PROPOSED 132KV POWERLINE, WALMER PORT ELIZABETH

AQUATIC IMPACT ASSESSMENT

Prepared for:

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(CK 2009/112403/23)

February 2016

SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant National and / or Provincial Policies related to biodiversity assessments.

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I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs.

Signed:… …… Date:…22 February 2016……

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ACRONYMS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
ECBCP	Eastern Cape Biodiversity Conservation Plan (Berliner & Desmet, 2007)
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

1 INTRODUCTION

Scherman Colloty & Associates (SC&A) was appointed by SRK Consulting South Africa (Pty) Ltd (SRK) as an independent specialist to evaluate the aquatic ecological aspects of the proposed Walmer to Lorraine 132kV transmission line that will connect two existing substations.

This document follows from results obtained in a survey of the regional literature and observations made during a site visit conducted in February 2016. The objective of this report is to provide comment on the potential impact of the proposed alternative alignments based on any constraints posed by any sensitive aquatic habitats.

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a course scale so it thus important to verify the actual status of the study area during this initial phase, prior to the final of the development plan being produced.

Certain aspects of the development may also trigger the need for Section 21, Water Use License Applications such towers within a watercourse or any structures that may be located within 500m of a wetland. These applications must then be submitted to the Department of Water and Sanitation PE Office, and information contained in this report must be used in the supporting documentation.

For the purposes of this report it is assumed that any existing roads and tracks will be used and thus no new roads will be required. It has also been assumed that **most** of the transmission line towers can avoid the observed water courses / waterbodies by spanning these areas. A further assumption is that water will be sourced from a licensed resource for construction purposes.

Figure 1: Google Earth image of study area indicating the alternative alignments and the underground cable section (Green line)

Several terms and definitions are used in this report and the reader is referred to the box below for additional detail.

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

Ecological Importance and Sensitivity (EIS) are the terms used to describe the rating of the any given wetland or river reach that provides an indication of the ecological importance of the aquatic system using criteria such as conservation needy habitat or species, protected ecosystems or unique habitat observed. The sensitivity is then derived by assessing the resilience the habitat exhibits under stress as a result of changes in flow or water quality.

1.1 Relevant legislation and policy

Locally the South African Constitution, seven (7) Acts and one (1) international treaty allow for the protection of rivers and water courses. These systems are thus protected from destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act, 2004 (Act 10 of 2004);
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999).

This report will be used as part of the relevant submissions to the Department of Water and Sanitation in terms of the registration / licensing (as required) for Section 21 c & i water uses should they be required.

Provincial legislation and policy

Various provincial guidelines on buffers have been issued within the province. These are stated below so that the engineers and contractors are aware of these buffers during the planning phase. Associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas. Until national guidelines for riverine and wetland buffers are established, the guidelines set out in the Eastern Cape Biodiversity Conservation Plan (Table 1) documentation should be applied (Berliner & Desmet, 2007). However, this will be discussed in greater detail later in this report with regard the sensitivity of the systems observed and the need for placing some of the towers within the water courses.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the sites are described in the ecological assessment.
- Eastern Cape Biodiversity Conservation Plan (ECBCP), (Berliner & Desmet, 2007) – Aquatic Critical Biodiversity Areas (CBAs)
- Nelson Mandela Bay Municipality Final Bioregional Plan Report 400919/3 (SRK Consulting, 2014)
- National Freshwater Ecosystems Priority Areas – (Nel *et al*., 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

Table 1: Recommended buffers for rivers (the predominant buffer for the study region is highlighted in blue) (Berliner & Desmet, 2007)

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 streams	32	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

2 METHODS

2.1 Study terms of reference

SC&A based this study on the following scope of work:

- Identify and delineate any aquatic systems and associated biota that may be impacted upon by the proposed project based on the DWS wetland and riparian delineation methodology (DWAF, 2005);
- Identify and rate potential environmental impacts on these systems and associated biota;
- Provide a significance rating of surface water impacts which includes a rating of the ecological sensitivity of the site, and the effect of the development on the aquatic ecology of the site;
- Identify mitigation measures for negative and enhancement measures for positive impacts.

Based on our understanding of these requirements, SC&A would produce the following:

- Riparian and /or wetland area delineation supplied together with an analysis of the potential aquatic sensitivity (including any wetlands should they occur).
- Present Ecological State (PES) assessment of any watercourses after a short site visit has been conducted, in line with the Department of Water Affairs requirements should any Section 21 c & i water use licenses be required.
- Compile the required impact assessment and provide suitable recommendations.

2.2 Study methods

This assessment was initiated with a survey of the pertinent literature, including past reports that exist for the study region. Maps and Geographical Information Systems (GIS) were then employed to ascertain, which portions of the proposed development, could have the greatest impact on the water courses and associated habitats.

A site visit was then conducted in January & February 2016 to ground-truth the above findings, thus allowing critical comment on the possible impacts. Information was also collected to determine the PES and Ecological Importance and Sensitivity (EIS). These analyses were based on the models developed by the Department of Water and Sanitation, with the results producing ratings (A – F), descriptions for which are summarised in Table 2.

Table 2: Description of A – F ecological categories based on Kleynhans *et al*., (1999).

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
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.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	**Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	**Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality**
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

2.3 Limitations

In order to obtain a comprehensive understanding of the dynamics of both the flora and fauna of the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are mostly based on instantaneous sampling.

Therefore, due to the scope of the work presented in this report, a detailed investigation of all, or part of, the proposed site was not possible and are not perceived as part of the Terms of Reference at this level of assessment and in part due to the current state of the environment. It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

3 STUDY AREA DESCRIPTION AND RESULTS

The proposed project is located along the banks of a tributary of the Baakens River (Figure 1 & 2), which over time has been modified through diversion, **riverbed modification** and the growth of alien trees such as *Acacia mearnsii, Datura spp* and *Eucalyptus spp*. All of the watercourse **banks** have also been further modified in terms of vegetation clearing / brush cutting or mowing.

The study area is located within the South Eastern Coastal Belt Ecoregion of the M20A (Baakens) quaternary catchment (Figure 2). The instream areas were naturally moderately steep to steep, incised with no major floodplain areas within the survey area. Wide riparian zones are thus not prevalent in these types of systems, and would have been between 2 and 15m wide. This has been altered over time, as previously mentioned either through:

- The inclusion of storm and flood water management structures such as the gabions walls that span the system in several areas and have created artificial reed bed wetlands (Plate 1);
- Land reclamation and infill of riverbanks to reduce the risk of flooding of adjacent properties (Plate 2); and
- Alien vegetation stands (Plate 3)

The only natural species observed along the remaining riverbanks (near 17th Ave), outside of the wetlands areas included *Searsia undulata*, *Cyperus latifolia, Chrysanthemoides monilifera*. The upper banks along all areas were dominated by grassy fynbos, mostly burnt or mowed during the time of the survey.

The study area hydrology was characterised mostly ephemeral flows entrained by a series of detention gabions along the length of the water course from where it intersects with Circular Drive until Hanover Place in Overbaakens. These gabion walls thus entrap / slow any flows which was then colonised by dense reedbeds. The natural riverine channel with instream vegetation and some aquatic habitat only reappears for a short section where it intersects with William Moffett / 17th Ave. The upper regions of the study area (along Macon Rd) do not form part of any natural water course, and the observed water courses are canals / channels (Plate 4 & 5) that have been dug to divert surface water runoff away from the Lorraine area, under the rail line and Circular Drive and into a large detention pond (Plate 6).

With regard instream habitat and aquatic biodiversity, for the remainder of the study area, this is limited by the dense reed (*Phragmites australis*) and bulrush (*Typha capensis*) growth within the observed areas, and although would be considered modified wetlands these contain a low number of obligate aquatic species. The only other animals associated with these areas included Bishops and Weavers, while the open channel area (Plate 7) is used by Mongoose, possibly foraging for small crabs in the open water areas.

The National Freshwater Ecosystems Priority Atlas (NFEPA - Nel *et al*., 2011) (Figure 3) and Eastern Cape Biodiversity Conservation Plan (ECBCP) (Figure 4 & 5) spatial databases have however indicated that the study area forms part of a Fish Support Area and an Aquatic CBA 2, as this system forms part of a hydrological connection between the upper catchment (Lorraine) and the Baakens River itself. This is a similar case shown the Nelson Mandela Bay Municipality Bioregional Plan – Critical Biodiversity Area (CBA) (Figure 5). All of these projects, based largely on the same data have identified the study area subquaternary catchments (SQ 9104) as important freshwater conservation areas due to the possible presence of rare endemic fish, i.e. Eastern Cape Redfin (*Pseudobarbus afer*) and Eastern Cape Rocky (*Sandelia bainsii*).

With regard natural wetlands, none were observed, with those already described observed associated with the stormwater control features within the project area. This was supported by the National Wetland Inventory (ver 4) contained in the NFEPA database (Figure 6).

From a riparian vegetation, fish, invertebrate and water quality standpoint the overall condition or Present Ecological State (PES) of the observed systems was also assessed using accepted methodologies. The

PES system, using an updated DWS method (2014) indicates that on a sub-quaternary level the study area is located within a Moderately Modified (PES = C) catchments (SQ9104). In this assessment the study area systems that were delineated an assessed were rated lower, i.e. PES = D (Largely Modified) due to all the impacts and hydrological changes already discussed.

The Environmental Importance and Sensitivity or EIS is a measure of the conservation value. In the most recent assessment (DWS, 2014), the Ecological Importance and Ecological Sensitivity was rated as Moderate and High respective due to the potential fish and invertebrates that occur within the sub-quaternary catchment (DWS, 2014). Based on the impacts and current state of the tributary assessed in this study (i.e. the watercourse and wetland areas associated with the proposed transmission line only) the EI & ES would be rated as Low and Low respectively due to the overall lack in aquatic biodiversity and the high degree of habitat modification that has taken place.

Plate 1: A typical gabion structure, one of approximately seventeen located within the study area, used to impeded surface water flows and now colonised by reeds and bulrushes.

Plate 2: Clearing (brush cutting) as well as infill has occurred on the upper banks of the water course

Plate 3: Large stands of alien trees, some cleared occur along the western and eastern portions of the study area

Plate 4: The western portion of the study area dominated by the hand dug channels to divert water from the roads and homes in Lorraine towards Circular Drive. Note the inset with alien vegetation and clearing operations as seen in a survey conducted in November 2013

Plate 5: A view towards the Loraine Substation with the small channel used to direct water away from the rail line visible along the right side of the fence. The area to the left of the is currently being prepared for the Lorraine stormwater pipeline

Plate 6: A view of the stormwater detention pond located above the water course located adjacent to the Circular Drive / Carrington Way intersection

Plate 7: The only signs of animals within the study area was these mongoose footprints on exposed sand bars within the incised channel near the 17th Ave Substation. Nail imprints are visible thus the spoor was not made by the Cape clawless otters known to occur downstream near Dodd's Farm

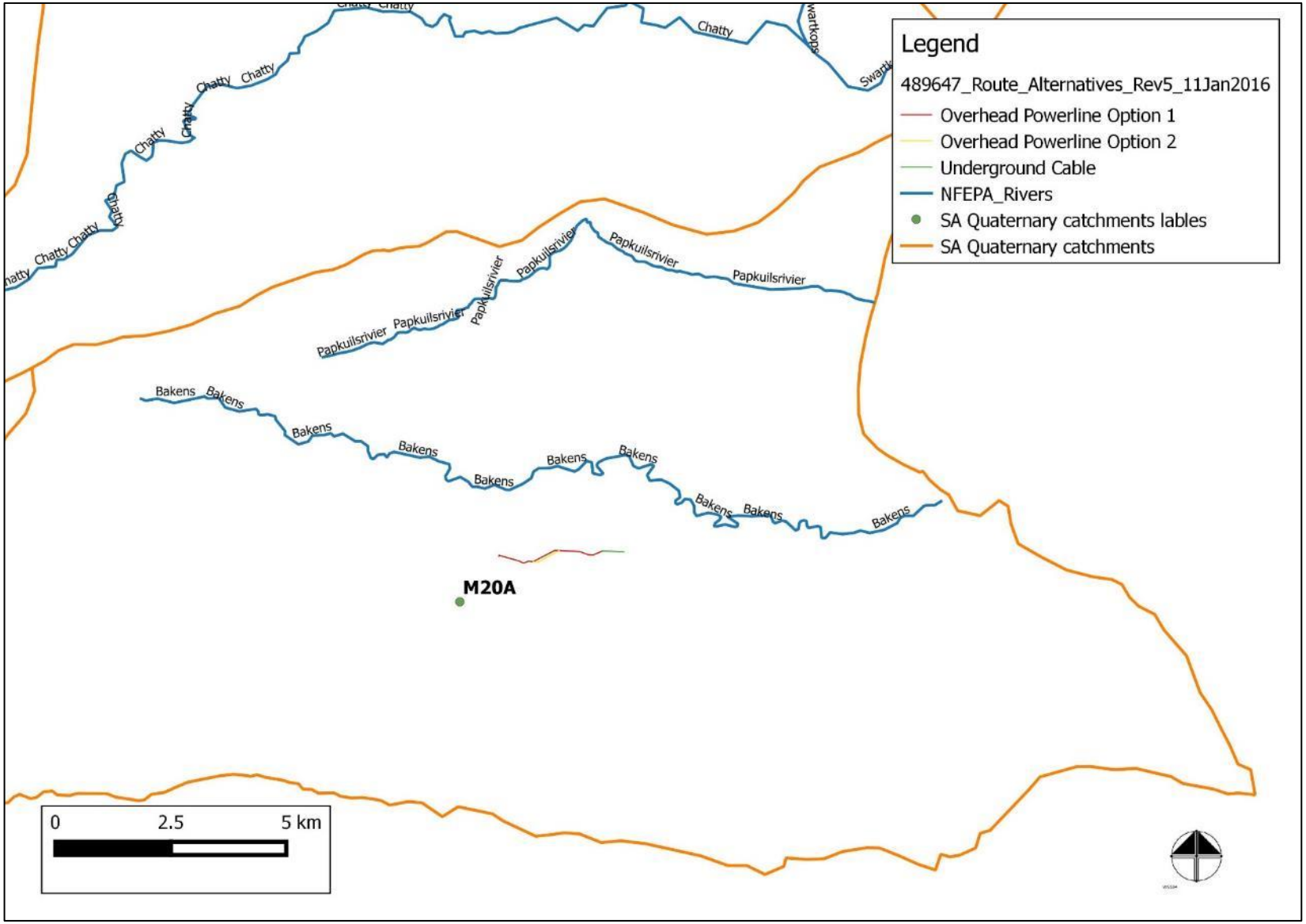

Figure 2: The project locality in relation to the various Quaternary Catchments and mainstem rivers as shown by NFEPA

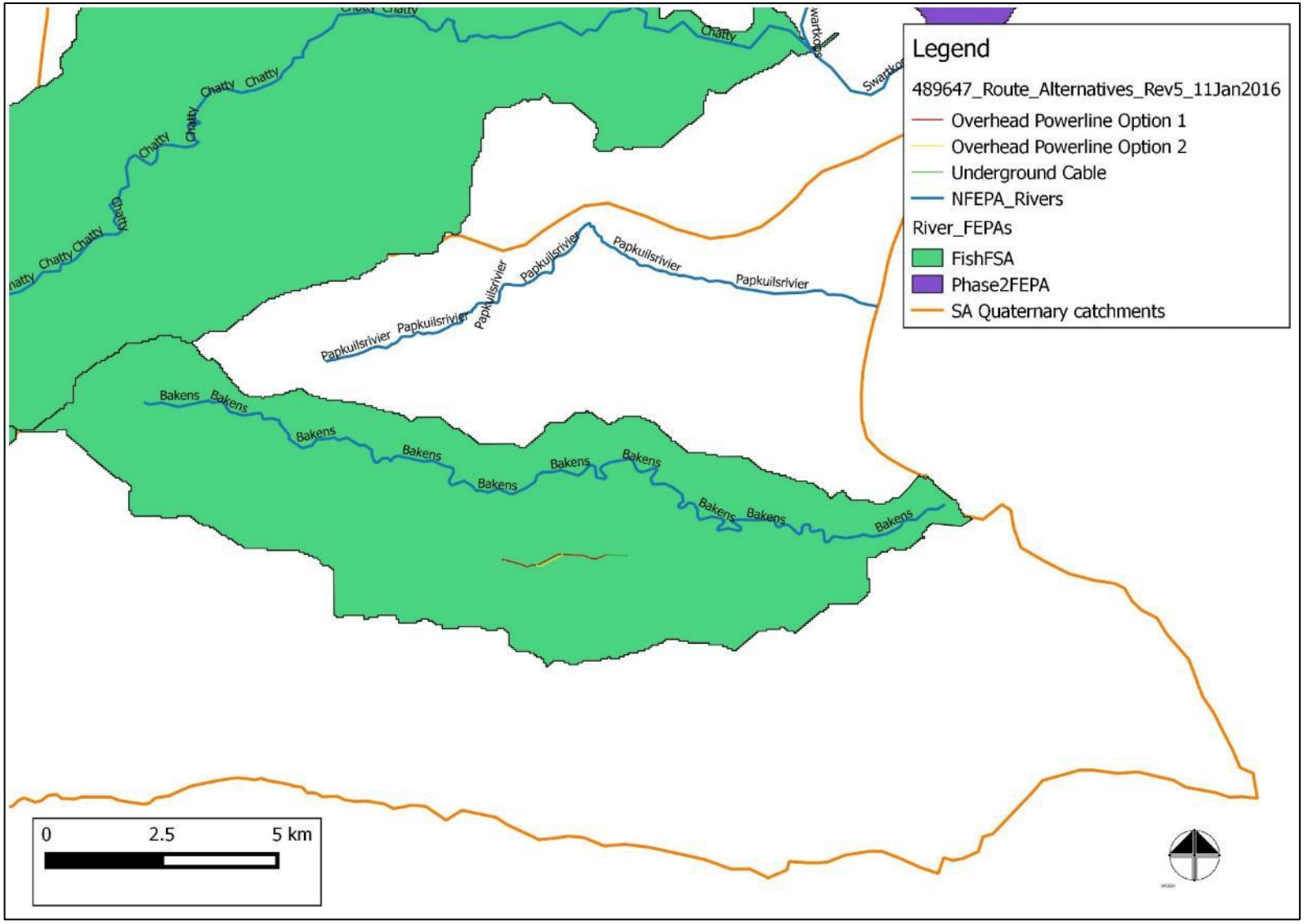

Figure 3: The project locality in relation the Freshwater Ecosystems Priority Areas - rivers (Nel *et al.*, 2011)

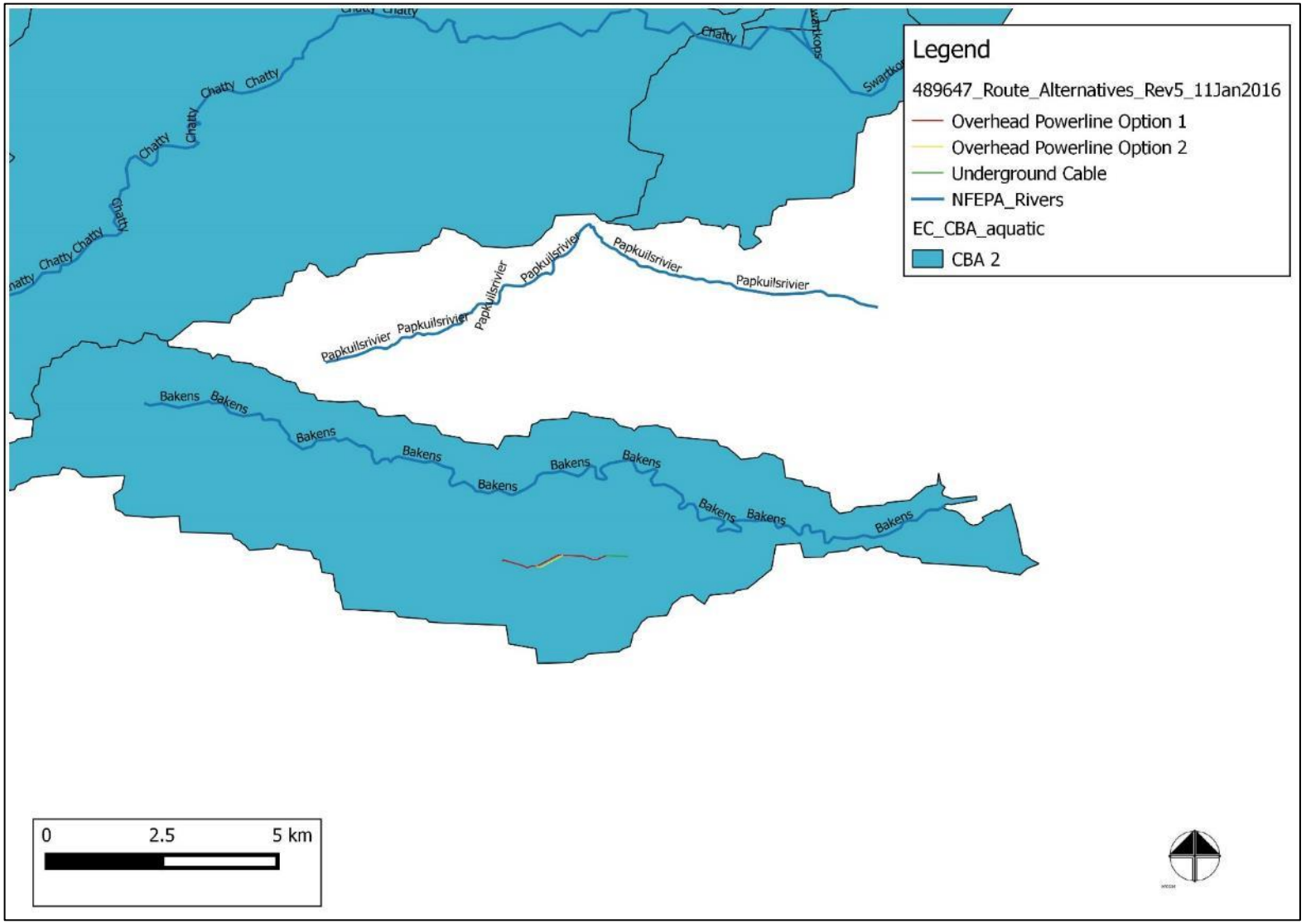

Figure 4: The project locality in relation the ECBCP Aquatic CBA spatial data.

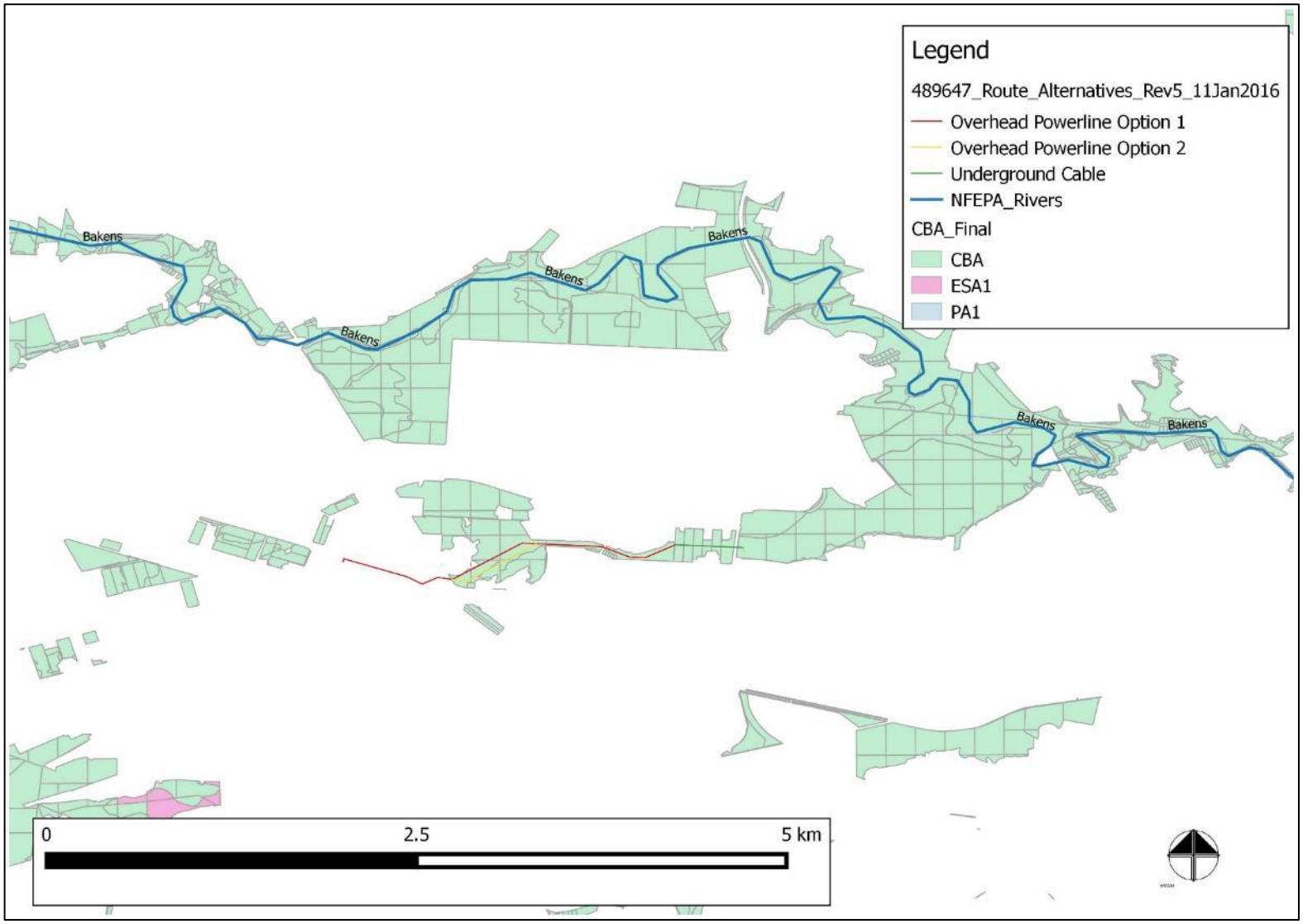

Figure 5: The Critical Biodiversity areas as shown in the Nelson Mandela Bay Municipality Bioregional Plan (2014) in relation to the study area

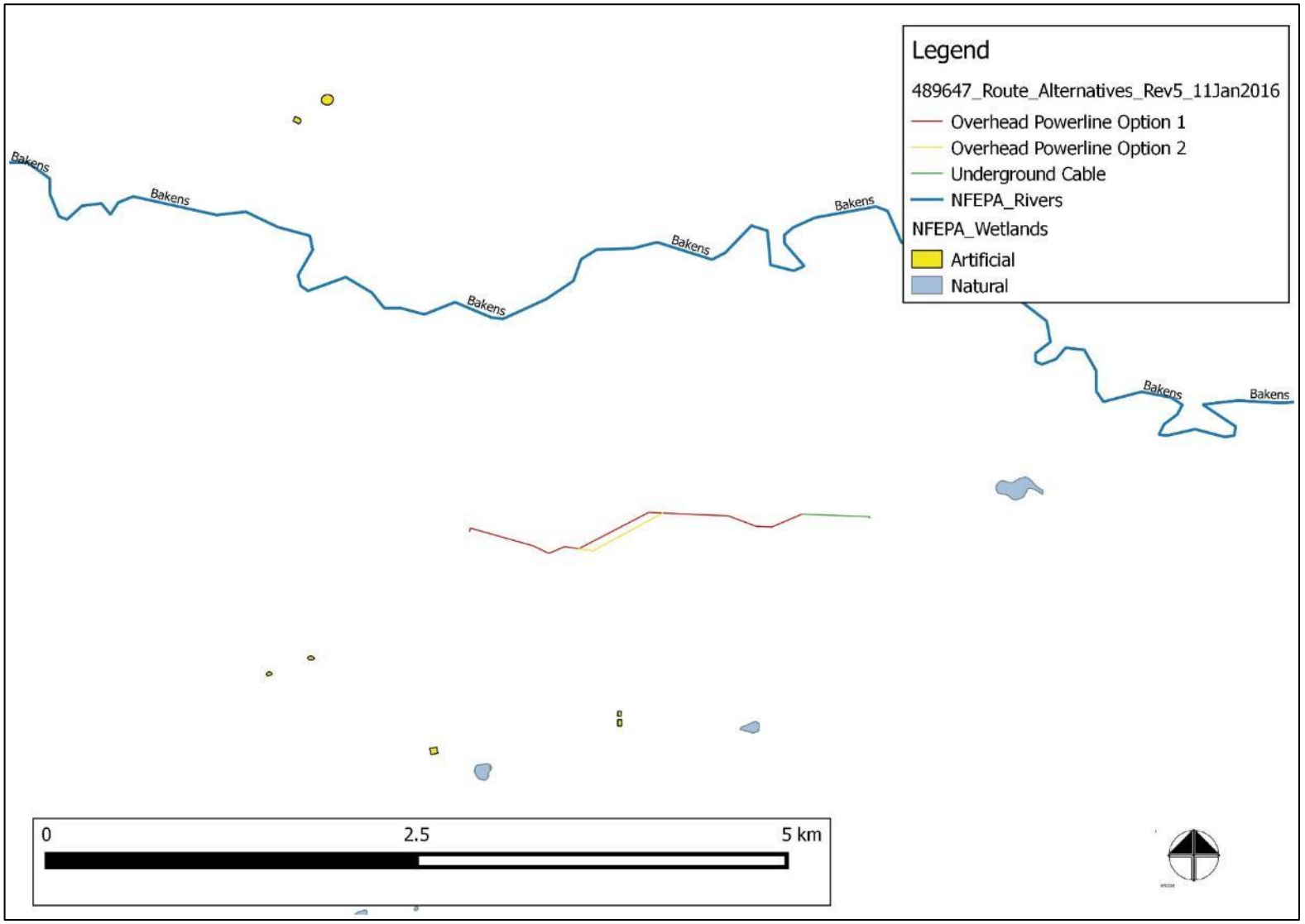

Figure 6: The project locality in relation the Freshwater Ecosystems Priority Areas - Wetlands (Nel *et al.*, 2011)

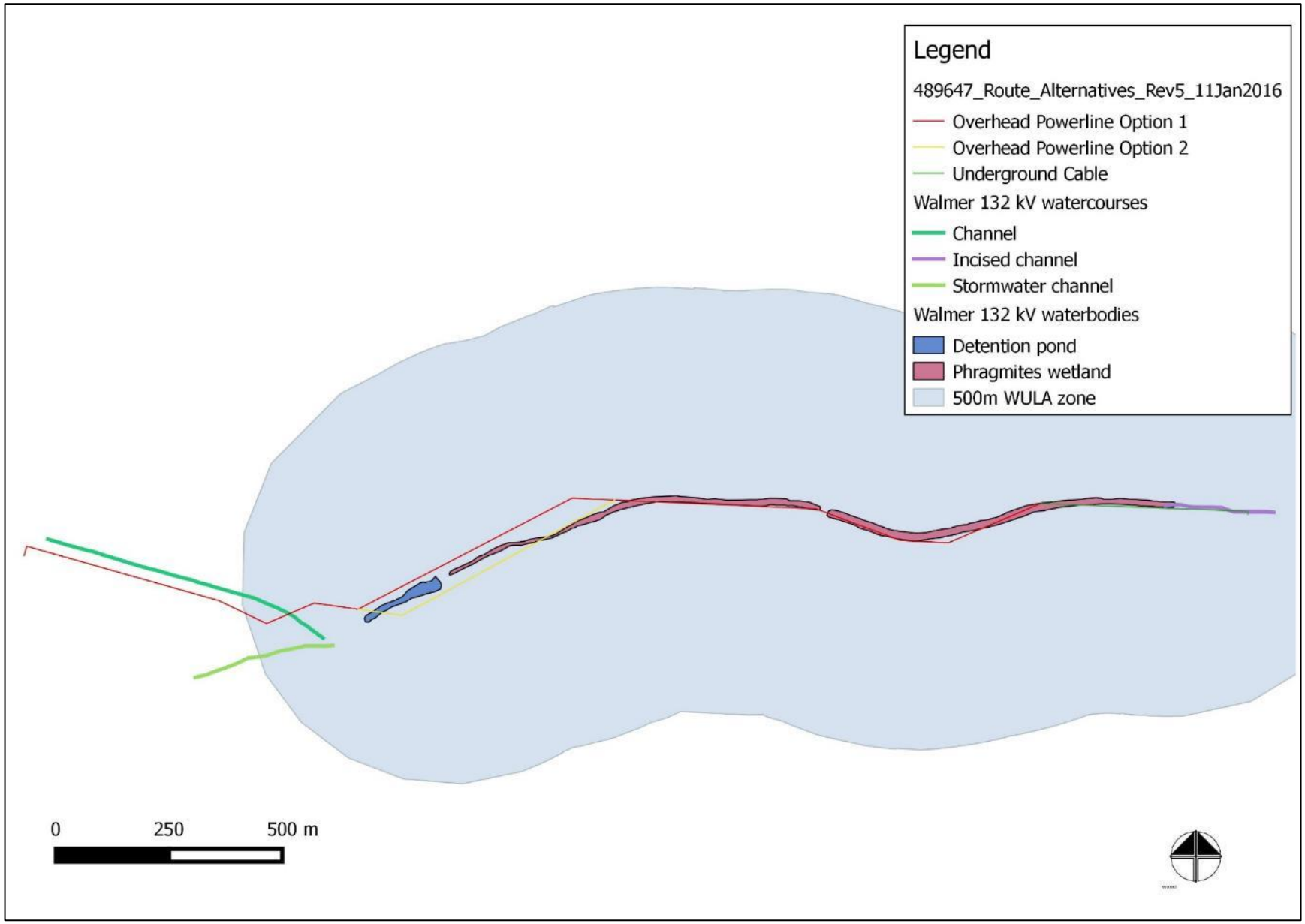

Figure 7: Delineated waterbodies for the study area and the 500m WULA regulated zone

4 IMPACT ASSESSMENT

The impact assessment was derived from the methodology provided by SRK Consulting and the design layout, which was the measured against the current state of the observed water courses. Several impacts have been highlighted and have been rated based on the project actions / impacts, as well as any potential cumulative impacts during the construction and operational phases of the project. These were also assessed with and without mitigation. The impact ratings are relevant to both alignment options. To reiterate the assumptions, the proposed transmission line will span as far as possible any of the shown watercourses, while existing access roads and tracks will be used. Furthermore, no laydown / temporary works areas will be located within any of the observed aquatic habitats (Figure 7).

4.1 Impact 1: Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion

Nature of the impact

Due to the nature of the proposed project this would be an operational phase impact, as a result of the clearing vegetation could destabilise the soils, resulting in downstream erosion and or sedimentation that could impact on aquatic habitats within the Baakens River, particularly if no post construction rehabilitation is done to allow revegetation of any disturbed sites.

Significance of impacts without mitigation

The soils within the study area are susceptible to erosion when subjected to high flows (high volumes and velocities), with head-cuts readily forming within the regional water courses. This creates bed and bank instability in the aquatic ecosystems and consequent sedimentation of downstream areas. Due to the nature of the study area hydrology, its present state and the surrounding impacts, this would although a negative impact, the overall significance of the impact would be rated as Low (Table 3).

Proposed mitigation

- Minimise the loss of aquatic habitats / vegetation by locating as many of the proposed towers outside of these areas thus maintaining a small footprint.
- No vehicles to refuel within watercourse / wetlands to prevent any compaction of soils.
- No flows within any of the water courses should be altered by the towers.

Significance of impact with mitigation

Medium-term changes to the local hydrological regime is possible, while the intensity in the operational and closure phases would be low, thus the overall significance of this impact would be Insignificant (Negative) (Table 3).

Cumulative impacts

The increase in surface run-off velocities is unlikely to occur considering that the site is located within a highly modified / managed system the cumulative impacts are Very Low

Residual impacts
Possible impact on the remaining catchment due to changes in run-off characteristics in the alignment is unlikely.

Table 3: A summary of the potential impacts (relevant to both alignment options)

Impact	Spatial Extent	Intensity	Duration	Consequence	Probability	Significance
Impact 1: Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion	**Significance without mitigation**					
	Regional (2)	Medium (2)	Medium-term (2)	Medium (6)	Possible	Low
	Significance with mitigation					
	Local (1)	Low (1)	Medium-term (2)	Very Low (4)	Possible	Insignificant
Impact 2: Impact of changes to water quality	**Significance without mitigation**					
	Local (1)	Medium (2)	Medium-term (2)	Low (5)	Possible	Very Low
	Significance with mitigation					
	Local (1)	Low (1)	Medium-term (2)	Very Low (4)	Possible	Insignificant
Impact 3: Loss of wetland vegetation / aquatic habitat	**Significance without mitigation**					
	Regional (2)	Medium (2)	Medium-term (2)	Medium (6)	Possible	Low
	Significance with mitigation					
	Local (1)	Low (1)	Medium-term (2)	Very Low (4)	Possible	Insignificant
Impact 4: Loss of species of special concern	N/A					

4.2 Impact 2: Impact of changes to water quality

Nature of the impact

Presently little is known about the water quality of the water courses directly in the study area, but it is assumed due to the activities observed, the aquatic systems contain some form of pollutants, other than elevated sediment loads during floods.

During construction various materials, such as sediments, diesel, oils and cement, could pose a threat to the continued functioning downstream areas, if by chance it is dispersed via surface run-off, or are allowed to permeate into the groundwater. The possible negative changes to water quality during the operational phase would be limited to sedimentation and erosion related issues assessed in Section 4.1. These negative impacts would persist into the medium term.

Significance of impacts without mitigation

Changes to water quality impact on the functioning of local plants and other instream biota are possible. This impact without mitigation would have a Medium intensity in the medium-term, as excessive pollution will also impact on instream conditions due the introduction of toxins. Potential toxins include the following:

- Grout and concrete – these products contain cement which increases the pH (basic) of surfaces waters impairs the metabolism and breathing physiology of aquatic organisms.
- Hydrocarbons (shutter oil, other lubricants, grease and fuels) – The persistent impact of these pollutants is varied, but can enact negatively on metabolic pathways, cellular structures (plant and animal), respiration and gene stability (heavy metals).

Therefore, the overall consequence would be rated as low, while the significance would be rated as Very Low (Table 3)

Proposed mitigation

- Chemicals used for construction must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early.
- Littering and contamination of water sources during construction must be prevented by effective construction camp management.
- Emergency plans must be in place in case of spillages onto road surfaces and water courses.
- No stockpiling should take place within a water course.
- All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
- Stockpiles must be located away from river channels.
- Erosion and sedimentation into channels must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed riverbanks.
- The construction camp and necessary ablution facilities meant for construction workers must be beyond the 32m of any of the watercourses.

Significance of impact with mitigation

Should the construction site and the works be managed properly, the negative impacts would remain localised and in the medium-term. This would result in an overall low intensity as the introduction of any pollutants would be probably be limited with mitigation. The consequence would thus be rated as Very Low and although possible, the impacts would be Insignificant (Table 3).

Cumulative impacts

The potential cumulative impact is likely but in the medium term once construction of the Lorraine Bulk Stormwater project commences, this is due to the size of that project, the impacts could be Moderate – Low with mitigation. This rating is also based on the assumption that the first detention pond near Circular Drive will capture any pollutants / sediments derived from the stormwater project.

Residual impacts

Possible impact on the remaining catchment due to changes in run-off characteristics in the alignment is unlikely.

4.3 Impact 3: Loss of wetland vegetation, and aquatic habitat and stream continuity (migration corridors)

Nature of the impact

Wetland vegetation and aquatic corridors create longitudinal links between a variety of habitats and refugia. The refugia are particularly important in times when surface flows are low, i.e. fish populations are able to survive in deeper pools during droughts. These populations are then able to recolonise the remaining river reaches, when reconnected by increased river flows. This function of a catchment and its ability to act as a refugia is highlighted by the conservation plans that have earmarked the study area as such. None of these habitats were observed within the study area

The proposed transmission line, would see a number of towers located within these areas based on the current alignments, but it is assumed that these tower footprints are small and no access roads will be required within the aquatic habitats.

Typically, an exclusion buffer is usually recommended (32m as shown in Table 1 or 50m for wetlands), however this will provide no value in terms of protecting any important habitat, firstly as the wetlands areas are largely artificial and secondly the adjacent terrestrial habitat is highly modified. It must also be noted that once the Lorraine Bulk Stormwater project is operational, the hydrology of the study area will certainly change once again and it is not known how the study area aquatic features will respond over time.

Significance of impacts without mitigation

This impact without mitigation where a large number of towers and disturbance occurs within the observed water courses/ wetlands would have a low significance over the medium-term on a regional scale. The overall significance would thus be Low (Table 3)

Proposed mitigation

- Tower footprints must be kept to a minimum and if possible outside of the demarcated water courses
- The number of towers that would need to be placed within or directly adjacent to the observed water courses / wetland areas would be lower if Option 1 is selected (i.e. red route as shown in Figure 1)

Significance of impact with mitigation

With the mitigations the negative impacts would remain localised and be medium-term. This would result in an Insignificant (negative) significance rating as the overall continuity of the instream areas, could remain (Table 3).

Cumulative impacts

The potential cumulative impact is likely but in the short term once construction of the Lorraine Bulk Stormwater project commences, this is due to the size of that project, the impacts could be Moderate – Low with mitigation. This rating is also based on the assumption that the first detention pond near Circular Drive will capture any pollutants / sediments derived from the stormwater project, which would result in altered hydrological patterns that also then affect migration routes / patterns.

Residual impacts
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

4.4 Impact 4: Loss of species of special concern

Nature of the impact

It is unlikely, that any species of concern are found within the study area, due to the lack of any available habitat (flowing water, pools and riffles), further supported by a lack of any records of fish within this tributary. Similarly, no aquatic plant species of special concern were observed during this study.

Therefore, this impact was not assessed.

5 CONCLUSION AND RECOMMENDATIONS

Based on the lack of any natural wetlands and the lack of general instream habitat required by any important / sensitive aquatic biota, coupled to the fact that only a small number of towers will be located within artificial wetlands areas (Option 1), the proposed project would seem to have no to little direct impact on the natural aquatic environment or species of special concern. For this reason, no buffers have been proposed as this would aid little in conserving any valuable habitat, but if possible the towers should be located outside of the demarked areas shown in this report. Furthermore, any such towers that remain within the areas as well as any within 500m of a wetland will require a Water Use License (Figure 7).

As the proposed activities have the potential to create erosion the following recommendations are provided:

- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 32m from any demarcated water courses.
- All cleared areas must be re-vegetated after construction has been completed.
- It is also advised that an Environmental Control Officer, with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.
- This is based on the assumption that following conditions will be adhered to:
    - Access will be kept to a minimum and where possible steep areas will be provided with suitable stormwater management features to prevent soil erosion and completely prevent any sediment from entering the downstream areas.
    - Chemicals (e.g. poisons / hazardous substances) must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early
    - Littering and contamination of water sources during construction/operation must be prevented by effective solid waste management.
    - Emergency plans must be in place in case of spillages onto works areas and water courses.
    - All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
    - Stockpiles must be located away from water courses.

Lastly it is also recommended that a detailed walk down survey is conducted once the towers positions are known by an aquatic specialist due to the close proximity of either of the options to the wetlands and water courses. This must also include an opportunity to assess the final design provisions prior to construction to ensure that minimal impact will occur as in all likelihood the Department of Water and Sanitation will require a detailed rehabilitation and monitoring plan. Once the tower positions are known site specific recommendations could be provided by the specialist.

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