed development, planned mitigation and conditions of authorization.

The NFEPA database indicates that a small portion of the headwaters of the Beerfontein se Laagte River is located within the 500m area of investigation (to the south of the distribution line for both alternatives). Additionally, the headwaters of several smaller systems are located to the south of the distribution line, within the investigation area. However, due to the topography of the area, it was not possible to access these headwaters, and thus they were not assessed. However, since the proposed distribution line is located approximately 300m to 400m from these headwaters, it is considered highly unlikely that any direct impact on the Beerfontein se Laagte River or the other headwaters, will occur. Nevertheless, it must be noted that although the proposed distribution line is located on the plateau above these headwaters, some indirect impacts may occur, and therefore it is imperative that the mitigation measures contained in this report are adhered to, in order to minimise the risk of such indirect impacts occurring.

The locality of the Riet, Vanwyk's and Juk Rivers and their associated tributaries, and the tributaries associated with the Portugal's River, are depicted in Figures 12 and 13.

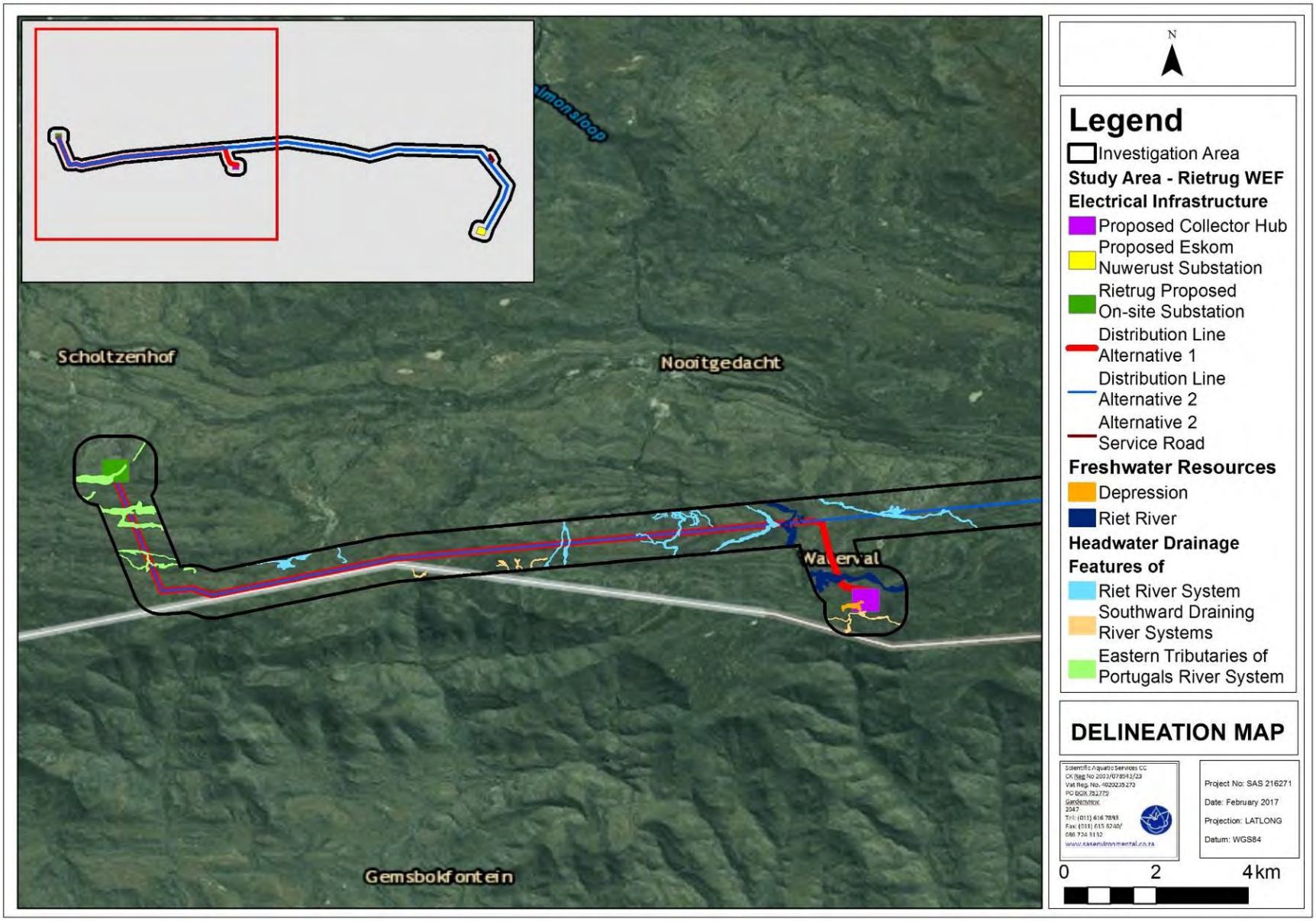


Figure 12: Location of the freshwater resources identified in relation to the western portion of the study area.

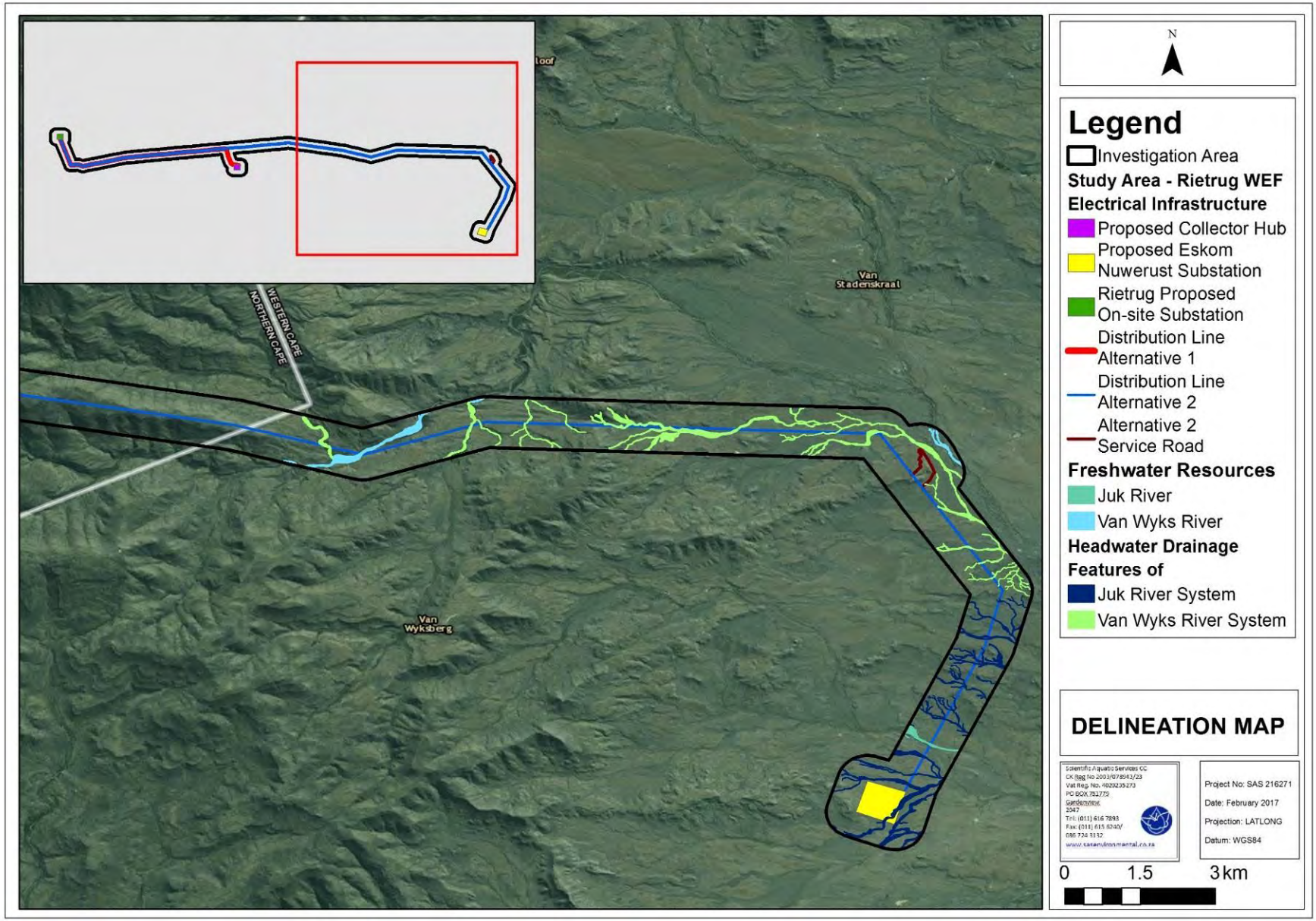


Figure 13: Location of the freshwater resources identified in relation to the eastern portion of the study area.

The above-mentioned systems were classified as rivers with established riparian habitat based on the characteristics as defined by the NWA (Act 36 of 1998), provided below:

- **Riparian habitat** includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure ***distinct*** from those of adjacent land areas. Rivers and non-perennial drainage lines with riparian characteristics are defined as watercourses, whilst smaller ephemeral drainage lines *without* riparian zones are not considered wetlands or systems with an associated riparian zone, but may still be defined as watercourses if the features have floodlines applicable to them; and
- **Wetland habitat** is land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

The freshwater features identified within the study area were classified (according to the Classification System outlined in Appendix C of this report) as Inland Systems falling within the Nama Karoo (Riet River) and Great Karoo (Vanwyk's and Juk Rivers) Ecoregions, and within the Karoo Shale Renosterveld (Riet and Portugal's Rivers and portions of Vanwyk's River) and the Lower Nama Karoo (Juk River) WetVeg groups. The table below presents the classification at Levels 3 and 4 of the Classification System.

Table 2: Characterisation of the wetland systems within the study area, according to the Classification System (Ollis *et al*., 2013).

System	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit	Longitudinal zonation / landform / Inflow drainage
Riet, Vanwyk's and Juk Rivers, and their respective tributaries; unnamed tributaries of the **Portugal's River**	Valley floor: The base of a valley, situated between two distinct valley side-slopes	River: a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.	Not applicable

In addition, as previously mentioned, portions of the headwater tributaries of several southern draining systems were identified within the investigation area during the desktop phase of the study, but were not assessed during the field visit. Nevertheless, since the characteristics and perceived impacts on the freshwater features in the investigation area are similar in nature, it is deemed highly likely that the condition of these features will be similar to those assessed. Whilst such headwaters may not necessarily enjoy legal protection if they do not meet the definition of a watercourse, they are nevertheless deemed critical in terms of managing the movement of water in the landscape and should therefore be avoided. Thus, the locality of these features is indicated in Figures 15 and 16, and the sensitivity maps provided in Section 8 should be taken into consideration during the final planning stages of the project.

In addition, a large depression-type feature associated with the floodplain of an unnamed tributary of the Riet River was identified approximately 200m west of Distribution Line Alternative 1 (Figure 15). Following on-site assessment of the characteristics of this feature, it was deemed to hold water temporarily during rainfall events, but without the development of wetland characteristics. For this reason it was not deemed to meet the definition of a wetland in terms of the NWA. Nevertheless should development be planned in the vicinity thereof, a suitably qualified hydrologist should be consulted to ascertain whether floodlines are applicable to the feature, thus classifying it as a watercourse in terms of the NWA. Therefore, this feature was not assessed during this study. However, if the locality of this

feature is taken into consideration during the planning stages, and the feature avoided, it is deemed highly unlikely that the proposed distribution line would have any significant direct impact on the feature.

4.3.2 Vegetation community considerations

According to the EIA Amendment Report for the proposed Rietrug WEF (Macdonald, 2011, in CSIR, 2016)[2] the farms forming the study area have been subjected to grazing for a significant period of time, predominantly by sheep, resulting in altered vegetation communities. Observations made during the site assessment undertaken in November 2016 confirmed this to be the case, although as noted in the EIA amendment, vegetation within the watercourses is considered to be more vigorous, and was observed to have marginally higher species diversity than the surrounding terrestrial areas.

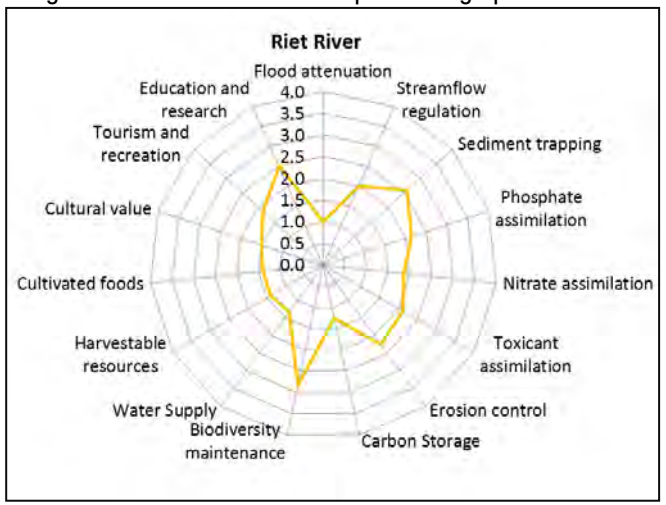
Please refer to the EIA amendment report for the proposed Rietrug WEF for further detail regarding the floral ecological of the study area.

4.3.3 Results of Field Verification

The tables below summarise the findings of the field verification in terms of relevant aspects (hydrology, geomorphology and vegetation components) of riparian ecology, whilst the PES and EIS of the various features is conceptually illustrated in Figures 14 and 15. The details pertaining to the methodology used to assess the various features are contained in Appendix C of this report.

[2] *Amendment Application for the Proposed Splitting of the Sutherland Renewable Energy Facility into three 140 MW Wind Energy Facilities, Sutherland, Northern and Western Cape Provinces. Amendment Report for the proposed Rietrug WEF*. 2016. Prepared by the CSIR for South Africa Mainstream Renewable Power Developments (Pty) Ltd.

Table 3: Summary of results of the assessment of the Riet River in the vicinity of the study area.

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2"> 
  </td></tr>
<tr><td rowspan="2">Vegetation Ecostatus (VEGRAI) and PES discussion</td><td rowspan="2">Category B/C (Largely natural to moderately modified)
There has been minimal change to the natural habitats present within the site, and therefore few changes to the natural biota from its reference state. Some invasion by alien species was evident and hence this accounts for the vast majority of modification. Basic ecosystem function will be marginally altered (e.g. nutrient cycling). Given this characterisation, the system is likely fairly resilient to minor modification of vegetation communities.

This portion of the Riet River was found to be largely natural, with few modifications to the ecosystem from its reference state. Minor modifications to the river include the impoundment of water for agricultural purposes, localised bank erosion which will marginally alter channel competency, as well as a negligible degree of exotic invasion. Minor loss of vegetation as a result of browsing by sheep and other ruminants, a common farming practice in the region, is considered possible. These impacts have caused a slight, albeit discernible change to ecosystem processes.</td><td>Photograph notes</td><td>Representative photograph of a section of the Riet River, illustrating the surrounding high lying regions in the distance and the associated river channel traversing it. Note the typical Roggeveld Karroo shrubland as well as the evidence of an altered growth habit (height/colour) of vegetation within and alongside the main stream channel. Snow melt contributes significantly to the hydraulic regime of the river, as depicted in the photograph on the right[3].</td></tr>
<tr><td colspan="2"><u>Watercourse characteristics:</u>
a) Hydraulic regime
Culverts and the artificial impoundment of the river along particular portions of its channel will have influenced the flow pattern/hydraulic regime of the system, albeit only moderately. Abstraction and redirection of water for agricultural purposes is evident and has resulted in a minor to moderate reduction in flow, especially given the limited surface water and high evaporative potential in the region. Furthermore, inundation of sections of the river course have resulted in permanent submersion, in order to facilitate the abstraction of this water for irrigation, thereby altering downstream sites by reducing flow, and upstream sites by increasing saturation potential. Given that Sutherland experiences an average of six snow days per year (Van der Merwe 2010), there is an increased likelihood of the development of preferential flow paths as a result of snow melt and subsequent water flow, especially from higher lying regions. Ultimately, this water will then feed into the river system. These flow paths may also be of substantial importance for diverting all forms of precipitation to groundwater systems (as well as the river channel) and as such these are considered sensitive areas, vital to the effective functioning of the catchment as a whole. Channel competency is high, with only minor modifications to the existing bank (e.g., erosion due to trampling by livestock) following flood events.

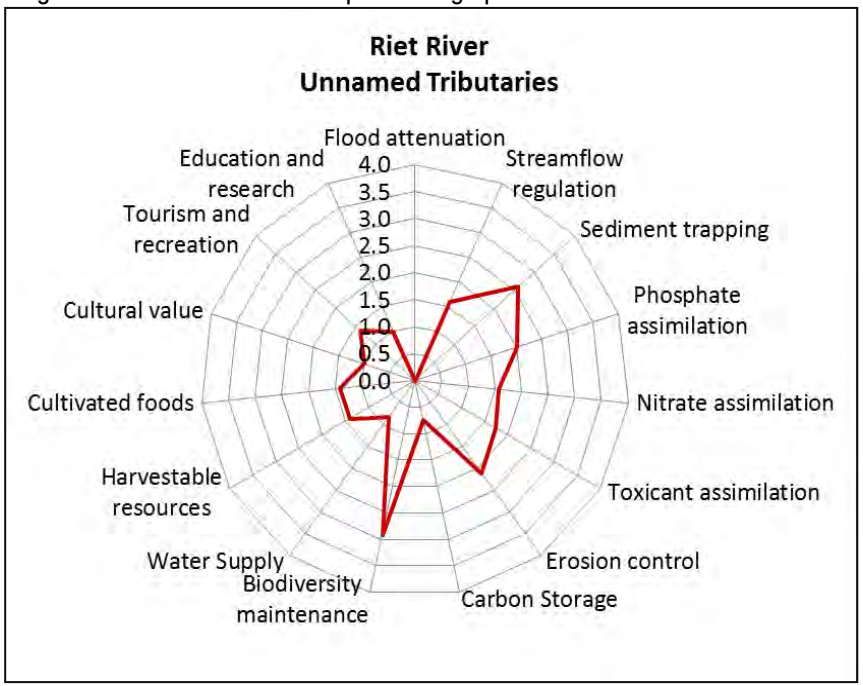
b) Water quality
Detailed assessment of water quality was not within the scope of this study, however water quality is anticipated to be high, and is likely, especially given the limited input of pollutants and lack of industry or urban development in the region. However, runoff from cultivated areas,</td></tr>
</table>

[3] Photographic credit: Sybrand Burger. Owner: Farm Nooitgedacht

Ecoservice provision	Intermediate: The Ecoservice most effectively provisioned by this system is that of biodiversity maintenance, which in exclusion of other services is considered moderately high. The system, and its high degree of connectivity to other natural areas makes it ecologically important in terms of provision of migratory corridors and habitat for a variety of biota, including potentially the endangered Riverine Rabbit (*Bunolagus monticularis*) as noted by ERM in CSIR (2016). Other important services provisioned by this system include sediment trapping given the connectivity provided by this river to other important wetland systems as well as the effectiveness of this feature in trapping sediment, which then serves to facilitate the removal of toxicants. Flood attenuation and carbon storage are two services poorly provisioned by the river, the latter which is the result of the poor ability of local soils to retain organic matter. Water supply is also minimal, given the predominantly ephemeral nature of the feature and thus highlights its limited water storage capacity. However, the presence of artificial impoundments, abstraction equipment and water diversion mechanisms indicate that water provision is important in certain areas. The river also functions as an important area for education and research, given the largely undisturbed nature of the habitat.	and faecal input from sheep and goats may contribute adversely to water quality. Crop cultivation is not extensive and thus this impact is likely isolated. c) Geomorphology and sediment balance Impacts on the geomorphology of the riparian features are moderately low overall given the extent of erosional features relative to the total size of the unit. However, where present, erosion, usually in the form of gullies, are highly incised. This will result in the transport of additional sediment downstream. Soil in the region is composed predominantly of sand, and hence is easily moved through the landscape, exacerbating the adverse effects of these incisions. Nonetheless, this is not considered a significant transformational factor in this system in the short-term, as surface roughness is predominantly intact. In the long-term, there is likely significant transport of sediment from higher to lower lying regions and the deposition of alluvial soils. Thus, despite limited erosion, geomorphology and sediment balance of this system has not been substantially modified and is likely to remain unchanged in the foreseeable future. d) Habitat and biota The region surrounding Sutherland forms part of the ecotone (transition) between the Fynbos, Succulent and Nama-Karroo biomes of South Africa, resulting in a unique assemblage of vegetation communities. This diverse community of vegetation is thus comprised of many microhabitats, creating a multitude of niches which can then be occupied by a diverse faunal assemblage. This translates into a number of red data and other unique species which use the river for migration, feeding and/or breeding purposes. Vegetation was found to be mostly intact at surveyed sites, with largely natural vegetation and sufficient connectivity to other areas via migration corridors. The critically endangered Riverine rabbit (*Bunolagus monticularis*) may occur in the area (ERM, 2011, in CSIR, 2016), highlighting the importance of maintaining riparian integrity. Minor invasion by alien *Prosopis glandulosa*, *Acacia cyclops, Gomphocarpus fruticosus,* and *Nicotiana glauca* species was evident, although monospecific stands were not observed, and thus are unlikely to have a marked impact on the river system.
EIS discussion	EIS Category: A (Ecologically important and sensitive) The river is considered to be ecologically important, particularly in terms of biodiversity service provision, i.e. provision of habitat for populations of threatened faunal and floral species, wildlife migratory corridors, and provision of suitable breeding/foraging habitat for a number of faunal species. Additionally, the results of the ecoservices assessment indicate a moderate level of importance in terms of hydrofunctionality, although socio-cultural service provision is deemed moderately low due to the ephemeral nature of the streams.	Business case, Conclusion and Mitigation Requirements: The results of the impact assessment (Sections 6 and 7 of this report) indicate that the significance of potential impacts on the freshwater resource as a result of the proposed activities is likely to be 'low', and that the significance can be further reduced to 'very low' with the strict implementation of cogent, well-developed, activity-specific mitigation measures. Recommended mitigation measures and monitoring recommendations applicable to this project are provided in Sections 6 and 9 of this report; however key mitigation measures include careful planning to prevent the placement of infrastructure within the riparian zone or active channel, minimising vegetation clearing, demarcating the riparian zone as "off-limits" to all but essential personnel and not permitting the movement of vehicles within the riparian zone or active channels, strict erosion control measures such as erosion berms, and protection of exposed soils. The delineation (Figures 12 and 13) and sensitivity maps (Figures 19 and 20) provided in this report should be consulted for guidance when planning the location of infrastructure.
REC Category	REC Category B (Largely natural with few modifications) This freshwater feature has undergone some modification resulting in marginally decreased ecological integrity. However, the system has not been significantly impacted upon and every effort should be taken to prevent any further degradation to the system as a result of the proposed activities.	
Possible significant impacts on the system	Vegetation losses or alteration due to clearing, potential risk of increased erosion as a result of soil disturbances within the active channel or close proximity thereof, possible movement of vehicles within the active channel and potential disposal of waste materials within the riparian zone or active channel.	

Table 4: Summary of results of the assessment of the tributaries associated with the Riet River.

Ecological & socio-cultural service provision graph:



Vegetation Ecostatus (VEGRAI) and PES discussion	Category B/C (Largely natural to moderately modified) There has been minimal change to the natural habitats present within the site, and therefore few changes to the natural biota from its reference state. Basic ecosystem function will be marginally altered (e.g., nutrient cycling) but these features are important to ecosystem functioning of the greater riparian system within the study area. The various tributaries of the Riet River were found to be largely natural, with few modifications to these systems relative to their reference state. Tributaries assessed were found to have undergone minor impacts such as erosion, trampling by domestic livestock, and hardening or compacting where the feature is intersected by a farm or public access road. These impacts are likely to alter flow patterns but overall may not have a significant effect on the ecological integrity of the affected systems.
Ecoservice provision	Intermediate: The ability of these resources to provide ecological services is considered to be reduced given the ephemeral nature of many portions of the tributaries. However, the Ecoservice most effectively provisioned by this system is that of biodiversity maintenance, which independently of other services is considered moderately high/high due to the relatively undisturbed status of the vegetation. The tributaries assessed drain into the larger Riet River, thereby acting

Photograph notes	Representative photographs of portions of two tributaries of the Riet River in the Rietrug study area, showing the primary stream channel which is predominantly devoid of vegetation or alternatively is sparsely vegetated. Note the relatively homogenous landscape surrounding the tributary, the rocky (top photograph) and sandy (bottom photograph) composition of the channel depending on its location in the landscape and the altered community structure of the *in-situ* vegetation.

Watercourse characteristics:

a) Hydraulic regime

Culverts and the artificial impoundment of the tributaries along particular portions of their channels will have influenced the flow pattern/hydraulic regime of the system to a minor degree. Abstraction and redirection of water for agricultural purposes is evident although is not as pronounced as within the main river. The ephemeral and episodic nature of the tributaries is also more marked than that of the main river, thus where impoundment occurs, this may have more significant impacts on up- and downstream features due to changes in the level of soil saturation. Where road crossings do occur, this may result in small changes to existing flow patterns, especially where crossings have been hardened. Where changes in the topography occur in the channel, small, localised pools may form following rain events, but these are uncommon. Overall, changes to the hydrological functioning of the system are not pronounced, with a moderately high channel competency.

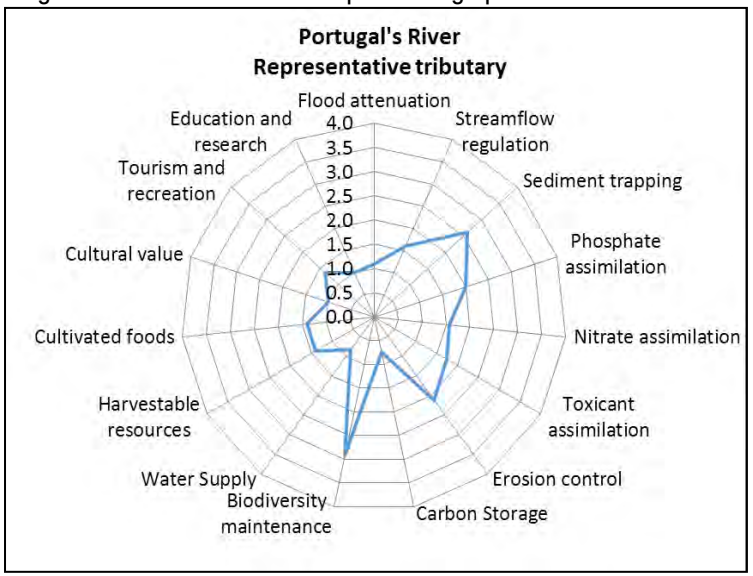
b) Water quality

For the most part, surface water within the system of tributaries was limited at the time of the study, although localised pools and regions of impoundment were encountered. A detailed assessment of water quality was not within the scope

	as ecological corridors for the movement of fauna. The ability of this resource to provide water is moderately low because of the highly seasonal nature of its surface water and is thus also the most poorly provisioned service along with carbon storage. Carbon storage is limited as soils lack capacity to store organic matter. The tributaries are considered of intermediate importance as harvestable resources and to cultivated foods as the ability to abstract water from these systems is far more limited than from the river.	of this study, however given the limited development and potential adverse modifiers, it is expected to be of relatively high quality. c) Geomorphology and sediment balance Minor erosion in the form of gullies was apparent in several areas along the course of the tributaries. Further evidence for erosion was provided in the form of unvegetated banks and a lack of vegetation within the channel, which will further exacerbate the impact of subsequent erosion. This may indicate frequent flooding events and correspond to the negligible flood attenuation capabilities provided by these features. Sediment from eroded surfaces is transported downstream, where this deposition may significantly impact local channel integrity. Trampling by livestock was observed during the assessment, which may contribute to increased sediment loads. This may have some impact given that large herbivores are uncommon in this region, although it is considered unlikely to have had a significant impact. d) Habitat and biota Vegetation along tributaries is considered largely intact and functional, providing important refugia for smaller fauna as well as being ecologically important to surrounding vegetation. Although more ephemeral in nature, the channels are inundated to a significant enough extent to alter the characteristics of *in-situ* vegetation. These tributaries are also important as they serve as connections between the primary river and the greater landscape, thus functioning as migratory corridors for a number of sensitive species in the area. Invasion by exotic species was found to be negligible, likely due to the episodic nature of available surface water. The most significant disturbance to vegetation in these systems is likely in the form of erosion where incision of channels prevents effective rooting of plants, or alternatively they fail to establish for any length of time.
EIS discussion	EIS Category: A (Ecologically important and sensitive) As with the Riet River, the tributaries are considered to be ecologically important in terms of biodiversity maintenance. Furthermore, it is the opinion of the specialist that these tributaries are of ecological importance as they occur in relatively undisturbed areas and contribute to the functioning of the greater riparian area located within the study site.	
REC Category	REC Category B (Largely natural with few modifications) These freshwater features have undergone some modification resulting in marginally decreased ecological integrity. However, the system has not been significantly impacted upon and every effort should be taken to prevent any further degradation to the system as a result of the proposed activities.	
Possible significant impacts on the system	Vegetation losses or alteration due to clearing, potential risk of increased erosion as a result of soil disturbances within the active channel or close proximity thereof, possible movement of vehicles within the active channel and potential disposal of waste materials within the riparian zone or active channel.	Business case, Conclusion and Mitigation Requirements: The results of the impact assessment (Sections 6 and 7 of this report) indicate that the significance of potential impacts on the freshwater resources as a result of the proposed activities is likely to be 'low', and that the significance can be further reduced to 'very low' with the strict implementation of cogent, well-developed, activity-specific mitigation measures. The delineation (Figures 12 and 13) and sensitivity maps (Figures 19 and 20) provided in this report should be consulted for guidance when planning the location of infrastructure. This is particularly important in terms of identifying the smaller tributaries of the Riet River, since the ephemeral nature of these features makes them difficult to identify in the field. Recommended mitigation measures and monitoring recommendations applicable to this project are provided in Sections 6 and 9 of this report; however key mitigation measures include careful planning to prevent the placement of infrastructure within the riparian zones or active channel, minimising vegetation clearing, demarcating the riparian zone as "off-limits" to all but essential personnel and not permitting the movement of vehicles within the riparian zone or active channels, and strict erosion control measures such as erosion berms, and protection of exposed soils.

Table 5: Summary of results of the assessment of the tributaries associated with the Portugal's River.

Ecological & socio-cultural service provision graph:



Vegetation Ecostatus (VEGRA) and PES discussion	REC Category: B/C (Largely natural to moderately modified) There has been minimal change to the natural habitats present within the site, and therefore few changes to the natural biota from its reference state. Some basic ecosystem functions may be marginally altered (e.g., nutrient cycling) but these features are important to ecosystem functioning of the greater riparian system within the study area. Tributaries of the Portugal's River traversing the study site were found to have undergone relatively minor modifications and hence are considered to be in largely natural condition. Minor impacts in the form of erosion, catchment hardening (culverts and roads), artificial impoundment and the building of swales will have influenced flow patterns but are not expected to have significantly altered the ecological integrity of the system.
Ecoservice provision	Intermediate: As in the Riet river tributaries, the ability of the tributaries of the Portugals river to provide ecological services is considered reduced given the ephemeral nature of many portions of these resources. However, the Ecoservice most effectively provisioned by this system is that of biodiversity maintenance, which independently of other services is considered moderately high/high due to the relatively undisturbed status of the vegetation. The tributaries assessed drain into the larger Portugals river (not within the extent of this study site),

Photograph notes	Representative photographs of a tributary of the Portugals River located within the Rietrug study area. The freshwater feature is composed predominantly of hydrophilic herbaceous vegetation, including a number of species of grass and sedges (such as *Scirpoides dioecus*- an obligate wetland plant).

Watercourse characteristics:

a) Hydraulic regime

Culverts and the artificial impoundment of the tributaries for abstraction of water for agricultural purposes have influenced the hydraulic regime of this system of tributaries. Furthermore, road crossings (a form of hardening) as well as the presence of artificial swales (formed during impoundment) have changed flow patterns, albeit at only a few sites along the course of the channel. As is common for watercourses in the region, these tributaries may be highly ephemeral at certain points, and only where topography allows may small pools form. The high evaporative potential of the region further exacerbates the already limited supply of surface water. The channel is characterised as having a greater number of inundated sites, in comparison to the tributaries of the Riet River. This may be an artefact of impoundment and is difficult to determine given the season in which the study was undertaken. Despite these impacts, channel competency is moderately high and in certain places in a better state than the tributaries of the Riet River.

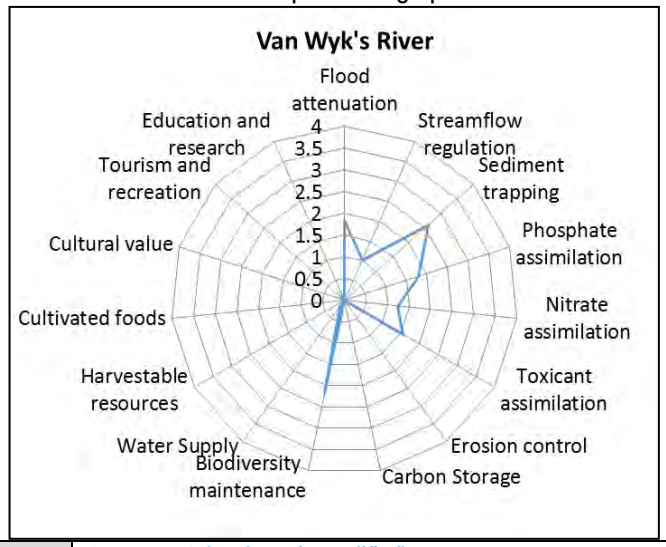
b) Water quality

For the most part, surface water within the system of tributaries was limited at the time of the study (with the season's first rains only beginning to fall during the assessment), although localised pools and regions of impoundment (artificial farm dams) were encountered along sections of some channels. A detailed assessment of water quality was not within the scope of this study, however given limited development in the area and the consequent lack of significant adverse modifiers, it is expected to be of relatively high quality.

	thereby acting as ecological corridors for the movement of aquatic biota. The ability of this resource to provide water is moderately low (an Ecoservice score of 0.8) due to the highly seasonal nature of its surface water and is thus also the most poorly provisioned service along with carbon storage. Carbon storage is limited as soils in the region lack the capacity to store organic matter. It is the opinion of the ecologist, that while the overall ecoservices score is low, the individual scores of certain components is high and these services are thus well provisioned by the system, especially in terms of biodiversity maintenance, sediment trapping and erosion control. The greater extent to which this tributary is vegetated than the comparable Riet river tributaries, enhanced the ability of the system to control erosion.	c) Geomorphology and sediment balance The most significant modifier to the geomorphological integrity was in the form of erosion gullies, which were found to be present at multiple locations along the length of various channels. The sandy soils contribute to the erosion potential of the system, however, given the large extent of this tributary system, the cumulative effect of these erosion gullies is not deemed severe. As evident in the pictures above, many locations along the tributary are characterised by dense vegetation, whose roots play a key role in binding soil, and thereby preventing erosion. Sites which lack dense vegetation are likely more ephemeral in nature and lack persistent vegetation due to periodic flooding which then exacerbates channel incision. Sediment from eroded surfaces (erosion gullies, exacerbated by animal trampling) may then be transported downstream, reducing channel integrity. The limited impoundment of sections of the tributary will also have altered the geomorphology of the system, especially those that are upstream. d) Habitat and biota Vegetation along tributaries is considered largely intact and functional, and provides important habitat for a number of faunal species. Given the higher number of saturated sites along the tributary (despite being largely ephemeral), the vegetation present is generally of a more hydrophilic habit than is the vegetation in the drier tributaries of the Riet river. These tributaries serve as important corridors to the movement of wildlife, and offer valuable breeding and foraging sites for fauna in the region. Invasion by exotic species and crop cultivation was observed to be inconsequential, and it is the opinion of the ecologist that it is of great importance that the tributary remains in this state, largely as a great number of riparian systems in the Greater Cape region are inundated by invasive species. The most significant modifier to vegetation in this system is the presence of eroded areas, which prevent the establishment of vegetation or reduce community diversity by exposing plant roots or through the deposition of sediment onto vegetated areas.
EIS discussion	EIS Category: A (Ecologically important and sensitive) The tributaries are considered to be ecologically important and biota may be sensitive to flow and habitat modifications. Furthermore, it is the opinion of the ecologist that these tributaries are of ecological importance as they occur in relatively undisturbed areas and contribute to the functioning of the greater riparian area located within the study site.	
REC Category	REC Category: B (Largely natural with few modifications) This freshwater feature has undergone some modification resulting in marginally decreased ecological integrity. However, the system has not been significantly impacted upon and every effort should be taken to prevent any further degradation to the system as a result of the proposed activities.	
Possible significant impacts on the system	Vegetation losses or alteration due to clearing, potential risk of increased erosion as a result of soil disturbances within the active channel or close proximity thereof, possible movement of vehicles within the active channel and potential disposal of waste materials within the riparian zone or active channel.	Business case, Conclusion and Mitigation Requirements: The results of the impact assessment (Sections 6 and 7 of this report) indicate that the significance of potential impacts on the freshwater resources as a result of the proposed activities is likely to be 'low', and that the significance can be further reduced to 'very low' with the strict implementation of cogent, well-developed, activity-specific mitigation measures. The delineation (Figures 12 and 13) and sensitivity maps (Figures 19 and 20) provided in this report should be consulted for guidance when planning the location of infrastructure. This is particularly important in terms of identifying the smaller tributaries of the Portugals River, since the ephemeral nature of some of these features makes them difficult to identify in the field. Recommended mitigation measures and monitoring recommendations applicable to this project are provided in Sections 6 and 9 of this report; however key mitigation measures include careful planning to prevent the placement of infrastructure within the riparian zones or active channel, minimising vegetation clearing, demarcating the riparian zone as "off-limits" to all but essential personnel and not permitting the movement of vehicles within the riparian zone or active channels, and strict erosion control measures such as erosion berms, and protection of exposed soils.

Table 6: Summary of results of the assessment of Vanwyks River.

Ecological & socio-cultural service provision graph:



Vegetation Ecostatus (VEGRAI) and PES discussion	Category: C (Moderately modified) The Vanwyks River is an ephemeral system, with a large portion of the system falling within the valley of the surrounding mountains, where there are likely to be minimal anthropogenic impacts. The system was observed to have little surrounding vegetation, due to the nature of the semi-arid environment, although some clearing has occurred to allow for the construction of informal farm roads through the river. Overgrazing by domestic livestock was also observed and is likely to have contributed to altered vegetation communities. Embankments of the system were visibly eroded and informal farm roads and fences were identified crossing the system, which may have impacted the hydrological regime marginally when surface water is present, in terms of hardened surfaces (causing increased water velocity and thus exacerbating bank incision) and potentially causing blockages, particularly if debris is caught up in the fences.
Ecoservice provision	Moderately low The Vanwyks River plays an intermediate role in flood attenuation, a moderately low role in streamflow regulation, and a moderately high role in sediment trapping. Although the system obtained an intermediate score in phosphate, nitrate and toxicant assimilation it should be noted that the system is ephemeral, with water available only during high rainfall/melting of snow from the surrounding plateau, and therefore the opportunity to provide these services is limited. Biodiversity maintenance is considered moderately high due to the connectivity of the resource to other natural features in the landscape, the anticipated good quality of water (when available) and the

Photograph notes	The Vanwyks River is an ephemeral system, and no surface water was present at the time of the assessment. No obligate or facultative wetland vegetation present, however Acacia species as well as other smaller terrestrial vegetation were observed surrounding the watercourse. Informal farm roads and fences were identified crossing the Vanwyks River.

Watercourse characteristics:

a) Hydraulic regime

The Vanwyks River is considered to be an ephemeral system, with water only flowing in the system during high rainfall events, and would be highly likely to convey water from melting snow within the upper plateau region, near Sutherland. Informal farm roads and fences traversing the system may contribute to altered hydrological patterns as referred to in the PES discussion.

b) Water quality

No water was present within the system during the site visit, however, due the relatively undeveloped surrounding area and the melting of snow from the upper plateau region it is anticipated that the water quality is likely to be relatively unimpaired.

c) Geomorphology and sediment balance

The Vanwyks River falls within the semi-arid Karoo region, mainly within the valley of the surrounding plateau, where water is scarce and the extreme temperatures and wind within the region has resulted in active erosion within the system, eroded likely due to vegetation fires, which have the effect of reducing soil anchorage, and potentially contributing to flash flooding within the system. Minimal anthropogenic impacts were encountered and the system flows within a valley that has restricted access, thereby further reducing anthropogenic impacts.

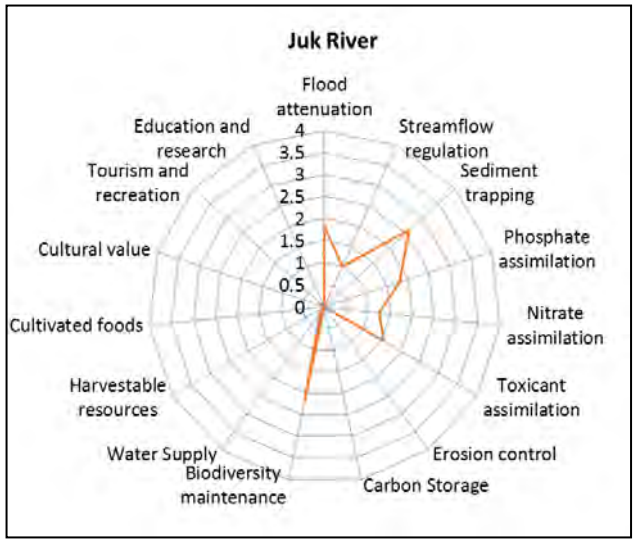
d) Habitat and biota

Due to the nature of a semi-arid environment, no facultative vegetation was observed, however, a unique assemblage of vegetation communities is present. *Acacia* species and other smaller terrestrial forbs and shrubs were observed growing within the system, providing roosting and breeding habitat for avifaunal species as well as foraging and protective cover for smaller faunal species. Eroded

	habitat provision for burrowing avifaunal species which utilise the incised river banks. No provision of water for human use, recreational provision or provision of cultivated foods were identified in the Vanwyks River.	embankments were observed to provide additional burrowing and nesting sites. Due to the undisturbed environment within the valley that the Vanwyks River flows, the system is considered to be an important corridor for faunal movement as well as a water source for faunal and floral species during rainfall events and when snow within the plateau melts.
EIS discussion	EIS Category: B (Moderate EIS) The Vanwyks River is considered to be ecologically important and sensitive, however, the biodiversity of this system is not considered to be sensitive to flow and habitat modifications due to the ephemeral nature of the system. The Vanwyks River plays a small role in moderating the quantity and quality of water flowing into the Dwyka River, located approximately 6 km south-east of the study area. The Vanwyks River is considered to be of low hydro-functional importance and has no direct human benefits due to the ephemeral nature of the system.	
REC Category	REC Category: C (Moderately modified) The Van Wyk's River has undergone some modification resulting in marginally decreased ecological integrity. However, the system has not been significantly impacted upon and every effort should be taken to prevent any further degradation to the system as a result of the proposed activities.	
Possible significant impacts on the system	Further vegetation losses or alteration due to clearing, potential risk of increased erosion as a result of soil disturbances within the active channel or close proximity thereof, possible movement of vehicles within the active channel and potential disposal of waste materials within the riparian zone or active channel.	Business case, Conclusion and Mitigation Requirements: The results of the impact assessment (Sections 6 and 7 of this report) indicate that the significance of potential impacts on the freshwater resource as a result of the proposed activities is likely to be 'low', and that the significance can be further reduced to 'very low' with the strict implementation of cogent, well-developed, activity-specific mitigation measures. Recommended mitigation measures and monitoring recommendations applicable to this project are provided in Sections 6 and 9 of this report; however key mitigation measures include careful planning to prevent the placement of infrastructure within the riparian zone or active channel, minimising vegetation clearing, demarcating the riparian zone as "off-limits" to all but essential personnel and not permitting the movement of vehicles within the riparian zone or active channels, and strict erosion control measures such as erosion berms, and protection of exposed soils. The delineation (Figures 12 and 13) and sensitivity (Figures 19 and 20) maps provided in this report should be consulted for guidance when planning the location of infrastructure.

Table 7: Summary of results of the assessment of the Juk River.

Ecological & socio-cultural service provision graph:



Vegetation Ecostatus (VEGRAI) and PES discussion	Category: C (Moderately modified) The riparian vegetation component of the Juk River is very similar in species composition and community structure to the Van Wyk's River, for similar reasons. Overgrazing by domestic livestock was observed at the assessment site. As with the Van Wyk's River, bank incision was observed within portions of the Juk River, but not deemed to be as significant as that within the Van Wyk's River. Informal farm roads and fences were identified traversing the system, thus potentially altering hydrological patterns when surface water is present.
Ecoservice provision	Moderately low The Juk River plays an intermediate role in flood attenuation, a moderately low role in streamflow regulation, and a moderately high role in sediment trapping. Although the system scored an intermediate role in phosphate, nitrate and toxicant assimilation it should be noted that, as with the Van Wyk's River, opportunity to provide these ecological functions is limited as a result of the ephemeral nature of the system. Biodiversity maintenance is considered moderately high due to the connectivity of the resource to other natural features in the landscape, the anticipated good quality of water (when available) and the habitat provision for burrowing avifaunal species which utilise the incised river banks. No recreational properties or provision of cultivated foods were identified in the Juk River.

Photograph notes	The Juk River is ephemeral and no surface water was present at the time of the site visit. No obligate or facultative wetland vegetation present, only Acacia species surrounding the watercourse. Various informal farm roads and fences were identified crossing the Juk River (image on the right).

Watercourse characteristics:

a) Hydraulic regime

The Juk River is considered to be a highly ephemeral system, with water only flowing in the system during a high rain event or when snow from the upper plateau region, near Sutherland, melts. The Juk River confluences with the Dwyka River to the south east of the study area.

b) Water quality

No water was present within the system during the site assessment, however, due the relatively undeveloped surrounding area and the melting of snow from the upper plateau region it is anticipated that the water quality is relatively unimpaired.

c) Geomorphology and sediment balance

The Juk River falls within the semi-arid Karoo region where water is scarce and the extreme temperatures and wind within the region has resulted in active erosion within the system, eroded likely due to vegetation fires, which have the effect of reducing soil anchorage as well as flash flooding within the system. Minimal anthropogenic impacts were encountered, with farmers utilizing the surrounding land for cattle and sheep grazing.

d) Habitat and biota

Due to the nature of a semi-arid environment, little natural vegetation was available surrounding the system, with no facultative vegetation present. *Acacia* species were observed to grow readily around the system, providing roosting and breeding habitat for avifaunal species

EIS discussion	EIS Category: B (Moderate EIS) The Juk River is considered to be ecologically important and sensitive, however, the biodiversity of this system is not considered to be sensitive to flow and habitat modifications due to the ephemeral nature of the system. The Juk River plays a small role in moderating the quantity and quality of water flowing into the Dwyka River, located approximately 6 km south-east of the study area. The Juk River is considered to be of low hydro-functional importance and has no direct human benefits due to the highly ephemeral nature of the system.	as well as a food source and protective cover for smaller faunal species. Eroded embankments were observed to provide additional burrowing and nesting sites making the Juk River a likely faunal movement corridor.
REC Category	REC Category: C (Moderately modified) The Juk River has undergone some modification, primarily to the vegetation community, resulting in marginally decreased ecological integrity. However, the system has not been significantly impacted upon and every effort should be taken to prevent any further degradation to the system as a result of the proposed activities.	
Possible significant Impacts on the system	Further vegetation losses or alteration due to clearing, potential risk of increased erosion as a result of soil disturbances within the active channel or close proximity thereof, possible movement of vehicles within the active channel and potential disposal of waste materials within the riparian zone or active channel.	Business case, Conclusion and Mitigation Requirements: The results of the impact assessment (Sections 6 and 7 of this report) indicate that the significance of potential impacts on the freshwater resource as a result of the proposed activities is likely to be 'low', and that the significance can be further reduced to 'very low' with the strict implementation of cogent, well-developed, activity-specific mitigation measures. Recommended mitigation measures and monitoring recommendations applicable to this project are provided in Sections 6 and 9 of this report; however key mitigation measures include careful planning to prevent the placement of infrastructure within the riparian zone or active channel, minimising vegetation clearing, demarcating the riparian zone as "off-limits" to all but essential personnel and not permitting the movement of vehicles within the riparian zone or active channels, and strict erosion control measures such as erosion berms, and protection of exposed soils. The delineation (Figures 12 and 13) and sensitivity (Figures 19 and 20) maps provided in this report should be consulted for guidance when planning the location of infrastructure.

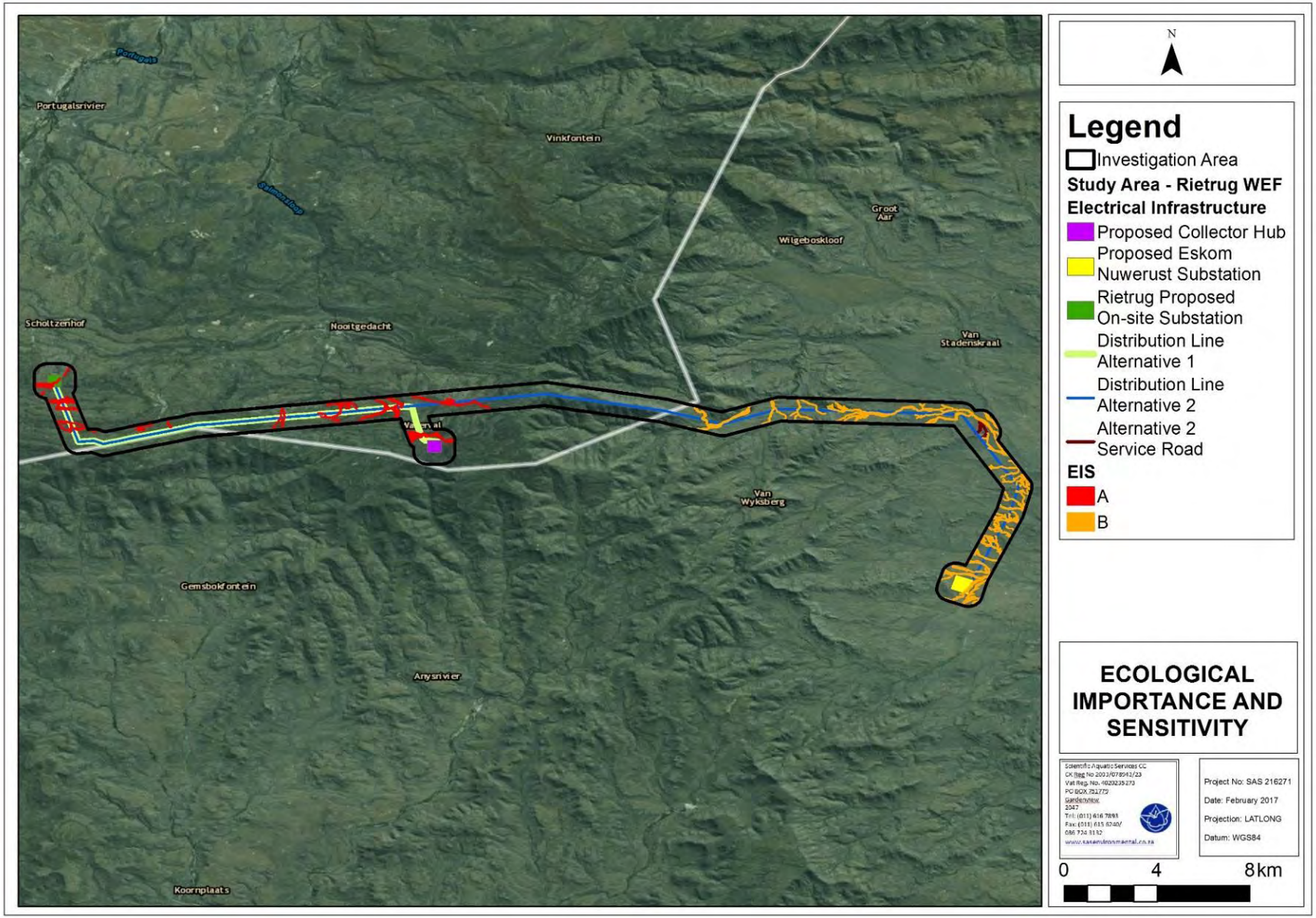


Figure 14: Conceptual illustration of the EIS categories of the freshwater resources associated with the study area.

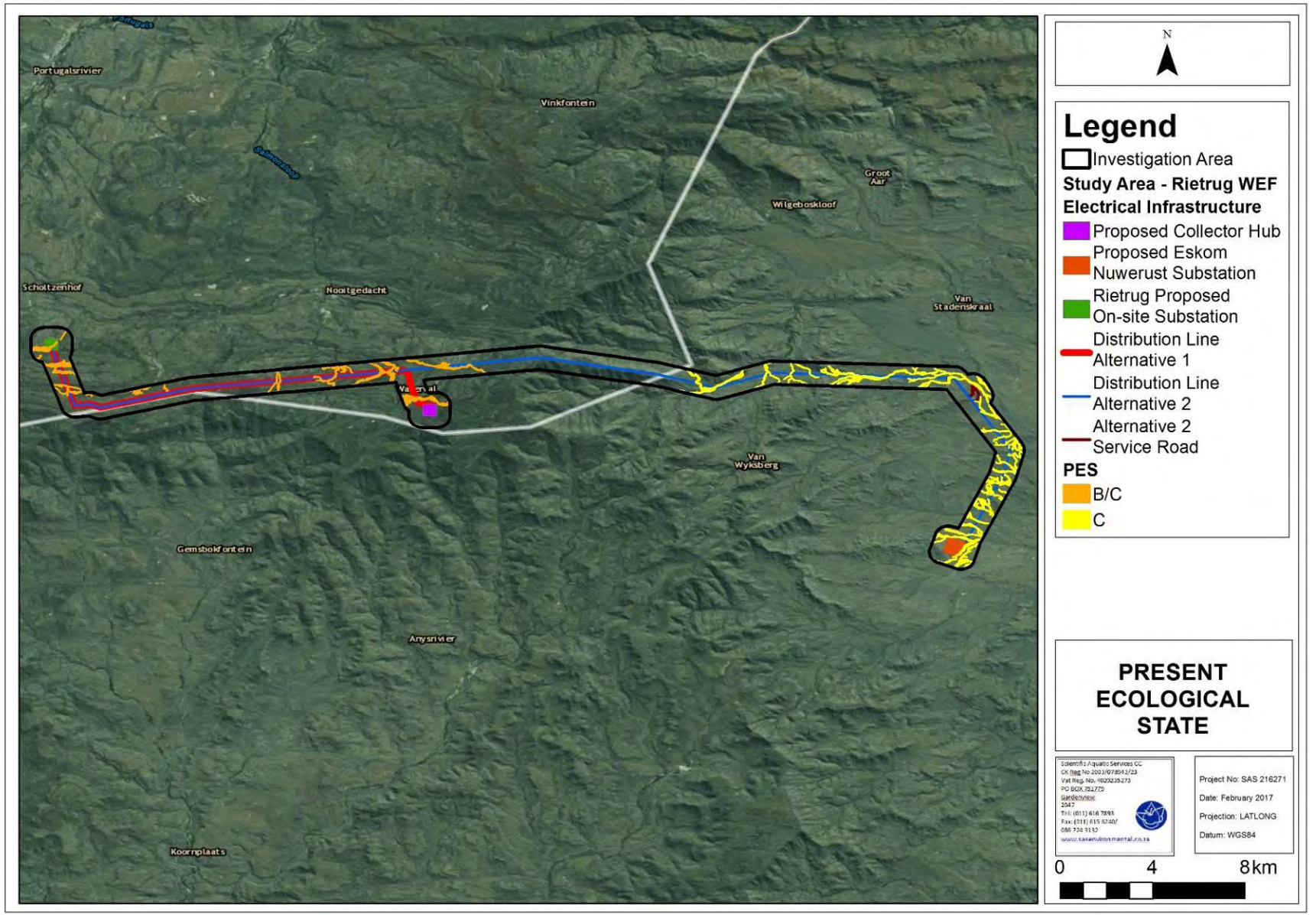


Figure 15: Conceptual illustration of the PES categories of the freshwater resources associated with the study area.

4.3.4 Delineation and Sensitivity Mapping

Prior to the site visit, points of interest were identified during the desktop phase of the study, and verified during the field survey according to the guidelines advocated by DWAF (2005 and 2008). The freshwater resource delineations as presented in this report are regarded as a best estimate of the temporary or riparian zone boundaries (as applicable) based on the site conditions present at the time; however, use was made of historical and current digital satellite imagery to further aid in the delineation of the freshwater resources.

During the assessment, the following indicators were used to ascertain the boundaries of the freshwater resources:

- Terrain units were used to determine in which parts of the landscape freshwater resources would most likely occur in;
- The presence of alluvial soils was used as an indication of where and how water would flow across a landscape (Figure 16). The deposition of alluvial soils within channels/gullies was used to identify possible watercourses; and
- The vegetation indicator was used where possible in the identification of the riparian boundary through the identification of the distribution of both facultative and obligate wetland vegetation associated with soils that are frequently saturated. Key species utilised included *Scirpoides dioecus* and *Schoenoplectus sp* (Figure 17). Changes in vegetation density and levels of greening were also considered during the delineation process, particularly in instances where ephemeral drainage lines were identified.

Figure 16: Representative photographs of evidence of alluvial soils present within smaller tributaries and ephemeral drainage lines.

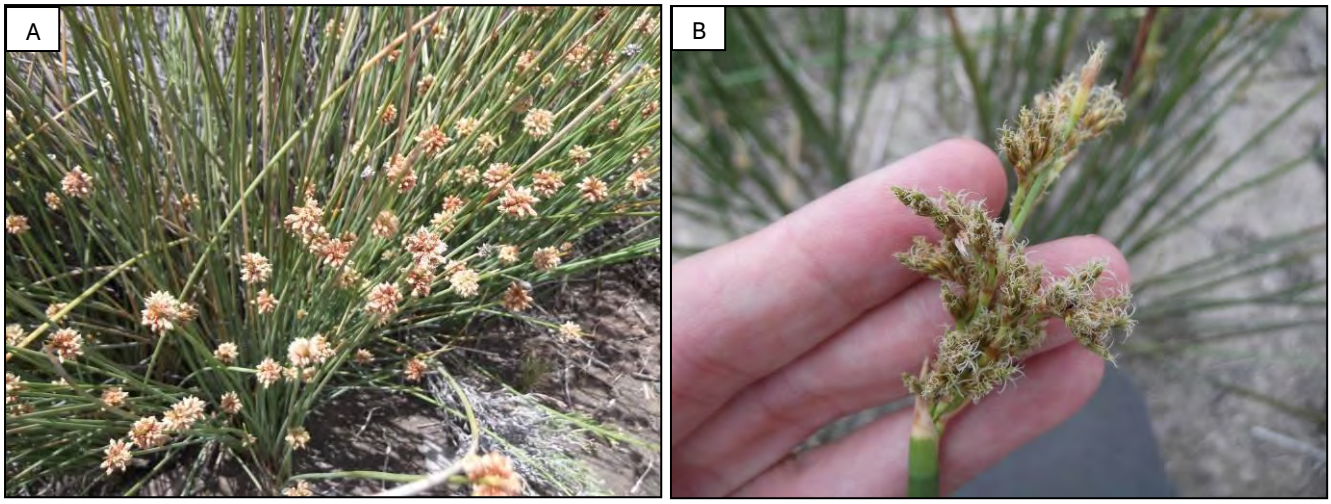


Figure 17: Representative photographs of some of the floral species associated with the riparian and drainage features identified within the study area (A: *Scirpoides dioecus*; B: *Schoenoplectus sp.*)

5 Issues, Risks and Impacts

5.1 Summary of Issues identified during the Project Notification Phase

No specific issues pertaining to the potential impacts of the proposed project on the freshwater resources were received from Interested and Affected Parties (I&APs) during the project notification phase.

According to CapeNature's "Requirements for providing comments on Agricultural, Environmental, Mining, Planning and Water Use related Applications" document of 2016, CapeNature considers rivers and wetlands as biodiversity "red flags" and as such, does not support activities which may negatively impact on freshwater resources. According to this document, "*appropriate buffers must be determined by a suitably qualified specialist to avoid impacting on these habitats and particular attention should be paid to avoiding the loss of intact habitat, maximizing connectivity at a landscape scale, maximizing habitat heterogeneity and reducing fragmentation at a local and regional scale*" (author's italics). As discussed in Section 8 of this report, the necessary legislative requirements in terms of NEMA and Regulation 509 (2016) of the NWA have been taken into consideration, and a 32m zone of regulation in terms of NEMA has been applied (please refer to Section 8).

Furthermore, potential issues arising from the proposed project and relating to freshwater resources have been identified by the freshwater specialist and mitigation measures developed to address these issues. The identified issues include:

- Site clearing and the removal of vegetation associated with the freshwater habitats;
- Site clearing and the disturbance of soils leading to alien and invasive floral species proliferation;
- Compaction of soils due to construction activities;
- Movement of construction vehicles as well as service road construction within the freshwater resource zones;
- Topsoil stockpiling adjacent to the freshwater resources and runoff from stockpiles leading to sedimentation of the system;
- Dumping of waste and construction material within freshwater resources;
- Loss of phosphate, nitrate assimilation and toxicant removal abilities due to vegetation clearing;
- Streamflow diversion and draining water from the freshwater resources resulting in the alteration of hydrological zones;

- Potential risk of contaminated runoff from the service roads associated with the proposed development, leading to pollution of surface water;
- Disturbance of soils and on-going erosion as part of maintenance activities;
- Ineffective rehabilitation may lead to habitat transformation and alien vegetation encroachment;
- Insufficient aftercare and maintenance of disturbed areas, leading to ongoing erosion, gully formation and increased sedimentation due to poor management;
- Increased water runoff into wetland areas due to unvegetated areas overlooked after construction;
- Vegetation trampling during maintenance activities; and
- Indiscriminate movement of vehicles and equipment within the freshwater resource areas during routine maintenance activities, resulting in soil compaction.

5.2 Identification of Potential Impacts/Risks

The key issues identified in Section 5.1 above may potentially impact on four aspects of freshwater system functioning and integrity, namely:

- Loss of habitat and ecological structure;
- Changes to ecological and sociocultural service provision;
- Hydrological function and sediment balance; and
- Impacts on water quality.

These four impacts may occur throughout all phases of the proposed development.

6 Impact Assessment

Due to the similarity of the perceived impacts, as well as the largely similar sensitivities of the freshwater resources associated with the study area, the impact assessment was undertaken once for both Alternative 1 and Alternative 2 of the proposed distribution line and connection to the third party substations, the service roads associated with the proposed development, and the proposed on-site substation and link to the third party substation. The perceived impacts, significance thereof, impact ratings and mitigation measures are the same for both alternatives.

As noted above, four aspects of riparian ecology are considered when assessing the impacts of the proposed electrical infrastructure and service roads associated with the proposed Rietrug WEF: loss of habitat and ecological structure, changes to ecological and sociocultural service provision, hydrological function and sediment balance, and impacts on water quality.

Riverine systems and particularly ephemeral riverine systems (such as all those found within the study area) or river systems that have very low flows as part of their annual hydrological cycles are particularly susceptible to changes in habitat condition. The Riet River, its associated tributaries, and the eastern tributaries of the Portugal's River, are all considered to be of increased EIS, and provide several important ecological functions. At present, the riparian resources within the study area are not considered to have been significantly impacted by previous and current activities within the vicinity of each resource. Whilst the construction of the distribution line and its associated infrastructure is considered to be a low-impact significance activity (before the implementation of mitigation measures), it is deemed important that the riparian habitats, and in particular those associated with the Riet River, are protected and that the proposed development does not impact in a significantly detrimental manner on the riparian habitat. In this regard, special mention is made of the need to ensure that careful planning of the placement of the monopoles takes place in order to minimise the risk of placing infrastructure unnecessarily within riparian zones. Wherever possible, it is highly recommended that the linear development spans the relevant watercourse, and every effort should be made to prevent placement

of monopoles within the riparian zone or associated 32m zone of regulation. If this is not avoidable, the monopoles should be placed as far from the active channel of the watercourse as possible.

The following tables serve as a summary description of the various activities and potential impacts associated with the various phases of the proposed Rietrug WEF Electrical Grid Infrastructure development within the study area. Please refer to Section 7 of this Specialist Report for the full impact assessment tables.

6.1 Potential Impacts during the Construction Phase

Aspect/Activity	• Site clearing and the removal of vegetation associated with the freshwater habitats • Site clearing and the disturbance of soils leading to alien and invasive floral species proliferation • Compaction of soils due to construction activities • Movement of construction vehicles as well as service road construction within the freshwater resource zones • Topsoil stockpiling adjacent to the freshwater resources and runoff from stockpiles leading to sedimentation of the system • Dumping of waste and construction material within freshwater resources • Loss of phosphate, nitrate and toxicant removal abilities due to vegetation clearing • Streamflow diversion and draining water from the freshwater resources resulting in the alteration of hydrological zones • Potential risk of contaminated runoff from the access roads associated with the proposed development, leading to pollution of surface water
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality
Status	Negative
Mitigation Required	• Careful planning of the placement of monopoles, taking into consideration the locality of riparian habitats and as much as possible, avoid placement of monopoles within riparian habitat, and powerlines are preferably to span the relevant resource. If at all possible, all monopoles should be developed above the applicable zone of regulation in terms of GN509 of the NWA. • Careful planning of the location of the substations. The applicable zone of regulation around the freshwater resources in terms of NEMA is 32m, and this must be adhered to, in order to assist in minimising impacts on the freshwater resources in close proximity to the proposed substations. Please refer to the figures in Section 8 of this report for the locality of the freshwater resources, and the applicable zone of regulation;

	• Where it is impossible to avoid placing infrastructure within riparian habitat, flow connectivity must be retained by preventing fragmentation of the riparian habitat. Fragmentation of the riparian habitat can be avoided by (for example) ensuring that the disturbance footprint remains as small as possible, that no solid strips are excavated within the riparian habitat, that structures (such as culverts or monopoles) placed within the active channel do not cause increased turbulence, which will result in erosion. It must also be ensured that no canalization or incision of the riparian resource takes place as a result of the construction activities. • Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize construction footprints and edge effects of construction activities. • Clearing of vegetation at all impact sites must be kept to an absolute minimum, and growth of indigenous vegetation must be promoted to protect soils. • Implement alien vegetation control program. • Construction activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function. • Use construction techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted for guidance in this regard. • Limit excavations to ensure that drainage patterns return to normal after construction. • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must be implemented on site and adequate waste disposal facilities must be provided. • Rehabilitate disturbed areas following completion of construction activities through reprofiling and revegetation. • Desilt the freshwater resource areas affected by construction activities in the vicinity of construction activities. Desilting should preferably be undertaken by hand, and not using heavy machinery to avoid further impacts on the freshwater resources. • Strict erosion control and soil management measures must be implemented during the construction and operational phases, particularly in areas where vegetation has been removed. • Stockpiled soil must be levelled as required during construction and post-construction to avoid sedimentation from runoff, and revegetated with indigenous vegetation. • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation following construction.

Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

6.2 Potential Impacts during the Operational Phase

Aspect/Activity	• Disturbance of soils and on-going erosion as part of maintenance activities. • Ineffective rehabilitation may lead to habitat transformation and alien vegetation encroachment. • Insufficient aftercare and maintenance of disturbed areas, leading to ongoing erosion, gully formation and increased sedimentation due to poor management. • Increased water runoff into wetland areas due to unvegetated areas overlooked after construction. • Vegetation trampling during maintenance activities. • Indiscriminate driving within the freshwater resource areas during routine maintenance activities, resulting in soil compaction.
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality
Status	Negative
Mitigation Required	• Rehabilitate areas where active erosion is identified to re-instate natural topography and hydrological conditions. • Monitor for erosion and incision within affected freshwater resources. • Implement alien vegetation control program and ensure establishment of indigenous species within areas where alien vegetation was identified. • Vehicles should not be driven indiscriminately within the freshwater resource areas during maintenance activities to prevent soil compaction, disturbances to fauna and destruction of riparian vegetation.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

6.3 Potential Impacts during the Decommissioning Phase

Aspect/Activity	• Compaction of and/or disturbances to soils due to demolition activities • Movement of heavy vehicles within the freshwater resource zones during demolition activities • Potential disposal of hazardous or non-hazardous waste and/or rubble within freshwater resources

	leading to proliferation of alien vegetation species, altered flow patterns and impacted water quality • Further removal of vegetation, particularly in the vicinity of the proposed on-site substations, impacting on the biodiversity maintenance of the freshwater environments; the overall sediment balance and the ability to control erosion • Site clearing and further removal of vegetation resulting in increased runoff which leads to erosion and alteration of the geomorphology of the freshwater resources • Inability to support biodiversity as a result of vegetation alteration, changes to water quality, increased sedimentation and alteration of natural hydrological regimes • Excavations and earthworks, leading to altered runoff patterns and altered preferential flow paths, resulting in stream bank incision, sheet erosion, and gully formation • Earthworks in the vicinity of watercourses, leading to increased runoff and erosion and increased sediment inputs, potentially smothering riparian flora and altering surface water quality • Potential risk of contaminated runoff from machinery, leading to pollution of surface water
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality
Status	Negative
Mitigation Required	• Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize decommissioning footprints and edge effects of demolition activities. • Promote indigenous vegetation growth to protect soils. • Implement alien vegetation control program. • Decommissioning activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function. • Use appropriate techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted in this regard, and these techniques should be incorporated into the EMPr and stormwater management plan. • Limit excavations to ensure that drainage patterns return to normal after decommissioning.

	• No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must be implemented on site and adequate waste disposal facilities must be provided. • Rehabilitate disturbed areas through reprofiling and revegetation concurrently with decommissioning activities. • Desilt the freshwater resource areas affected by decommissioning activities. Desilting should preferably be undertaken by hand, and not using heavy machinery to avoid further impacts on the freshwater resources. • Stockpiled soil must be levelled during decommissioning to avoid sedimentation from runoff, and revegetated with indigenous vegetation. • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

6.4 Cumulative Impacts

As noted in Section 2.2 of this report, the following projects were considered when undertaking the cumulative impact assessment:

- Suurplaat WEF (Moyeng Energy Pty Ltd, DEA/EIA/0000137/2011 and DEA Reference: 12/12/20/1583) located approximately in the centre of the study area. It should be noted that the Suurplaat WEF project has subsequently been split. The EIA for the Moyeng Energy (PTY) Ltd Suurplaat WEF was undertaken by a separate EAP and it included a separate assessment of the three phases of the WEF, the transmission lines and substations (Savannah Environmental, 2017), however a single EIA Process was followed and a single EA was received. It is understood that Moyeng Energy (PTY) Ltd is currently undertaking an Application for EA Amendment to split the approved Moyeng Energy (PTY) Ltd Suurplaat WEF EIA project into four separate EAs (DEA Reference Number: 12/12/20/1583/AM3).
- 140 MW Sutherland WEF, near Sutherland, Northern and Western Cape (South Africa Mainstream Renewable Power Developments (Pty) Ltd, NEAS No. unknown and DEA Reference: 12/12/20/1782/2);
- 140 MW Sutherland 2 WEF, near Sutherland, Northern Cape (South Africa Mainstream Renewable Power Developments (Pty) Ltd, NEAS No. unknown and DEA Reference: 12/12/20/1782/3);
- 140 MW Rietrug WEF, near Sutherland, Northern Cape (South Africa Mainstream Renewable Power Developments (Pty) Ltd, NEAS No. unknown and DEA Reference: 12/12/20/1782/1);
- Basic Assessment for the Proposed Construction of Electrical Grid Infrastructure to support the Sutherland 2 WEF, Northern and Western Cape Provinces (Sutherland 2 WEF – Electrical Grid Infrastructure); and
- Basic Assessment for the Proposed Construction of Electrical Grid Infrastructure to support the Sutherland WEF, Northern and Western Cape Provinces (Sutherland WEF – Electrical Grid Infrastructure).

The proposed Komsberg East and Komsberg West WEFs[4] (and their associated grid infrastructure) were identified adjacent to the study area and were therefore considered during the cumulative impact

[4] Draft Environmental Impact Assessment Report Volume 1: The Proposed Komsberg East Wind Energy Facility, Western Cape Province on behalf of Komsberg Wind Farms (Pty) Ltd April 2016. DEA

assessment. However, these projects are not located within the same catchment as the freshwater resources identified within the study area, and furthermore are located downgradient of the proposed Rietrug WEF project area, therefore, no cumulative impacts arising from the proposed Komsberg East and Komsberg West WEFs are deemed likely.

Please refer to Figure 18 below for the location of all identified renewable energy projects within a 50 km radius of the proposed Rietrug WEF grid infrastructure project.

Reference Number: 14/12/16/3/3/2/857 and Draft Environmental Impact Assessment Report Volume 1: The Proposed Komsberg West Wind Energy Facility, Western & Northern Cape Provinces on behalf of Komsberg Wind Farms (Pty) Ltd April 2016 DEA Reference Number: 14/12/16/3/3/2/856.

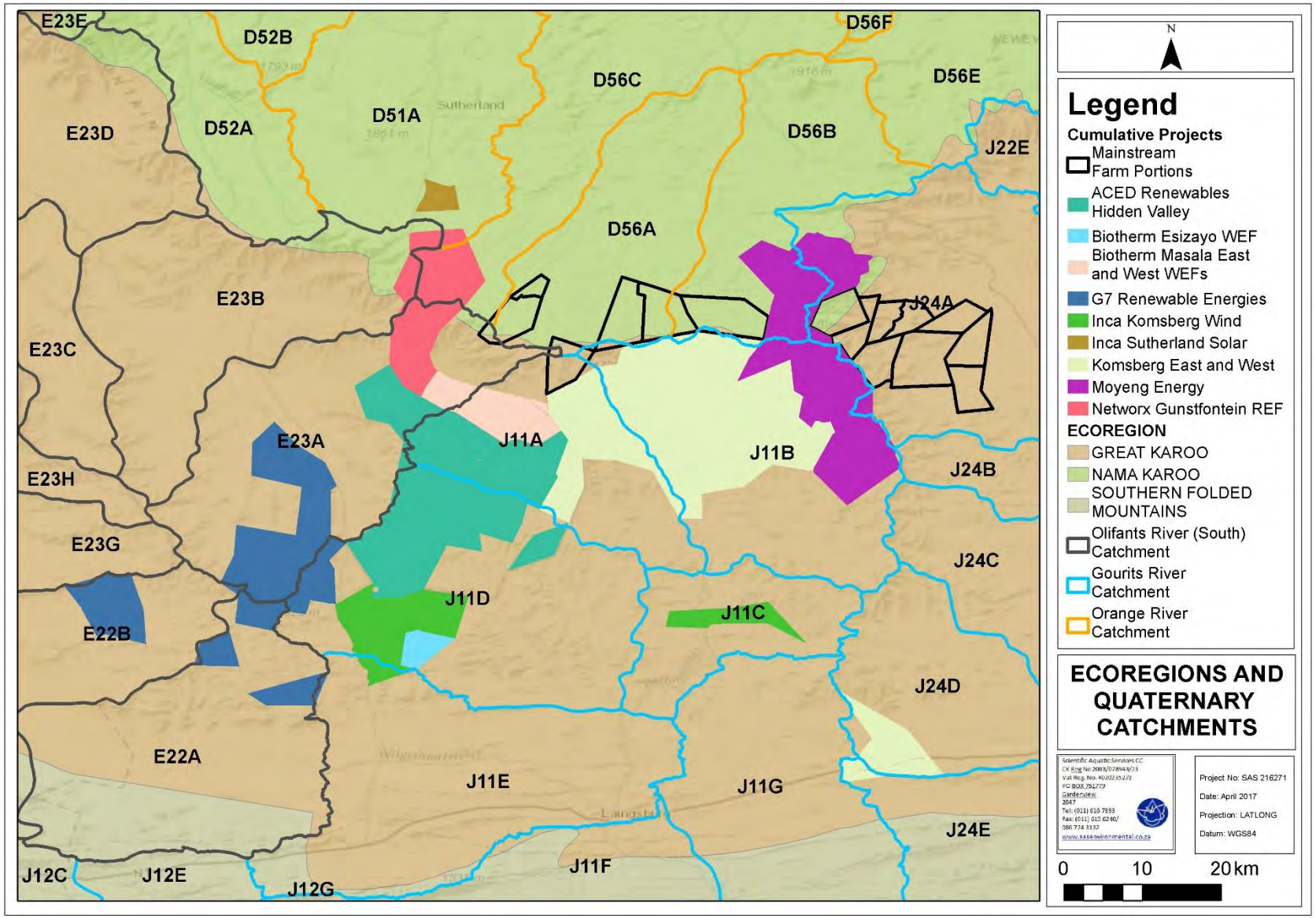


Figure 18: Conceptual depiction of the identified renewable energy projects within a 50 km radius of the proposed Rietrug WEF grid infrastructure project, in relation to the relevant quaternary catchments.

Since the potential impacts associated with the proposed projects listed above will be largely similar in nature, the cumulative impact assessment was undertaken once for all of these proposed developments. The table below summarises the impact assessment.

Aspect/Activity	<u>Construction phase impacts</u> • Site clearing and the removal of vegetation associated with the freshwater habitats • Site clearing and the disturbance of soils leading to alien and invasive floral species proliferation • Compaction of soils due to construction activities • Movement of construction vehicles as well as service road construction within the freshwater resource zones • Topsoil stockpiling adjacent to the freshwater resources and runoff from stockpiles leading to sedimentation of the system • Dumping of waste and construction material within freshwater resources • Loss of phosphate, nitrate and toxicant removal abilities due to vegetation clearing • Streamflow diversion and draining water from the freshwater resources resulting in the alteration of hydrological zones • Potential risk of contaminated runoff from the access roads associated with the proposed development, leading to pollution of surface water. <u>Operational phase impacts</u> • Disturbance of soils and on-going erosion as part of maintenance activities • Ineffective rehabilitation may lead to habitat transformation and alien vegetation encroachment • Insufficient aftercare and maintenance of disturbed areas, leading to ongoing erosion, gully formation and increased sedimentation due to poor management • Increased water runoff into wetland areas due to unvegetated areas overlooked after construction • Vegetation trampling during maintenance activities <u>Decommissioning phase impacts</u> • Indiscriminate driving within the freshwater resource areas during routine maintenance activities, resulting in soil compaction; • Compaction of and/or disturbances to soils due to demolition activities • Movement of heavy vehicles within the freshwater resource zones during demolition activities • Dumping of waste and rubble within freshwater resources leading to proliferation of alien vegetation species, altered flow patterns and impacted water quality • Further removal of vegetation, particularly in the vicinity of the proposed on-site substations, impacting on the biodiversity maintenance of the freshwater environments; the overall sediment balance and the ability to control erosion

	• Site clearing and further removal of vegetation resulting in increased runoff which leads to erosion and alteration of the geomorphology of the freshwater resources • Inability to support biodiversity as a result of vegetation alteration, changes to water quality, increased sedimentation and alteration of natural hydrological regimes • Excavations and earthworks, leading to altered runoff patterns and altered preferential flow paths, resulting in stream bank incision, sheet erosion, and gully formation • Earthworks in the vicinity of watercourses, leading to increased runoff and erosion and increased sediment inputs, potentially smothering riparian flora and altering surface water quality • Potential risk of contaminated runoff from machinery, leading to pollution of surface water • Potential disposal of hazardous and non-hazardous waste (particularly solid wastes) into the freshwater areas
Type of Impact (i.e. Impact Status)	Cumulative
Potential Impact	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality
Status	Negative
Mitigation Required	• If required, road crossings should be minimized, and where these are unavoidable, crossings must be made at right angles to the freshwater resource. Bridge designs should prevent flow interruption, should not cause turbulent flow, and preferably span rivers, to avoid placement of support structures within active channels. • Placement of substations must not be permitted within the 32m zone of regulation in terms of NEMA. • Where it is impossible to avoid placing infrastructure within riparian habitat, flow connectivity must be retained by preventing fragmentation of the riparian habitat (please refer to Section 6.1 for examples of how to minimise habitat fragmentation), and it must be ensured that no canalization or incision of the riparian resource takes place as a result of the construction activities. • Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize construction footprints and edge effects of construction activities. Apply the same during the decommissioning phase. • Promote indigenous vegetation growth to protect soils.

	• Implement alien vegetation control program. • Construction and decommissioning activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function. • Limit excavations to ensure that drainage patterns return to normal after construction and decommissioning. • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must be implemented on site and adequate waste disposal facilities must be provided. • Rehabilitate disturbed areas following completion of construction activities through reprofiling and revegetation. • Desilt the freshwater resource areas affected by construction and demolition activities, in the vicinity of construction/demolition activities. Desilting should preferably be undertaken by hand, and not using heavy machinery to avoid further impacts on the freshwater resources. • Use construction techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted for guidance in this regard, and these techniques should be incorporated into the EMPr and stormwater management plan. • Strict erosion control and soil management measures must be implemented during the construction and operational phases, particularly in areas where vegetation has been removed. • Stockpiled soil must be levelled as required during construction and post-construction to avoid sedimentation from runoff, and revegetated with indigenous vegetation • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation following construction.
Impact Significance (Pre-Mitigation)	Low (Level 4)
Impact Significance (Post-Mitigation)	Very Low (Level 5)
I&AP Concern	No

6.4.1 Cumulative Impacts Discussion

Due to the topography of the area, it is considered very likely that several potential impacts associated with the proposed Sutherland, Sutherland 2, Rietrug and Suurplaat WEFs, as well as the proposed Sutherland and Sutherland 2 Electrical Grid Infrastructure projects on the freshwater resources associated with the proposed Rietrug project will be minimized, as the predominantly mountainous terrain will aid in containing impacts. For example, contaminated runoff from the proposed Suurplaat substation may reach the Riet River, but is highly unlikely to reach the tributaries of the Portugals' River.

Nevertheless, it is extremely important that strict enforcement of cogent, well-developed mitigation measures by all parties takes place, in order to reduce the risks of cumulative impacts on the freshwater resources in the area.

6.5 “No-go” Alternative

Should the proposed development not be authorised, no negative impact will occur on the freshwater resources within the study area.

7 Impact Assessment Tables

The assessment of impacts and recommendation of mitigation measures as discussed above is collated in the tables below. Due to the overall low direct impact significance of the proposed electrical infrastructure during the construction, operational and decommissioning phases when mitigation measures are applied, potential indirect impacts which the proposed electrical infrastructure might have on the receiving freshwater resources were therefore considered to be negligible, and were therefore not assessed in this report since they are considered to be inconsequential.

Table 8: Impact assessment summary table for the construction phase for Alternative 1 and Alternative 2.

Construction Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Site clearing and the removal of vegetation associated with the freshwater habitats • Site clearing and the disturbance of soils leading to alien and invasive floral species proliferation • Compaction of soils due to construction activities • Movement of construction vehicles as well as service road construction within the freshwater resource zones • Topsoil stockpiling adjacent to the freshwater resources and runoff from stockpiles leading to sedimentation of the system • Dumping of waste and construction material within freshwater resources • Loss of phosphate, nitrate and toxicant removal abilities due to vegetation clearing • Streamflow diversion and draining water from the freshwater resources resulting in the alteration of hydrological zones • Potential risk of contaminated runoff from the service roads associated with the proposed development, leading to pollution of surface water	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function • Potential impacts on water quality	Negative	Site Specific	Short term	Moderate	Likely	Moderate	Low	• Special mention is made of the need to ensure that careful planning of the placement of the monopoles takes place in order to minimise the risk of placing infrastructure unnecessarily within riparian zones. Wherever possible, it is highly recommended that the linear development spans the relevant watercourse, and every effort should be made to prevent placement of monopoles within the riparian zone or applicable zones of regulation in terms of NEMA and/or GN509. If this is not avoidable, the monopoles should be placed as far from the active channel of the watercourse as possible. • If at all practicable, all monopoles should be developed above the applicable zone of regulation in terms of Regulation GN509 of the NWA. • Where it is impossible to avoid placing infrastructure within riparian habitat, flow connectivity must be retained by preventing fragmentation of the riparian habitat Fragmentation of the riparian habitat can be avoided by (for example) ensuring that the disturbance footprint remains as small as possible, that no solid strips are excavated within the riparian habitat, that structures (such as culverts or monopoles) placed within the active channel do not cause increased turbulence, which will result in erosion. It must also be ensured that no canalization or incision of the riparian resource takes place as a result of the construction activities.	Low	Very Low	5	Medium

Construction Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									• Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize construction footprints and edge effects of construction activities • Clearing of vegetation at all impact sites must be kept to an absolute minimum, and growth of indigenous vegetation must be promoted to protect soils • Implement alien vegetation control program • Construction activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function • Use construction techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted for guidance in this regard. • Limit excavations to ensure that drainage patterns return to normal after construction • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must be implemented on site and adequate waste disposal facilities must be provided.				

Construction Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									• Rehabilitate disturbed areas following completion of construction activities through reprofiling and revegetation • Desilt the freshwater resource areas affected by construction activities, near construction activities. Desilting should preferably be undertaken by hand, and not using heavy machinery to avoid further impacts on the freshwater resources • Strict erosion control and soil management measures must be implemented during the construction and operational phases, particularly in areas where vegetation has been removed. • Stockpiled soil must be levelled as required during construction and post-construction to avoid sedimentation from runoff, and revegetated with indigenous vegetation • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation following completion of construction activities.				

Table 9: Impact assessment summary table for the operational phase for Alternative 1 and Alternative 2.

Operational Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Disturbance of soils and on-going erosion as part of maintenance activities • Ineffective rehabilitation may lead to habitat transformation and alien vegetation encroachment • Insufficient aftercare and maintenance of disturbed areas, leading to ongoing erosion, gully formation and increased sedimentation due to poor management • Increased water runoff into wetland areas due to unvegetated areas overlooked after construction • Vegetation trampling during maintenance activities • Indiscriminate driving within the freshwater resource areas during routine maintenance activities, resulting in soil compaction	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function • Potential impacts on water quality	Negative	Site Specific	Short term	Moderate	Likely	Moderate	Low	• Rehabilitate areas where active erosion is identified to re-instate natural topography and hydrological conditions • Monitor for erosion and incision within affected freshwater resources • Implement alien vegetation control program and ensure establishment of indigenous species within areas where alien vegetation was identified • Vehicles should not be driven indiscriminately within the freshwater resource areas during maintenance activities to prevent soil compaction, disturbances to fauna and destruction of riparian vegetation	Low	Very Low	5	Medium

Table 10: Impact assessment summary table for the decommissioning phase for Alternative 1 and Alternative 2.

Decommissioning Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Compaction of and/or disturbances to soils due to demolition activities • Movement of heavy vehicles within the freshwater resource zones during demolition activities • Dumping of waste and rubble within freshwater resources leading to proliferation of alien vegetation species, altered flow patterns and impacted water quality • Further removal of vegetation, particularly in the vicinity of the proposed on-site substations, impacting on the biodiversity maintenance of the freshwater environments; the overall sediment balance and the ability to control erosion • Site clearing and further removal of vegetation resulting in increased runoff which leads to erosion and alteration of the geomorphology of the freshwater resources • Inability to support biodiversity as a result of vegetation alteration, changes to water quality, increased sedimentation and alteration of natural hydrological regimes • Excavations and earthworks, leading to altered runoff patterns and altered preferential flow paths, resulting in stream bank	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function • Potential impacts on water quality	Negative	Site Specific	Short term	Moderate	Likely	Moderate	Low	• Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize decommissioning footprints and edge effects of decommissioning activities • Decommissioning activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function • Limit excavations to ensure that drainage patterns return to normal after decommissioning • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles	Low	Very Low	5	Medium

Decommissioning Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
incision, sheet erosion, and gully formation • Earthworks in the vicinity of watercourses, leading to increased runoff and erosion and increased sediment inputs, potentially smothering riparian flora and altering surface water quality • Potential risk of contaminated runoff from machinery, leading to pollution of surface water • Potential disposal of hazardous and non-hazardous waste (particularly solid wastes) into the freshwater areas									must be implemented on site and adequate waste disposal facilities must be provided. • Promote indigenous vegetation growth to protect soils • Implement alien vegetation control program • Rehabilitate disturbed areas through reprofiling and revegetation, concurrently with decommissioning activities. • Use appropriate techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted in this regard, and these techniques should be incorporated into the EMPr and stormwater management plan. • Desilt the freshwater resource areas affected by demolition activities. Desilting should preferably be undertaken by hand, and not using heavy machinery in order to avoid further impacts on the freshwater resources				

Decommissioning Phase												
Direct Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									• Stockpiled soil must be levelled during decommissioning to avoid sedimentation from runoff, and revegetated with indigenous vegetation • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation				

Table 11: Cumulative impact assessment summary table: construction phase for Alternative 1 and Alternative 2.

Cumulative Impacts: Construction												
Cumulative Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Site clearing and the removal of vegetation associated with the freshwater habitats • Site clearing and the disturbance of soils leading to alien and invasive floral species proliferation • Compaction of soils due to construction activities • Movement of construction vehicles as well as service road construction within the freshwater resource zones • Topsoil stockpiling adjacent to the freshwater resources and runoff from stockpiles leading to sedimentation of the system • Dumping of waste and construction material within freshwater resources • Loss of phosphate, nitrate and toxicant removal abilities due to vegetation clearing • Streamflow diversion and draining water from the freshwater resources resulting in the alteration of hydrological zones • Potential risk of contaminated runoff from the service roads associated with the proposed development, leading to pollution of surface water	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function • Potential impacts on water quality	Negative	Site	Short term	Moderate	Likely	Moderate	Low	• Placement of substations must not be permitted within the 32m zone of regulation in terms of NEMA. • If required, road crossings should be minimized, and where these are unavoidable, crossings must be made at right angles to the freshwater resource. Bridge designs should prevent flow interruption, should not cause turbulent flow, and preferably span rivers, so as to avoid placement of support structures within active channels • Where it is impossible to avoid placing infrastructure within riparian habitat, flow connectivity must be retained by preventing fragmentation of the riparian habitat, and it must be ensured that no canalization or incision of the riparian resource takes place as a result of the construction activities • Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m	Low	Very Low	5	Medium

Cumulative Impacts: Construction													
Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									NEMA zone of regulation around the identified freshwater resources; • Minimize construction footprints and edge effects of construction activities • Promote indigenous vegetation growth to protect soils • Implement alien vegetation control program • Construction activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function • Use construction techniques to support the hydrology and sediment control functions of the freshwater resource. A suitably qualified engineer should be consulted in this regard, and these techniques should be incorporated into the EMPr and stormwater management plan. • Limit excavations to ensure that drainage patterns return to normal after construction • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must be implemented on site and adequate waste disposal facilities must be provided. • Rehabilitate disturbed areas through reprofiling and revegetation				

Cumulative Impacts: Construction												
Cumulative Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
									• Desilt the freshwater resource areas affected by construction activities. Desilting should preferably be undertaken by hand and not using heavy machinery in order to avoid further impacts on the freshwater resources. • Strict erosion control and soil management measures must be implemented during the construction and operational phases, particularly in areas where vegetation has been removed. • Stockpiled soil must be levelled to avoid sedimentation from runoff, and revegetated with indigenous vegetation • Compacted soil should be ripped, reprofiled & reseeded with indigenous vegetation.				

Table 12: Cumulative impact assessment summary table: operational phase for Alternative 1 and Alternative 2.

Cumulative Impacts: Operational Phase												
Cumulative Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Disturbance of soils and on-going erosion as part of maintenance activities • Ineffective rehabilitation may lead to habitat transformation and alien vegetation encroachment • Insufficient aftercare and maintenance of disturbed areas, leading to ongoing erosion, gully formation and increased sedimentation due to poor management • Increased water runoff into wetland areas due to unvegetated areas overlooked after construction • Vegetation trampling during maintenance activities • Indiscriminate driving within the freshwater resource areas during routine maintenance activities, resulting in soil compaction	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality	Negative	Site	Short term	Moderate	Likely	Moderate	Low	• Rehabilitate areas where active erosion is identified to re-instate natural topography and hydrological conditions • Monitor for erosion and incision within affected freshwater resources • Implement alien vegetation control program and ensure establishment of indigenous species within areas where alien vegetation was identified • Vehicles should not be driven indiscriminately within the freshwater resource areas during maintenance activities to prevent soil compaction, disturbances to fauna and destruction of riparian vegetation	Low	Very Low	5	Medium

Table 13: Cumulative impact assessment summary table: decommissioning phase for Alternative 1 and Alternative 2.

Cumulative Impacts: Decommissioning Phase												
Cumulative Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
• Compaction of and/or disturbances to soils due to demolition activities • Movement of heavy vehicles within the freshwater resource zones during demolition activities • Dumping of waste and rubble within freshwater resources leading to proliferation of alien vegetation species, altered flow patterns and impacted water quality • Further removal of vegetation, particularly in the vicinity of the proposed on-site substations, impacting on the biodiversity maintenance of the freshwater environments; the overall sediment balance and the ability to control erosion • Site clearing and further removal of vegetation resulting in increased runoff which leads to erosion and alteration of the geomorphology of the freshwater resources • Inability to support biodiversity as a result of vegetation alteration, changes to water quality, increased sedimentation and alteration of natural hydrological regimes • Excavations and earthworks, leading to altered runoff patterns and altered preferential flow paths, resulting in stream bank	• Loss of freshwater habitat and ecological structure • Changes to the freshwater resource ecological and sociocultural service provision • Impacts on the freshwater resources hydrological function and sediment balance • Potential impacts on water quality	Negative	Site	Short term	Moderate	Likely	Moderate	Low	• Ensure that vegetation clearing and indiscriminate vehicle driving does not occur within demarcated sensitive areas, including the identified freshwater resources, their associated riparian zones and the applicable 32m NEMA zone of regulation. • Contractor laydown areas must not be permitted within the 32m NEMA zone of regulation around the identified freshwater resources; • Minimize demolition footprints and edge effects of decommissioning activities • Promote indigenous vegetation growth to protect soils • Implement alien vegetation control program • Decommissioning activities should occur in the low flow season/ dry season to avoid sedimentation and minimize disturbance to hydraulic function • Limit excavations to ensure that drainage patterns return to normal after decommissioning. • No disposal of waste within/in the vicinity of the freshwater resources. Correct waste management principles must	Low	Very Low	5	Medium

Cumulative Impacts: Decommissioning Phase												
Cumulative Impacts												
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
incision, sheet erosion, and gully formation • Earthworks in the vicinity of watercourses, leading to increased runoff and erosion and increased sediment inputs, potentially smothering riparian flora and altering surface water quality • Potential risk of contaminated runoff from machinery, leading to pollution of surface water Potential disposal of hazardous and non-hazardous waste (particularly solid wastes) into the freshwater areas									be implemented on site and adequate waste disposal facilities must be provided • Rehabilitate disturbed areas through reprofiling and revegetation • Desilt the freshwater resource areas affected by demolition activities. Desilting should preferably be undertaken by hand and not using heavy machinery in order to avoid further impacts on the freshwater resources. • Stockpiled soil must be levelled to avoid sedimentation from runoff, and revegetated with indigenous vegetation • Compacted soil should be ripped, reprofiled and reseeded with indigenous vegetation				

7.1 Impact Assessment Summary

The overall impact significance findings, following the implementation of the proposed mitigation measures are summarised in Table 14 below:

Table 14: Overall impact significance (Post Mitigation).

Phase	**Overall Impact Significance**
Construction	Very Low
Operational	Very Low
Decommissioning	Very Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Very Low
Cumulative - Operational	Very Low
Cumulative - Decommissioning	Very Low

8 Legislative and Permit Requirements

8.1 Legislative Requirements, national and provincial guidelines pertaining to the application of buffer zones

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

Legislative requirements were the primary consideration when determining a suitable buffer zone for the freshwater resources. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the freshwater resources can be summarised as follows:

- Activity 12 (ii) (a), (b) and (c) of GN927 (Listing Notice 1) of the EIA Regulations (2014, as amended), of the NEMA, 1998 (Act 107 of 1998) must be considered in defining the relevant regulated zone associated with any watercourse (including wetlands as well as rivers). This Listed Activity states that any development of infrastructure or structures with or exceeding a physical footprint of 100 m^2 (a) within a watercourse, (b) in front of a development setback or, (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such development occurs within an urban area, or within existing roads, road reserves or railway line reserves, will require an Environmental Authorisation (EA) in terms of the EIA Regulations and NEMA, 1998 (Act 107 of 1998);

- Activity 14 (ii), (a), (b), and (c) [(g), (ii), (ff)] and [(i), (i), (ff)] of GN924 (Listing Notice 3) of the EIA Regulations (2014, as amended), of the NEMA, 1998 (Act 107 of 1998) must also be considered in defining the relevant regulated zone associated with any watercourse (including wetlands as well as rivers). This Listed Activity states that any development of infrastructure or structures with or exceeding a physical footprint of 10 m^2 (a) within a watercourse, (b) in front of a development setback or, (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse, within various specific environments

outside urban areas in the Northern and Western Cape Provinces, will require an Environmental Authorisation (EA) in terms of the EIA Regulations and NEMA, 1998 (Act 107 of 1998);
    - In terms of the NEMA, the definition of an "urban area" means "areas situated within the urban edge (as defined or adopted by the competent authority), or in instances where no urban edge or boundary has been defined or adopted, it refers to areas situated within the edge of built-up areas."

- In accordance with GN509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:
    - the outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
    - in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
    - a 500 m radius from the delineated boundary (extent) of any wetland or pan.

Thus, a 32m regulated zone is prescribed to all the freshwater features as stipulated by the NEMA (Act 107 of 1998). Should any infrastructure (e.g. monopoles for the distribution lines or road culverts which may be required along the course of the service road) need to be placed directly within the active channel of any freshwater resource, a Water Use Licence (WUL) will be required and must be applied for by the proponent. This includes any road crossings/bridges (please refer to Section 9.1.1 for mitigation measures pertaining to road crossings) In addition, the regulated area of a watercourse in terms of Regulation 509 of 2016 must be considered, and it is recommended that the Risk Assessment Protocol as advocated by the DWS be applied in order to ascertain the significance of perceived impacts to the receiving environment, and enable informed decision-making by the proponent and the relevant authorities. Please refer to Appendix B for further detail pertaining to activities requiring authorisation under the NWA.

Whilst it is not practical to implement a buffer around the freshwater resources during construction of linear developments such as the distribution lines or service roads, as much as feasible, construction activities should be excluded from the NEMA zone of regulation (i.e. 32 m), for example by ensuring that contractor laydown areas are placed outside of the stipulated area. Where feasible, the layout of the distribution lines and service road should be routed so as to avoid sensitive watercourse crossings (all watercourses are considered sensitive – please refer to Figures 19 and 20) and minimise disturbances. However, the NEMA regulated zone around the freshwater features must be adhered to in the vicinity of the substations, and in this regard, no activity may be permitted within the 32m zone of regulation or any watercourse without obtaining the necessary authorisations from the respective authorities.

As far as could be ascertained, no true wetlands that meet the definition of a wetland as per the NWA, were identified during the site assessment. As per Section 4.3 of this report, all features which were identified within the infrastructure footprint were classified as rivers, with associated riparian zones.

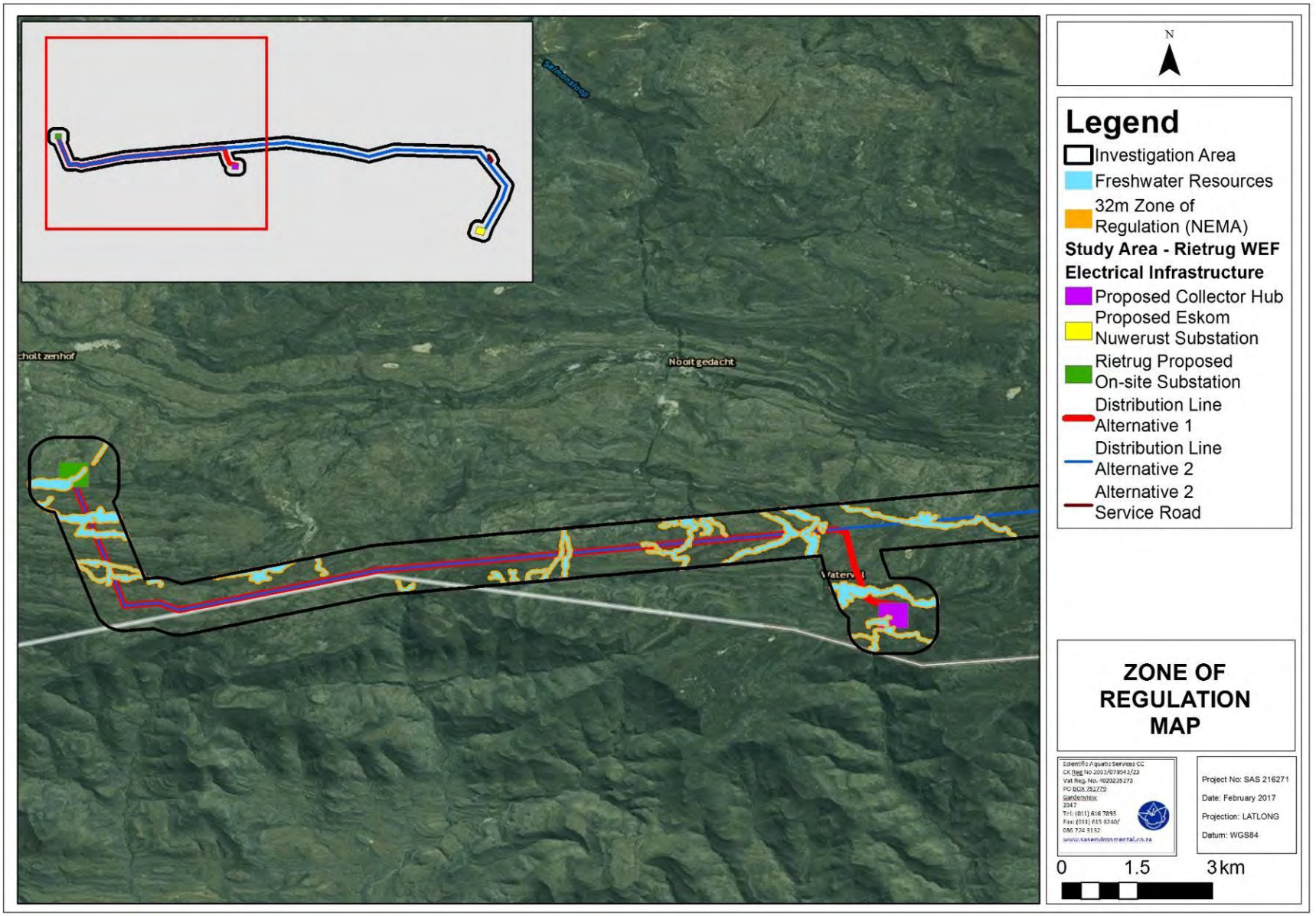


Figure 19: Conceptual presentation of the freshwater resources associated with the western portion of the study area, and the associated 32m zone of regulation as stipulated by NEMA.

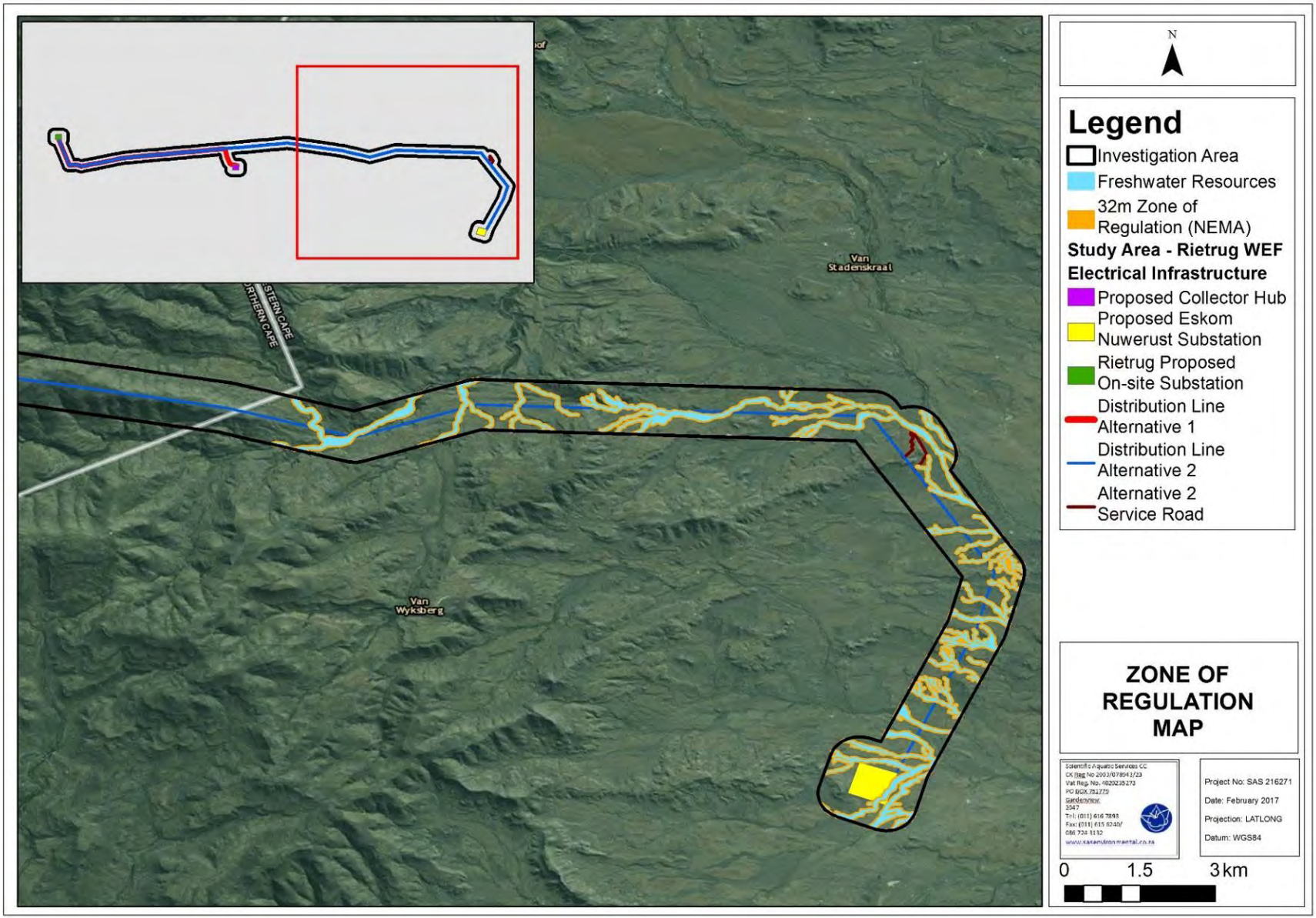


Figure 20: Conceptual presentation of the freshwater resources associated with the eastern portion of the study area, and the associated 32m zone of regulation as stipulated by NEMA.

9 Environmental Management Programme (EMPr) Inputs

9.1 Key Management and Monitoring Requirements

9.1.1 General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to development of this nature, and must be implemented during all phases of the proposed electrical infrastructure construction activities, in conjunction with those stipulated in the individual tables in the previous section which define the mitigatory measures specific to the minimisation of impacts on freshwater resources.

Development and operational footprint

- Sensitivity maps have been developed for the study area, indicating the freshwater environments, and the applicable regulatory zones in accordance with the National Environmental Management Act (Act 107 of 1998), as shown in Figures 19 and 20. It is recommended that these sensitivity maps be considered during all phases of the development and with special mention of the planning of infrastructure layout, to aid in the conservation of the freshwater habitats within the study area;
- All development footprint areas should remain as small as possible and should not encroach onto surrounding more sensitive areas. It must be ensured that the freshwater resources, and their associated regulatory zones are off-limits to construction vehicles and personnel;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Planning of temporary roads and access routes should take the site sensitivity plan into consideration, and wherever possible, existing roads should be utilised. If additional roads are required, then wherever feasible such roads should be constructed a distance from the more sensitive riparian areas and not directly adjacent thereto. If crossings are required they should cross the system at right angles, as far as possible to minimise impacts in the receiving environment, and any areas where bank failure is observed due to the effects of such crossings should be immediately repaired by reducing the gradient of the banks to a maximum of a 1:3 slope and where needed necessary, installing support structures. This should only be necessary if existing access roads are not utilised;
- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel;
- The duration of possible impacts on the riverine system should be minimised as far as possible by ensuring that the duration of time in which possible flow alteration and sedimentation will take place is minimised;
- Appropriate sanitary facilities must be provided for the life of the construction and all waste removed to an appropriate waste facility;
- All hazardous chemicals should be stored on bunded surfaces and no storage of such chemicals should be permitted within the riparian buffer zones;
- No informal fires should be permitted in or near the construction areas;
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills; and
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed.

Vehicle access

- All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant South African Bureau of Standards (SABS) standards to prevent leakage. All vehicles

must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; and
- All spills, should they occur, should be immediately cleaned up and treated accordingly.

Alien plant species
- Proliferation of alien and invasive species is expected within any disturbed areas particularly as there is a degree of alien and invasive species within the study area at present. These species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered on the property must take place to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction, operational, closure/decommissioning and rehabilitation/ maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species; and
  - No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.

Riparian habitat
- Ensure that as far as possible all infrastructure is placed outside of freshwater resource areas and their respective buffer zones. If these measures cannot be adhered to, strict mitigation measures, will be required to minimize the impact on the receiving watercourses;
- Permit only essential construction personnel within 32m of the freshwater habitat, if absolutely necessary that they enter the regulatory zone;
- Limit the footprint area of the construction activities to what is only essential in order to minimise environmental damage;
- During the construction phase, no vehicles should be allowed to indiscriminately drive through the freshwater resource areas; and
- Implement effective waste management in order to prevent construction related waste from entering the freshwater environments.

Soils
- To prevent the erosion of soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas particularly susceptible to erosion;
- Install erosion berms during construction to prevent gully formation. Berms every 50m should be installed where any disturbed soils have a slope of less than 2%, every 25m where the track slopes between 2% and 10%, every 20m where the track slopes between 10% and 15% and every 10m where the track slope is greater than 15%;
- Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags;
- Maintain topsoil stockpiles below 5 meters in height;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and

- Monitor all areas for erosion and incision, particularly any freshwater resource crossings. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible and in conjunction with other role players in the catchment.

Rehabilitation

- All soils compacted as a result of construction activities falling outside of the project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat;
- Rehabilitate all wetland and riparian habitat areas possibly affected by the proposed electrical infrastructure operations to ensure that the ecology of these areas is re-instated during all phases.
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;
- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier summer months.
- As much vegetation growth as possible should be promoted within the proposed electrical infrastructure construction area in order to protect soils;
- All alien vegetation identified should be removed from rehabilitated areas and reseeded with indigenous vegetation as specified by a suitably qualified specialist (ecologist);
- All areas affected by the electrical infrastructure construction should be rehabilitated upon completion of the electrical infrastructure construction;
- Riparian vegetation cover should be monitored to ensure that sufficient vegetation is present to bind the bankside soils and prevent bankside erosion and incision; and
- It is recommended that a detailed rehabilitation plan be developed by a suitably qualified ecologist during the operations phase in order to address specific rehabilitation requirements.

9.2 Monitoring Plan

Prudent monitoring of the identified river systems and their respective tributaries associated with the proposed electrical infrastructure development (particularly in the vicinity of the substations) is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage freshwater resources related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Fixed point monitoring should be applied as the preferred method of monitoring;
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring reports should be repeatable;
- Data should be auditable; and
- General habitat unit overviews should also be undertaken.

The table below illustrates data capturing for the monitoring plan.

Table 15: Monitoring actions for the proposed development.

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting	Report Content
During the construction phase				
Erosion	The portion of any river (Riet, Van Wyk's or Juk) and/or their associated tributaries, and the tributaries associated with the Portugal's River within the study area, but with specific reference to those areas directly impacted by distribution line crossings.	Monitoring of erosion should occur on a weekly basis during construction by the contractor, and after every major rainstorm and/or flood. Any evidence of erosion should be recorded photographically /diagrammatically and reported during the Environmental Control Officer (ECO) site visit	1. After every major rainstorm and / or flood. 2. Monthly monitoring report compiled by the appointed ECO during the construction phase.	1. Brief indication of the method of assessment. 2. Assumptions and limitations must be listed. 3. Photos and GPS point locations taken of existing erosion in the freshwater features and adjacent banks must be incorporated into the report. 4. Any erosion observed must be discussed in detail and management recommendations made. 5. Map indicating where erosion is present. 6. Control measures which are recommended, or which have been undertaken.
During the operational phase				
Erosion	The portion of any river (Riet, Van Wyk's or Juk) and/or their associated tributaries, and the tributaries associated with the Portugal's River within the study area, but with specific reference to those areas directly impacted by distribution line crossings.	Monitoring of erosion should occur after every rainstorm and/or following any rainfall event where there is surface flow in the system.	1. After every major rainstorm and / flood for the first wet season post construction. 2. Monthly monitoring report compiled by the appointed ECO.	1. Brief indication of the method of assessment. 2. Assumptions and limitations must be listed. 3. Photos and GPS point locations taken of existing erosion in the freshwater features and adjacent banks must be incorporated into the report. 4. Any erosion observed must be discussed in detail and management recommendations made (such as revegetation etc.). 5. Map indicating where erosion is present. 6. Control measures undertaken to be reported.
Alien vegetation control	The portion of any river (Riet, Van Wyk's or Juk) and/or their associated tributaries, and the tributaries associated with the Portugal's River within the study area, but with specific focus on those areas directly impacted by distribution line crossings.	Regrowth of alien vegetation should be monitored monthly during the first growing season.	At the end of the first growing season following the completion of construction.	1. Provide a list of species occurring within the study area. 2. Discuss the density of species. 3. Freshwater feature integrity and risk to be discussed. 4. Fixed point photo (i.e. taking photo at specific point within priority area to show effect of alien vegetation control). 5. Control measures undertaken to be recorded. 6. Assess the necessity of further alien and invasive vegetation control. 7. The VEGRAI method should be utilised at each assessment, both upstream and downstream of the disturbed areas, in order to provide an auditable result of the riparian habitat Ecostatus.

10 Conclusion and Recommendations

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater assessment as part of the Environmental Assessment and authorisation process for the proposed electrical infrastructure (including the distribution line alternatives and connection to third party substations) associated with the proposed Rietrug WEF project in the Northern Cape and Western Cape Provinces.

The proposed distribution lines traverse several freshwater resources, including three major river systems and associated tributaries, as well as numerous smaller, poorly defined ephemeral drainage lines. The primary river systems traversed are the Riet, Van Wyk's and Juk Rivers, as well as unnamed tributaries of these systems. In addition, the distribution line traverses unnamed tributaries of the Portugal's River. During the site assessment, no features which meet the definition of a wetland as per that contained in the NWA (Act 36 of 1998) were identified. Several smaller, ephemeral drainage lines without riparian vegetation were identified; however, these features were not assessed as they do not have any true riparian characteristics (i.e. vegetation of the terrestrial zone does not differ from that of the vegetation found within the adjacent terrestrial areas) and thus from an **ecological** point of view cannot be defined as watercourses as defined by the NWA (Act 36 of 1998). It must however be noted that, should any of these ephemeral drainage lines have a floodline applicable to them they would be defined as a watercourse and therefore require protection as such. This should be verified by a suitably qualified hydrologist. It is recommended that a surface water baseline study should be undertaken as part of the WULA process in consultation with the DWS, and should be used to guide the layout of the proposed development, planned mitigation and conditions of authorization.

The headwaters of the Beerfontein se Laagte River was identified by the NFEPA database (2011) to be located within the 500m area of investigation, south of the distribution line, along with the headwaters of two other ephemeral systems; however, these were not assessed due to the inaccessibility thereof. The proposed distribution line is located approximately 300m to 400m away from these headwaters and therefore direct impacts on these systems associated with the proposed development are considered highly unlikely to occur. Nevertheless, since the proposed gridline is situated upgradient of these freshwater resources, it is imperative that the mitigation measures contained in this report are adhered to, in order to minimise the risk of indirect impacts occurring.

All freshwater resources which were assessed were found to be in largely natural to moderately modified condition. Due to the relatively remote nature of the terrain, and minimal anthropogenic activity within the study area and greater catchment of these resources, few impacts have occurred. Modifications to these systems are primarily as a result of agriculture (livestock farming) such as overgrazing, fences and roads traversing systems, and impoundment of larger systems. Due to the ephemeral nature of most the river systems in the area, abstraction of water is not prevalent. Very little alien vegetation was observed during the site assessments, and where alien invasive flora was observed, the encroachment was not considered to be severe at this time. A summary of the PES, EIS and REC of each of the assessed freshwater resources is provided in the table below.

Table 16: Summary of the results of the assessment of the freshwater resources.

Resource	Vegetation Ecostatus and PES (VEGRAI)	Ecoservice Provision	EIS	REC
Riet River	B/C (largely natural to moderately modified)	Intermediate	A	B
Riet River: tributaries	B/C (largely natural to moderately modified)	Intermediate	A	B
Van Wyk's River	C (Moderately modified)	Intermediate	B	C
Juk River	C (Moderately modified)	Intermediate	B	C

Portugal's River: tributaries	B/C (largely natural to moderately modified)	Intermediate	A	B

Legislative requirements were the primary consideration when determining a suitable buffer zone for the freshwater resources. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the freshwater resources is discussed in Section 8.1 of this report. In summary however, the following applies:

- In terms of the applicable legislation, a 32m zone of regulation in terms of the NEMA (Act 107 of 1998) is stipulated around all freshwater features;
- For those ephemeral drainage lines which were not defined as having riparian vegetation and therefore were not defined as true watercourses from an ecological point of view, the zone of regulation in terms of GN509 of 2016 as it relates to the NWA (Act 36 of 1998) is the 1:100 year floodline, as determined by a suitably qualified hydrologist. It is recommended that a surface water baseline study should be undertaken as part of the WULA process in consultation with the DWS, and should be used to guide the layout of the proposed development, planned mitigation and conditions of authorization;
- In terms of Section 21 (c) and (i) of the NWA (Act 36 of 1998) the relevant authorisation must be obtained from the DWS for any and all any activities that take place within the watercourses. It is recommended that the relevant DWS officials be consulted in this regard to ensure that all legislative requirements are complied with.

Due to the similarity of the perceived impacts, as well as the largely similar sensitivities of the freshwater resources associated with the study area, the impact assessment was undertaken once for both Alternative 1 and Alternative 2 of the proposed distribution line and connection to a third party substation, the service roads associated with the proposed development, and the proposed on-site substation and link to the third party substation. The perceived impacts, significance thereof, impact ratings and mitigation measures are the same for both alternatives.

The results of the impact assessment indicate that overall, during the construction, operational and decommissioning phases, the significance of potential impacts on any of the freshwater resources is likely to be 'low' (before the implementation of mitigation measures). Careful planning of the location of the proposed on-site substation, connection to a third party substation, proposed distribution line and service road beneath the distribution line, in order to avoid freshwater resources as far as possible, will aid in minimising the impact significance. In addition, strict adherence to cogent, well-developed mitigation measures, such as spanning channels wherever possible, minimising vegetation clearing, implementing effective erosion controls, and ensuring that good soil management takes place (e.g. protection of exposed soils and soil stockpiles) will further minimise risks, reducing the impact significance to 'very low' levels. Therefore, from a freshwater resource conservation perspective, the proposed project is not considered to be "fatally flawed" although it is considered essential that suitable mitigation measures are implemented throughout all phases of the project in order to ensure that perceived impacts remain of low significance. Please refer to Sections 6, 7 and 9 for details of all recommended mitigation measures applicable to this project.

Although several renewable energy projects are located within a 50 km radius of the study area, only those projects which are located within the same quaternary catchment as the study area were considered in the cumulative impact assessment, since those projects outside of the catchment will not have an impact on the freshwater resources associated with the study area. The results of the cumulative impact assessment are presented in Section 6.4 of this report, and indicate that the anticipated impact significance associated with these renewable energy projects on the freshwater resources in the study area are likely to be 'very low', assuming that adherence to strict mitigation measures takes place throughout.

11 Final Specialist Statement and Authorisation Recommendation

The proposed distribution line (and the service road below the distribution line) traverse three large river systems and several smaller tributaries thereof, as well as numerous small ephemeral drainage lines. The proposed on-site substation and connection to the alternatives of a third party substation (as well as the third party substations themselves) are located well outside of the 32m zone of regulation applicable to the freshwater resources, and therefore, should mitigation measures as recommended in this report be strictly adhered to, the significance of impacts associated with the substations is likely to be of 'low' to 'very low' levels. All mitigation measures provided in Sections 6 and 7 of this report must be included in the EMPr in order to ensure that potential risks associated with the proposed development are managed in accordance with the mitigation hierarchy as advocated by the DEA.

Following the outcome of the assessment, it is the reasoned opinion of the ecologists that, from a freshwater resource ecological perspective, the proposed activities may be authorised, provided that strict adherence to the mitigation measures as provided in this report takes place.

11.1 EA Condition Recommendations

The relevant authorisations required for must be obtained in terms of Section 21 (c) and (i) of the NWA, and in terms of Regulation 509 of 2016 as it pertains to the NWA. In addition, it is considered essential that the mitigation measures as set out in this report (please refer to Sections 6, 7 and 9) are adhered to throughout the life of the project. Key mitigation measures are summarised here, and include (but are not limited to):

- Careful planning of the location of monopoles, taking into consideration the locality of riparian habitats and as much as possible, avoid placement of monopoles within riparian habitat, and powerlines are preferably to span the relevant resource. If at all possible, all monopoles should be developed above the relevant zone of regulation in terms of Regulation GN509 of the NWA;
- Where it is impossible to avoid placing infrastructure within riparian habitat, flow connectivity must be retained by preventing fragmentation of the riparian habitat. Fragmentation of the riparian habitat can be avoided by (for example) ensuring that the disturbance footprint remains as small as possible, that no solid strips are excavated within the riparian habitat, that structures (such as culverts or monopoles) placed within the active channel do not cause increased turbulence, which will result in erosion. It must also be ensured that no canalization or incision of the riparian resource takes place as a result of the construction activities;
- Careful planning of the location of the substations. The applicable zone of regulation around the freshwater resources in terms of NEMA is 32m, and this must be adhered to, in order to assist in minimising impacts on the freshwater resources in close proximity to the proposed substations. Please refer to the figures in Section 8 of this report for the locality of the freshwater resources, and the applicable zone of regulation;
- Clearing of vegetation at all impact sites must be kept to an absolute minimum, and strict alien vegetation controls must be implemented throughout all phases of the project. The re-growth of indigenous vegetation must be encouraged following construction; and
- Strict erosion control and soil management measures must be implemented during the construction and operational phases, particularly in areas where vegetation has been removed.

References

CSIR. 2016. Amendment Application for the Proposed Splitting of the Sutherland Renewable Energy Facility into three 140 MW Wind Energy Facilities, Sutherland, Northern and Western Cape Provinces. Amendment Report for the proposed Rietrug Wind Energy Facility. 2016. Prepared by the CSIR for South Africa Mainstream Renewable Power Developments (Pty) Ltd.

Department of Water Affairs (DWA). 1999. Version 1.0 of Resource Directed Measures for Protection of Water Resources [Appendix W3].

Department of Water Affairs (DWA): Kleynhans CJ, Louw MD, Graham M. 2007. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (IHI) (Section 1, Technical manual) Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08

Department of Water Affairs and Forestry (DWAF. 2007. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types. Prepared by Rountree, M.W., Todd, C.P., Kleynhans, C.J., Batchelor, A.L., Louw, M.D., Kotze, D., Schroeder, S., Illgner, P. Uys, M. and Marneweck, G.C. Report Number N/0000/00/WEI/0407

Department of Water Affairs and Forestry (DWAF). 2005. A practical field procedure of identification and delineation of wetlands and riparian areas. DWA, Pretoria.

Department of Water Affairs and Forestry (DWAF). 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. XXXXXXXXX. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed in December 2016.

Kleynhans C.J. 1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African River. Institute of Water Quality Studies, Department of Water Affairs & Forestry, Pretoria.

Kleynhans CJ, Mackenzie J, Louw MD. 2007. Module F: Riparian Vegetation Response Assessment Index (VEGRAI) in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No.

Kleynhans, C. J. 2007. Module D: Fish response assessment index (FRAI). In: River ecoclassification manual for ecostatus determination (Version 2): Report produced for the Department of Water Affairs and Forestry (Resource Quality Services) and the Water Research Commission.

Kotze DC, Marneweck GC, Batchelor, AL, Lindley DS and Collins NB. 2009. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No TT 339/08, Water Research Commission, Pretoria.

Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2008. WET-Health: A technique for rapidly assessing wetland health. WRC Report No. TT 340/08. Water Research, Commission, Pretoria.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2015. Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries.

Mucina, L. & Rutherford, M.C. (Eds). 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria, RSA.

National Environmental Management Act (NEMA) 107 of 1998

National Freshwater Ecosystem Priority Areas (NFEPA): Driver, A., Nel, J.L., Snaddon, K., Murruy, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Water Research Commission. Report No. 1801/1/11. Online available: http://bgis.sanbi.org/nfepa/project.asp

National Water Act 36 of 1998. Section 21(c) and (i).

Nel, JL, Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria, RSA.

NPSDF (2012). Northern Cape Provincial Spatial Development Framework/ Provincial Development and Resource Management Plan. Department of Cooperative Governance, Human Settlements and Traditional Affairs.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Rountree, M.W. and Kotze, D.C. 2013. Appendix A3: Ecological Importance and Sensitivity Assessment. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/12. Pretoria.

Savanna Environmental. 2017. Final Split Environmental Impact Assessment Report 1: Proposed Suurplaat Wind Energy Facility and Associated Infrastructure: Suurplaat Phase. DEA Reference 12/12/20/1583 AM3.

The South African National Biodiversity Institute (SANBI) - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org as retrieved in December 2016

Van der Merwe, H. 2010. Patterns of plant diversity in the Hantam-Tanqua-Roggeveld subregion of the succulent Karoo, South Africa. Thesis. Available: http://repository.up.ac.za/handle/2263/25281 [2016, December 07].

WCBF: Pence, Genevieve Q.K. 2014. Western Cape Biodiversity Framework 2014 Status Update: Critical Biodiversity Areas of the Western Cape. Unpublished CapeNature project report. Cape Town, South Africa

Appendix A: Indemnity and Terms of Use

INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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Appendix B: Legislative Requirements

National Environmental Management Act (NEMA, Act 107 of 1998)

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

National Water Act, 1998 (NWA, Act 36 of 1998)

- The NWA (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved;
- No activity may therefore take place within a watercourse unless it is authorised by DWS;
- A watercourse is defined by the NWA as:
  - A river or spring;
  - A natural channel in which water flows regularly or intermittently;
  - A wetland, lake or dam into which, or from which, water flows; and
  - Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
- Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWA in terms of Section 21.

The Department of Water Affairs and Forestry (2007) Internal Guideline: Generic Water Use Authorisation Application Process (hereinafter referred to as the "Internal Guideline") provides further guidance on the interpretation of the abovementioned water uses. A brief explanation of each of the triggered water uses will follow hereunder.

- **Section 21(c): Impeding or diverting the flow of water in a watercourse**

  The Internal Guideline defines this water use as:
  - Causing an obstruction to the flow of water in a watercourse or diverting some or all of the flow in or from a watercourse.
  - Impeding or diverting flow does not normally cause any loss of water, but influences the flow regime in a watercourse. Impeding or diverting structures can fully or partially extend into a river, forcing the natural flow direction to be re-directed by the structure.
- **Section 21(i): Altering the bed, banks, course or characteristics of a water course**

  The Internal Guideline defines this water use as:
  - The alteration of the course (including the beds, banks or characteristics) of a watercourse.
  - Alteration of the course refers to any changes affecting:
  - The energy of the watercourse [e.g. the straightening of a river generally leads to an increase in energy, which will cause erosion with the system adjusting to the new situation (new equilibrium)].
  - The morphology (bed, banks, macro-channels) of the watercourse, including changes affecting the riparian and in-stream habitat characteristics, (e.g. sand mining, canalisation of streams).
  - The physical characteristics (e.g. the removal of riparian vegetation, mining of river banks for sand, changes to geo-hydrology and geology that affect groundwater-fed systems such as wetlands and rivers).
  - The chemical characteristics (change in temperature, pH, turbidity, etc.).
  - Flood dynamics (e.g. developments occurring below flood-lines alter onsite and downstream flood patterns).
  - Biotic components (e.g. a change of habitat that will lead to a change in the composition of the biota).

General Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)

In accordance with GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:

- *the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;*
- *in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or*
- *a 500 m radius from the delineated boundary (extent) of any wetland or pan*.

This notice replaces GN1199 and may be exercised as follows:

i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in Table B1 below, subject to the conditions of this authorisation;
ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix;
iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix;
iv) Conduct river and stormwater management activities as contained in a river management plan;
v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and
vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol.

Table B1: Activities that are generally authorized for any person subject only to compliance to the conditions of this notice:

Any Person	ACTIVITY
Farmers and any other landowners	Emergency River crossings for vehicles to gain access to livestock, crops or residences etc.
Any landowner	Maintenance to private roads and river crossings provided that footprint remains the same and the road is less than 4 m wide
Any landowner	Erection of fences provided that the fence will not in any way impede or divert flow, or affect resource quality detrimentally in the short, medium or long term

The General Authorisation (GA) issued, as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA.

Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

Appendix C: Method of Assessment

FRESHWATER RESOURCE ASSESSMENT APPROACH

1. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis *et. al*., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary Hydrogeomorphic Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[5] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions and NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular

[5] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: HGM Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

2. Wet-Ecoservices (2009)

“The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class” (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and

- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

3. Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results[6]. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Table C4: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

4. Ecological Importance and Sensitivity (EIS)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

[6] Kleynhans et al, 2007

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- EIS, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C5) of the wetland system being assessed.

Table C5: EIS Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

5. Recommended Ecological Category (REC)

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure” (DWA, 1999).

The REC (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the resource (sections above), and is followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

A wetland may receive the same class for the PES as the REC if the wetland is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the wetland feature.

Table C6: Description of REC classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

6. Freshwater Resource Delineation

The freshwater resource delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

Appendix D: Summary of PES/EIS Data

Table D1: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR D56B- 07731 (Riet River Tributary) based on the DWS RQS PES/EIS database.

Synopsis SQR D56B- 07731 (Riet River Tributary)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
N/A	Low	Low	12.34	1	D
PES details					
Instream habitat continuity MOD		None	Riparian/wetland zone MOD		None
RIP/wetland zone continuity MOD		None	Potential flow MOD activities		None
Potential instream habitat MOD activities		None	Potential physico-chemical MOD activities		None
EI details					
Fish spp/SQ		N/A	Fish average confidence		N/A
Fish representivity per secondary class		N/A	Fish rarity per secondary class		N/A
Invertebrate taxa/SQ		N/A	Invertebrate average confidence		N/A
Invertebrate representivity per secondary class		N/A	Invertebrate rarity per secondary class		N/A
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Very High	Habitat diversity class		Moderate
Habitat size (length) class		Very Low	Instream migration link class		N/A
Riparian-wetland zone migration link		N/A	Riparian-wetland zone habitat integrity class		N/A
Instream habitat integrity class		N/A	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					Low
ES details					
Fish physical-chemical sensitivity description		N/A	Fish no-flow sensitivity		N/A
Invertebrates physical-chemical sensitivity description		N/A	Invertebrates velocity sensitivity		N/A
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very Low
Stream size sensitivity to modified flow/water level changes description					N/A
Riparian-wetland vegetation intolerance to water level changes description					Moderate

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

Table D2: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR D56B- 07733 (Riet River) based on the DWS RQS PES/EIS database.

Synopsis SQR D56B- 07733 (Riet River)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
C	Low	Very Low	8.89	1	D
PES details					
Instream habitat continuity MOD		Large	Riparian/wetland zone MOD		Large
RIP/wetland zone continuity MOD		Moderate	Potential flow MOD activities		Moderate
Potential instream habitat MOD activities		Moderate	Potential physico-chemical MOD activities		None
EI details					
Fish spp/SQ		1.00	Fish average confidence		1.0
Fish representivity per secondary class		Low	Fish rarity per secondary class		Very Low
Invertebrate taxa/SQ		4.00	Invertebrate average confidence		1.00
Invertebrate representivity per secondary class		Low	Invertebrate rarity per secondary class		Very Low
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Low	Habitat diversity class		Low
Habitat size (length) class		Very Low	Instream migration link class		Moderate
Riparian-wetland zone migration link		High	Riparian-wetland zone habitat integrity class		Moderate
Instream habitat integrity class		High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					N/A
ES details					
Fish physical-chemical sensitivity description		Very Low	Fish no-flow sensitivity		Very Low
Invertebrates physical-chemical sensitivity description		Very Low	Invertebrates velocity sensitivity		False
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very Low
Stream size sensitivity to modified flow/water level changes description					High
Riparian-wetland vegetation intolerance to water level changes description					N/A

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means

Table D3: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR D56A – 07650 (Portugals River Tributary) based on the DWS RQS PES/EIS database

Synopsis SQR D56A – 07650 (Portugals River Tributary)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
B	Moderate	Very Low	18.52	1	C
PES details					
Instream habitat continuity MOD		Moderate	Riparian/wetland zone MOD		Small
RIP/wetland zone continuity MOD		Small	Potential flow MOD activities		Small
Potential instream habitat MOD activities		Small	Potential physico-chemical MOD activities		None
EI details					
Fish spp/SQ		1.00	Fish average confidence		1.00
Fish representivity per secondary class		Low	Fish rarity per secondary class		Low
Invertebrate taxa/SQ		4.00	Invertebrate average confidence		1.00
Invertebrate representivity per secondary class		Low	Invertebrate rarity per secondary class		Very Low
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Low	Habitat diversity class		Moderate
Habitat size (length) class		Very Low	Instream migration link class		High
Riparian-wetland zone migration link		Very High	Riparian-wetland zone habitat integrity class		Very High
Instream habitat integrity class		Very High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					Low
ES details					
Fish physical-chemical sensitivity description		Very Low	Fish no-flow sensitivity		Very Low
Invertebrates physical-chemical sensitivity description		Very Low	Invertebrates velocity sensitivity		False
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very Low
Stream size sensitivity to modified flow/water level changes description					High
Riparian-wetland vegetation intolerance to water level changes description					Moderate

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

EC = Ecological Category; default based on median PES and highest of EI or ES means

Table D4: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR J11B – 07772 (Beerfontein se Laagte River) based on the DWS RQS PES/EIS database.

Synopsis SQR J11B – 07772 (Beerfontein se Laagte River)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
B	High	Moderate	20.03	1	B
PES details					
Instream habitat continuity MOD		Small	Riparian/wetland zone MOD		None
RIP/wetland zone continuity MOD		Small	Potential flow MOD activities		Small
Potential instream habitat MOD activities		None	Potential physico-chemical MOD activities		Small
EI details					
Fish spp/SQ		N/A	Fish average confidence		N/A
Fish representivity per secondary class		N/A	Fish rarity per secondary class		N/A
Invertebrate taxa/SQ		19.00	Invertebrate average confidence		3.00
Invertebrate representivity per secondary class		Moderate	Invertebrate rarity per secondary class		Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Very High	Habitat diversity class		Moderate
Habitat size (length) class		Moderate	Instream migration link class		Very High
Riparian-wetland zone migration link		Very High	Riparian-wetland zone habitat integrity class		Very High
Instream habitat integrity class		Very High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					Low
ES details					
Fish physical-chemical sensitivity description		N/A	Fish no-flow sensitivity		N/A
Invertebrates physical-chemical sensitivity description		Moderate	Invertebrates velocity sensitivity		High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Very High
Stream size sensitivity to modified flow/water level changes description					High
Riparian-wetland vegetation intolerance to water level changes description					Low

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

Table D5: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR J24A – 07720 (Vanwyks River) based on the DWS RQS PES/EIS database.

Synopsis SQR J24A – 07720 (Vanwyks River)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
A	Very High	Low	34.14	1	A
PES details					
Instream habitat continuity MOD		None	Riparian/wetland zone MOD		None
RIP/wetland zone continuity MOD		None	Potential flow MOD activities		Small
Potential instream habitat MOD activities		None	Potential physico-chemical MOD activities		None
EI details					
Fish spp/SQ		N/A	Fish average confidence		N/A
Fish representivity per secondary class		N/A	Fish rarity per secondary class		N/A
Invertebrate taxa/SQ		15.00	Invertebrate average confidence		1.00
Invertebrate representivity per secondary class		Moderate	Invertebrate rarity per secondary class		Very High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Very High	Habitat diversity class		High
Habitat size (length) class		High	Instream migration link class		Very High
Riparian-wetland zone migration link		Very High	Riparian-wetland zone habitat integrity class		Very High
Instream habitat integrity class		Very High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					High
ES details					
Fish physical-chemical sensitivity description		N/A	Fish no-flow sensitivity		N/A
Invertebrates physical-chemical sensitivity description		Moderate	Invertebrates velocity sensitivity		High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Low
Stream size sensitivity to modified flow/water level changes description					Low
Riparian-wetland vegetation intolerance to water level changes description					Low

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

Table D6: Summary of the ecological status of the sub-quaternary catchment (SQ) reach SQR J24A – 07778 (Juk River) based on the DWS RQS PES/EIS database.

Synopsis SQR J24A – 07778 (Juk River)					
PES[1] category median	Mean EI[2] class	Mean ES[3] class	Length	Stream order	Default EC[4]
A	Very High	Low	31.51	1	A
PES details					
Instream habitat continuity MOD		None	Riparian/wetland zone MOD		Small
RIP/wetland zone continuity MOD		None	Potential flow MOD activities		Small
Potential instream habitat MOD activities		None	Potential physico-chemical MOD activities		None
EI details					
Fish spp/SQ		N/A	Fish average confidence		N/A
Fish representivity per secondary class		N/A	Fish rarity per secondary class		N/A
Invertebrate taxa/SQ		15.00	Invertebrate average confidence		1.00
Invertebrate representivity per secondary class		Moderate	Invertebrate rarity per secondary class		High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating		Very High	Habitat diversity class		High
Habitat size (length) class		Moderate	Instream migration link class		Very High
Riparian-wetland zone migration link		Very High	Riparian-wetland zone habitat integrity class		Very High
Instream habitat integrity class		Very High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m		Very High
Riparian-wetland natural vegetation rating based on expert rating					High
ES details					
Fish physical-chemical sensitivity description		N/A	Fish no-flow sensitivity		N/A
Invertebrates physical-chemical sensitivity description		Moderate	Invertebrates velocity sensitivity		High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					Low
Stream size sensitivity to modified flow/water level changes description					Low
Riparian-wetland vegetation intolerance to water level changes description					Low

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;

[2] EI = Ecological Importance;

[3] ES = Ecological Sensitivity

[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

Appendix E: Field Assessment Results

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

1. Results of the Assessments Applied to the Riet River and associated Tributaries

Table E1: Presentation of the results of the VEGRAI assessment applied to the Riet River and associated tributaries.

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	80.0	50.0	3.3	1.0	100.0
NON MARGINAL	80.0	30.0	0.0	2.0	60.0
2.0					160.0
LEVEL 3 VEGRAI (%)				80.0	
VEGRAI EC				B/C	
AVERAGE CONFIDENCE				1.7	

Table E2: Presentation of the results of the Ecoservices assessments applied to the Riet River and associated tributaries.

Ecosystem service	Riet River	Unnamed Tributary A	Unnamed Tributary B	Unnamed Tributary C	Unnamed Tributary D
Flood attenuation	1.0	1.1	1.1	1.1	0.0
Streamflow regulation	2.0	1.6	1.6	1.6	1.6
Sediment trapping	2.6	2.6	2.6	2.6	2.6
Phosphate assimilation	2.1	2.0	2.0	2.0	2.0
Nitrate assimilation	1.9	1.6	1.6	1.6	1.6
Toxicant assimilation	2.1	1.8	1.8	1.8	1.8
Erosion control	2.3	2.1	2.1	2.1	2.1
Carbon Storage	1.3	0.8	0.8	0.8	0.8
Biodiversity maintenance	2.8	2.9	2.9	2.9	2.9
Water Supply	1.3	0.8	0.8	0.8	0.8
Harvestable resources	1.4	1.4	1.4	1.4	1.4
Cultivated foods	1.4	1.4	1.4	1.4	1.4
Cultural value	1.5	1.0	1.0	1.0	1.0
Tourism and recreation	1.9	1.4	1.4	1.4	1.4
Education and research	2.5	1.0	1.0	1.0	1.0
SUM	28.1	23.4	23.4	23.4	22.3
Average score	1.9	1.6	1.6	1.6	1.5

Table E3: Presentation of the results of the EIS assessments applied to the Riet River and associated tributaries.

EIS	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	(average)
	3.00	3.00
Presence of Red Data species	3	3
Populations of unique species	3	3
Migration/breeding/feeding sites	3	3
Landscape scale	B (average)	(average)
	3.00	3.80
Protection status of the wetland	2	3
Protection status of the vegetation type	4	4
Regional context of the ecological integrity	3	4
Size and rarity of the wetland type/s present	3	4
Diversity of habitat types	3	4
Sensitivity of the wetland	C (average)	(average)
	2.00	3.33
Sensitivity to changes in floods	3	3
Sensitivity to changes in low flows/dry season	1	4
Sensitivity to changes in water quality	2	3
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A,B or C)	*(average of A, B or C)*
Fill in highest score:	A	3.00

Hydro-Functional Importance			Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	Flood attenuation		1	4
	Streamflow regulation		2	4
	Water Quality Enhancement	*Sediment trapping*	3	4
		Phosphate assimilation	2	4
		Nitrate assimilation	2	4
		Toxicant assimilation	2	4
		Erosion control	2	4
	Carbon storage		1	4
HYDRO-FUNCTIONAL IMPORTANCE			2	4

Direct Human Benefits		Score (0-4)	*Confidence (1-5)*
Subsistence benefits	*Water for human use*	1	4
	Harvestable resources	1	4
	Cultivated foods	1	4
Cultural benefits	*Cultural heritage*	1	4
	Tourism and recreation	2	4
	Education and research	2	4
DIRECT HUMAN BENEFITS		1.25	4

2. Results of the Assessments Applied to the Portugal's River and Associated Tributaries

Table E4: Presentation of the results of the VEGRAI assessment applied to the Portugal's River and associated tributaries.

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	80.0	50.0	3.3	1.0	100.0
NON MARGINAL	80.0	30.0	0.0	2.0	60.0
2.0					160.0
LEVEL 3 VEGRAI (%)				80.0	
VEGRAI EC				B/C	
AVERAGE CONFIDENCE				1.7	

Table E5: Presentation of the results of the Ecoservices assessments applied to the Portugal's River and associated tributaries.

Ecosystem service	Portugal's River	Unnamed Tributary A	Unnamed Tributary B	Unnamed Tributary C
Flood attenuation	1.0	1.1	1.1	1.1
Streamflow regulation	2.0	1.6	1.6	1.6
Sediment trapping	2.6	2.6	2.6	2.6
Phosphate assimilation	2.1	2.0	2.0	2.0
Nitrate assimilation	1.9	1.6	1.6	1.6
Toxicant assimilation	2.1	1.8	1.8	1.8
Erosion control	2.3	2.1	2.1	2.1
Carbon Storage	1.3	0.8	0.8	0.8
Biodiversity maintenance	2.8	2.9	3.0	3.0
Water Supply	1.3	0.8	0.8	0.8
Harvestable resources	1.4	1.4	1.4	1.4
Cultivated foods	1.4	1.4	1.4	1.4
Cultural value	1.5	1.0	1.0	1.0
Tourism and recreation	1.9	1.4	1.4	1.4
Education and research	2.5	1.0	1.0	1.0
SUM	28.1	23.4	23.5	23.5
Average score	1.9	1.6	1.6	1.6

Table E6: Presentation of the results of the EIS assessment applied to the Portugal's River and associated tributaries.

EIS	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	(average)
	3.00	3.00
Presence of Red Data species	3	3
Populations of unique species	3	3
Migration/breeding/feeding sites	3	3
Landscape scale	B (average)	(average)
	3.00	3.80
Protection status of the wetland	2	3
Protection status of the vegetation type	4	4
Regional context of the ecological integrity	3	4
Size and rarity of the wetland type/s present	3	4
Diversity of habitat types	3	4
Sensitivity of the wetland	C (average)	(average)
	2.00	3.33
Sensitivity to changes in floods	3	3
Sensitivity to changes in low flows/dry season	1	4
Sensitivity to changes in water quality	2	3
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A,B or C)	*(average of A, B or C)*
Fill in highest score:	A	3.00

Hydro-Functional Importance			Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	Flood attenuation		1	4
	Streamflow regulation		2	4
	Water Quality Enhancement	*Sediment trapping*	3	4
		Phosphate assimilation	2	4
		Nitrate assimilation	2	4
		Toxicant assimilation	2	4
		Erosion control	2	4
	Carbon storage		1	4
HYDRO-FUNCTIONAL IMPORTANCE			2	4

Direct Human Benefits		Score (0-4)	*Confidence (1-5)*
Subsistence benefits	*Water for human use*	1	4
	Harvestable resources	1	4
	Cultivated foods	1	4
Cultural benefits	*Cultural heritage*	1	4
	Tourism and recreation	2	4
	Education and research	2	4
DIRECT HUMAN BENEFITS		1.25	4

3. Results of the Assessments Applied to the Van Wyk's River

Table E7: Presentation of the results of the VEGRAI assessment applied to the Van Wyk's River.

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	70.4	44.0	2.5	1.0	100.0
NON MARGINAL	70.4	26.4	0.0	2.0	60.0
2.0					160.0
LEVEL 3 VEGRAI (%)				70.4	
VEGRAI EC				C	
AVERAGE CONFIDENCE				1.3	

Table E8: Presentation of the results of the Ecoservices assessment applied to the Van Wyk's River.

Ecosystem service	Vanwyks River
Flood attenuation	1.8
Streamflow regulation	1.0
Sediment trapping	2.6
Phosphate assimilation	1.8
Nitrate assimilation	1.2
Toxicant assimilation	1.6
Erosion control	0.0
Carbon Storage	0.0
Biodiversity maintenance	2.2
Water Supply	0.2
Harvestable resources	0.0
Cultivated foods	0.0
Cultural value	0.0
Tourism and recreation	0.1
Education and research	0.8
SUM	13.2
Average score	0.9

Table E9: Presentation of the results of the EIS assessment applied to the Van Wyk's River

EIS	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	(average)
	1.00	3.00
Presence of Red Data species	0	3
Populations of unique species	0	3
Migration/breeding/feeding sites	3	3
Landscape scale	B (average)	(average)
	1.40	3.00
Protection status of the wetland	1	3
Protection status of the vegetation type	1	3
Regional context of the ecological integrity	3	3
Size and rarity of the wetland type/s present	1	3
Diversity of habitat types	1	3
Sensitivity of the wetland	C (average)	(average)
	1.00	2.00
Sensitivity to changes in floods	1	3
Sensitivity to changes in low flows/dry season	1	2
Sensitivity to changes in water quality	1	1
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A,B or C)	*(average of A, B or C)*
Fill in highest score:	B	1.20

Hydro-Functional Importance			Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	Flood attenuation		2	4
	Streamflow regulation		2	4
	Water Quality Enhancement	*Sediment trapping*	2	4
		Phosphate assimilation	2	4
		Nitrate assimilation	1	4
		Toxicant assimilation	1	4
		Erosion control	0	4
	Carbon storage		0	4
HYDRO-FUNCTIONAL IMPORTANCE			1	4

Direct Human Benefits		Score (0-4)	*Confidence (1-5)*
Subsistence benefits	*Water for human use*	0	4
	Harvestable resources	0	4
	Cultivated foods	0	4
Cultural benefits	*Cultural heritage*	0	4
	Tourism and recreation	0	4
	Education and research	0	4
DIRECT HUMAN BENEFITS		0.00	4

4. Results of the Assessments Applied to the Juk River

Table E10: Presentation of the results of the VEGRAI assessment applied to the Juk River

LEVEL 3 ASSESSMENT					
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT
MARGINAL	70.4	44.0	2.5	1.0	100.0
NON MARGINAL	70.4	26.4	0.0	2.0	60.0
2.0					160.0
LEVEL 3 VEGRAI (%)				70.4	
VEGRAI EC				C	
AVERAGE CONFIDENCE				1.3	

Table E11: Presentation of the results of the Ecoservices assessment applied to the Juk River

Ecosystem service	Juk River
Flood attenuation	1.8
Streamflow regulation	1.0
Sediment trapping	2.6
Phosphate assimilation	1.8
Nitrate assimilation	1.2
Toxicant assimilation	1.6
Erosion control	0.0
Carbon Storage	0.0
Biodiversity maintenance	2.2
Water Supply	0.2
Harvestable resources	0.0
Cultivated foods	0.0
Cultural value	0.0
Tourism and recreation	0.1
Education and research	0.8
SUM	12.5
Average score	0.8

Table E12: Presentation of the results of the EIS assessment applied to the Juk River

EIS	Score (0-4)	*Confidence (1-5)*
Biodiversity support	A (average)	(average)
	1.67	3.00
Presence of Red Data species	2	3
Populations of unique species	1	3
Migration/breeding/feeding sites	2	3
Landscape scale	B (average)	(average)
	1.40	3.00
Protection status of the wetland	1	3
Protection status of the vegetation type	3	3
Regional context of the ecological integrity	1	3
Size and rarity of the wetland type/s present	1	3
Diversity of habitat types	1	3
Sensitivity of the wetland	C (average)	(average)
	2.33	1.67
Sensitivity to changes in floods	2	2
Sensitivity to changes in low flows/dry season	2	2
Sensitivity to changes in water quality	3	1
ECOLOGICAL IMPORTANCE & SENSITIVITY	(max of A,B or C)	*(average of A, B or C)*
Fill in highest score:	C	2.33

Hydro-Functional Importance			Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	Flood attenuation		2	4
	Streamflow regulation		1	4
	Water Quality Enhancement	*Sediment trapping*	2	4
		Phosphate assimilation	1	4
		Nitrate assimilation	2	4
		Toxicant assimilation	2	4
		Erosion control	0	4
	Carbon storage		0	4
HYDRO-FUNCTIONAL IMPORTANCE			1	4

Direct Human Benefits		Score (0-4)	*Confidence (1-5)*
Subsistence benefits	*Water for human use*	3	4
	Harvestable resources	0	4
	Cultivated foods	1	4
Cultural benefits	*Cultural heritage*	0	4
	Tourism and recreation	1	4
	Education and research	0	4
DIRECT HUMAN BENEFITS		0.83	4

BASIC ASSESSMENT REPORT

Basic Assessment for the Proposed Construction of Electrical Grid Infrastructure to support the Rietrug Wind Energy Facility (WEF), Northern and Western Cape Provinces (Rietrug WEF – Electrical Grid Infrastructure)

APPENDIX D.3: Visual Impact Assessment

VISUAL IMPACT ASSESSMENT:

Basic Assessment for the proposed Construction of Electrical Grid Infrastructure to support the proposed Rietrug Wind Energy Facility, near Sutherland, in the Northern and Western Cape Provinces

Report prepared for:
CSIR – Environmental Management Services
P O Box 320
Stellenbosch, 7599
South Africa

Report prepared by:
Henry Holland
8 Cathcart Street
Grahamstown, 6139
South Africa

April 2017

SPECIALIST CV

Henry Holland

NAME:	Henry Holland
PROFESSION:	GIS Consultant

BIOGRAPHICAL SKETCH

Henry has been doing GIS related work since 1992 when he started his M.Sc. in Geology. Since finishing his Masters he worked in Angola establishing a GIS department for a diamond exploration company, after which he worked on a freelance basis for eight years doing GIS related work and computer programming. Henry has been involved in Visual Impact Assessments (VIAs) since 1997.

EDUCATION

- 1996 - M. Sc. Geology/GIS, Rhodes University
- 1986 - B.Sc. Hons, UOFS

KEY EXPERIENCE

The table below presents an abridged list of Henry's project experience relevant to this proposal:

Completion Date	Project description	Role	Client
2016	Visual Impact Assessment - Scoping and Environmental Impact Assessment for the proposed development of the Teekloof Wind Energy Facility and supporting electrical infrastructure near Victoria West, Northern Cape Province	Author	CSIR
2016	Visual Impact Assessment - Scoping and Environmental Impact Assessment for the proposed development of the Platberg Wind Energy Facility and supporting electrical infrastructure near Victoria West, Northern Cape Province	Author	CSIR
2016	Visual Impact Assessment Rietkloof Wind Energy Facility, Western Cape, South Africa	Peer Review	EOH Coastal & Environmental Services
2016	Visual Impact Assessment Brandvalley Wind Energy Facility, Western Cape, South Africa	Peer Review	EOH Coastal & Environmental Services
2016	29 Solar Dealesville PV EIA, Free State – VIA Reports	Author	CSIR
2016	Mulilo Nieuwehoop PV Phase 2 EIA, Northern Cape – VIA Reports	Author	CSIR
2015	Scatec Kenhardt PV EIA, Northern Cape – VIA report	Author	CSIR
2015	Vredenburg Landfill Extension BA, Western Cape – VIA Report	Author	Jeffares & Green (Pty) Ltd

2015	Umgeni Lovu and Tongaat Desalination Plants EIAs, KwaZulu-Natal – VIA Reports	Author	CSIR
2015	Inyanda-Roodeplaat WEF, Uitenhage, EC – VIA Report	Author	SRK
2015	OTGC Oil Storage Terminal BA – Visual Impact, Durban, KZN	Author	CSIR
2014	Mainstream Dealesville Solar Plants VIA, Free State Province – VIA Report	Author	CSIR
2014	Mulilo Nieuwehoop PV Phase 1, Northern Cape – VIA Report	Author	CSIR
2014	Frontier SRMOP EIA, Saldanha, WC	Author	CSIR
2013	Ishwati Emoyeni Wind Energy Facility VIA, Western Cape	Author	CSIR
2013	Venter Fert Composting and Fertiliser Plant – VIA Report	Author	Public Process Consultants
2013	Kipeto Power Line, Kenya – VIA Report	Author	Kipeto Energy Ltd.
2012	Ngqura Manganese Export Facility VIA, Coega, Eastern Cape	Author	CSIR
2012	Toliara Sands Mining Project VIA, Toliara, Madagascar	Author	CES
2012	Mkuze Biofuel Power Plant VIA, Mkuze, KwaZulu-Natal	Author	CSIR
2012	Vleesbaai WEF VIA, Western Cape	Author	CSIR
2012	Saldanha Desalination Plant VIA, Saldanha Bay, Western Cape	Author	CSIR
2012	Mossel Bay WEF, Western Cape – VIA Report	Author	CES
2012	Keimoes Solar Energy Facility, NC – VIA Report	Author	CSIR
2012	Douglas Solar Energy Facility, NC – VIA Report	Author	CSIR
2012	Richards Bay WEF VIA, KZN	Author	CES
2012	Hluhluwe WEF VIA, KZN	Author	CES
2012	Plan8 Grahamstown Wind Farm VIA, Eastern Cape	Author	CES
2012	Kipeto Wind Farm VIA, Kenya	Author	Galetech Energy Developments Ltd.
2011	Coega IDZ Zone 12 Wind Farm – VIA Report	Author	CSIR
2011	Haverfontein Wind Farm, Mpumalanga – VIA Report	Author	CES
2011	Middleton Wind Farm, Cookhouse	Author	CES
2011	Broadlands PV Plant, Humansdorp	Author	CSIR
2011	Ubuntu Wind Farm, Jeffrey's Bay	Author	CSIR
2011	Lushington Park Wind Farm, East London	Author	CES
2011	Chaba Wind Farm, Komga	Author	CES
2010	Thomas River Wind Farm and PV Park VIA, Stutterheim	Author	CES

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me, and that I am available to work on this project.

Date: 25/07/17

Full name of staff member: *Henry Holland*

SPECIALIST DECLARATION

I, Henry Holland, as the appointed independent specialist hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Henry Holland

Signature of the specialist

Date: 11 April 2017

EXECUTIVE SUMMARY

The Visual Impact Assessment specialist study compiled as part of the Basic Assessment (BA) Process for the proposed construction of electrical grid infrastructure to support the proposed Rietrug Wind Energy Facility (WEF), near Sutherland, in the Northern and Western Cape Provinces was conducted by Henry Holland.

The landscape surrounding the proposed site has a rural agricultural character with a strong sense of remoteness, and potential for scenic views.

Very few sensitive visual receptors will potentially be affected by the proposed power line:

- Residents and viewpoints on farms surrounding the proposed development site. These are highly sensitive visual receptors since they have an active interest in their surrounding landscape; and
- Motorists using secondary gravel roads and private tracks. These are low sensitivity visual receptors since their attention will be on the road.

Visual intrusion will be low for visual receptors on surrounding farms since the landscape is already transformed by structures similar to those of the proposed power line.

The significance of the potential visual impact of construction activities for both alternatives is low if mitigation measures are successfully implemented. Mitigation measures include locating construction camps and laydown sites in low visibility areas, and avoiding erosion scarring on higher slopes.

The potential impact significance of the proposed development on the landscape character of the region is very low for Alternative 1 and low for Alternative 2 before and after the implementation of mitigation measures, for the operational phase. It is higher for Alternative 2 because the route traverses the escarpment and may affect the potential for scenic views. The construction and decommissioning phases of the project will not alter the landscape character.

The significance of the potential visual impact of the proposed development during the operational phase is very low for Alternative 1 and low for Alternative 2 if mitigation measures (e.g. lattice type towers rather than monopole) are implemented. The rating after mitigation measures are implemented is higher for Alternative 2 because it is a longer route that traverses the escarpment, which means that it can potentially affect more sensitive visual receptors.

The significance of the potential visual impact of decommissioning activities is the same as for construction activities (low for both Alternatives after mitigation). Mitigation measures are the same as for construction activities but also include measures to rehabilitate disturbed landscape.

A number of large renewable energy projects are proposed for the region and if any of them are developed then the current agricultural landscape will include a large renewable energy generation component. The proposed electrical infrastructure for the Rietrug WEF is unlikely to alter that landscape character and therefore the significance of the cumulative landscape impact will be very low regardless of phase. No mitigation is required for this impact.

If any of the renewable energy projects proposed for this region are built then the electrical infrastructure proposed for the Rietrug WEF will be familiar elements of views and the significance of the cumulative visual impact will be low before mitigation and very low thereafter.

In terms of visual and landscape impacts the preferred route is Alternative 1 since it is shorter and will affect fewer sensitive visual receptors but no fatal flaws were identified for Alternative 2.

In light of the overall low significance of the potential visual impact there is no reason this project should not be authorised.

contents

SPECIALIST CV 1

SPECIALIST DECLARATION 4

EXECUTIVE SUMMARY 5

LIST OF ABBREVIATIONS 10

GLOSSARY 10

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED) 12

1 VISUAL IMPACT ASSESSMENT 13

1.1 INTRODUCTION AND METHODOLOGY 13
1.1.1 Scope, Purpose and Objectives 13
1.1.2 Terms of Reference 13
1.1.3 Assessment Details 14
1.1.4 Approach and Methodology 14
1.1.5 Information Sources 15
1.1.6 Assumptions and Limitations 15
1.1.6.1 Assumptions 15
1.1.6.2 Limitations 16
1.1.7 Consultation Processes Undertaken 17

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO VISUAL IMPACTS 17
1.2.1 Construction and Decommissioning Phases 18
1.2.2 Operational Phase 19

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT 19

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS 22

1.5 ISSUES, RISKS and Impacts 23
1.5.1 Key Issues Identified During the BA Process 23
1.5.2 Identification of Potential Impacts 23
1.5.2.1 Landscape 23
1.5.2.2 Sensitive Visual Receptors 24
1.5.2.3 Construction Phase 26
1.5.2.4 Operational Phase 26
1.5.2.5 Decommissioning Phase 27
1.5.2.6 Cumulative Impacts 27

1.6 VISUAL IMPACT CONCEPTS AND ASSESSMENT CRITERIA 27
1.6.1 Visibility Ratings 27
1.6.2 Visual Exposure 28
1.6.2.1 Residents and Viewpoints on Surrounding Farms 29
1.6.2.2 Motorists 30
1.6.3 Visual Intrusion 30

1.6.3.1 Photographic Survey 30
1.6.3.2 Residents and viewpoints on surrounding farms 37
1.6.3.3 Motorists 37

1.7 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS 46
1.7.1 Construction Phase: Potential visual intrusion of activities associated with the construction of electrical infrastructure along Alternative 1 on existing views of sensitive visual receptors in the surrounding landscape 46
1.7.1.1 Significance Statement 46
1.7.1.2 Mitigation Measures 46
1.7.2 Construction Phase: Potential visual intrusion of activities associated with the construction of electrical infrastructure along Alternative 2 on existing views of sensitive visual receptors in the surrounding landscape 47
1.7.2.1 Significance Statement 47
1.7.2.2 Mitigation Measures 47
1.7.3 Operational Phase: Potential landscape impact of the proposed electrical infrastructure along Alternative 1 on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views 48
1.7.3.1 Significance Statement 48
1.7.4 Operational Phase: Potential landscape impact of the proposed electrical infrastructure along Alternative 2 on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views 49
1.7.4.1 Significance Statement 49
1.7.5 Operational Phase: Potential visual intrusion of the proposed electrical infrastructure along Alternative 1 on the views of sensitive visual receptors 49
1.7.5.1 Significance Statement 49
1.7.5.2 Mitigation Measures 50
1.7.6 Operational Phase: Potential visual intrusion of the proposed electrical infrastructure along Alternative 2 on the views of sensitive visual receptors 52
1.7.6.1 Significance Statement 52
1.7.6.2 Mitigation Measures 53
1.7.7 Decommissioning Phase: Potential visual intrusion of decommissioning activities associated with electrical infrastructure along Alternative 1 on views of sensitive visual receptors 54
1.7.7.1 Significance Statement 54
1.7.7.2 Mitigation Measures 54
1.7.8 Decommissioning Phase: Potential visual intrusion of decommissioning activities associated with electrical infrastructure along Alternative 2 on views of sensitive visual receptors 55
1.7.8.1 Significance Statement 55
1.7.8.2 Mitigation Measures 55
1.7.9 Cumulative impact of renewable energy generation projects and large scale electrical infrastructure on the existing rural-agricultural landscape 56
1.7.9.1 Significance Statement 56
1.7.10 Cumulative visual impact of renewable energy generation projects and large scale electrical infrastructure on existing views of sensitive visual receptors in the surrounding landscape 57
1.7.10.1 Significance Statement 57
1.7.11 No-go Alternative 59

1.8 IMPACT ASSESSMENT SUMMARY 60

1.9 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME 67
1.9.1 Planning and Design 67
1.9.2 Construction Phase 67
1.9.3 Operational Phase 67
1.9.4 Decommissioning Phase 67

1.10 IMPACT ASSESSMENT SUMMARY 67

1.11 CONCLUSION AND RECOMMENDATIONS 68

1.12 FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION 69

1.13 REFERENCES **69**

1.14 APPENDICES **70**
1.14.1 Maps 70

Map 1 Proposed Alternative 1 of the 132 kV overhead line and substations associated with the Rietrug WEF. 71
Map 2 Proposed Alternative 2 of the 132 kV overhead line and substations associated with the Rietrug WEF. 72
Map 3 Map describing the main elements of the landscape traversed by Alternative 1. 73
Map 4 Map describing the main elements of the landscape traversed by Alternative 2. 74
Map 5 Topographic profiles of proposed alternative routes for the overhead lines. 75
Map 6 Viewshed of the proposed 132 kV power line along Alternative 1. 76
Map 7 Viewshed of the proposed 132 kV power line along Alternative 2. 77
Map 8 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 1 distribution line route. 78
Map 9 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 2 distribution line route. 79
Map 10 Sites visited during photographic survey. 80
Map 11 Visual sensitivity map of the properties hosting the proposed electrical infrastructure. 81
Map 12 Map showing various renewable energy projects in the region surrounding the Rietrug electrical infrastructure project. The map shows the properties on which the projects will be developed and not the footprints of the proposed developments. 82

tables

Table 1-1: Number of buildings within 5 km of the proposed development, and their potential visual exposure rating. 29
Table 1-2 Visual Impact Criteria and Impact Intensity for the Rietrug 132 kV electrical infrastructure project. 38
Table 1-3 Impact Summary Rating 46
Table 1-4 Impact Summary Rating 48
Table 1-5 Impact Summary Rating 48
Table 1-6 Impact Summary Rating 49
Table 1-7 Impact Summary Rating 52
Table 1-8 Impact Summary Rating 53
Table 1-9 Impact Summary Rating 54
Table 1-10 Impact Summary Rating 56
Table 1-11 Impact Summary Rating 57
Table 1-12 Impact Summary Rating 58
Table 1-13 Impact assessment summary table for the Construction Phase 61
Table 1-14 Impact assessment summary table for the Operational Phase 63
Table 1-15 Impact assessment summary table for the Decommissioning Phase 64
Table 1-16 Cumulative impact assessment summary table 66
Table 1-17 Overall Impact Significance (Post Mitigation) 68

figures

Figure 1-1 Proposed Alternative 1 132 kV overhead line and substations associated with the Rietrug WEF. 17
Figure 1-2 Proposed Alternative 2 132 kV overhead line and substations associated with the Rietrug WEF. 18
Figure 1-3 Map describing the main elements of the landscape traversed by Alternative 1. 20
Figure 1-4 Map describing the main elements of the landscape traversed by Alternative 2. 21
Figure 1-5 Topographic profiles of proposed alternative routes for the overhead lines. 22
Figure 1-6 Viewshed of the proposed 132 kV power line along Alternative 1. 24
Figure 1-7 Viewshed of the proposed 132 kV power line along Alternative 2. 25
Figure 1-8 Inset map showing the viewshed for Alternative 1 near Sutherland and the SA Astronomical Observatory. The Observatory is more than 30 km from Alternative 1 and 2, and it is very unlikely that the proposed power line will be noticed from here. 26
Figure 1-9 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 1 distribution line route. 28
Figure 1-10 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 2 distribution line route. 29
Figure 1-11 Sites visited during photographic survey. 30
Figure 1-12 Visual sensitivity map of the properties hosting the proposed electrical infrastructure. 31
Figure 1-13 View east from photo site SVP015 showing the general landscape character of the region on top of the plateau. Distribution lines are visible in the lower left corner but their visibility is reduced by the mottled vegetation background. Farmsteads are often surrounded by high trees but vegetation is general low growing shrubs and fynbos. 32
Figure 1-14 View south-east from the Nooitgedacht farmstead (SVP018). 32
Figure 1-15 View south-east from SVP019 showing landscape character of the region. Distribution lines and gravel road visible in the foreground. 33
Figure 1-16 View of the escarpment and plains below it from the Rooiberg Pass (towards the east). 33
Figure 1-17 View south-west from SVP021 near the Hamelkraal farmstead. Existing high voltage transmission line towers are visible on the distant hills. This site (SVP021) is on the plains below the escarpment. 34
Figure 1-18 View west from SVP021 towards the escarpment. Proposed Alternative 2 will pass through the Kloof in the centre of the photograph. 34
Figure 1-19 View south from the road between SVP023 and SVP024 showing the existing high voltage power lines that form a prominent man-made feature of the landscape in this region. 35
Figure 1-20 View west from SVP024 towards the proposed site for the proposed Eskom substation at the eastern end of Alternative 2. Due to the high ridges (escarpment) in the background the substation is unlikely to be exposed above the skyline for motorists. 35
Figure 1-21 High voltage power lines crossing the road at SVP025 (looking east). 36
Figure 1-22 An example of lattice towers used for 132 kV power lines. (Source: https://optipower.co.za/mizpah-msinga/) 50
Figure 1-23 An example of monopole towers next to a lattice type tower for 132 kV power lines. (Source: http://www.rame.co.za/flagship-projects/132kv-lattice-to-mono-pole-replacement/nggallery/image/578) 51
Figure 1-24 High voltage transmission lines with lattice towers against a mottled landscape similar to that of the Sutherland region (photo taken by author). 52
Figure 1-25 Map showing various renewable energy projects in the region surrounding the Rietrug electrical infrastructure project. The map shows the properties on which the projects will be developed and not the footprints of the proposed developments. 59

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
CPV	Concentrated Photovoltaic
DEM	Digital Elevation Model
GIS	Geographic Information System
PV	Photovoltaic
VIA	Visual Impact Assessment

GLOSSARY

	DEFINITIONS
Cumulative viewshed	A viewshed which indicates in some way how much of a development is visible from a particular viewpoint. In a raster based cumulative viewshed each pixel value will indicate how many points within the development area are visible. A power line development could, for example, use pylons as points to generate a cumulative viewshed for the development. Each pixel value in the viewshed will be a count (accumulation) of the number of pylons that will potentially be visible from that pixel.
Digital Elevation Model (DEM)	A digital or computer representation of the topography of an area.
Landscape baseline	A description of the existing elements, features, characteristics, character, quality and extent of the landscape (GLVIA, 2002).
Landscape character	The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape (GLVIA, 2002).
Landscape impacts	Change in the elements, characteristics, character and qualities of the landscape as the result of development (GLVIA, 2002). These effects can be positive or negative, and result from removal of existing landscape elements, addition of new elements, or the alteration of existing elements.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. The unique quality or character of a place, whether natural, rural or urban. Relates to uniqueness, distinctiveness or strong identity (Oberholzer 2005).

Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Viewshed	A viewshed is an area of land, water, and other environmental elements that is visible from a fixed vantage point. In digital imaging, a viewshed is a binary raster indicating the visibility of a viewpoint for an area of interest. A pixel with a value of unity indicates that the viewpoint is visible from that pixel, while a value of zero indicates that the viewpoint is not visible from the pixel.
Visual exposure	Visual exposure refers to the relative visibility of a project or feature in the landscape (Oberholzer, 2005). Exposure and visual impact tend to diminish exponentially with distance.
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.
Visual intrusion	Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer 2005).
Visual receptors	Visual receptors include viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible.
Visual resource	Visual resource is an encompassing term relating to the visible landscape and its recognisable elements which, through their coexistence, result in a particular landscape and visual character

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R326 (7 April 2017)	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary Section of this Report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Preliminary Section of this Report and Appendix I of the BA Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section1.1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 1.3, 1.5, 1.6 and 1.7
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1.4
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternatives;	Section 1.3 and Map 11
g) an identification of any areas to be avoided, including buffers;	1.6.3.1
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 1-12 and **Map 11**
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.6
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 1.5 to 1.7
k) any mitigation measures for inclusion in the EMPr;	Section 1.9
l) any conditions for inclusion in the environmental authorisation;	No
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.12
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	None
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not Applicable

1 VISUAL IMPACT ASSESSMENT

This report presents the Visual Impact Assessment that was prepared by Henry Holland as part of the Basic Assessment (BA) Process for the proposed construction of electrical grid infrastructure to support the proposed Rietrug Wind Energy Facility (WEF), near Sutherland, in the Northern and Western Cape Provinces.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope, Purpose and Objectives

Rietrug Electrical Grid Infrastructure BA project will include one on-site substation (including an Operational and Maintenance (O&M) Building and laydown area), one 132 kV distribution line (two alternative routing options), the connection to a third party substation (i.e. two alternative options) and a service road below the line.

This Visual Impact Assessment is being undertaken as part of the requisite BA Process for the proposed distribution line and associated electrical grid infrastructure to service the proposed Rietrug WEF project, which received an amended Environmental Authorisation in November 2016.

The overall scope and objectives of this Visual Impact Assessment are to:

- Determine the current conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts that may occur during the construction, operational and decommissioning phases of development, as well as impacts associated with future environmental changes if the "no-go" option is implemented (both positive and negative);
- Assess the impacts, in terms of direct, indirect and cumulative impacts;
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts; and
- Incorporate and address all issues and concerns raised by Interested and Affected Parties (I&APs) and the public.

1.1.2 Terms of Reference

The Terms of Reference for the Visual Impact Assessment are as follows:

- Review detailed information relating to the project description and precisely define the environmental risks to the landscape and the risks to sensitive viewers, as well as the consequences thereto.
- Conduct a site visit and undertake a Photographic Survey of the surrounding region from which the landscape and visual baselines can be prepared.
- Compile a baseline description of the visual character/baseline and the landscape of the affected area.
- Undertake data preparation and the visibility analysis, which includes the calculation of viewsheds for various elements of the proposed development. Identify principal viewpoints and sensitive visual receptors.

- Identify and rate potential direct, indirect and cumulative impacts on the landscape and on sensitive viewers/receptors for the construction, operation and decommissioning phases of the proposed project. Study the cumulative impacts of the proposed project by considering the impacts of existing and proposed renewable energy facilities and electrical infrastructure within the area, together with the impact of the proposed project.
- Provide input to the Environmental Management Programme (EMPr), including mitigation and monitoring requirements to ensure that the visual impacts on the principal viewpoints and sensitive viewsheds are mitigated.
- Compile an assessment report (i.e. this report) qualifying the results of the fieldwork, risks and potential visual impacts, and impact evaluations, including potential mitigation measures, monitoring requirements as well as relevant recommendations.

1.1.3 Assessment Details

Type of Specialist Investigation	Visual Impact Assessment
Date of Specialist Site Investigation	11 to 13 January 2017
Season	Summer
Relevance of Season	Natural vegetation in the area is very low shrubs and bushes and seasonal differences are unlikely to affect visibility of the proposed project. The region has very low annual rainfall and seasonal differences in vegetation are unlikely to affect the potential impact of the proposed project on the landscape.

1.1.4 Approach and Methodology

This Visual Impact Assessment (VIA) is based on guidelines for visual assessment specialist studies as set out by South Africa's Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) (Oberholzer 2005), as well as guidelines provided by the Landscape Institute of the UK (GLVIA 2002).

A visibility analysis was conducted for the region surrounding the proposed development site and components of the development relevant to the assessment of the potential visual impact (10 km radius) to identify key representative viewpoints and sensitive visual receptors. A site visit and photographic survey of this region followed (11 to 13 January 2017) to establish a baseline for visual resources to compare the proposed developments against. Spatial Development Frameworks (SDF) and Integrated Development Plans (IDP) for the relevant municipalities were studied to align the VIA with municipal objectives in terms of landscape and visual resources.

The key steps followed in the VIA are presented below:

Site Visit and Photographic Survey

The field survey (conducted on 11 to 13 January 2017) provided an opportunity to:

- Determine the actual or practical extent of potential visibility of the proposed development, by assessing the screening effect of landscape features;
- Conduct a photographic survey of the landscape surrounding the development;
- Take photos for use in photomontage images;
- Identify sensitive landscape and visual receptors;
- Choose viewpoints using the following criteria:
    - High visibility – sites from where most of the proposed electrical grid infrastructure will be visible;
    - High visual exposure – sites at various distances from the proposed project site; and

  - Sensitive areas and viewpoints such as nature reserves and game farms from which the proposed electrical grid infrastructure will potentially be seen.
- Additionally, choose photo sites to aid in describing the landscape surrounding, and potentially affected by, the proposed development.

Landscape Description

A desktop study was conducted to establish and describe the landscape character of the receiving environment. A combination of data analysis using a Geographic Information System (GIS), literature review and photographic survey was used to identify land cover, landforms and land use in order to gain an understanding of the current landscape within which the proposed development will take place (GLVIA 2002). Areas of scenic interest, potential sensitive receptors (viewpoints, residences), preliminary zone of visual influence, and principal representative viewpoints were also identified. Landscape features of special interest were identified and mapped, as were landscape elements that may potentially be affected by the proposed development.

Visual Impact Assessment

A GIS (TNTmips[1]) was used to calculate viewsheds for various components of the proposed development. The viewsheds and information gathered during the field survey were used to define criteria such as visibility, viewer sensitivity, visual exposure and visual intrusion for the proposed development. These criteria were, in turn, used to determine the intensity of potential visual impacts on sensitive viewers. All information and knowledge acquired as part of the assessment process was then used to determine the potential significance of the impacts according to the standardised rating methodology as described in Section D of the BA Report for the project.

1.1.5 Information Sources

The VIA is based on the following information:

- Documentation supplied by the client and the CSIR;
- Digital topocadastral data at 1:50 000 scale from the National Geo-spatial Information database[2];
- ENPAT geology layer;
- Google Earth software and data;
- South African digital land cover dataset of 2013;
- Renewable Energy EIA Application Database for SA, 2016 Quarter 1[3];
- Protected Areas Data Release - First Quarter 2016[3]; and
- Eskom SPOT Building Count data set (de la Rey 2008).

The data is the most recent available and adequate for the visibility analyses.

1.1.6 Assumptions and Limitations

1.1.6.1 Assumptions

Mitigation Measures

Mitigation measures in this report will assume that construction activities are managed and performed in such a way as to minimise its impact on the receiving environment. The following

[1] http://www.microimages.com/products/tntmips.htm
[2] http://www.ngi.gov.za
[3] http://egis.environment.gov.za/

assumptions, in particular, apply since they are relevant to minimising visual impact during the construction phase:

- The contractor will maintain good housekeeping on site to avoid litter and minimise waste;
- Project developers will demarcate construction boundaries and minimise areas of surface disturbance;
- Vegetation and ground disturbance will be minimized. Take advantage of existing clearings;
- Construction of new access roads will be minimised and existing roads will be used where possible;
- Topsoil from the site will be stripped, stockpiled, and stabilised before excavating earth for the construction of the proposed distribution line;
- Vegetation material from vegetation removal will be mulched and spread over fresh soil disturbances to aid in the rehabilitation process;
- Plans will be in place to control and minimise erosion risks;
- Plans will be in place to minimise fire hazards and dust generation; and
- Plans will be in place to rehabilitate cleared areas as soon as possible.

Cumulative Impacts

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include:

- Suurplaat WEF;
- Rietrug WEF;
- Sutherland WEF;
- Sutherland 2 WEF;
- Roggeveld WEF;
- Ikarus Photovoltaic Solar Energy Facility;
- Hidden Valley WEF;
- Gunsfontein WEF;
- Maralla East WEF;
- Maralla West WEF;
- Esizayo WEF;
- Komsberg East WEF;
- Komsberg West WEF;
- Gunstfontein Switching Station, 132kV overhead power line and ancillary infrastructure for the proposed Gunstfontein WEF;
- Electrical infrastructure (132 kV overhead power lines and substations) for the proposed Sutherland WEF; and
- Electrical infrastructure (132 kV overhead power lines and substations) for the proposed Sutherland 2 WEF.

1.1.6.2 Limitations

Spatial Data Accuracy

Spatial data used for visibility analysis originate from various sources and scales. Inaccuracy and errors are therefore inevitable. Where relevant these will be highlighted in the report. Every effort was made to minimize their effect.

Viewshed Calculations

Calculation of the viewsheds does not take into account the potential screening effect of vegetation and buildings. Due to the relatively low vegetation cover in the region and the size and extent of the proposed electrical grid infrastructure, the screening potential of vegetation is likely to be minimal over most distances.

Viewsheds are calculated using Digital Elevation Model (DEM) which is derived from 1:50000 scale contour lines with a 20 m vertical distance between contours. The DEM has a pixel resolution of 20 m x 20 m and covers a 70 km x 30 km area (within which the study area is located at 5 km radius around the development site).

1.1.7 Consultation Processes Undertaken

No consultation with landowners was undertaken.

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO VISUAL IMPACTS

This section describes the aspects of the proposed project that are relevant in terms of potential visual impacts. Figure 1-1 and Figure 1-2 below show the proposed 132 kV overhead lines (Alternatives 1 and 2) and substations associated with the Rietrug WEF.

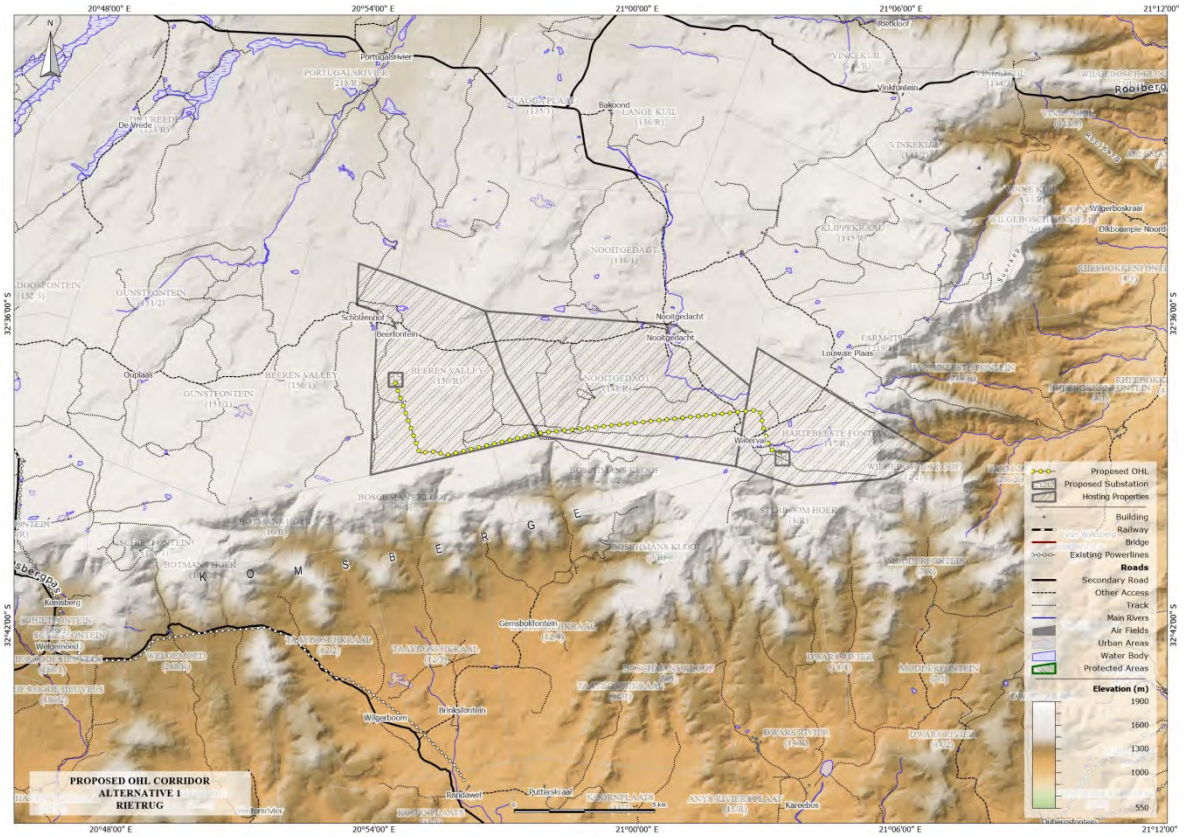


Figure 1-1 Proposed Alternative 1 132 kV overhead line and substations associated with the Rietrug WEF.

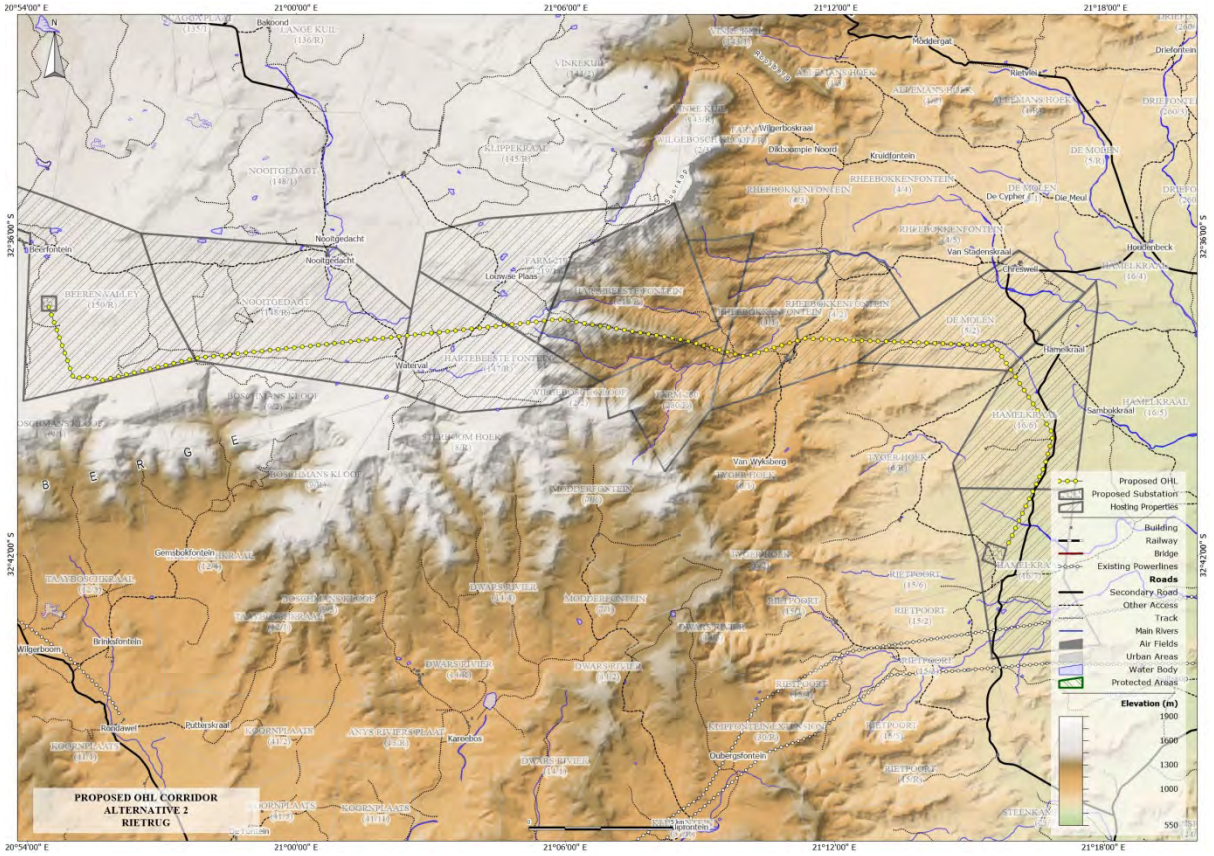


Figure 1-2 Proposed Alternative 2 132 kV overhead line and substations associated with the Rietrug WEF.

1.2.1 Construction and Decommissioning Phases

Elements of the construction and decommissioning phases of the proposed powerline that will have a potential visual impact include:

- Some construction activities will potentially be exposed above the skyline due to the height of the pylons, and as such it is likely to be more intrusive on views;
- Laydown areas for equipment will be required, although these will be temporary;
- Access roads, maintenance roads and power line servitudes will potentially require clearing of vegetation;
- Soil stockpiles and removed vegetation heaps will be visible;
- Alien invasive plant species, if not adequately controlled, may contrast strongly with surrounding vegetation;
- An increase in human activity in a remote area is likely to be noticed even by only a small number of visual receptors. Relatively large construction equipment and vehicles will be operating during these phases of development, and an increase in traffic on roads in the region is likely;
- Exposure of large areas of soil, and worker and equipment traffic will increase dust generation which will increase construction visibility; and
- Construction of service roads or improvement of access roads will be more visible than the operational roads.

1.2.2 Operational Phase

The proposed power line pylons are expected to extend up to 32 m high for 132 kV lines. The power lines can potentially intrude on scenic views and due to the linear nature of the proposed development the potential for scenic views can be affected for a large region. Alternative 1 is approximately 17 km long and Alternative 2 is approximately 43 km. Maintenance of the servitude is unlikely to happen often since vegetation cover within the general area is low.

It is important to note that a complete, detailed project description is included in Section A of the BA Report. The proposed distribution line and electrical infrastructure BA project will include the following connectivity options:

- The construction of a 132 kV distribution line from the proposed on-site substation at the Rietrug WEF along the Alternative 1 route to a collector hub on Hartebeestefontein Farm (147/Remainder); or
- The construction of a 132 kV distribution line from the proposed on-site substation at the Rietrug WEF along the Alternative 2 route to a proposed substation on Hamelkraal Farm (16/7).

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The topography of the region is dominated by the escarpment (the Great Escarpment) which is located just south of the proposed distribution line routes (between 500 m and 5 km). Seen from the lower lying regions to the south it appears as a mountain range (named Komsberg). The difference in elevation between the top of the escarpment and the base is roughly 800 m (Figure 1-5b). Rivers, such as the Dwyka, Tronk and Blouval Rivers create steeply incised valleys in the plateau above the escarpment, although in general the plateau itself is open with gently rolling hills (Figure 1-5a). Important rivers on the plateau are the Portugals and Riet Rivers. The geology of the region consists mostly of sedimentary rocks of the Beaufort Subgroup in sub-horizontal layers. There are erosion resistant dolerite dykes and sills which form steep hills and ridges in places. Vegetation consists mainly of fynbos and shrubs with very few trees or taller plants (these are mostly located near farmsteads) (Figure 1-3 and Figure 1-4). River and stream valleys may contain thicket. Land use is predominantly stock (sheep) and game farming. The region is sparsely populated with farmsteads located far from each other (and often unoccupied or derelict). Sutherland is a small settlement approximately 30 km north of the proposed development sites which provides services to the surrounding agricultural community. The town is a tourist attraction due to its proximity to the South African Astronomical Observatory (which is located on a hill outside town and is visible across much of the plateau within the study region). There are two secondary roads (gravel) that pass near the proposed development, but access to the sites are little more than tracks on private land. An existing 132 kV power line follows the secondary road west of the proposed development sites, and several high voltage transmission lines are located south of the sites below the escarpment. These lines pass within 3 km of the proposed Eskom substation at the eastern end of Alternative 2.

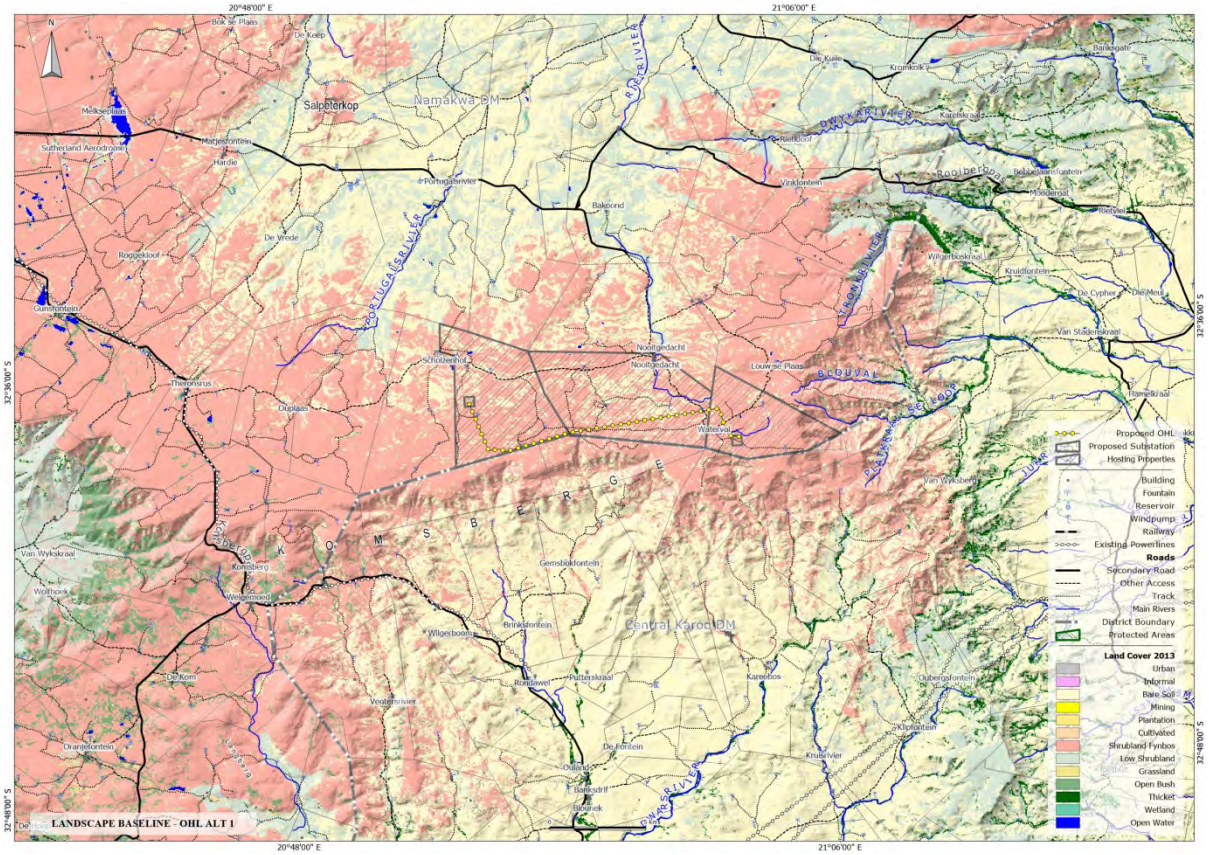


Figure 1-3 Map describing the main elements of the landscape traversed by Alternative 1.

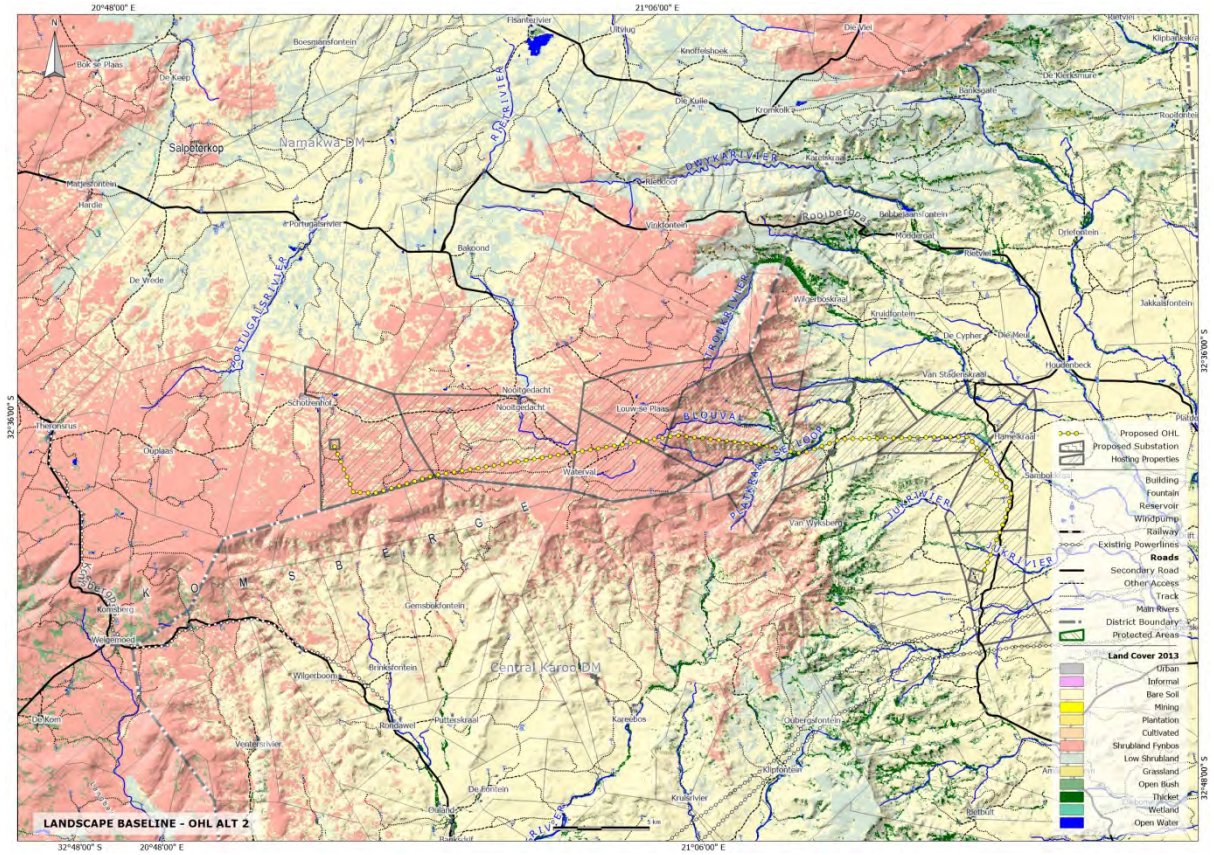


Figure 1-4 Map describing the main elements of the landscape traversed by Alternative 2.

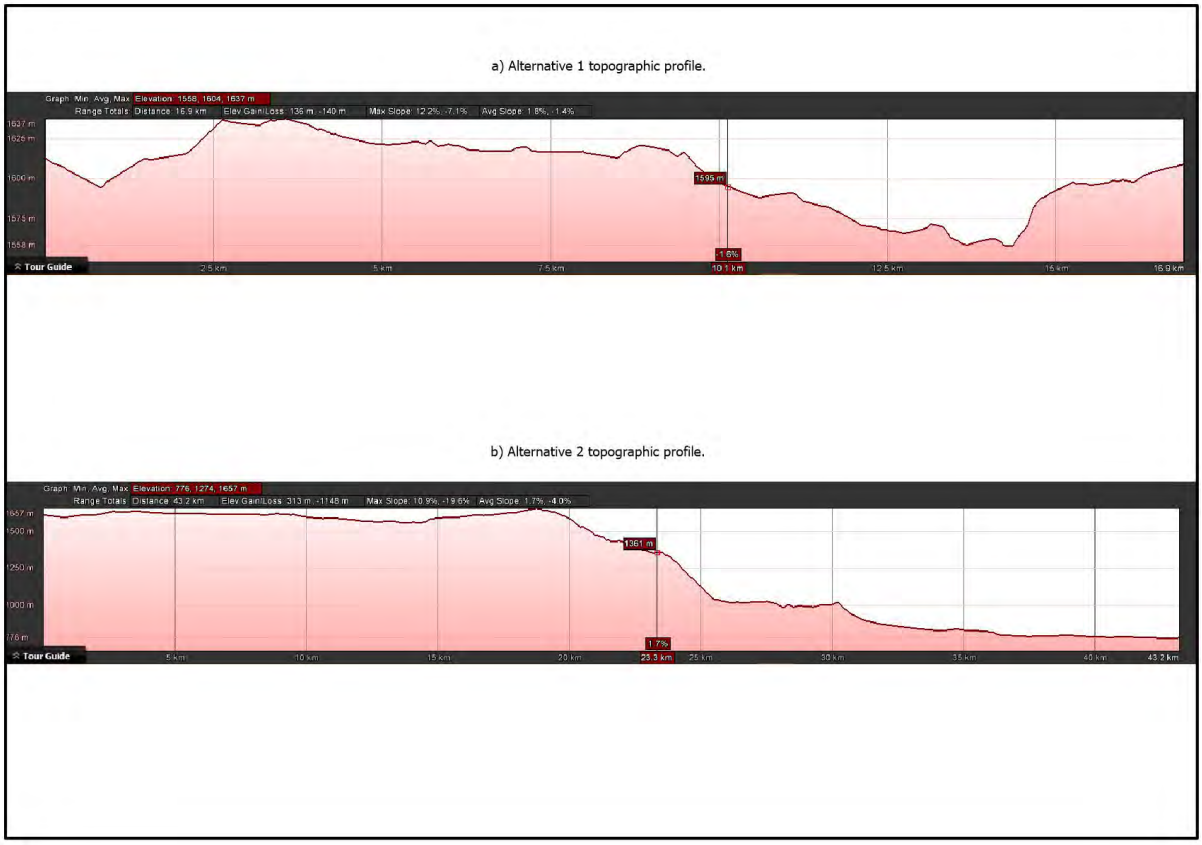


Figure 1-5 Topographic profiles of proposed alternative routes for the overhead lines.

The landscape surrounding the proposed site has a rural agricultural character with a strong sense of remoteness and potential for scenic views, particularly near the escarpment. It is in a remote part of the country and is sparsely populated. There are a few existing elements similar to the proposed electrical infrastructure but overall man-made structures in the region are consistent with a rural agricultural landscape.

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The following legislation and local and district municipal plans are applicable to the proposed project:

- The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA (Act 107 of 1998);
- The Protected Areas Act (PAA) (Act 57 of 2003, Section 17) which refers to the conservation and protection of natural landscapes;
- The Western Cape Government has *"Conserve and strengthen the sense of place of important natural, cultural and productive landscapes, artefacts and buildings"* as one of its Resource Management Policy objectives. In the Provincial SDF (Western Cape Government 2014) it further states: *"A number of scenic landscapes of high significance are under threat and require strategies to ensure their long-term protection. These include: iii) Landscapes under pressure for large scale infrastructural developments such as wind farms, solar energy facilities, transmission lines and shale gas development in the Central Karoo.* Provincial Spatial Policy R5 on Safeguarding Cultural and Scenic Assets state: *"2.*

Protect heritage and scenic assets from inappropriate development and land use change. 5. Priority focus areas proposed for conservation or protection include: iii. Landscapes under pressure for large scale infrastructural developments such as wind farms, solar energy facilities, transmission lines and fracking, e.g. Central Karoo. iv. Vulnerable historic mountain passes and 'poorts'.

- The Laingsburg Local Municipality SDF (CNdV Africa 2012) does not refer to scenic landscapes or visual impact. It does suggest improvement or upgrading of "scenic routes to Sutherland" should be included in sector plans but does not specify which routes those are.
- The Hoogland Karoo Local Municipality SDF (Umsebe Development Planners 2010) also does not refer to scenic landscapes or visual impact. It does mention that tourism is not highly developed in the municipality and *"that the majority of tourists or visitors to the region may be passing through and may therefore be of the "Stop and Drop" variety, spending money on lunch or dinner and local curios and perhaps staying overnight for one night."*
- Renewable Energy Development Zones (REDZ) (CSIR 2014) – The Mainstream projects are located in Focus Area 2 – Komsberg which was identified by the Strategic Environmental Assessment (SEA) as a potential development zone for wind and solar energy. Landscape and visual specialists were involved in the Scoping Assessments of the Focus Areas.

1.5 ISSUES, RISKS and Impacts

1.5.1 Key Issues Identified During the BA Process

The potential visual issues identified during the BA Process include:

- Construction Phase: Visual intrusion of construction activities on existing views of sensitive visual receptors in the surrounding landscape;
- Operational Phase: Landscape impact of proposed electrical infrastructure on a rural agricultural landscape with strong sense of remoteness and potential for scenic views;
- Operational Phase: Visual intrusion of proposed electrical infrastructure on the views of sensitive visual receptors;
- Decommissioning Phase: Visual intrusion of decommissioning activities on existing views of sensitive visual receptors;
- Cumulative landscape impact of renewable energy projects and electrical infrastructure in the region; and
- Cumulative visual impact of renewable energy projects and electrical infrastructure in the region.

To date, no comments have been raised by I&APs that relate to visual impacts.

1.5.2 Identification of Potential Impacts

Features at risk of impact in a VIA are the landscape and sensitive visual receptors in the landscape.

1.5.2.1 Landscape

A landscape impact occurs when a development alters the existing landscape character. If the landscape character is highly sensitive to the development type then the intensity of the impact will be high. A high intensity landscape impact, for instance, will be highly significant if the landscape character type is scarce as well as highly valued by the community (local, regional, national and international). The landscape impact does not depend only on the existing sensitive

visual receptors since it can also affect future visual receptors and communities beyond the local or regional context.

The current landscape character of the region surrounding the proposed distribution line (Alternatives 1 and 2) is rural-agricultural with a strong sense of remoteness. All roads within 25 km of the proposed distribution line (Alternatives 1 and 2) are gravel roads, and traffic is very light – access to the sites is very limited. Sutherland (30 km away) and Merweville (between 20 and 40 km away) are the closest settlements. The proposed power lines will potentially affect the sense of remoteness of the area and as such the sensitivity of the landscape character to the proposed development is rated as **moderate** (there is a moderate chance of the proposed development changing the landscape character of the region).

1.5.2.2 Sensitive Visual Receptors

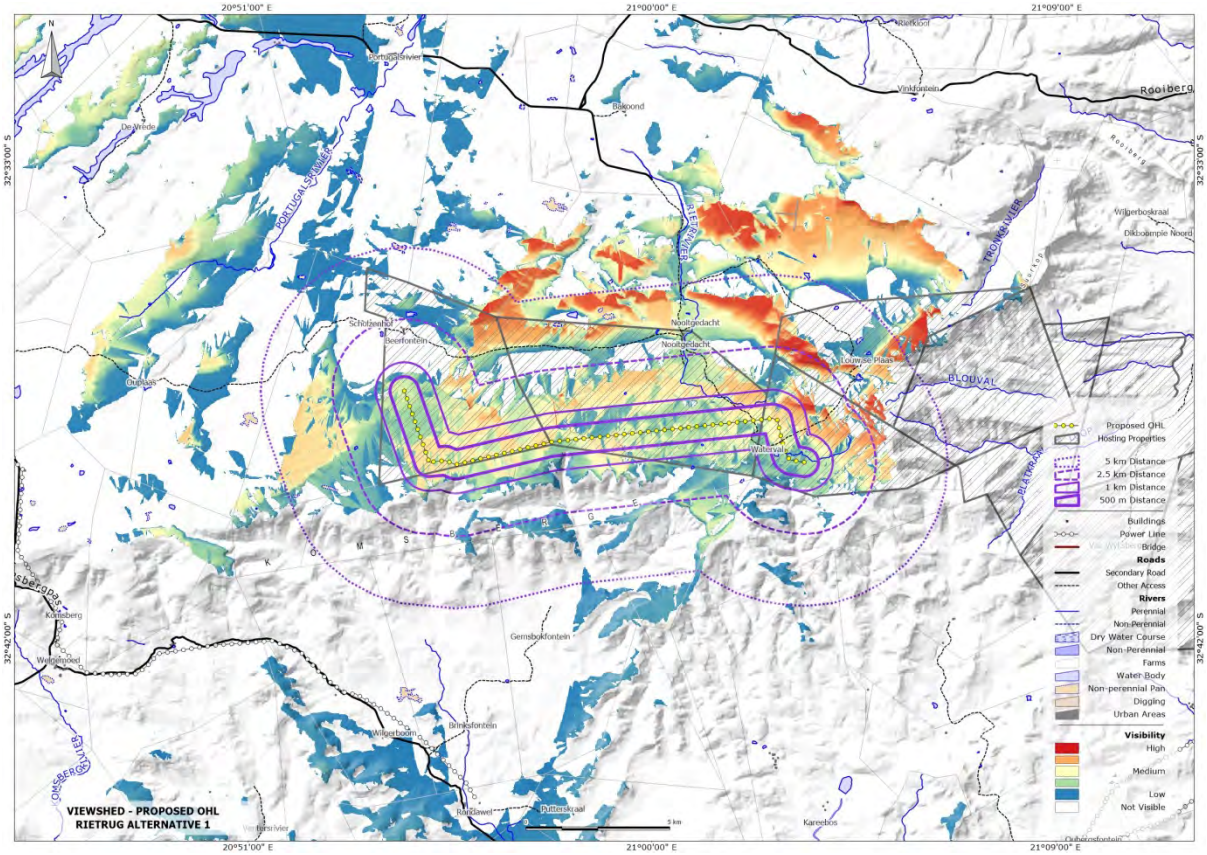


Figure 1-6 Viewshed of the proposed 132 kV power line along Alternative 1.

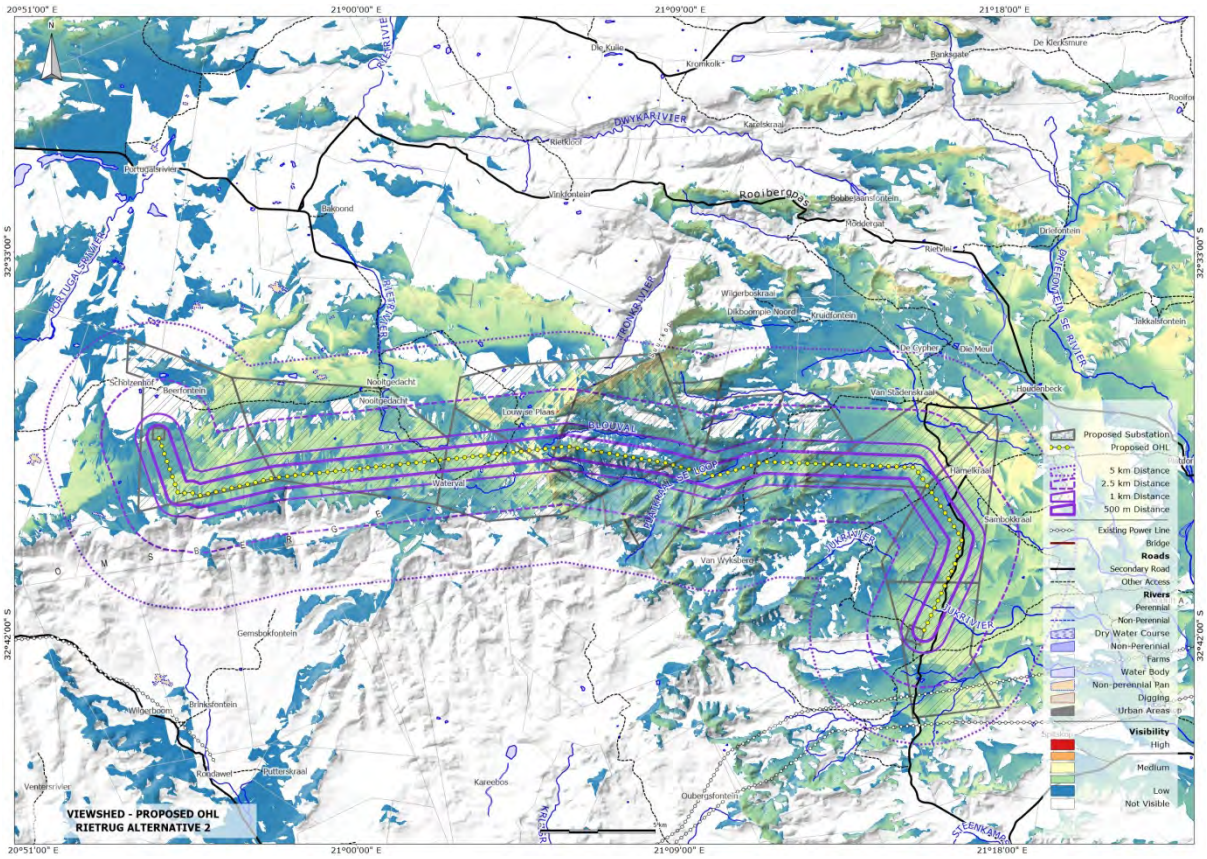


Figure 1-7 Viewshed of the proposed 132 kV power line along Alternative 2.

The viewshed map of the 132 kV power line along the proposed Alternative 1 route (Figure 1-6) shows that potentially affected sensitive visual receptors are mainly limited to farmsteads, dwellings and viewpoints on farms surrounding it. The viewshed is mostly limited to the plateau above the escarpment. Motorists driving along the secondary road from Sutherland to Merweville will only be exposed to the proposed power line along sections that are more than 10 km from the proposed route.

Sensitive visual receptors therefore include:

- Residents and viewpoints on farms surrounding the proposed distribution line route; and
- Motorists using secondary road between Sutherland and Merweville north of the proposed route.

The viewshed map for Alternative 2 of the proposed 132 kV power line (Figure 1-7) shows that potentially affected sensitive visual receptors are mainly limited to farmsteads, dwellings and viewpoints on farms surrounding this proposed route. The viewshed is mostly limited to the plateau above the escarpment as well as the plains east of the escarpment near Merweville. Motorists driving along the secondary road between Sutherland and Merweville (more than 20 km from the route) north of the proposed route will be more than 5 km from the proposed power line when in the viewshed. The Rooiberg Pass is located in the viewshed but is more than 10 km from the proposed power line route. The secondary road from Houdenbeck farmstead to the N1 passes within 100 m of the power line route (Figure 1-7).

Residents on surrounding farms are highly sensitive to changes in their views since they have an active interest in the landscape. There are likely to be viewpoints on some of these farms that are valued for their scenic qualities, particularly for views from the top of the escarpment. These viewpoints are highly sensitive to the potential intrusion of distribution lines on views.

Traffic on the secondary roads that will potentially be affected by the proposed power lines is very light. The sections of these roads where views of scenic quality may be affected are more than 10 km from the proposed routes. Motorists are therefore seen as low sensitivity visual receptors since they are passing through the landscape concentrating on the road rather than on the views.

It should further be noted that Sutherland is not located in viewsheds for either route, and although the South African Astronomical Observatory is located in both viewsheds (Figure 1-8) it is approximately 30 km from the proposed routes and viewers are highly unlikely to notice a 132 kV power line over this distance.

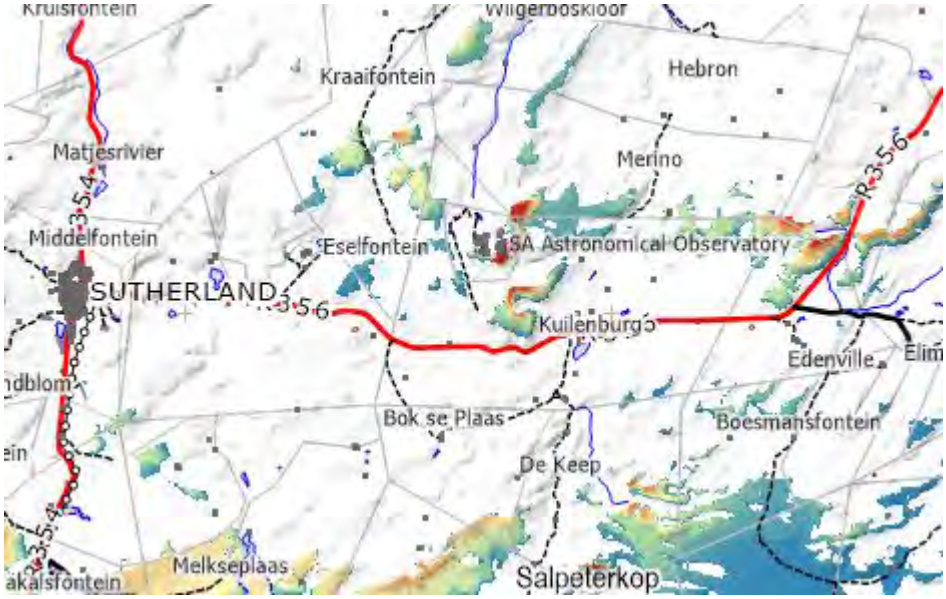


Figure 1-8 Inset map showing the viewshed for Alternative 1 near Sutherland and the SA Astronomical Observatory. The Observatory is more than 30 km from Alternative 1 and 2, and it is very unlikely that the proposed power line will be noticed from here.

The potential impacts identified as part of the VIA are noted below.

1.5.2.3 Construction Phase

Potential visual intrusion of construction activities (discussed in Section 1.1.6.1) on existing views of sensitive visual receptors in the surrounding landscape.

1.5.2.4 Operational Phase

Potential landscape impact of the proposed electrical infrastructure on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views; and
Potential visual intrusion of the proposed electrical infrastructure on the views of sensitive visual receptors.

1.5.2.5 Decommissioning Phase

Potential visual intrusion of decommissioning activities (discussed in Section 1.1.6.1) on existing views of sensitive visual receptors.

1.5.2.6 Cumulative Impacts

Cumulative impact of renewable energy generation projects and electrical infrastructure on the existing rural-agricultural landscape; and
Cumulative visual impact of renewable energy generation projects and electrical infrastructure on existing views of sensitive visual receptors in the surrounding landscape.

1.6 VISUAL IMPACT CONCEPTS AND ASSESSMENT CRITERIA

The assessment of potential impacts for the proposed Rietrug WEF electrical grid infrastructure project is conducted in the following steps:

- Identification of visual impact criteria (key theoretical concepts);
- Conducting a visibility analysis; and
- Assessment of impacts of the project on the landscape and on receptors (viewers) taking into consideration factors such as viewer sensitivity, visual exposure and visual intrusion.

Potential visual impacts are assessed using a number of criteria which provide the means to measure the intensity of the impacts. The intensity or consequence and other criteria such as spatial extent and duration of the impact are then used to determine its potential significance (Oberholzer, 2005). The visibility of the project is an indication of where in the region the development will potentially be visible from. The rating is based on viewshed area size and is an indication of how much of a region will potentially be visually affected by the development. A high visibility rating does not necessarily signify a high visual impact, although it can if the region is densely populated with sensitive visual receptors. Viewer (or visual receptor) sensitivity is a measure of how sensitive potential viewers of the development are to changes in their views. Visual receptors are identified by looking at the viewshed of the proposed development, and include scenic viewpoints, residents, motorists and recreational users of facilities within the viewshed. Their distance from the development (visual exposure) and the composition of their existing views (visual intrusion) will determine impact intensity/consequence.

1.6.1 Visibility Ratings

Visibility is the geographic area from which the proposed project will be visible, or view catchment area (Figure 1-6 and Figure 1-7). The number of visual receptors in the viewshed has an influence on the visibility rating (Oberholzer, 2005).

- *High* - visible from a large area (e.g. several square kilometres);
- *Moderate* – visible from an intermediate area (e.g. several hectares); and
- *Low* – visible from a small area around the project site.

The visibility of the project is high in terms of the definition above since the viewshed area is approximately 105 km^2 for Alternative 1 and 350 km^2 for Alternative 2[4]. The actual viewshed is likely to be similar to the calculated viewshed since existing vegetation in the region is low and will not affect the visibility of the proposed development. However, within these areas there are 14

[4] For an area within 5 km of the proposed power line.

buildings (not all of which are residences) in the viewshed for Alternative 1 and 56 buildings in the viewshed for Alternative 2 that will potentially be affected[5]. This is indicated in Table 1.1. This indicates a low number of potentially affected visual receptors and **low** visibility for Alternative 1 and **moderate** visibility for Alternative 2.

1.6.2 Visual Exposure

Visual exposure refers to the relative visibility of a project or feature in the landscape and is related to the distance between the observer and the project (Oberholzer 2005). Exposure and visual impact tend to diminish exponentially with distance since the observed element comprises a smaller part of the view. Visual exposure is classified as follows:

- *High* – dominant or clearly noticeable;
- *Moderate* – recognisable to the viewer; and
- *Low* – not particularly noticeable to the viewer.

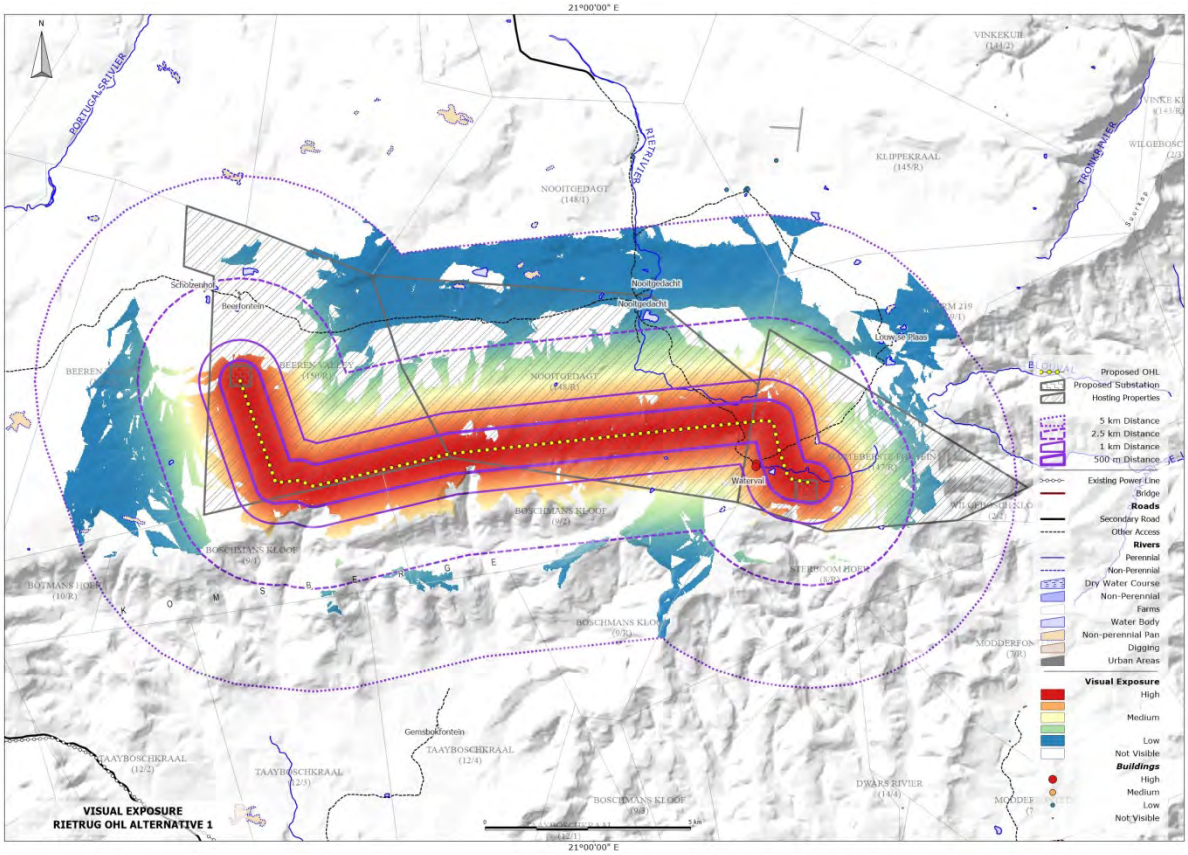


Figure 1-9 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 1 distribution line route.

[5] For an area within 5 km of the proposed power line.

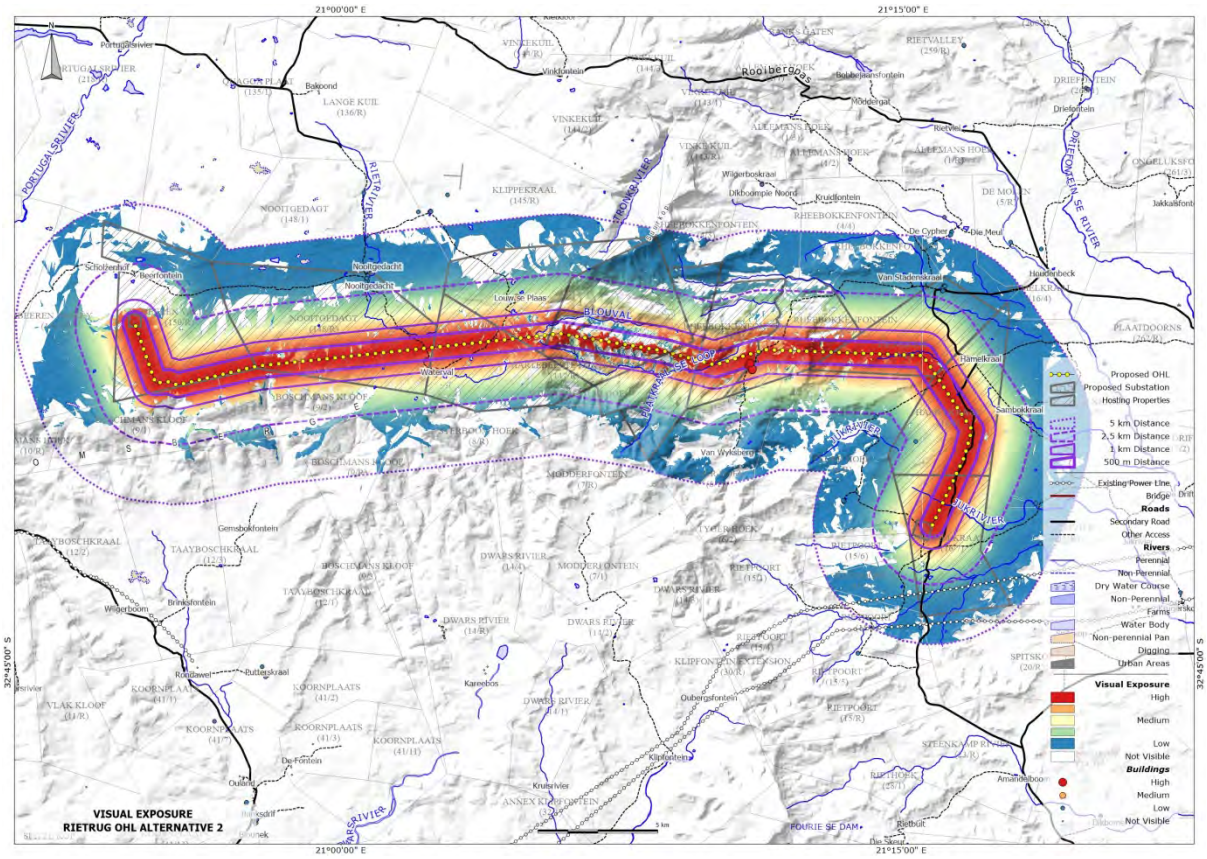


Figure 1-10 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 2 distribution line route.

Table 1-1 below provides a summary of the number of buildings within 5 km of the proposed development, as well as their corresponding visual exposure rating.

Table 1-1: Number of buildings within 5 km of the proposed development, and their potential visual exposure rating.

Component	Number of Buildings and their Visual Exposure			
	Low	Medium	High	Total
Alternative 1	11	0	3	14
Alternative 2	44	4	8	56

1.6.2.1 Residents and Viewpoints on Surrounding Farms

Alternative 1
There are only 3 buildings that will potentially be highly exposed to the power line along the proposed Alternative 1 route (Table 1-1). The buildings are all located at the Waterval farmstead which is approximately 700 m from the route (Figure 1-9). Access to this farmstead is limited to a farm track.

Alternative 2
Two of the buildings at the Waterval farmstead will potentially be highly exposed to the power line along the proposed Alternative 2 route (Figure 1-10). They are approximately 1 km from the route. Three buildings on the Farm Rheebokkenfontein (4/1) are about 320 m away from the route and 3

buildings on the Farm Rheebokkenfontein (4/2) are located about 600 m from the route (although these last three buildings are likely to be screened from views by trees).

1.6.2.2 Motorists

A section of approximately 8 km of the secondary road next to proposed Alternative 2 route (eastern end of the route) will potentially be highly exposed to a power line along this route. Motorists on other public roads in the region will experience low visual exposure to power lines along either proposed route when they are within the viewsheds.

1.6.3 Visual Intrusion

Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its *sense of place*. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer, 2005). It can be ranked as follows:

- *High* – results in a noticeable change or is discordant with the surroundings;
- *Moderate* – partially fits into the surroundings, but is clearly noticeable; and
- *Low* – minimal change or blends in well with the surroundings.

1.6.3.1 Photographic Survey

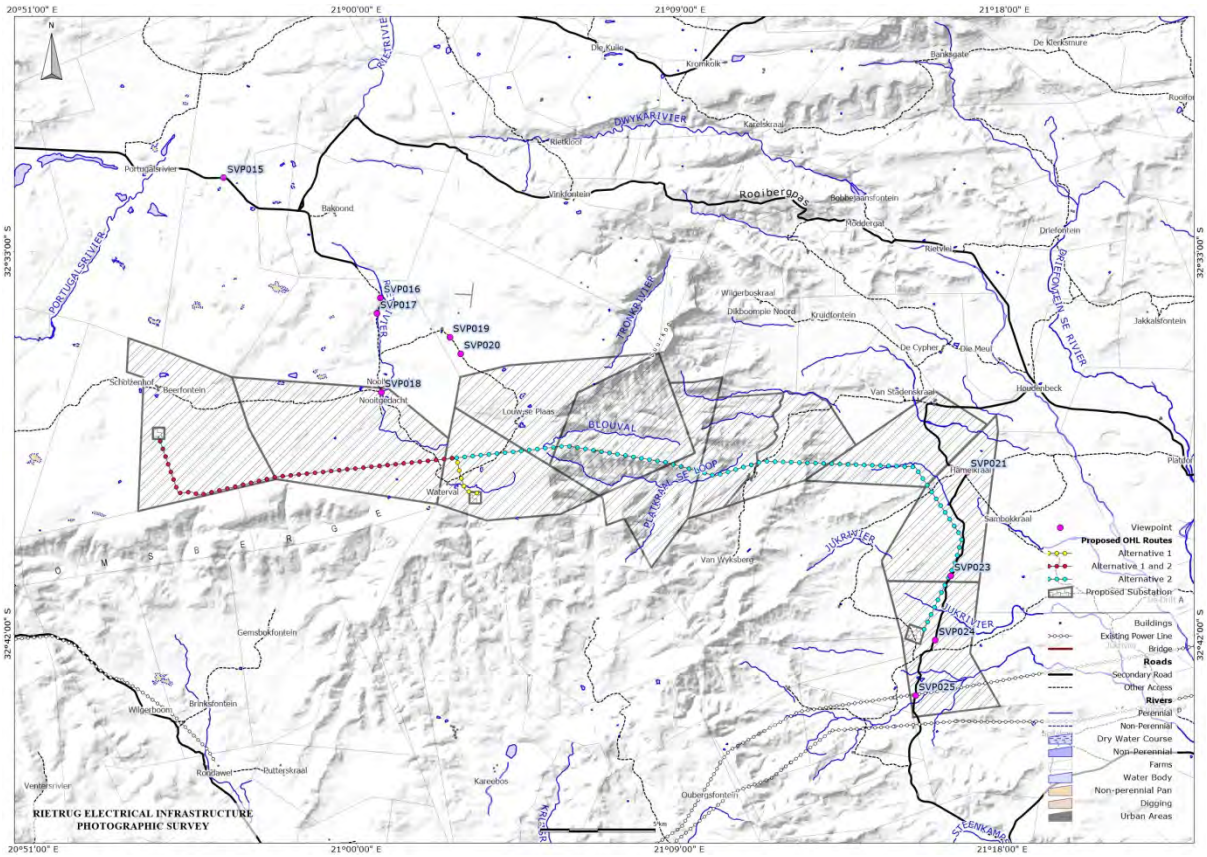


Figure 1-11 Sites visited during photographic survey.

Sites from which landscape photographs were taken are shown in Figure 1-11. The discussion below refers to photograph sites on the map (see also photographs in Figure 1-13 to Figure 1-21).

The landscape surrounding the proposed overhead line routes is covered in low growing shrubs and fynbos which provide very little screening opportunities for the development. The land is mostly used for stock farming. Farmsteads are few and far removed from each other, and many are not permanently occupied. There are two main secondary roads in the region and they are located more than 10 km from Alternative 1. A secondary road passes within 100 m of the eastern end of Alternative 2. Other access roads are gravel tracks and contain very little traffic. Elements in the landscape are typical of rural agricultural practices and include fencing, telephone lines, distribution and transmission electrical lines, and farm buildings of various types. The 132 kV lines along the proposed routes are unlikely to be more than moderately intrusive on existing views unless they are exposed above the skyline since there are similar structures in the surrounding landscape (e.g. distribution and transmission lines, fences (particularly game fences) and roads). The mottled background of vegetation and rocks in the region will do much to reduce visibility of the power lines. Power lines and pylons are likely to be exposed against the skyline where they are in close proximity to visual receptors as well as where they cross highly visible ridges. The map in Figure 1-12 shows sensitive areas on the farms hosting the proposed development. The map indicates areas of high-moderate-low visibility in the landscape (e.g. ridges are often moderately to highly visible in the landscape) as well as areas around farmsteads and buildings which should be avoided. There are no guidelines for set-back distances from power lines other than for health reasons, but studies have shown that proximity to power lines can lower property prices (indicating negative visual impact). It seems reasonable then to use setback distances based on these studies to avoid highly sensitive areas. A distance of 100 m from farm buildings is indicated as highly sensitive and 200 m as moderately sensitive. The routes avoid highly visible ridges and do not pass within 200 m of any buildings. It is therefore unlikely that the overhead lines will be exposed above the skyline for most visual receptors in the region.

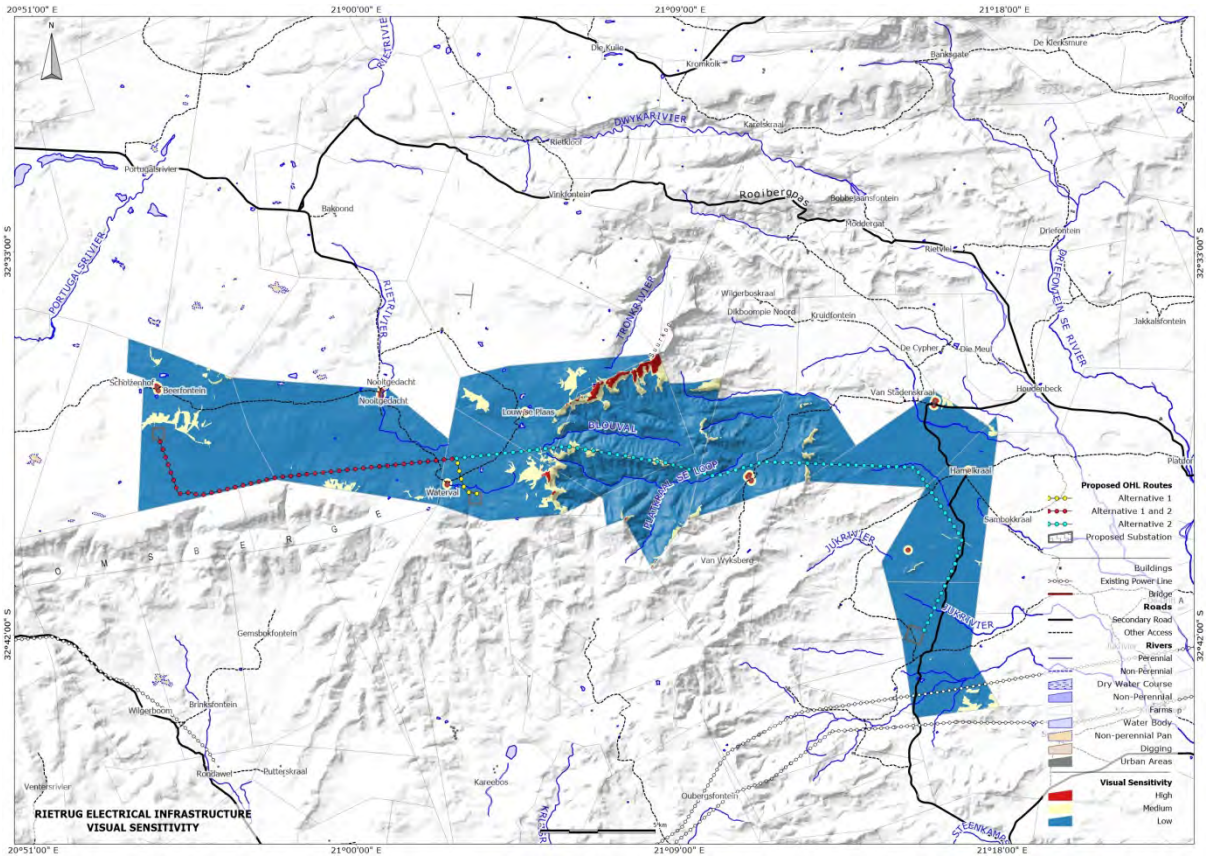


Figure 1-12 Visual sensitivity map of the properties hosting the proposed electrical infrastructure.

Figure 1-13 View east from photo site SVP015 showing the general landscape character of the region on top of the plateau. Distribution lines are visible in the lower left corner but their visibility is reduced by the mottled vegetation background. Farmsteads are often surrounded by high trees but vegetation is general low growing shrubs and fynbos.

Figure 1-14 View south-east from the Nooitgedacht farmstead (SVP018).

Figure 1-15 View south-east from SVP019 showing landscape character of the region. Distribution lines and gravel road visible in the foreground.

Figure 1-16 View of the escarpment and plains below it from the Rooiberg Pass (towards the east).

Figure 1-17 View south-west from SVP021 near the Hamelkraal farmstead. Existing high voltage transmission line towers are visible on the distant hills. This site (SVP021) is on the plains below the escarpment.

Figure 1-18 View west from SVP021 towards the escarpment. Proposed Alternative 2 will pass through the Kloof in the centre of the photograph.

Figure 1-19 View south from the road between SVP023 and SVP024 showing the existing high voltage power lines that form a prominent man-made feature of the landscape in this region.

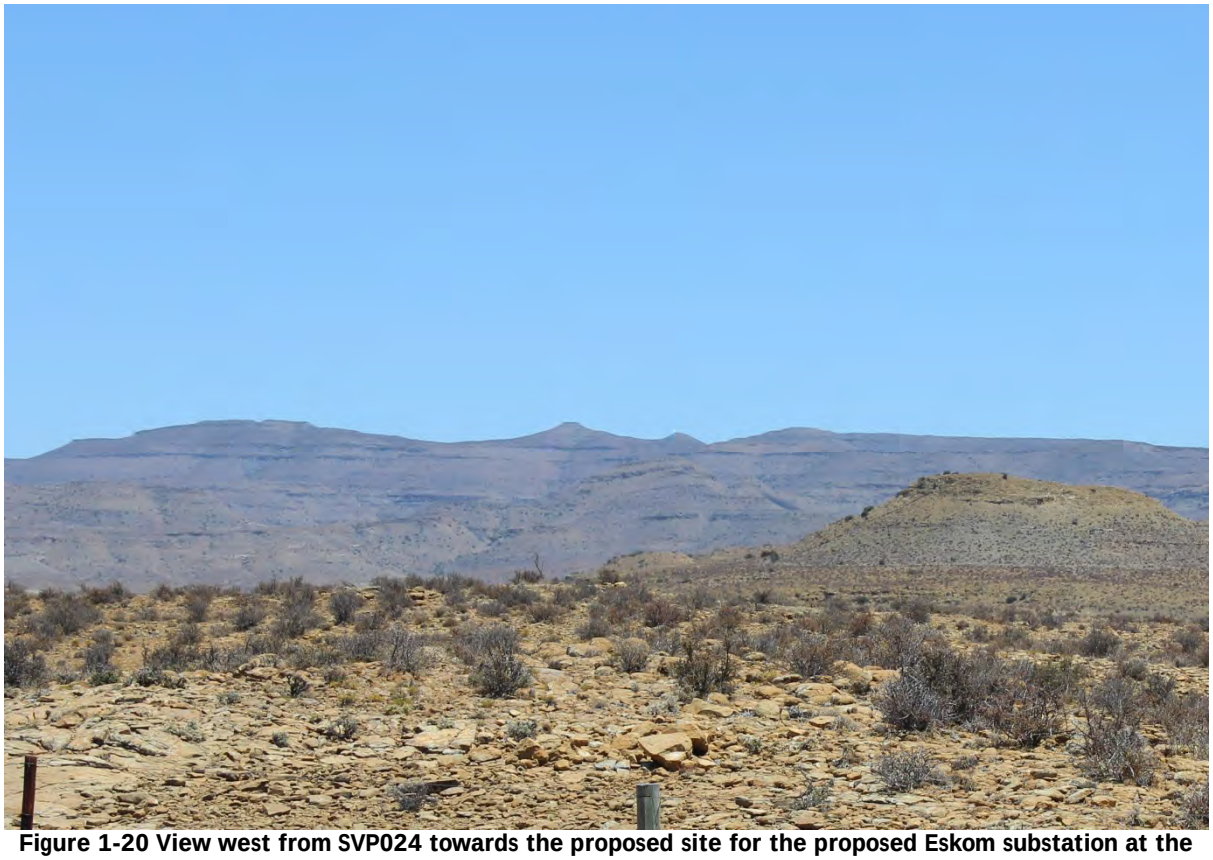


Figure 1-20 View west from SVP024 towards the proposed site for the proposed Eskom substation at the eastern end of Alternative 2. Due to the high ridges (escarpment) in the background the substation is unlikely to be exposed above the skyline for motorists.

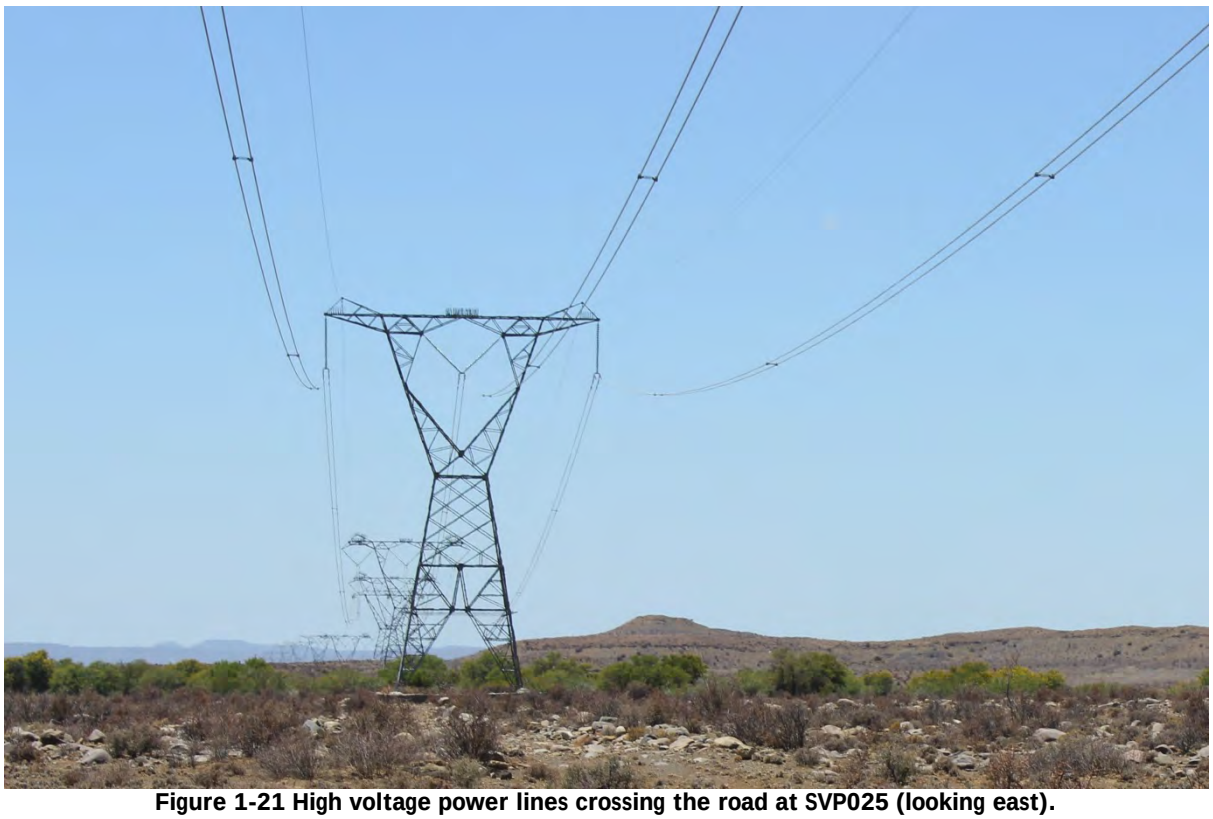


Figure 1-21 High voltage power lines crossing the road at SVP025 (looking east).

1.6.3.2 Residents and viewpoints on surrounding farms

Alternative 1
Very few visual receptors will be affected by a 132 kV overhead line along route Alternative 1 and high visual exposure is mostly limited to the farms that will be hosting the overhead lines. All buildings and the farmstead that are potentially highly exposed to the lines are on the hosting farms. The lines are unlikely to affect viewpoints valued for their scenic qualities since the route is far enough from the escarpment and most of these views will be away from the route and towards the escarpment. It is also very unlikely that the power lines will be exposed against the skyline in views from below the escarpment. Visual intrusion for Alternative 1 is rated as **low**.

Alternative 2
A large section of the route is on the plains below the escarpment in the east. The landscape in this region is different from that on top of the plateau and most views of the overhead lines will have the escarpment as a backdrop. The overhead lines are therefore unlikely to be exposed above the skyline for most visual receptors in this region unless they are very close to the lines (it is unlikely that there are buildings with views where the lines will be exposed above the skyline). Visual intrusion for Alternative 2 is rated as **low**.

1.6.3.3 Motorists

Alternative 1
Only motorists on private roads are likely to be affected by the overhead lines since public roads are more than 5 km from the proposed route. Very few motorists will therefore be affected. The 132 kV power lines will however be noticed in this region and visual intrusion is expected to be **low** for Alternative 1.

Alternative 2
Visual intrusion will be the same for Alternative 2 as for Alternative 1 where it is on the plateau above the escarpment and **low** for the plain below the escarpment for similar reasons. This part of the route (below the escarpment) also contains existing high voltage power lines and pylons.

Table 1-2 below provides a summary of the visual analysis of the region.

Table 1-2 Visual Impact Criteria and Impact Intensity for the Rietrug 132 kV electrical infrastructure project.

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
Construction of 132 kV Overhead Line along Alternative 1	Residents and viewpoints on surrounding farms	High	Residents have an active interest in their surrounding landscape and the proposed development will cause changes in existing views.	High	There are 3 buildings at one farmstead that will potentially be highly exposed to construction of a distribution line along this route.	Moderate	Construction activities associated with power lines will be introduced into a very remote landscape and will be recognisable by visual receptors.	Substantial	There are only 3 buildings (one farmstead) that will be highly exposed to the proposed development. In other words very few visual receptors will be highly affected by construction activities (assuming any of the buildings are occupied).
	Motorists	Low	Very light traffic on gravel secondary roads. Motorists are low sensitivity visual receptors because their focus will be on the road.	Low	There are only private gravel roads within 5 km of the route.	Moderate	Construction activities associated with power lines will be introduced into a very remote landscape and will be recognisable by visual receptors.	Moderate	Low sensitivity visual receptors, low visual exposure and moderate visual intrusion.
Construction of 132 kV Overhead Line along Alternative 2	Residents and viewpoints on surrounding farms	High	Residents have an active interest in their surrounding landscape and the proposed development will cause changes in existing views.	High	There are several buildings at two farmsteads that will potentially be highly exposed to construction activities.	Moderate	Construction activities associated with power lines will be introduced into a very remote landscape and will be recognisable by visual receptors.	Substantial	Buildings at two farmsteads are potentially highly exposed to construction activities.
	Motorists	Low	Very light traffic on gravel	High	A secondary road with very light traffic	Moderate	Construction activities	Moderate	Construction will occur very close to the road

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
			secondary roads. Motorists are low sensitivity visual receptors because their focus will be on the road.		passes within 100 m of a section of this route.		associated with power lines will be introduced into a very remote landscape and will be recognisable by visual receptors.		(within 100 m) for an 8 km section of the road.
Operation of the 132 kV Overhead Line along Alternative 1	Residents and viewpoints on surrounding farms	High	Residents have an active interest in their surrounding landscape and the proposed development will cause changes in existing views.	High	There are 3 buildings at one farmstead that will potentially be highly exposed to a distribution line along this route.	Low	Very few visual receptors will be affected and there are structures in the surrounding landscape that are similar to power lines. It will seldom be exposed above the skyline for visual receptors. Highly exposed visual receptors are mostly limited to hosting farms.	Moderate	Low visual intrusion on the existing views of highly sensitive visual receptors.
	Motorists	Low	Very few motorists will see the proposed power line. They will be driving along private farm tracks and will be concentrating on	Low	There are only private gravel roads within 5 km of the route.	Low	Very few motorists will be affected and there are similar structures in the existing landscape.	Slight	Low visual intrusion on the existing views of low sensitivity visual receptors.

Proposed Development Component	Sensitive Receptor	Sensitivity	Visual Exposure	Visual Intrusion	Impact Consequence
		the road rather than the scenery.			
	Landscape Character	Moderate	The landscape has a rural-agricultural character with a strong sense of remoteness and potential for views valued for their scenic qualities. It is moderately sensitive to the proposed electrical infrastructure which may reduce the sense of remoteness and the potential for scenic views.	N/A N/A	N/A N/A	Slight	Alternative 1 is relatively short and due to its position is unlikely to affect scenic views down the escarpment to the south.

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
Operation of the 132 kV Overhead Line along Alternative 2	Residents and viewpoints on surrounding farms	High	Residents have an active interest in their surrounding landscape and the proposed development will cause changes in existing views.	High	There are several buildings at two farmsteads that will potentially be highly exposed to a distribution line along this route.	Low	Very few visual receptors will be affected and there are structures in the surrounding landscape that are similar to power lines. The proposed development will therefore be noticed but will not be incongruent with existing views. It will seldom be exposed above the skyline for visual receptors.	Moderate	The route is much longer than that of Alternative 1 and more visual receptors are likely to be affected.
	Motorists	Low	Very few motorists will see the proposed power line. They will most often be driving along private farm tracks and will be concentrating on the road rather than the scenery.	High	A secondary road with very light traffic passes within 100 m of a section of this route.	Low	Very few motorists will be affected and there are similar structures in the existing landscape.	Slight	Low visual intrusion on existing views of low sensitivity visual receptors.

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
	Landscape Character	Moderate	The landscape has a rural-agricultural character with a strong sense of remoteness and potential for views valued for their scenic qualities. It is moderately sensitive to the proposed electrical infrastructure which may reduce the sense of remoteness and the potential for scenic views.	N/A	N/A	N/A	N/A	Moderate	Alternative 2 is a long route which traverses the escarpment.
Decommissioning of the 132 kV Overhead Line along Alternative 1	Residents and viewpoints on surrounding farms	High	Residents have an active interest in their surrounding landscape and the changes brought about by decommissioning activities during the decommissioning phase will cause changes in existing views.	High	There are 3 buildings at one farmstead that will potentially be highly exposed to the decommissioning of a distribution line along this route.	Moderate	Decommissioning activities associated with the proposed power line will be introduced into a very remote landscape and will be recognisable by visual receptors.	Substantial	Moderate visual intrusion on existing views of highly sensitive visual receptors in close proximity to the (decommissioning activities) proposed development.

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
	Motorists	Low	Very light traffic on gravel secondary roads. Motorists are low sensitivity visual receptors because their focus will be on the road.	Low	There are only private gravel roads within 5 km of the route.	Moderate	Decommissioning activities associated with the proposed power line will be introduced into a very remote landscape and will be recognisable by visual receptors.	Moderate	Moderate visual intrusion on low sensitivity visual receptors.
Decommissioning of the 132 kV Overhead Line along Alternative 2	Residents and viewpoints on surrounding farms	High	Residents have an active interest in the landscape and the proposed development activities during the decommissioning phase will cause changes in existing views.	High	There are several buildings at two farmsteads that will potentially be highly exposed to the decommissioning activities.	Moderate	Decommissioning activities associated with the proposed power line will be introduced into a very remote landscape and will be recognisable by visual receptors.	Substantial	Moderate visual intrusion on the existing views of highly sensitive visual receptors.
	Motorists	Low	Very light traffic on gravel secondary roads. Motorists are low sensitivity visual receptors because their focus will be on the road.	Low	A secondary road with very light traffic passes within 100 m of a section of this route.	Moderate	Decommissioning activities associated with the proposed power line will be introduced into a very remote landscape and will be recognisable by visual receptors.	Moderate	Moderate visual intrusion on existing views of low sensitivity visual receptors.

Proposed Development Component	Sensitive Receptor	Sensitivity		Visual Exposure		Visual Intrusion		Impact Consequence	
Existing and Proposed Renewable Energy and Electrical Infrastructure Projects in Surrounding Landscape (Cumulative Impact)	Landscape Character	High	The high visibility of structures associated with WEFs means that landscape character of the region above the escarpment - rural agricultural with a strong sense of remoteness - will be highly sensitive to these proposed developments.	N/A	N/A	N/A	N/A	Slight	Renewable projects proposed for this region which are most likely to change the landscape character are the wind energy facilities due to the high visibility, size and number of wind turbines, as well as their novelty in South African landscapes. 132 kV power lines are relatively familiar elements of rural agricultural landscapes. If any of the WEFs are built then the cumulative effect of adding a power line to the landscape will have slight consequences for the landscape character which will have been altered by the WEFs.
	Visual Receptors	High	There are many highly sensitive visual receptors in the region that will be affected by these existing and proposed projects. Sutherland and its surroundings	High	There are only very few visual receptors that will be highly exposed to the proposed power line (for either alternative route).	Low	Assuming that any of the wind farms are built and the sensitive visual receptors have views that include both the power line and any of the wind turbines then the power	Slight to Moderate	The proposed power line will fit into a renewable energy generation landscape and will have low impact consequences on visual resources that already include other, larger structures associated with WEFs (assuming

Proposed Development Component	Sensitive Receptor	Sensitivity	Visual Exposure	Visual Intrusion	Impact Consequence	
		are tourist attractions.		line is likely to be congruent with other elements in the view (e.g. structures associated with large WEFs).		that any of the proposed projects are built). Moderate impact consequence is expected for the few highly exposed visual receptors.

1.7 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.7.1 Construction Phase: Potential visual intrusion of activities associated with the construction of electrical infrastructure along Alternative 1 on existing views of sensitive visual receptors in the surrounding landscape

1.7.1.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed distribution line route will at most experience low visual exposure. High visual exposure to construction activities will mostly be contained to properties hosting the route. The consequence of the potential impact will be **substantial** since construction will introduce activities and elements that are incongruent with the quiet rural nature of the region and its sense of remoteness. The impact will be of **short-term** duration since the proposed distribution line is only approximately 17 km long (Alternative 1). Reversibility of the impact is **high** and irreplaceability of the visual resource is **low** since it is a short term impact with no long lasting effects. The impact status will be **negative** since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected but construction activities will draw attention in the landscape.

The significance of the potential impact without the implementation of mitigation measures is rated as **moderate** since the consequence of the visual impact is substantial (moderate visual intrusion on views of highly sensitive visual receptors) and the probability of it occurring is likely.

1.7.1.2 Mitigation Measures

Assumptions regarding the management of construction activities are discussed in Section 1.1.6.1 of this report. Mitigation measures in addition to the best practice guidelines are:

- Where possible construction camps and laydown areas should be located:
  - In low visibility areas (e.g. avoid ridgelines and open plains);
  - Previously disturbed areas (e.g. clearings created by farmers for other purposes which are no longer being used); and/or
  - Areas near derelict farmsteads (taking into consideration the findings of the Heritage Impact Assessment as well as other assessments that may be relevant) – particularly where existing trees can be used to screen these areas from views.
- Night time construction should be avoided where possible (however some construction work on electrical components may need to occur after dark); and
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will be **low** since the likelihood of the impact occurring will be lowered. Refer to Table 1-3 below which provides a summary of the impact assessment rating:

Table 1-3 Impact Summary Rating

Aspect/Activity	Various activities associated with the construction of the proposed electrical infrastructure along Alternative 1
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Visual intrusion of construction activities on existing views of

	sensitive visual receptors
Status	Negative
Mitigation Required	• Best practice guidelines for construction; • Locate construction camps and laydown areas where sensitive visual receptors are least likely to be affected; and • Night lighting of the construction site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.2 Construction Phase: Potential visual intrusion of activities associated with the construction of electrical infrastructure along Alternative 2 on existing views of sensitive visual receptors in the surrounding landscape

1.7.2.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed distribution line route will at most experience low visual exposure. High visual exposure to construction activities will mostly be contained to properties hosting the route. The consequence of the potential impact will be **substantial** since construction will introduce activities and elements that are incongruent with the quiet rural nature of the region and its sense of remoteness. The impact will be of **short-term** duration since the proposed distribution line is approximately 43 km long (Alternative 2). Reversibility of the impact is **high** and irreplaceability of the visual resource is **low** since it is a short term impact with no long lasting effects. The impact status will be **negative** since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected but construction activities will draw attention in the landscape.

The significance of the potential impact without the implementation of mitigation measures is rated as **moderate** since the consequence of the visual impact is substantial (moderate visual intrusion on views of highly sensitive visual receptors) and the probability of it occurring is likely.

1.7.2.2 Mitigation Measures

Assumptions regarding the management of construction activities are discussed in Section 1.1.6.1 of this report. Mitigation measures in addition to the best practice guidelines are:

- Where possible construction camps and laydown areas should be located:
  - In low visibility areas (e.g. avoid ridgelines and open plains);
  - Previously disturbed areas (e.g. clearings created by farmers for other purposes which are no longer being used); and/or
  - Areas near derelict farmsteads (taking into consideration the findings of the Heritage Impact Assessment as well as other assessments that may be relevant) – particularly where existing trees can be used to screen these areas from views.
- Particular care should be taken to avoid erosion scarring and damage along the ridge down the escarpment;
- Night time construction should be avoided where possible (however some construction work on electrical components may need to occur after dark); and
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will be **low** since the likelihood of the impact occurring will be lowered. Refer to Table 1-4 below which provides a summary of the impact assessment rating:

Table 1-4 Impact Summary Rating

Aspect/Activity	Various activities associated with the construction of the proposed electrical infrastructure along Alternative 2
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Visual intrusion of construction activities on existing views of sensitive visual receptors
Status	Negative
Mitigation Required	• Best practice guidelines for construction; • Locate construction camps and laydown areas where sensitive visual receptors are least likely to be affected; • Care should be taken to avoid erosion scarring along ridge down the escarpment; and • Night lighting of the construction site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.3 Operational Phase: Potential landscape impact of the proposed electrical infrastructure along Alternative 1 on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views

1.7.3.1 Significance Statement

The spatial extent of the potential impact will be **local** since it is unlikely to affect the landscape beyond 2 km from the proposed distribution line route. The consequence of the potential impact will be **slight** since it is a short route which is unlikely to affect scenic views near the escarpment. The impact will be **long term** and will cease only once the power line has been removed. The reversibility of the impact is **high**. The irreplaceability of the landscape character type is **low** since landscapes along the escarpment have a similar character further east (e.g. in the Karoo National Park near Beaufort West). The impact status will be **negative** since the rural sense of place of the region will change. The probability of the impact occurring is **unlikely** since it is a short route.

The significance of the potential impact before mitigation is rated as **very low** since the impact is localised and has a slight consequence. No mitigation measures are recommended. Refer to Table 1-5 below which provides a summary of the impact assessment rating:

Table 1-5 Impact Summary Rating

Aspect/Activity	Potential change in landscape character
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Landscape impact of proposed electrical infrastructure along Alternative 1
Status	Negative
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Very Low
Impact Significance (Post-Mitigation)	Very Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.4 Operational Phase: Potential landscape impact of the proposed electrical infrastructure along Alternative 2 on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views

1.7.4.1 Significance Statement

The spatial extent of the potential impact will be **local** since it is unlikely to affect the landscape beyond 2 km from the proposed distribution line route. The consequence of the potential impact will be **moderate** since it is a longer route which traverses the escarpment. The impact will be **long term** and will cease only once the power line has been removed. The reversibility of the impact is **high**. The irreplaceability of the landscape character type is **low** since landscapes along the escarpment have a similar character further east (e.g. in the Karoo National Park near Beaufort West where the landscape character type is being conserved). The impact status will be **negative** since the rural sense of place of the region will change. The probability of the impact occurring is **likely** since the proposed power line traverses the escarpment and has a high visibility – it is therefore more likely to reduce the sense of remoteness and the potential for scenic views.

The significance of the potential impact before mitigation is rated as **low** since the impact is localized and has a moderate consequence. No mitigation measures are recommended. Refer to Table 1-6 below which provides a summary of the impact assessment rating:

Table 1-6 Impact Summary Rating

Aspect/Activity	Potential change in landscape character
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Landscape impact of proposed electrical infrastructure along Alternative 2
Status	Negative
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.5 Operational Phase: Potential visual intrusion of the proposed electrical infrastructure along Alternative 1 on the views of sensitive visual receptors

1.7.5.1 Significance Statement

The spatial extent of the potential impact will be **local** since only sensitive visual receptors within 2 km of the proposed development are likely to be affected and there are very few within this distance of the proposed Alternative 1 route. The consequence of the impact will be rated as **moderate slight** since very few highly sensitive visual receptors will potentially be affected and visual intrusion is expected to be low. The potential impact is rated with **long term** duration since it will only end once the project ends. The reversibility of the potential impact is rated as **high** since it is unlikely that vegetation will have to be removed for the servitude (considering the sparse vegetative cover within the general area). The irreplaceability of the visual resources is **low** since there are very few visual receptors that will potentially be affected. The impact status will be **negative** since power lines detract from the scenic potential of views. The probability of the impact occurring is **unlikely** since there are so few visual receptors that will potentially be highly exposed and they are limited to the farms hosting the proposed development.

The significance of the impact (without the implementation of mitigation measures) is rated as **low** since very few sensitive visual receptors are likely to be affected by the proposed development.

1.7.5.2 Mitigation Measures

It is recommended that the type of towers used for the proposed power line should be lattice towers rather than monopole. Lattice type towers are framework towers made up of thin "*metal strips arranged to form a diagonal pattern of open spaces between the strips*" (Figure 1-22) which allows for the background to be visible through the spaces. The towers proposed for this project are monopole structures (Figure 1-23) which are solid. Although monopole structures can be seen as aesthetically more pleasing than lattice type structures, either is likely to cause negative visual impacts on views. The mitigation measure proposed here is therefore intended to reduce the visibility of the structures rather than to improve its aesthetics. It is believed by the author that a lattice tower will be less visible against the mottled landscape background of the region than a monopole tower (Figure 1-24). This is not an essential mitigation measure but its implementation will potentially lower the significance of the impact for Alternative 1 to very low

Figure 1-22 An example of lattice towers used for 132 kV power lines. (Source: https://optipower.co.za/mizpah-msinga/)

Figure 1-23 An example of monopole towers next to a lattice type tower for 132 kV power lines. (Source: http://www.rame.co.za/flagship-projects/132kv-lattice-to-mono-pole-replacement/nggallery/image/578)

Figure 1-24 High voltage transmission lines with lattice towers against a mottled landscape similar to that of the Sutherland region (photo taken by author).

The significance of the impact after mitigation will be **very low** since the consequence of the impact will be lowered to slight (lower visual intrusion) if the structures are less visible. Refer to Table 1-7 below which provides a summary of the impact assessment rating:

Table 1-7 Impact Summary Rating

Aspect/Activity	Visual intrusion
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Potential visual impact on existing views of sensitive visual receptors of electrical infrastructure along Alternative 1
Status	Negative
Mitigation Required	Lattice type towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers. This mitigation measure is not essential but it will potentially lower the impact significance.
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.6 Operational Phase: Potential visual intrusion of the proposed electrical infrastructure along Alternative 2 on the views of sensitive visual receptors

1.7.6.1 Significance Statement

The spatial extent of the potential impact will be **local** since only sensitive visual receptors within 2 km of the proposed development are likely to be affected and there are very few within this

distance of the proposed Alternative 2 route. The consequence of the impact will be rated as **moderate** since very few highly sensitive visual receptors will potentially be affected and visual intrusion is expected to be low. The potential impact is rated with **long term** duration since it will only end once the project ends. The reversibility of the potential impact is rated as **high** since it is unlikely that vegetation will have to be removed for the servitude (considering the sparse vegetative cover within the general area). The irreplaceability of the visual resources is **low** since there are very few visual receptors that will potentially be affected. The impact status will be **negative** since power lines detract from the scenic potential of views. The probability of the impact occurring is **likely** since there is a higher potential (than Alternative 1) for the structures to be exposed above the skyline for some visual receptors, and a few more highly sensitive visual receptors that may potentially be affected.

The significance of the impact (without the implementation of mitigation measures) is rated as **low** since very few sensitive visual receptors are likely to be affected by the proposed development.

1.7.6.2 Mitigation Measures

It is recommended that the type of towers used for the proposed power line should be lattice towers rather than monopole. Lattice type towers are framework towers made up of thin "*metal strips arranged to form a diagonal pattern of open spaces between the strips*"[6] (Figure 1-22) which allows for the background to be visible through the spaces. The towers proposed for this project are monopole structures (Figure 1-23) which are solid. Although monopole structures can be seen as aesthetically more pleasing than lattice type structures, either are likely to cause negative visual impacts on views. The mitigation measure proposed here is therefore intended to reduce the visibility of the structures rather than to improve its aesthetics. It is believed by the author that a lattice tower will be less visible against the mottled landscape background of the region than a monopole tower (Figure 1-24). This is not an essential mitigation measure and it is unlikely to lower the significance of the impact for Alternative 2 but will reduce the visibility of the development.

The significance of the impact after mitigation will remain **low** since it is a long route that traverses the escarpment and which has a higher likelihood (in comparison to Alternative 1) to be exposed above the skyline for sensitive visual receptors. Refer to Table 1-8 below which provides a summary of the impact assessment rating:

Table 1-8 Impact Summary Rating

Aspect/Activity	Visual intrusion
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Potential visual impact on existing views of sensitive visual receptors of electrical infrastructure along Alternative 2
Status	Negative
Mitigation Required	Lattice type towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers. This mitigation measure is not essential.
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

[6] Lattice - http://www.dictionary.com/browse/lattice

1.7.7 Decommissioning Phase: Potential visual intrusion of decommissioning activities associated with electrical infrastructure along Alternative 1 on views of sensitive visual receptors

1.7.7.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed distribution line route will at most experience low visual exposure. High visual exposure to decommissioning activities will mostly be contained to properties hosting the route and associated decommissioning activities. The consequence of the potential impact will be **substantial** since decommissioning will introduce activities and elements that are incongruent with the quiet rural nature of the region and its sense of remoteness. The impact will be of **short-term** duration (shorter than for construction) since the proposed distribution line is only approximately 17 km long. Reversibility of the impact is **high** and irreplaceability of the visual resource **low** since it is a short term impact with no long lasting effects. The impact status will be **negative** since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected but decommissioning activities will draw attention in the landscape.

The significance of the potential impact without the implementation of mitigation measures is rated as **moderate** since the consequence of the visual impact is substantial (moderate visual intrusion on views of highly sensitive visual receptors) and the probability of it occurring is likely.

1.7.7.2 Mitigation Measures

The following mitigation measures have been recommended (in addition to assumptions regarding the management of construction activities as discussed in Section 1.1.6.1 of this report):

- Where possible decommissioning camps and laydown areas should be located:
  - In low visibility areas (e.g. avoid ridgelines and open plains);
  - Previously disturbed areas (e.g. clearings created by farmers for other purposes which are no longer being used); and/or
  - Areas near derelict farmsteads (taking into consideration the findings of the Heritage Impact Assessment as well as other assessments that may be relevant) – particularly where existing trees can be used to screen these areas from views.
- Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes;
- Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape;
- Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape;
- Working at night should be avoided, where possible; and
- Night lighting of reclamation sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will be **low** since the likelihood of the impact occurring will be lowered. Refer to Table 1-9 below which provides a summary of the impact assessment rating:

Table 1-9 Impact Summary Rating

Aspect/Activity	Various activities associated with the decommissioning of the proposed electrical infrastructure along Alternative 1
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Visual intrusion of decommissioning activities on existing views

	of sensitive visual receptors
Status	Negative
Mitigation Required	• Revegetation and reclamation of cleared areas should be done in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Locate decommissioning camps and laydown areas where sensitive visual receptors are least likely to be affected; • Night lighting of the decommissioning site should be minimised within safety and efficiency requirements and work at night should be avoided where possible.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.8 Decommissioning Phase: Potential visual intrusion of decommissioning activities associated with electrical infrastructure along Alternative 2 on views of sensitive visual receptors

1.7.8.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed distribution line route will at most experience low visual exposure. High visual exposure to decommissioning activities will mostly be contained to properties hosting the route or the proposed decommissioning activities. The consequence of the potential impact will be **substantial** since decommissioning will introduce activities and elements that are incongruent with the quiet rural nature of the region and its sense of remoteness. The impact will be of **short-term** duration (shorter than for construction) since the proposed distribution line is only approximately 43 km long. Reversibility of the impact is **high** and irreplaceability of the visual resource **low** since it is a short term impact with no long lasting effects. The impact status will be **negative** since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected but decommissioning activities will draw attention in the landscape.

The significance of the potential impact without the implementation of mitigation measures is rated as **moderate** since the consequence of the visual impact is substantial (moderate visual intrusion on views of highly sensitive visual receptors) and the probability of it occurring is likely.

1.7.8.2 Mitigation Measures

The following mitigation measures have been recommended (in addition to assumptions regarding the management of construction activities as discussed in Section 1.1.6.1 of this report):

- Where possible decommissioning camps and laydown areas should be located:
  - In low visibility areas (e.g. avoid ridgelines and open plains);
  - Previously disturbed areas (e.g. clearings created by farmers for other purposes which are no longer being used); and/or
  - Areas near derelict farmsteads (taking into consideration the findings of the Heritage Impact Assessment as well as other assessments that may be relevant) – particularly where existing trees can be used to screen these areas from views.
- Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes;
- Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape;

- Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape;
- Working at night should be avoided, where possible; and
- Night lighting of reclamation sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will be **low** since the likelihood of the impact occurring will be lowered. Refer to Table 1-10 below which provides a summary of the impact assessment rating:

Table 1-10 Impact Summary Rating

Aspect/Activity	Various activities associated with the decommissioning of the proposed electrical infrastructure along Alternative 2
Type of Impact (i.e. Impact Status)	Direct
Potential Impact	Visual intrusion of decommissioning activities on existing views of sensitive visual receptors
Status	Negative
Mitigation Required	• Revegetation and reclamation of cleared areas should be done in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Locate decommissioning camps and laydown areas where sensitive visual receptors are least likely to be affected; • Night lighting of the decommissioning site should be minimised within safety and efficiency requirements and work at night should be avoided where possible.
Impact Significance (Pre-Mitigation)	Moderate
Impact Significance (Post-Mitigation)	Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.9 Cumulative impact of renewable energy generation projects and large scale electrical infrastructure on the existing rural-agricultural landscape

1.7.9.1 Significance Statement

The significance of this impact is assessed for the operational phase of the proposed development since the construction and decommissioning phases are temporary and will not change the landscape character.

A number of large wind energy projects are being proposed for the region surrounding the Rietrug electrical infrastructure project (Figure 1-25) (specifically within a 50 km radius). Some of these projects have received environmental authorization from the DEA. It is therefore likely that at least a few will actually be built (depending if they receive preferred bidder status in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)) and wind turbines and electrical infrastructure associated with them will become part of the landscape. The existing landscape for most of this region has a rural-agricultural character with a sense of remoteness. There is potential for scenic views, particularly in the vicinity of the Great Escarpment. The proposed wind energy projects will be highly visible in the landscape and will potentially change the landscape character by affecting the sense of remoteness and the scenic views. The proposed solar energy projects are not as highly visible, but their immediately surrounding landscape character is also likely to change since large areas currently under natural vegetation (fynbos and shrubland) will be converted to artificial structures with regular patterns and textures, and monochrome colours. It is not clear how the sense of remoteness in the region will be altered since these structures and wind turbines are passive structures and very little human activity is involved once the projects are operational. However scenic views are likely to be

affected (although the effect on the quality of the views will depend on whether the viewer has a positive or negative view of wind turbines and solar fields). The electrical infrastructure proposed for the Rietrug WEF will not seem out of character in a landscape dominated by structures associated with renewable energy developments.

The spatial extent of the cumulative impact is **regional**. The duration of the potential impact is rated as **permanent** since there are several proposed projects with different time frames (and at least some of them are likely to be renewed at the end of their lifetimes). The status of the impact is **negative** (although this will depend on, for instance, whether wind turbines can improve a rural-agricultural landscape). The reversibility of the landscape impact is rated as **high** since, if all these projects are removed, it is likely that the landscape character will return to what it was before: rural-agricultural. **Irreplaceability** of the landscape character type is **low** – there are similar landscape character types elsewhere along the escarpment that will not be affected by these projects. The impact is **likely** to occur since there are several proposed projects and a large region will be altered by them. Power lines and substations will be congruent with this new landscape and will not alter its character. The consequence of the cumulative landscape impact will therefore be **slight** and its probability of occurring is **unlikely**.

The significance of this cumulative impact (without the implementation of mitigation measures) on the landscape is rated as **very low** regardless of which alternative route is used. No mitigation is recommended. Refer to Table 1-11 below which provides a summary of the impact assessment rating:

Table 1-11 Impact Summary Rating

Aspect/Activity	Cumulative Landscape Impact
Type of Impact (i.e. Impact Status)	Cumulative
Potential Impact	Cumulative impact on the landscape character of the region of several renewable energy projects and their associated electrical infrastructure.
Status	Negative
Mitigation Required	None
Impact Significance (Pre-Mitigation)	Very Low
Impact Significance (Post-Mitigation)	Very Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

1.7.10 Cumulative visual impact of renewable energy generation projects and large scale electrical infrastructure on existing views of sensitive visual receptors in the surrounding landscape

1.7.10.1 Significance Statement

The significance of this impact is assessed for the operational phase of the proposed development since the construction and decommissioning phases are temporary and the cumulative impact on views will be negligible.

The region that will be affected straddles the Great Escarpment which is known for its scenic views. The large number of proposed wind turbines and associated electrical infrastructure will affect many highly sensitive visual receptors in the region, many of which will be in close proximity to these structures. The region is relatively underdeveloped and structures comparable in scale to that of wind turbines are not familiar in existing views. Many existing views valued for their scenic qualities are likely to be affected by the proposed developments. The visual intrusion of power lines and substations on views which include structures associated with renewable energy developments such as wind turbines and solar fields will be low since they are associated with

these developments. In other words, if these renewable energy projects are developed then adding power lines to views that will include structures associated with them, will not seem out of place.

The spatial extent of the cumulative impact is **regional**. The duration of the potential impact is rated as **permanent** since there are several proposed projects with different time frames (and at least some of them are likely to be renewed at the end of their lifetimes). The status of the impact is **negative** (although this is not necessarily true as there are viewers for whom wind turbines are a positive addition to views). The reversibility of the visual impact is rated as **high** since, if the highly visible components are removed from views then it is likely that most of the visual impact will also be removed. **Irreplaceability** of the visual resources (e.g. existing views of highly sensitive visual receptors in the region) of the affected region is **low** since power lines and substations are associated with renewable energy developments. The impact is **likely** to occur since there are potentially a small number of sensitive visual receptors that will be highly exposed to the proposed power lines. The consequence of the impact is **slight to moderate** because although the proposed electrical infrastructure will fit in with other elements in views a small number of highly sensitive visual receptors will be highly exposed to these lines.

The significance of the cumulative impact (without the implementation of mitigation measures) is rated as **low**. Mitigation measures referred to in section 1.7.5.2 will lower the significance to **very low**. The assessment of this impact is applicable to both routes. Refer to Table 1-12 below which provides a summary of the impact assessment rating:

Table 1-12 Impact Summary Rating

Aspect/Activity	Cumulative visual impact
Type of Impact (i.e. Impact Status)	Cumulative
Potential Impact	Visual intrusion of several renewable energy projects on existing views of highly sensitive visual receptors
Status	Negative (could also be positive)
Mitigation Required	Lattice type towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers (see section 1.7.6.2). This is not an essential mitigation measure but it will potentially lower the impact significance.
Impact Significance (Pre-Mitigation)	Low
Impact Significance (Post-Mitigation)	Very Low
I&AP Concern	No – Refer to Appendix E of the BA Report for comments received from I&APs to date.

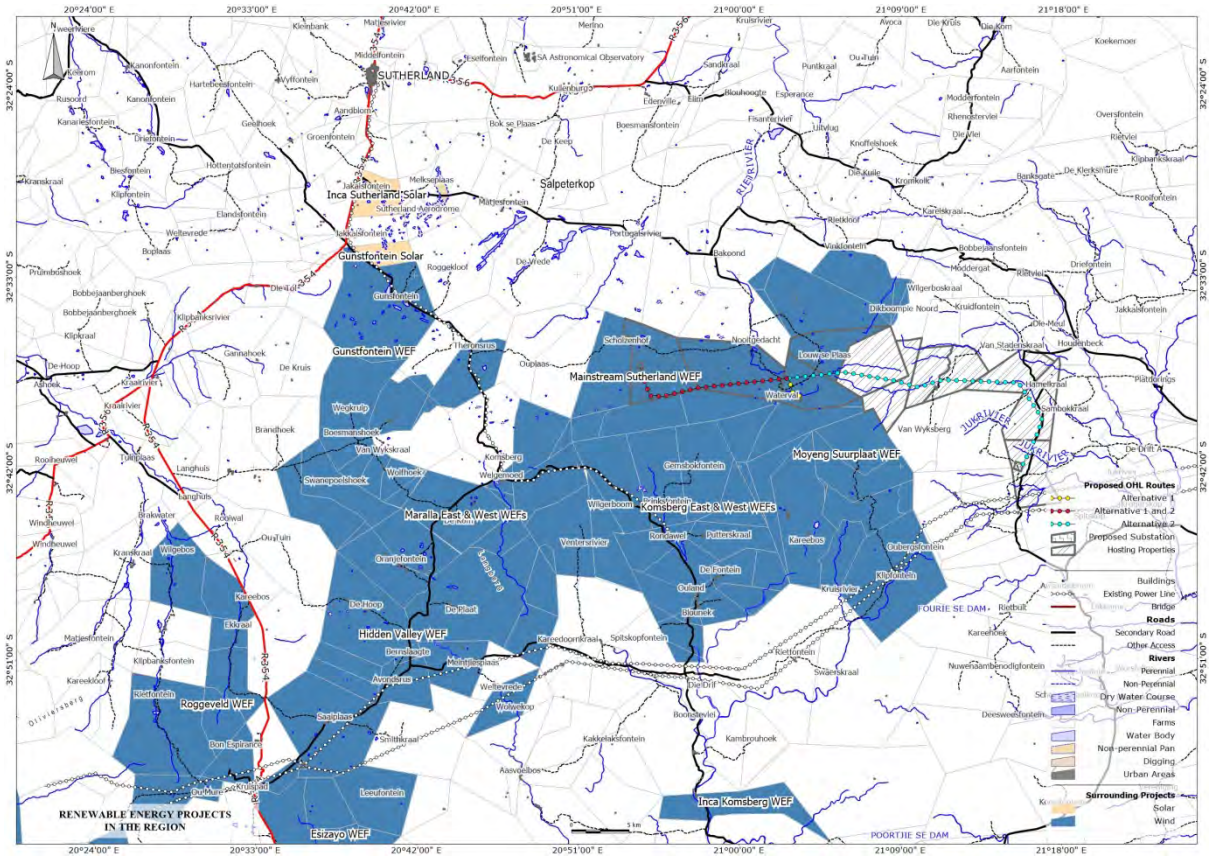


Figure 1-25 Map showing various renewable energy projects in the region surrounding the Rietrug electrical infrastructure project. The map shows the properties on which the projects will be developed and not the footprints of the proposed developments.

1.7.11 No-go Alternative

The proposed electrical infrastructure development is required in order to connect the proposed Rietrug WEF with the Eskom grid. The proposed Rietrug WEF was split via an amendment and received Environmental Authorisation in November 2016, and is currently undergoing a second separate Amendment Process. It is unclear what will happen if the amended Rietrug WEF is not authorised.

If authorised and built the Rietrug WEF will dominate the landscape in the vicinity of the proposed electrical infrastructure. Wind turbines will be prominent elements in most views in the surrounding region. The proposed electrical infrastructure is a very minor visual aspect of a WEF landscape. As such the No-go Alternative will not make much of a difference to the landscape or views, particularly if wind turbines are seen as a negative impact by visual receptors.

The Western Cape Provincial SDF (Western Cape Government 2014) indicates that there are two shale gas exploration permits issued for the area proposed for this project, while the Hoogland Karoo SDF (Umsebe Development Planners 2010) refers to the possibility of Uranium mining in the Salpeterkop region along the banks of the Rietrivier. The No-go Alternative therefore does not guarantee that there will not be pressure to develop the region in the future.

1.8 IMPACT ASSESSMENT SUMMARY

Table 1-13 Impact assessment summary table for the Construction Phase

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Potential Visual Intrusion of Construction Activities on existing views of sensitive visual receptors in the surrounding landscape – Alternative 1	Loss of visual resources	Negative	Local	Short Term	Substantial	Likely	High	Low	• Best practice guidelines for construction; • Locate construction camps and laydown areas where sensitive visual receptors are least likely to be affected; • Night lighting of the construction site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible.	Moderate	Low	4	High

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Potential Visual Intrusion of Construction Activities on existing views of sensitive visual receptors in the surrounding landscape – – Alternative 2	Loss of visual resources	Negative	Local	Short Term	Substantial	Likely	High	Low	• Best practice guidelines for construction. • Locate construction camps and laydown areas where sensitive visual receptors are least likely to be affected. • Night lighting of the construction site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible. • Particular care should be taken to avoid erosion scarring and damage along the ridge down the escarpment.	Moderate	Low	4	High

Table 1-14 Impact assessment summary table for the Operational Phase

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Landscape impact – Alternative 1	Change of landscape character	Negative	Local	Long Term	Slight	Unlikely	High	Low	None specified	Very Low	Very Low	5	High
Landscape impact – Alternative 2	Change of landscape character	Negative	Local	Long Term	Moderate	Likely	High	Low	None specified	Low	Low	4	High
Visual intrusion of the proposed electrical infrastructure along Alternative 1 on views of sensitive visual receptors	Change in existing views of sensitive visual receptors.	Negative	Local	Long Term	Moderate	Unlikely	High	Low	Lattice towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers. This is not an essential mitigation measure but it will potentially lower the significance of the impact.	Low	Very Low	5	High
Visual intrusion of the proposed electrical infrastructure along Alternative 2 on views of sensitive visual receptors	Change in existing views of sensitive visual receptors.	Negative	Local	Long Term	Moderate	Likely	High	Low	Lattice towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers. This is not an essential mitigation measure but it will potentially lower the visibility of the development.	Low	Low	4	High

Table 1-15 Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Visual impact of decommissioning activities on existing views of sensitive visual receptors – Alternative 1	Impact on visual resources.	Negative	Local	Short Term	Substantial	Likely	High	Low	• Revegetation and reclamation of cleared areas should be done in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Locate decommissioning camps and laydown areas where sensitive visual receptors are least likely to be affected; and • Night lighting of the decommissioning site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible.	Moderate	Low	4	High

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Visual impact of decommissioning activities on existing views of sensitive visual receptors – Alternative 2	Impact on visual resources.	Negative	Local	Short Term	Substantial	Likely	High	Low	• Revegetation and reclamation of cleared areas should be done in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Locate decommissioning camps and laydown areas where sensitive visual receptors are least likely to be affected; and • Night lighting of the decommissioning site should be minimised within safety and efficiency requirements, and work at night should be avoided where possible.	Moderate	Low	4	High

Table 1-16 Cumulative impact assessment summary table

Cumulative Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Cumulative impact on the landscape of the region.	Change in landscape character	Negative	Regional	Long Term	Slight	Unlikely	High	Low	None	Very Low	Very Low	5	High
Cumulative impact on sensitive visual receptors.	Visual intrusion	Negative	Regional	Long Term	Slight to Moderate	Likely	High	Low	Lattice type towers should be used as they will be better camouflaged against the mottled vegetation and rock background than monopole towers. This is not an essential mitigation measure but it can potentially lower the significance of this impact.	Low	Very Low	4	High

1.9 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

1.9.1 Planning and Design

There are some mitigation measures that require input during the design and planning phase of the proposed project in order to reduce visual intrusion of construction and decommissioning activities. These include plans to minimize fire hazards and dust generation, and rehabilitation plans for areas temporarily cleared for construction purposes. Sites for construction camps and laydown areas should be located in low visibility areas, existing disturbed areas and/or areas near derelict farmsteads (taking into consideration the findings of the Heritage Impact Assessment as well as other assessments that may be relevant) (particularly where existing trees can be used to screen these sites from views).

1.9.2 Construction Phase

Adherence to the erosion, dust, fire and light plans is necessary to minimise visual intrusion of construction activities and should be monitored regularly by the construction manager. Construction boundaries should be clearly demarcated and monitored, and good housekeeping on site should be maintained. Rehabilitation of temporary cleared areas should commence as soon as possible and the rehabilitation process should be regularly monitored by the Environmental Officer.

1.9.3 Operational Phase

A maintenance plan for buildings and structures should be followed to ensure that structures remain as non-reflective as possible. Maintenance of access and service roads should not cause further disturbance and damage to the surrounding landscape.

1.9.4 Decommissioning Phase

The decommissioning phase of the project will potentially cause similar visual impacts as that during the construction phase and as such similar mitigation measures apply. The successful completion of this phase should leave the project site in a similar condition, visually, as before construction commenced. This can be accomplished by appropriate landscaping and revegetation of disturbed areas.

1.10 IMPACT ASSESSMENT SUMMARY

Construction and decommissioning activities will potentially cause a low significance visual impact for either alternative if mitigation measures are successfully implemented.

The overall significance of the potential visual impact of the operation of the proposed electrical infrastructure will be very low for Alternative 1 and low for Alternative 2 if mitigation measures are successfully implemented.

The overall significance of the cumulative visual impact of the projects listed above (Section 1.1.6.1) on sensitive visual receptors is expected to be low for all phases of the projects since the proposed electrical infrastructure will fit into the landscape and will be familiar elements in views. Successful mitigation should lower the significance to very low.

The overall significance of the landscape impact is very low for all phases of the project, regardless of the route and no mitigation is required.

Table 1-17 below indicates a summary of the impact significance for each phase, with the implementation of mitigation measures.

Table 1-17 Overall Impact Significance (Post Mitigation)

Phase	Overall Impact Significance
Construction	Low (Alternative 1) and Low (Alternative 2)
Operational	Very Low (Alternative 1) and Low (Alternative 2)
Decommissioning	Low (Alternative 1) and Low (Alternative 2)
Nature of Impact	**Overall Impact Significance**
Cumulative - Operational	Very Low (Alternative 1 and Alternative 2)

1.11 CONCLUSION AND RECOMMENDATIONS

The landscape surrounding the proposed site has a rural agricultural character with a strong sense of remoteness, and potential for scenic views. The significance of the potential landscape impact of the proposed power line (during the operational phase) is rated as very low (with and without the implementation of mitigation measures for Alternative 1) and low (with and without the implementation of mitigation measures for Alternative 2) since the impact is localised and has a slight consequence for Alternative 1 and moderate consequence for Alternative 2. No mitigation measures are recommended for the potential landscape impact of the proposed electrical infrastructure on a rural agricultural landscape with a strong sense of remoteness and potential for scenic views.

Very few sensitive visual receptors will potentially be affected by the proposed power line:

- Residents and viewpoints on farms surrounding the proposed development site. These are highly sensitive visual receptors since they have an active interest in their surrounding landscape; and
- Motorists using secondary gravel roads and private tracks. These are low sensitivity visual receptors since their attention will be on the road.

The significance of the visual impact of the proposed infrastructure during operation for either route is low during the operational phase and before mitigation. Mitigation measures will potentially lower the significance for Alternative 1 to very low. Due to the length (and therefore higher number of potentially affected visual receptors) and the fact that it passes over the escarpment the significance of impact for Alternative 2 (operational phase) will remain low after mitigation.

The significance of cumulative impact on the surrounding landscape character is rated as very low (before the implementation of mitigation measures) since the consequence of adding electrical infrastructure to a renewable energy generation landscape (if any of the proposed projects are developed) will not change the character of the landscape. No mitigation is required.

The significance of the cumulative visual impact on sensitive visual receptors is rated as low (before the implementation of mitigation measures) because electrical infrastructure is associated with renewable energy generation landscapes and power lines and substations will be congruent

with views if any of these projects are developed. Successful mitigation should lower the significance to very low.

Overall the significance of the visual impact of the proposed electrical infrastructure is very low if mitigation measures are successfully implemented for either route (Alternative 1 or 2). Overall the significance of the potential cumulative visual impact of all the renewable energy projects in the region is very low for all phases of the project regardless of the route (Alternative 1 or 2) used. The preferred route is Alternative 1 since it is shorter and it will affect fewer sensitive visual receptors, but no fatal flaws were associated with Alternative 2.

1.12 FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

In light of the VIA above and the overall low significance of the potential visual impact there is no reason that this project should not be authorised and from a visual impact perspective the proposed development is acceptable. The preferred route from a visual impact perspective is Alternative 1 but no fatal flaws were identified for Alternative 2.

1.13 REFERENCES

CNdV Africa. 2012. “Laingsburg Municipal Spatial Development Framework Draft Final Report.” Spatial Development Framework. Laingsburg, Western Cape: Laingsburg Municipality.

CSIR. 2014. “REDZs | Project Summary.” *Strategic Environmental Assessment for Wind and Solar PV Energy in South Africa - Renewable Energy Development Zones (REDZ)*. https://redzs.csir.co.za/?page_id=445.

GLVIA. 2002. *Guidelines for Landscape and Visual Impact Assessment*. 2nd ed. United Kingdom: Spon Press.

Oberholzer, Bernard. 2005. “Guideline for Involving Visual & Aesthetic Specialists in EIA Processes.” Guidelines ENV-S-C 2005 053 F. Cape Town: CSIR, Provincial Government of the Western Cape, Department of Environmental Affairs & Development. http://www.capegateway.gov.za/Text/2005/10/5_deadp_visual_guideline_june05.pdf.

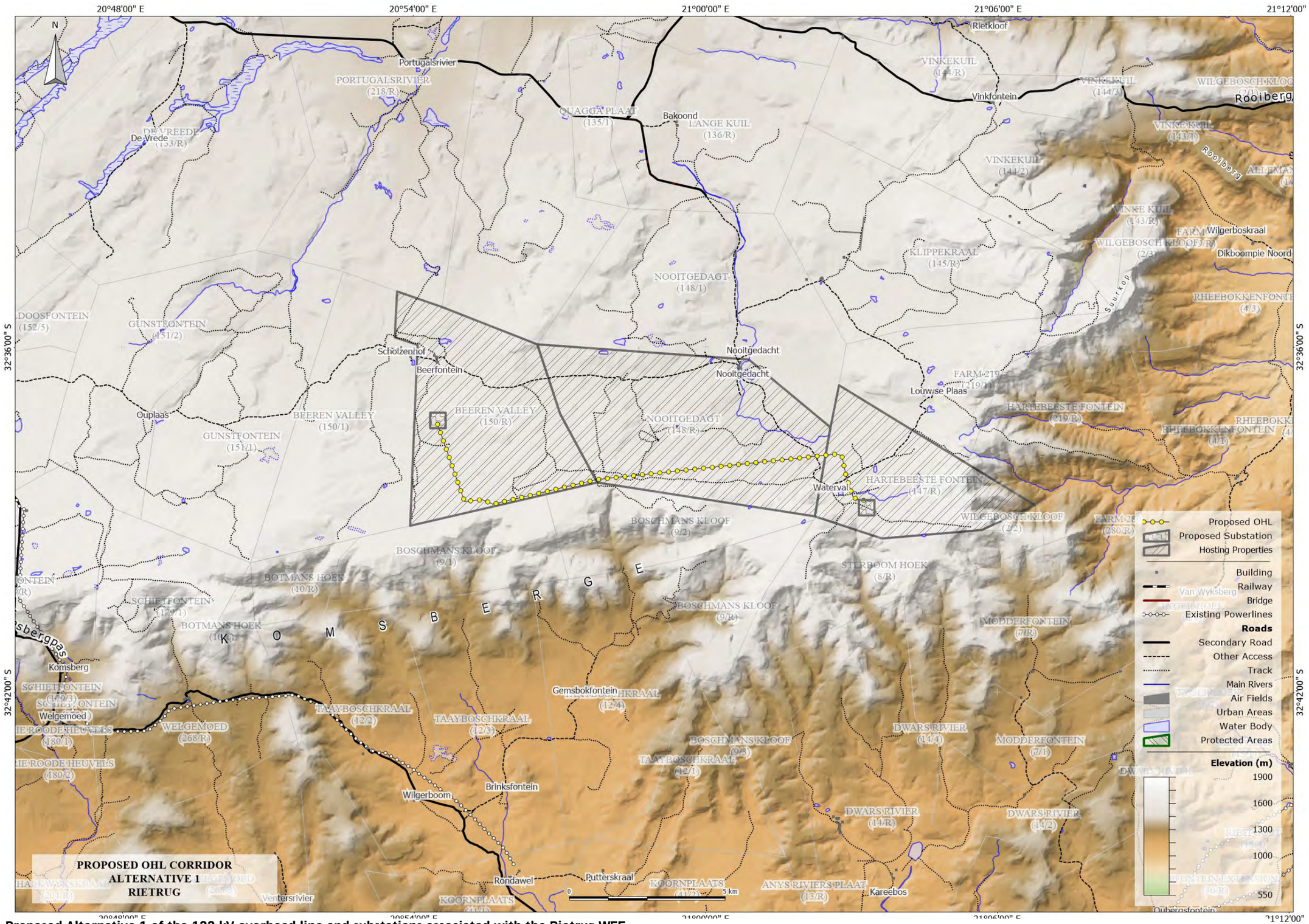
Rey, Adri de la. 2008. “Enabling Decision Making with the SPOT 5 Building Count.” *PositionIT*.

Umsebe Development Planners. 2010. “Karoo Hoogland Rural Spatial Development Framework/Land Development Plan.” Spatial Development Framework. Karoo Hoogland Municipality.

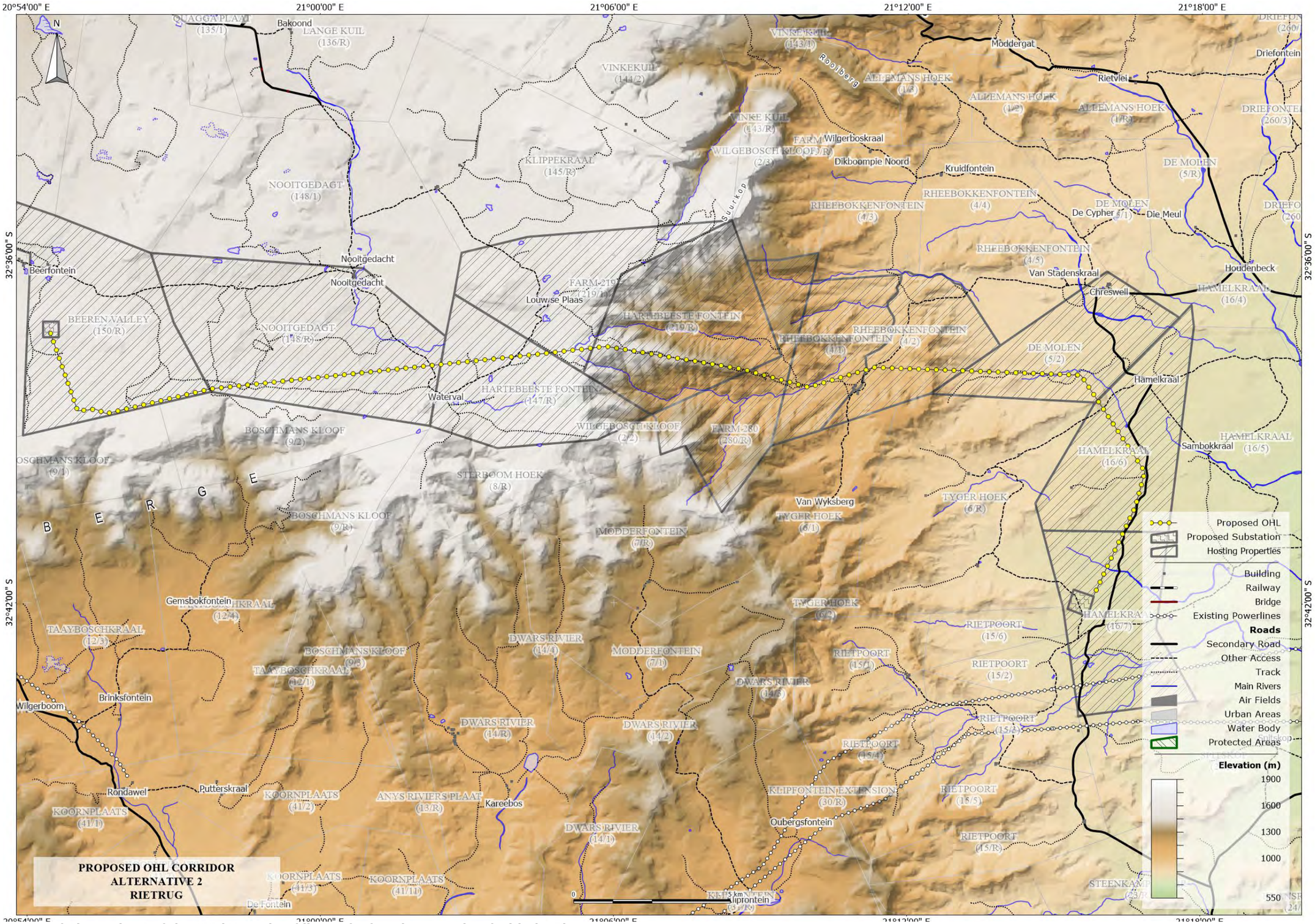
Western Cape Government. 2014. “Western Cape Provincial Spatial Development Framework - Final Report.” Spatial Development Framework. Cape Town, South Africa: Western Cape Government.

1.14 APPENDICES

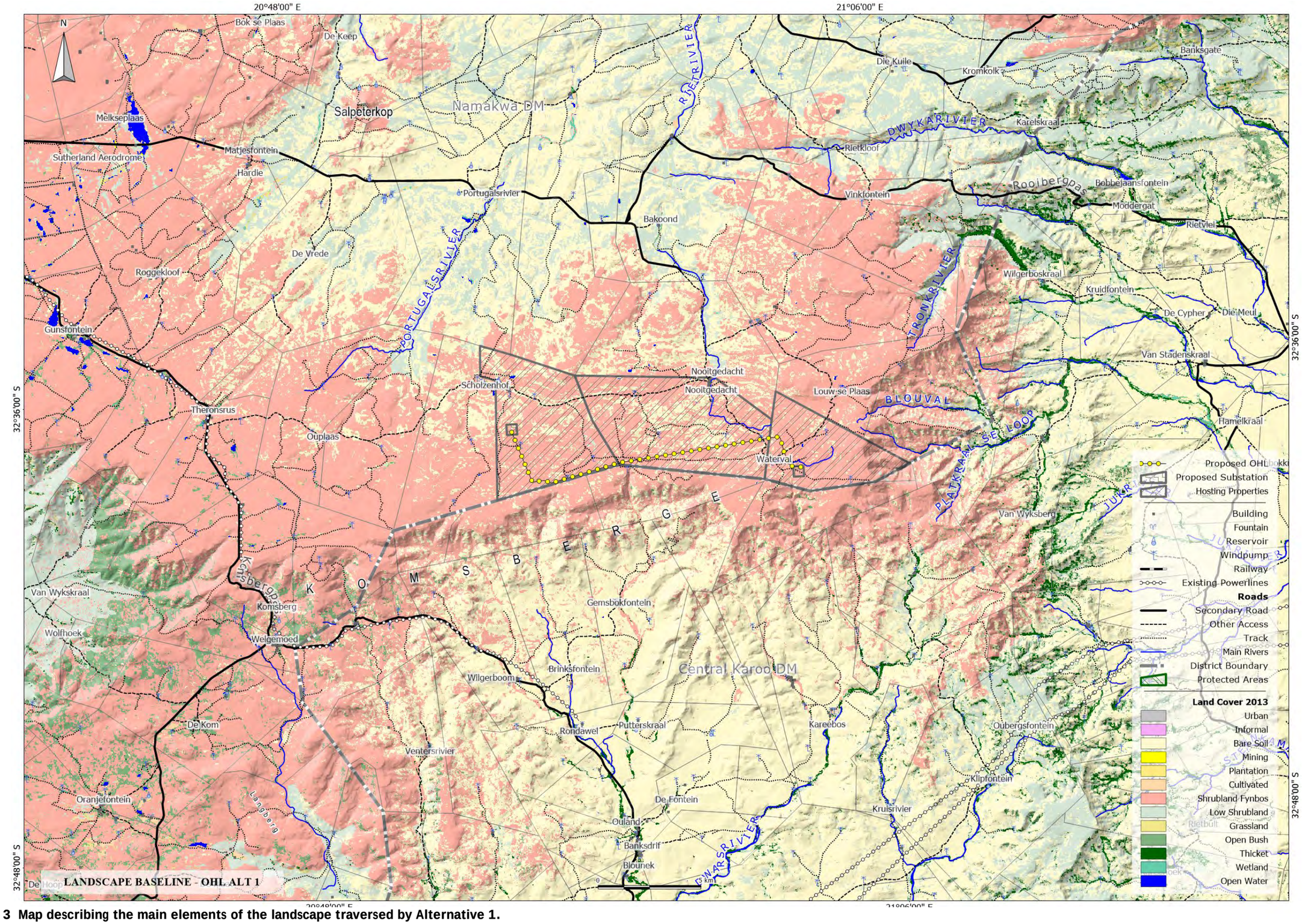
1.14.1 Maps



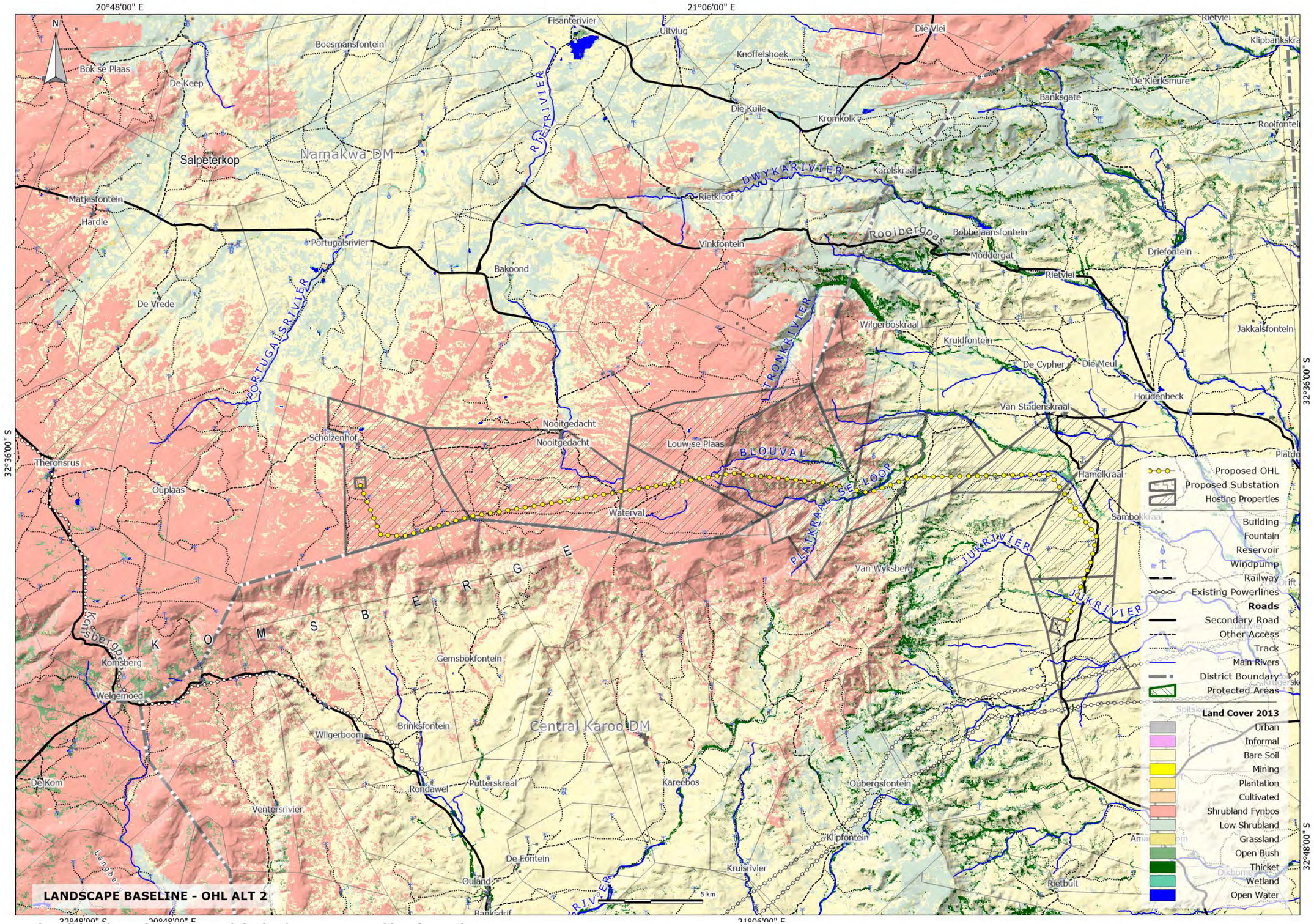
Map 1 Proposed Alternative 1 of the 132 kV overhead line and substations associated with the Rietrug WEF.



Map 2 Proposed Alternative 2 of the 132 kV overhead line and substations associated with the Rietrug WEF.



Map 3 Map describing the main elements of the landscape traversed by Alternative 1.

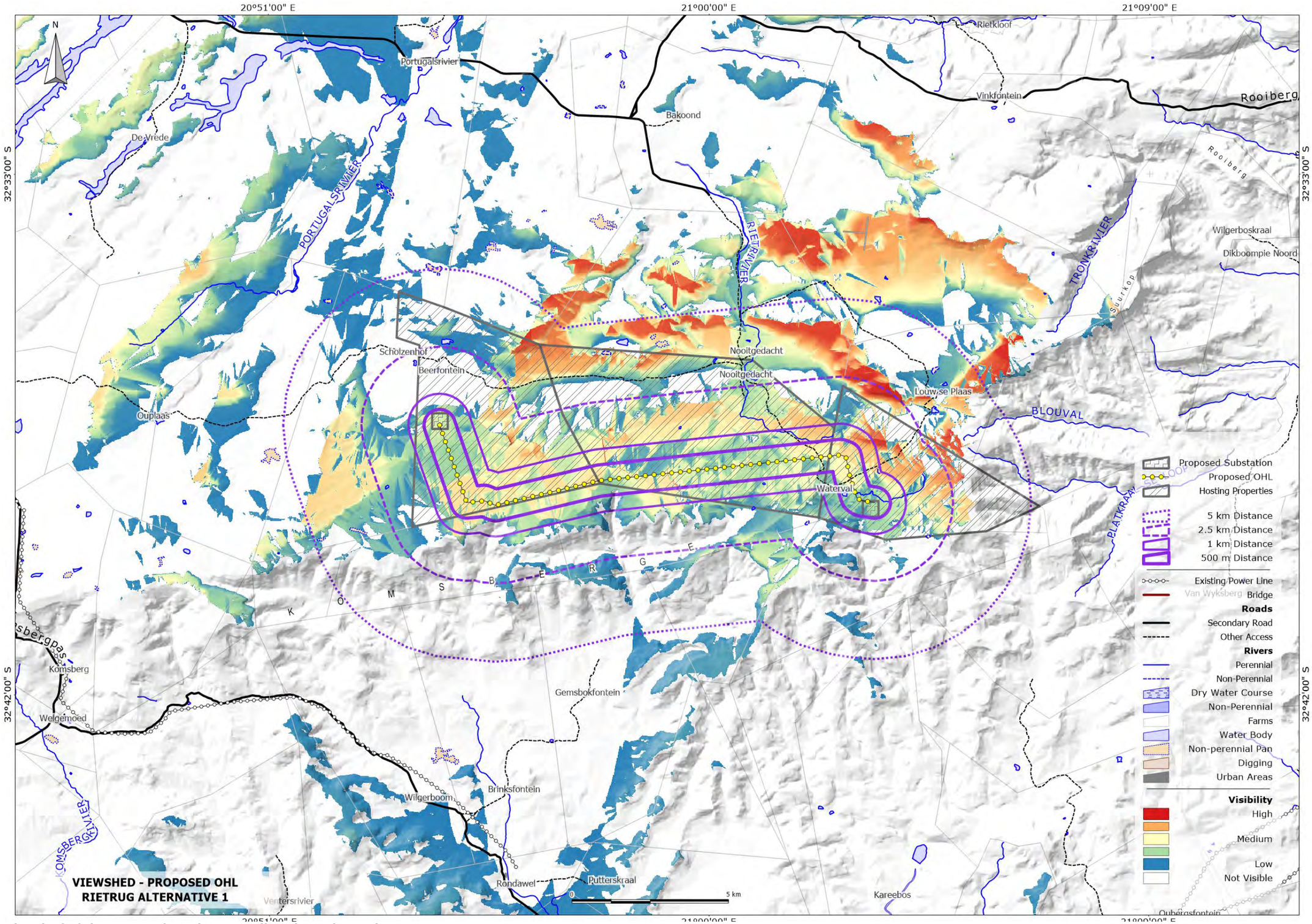


Map 4 Map describing the main elements of the landscape traversed by Alternative 2.

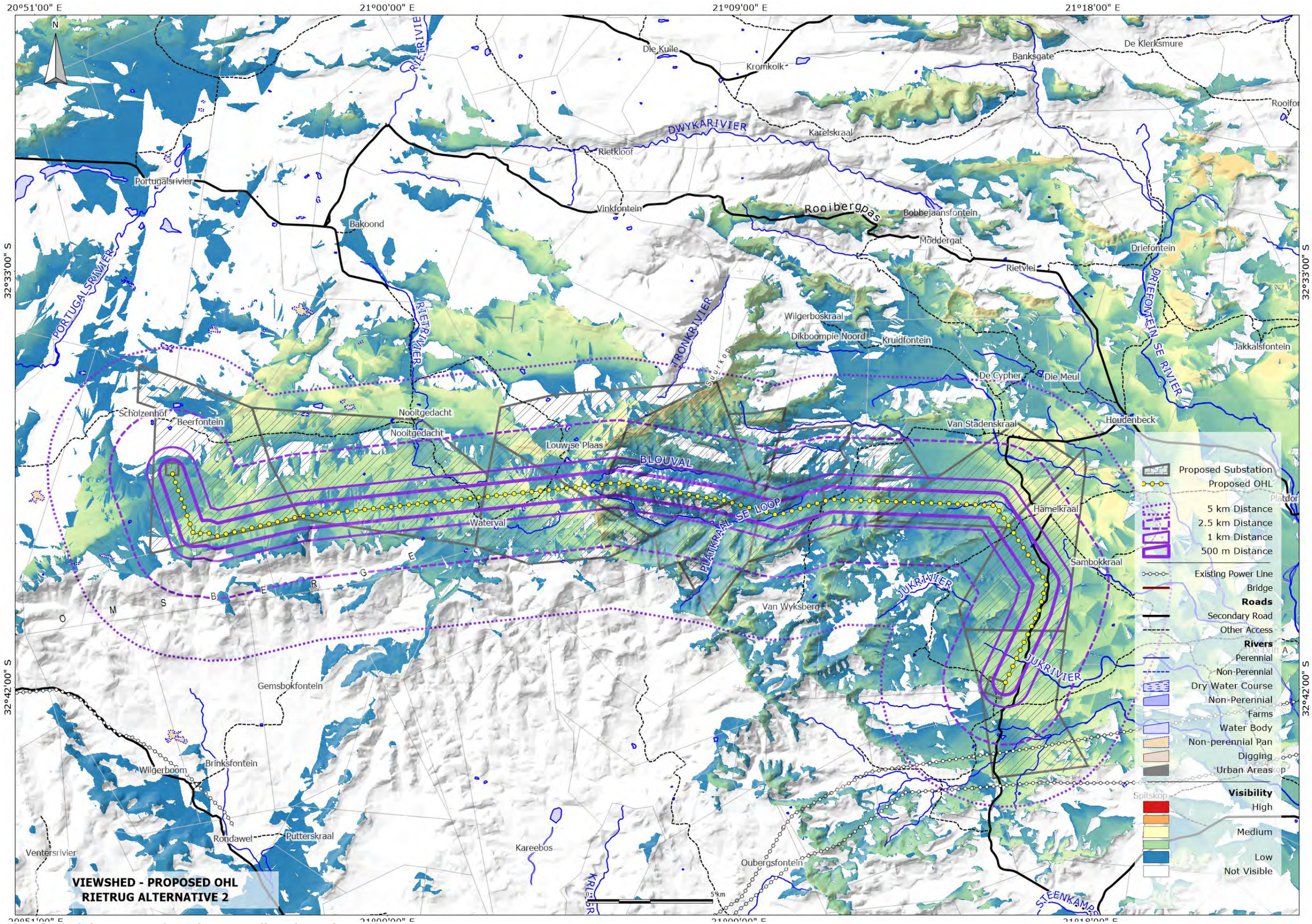
a) Alternative 1 topographic profile.

b) Alternative 2 topographic profile.

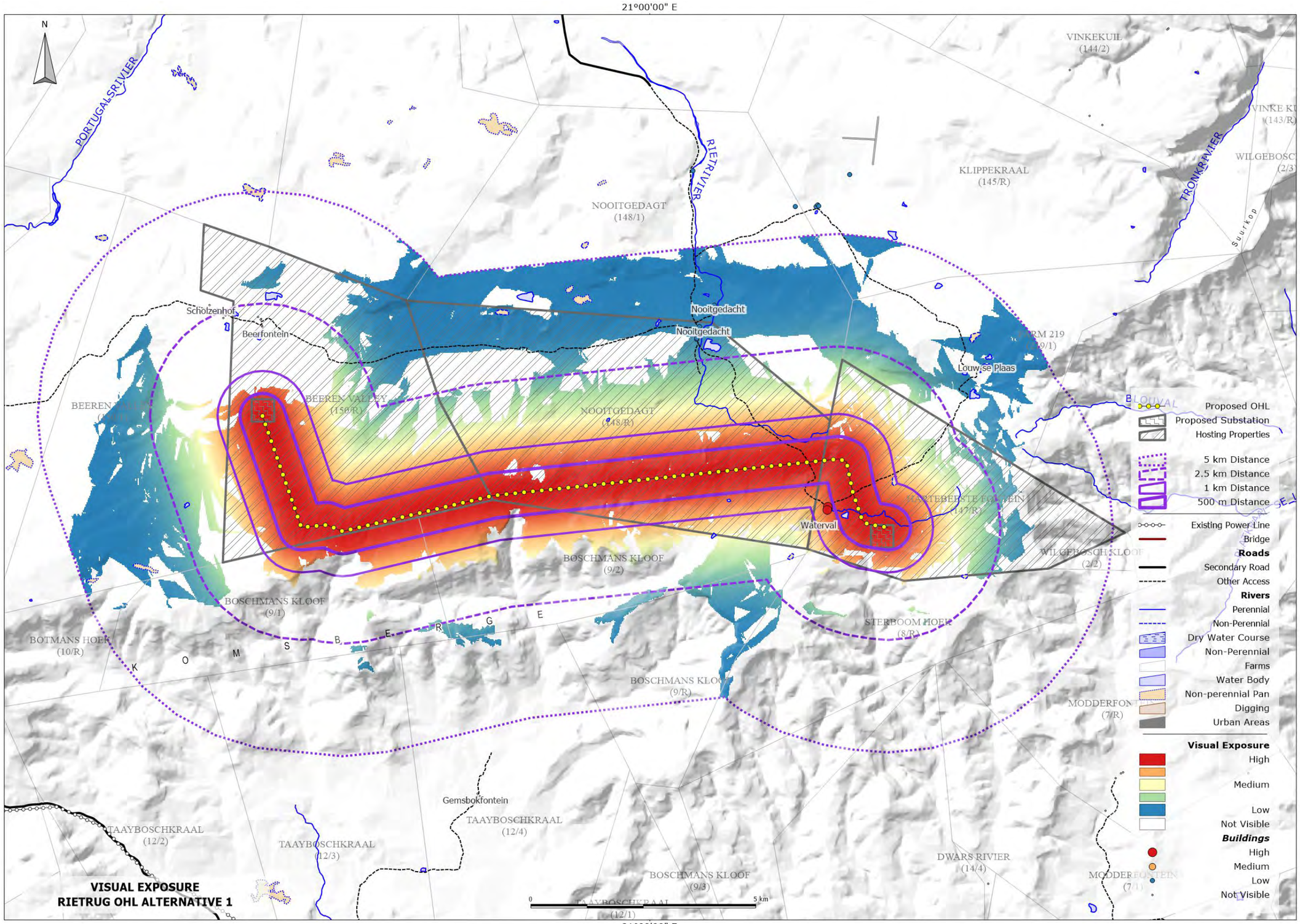
Map 5 Topographic profiles of proposed alternative routes for the overhead lines.



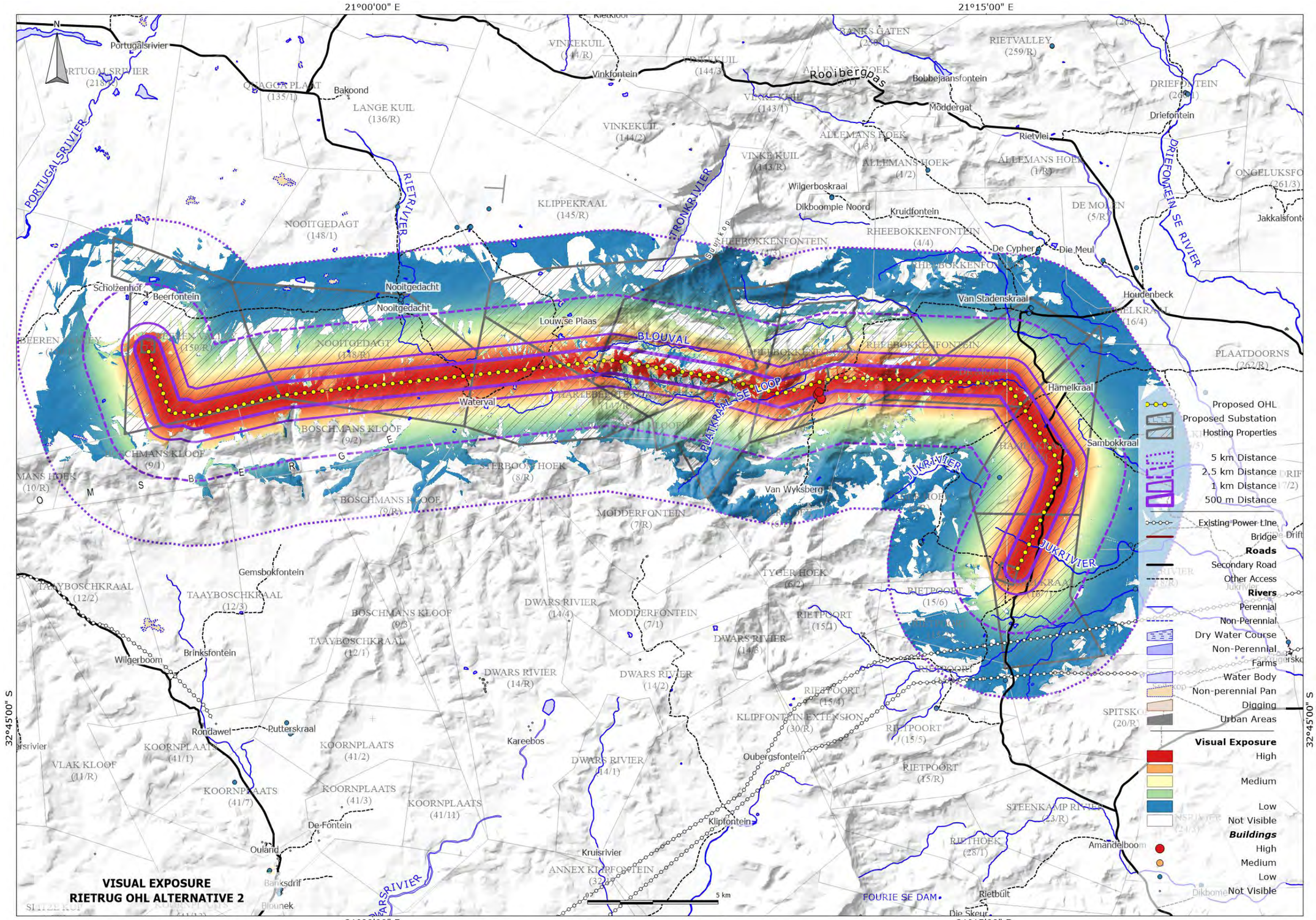
Map 6 Viewshed of the proposed 132 kV power line along Alternative 1.



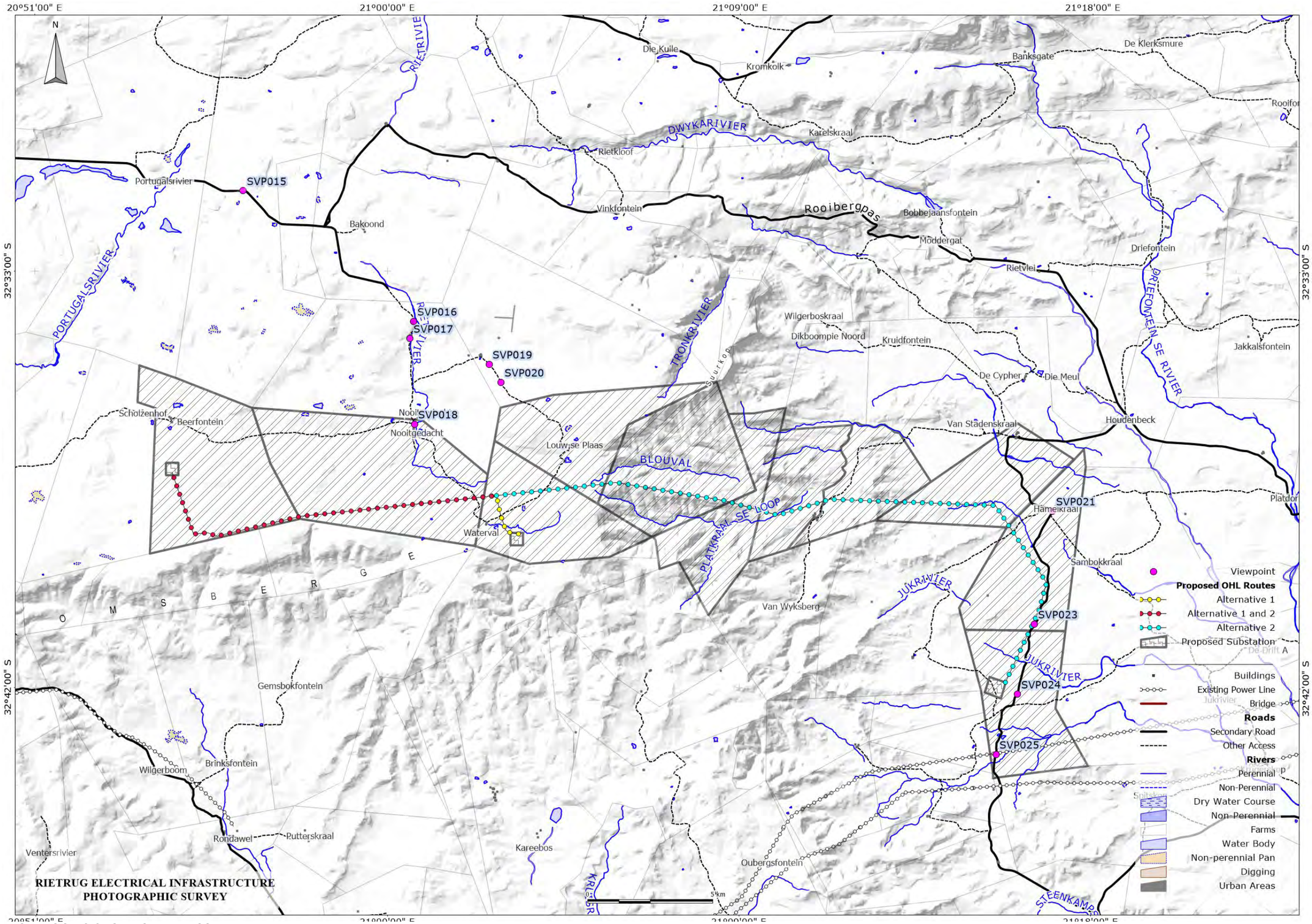
Map 7 Viewshed of the proposed 132 kV power line along Alternative 2.



Map 8 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 1 distribution line route.



Map 9 Visual exposure for sensitive visual receptors within 5 km of the proposed Alternative 2 distribution line route.



Map 10 Sites visited during photographic survey.