FRESHWATER ASSESSMENT FOR THE PROPOSED ESKOM BLANCO-DROËRIVIER POWERLINE UPGRADE

SEPTEMBER 2016

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APPROVED BY Mr Dana Grobler

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EXECUTIVE SUMMARY

This freshwater assessment is intended to inform the authorisation process for the proposed Eskom Project between Blanco and Droërivier Substations. The project will consist of the construction of an approximately 250km 400kV transmission power line between George and Beaufort West.

The following water features were identified and assessed within the study area:

- *Gouritz River System: Upper Gamka River tributaries in the Quaternary Catchments J21A/B/C/E; J23B/D, J32A, as well as the Olifants River and its tributaries in the Quaternary Catchments J31A-D; J32A/E; J33C/E/F; J34A-F; J35B;*
- *Southern Cape Coastal Rivers: Upper Maalgate River (K30A) and Upper Keurbooms River (K60A);*
- *Gamtoos River System: Upper Groot/Sout River tributaries in the Quaternary Catchments L11G; L30B; and*
- *Some valley-bottom/floor wetlands that are largely associated with the rivers as well as some seeps and pans.*

The habitat integrity of the rivers range from being largely natural (upper reaches of the larger rivers as well as the smaller streams) to being in the seriously modified ecological state (lower reaches of the larger river systems). The riparian habitat of these rivers tends to be more impacted by the direct impact of the surrounding land use activities which has resulted in removal of the natural indigenous vegetation and the subsequent growth of invasive alien plants. Within the instream habitat, water abstraction and flow modification have the most impact, particularly on the lower reaches.

The wetland areas are predominantly valley bottom wetlands that are linked to the rivers with their ecological condition and importance directly linked to that of the rivers. Some smaller seeps are also located on the mountain slopes of the Outeniqua Mountains that are still in a natural condition. The pans along the Alternative 2 corridor near Beaufort West are considered to be in a largely natural ecological state.

The ecological importance and sensitivity of the rivers within the study area range from being of a medium to very high importance. The Olifants River in particular has been identified as FEPA river and a Fish Sanctuary Area as the river contains populations of an endangered fish species (Small-scale redfin P. asper).

With the potential impacts of the proposed activities, it is often the access roads associated with the transmission lines that are likely to have a greater impact on the freshwater features than the power lines themselves as the lines can usually span the freshwater features such that the pylons can be constructed outside of the rivers and wetland areas as well as their recommended buffer areas, whereas the roads need to be constructed through the freshwater features. It is thus often best if the new power lines are placed adjacent to existing lines or roads where new roads do not need to be constructed as part of the project.

In terms of the selection of the route selection for the transmission lines, it is recommended that a buffer of 50 from the top of the river banks; approximately 100m from the edge of the wetland areas and 500m from the pans be allowed for as a development setback for the construction of the pylons.

The alternative corridor with the least potential impact on the freshwater features in the area is likely to be the more direct route (Alternative 1) as it would need to cross fewer rivers than the Alternative 2 route. In addition, it would avoid more sensitive areas crossed by the Alternative 2 corridor such as the many smaller tributaries and associated wetlands of the Kammanassie River in the Little Karoo as well as the large area of pans near Beaufort West. The alignment of the route within the corridor could also be determined to minimise the potential impact on the freshwater features within the study area. With mitigation, Alternative 1 is likely to have an impact of a very low significance on the freshwater features while Alternative 2 is likely to have an impact of a low impact.

Assessment Criteria	**Alternative 1**	
	Without Mitigation	With Mitigation
Locality/Extent	Local	Local
Duration	Short and longer term	Short term
Intensity	Low	Low
Probability	Probable	Probable to improbable
Significance	Low to Very Low	Very Low to insignificant
Confidence	Medium to High	Medium to High
Nature of Cumulative impact	Loss of aquatic habitat with some flow and water quality impacts	
Degree to which impact can be reversed	Partially to fully reversible	
Degree impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Low to very low	
Assessment Criteria	**Alternative 2**	
	Without Mitigation	With Mitigation
Locality/Extent	Local to regional	Local
Duration	Short and longer term	Short term
Intensity	Medium to Low	Medium to Low
Probability	Probable	Probable to improbable
Significance	Medium to Low	Low
Confidence	Medium to High	Medium to High
Nature of Cumulative impact	Loss of aquatic habitat with some flow and water quality impacts	
Degree to which impact can be reversed	Partially Reversible	
Degree impact may cause irreplaceable loss of resources	Medium to Low	
Degree to which impact can be mitigated	Low to very low	

A water use authorization may need to be obtained from the Department of Water and Sanitation: Western Cape Regional Office for approval of the water use aspects of the proposed activities.

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1. BACKGROUND

The need to upgrade the existing Eskom infrastructure was identified in the Western Cape Generation Expansion Planning report, where a third line needs to be built out of the Gourikwa power station. As a first step to address this need it is proposed to construct a 400kV transmission power line from the Gourikwa substation to Blanco substation, a new substation to be constructed approximately 60km to the north-east of the Gourikwa substation. The second step is to construct a 400kV transmission power line from the new Blanco Substation to the existing Droërivier Substation. Two alternative routes have been selected for the proposed transmission line route. This freshwater assessment is intended to inform the authorisation process for the proposed Eskom Project between the Blanco and Droërivier Substations.

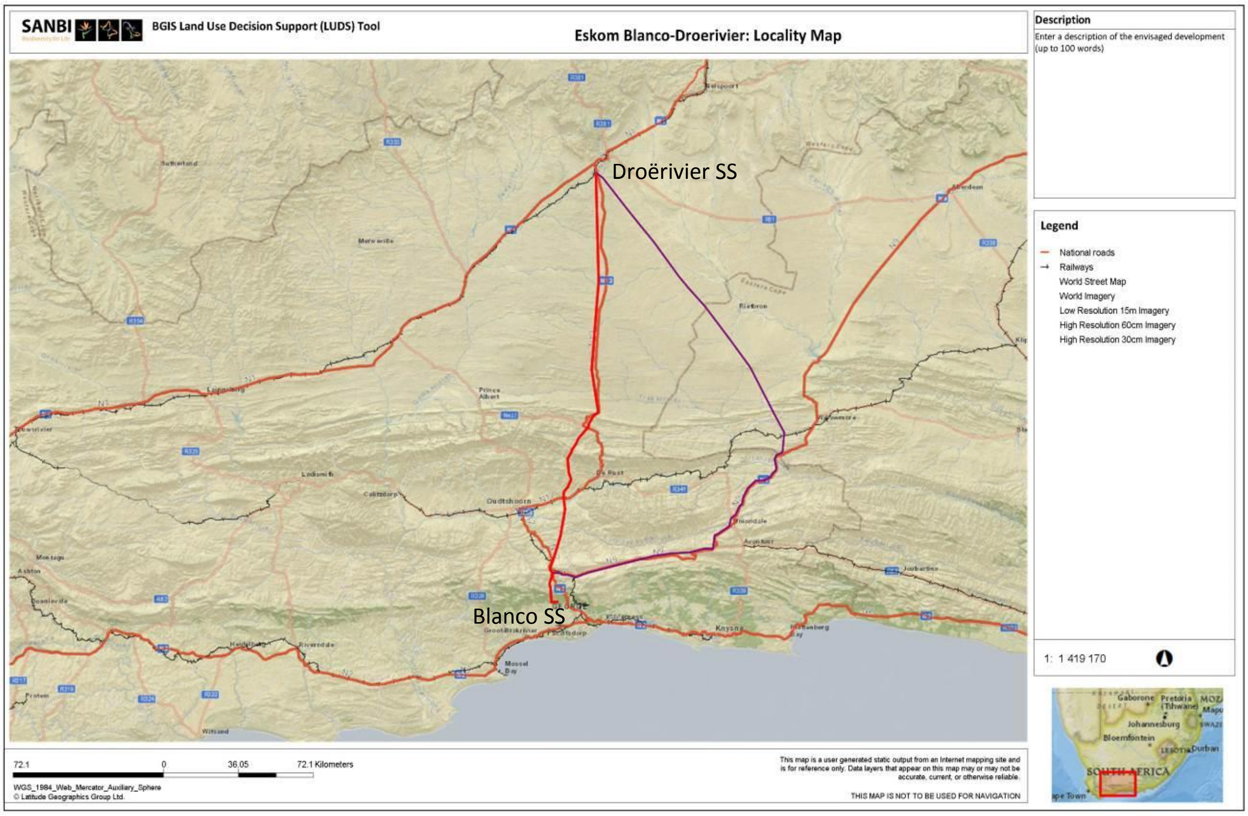


Figure 1. Locality map of the proposed alternative routes (SANBI Biodiversity GIS, 2015)

2. TERMS OF REFERENCE

The suggested and agreed upon work programme based on the above terms of reference were:

Task 1: Freshwater impact Assessment

Task 1.1.Literature Review and assessment of existing information: Conduct a review of existing studies, reports and data of the area and the detail on the proposed activity.

Task 1.2.Site Assessment of the freshwater ecosystems that may be impacted upon by the proposed development activities: Undertake a site assessment of the area in which the lines are proposed. The assessment will include:

- an assessment of the ecological condition of the freshwater features (rivers) and wetlands (pans) in the study area and ephemeral streams and drainage lines to determine the overall ecostatus of the streams and provide data that will inform Task 1.3 of the project;

Task 1.3.Compilation of the report: Impact assessment: Based on the data and information collected in the previous tasks, describe ecological characteristics of the freshwater systems to be impacted. Evaluate the proposed development activities and their potential impacts, and propose mitigation measures for the development. Describe the potential impacts, the significance of those impacts, and weigh and rank each impact during the project life cycle stages, according to the assessment, ranking, weighting and scaling criteria as laid out in the EIA Regulations. Write up findings and recommendations for EIA process.

Task 1.4.Review reports and findings in line with alternative options presented: Most likely the final routes cannot be determined before some of the technical studies have been undertaken to inform the decisions. This will lead to changes in the layout plans and will require the updating of reports to reflect the changes.

Task 1.5: Review and liaison and finalisation of the report: Liaise with the DWS in the Western Cape to determine the need to make comment on report and the need for water used authorisation.

3. LIMITATIONS AND ASSUMPTIONS OF THE STUDY

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features at the dam site. The site was visited in May 2015. During the field visit, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using a Garmin Colorado 300 GPS and mapped in PlanetGIS Professional. The SANBI Biodiversity GIS website was also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping as well as possible freshwater features mapped in the Freshwater Ecosystem Priority Areas maps. This information/data was used to inform the resource protection related recommendations as well as the instream flow requirement determination.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following limitations apply to the techniques and methodology utilized to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments;
- The EcoStatus assessment of the South African Department of Water and Sanitation was utilised to provide information on the ecological condition and ecological importance and sensitivity of the river systems impacted on a sub-catchment level.
- Recommendations are made with respect to the adoption of buffer zones within the development site, based on the river's functioning and site characteristics.

The level of aquatic assessment undertaken was considered to be adequate for this study.

4. USE OF THIS REPORT

This report reflects the professional judgment of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

5. OVERVIEW OF THE PROJECT AND STUDY AREA

5.1. OVERVIEW OF THE STUDY AREA

The study area lies in three district municipal areas, namely the Eden, Central Karoo and Cacadu District Municipalities, and five local municipal areas, namely George, Oudtshoorn, Prince Albert, Beaufort West and Baviaans Local Municipalities. It also falls over the boundary between the Western and Eastern Cape Provinces and stretches from the Southern Cape, through the Little and into Great Karoo between the towns of George, Willowmore, Beaufort West and Oudtshoorn. Table 1 provides a summary of the main features of the freshwater and hydrological features of the area. Large freshwater features within the study area include the upper reaches of the Southern Cape coastal Maalgate and Keurbooms Rivers and tributaries of the Gouritz River within the Gouritz Water Management Area (WMA), as well as the upper reaches of the Gamtoos River in the Fish to Tsitsikamma WMA.

Table 1: Key information related to the water resources which may be impacted by the proposed activities

Descriptor	Name / details	Notes
Water Management Area	Gouritz and Fish to Tsitsikamma WMAs	
Catchment Area	Gamka and Olifants tributaries of the Gouritz River; Maalgate River; Keurbooms River; Groot tributary of the Gamtoos River	
Quaternary Catchment	Gamka Tributaries (J21A/B/C/E; J23B/D) Olifants and Kammanassie Tributaries (J31A-D; J32A/E; J33C/E/F; J34A-F; J35B) Maalgate River (K30A) and Upper Keurbooms River (K60A) Upper Groot/Sout River Tributaries (L11G; L30B)	
Present Ecological state*	Gamka Tributaries (A-C) Olifants and Kammanassie Tributaries (B-E) Maalgate River (D) and Upper Keurbooms River (D) Upper Groot/Sout River Tributaries (A-C)	DWA 2012; See Freshwater Assessment Section of this report for individual river scores
Ecological Importance; Ecological Sensitivity	Gamka Tributaries (High/Very high; Low to High) Olifants and Kammanassie Tributaries (Medium to high; Very low to Very high) Maalgate River (High/Very high) and Upper Keurbooms River (High/Very high) Upper Groot/Sout River Tributaries (Medium to high; Medium)	DWA 2012; See Freshwater Assessment Section of this report for individual river scores
Type of water resource	Rivers and streams	
Latitude	32°24’21.5”S	Location of Droërivier Substation
Longitude	22°31’52.1”E	
Latitude	33°55’32.0”S	Location of Blanco Substation
Longitude	22°22’08.4”E	
Status of Environmental authorisation process	This freshwater assessment report is prepared as input into the EIA process	Envirolution Consulting, 223 Columbine Avenue, Mondeor
Site visit	Mr Dana Grobler and Ms Toni Belcher	May 2015

* *Where A = natural; B = largely natural; C = moderately modified; D = largely modified; E = seriously modified*

5.2. ACTIVITY DESCRIPTION

The project will consist of the construction of an approximately 250km 400kV power line from the Blanco Substation to Droërivier Substation. The power line is proposed to traverse over the Outeniqua Mountains, through the Little Karoo, over the Groot Swartberg Mountains and through the southern portion of the Great Karoo to Beaufort West. Two corridors have been selected for the Blanco – Droërivier proposed 400kV power line; the red corridor and the purple corridor in Figure 2. Blanco Substation is proposed to be built approximately 10km north-west of the town of George. Droërivier Substation is located approximately 8km south-west of Beaufort West Town.

The red corridor is approximately 178km long. It is aligned directly northward towards the Droërivier Substation and parallel to the existing Droërivier – Proteus 400kV power-line. From the proposed Blanco Substation, the red corridor crosses the Outeniqua Mountains which has a section of approximately one kilometre of land declared as the Ruitersbos Nature Reserve. The route then crosses the Little Karoo, following existing power lines and passes over the Groot Swartberg Mountains north of Dysseldorp. The corridor will need to pass through the Groot Swartberg Nature Reserve. The proposed corridor then runs through the Great Karoo on the eastern side along the N12 toward Droërivier Substation.

The purple corridor exits Blanco substation using the same alignment as the red corridor. On the intersection of the N9 and the N12 roads, the purple corridor turns easterly to go along the N9 road as compared to the red corridor that continues northerly along the N12 road. The purple corridor is aligned along the N9 road to cover both the Northern and the Southern sections of the road. The purple corridor alignment continues to pass closer to the Uniondale town. The purple corridor traverses easterly along the N9 road to minimise the impact on the nature reserves. The corridor then swings to a north-westerly direction between the R407 broad and Droërivier Substation and passes through largely undisturbed lands of the Great Karoo.

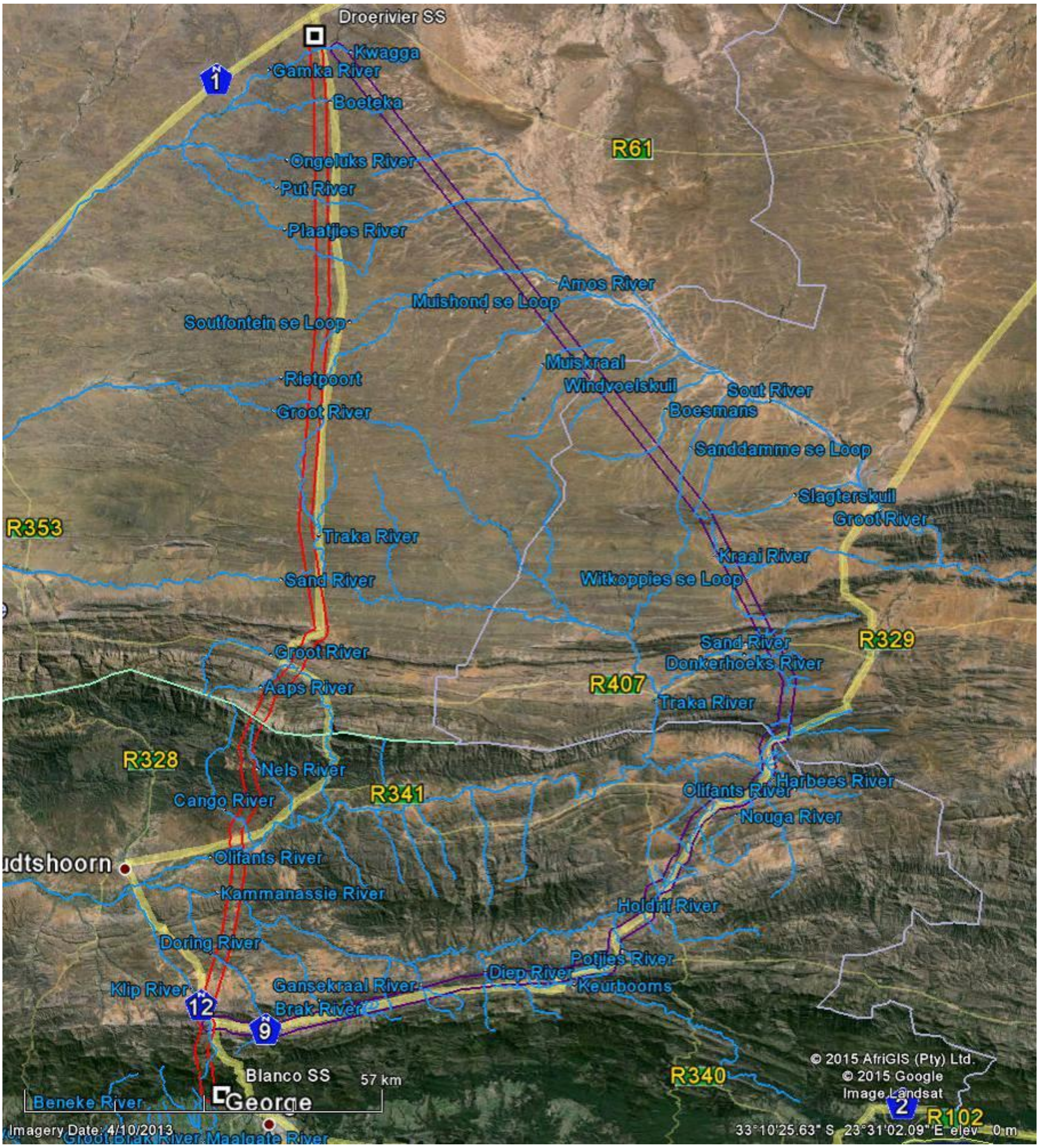


Figure 2: Google Earth image showing the alternative routes under consideration for the transmission line between Blanco and Droërivier

6. DESCRIPTION OF THE STUDY AREA

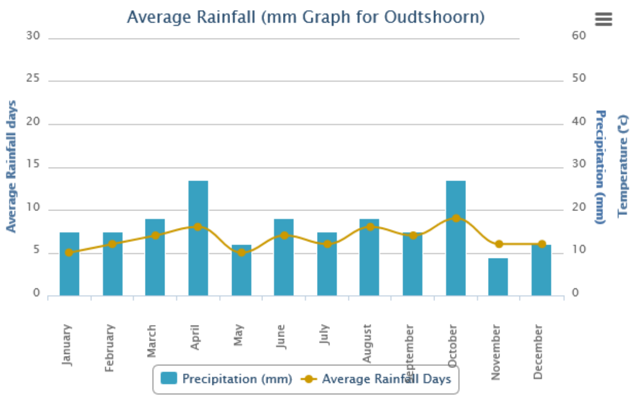
6.1. VISUAL CHARACTERISTICS

The study area largely lies between George and Beaufort West and encompasses the Little Karoo and southern extent of the Great Karoo, passing over the Outeniqua and Groot Swartberg Mountains. The topography that varies between the steep slopes of the mountain ranges and the slightly undulating plains of the Karoo. The rivers within the study area also vary between short perennial coastal rivers and mountain streams with a relatively steep gradient and the very low gradient and poorly defined ephemeral rivers of the Karoo. Large portions of the study are still largely natural with cultivated and urban areas in general being located along the seasonal and perennial river systems. The natural vegetation cover also varies from fynbos on the mountain slopes to succulent Karoo and Gwarrieveld with dwarf shrubland and rare low trees.

Figure 3: View of the Droërivier Substation in the northern extent of the study area, surrounded by a low shrubland with the occasional *Acacia Karoo* tree along the watercourses

6.2. CLIMATE

Most of the area receives about 160 to 200 mm of rain per year, with rainfall occurring throughout the year. It receives the lowest rainfall (10mm) in January, July and November and the highest (22mm) in March/April and October. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures range from 17 ^{o}C in June/July to above 30^{o}C in January/February. The region is coldest during July when an average below 4^{o}C is experienced.



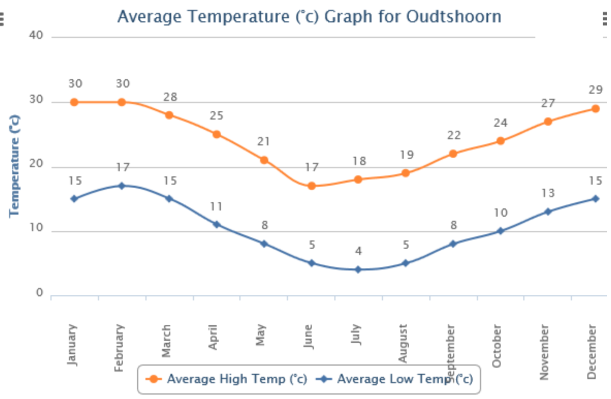


Figure 4: Average monthly rainfall and temperature graphs for the area (worldweatheronline.com)

6.3. SOILS

Much of the area to the north, in the Karoo is underlain by mudstones and sandstones of the Beaufort Group (Adelaide Subgroup) with sedimentary rocks of the Ecca Group (Prince Albert Formation) and diamictite of the Dwyka Group. Shales and quartzites of the Devonian Witteberg Group also occur, together with tertiary alluvial and slope deposits. Shale, sandstone and siltstone of the Bokkeveld Group (Traka and Ceres Subgroups) occur south of the Groot Swartberg in the Little Karoo. The Outeniqua and Groot Swartberg Cape Fold Mountains comprise sandstones of the Table Mountain Group (Cape Supergroup).

The soils of the proposed routes in general, have minimal development, being shallow on hard or weathering rock with limestone generally being present (pink-brown areas in Figure 5). Along the larger rivers, deep alluvial soils occur (cream areas) while on the mountain slopes little to no soil occurs only rock. On the slopes of the foothills (grey/brown areas), sandy leeched soils with organic matter overlie hard or weathering rock.

6.4. FLORA

The study area lies within the Nama Karoo (red in Figure 6a); Succulent Karoo (yellow) Fynbos (purple); Albany Thicket (light green) and Azonal (dark green Biomes). According to Marcina (2006) the area consists of the following indigenous vegetation types (Figure 6b):

Vegetation Type	Conservation Status	Colour in Figure 6
North Swartberg Sandstone Fynbos (FFs23)	Least threatened	
South Swartberg Sandstone Fynbos (FFs24)	Least threatened	
Grassy Sandstone Fynbos (FFs28)	Least threatened	
South Outeniqua Sandstone Fynbos (FFs18)	Vulnerable	
North Outeniqua Sandstone Fynbos (FFs19)	Least threatened	
Uniondale Shale Renosterveld (FR16)	Least threatened	
Swartberg Shale Renosterveld (FRs15)	Least threatened	
Kango Limestone Renosterveld (FFl1)	Least threatened	
PrinceAlbert Succulent Karoo (SKv13)	Least threatened	
Willowmore Gwarrieveld (SKv12)	Least threatened	
Eastern Little Karoo (SKv11)	Least threatened	
Gamka Karoo (NKl1)	Least threatened	
Muscadel Riviere (AZi8)	Endangered	

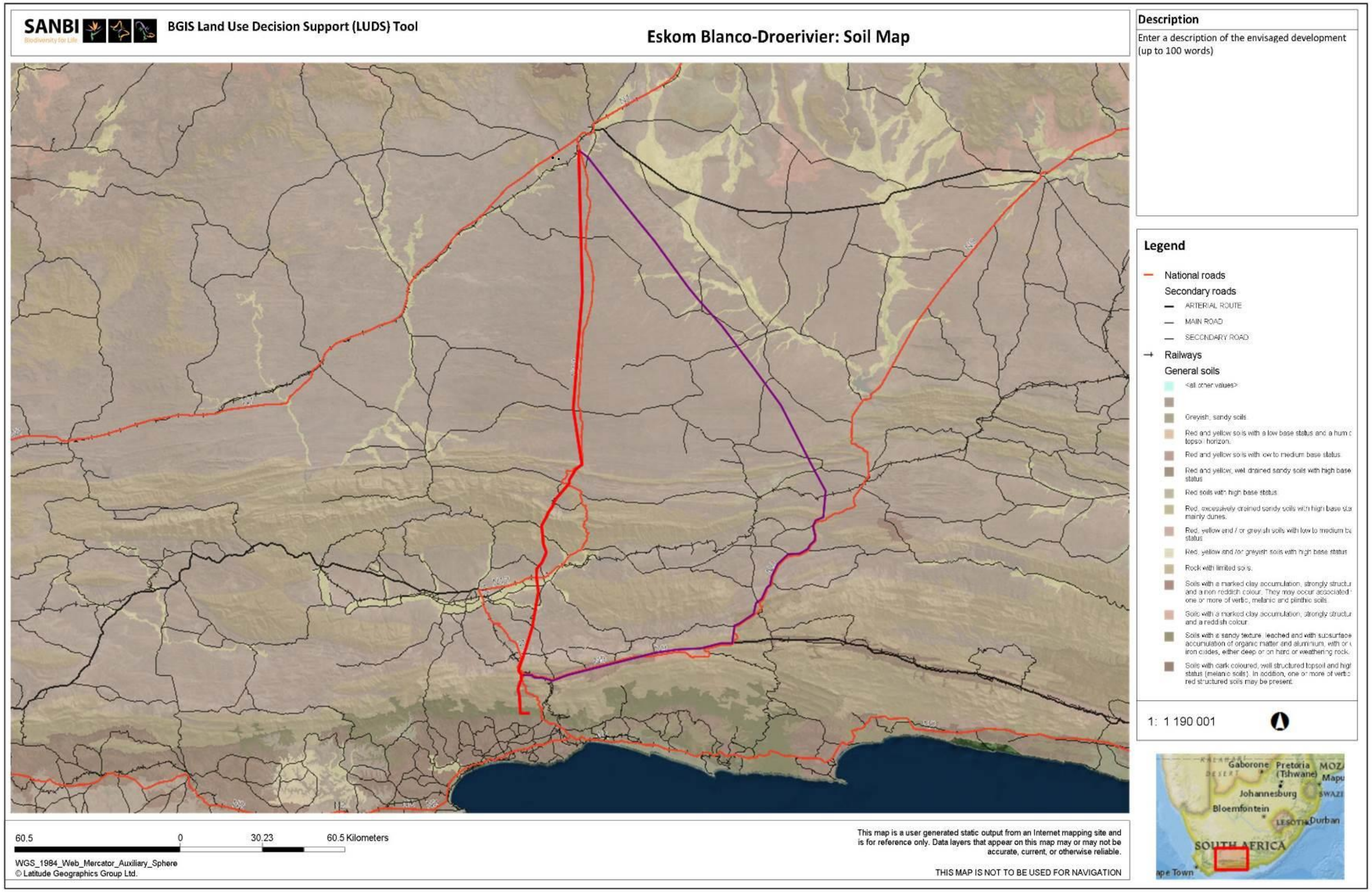


Figure 5: Soils map for the area and surroundings (SANBI Biodiversity GIS, 2015)

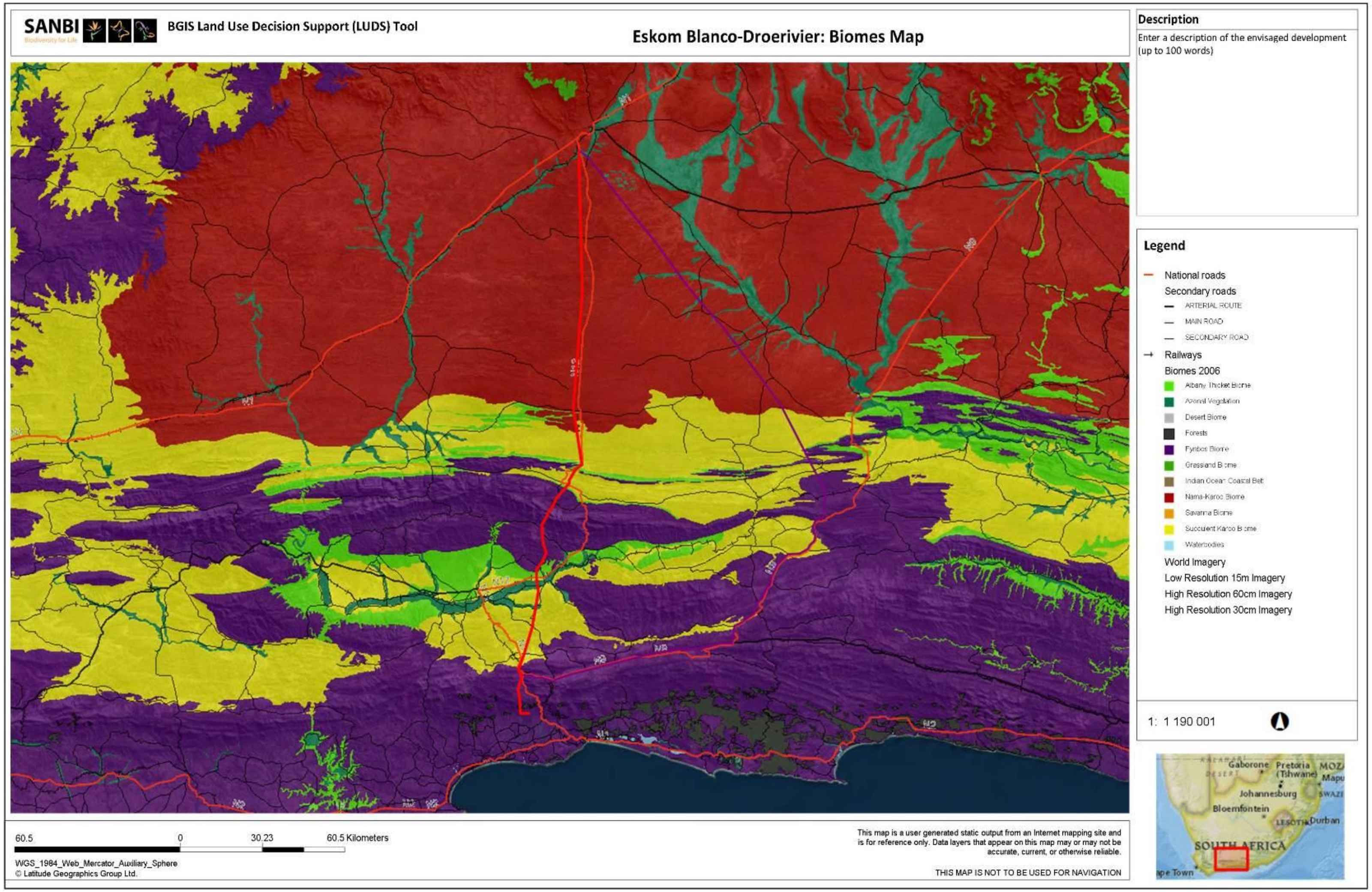


Figure 6a: Biome map for the area (SANBI Biodiversity GIS, 2015)

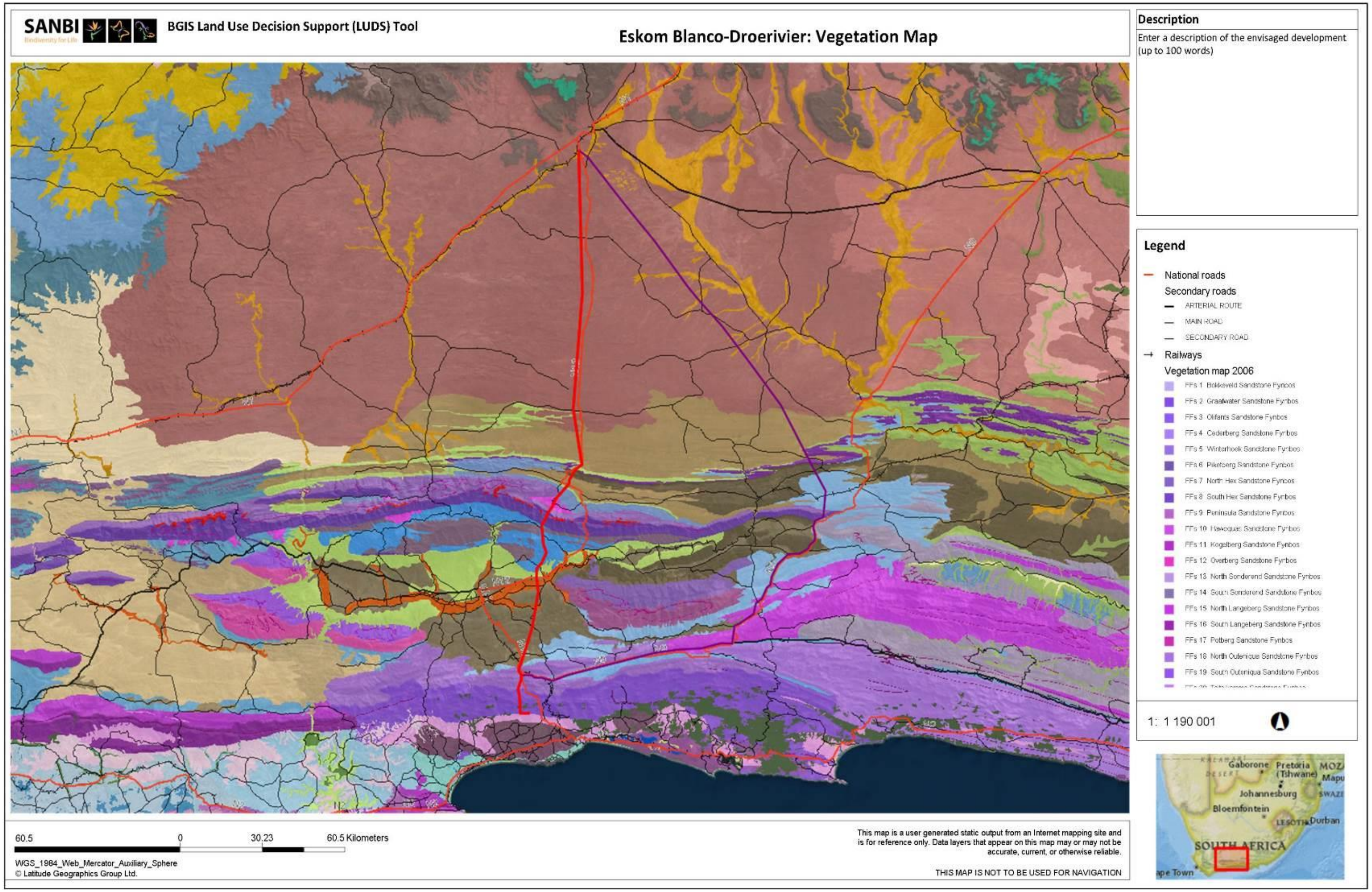


Figure 6b: Vegetation map for the area (SANBI Biodiversity GIS, 2015)

The natural vegetation has however at most places still largely natural with cultivated and urban areas only resulting in loss of natural vegetation cover mostly within the river valleys, in particular along the Kammanassie and Olifants Rivers. Some of the riparian vegetation found in the rivers and ephemeral streams includes Sweet thorn *Acacia karoo*, karee trees *Searsia lancea*, kuni-bush *Searsia undulata***,** the common reeds *Phragmites australis* in the marginal zone and invasive species such as black wattle *Acacia mearnsii*, Spanish reed *Arundo donax* and mesquite *Prosopis glandulosa*. More detail on the vegetation occurring associated with the rivers and streams in the study area is provided in the following section.

6.5. AQUATIC FEATURES AND FAUNA

The following water features were identified and assessed within the study area:

- Gouritz River System: Upper Gamka River tributaries in the Quaternary Catchments J21A/B/C/E; J23B/D, J32A, as well as the Olifants River and its tributaries in the Quaternary Catchments J31A-D; J32A/E; J33C/E/F; J34A-F; J35B;
- Southern Cape Coastal Rivers: Upper Maalgate River (K30A) and Upper Keurbooms River (K60A);
- Gamtoos River System: Upper Groot/Sout River tributaries in the Quaternary Catchments L11G; L30B; and
- Some valley-bottom/floor wetlands that are largely associated with the rivers as well as some seeps and pans (Figure 11).

Whilst the larger river systems are all perennial, the tributaries tend to be seasonal to ephemeral (particularly in the north and eastern portions of the study area), flowing only during the rainfall period or sporadically for short periods after heavy rainfall. The most significant wetland areas within the study area are the valley bottom and valley floor wetlands associated with the Olifants and Kammanassie Rivers near Oudtshoorn which fall mostly outside of the proposed corridors; largely natural seeps on the southern slopes of the Outeniqua Mountains; and the pans approximately 15km south-east of Beaufort West in the upper Gamka River tributaries that lie within and just east of the proposed corridor for Alternative 2. The freshwater features are discussed in more detail in the following section.

6.6. BIODIVERSITY CONSERVATION AND PROTECTED AREAS

In South Africa two sets of mapping initiatives are available for the study area that are of relevance to the conservation and biodiversity importance of the aquatic ecosystems, that is, the Critical Biodiversity Areas (CBA) maps and the Freshwater Ecosystem Priority Areas (FEPA) maps.

The CBA maps serve as the common reference for all multi-sectorial planning procedures, advising which areas can be developed, and which areas of critical biodiversity value and their support zones should be protected against impacts. The main CBA categories are Critical Biodiversity Areas (Terrestrial and Aquatic), Ecological Support Areas (Critical and Other), Other Natural Remaining Areas and No Natural Remaining Areas. The first two mentioned categories represent the biodiversity priority areas which should be maintained in a natural to near natural state. The last two mentioned categories are not considered as priority areas and a loss of biodiversity within these areas may be acceptable.

FEPAs are strategic spatial priorities for conserving freshwater ecosystems and associated biodiversity that were determined through a process of systematic biodiversity planning using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. FEPA rivers and Fish Support Areas should be maintained in their current condition should not be degraded any further. Upstream catchment areas should be maintained in such a manner so as not to allow downstream of a FEPA river to become degraded. In terms of wetland FEPAs, wetlands currently in an A or B ecological condition should be managed to maintain their good condition. Those currently in a condition lower than A or B should be rehabilitated.

The conservation value of the river systems in the study area is depicted in Figure 8 (FEPAs) and Figure 9 (CBAs) and summarised in Table 2.

Table 2. Biodiversity Conservation Value of the rivers in the study area

River	FEPA status	CBA status
Gamka Tributaries	Plaatjies & Put Rivers FEPA rivers; remainder Upstream Catchments; pan system near Beaufort West a FEPA wetland	Kwagga, Boeteka, Ongeluks & Plaatjies and pans are CBAs, remainder are ESAs
Olifants and Kammanassie Tributaries	Aaps is a FEPA River, Olifants, Holdrif and Groot Rivers are Fish Support Areas, Remainder are Upstream Catchments; Valley bottom wetland areas associated with Olifants and Kammanassie FEPA wetlands	Aaps, Traka, Olifants and Kammanassie have portions as CBAs, remainder are ESAs
Maalgate River	No River FEPAs only Valley bottom wetland areas	ESAs
Upper Keurbooms River	FEPA river	ESA
Upper Groot/Sout River Tributaries	Kraai, Muiskraal, Rensburgskuil se Loop, Boesmans and Sanddamme se Loop are FEPA rivers, Groot is a Fish support Area	Amos and Muishond se Loop are CBAs, remainder are ESAs

The Kammanassie and Olifants River tributaries have been identified as an upstream management area where human activities need to be managed to prevent degradation of the downstream Olifants and Gouritz Rivers which have been identified as FEPA river and Fish Sanctuary Areas (Figure 8). Fish sanctuaries are rivers that are essential for protecting threatened freshwater fish that are indigenous to South Africa, and the Gouritz River (Olifants Tributary in particular) contains populations of an endangered fish species (Table 3). No further deterioration in river condition in fish sanctuaries should be allowed.

Table 3. Freshwater indigenous fish of the Olifants River in the Gouritz River System

Species	Conservation Status
Family: Cyprinidae	
Chubbyhead barb *Barbus anoplus*	Least Concern
Moggel *Labeo umbratus*	Least Concern
Slender redfin *P. tenuis*	Near Threatened
Small-scale redfin *P. asper*	Endangered
Family: Galaxidae	
Cape Galaxias *Galaxias zebratus*	Data deficient
Family: Anabantidae	
Cape kurper *Sandelia capensis*	Data deficient
Family: Anguillidae	
Longfin eel *Anguilla mossambica*	Least Concern

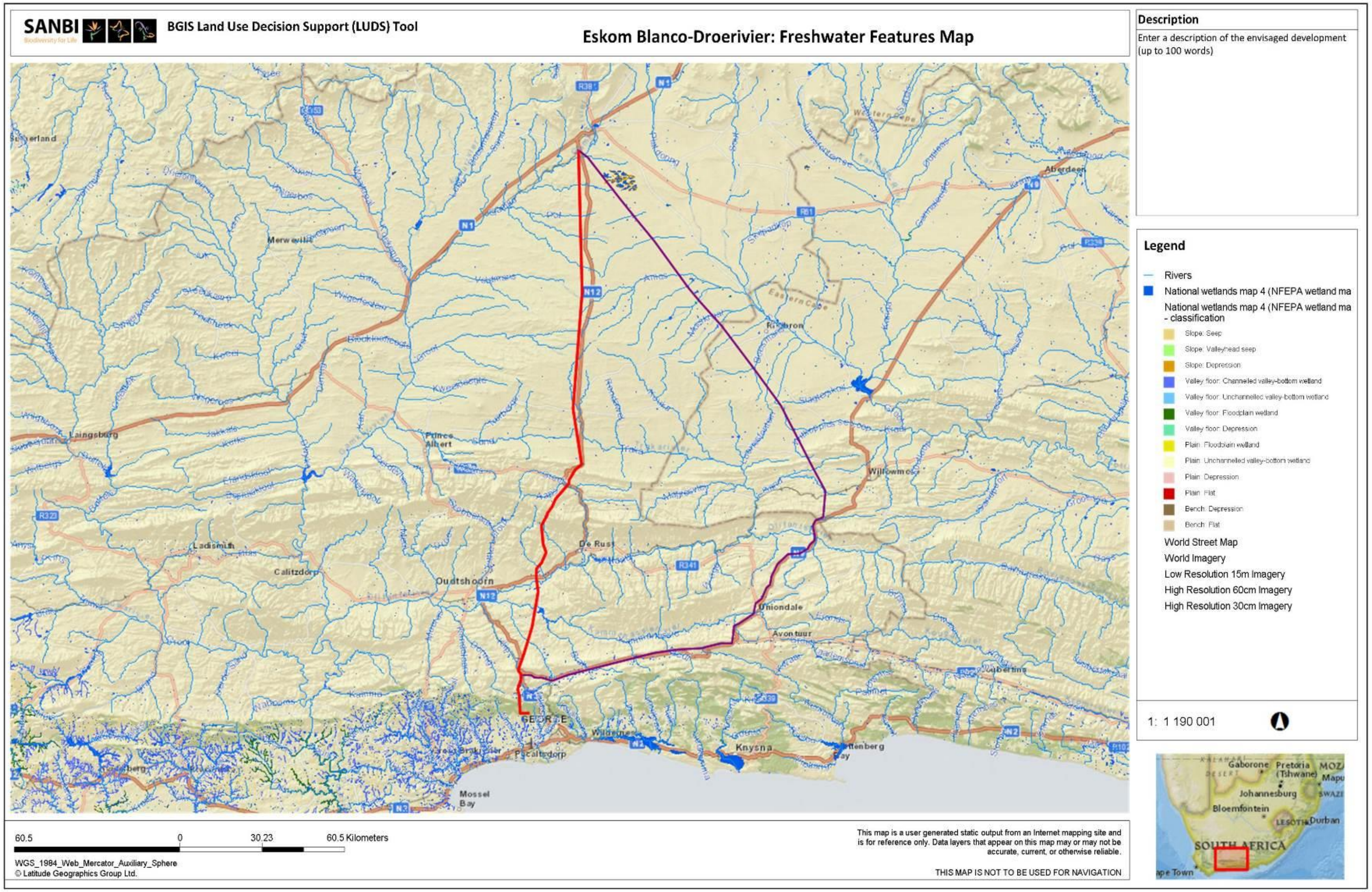


Figure 7: Rivers and wetlands within the study area (SANBI Biodiversity GIS, 2015)

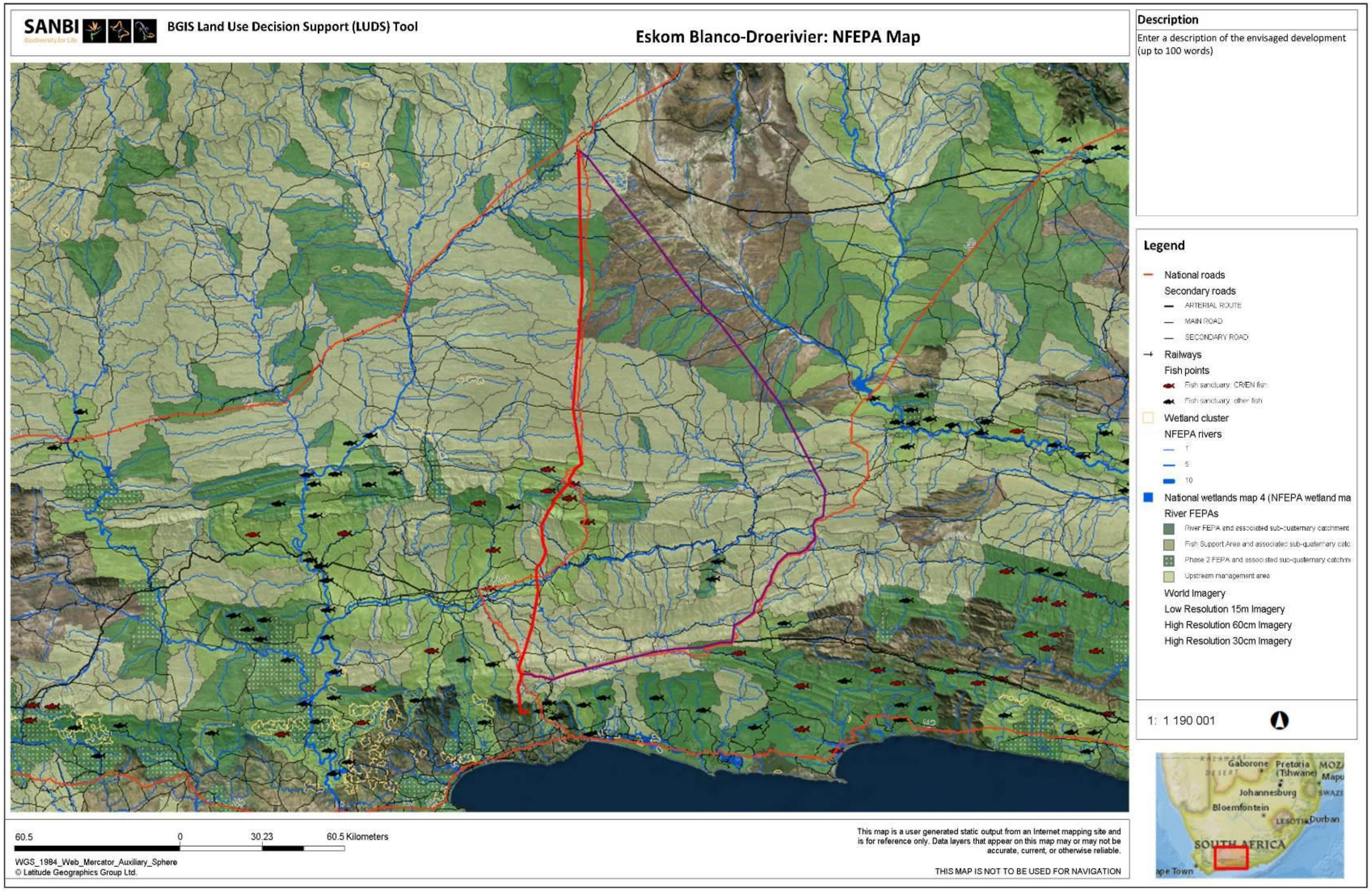


Figure 8: FEPA map for the study area (SANBI Biodiversity GIS, 2015)

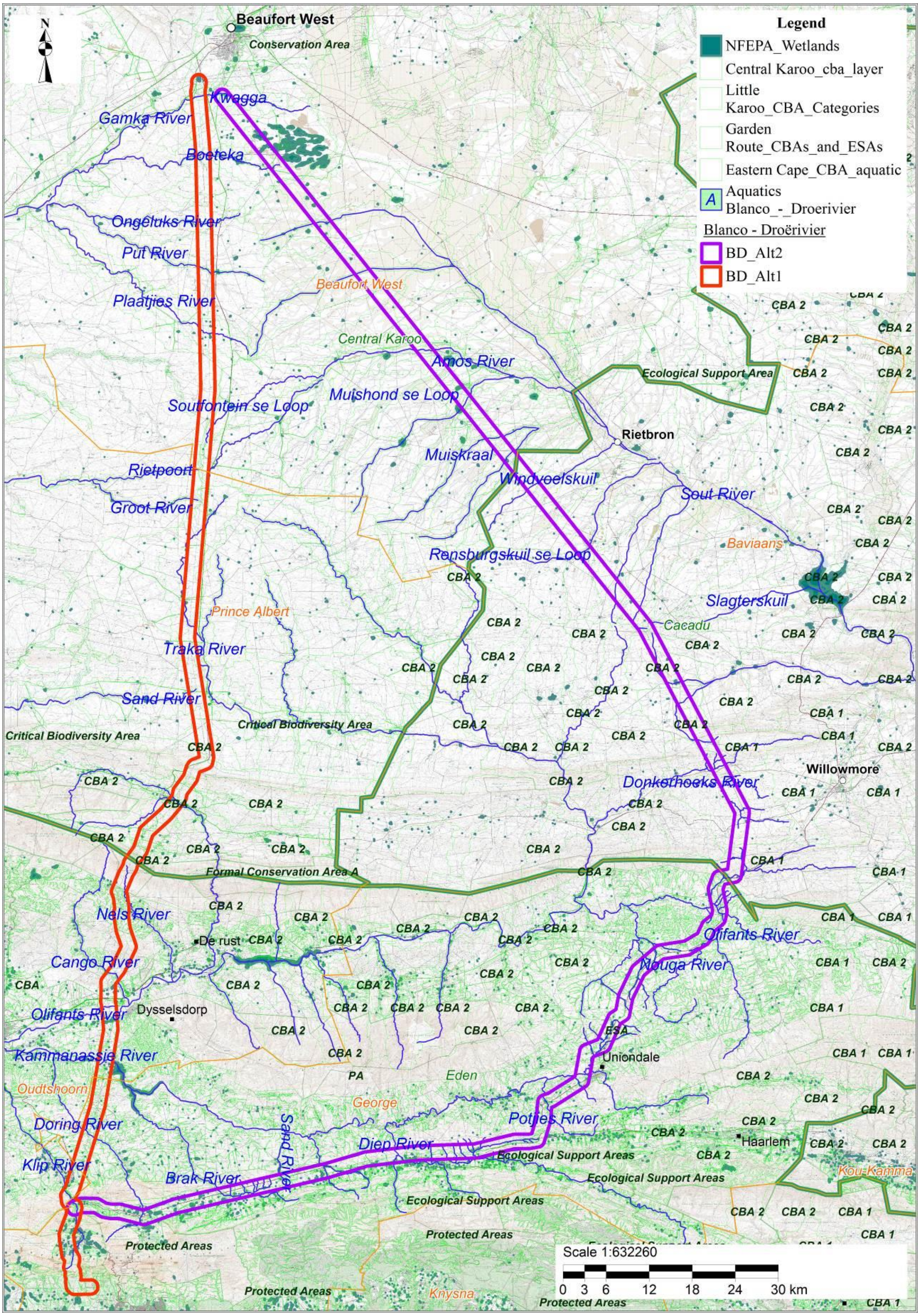


Figure 9: Aquatic CBA and FEPA wetland map for the study area, where CBA1 = critically important sub-catchments and CBA2= important sub-catchments (Eastern Cape Biodiversity Conservation Plan: Aquatic)

6.7. LAND USE

Land use within the study area consists largely of natural areas (pale green areas) with some cultivated land (yellow areas in Figure 10) along the river valleys, particularly in the Little Karoo. Beaufort West, Prince Albert, Klaarstroom, Oudtshoorn, Dysseldorp, De Rust, Uniondale, Willowmore and George are towns in the area. A number of storage dams (blue areas) occur along the rivers, particularly in the Olifants and Kammanassie Rivers. Forestry occurs along the foot of the Outeniqua Mountains.

A number of formally protected areas (green hatched areas) occur within the Outeniqua Mountains (Witfontein Nature Reserves and the Doringrivier Wilderness Area) and in the Groot Swartberg Mountains (Groot Swartberg Mountain Catchment Area, Swartberg East nature Reserve, Kammanassie Nature Reserve and the Baviaanskloof Nature Reserve east of Willowmore). The Karoo National Park is also located just north of Beaufort West.

Figure 10: Land cover in the area (SANBI Biodiversity GIS, 2015)

7. AQUATIC ASSESSMENT FOR THE STUDY AREA

The purpose of the freshwater assessment is to determine the relative importance, sensitivity and current condition (ecological state) of the significant freshwater features in order to assess the impact of proposed development activities on those freshwater resources. This assessment of the rivers and streams identified within the study area is based on existing information as well as the field assessment. The Present Ecological Status, Ecological Importance and Ecological Sensitivity and Site Characterisation assessments were utilised to provide information on the ecological condition and physical characteristics of the streams and significant drainage lines in the study area. The wetland areas are predominantly valley bottom wetlands that are linked to the rivers with their ecological condition and importance directly linked to that of the rivers. Some smaller seeps are also located on the mountain slopes of the Outeniqua Mountains that are still in a natural condition. The pans along the Alternative 2 corridor near Beaufort West have been assessed separately.

7.1. RIVER ASSESSMENT

7.1.1. DESCRIPTION OF THE RIVERS

GAMKA TRIBUTARIES

The main tributaries of the Gamka River, viz. Dwyka, Koekemoers, Gamka and Leeuw, rise in the Greater Karoo. These tributaries join at Leeu Gamka and flow southwards as the Gamka River which cuts through the Swartberg Mountains to join the Olifants River south of Calitzdorp where it becomes the Gouritz River. Gamka Dam and Springfontein Dam in the Upper Gamka provide Beaufort West with water. The remainder of the upper catchment is still largely undeveloped. Most of the upper reaches are in a largely natural ecological state. These areas are generally seasonal or ephemeral, and impacts are limited to livestock farming, some agriculture and dams as well as towns. The rivers tend to be wide gravel-bed watercourses, with scattered *A. Karoo* and drought resistant grasses along the banks (Figure 11).

OLIFANTS/KAMMANASSIE RIVERS

The northern tributaries of the Olifants River rise in the Greater Karoo to the north of the Swartberg Mountains, while the Olifants River itself rises to the east and flows westwards between the Swartberg and Kammanassie mountains to its confluence with the Gamka River. The Groot, Kango, Grobbelaars, Wynands, Kansa and Vlei tributaries all drain the southern slopes of the Swartberg and flow throughout the year into the Olifants River. The Kammanassie River rises in the Outeniqua and Kammanassie mountains near Uniondale and joins the Olifants River upstream of Oudshoorn. Two large instream dams occur within these rivers, the Stompdrift Dam in the Olifants River upstream of De Rust and the Kammanassie Dam in the Kammanassie River upstream of Oudtshoorn. Intensive agriculture takes place within the valley floor of the two rivers. The rivers consist of wide often braided channels that are dominated by *P. australis* reeds, but also consisting of rushes and sedges such as *Juncus kraussii* and *Cyperus textilis*. Cape willows *Salix mucronata* and A. Karoo trees occur together in invasive trees such as *A. mearnsii* and red river gums *Eucalyptus camaldulensis* (Figure 12).

UPPER MAALGATE RIVER

The Maalgate River rises in the Outeniqua Mountains west of George. The river flows across the narrow coastal plain to the sea near the small towns of Glentana and Herolds Bay. The river is still largely natural in its upper reaches that lies within formally protected areas, however the middle and lower reaches are also progressively impacted by pine forests immediately below the protected areas and then mostly by agricultural activities on the lower lying areas. Many of the tributaries and parts of the main stem of the rivers however flow within deep valleys that have not been impacted by the surrounding land use activities. These valleys however tend to be invaded primarily by alien black wattle *Acacia mearnsii* trees (Figure 13).

UPPER KEURBOOMS RIVER

The Keurbooms River originates in the Outeniqua Mountains in the Kransberg and flows in the south-easterly direction for approximately 70km before discharging via the Keurbooms Estuary into the sea at Plettenberg Bay. Within its upper reaches in the study area, the conditions are arid and even within its upper reaches, the river and its surrounding catchment has been cultivated. The river is also invaded with *A. mearnsii* in particular (Figure 14).

UPPER GROOT/SOUT RIVER

The Gamtoos River System comprises three main rivers, the Groot River, the Baviaanskloof River and the Kouga River, only the very upper reaches of tributaries of the Groot River fall within the study area. Tributaries of the Sout River originate along the eastern boundary of the study area south-east of Beaufort West. They all consist of poorly defined ephemeral drainage features, together with ephemeral pans (Figure 15). The Sout River joins the Kariega River near the Beervlei Dam. Downstream of the dam, the river becomes the Groot River which flows in a south-east direction to join the Kouga River where it forms the Gamtoos River. The Gamtoos drains into the sea north-east of Jeffrey's Bay

Figure 11. View of a tributaries of the Gamka River on the Alternative 1 corridor

Figure 12. View of the Kammanassie (top) and Olifants (bottom) River on the Alternative 1 corridor

Figure 13. View of the upper catchment of the Maalgate River near the proposed Blanco Substation

Figure 14. View of the upper Keurbooms River on the proposed Alternative 2 corridor

Figure 15. View of a tributary of the Groot/Sout River on the Alternative 2 corridor

7.1.2. RIVER CHARACTERISATION

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river/stream condition should only be done between rivers or streams that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers/streams provides the basis for assessing their ecological condition and allows comparison between similar river/stream types. The primary classification of rivers and streams is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers and streams within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation (DWAF 1999). For the purposes of this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used. The rivers assessed are within the South Eastern Coastal Belt (southern portion); Southern Folded Mountains (central portion) and Great Karoo (northern portion) Ecoregions, with the characteristics as described in Table 4.

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota. The geomorphological and physical characteristics of the rivers and streams are provided in Table 5.

7.3. ECOSTATUS ASSESSMENT

EcoStatus is the characteristic and functionality of the river and its riparian areas that influence its ability to support biota as well as provide a variety of goods and services. Due to the extent of the study area, the Desktop Present Ecological Assessment (PES) and Ecological Importance (EI) and Ecological Sensitivity (ES) Assessment were utilized to assessment the EcoStatus of the watercourses in the area.

The determination and categorisation of the PES; health or integrity of various biophysical attributes of rivers relative the natural or close to the natural reference condition, referred to as EcoClassification, provides insight and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition and its potential to remain in that condition or to be impaired by certain activities. The PES is determined according to instream and riparian habitat intactness as well as flow and water quality modification. A final habitat integrity category is established as described in Table 4.

Table 4: Present Ecological Status categories

CATEGORY	DESCRIPTION
A	Unmodified, natural.
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	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 worst instances, basic ecosystem functions have been destroyed and changes are irreversible.

The ecological importance of a river is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity. The ecological importance and ecological sensitivity categories are described in Table 7.

Table 5. Ecoregion Characteristics (Dominant Types In Bold)

Ecoregion	**South Eastern Coastal Belt**	**Southern Folded Mountains**	**Great Karoo**
Terrain Morphology	Plains; Low Relief Plains Moderate Relief; **Closed Hills; Mountains; Moderate and High Relief**	Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief**	**Plains; Low Relief**; Plains Moderate Relief; Lowlands; Hills & Mountains; Moderate & High Relief; Open Hills, Lowlands; Mountains; Moderate/High Relief; **Closed Hills; Mountains; Moderate and High Relief;** Table-Lands: Moderate and High Relief
Vegetation types	Dune Thicket; **Mesic Succulent Thicket;** Valley Thicket; Coastal Grassland; Eastern Thorn Bushveld; Mountain Fynbos; South and South West Coast Renosterveld; **Afromontane Forest**;	Patches Afromontane Forest; Spekboom Succulent Thicket; **Grassy Fynbos; Mountain Fynbos;** South and South West Coast Renosterveld; Central Mountain Renosterveld; Eastern Mixed Nama Karoo; Central Nama Karoo; Great Nama Karoo	Valley Thicket; **Central Nama Karoo;** Eastern Mixed Nama Karoo; **Great Nama Karoo;** Upper Nama Karoo; Lowland Succulent Karoo; Upland Succulent Karoo; Escarpment Mountain Renosterveld
Altitude (m a.m.s.l)	0-500; 500-700 limited	0-300 limited; 300-1900	300-1700; 1700-1900 limited
MAP (mm)	300 to 1000	200 to 1500	0 to 500
Rainfall seasonality	All year to very late summer	<15 to 54	Very late summer to winter
Mean annual temp. (°C)	14 to 20	Very late summer to winter to all year	10 to 20

Table 6. Geomorphological and Physical features of the rivers

River	Gamka Tributaries	Olifants/Kammanassie Rivers	Maalgate River	Keurbooms River	Groot/Sout Tributaries
Geomorphological Zone	Upper foothill rivers	Upper and Lower foothill rivers	Upper foothill rivers		
Lateral mobility	Unconfined	Semi-confined	Confined		Unconfined
Channel form	Simple or braided		Simple		Simple or braided
Channel pattern	Simple/multiple: Moderate to low sinuosity		Single thread: moderate sinuosity		Simple/multiple: low sinuosity
Substrate	Gravel	Alluvial	Boulders and Cobble-bed		Gravel/alluvial
Channel modification	Largely natural	Moderate to large	Moderate		Largely natural
Hydrological type	Ephemeral	Perennial and seasonal	Perennial		Ephemeral
Ecoregion	Great Karoo	Southern Folded Mountains	South Eastern Coastal Belt	Southern Folded Mountains	Great Karoo
DWA catchment	J21A/B/C/D J23B	J31A-D; J32A/E; J33C/E/F; J34A-F; J35B	K30A	K60A	L11G; L21A/C/D; L30B
Vegetation type	Gamka Karoo Southern Karoo Riviere	Prince Albert Succulent Karoo; Mascadel Riviere	South Outeniqua Sandstone Fynbos	North Outeniqua Sandstone Fynbos	Gamka Karoo; Southern Karoo Riviere
Rainfall region	Throughout the year				

Table 7. Present Ecological Status, Ecological Importance and Ecological Sensitivity and Biodiversity Conservation Importance of the streams in the study area

River System	River / Tributary	Powerline Corridor	Quaternary Catchment	Freshwater Ecosystem Priority Area	Critical Biodiversity Areas	Present Ecological Status (Table 4 for category descriptors)	Ecological Importance	Ecological Sensitivity
							(See Table 8 for category descriptors)	
Gouritz - Gamka	Kwagga	Alternative 1	J21A	Upstream Catchment; FEPA wetlands	CBA	C	H	H
	Boeteka	Alternative 1	J21B	Upstream Catchment	CBA	C	H	L
	Ongeluks	Alternative 1	J21C	Upstream Catchment	CBA	B	H	H
	Put	Alternative 1	J21C	FEPA river	ESA	B	VH	H
	Plaatjies	Alternative 1	J21C	FEPA river	CBA	C	H	M
	Veldmans	Alternative 1	J21E	Upstream Catchment	ESA	B	H	M
	Rietpoort	Alternative 1	J23B	Upstream Catchment	ESA	A	VH	H
	Groot	Alternative 1	J23B	Upstream Catchment	ESA	A	H	H
	Sand	Alternative 1	J23D	Upstream Catchment	ESA	A	H	H
Gouritz - Olifants	Olifants	Alternative 2	J31A	Fish Support Area	CBA/ESA	C	H	M
	Hartbees	Alternative 2	J31B	Upstream Catchment	ESA	C	H	VL
	Nouga	Alternative 2	J31B	Upstream Catchment	ESA	C	H	M
	Olifants	Alternative 2	J31C	Upstream Catchment	CBA/ESA	C	M	M
	Unnamed	Alternative 2	J31C	Upstream Catchment	ESA	B	H	VL
	Unnamed	Alternative 2	J31D	Upstream Catchment	ESA	C	H	M
	Traka	Alternative 1	J32A	Upstream Catchment	CBA	C	H	H
	Sand	Alternative 2	J32E	Upstream Catchment	ESA	B	H	L
	Donkerhoeks	Alternative 2	J32E	Upstream Catchment	ESA	B	H	VL
	Groot	Alternative 1	J33C	Fish Support Area	CBA	C	H	VH
	Aaps	Alternative 1	J33C	FEPA river	CBA	B	H	H
	Nels	Alternative 1	J33E	Upstream Catchment	ESA	D	M	H
	Cango	Alternative 1	J33F	Upstream Catchment	ESA	C	H	VH
	Olifants	Alternative 1	J33F	Fish Support Area; FEPA wetlands	ESA	D	M	VH
	Kammanassie	Alternative 2	J34B	Upstream Catchment	CBA/ESA	D	M	H
	Holdrif	Alternative 2	J34A	Fish Support Area	ESA	C	H	VH
	Potjies	Alternative 2	J34A	Upstream Catchment	ESA	E	M	H
	Diep	Alternative 2	J34C	Upstream Catchment	ESA	E	M	H
	Gansekraal	Alternative 2	J34D	Upstream Catchment	ESA	E	M	H
	Brak	Alternative 2	J34E	Upstream Catchment	ESA	E	M	H
	Kammanassie	Alternative 1	J34F	Upstream Catchment; FEPA wetlands	CBA/ESA	E	M	VH
	Doring	Alternative 1	J34F	Upstream Catchment	ESA	D	H	H
	Klip	Alternative 1	J35B	Upstream Catchment	ESA	C	H	VH

Table 7 *cont.* Present Ecological Status, Ecological Importance and Ecological Sensitivity and Biodiversity Conservation Importance of the streams in the study area

River System	River / Tributary	Powerline Corridor	Quaternary Catchment	Freshwater Ecosystem Priority Area	Critical Biodiversity Areas	Present Ecological Status (Table 4 for category descriptors)	Ecological Importance (See Table 8 for category descriptors)	Ecological Sensitivity
Maalgate	Kruis, Keurbos & Platbos	Alternative 1&2	K30A	-	ESA	D	H	VH
Keurboom	Sand	Alternative 2	K60A	FEPA river	ESA	D	H	VH
Gamtoos - Groot	Unnamed	Alternative 2	L11G	-	ESA	B	M	M
	Amos	Alternative 2	L12A	-	CBA	C	M	M
	Muishond se Loop	Alternative 2	L12A	-	CBA	B	H	M
	Unnamed	Alternative 2	L12A	FEPA river	ESA	C	M	M
	Muiskraal	Alternative 2	L12C	FEPA river	ESA	C	M	M
	Unnamed	Alternative 2	L12C	-	ESA	B	H	M
	Windvoelskuils	Alternative 2	L12C	-	ESA	B	M	M
	Boesmans	Alternative 2	L12C	FEPA river	ESA	A	H	M
	Sanddamme se Loop	Alternative 2	L21C	FEPA river	ESA	A	H	M
	Unnamed	Alternative 2	L21C	FEPA river	ESA	A	H	M
	Rensburgskuil se Loop	Alternative 2	L12C	FEPA river	ESA	C	H	M
	Slagterskuil	Alternative 2	L12D	-	ESA	B	H	M
	Kraai	Alternative 2	L30B	FEPA river	ESA	C	M	M
	Witkoppies se Loop	Alternative 2	L30B	-	ESA	B	H	M

Table 8. Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description
Very high (VH)	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.
High (H)	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.
Moderate (M)	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.
Low(L) to Very Low (VL)	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.

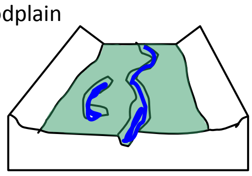
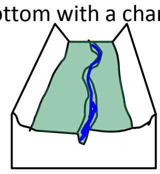
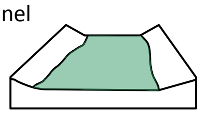
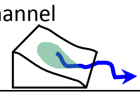
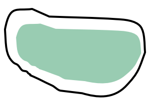
7.2. WETLAND ASSESSMENT

This assessment of the pans within the study area is based on existing information as well as the field assessment. The wetland assessment consists of the following aspects: Wetland classification; Wetland integrity; and Ecosystem services supplied by the wetland. The pans consist of a number of wide shallow depressions clustered together on the watershed between the Gamka and Groot/Sout Rivers within an area of approximately 7 ha. The pans are largely devoid of vegetation, with the exception of sparse dwarf shrubs on their outer edges. They are only inundated for short periods after good rain.

7.2.1. WETLAND CLASSIFICATION

The classification of the wetlands in the study area into different wetland types was based on the WET-EcoServices technique (Kotze *et al*, 2005). The WET-EcoServices technique identifies seven main types of wetland based on hydro-geomorphic characteristics (Table 9).

Table 9. Wetland hydro-geomorphic types typically supporting inland wetlands in South Africa

Hydro-geomorphic types	Description	Source of water maintaining the wetland[1]	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well-defined stream channel, gently sloped & characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel 	Slopes on hillsides, characterized by colluvial movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans) 	A basin shaped area with a closed elevation contour that allows for accumulation of surface water. It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important
Water source: * Contribution usually small
*** Contribution usually large
*/ *** Contribution may be small or important depending on local circumstances
 Wetland

According to Table 9 the wetland features within the study area can be classified as follows:

Table 10: Classification of wetland areas within study area

Name	Pans along the proposed Alternative 2 corridor near Beaufort West
System	Inland
Ecoregion	Great Karoo
Landscape setting	Depression on a plain
Longitudinal zonation	Not applicable
Drainage	Endorheic (water mostly exists by means of infiltration and evaporation)
Seasonality	Ephemeral
Anthropogenic influence	Some disturbances due to farming and infrastructure development
Geology	Mudstones and sandstones of the Beaufort Group
Vegetation	Gamka Karoo
Substrate	Shallow Sands
Salinity	Fresh becoming saline through the season

7.2.2. WETLAND INTEGRITY

The Present Ecological Status (PES) Method (DWAF 2005) was used to establish the integrity of the wetlands/pans in the study area and was based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999; Dickens *et al*, 2003). Table 11 shows the criteria and results from the assessment of the habitat integrity of the wetlands. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 11. Habitat integrity assessment criteria for palustrine wetlands (Dickens *et al*, 2003)

Criteria & Attributes	Relevance
Hydrologic	
Flow Modification	From abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime, volumes, velocity which affect inundation of wetland habitats resulting in floralistic changes or incorrect cues to biota. Abstraction of groundwater flows.
Perm. Inundation	From impoundments resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands.
Hydraulic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Ind. Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, etc.

Table 12. Wetland habitat integrity assessment (score of 0=critically modified to 5=unmodified)

Criteria & Attributes	Pans
Hydrologic	
Flow Modification	3.7
Permanent Inundation	3.9
Water Quality	
Water Quality Modification	4.1
Sediment Load Modification	2.8
Hydraulic/Geomorphic	
Canalisation	4.0
Topographic Alteration	4.5
Biota	
Terrestrial Encroachment	3.4
Indigenous Vegetation Removal	3.1
Invasive Plant Encroachment	3.9
Alien Fauna	4.2
Over utilisation of Biota	3.5
Category	**B (Largely natural)**

The pans in the study area are subjected to some physical habitat modification with some flow and water quality modification and invasive plant growth largely as a result of the surrounding farming activities. In terms of the current ecological state of the pans, they are as a whole considered to be in a largely natural ecological state.

Table 13. Relation between scores given and ecological categories

Scoring Guidelines Per Attribute*	Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PESC)
Natural, unmodified - score=5.	Within general acceptable range CATEGORY A >4; Unmodified, or approximates natural condition.
Largely natural - score=4.	CATEGORY B >3 and <4; Largely natural with few modifications, but with some loss of natural habitats.
Moderately modified- score=3.	CATEGORY C >2 and <3; moderately modified, but with some loss of natural habitats.
Largely modified - score=2.	CATEGORY D <2; largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
	OUTSIDE GENERALLY ACCEPTABLE RANGE
Seriously modified - rating=1.	CATEGORY E >0 and <2; seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
Critically modified - rating=0.	CLASS F 0; critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

7.2.3. ECOSYSTEM SERVICES SUPPLIED BY THE PANS

The assessment of the ecosystem services supplied by the pans was conducted according to the guidelines as described by Kotze *et* al (2005). An assessment was undertaken that examines and rates the services listed in Table 14. The characteristics were scored according to the general levels of services provided. It is important to ensure that these pans and wetland area can continue to provide the valued goods and services.

Table 14. Goods and services assessment results for wetland (high=4; low=0)

Goods and services	Pans
Flood attenuation	3.0
Stream flow regulation	2.0
Sediment trapping	3.0
Phosphate trapping	2.5
Nitrate removal	2.0
Toxicant removal	2.0
Erosion control	2.5
Carbon storage	1.0
Maintenance of biodiversity	3.5
Water supply for human use	0.5
Natural resources	1.0
Cultivated foods	0
Cultural significance	0
Tourism and recreation	1.0
Education and research	0

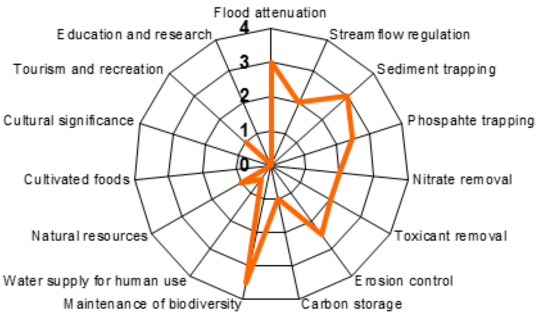


Figure 13. Ecosystem services provided by the pans in the study area

From Figure 13 it can be clearly seen that in terms of goods and services, the pans provide valuable services, particularly in terms of provides habitat for aquatic life as well as providing some flood attenuation/ stream flow regulation functionality.

8. CONSTRAINTS MAP AND CONSIDERATION OF ALTERNATIVES

Approximately 250km of 400kV power line is being considered from the new Blanco Substation to the Droërivier Substation. Two alternative routes are being considered where a 2km wide corridor is being investigated for all the route alternatives. These alternative routes will need to cross the upper reaches or middle reaches of the rivers in the study area. Figure 16 provides an overview of the freshwater constraints within the study area for the rivers only. Figures 17a-d provide more detailed mapping of the freshwater features within the study area.

With the potential impacts of the proposed activities, it is often the access roads associated with the transmission lines that are likely to have a greater impact on the freshwater features than the power lines themselves as the lines can usually span the freshwater features such that the pylons can be constructed outside of the rivers and wetland areas as well as their recommended buffer areas, whereas the roads need to be constructed through the freshwater features. It is thus often best if the new power lines are placed adjacent to existing lines or roads where new roads do not need to be constructed as part of the project.

In terms of the selection of the route selection for the transmission lines, it is recommended that a buffer of 50 from the top of the river banks; approximately 100m from the edge of the wetland areas and 500m from the pans be allowed for as a development setback for the construction of the pylons.

The alternative corridor with the least potential impact on the freshwater features in the area is likely to be the more direct route (Alternative 1) as it would need to cross fewer rivers than the Alternative 2 route. In addition, it would avoid more sensitive areas crossed by the Alternative 2 corridor such as the many smaller tributaries and associated wetlands of the Kammanassie River in the Little Karoo (Figure 17c) as well as the large area of pans near Beaufort West (Figure 17d). The alignment of the route within the corridor could also be determined to minimise the potential impact on the freshwater features within the study area.

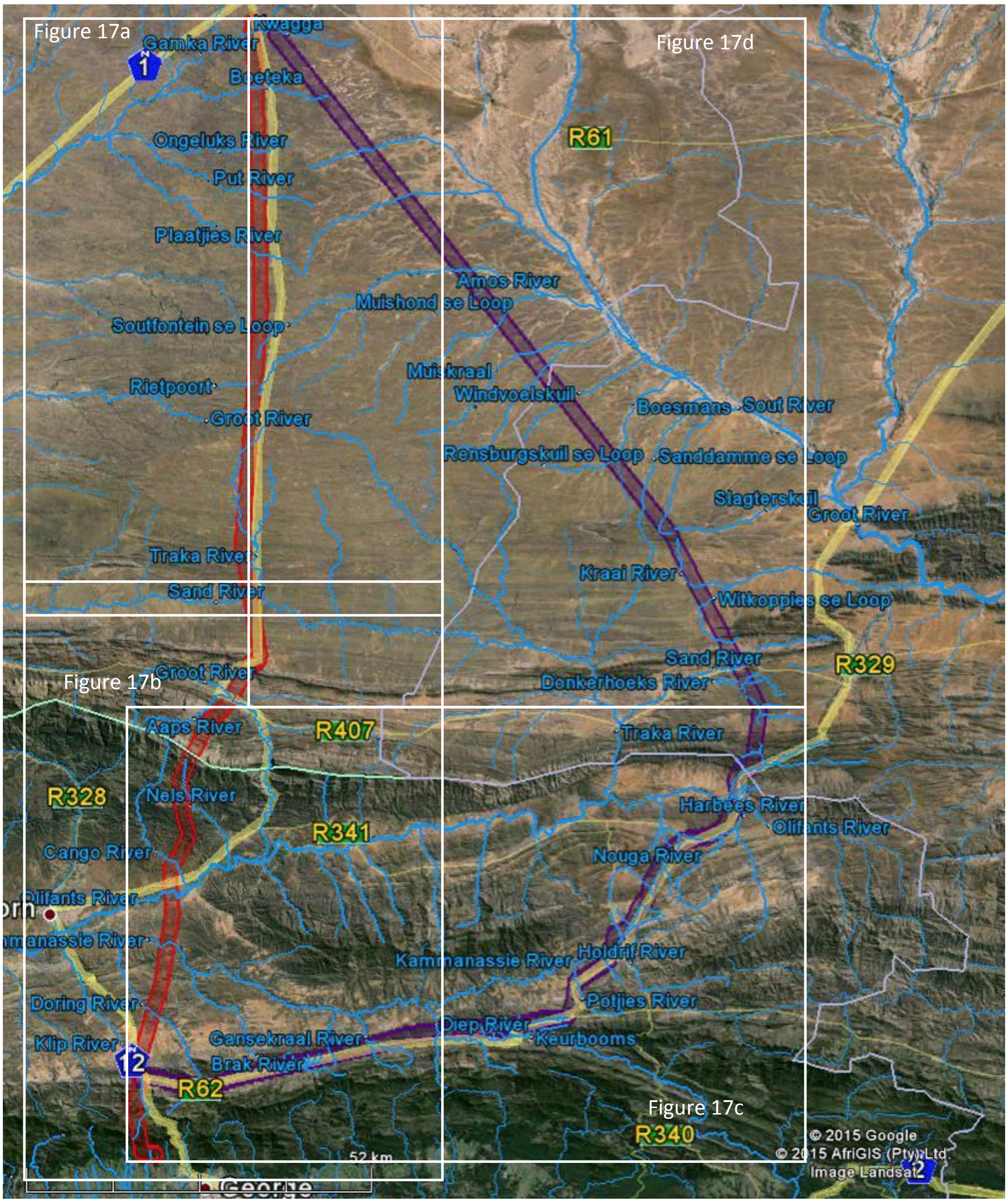


Figure 16: Overview of Freshwater constraints map in Google Earth showing the alternative routes for the proposed new power line, where the red line represents Alternative 1; the purple line Alternative 2 and blue lines indicate rivers

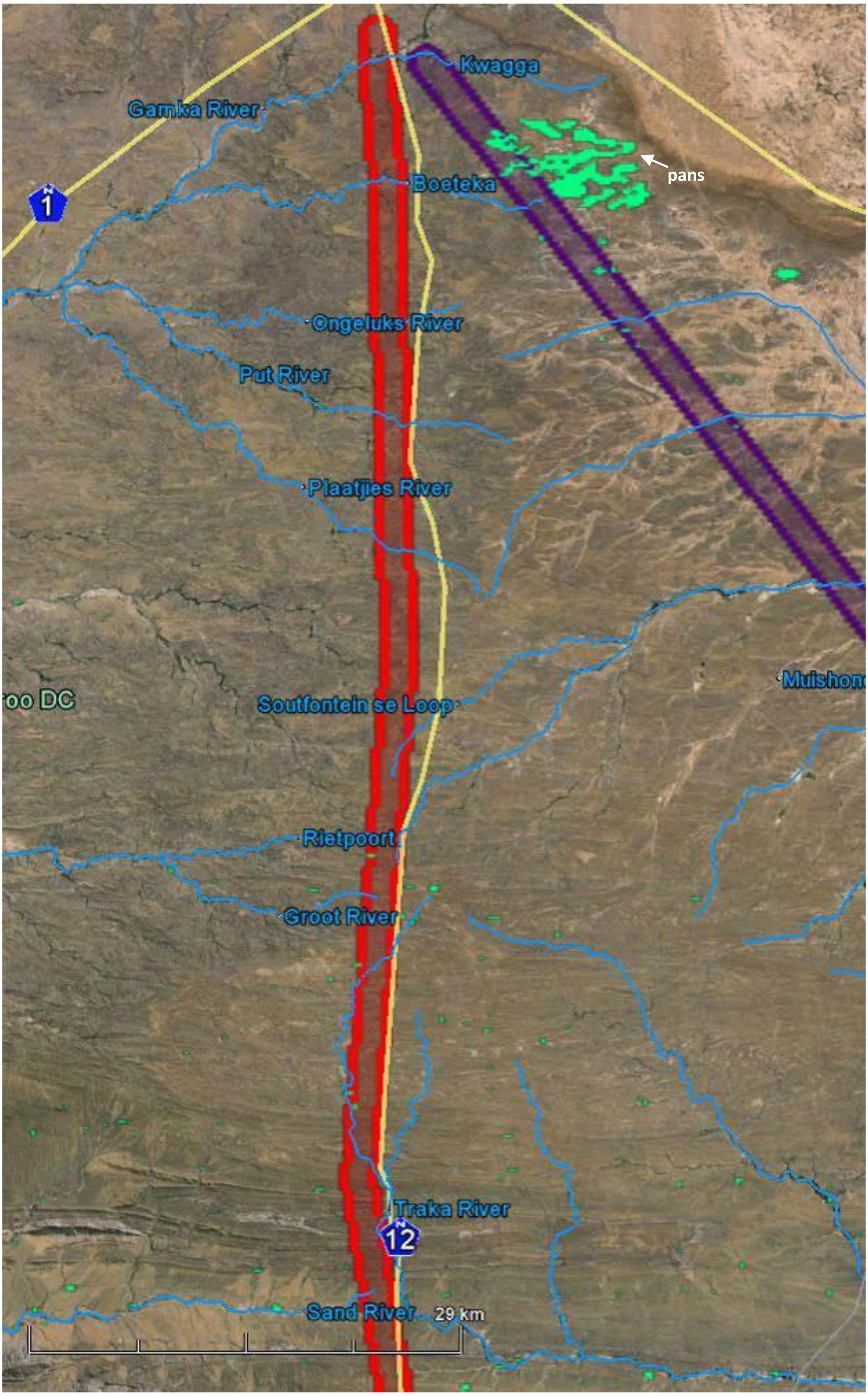


Figure 17a: Freshwater constraints map (Alternative 1, Part 1) in Google Earth showing the alternative route for the proposed new power line, where the red line represents Alternative 1; blue lines indicate rivers and green polygons wetland areas

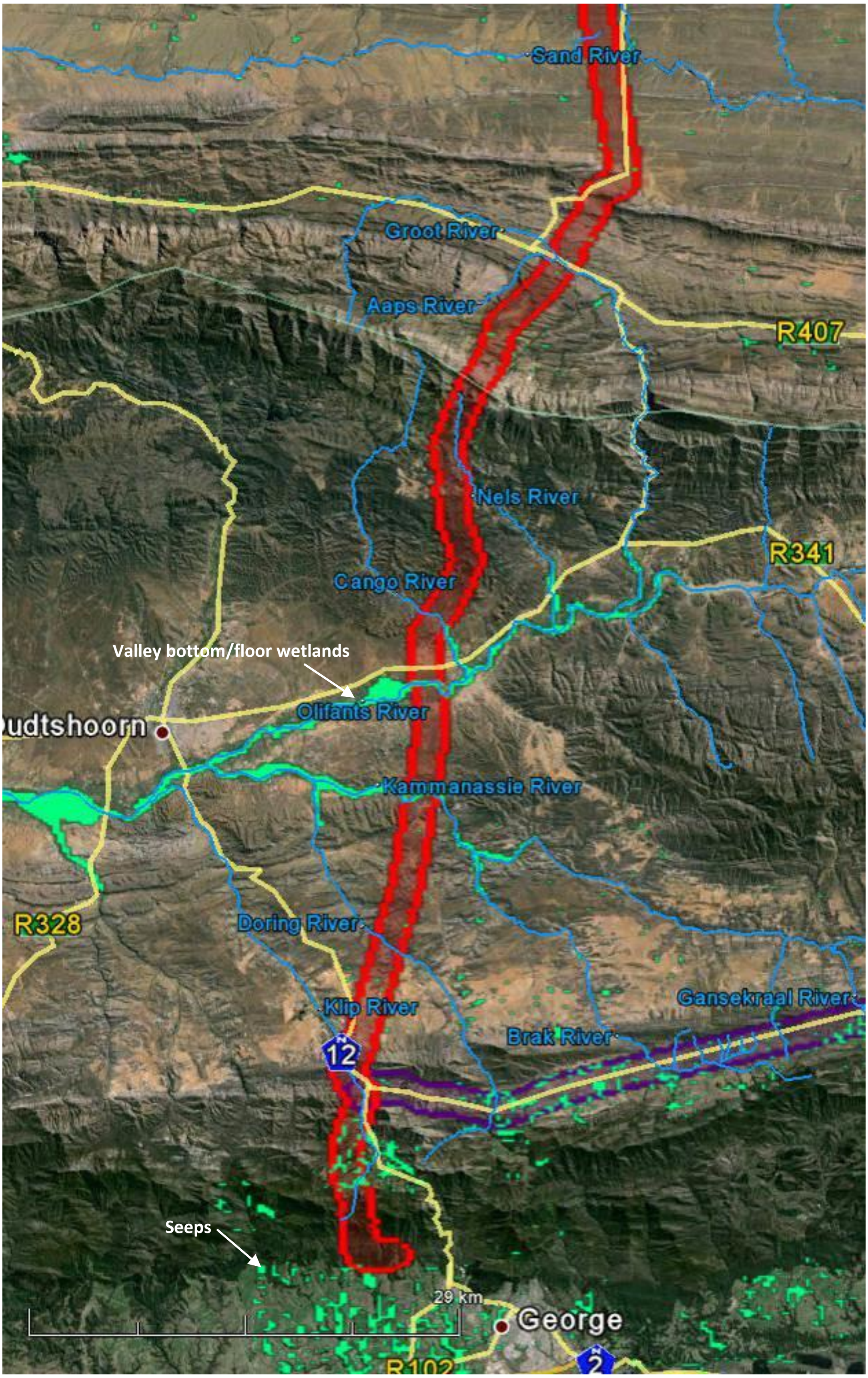


Figure 17b: Freshwater constraints map (Alternative 1, Part 2) in Google Earth showing the alternative route for the proposed new power line, where the red line represents Alternative 1; blue lines indicate rivers and green polygons wetland areas

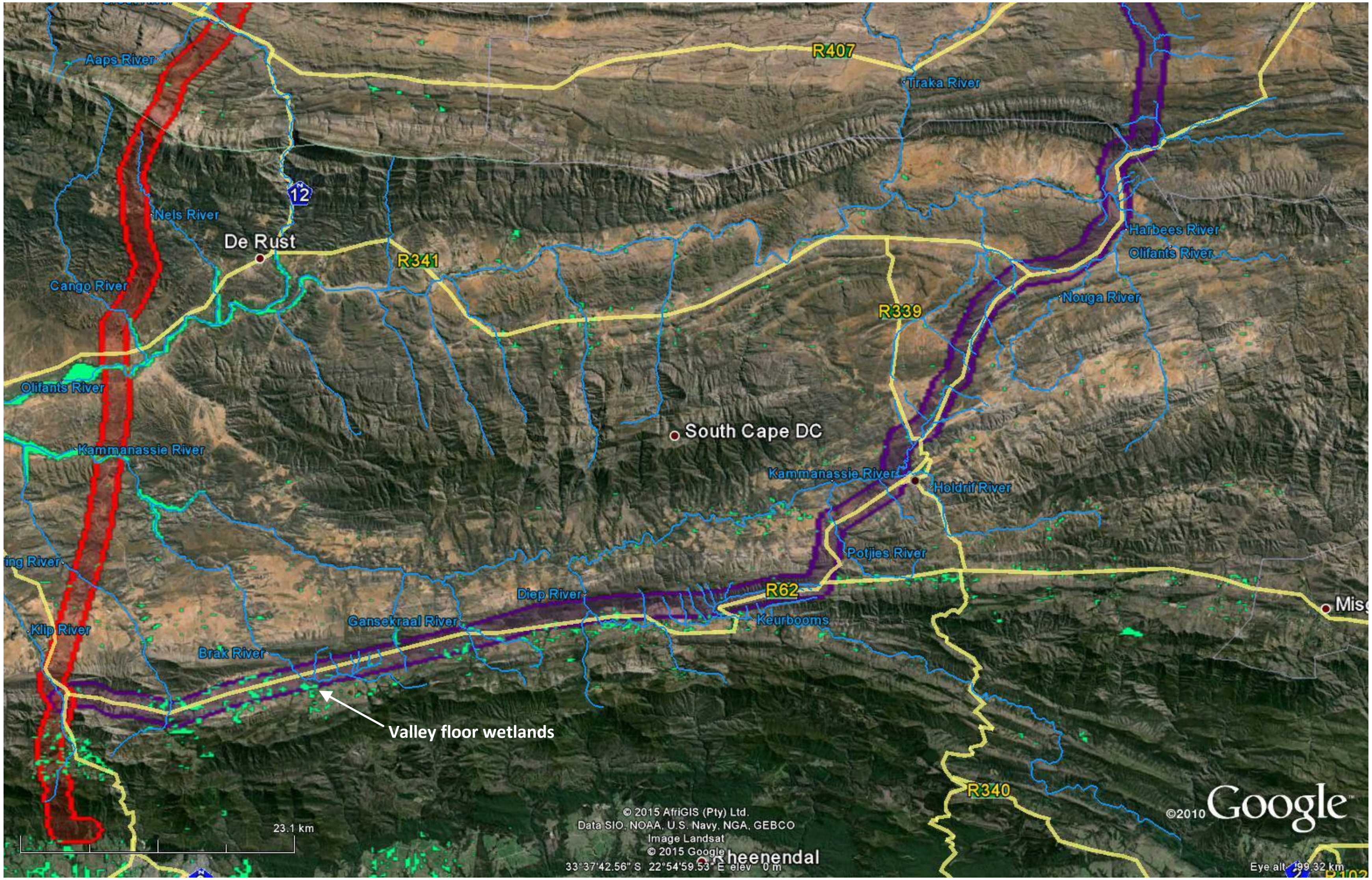


Figure 17c: Freshwater constraints map (Alternative 2, Part 1) in Google Earth showing the alternative routes for the proposed new power line, where the purple line represents Alternative 2; blue lines indicate rivers and green polygons wetland areas

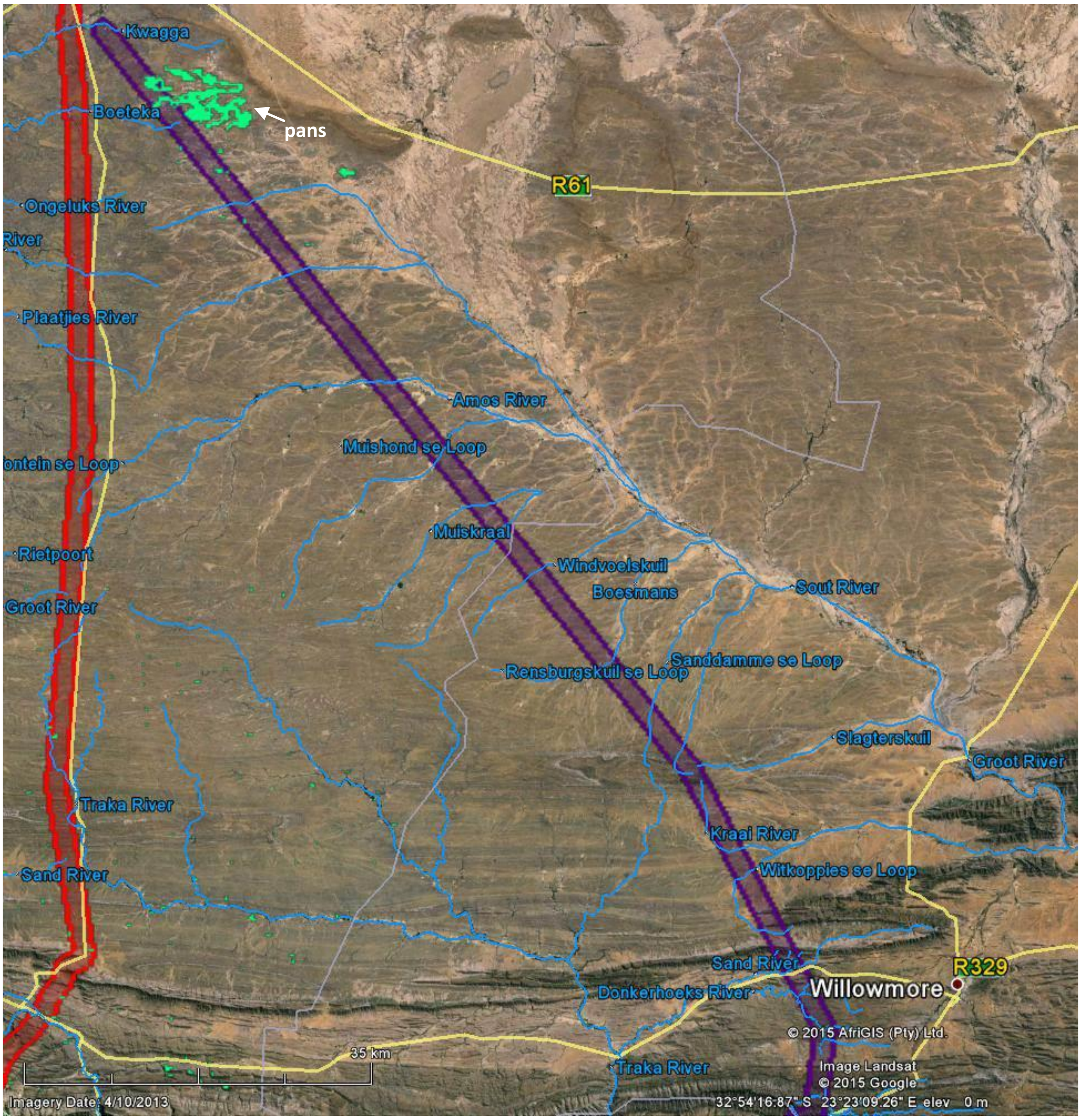


Figure 17d: Freshwater constraints map (Alternative 2, Part 2) in Google Earth showing the alternative route for the proposed new power line, where the purple line represents Alternative 2; blue lines indicate rivers and green polygons wetland areas

9. IMPACTS OF PROPOSED OVERHEAD POWER LINE FOR THE ALTERNATIVES

9.1. DESCRIPTION AND ASSESSMENT OF IMPACTS OF PROPOSED ACTIVITIES

This section provides a generic description of the potential impacts to freshwater ecosystems that are likely to be associated with proposed power line development. The potential impacts on the freshwater resources can be divided into impacts associated with the construction of the power lines and those impacts related to the maintenance activities.

IMPACT OF OVERHEAD POWER LINES

CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: Approximately 250km of 400kV power line is being considered from the proposed new Blanco Substation and the Droërivier Substation. Activities that would be associated with the construction activities would include the installation of foundations and pylons.

Activities during the construction phase of the project could be expected to result in some shorter term disturbance of stream/riverine and wetland associated vegetation cover and to the bed and banks of the freshwater features where access for the construction works associated with the line may need to cross freshwater features.

Significance of impacts without mitigation: As a whole Alternative 1 has the potential to impact less of the freshwater features within the study area. Should this alignment be selected, a localized shorter term impact of moderate to low intensity (depending on the distance between the construction activities and the freshwater features) with a low overall significance in terms of its impact on the identified aquatic ecosystems in the area could be expected.

Proposed mitigation: Construction activities should as far as possible be limited to the area outside the proposed buffer zones. It is recommended that a buffer of 50 from the top of the river banks ; approximately 100m from the edge of the wetland areas and 500m from the pans be allowed for as a development setback for the construction of the pylons. Neither the pylons nor the anchors should be constructed within the proposed buffer zones. The power lines may cross over the buffer zones for the wetlands, pans and watercourses as the limitations are not applicable to overhead infrastructure.

With regards to the temporary crossings over the watercourses required for the construction phase, existing access should be used as far as possible. Where this is unavoidable, the disturbance to the watercourse should be minimised as far as possible and wetland areas should be avoided. The disturbed areas should be rehabilitated as soon as possible after construction is complete by reshaping and revegetating the disturbed areas with suitable indigenous vegetation (replace indigenous riparian and instream vegetation where possible). Any invasive alien plants that currently exist within the immediate area of the construction activities should also be removed. To reduce the risk of erosion, run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring within the freshwater features.

Contaminated runoff from the construction sites should be prevented from entering the rivers/streams and wetland areas. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 50m away from the river/stream systems and wetland areas and regularly serviced. These measures should be addressed, implemented and monitored in terms of the EMP for the construction phase.

Significance of impacts after mitigation: A localized, short-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be very low.

OPERATION PHASE ACTIVITIES

Nature of Impact: Some disturbance of the freshwater features in the area of the constructed power line could be expected over the longer term that would be associated with the maintenance activities for the project.

Significance of impacts without mitigation: The severity of this impact will depend on the final route selected as well as the area in which the substation is constructed. A localized longer term impact of low intensity may occur that is expected to have a very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: Maintenance of the power lines should only take place via the designated access routes. The establishment of alien vegetation in the riparian zones along the transmission line route should specifically be prevented, and controlled if it does occur.

Significance of impacts after mitigation: A localized, long-term impact of a very low overall significance could be expected to occur.

IMPACT OF THE ACCESS ROUTES:

CONSTRUCTION PHASE ACTIVITIES

Nature of Impact: The major impacts associated with the establishment of the service road along the line relate to the potential loss of habitat within wetland areas and the rivers/streams, invasive alien plant growth, flow and water quality impacts and erosion of drainage channels/stream or river banks.

Significance of impacts without mitigation: The severity of this impact will depend on the final route selected. A localized shorter term impact of moderate to low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. Where access routes need to be constructed through streams, disturbance of the channel should be limited and multiple crossings should not be created. Any new roads parallel to the watercourses should remain outside of the 50m buffer zone from the top of bank of the rivers/streams and outside of the indicated buffer areas for the wetland areas (approx. 100m) and pans (approx.. 500m). All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. Road infrastructure and cable alignments should coincide as much as possible to minimize the impact. Any disturbed areas should be rehabilitated to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Significance of impacts after mitigation: A localized, short-term impact will occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact.

OPERATION PHASE ACTIVITIES

Nature of Impact: The major impacts associated with the access roads during the operation phase relate to disturbance to the instream and riparian habitat of the freshwater ecosystems along the designated routes.

Significance of impacts without mitigation: The severity of this impact will depend on the final route selected as well as the area in which the substation is to be expanded. A localized longer term impact of moderate to low intensity that is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Proposed mitigation: Maintenance of infrastructure related to the project should only take place via the designated access routes. Disturbed areas along the access routes should be monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Significance of impacts after mitigation: A localized, longer-term impact will occur during the operation phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be a very low impact.

9.2. CUMULATIVE IMPACT OF THE ACTIVITIES ON FRESHWATER ECOSYSTEMS

Most of the freshwater features within the proposed corridors are already in a modified ecological state as a result of the existing land use activities. The proposed lines are in general proposed along routes where there are already power lines in place. Provided the new lines are constructed close to these lines such that the associated access roads can be shared, the cumulative impacts are likely to be low. Erosion and sedimentation from the project activities, together with invasive alien plant growth and the possible modification of surface water runoff and water quality may lead to additional impacts on the freshwater habitats within the study area. In general, by selecting the route with the least impact, one can prevent any unacceptable impacts, particularly over the longer term, from taking place within the freshwater features within the study area. These impacts are likely to be of a low significance and can be monitored and easily mitigated. The proposed mitigation measures are largely intended to minimise the impacts that may occur within the construction phase when the potential impact is the greatest.

9.3. CONSIDERATION OF ALTERNATIVES

Each of the proposed power line route alternative's impacts on freshwater ecosystems of varying ecological condition, conservation importance and ecological sensitivities. Table 7 summarises the potential freshwater features according to the various alternatives in order to clarify which of these routes would have the lesser impact on the freshwater ecosystems. Table 15 provides a comparative assessment of the potential impacts of each alternative considered.

Table 15: Summary of assessment of potential impacts of the proposed activities for the alternatives considered

Alternative 1	**Without mitigation**	**With mitigation**
Construction phase		
Nature: Limited modification of freshwater habitat, water quality impacts and possibly impedance of flow at river crossings associated with the construction of the transmission line and any access roads required		
Extent	Local (2)	Local (1)
Duration	Medium to Short-term (2)	Short-term (1)
Magnitude	Low (4)	Very Low (2)
Probability	Probable (3)	Probable to improbable (2)
Significance	**24 (Low)**	**8 (Very Low)**
Status (positive or negative)	Negative	Negative
Operation phase		
Nature: Limited long term disturbance of aquatic habitat and the facilitation for invasive alien plant growth associated with maintenance of the transmission lines		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very low (2)	Very Low (1)
Probability	Probable to improbable (2)	Probable to improbable (2)
Significance	**16 (Low)**	**12 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High (Fully reversible)
Irreplaceable loss of resources?	Medium to low	Low
Can impacts be mitigated? Impacts can be mitigated during the construction phase, but little mitigation is possible during the operational phase. The impacts during this phase are however also minimal.		
Mitigation: See Section 9.1 for more detailed description of potential impacts and the associated recommended mitigation measures.		
Cumulative impacts: Cumulative Impacts are as described in Section 9.2.		
Residual Risks: Residual risks are associated with the need to access and maintain the power lines that require ongoing disturbance to aquatic features along the transmission line route that will need to take place for the lifetime of the project.		
Alternative 2	**Without mitigation**	**With mitigation**
Construction phase		
Nature: Limited modification of freshwater habitat, water quality impacts and possibly impedance of flow at river crossings associated with the construction of the transmission line and any access roads required		
Extent	Local to regional (3)	Local (2)
Duration	Medium to Short-term (2)	Short-term (1)
Magnitude	Medium to Low (4)	Low (3)
Probability	Probable (3)	Probable to improbable (2)
Significance	**27 (Medium to low)**	**12 (Low)**
Status (positive or negative)	Negative	Negative
Operation phase		
Nature: Limited long term disturbance of aquatic habitat and the facilitation for invasive alien plant growth associated with maintenance of the transmission lines		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)

Duration	Long-term (4)	Long-term (4)
Magnitude	Very low (2)	Very Low (1)
Probability	Probable ()	Probable to improbable (2)
Significance	**32 (Medium to Low)**	**14 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium (Partially reversible)
Irreplaceable loss of resources?	Medium to low	Low
Can impacts be mitigated? Impacts can be mitigated to a certain extent during the construction phase, but due to the fact that the line will need to cross the lower reaches of the rivers with their wide associated floodplain wetlands, the probability that there will be some loss or modification of aquatic habitat that is more sensitive is greater. Little mitigation is possible during the operational phase. The impacts during this phase are however also minimal.		
Mitigation: See Section 9.1 for more detailed description of potential impacts and the associated recommended mitigation measures.		
Cumulative impacts: Cumulative Impacts are as described in Section 9.2.		
Residual Risks: Residual risks are associated with the need to access and maintain the power lines that require ongoing disturbance to aquatic features along the transmission line route that will need to take place for the lifetime of the project.		

As mentioned in the previous section, the alternative corridor with the least potential impact on the freshwater features in the area is likely to be Alternative 1 as it would need to cross fewer rivers than Alternative 2. Alternative 2 also crossed more sensitive areas such as the many smaller tributaries and associated wetlands of the Kammanassie River in the Little Karoo as well as the large area of pans near Beaufort West. With mitigation, Alternative 1 is likely to have an impact of a very low significance on the freshwater features while Alternative 2 is likely to have an impact of a low impact.

10. CONCLUSIONS AND RECOMMENDATIONS

The following water features were identified and assessed within the study area:

- Gouritz River System: Upper Gamka River tributaries in the Quaternary Catchments J21A/B/C/E; J23B/D, J32A, as well as the Olifants River and its tributaries in the Quaternary Catchments J31A-D; J32A/E; J33C/E/F; J34A-F; J35B;
- Southern Cape Coastal Rivers: Upper Maalgate River (K30A) and Upper Keurbooms River (K60A);
- Gamtoos River System: Upper Groot/Sout River tributaries in the Quaternary Catchments L11G; L30B; and
- Some valley-bottom/floor wetlands that are largely associated with the rivers as well as some seeps and pans.

The habitat integrity of the rivers range from being largely natural (upper reaches of the larger rivers as well as the smaller streams) to being in the seriously modified ecological state (lower reaches of the larger river systems). The riparian habitat of these rivers tends to be more impacted by the direct impact of the surrounding land use activities which has resulted in removal of the natural indigenous vegetation and the subsequent growth of invasive alien plants. Within the instream habitat, water abstraction and flow modification have the most impact, particularly on the lower reaches.

The wetland areas are predominantly valley bottom wetlands that are linked to the rivers with their ecological condition and importance directly linked to that of the rivers. Some smaller seeps are also located on the mountain slopes of the Outeniqua Mountains that are still in a natural condition. The pans along the Alternative 2 corridor near Beaufort West are considered to be in a largely natural ecological state.

The ecological importance and sensitivity of the rivers within the study area range from being of a medium to very high importance. The Olifants River in particular has been identified as FEPA river and a Fish Sanctuary Area as the river contains populations of an endangered fish species (Small-scale redfin *P. asper*).

With the potential impacts of the proposed activities, it is often the access roads associated with the transmission lines that are likely to have a greater impact on the freshwater features than the power lines themselves as the lines can usually span the freshwater features such that the pylons can be constructed outside of the rivers and wetland areas as well as their recommended buffer areas, whereas the roads need to be constructed through the freshwater features. It is thus often best if the new power lines are placed adjacent to existing lines or roads where new roads do not need to be constructed as part of the project.

In terms of the selection of the route selection for the transmission lines, it is recommended that a buffer of 50 from the top of the river banks; approximately 100m from the edge of the wetland areas and 500m from the pans be allowed for as a development setback for the construction of the pylons.

The alternative corridor with the least potential impact on the freshwater features in the area is likely to be the more direct route (Alternative 1) as it would need to cross fewer rivers than the Alternative 2 route. In addition, it would avoid more sensitive areas crossed by the Alternative 2 corridor such as the many smaller tributaries and associated wetlands of the Kammanassie River in the Little Karoo as well as the large area of pans near Beaufort West. The alignment of the route within the corridor could also be determined to minimise the potential impact on the freshwater features within the study area. With mitigation, Alternative 1 is likely to have an impact of a very low significance on the freshwater features while Alternative 2 is likely to have an impact of a low impact.

A water use authorization may need to be obtained from the Department of Water and Sanitation: Western Cape Regional Office for approval of the water use aspects of the proposed activities.

11. REFERENCES

Department of Water Affairs and Forestry. (1999). *Resource Directed Measures for Protection of Water Resources. Volume 3: River Ecosystems Version 1.0*. Resource Directed Measures for Protection of Water Resources, Pretoria, South Africa.

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

Department of Water Affairs and Forestry. (2007). *River Ecoclassification: Manual for Ecostatus Determination (Version 2)*. Water Research Commission Report Number KV 168/05. Pretoria.

Dickens, C. Kotze, D. Mashigo, S. MacKay H. & Graham M. Guidelines for integrating the protection, conservation and management of wetlands into catchment management planning (Report TT220/04)

Driver, Nel, Snaddon, Murray, Roux, Hill. (2011). Implementation Manual for Freshwater Ecosystem Priority Areas. Draft Report for the Water Research Commission.

Holness, S., Bradshaw, P., & Brown, A. (2010). *Critical Biodiversity Areas of the Garden Route: Conservation Planning Technical Report.*

Kleynhans, CJ, Thirion, C and Moolman, J (2005). *A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland.* Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Kleynhans CJ, Louw MD, Graham M. (2008). Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical manual) Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08

Marneweck, G.C. and Batchelor, A. 2002. *Wetland inventory and classification.* In: Ecological and economic evaluation of wetlands in the upper Olifants River catchment. (Palmer, R.W., Turpie, J., Marneweck, G.C and Batchelor (eds.). Water Research Commission Report No. 1162/1/02.

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

SANBI. 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

SANBI Biodiversity GIS: http://bgis.sanbi.org/

River Health Programme (2007). *State-of-Rivers Report: River of the Gouritz Water Management Area*. Department of Water Affairs and Forestry, Pretoria. ISBN No: 0-620-30757-9.

Van Ginkel, C. E., Glen, R. P., Gordon-Gray, K. D., Cilliers, C. J., Muasya, M. and P. P. van Deventer (2011) *Easy identification of some South African wetland plants.* WRC Report No TT 479/10

Vlok, J.H.J., Euston-Brown D.I.W. and Wolf, T. 2008. A vegetation map for the Garden Route Initiative

WRC. 2011. *Atlas for Freshwater Ecosystem Priority Areas* – Maps to support sustainable development of water resources (WRC Report No. TT 500/11).

APPENDIX A: DECLARTION OF INDEPENDENCE

I, Antonia Belcher, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, 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, 2010 and any specific environmental management Act;

- have no and will not have any vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference is included in the report.

Signature of the specialist:

Ms Antonia Belcher

Date: 30 June 2015

APPENDIX B: QUALIFICATIONS OF SPECIALIST CONSULTANTS

Contact details: PO Box 455, Somerset Mall, 7137

Name: Mr Dana Grobler and Ms Antonia Belcher

Profession: Mr Dana Grobler (Environmental Scientist – *Pr. Sci. Nat 400058/93*) and Ms Antonia Belcher (Aquatic Scientist *Pr. Sci. Nat.* 400040/10);

Fields of Expertise: Specialist in environmental water requirements, river and wetland monitoring and reporting.

Relevant work experience:

Due to Ms Belcher's involvement in the development and implementation of the River Health Programme as well as the Resource Directed Measures (RDM) directorate of the Department of Water Affairs in the Western Cape, she have been a key part of the team that has undertaken six catchment or area wide 'state-of-river' assessments as well as routine monitoring and specialised assessments of rivers and wetlands in all the major catchments in the Western Cape. Ms Belcher and Mr Grobler have also undertaken the River Health Monitoring for the Free State Region in 2011 and 2012.

Relevant publications:

Belcher Toni and Grobler DF. (2014). Freshwater Assessment for the Proposed Eskom Longdown Substation and associated Vyeboom Turn-in Lines

Belcher Toni and Grobler DF. (2014). Freshwater Assessment for the Proposed Upgrade to the Eskom Swartberg Repeater Road Upgrade

Belcher Toni and Grobler DF. (2014). Freshwater assessment for the proposed Eskom Kimberley Strengthening Phase 4 Project: Boundary to Ferrum

Belcher T and Grobler D. (2013). Freshwater Assessment for the proposed electrification of the Mission Station, Farm Goedverwacht No. 146, Piketberg

Belcher T and Grobler D. (2013).Freshwater Assessment for the Proposed Eskom De Hoek-Mountain 66kv Powerline and Associated Infrastructure, Piketberg

Belcher T and Grobler D. (2013).Freshwater Assessment for the Proposed upgrading of the Eskom Firgrove Substation

Belcher T and Grobler D. (2013). Freshwater Assessment for the Proposed 11kv Overheard Power Line linked to the Eskom Palmiet Substation

Belcher T and Grobler D. (2013). Freshwater Assessment for Kwaggaskloof-Hammanshof 66kv Line Refurbishment near Worcester

Grobler D and Belcher T. (2013). Freshwater Assessment for the Proposed Eskom Groblershoop 132/22kv Substation and the Garona – Groblershoop 132kv Kingbird Line of Approximately 20 Km

Grobler D and Belcher T. (2013). Proposed Development of the Gamka River 66kv Substation and Associated 66kv Overhead Powerline (150m), Calitzdorp, Western Cape

Grobler D and Belcher T. (2013). Freshwater Assessment for Proposed Eskom Bredasdorp-Arniston 66kv Powerline Re-Build And Dismantling of the Old Powerline

APPENDIX C: IMPACT ASSESSMENT METHODOLOGY

Criteria and ratings:

1. Extent

"Extent" defines the physical extent or spatial scale of the impact.

Rating	Description
LOCAL	Extending only as far as the activity, limited to the site and its immediate surroundings. Specialist studies to specify extent.
REGIONAL	Western Cape. Specialist studies to specify extent.
NATIONAL	South Africa
INTERNATIONAL	

2. Duration

"Duration" gives an indication of how long the impact would occur.

Rating	Description
SHORT TERM	0 - 5 years
MEDIUM TERM	5 - 15 years
LONG TERM	Where the impact will cease after the operational life of the activity, either because of natural processes or by human intervention.
PERMANENT	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.

3. Intensity

"Intensity" establishes whether the impact would be destructive or benign.

Rating	Description
ZERO TO VERY LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes continue, albeit in a slightly modified way.
MEDIUM	Where the affected environment is altered, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where natural, cultural and social functions or processes are altered to the extent that it will temporarily or permanently cease.

4. Loss of resources

"Loss of resource" refers to the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable.

Rating	Description
LOW	Where the activity results in a loss of a particular resource but where the natural, cultural and social functions and processes are not affected.
MEDIUM	Where the loss of a resource occurs, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where the activity results in an irreplaceable loss of a resource.

5. Status of impact

The status of an impact is used to describe whether the impact would have a negative, positive or zero effect on the affected environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

6. Probability

"Probability" describes the likelihood of the impact occurring.

Rating	Description
IMPROBABLE	Where the possibility of the impact to materialise is very low either because of design or historic experience.
PROBABLE	Where there is a distinct possibility that the impact will occur.
HIGHLY PROBABLE	Where it is most likely that the impact will occur.
DEFINITE	Where the impact will occur regardless of any prevention measures.

7. Degree of confidence

This indicates the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge.

Rating	Description
HIGH	Greater than 70% sure of impact prediction.
MEDIUM	Between 35% and 70% sure of impact prediction.
LOW	Less than 35% sure of impact prediction.

8. Significance

"Significance" attempts to evaluate the importance of a particular impact, and in doing so incorporates the above three scales (i.e. extent, duration and intensity).

Rating	Description
VERY HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the long term; OR of high intensity at a national level in the medium term; OR of medium intensity at a national level in the long term.
HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the medium term; OR of high intensity at a national level in the short term; OR of medium intensity at a national level in the medium term; OR of low intensity at a national level in the long term; OR of high intensity at a local level in the long term; OR of medium intensity at a regional level in the long term.
MEDIUM	Impacts could be EITHER: of high intensity at a local level and endure in the medium term; OR of medium intensity at a regional level in the medium term; OR of high intensity at a regional level in the short term; OR of medium intensity at a national level in the short term; OR of medium intensity at a local level in the long term; OR of low intensity at a national level in the medium term; OR of low intensity at a regional level in the long term.
LOW	Impacts could be EITHER of low intensity at a regional level and endure in the medium term; OR of low intensity at a national level in the short term; OR of high intensity at a local level and endure in the short term; OR of medium intensity at a regional level in the short term; OR of low intensity at a local level in the long term; OR of medium intensity at a local level and endure in the medium term.
VERY LOW	Impacts could be EITHER of low intensity at a local level and endure in the medium term; OR of low intensity at a regional level and endure in the short term; OR of low to medium intensity at a local level and endure in the short term.
INSIGNIFICANT	Impacts with: Zero to very low intensity with any combination of extent and duration.
UNKNOWN	In certain cases it may not be possible to determine the significance of an impact.

9. Degree to which impact can be mitigated

This indicates the degree to which an impact can be reduced / enhanced.

Rating	Description
NONE	No change in impact after mitigation.
VERY LOW	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
LOW	Where the significance rating drops by one level, after mitigation.
MEDIUM	Where the significance rating drops by two to three levels, after mitigation.
HIGH	Where the significance rating drops by more than three levels, after mitigation.

10 Reversibility of an impact

This refers to the degree to which an impact can be reversed.

Rating	Description
IRREVERSIBLE	Where the impact is permanent.
PARTIALLY REVERSIBLE	Where the impact can be partially reversed.
FULLY REVERSIBLE	Where the impact can be completely reversed.