ESKOM TRANSMISSION

EIA FOR THE THYSPUNT TRANSMISSION LINES INTEGRATION PROJECT

Surface Water Impact Assessment Report – EIA – Northern Corridor

Issue Date: 20 June 2010
Revision No.: Rev 1
Project No.: 9520

Date:	20/06/2011
Document Title:	Surface Water Impact Assessment Report – TTLIP – EIA – Northern Corridor
Author:	Paul da Cruz, Shaun Taylor
Revision Number:	1
Checked by:	Paul da Cruz
Approved:	Paul da Cruz
Signature:	
For:	SiVEST Environmental Division

The Independent Environmental Assessment Practitioner:

We, SiVEST Environmental, declare that we –

- act as the Independent Environmental Assessment Practitioners in this application for the proposed Eskom Thyspunt Nuclear Integration Project in the Eastern Cape;
- 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 Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

EXECUTIVE SUMMARY

SiVEST has been appointed by Eskom Transmission to undertake an EIA study for the proposed development of powerlines and associated electricity infrastructure to provide a link between the proposed Thyspunt Nuclear Power Station and the Port Elizabeth area in the Eastern Cape (the Thyspunt Transmission Lines Integration Project - TTLIP). The proposed construction will involve the construction of a maximum of 5 powerlines (400kV) which will follow two separate routes for the purposes of risk aversion. A new substation will accompany the proposed development and upgrading of the existing Dedisa and Grassridge Substations will also take place.

This study addresses the impact that the proposed development will have on the environment from a surface water perspective. This report specifically assesses the impacts as related to the proposed construction of the transmission powerlines in terms of the Northern Corridor. The objective of this report is to identify potentially affected surface water resources that may be encountered in the proposed route alternatives. This was undertaken by means of a desktop study and limited in-field investigation of certain prioritised wetlands. All potentially affected surface water resources were identified and delineated.

Overall, the presence of surface water resources will not affect the proposed development to the extent that it should not take place. However, various impacts are anticipated. Most of the potential impacts can adequately be addressed whilst others will require more intense mitigation measures. The potential impacts associated with the proposed development of the transmission lines include:

- Potential disturbance of wetland / riparian habitat is towers were to be placed in a surface water feature – this applies especially to those wetlands that are too wide to be spanned
- Potential indirect impacts on surface water features through incorrect construction practices and negligence

It should be noted that one wetland to the south of the Krom River is too wide to be spanned along certain parts of its width, and further assessment is recommended.

Specific areas of sensitivity or likely impact in light of the aforementioned potential impacts were identified. Site specific mitigation measures for these areas have been identified. Importantly further assessment of tower locations in certain parts of the study area has been recommended once the final route has been determined.

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1 INTRODUCTION

SiVEST have been appointed by Eskom Transmission to undertake an EIA study for the proposed development of powerlines and associated electricity infrastructure to provide a link between the proposed Thyspunt Nuclear Power Station and the Port Elizabeth area in the Eastern Cape (the Thyspunt Transmission Lines Integration Project - TTLIP). As part of the EIA studies, the need to undertake a surface water impact assessment study has been identified. Accordingly, a detailed surface water impact assessment study has been conducted to identify all potential surface water-related impacts and issues related to the proposed development. The study aims to identify potential issues and impacts on surface water resources associated with the proposed powerlines. This is done by characterising the surface water resources in the study area and identifying areas of potential sensitivity that may be subject to impacts. Recommendations are made in terms of mitigation measures for all identified impacts. This particular study is an in-depth report compiled for the EIA phase of the project. It essentially seeks to provide a detailed assessment the surface water-related impacts associated with the proposed powerlines.

The proposed development broadly encompasses the construction of transmission lines from Thyspunt to Grassridge, a new substation (Port Elizabeth Transmission Substation) and the upgarding of the existing Dedisa and Grassridge substations. As a result of this, three different applications have been submitted to DEA for different components of the proposed powerline development (the Northern Corridor, the Southern Corridor and a new proposed Port Elizabeth Transmission Substation). Hence, separate reports for each component of the proposed development have been compiled. This report assesses the potential surface water impacts associated with the various Northern Corridor alternatives of the proposed transmission powerline alignment. A separate report has been generated for the other components of the proposed development (i.e. the proposed Southern corridor alternatives and the proposed Port Elizabeth Substation alternative sites). The potential impacts associated with the upgrading of the Grassridge and Dedisa Substations have been included in this report.

1.1 Definition of Surface Water Resources as assessed in this study

Surface water resources can be divided up into a number of different types. For the purposes of this study, surface water resources have been defined based on the definition for non-groundwater resources which appears in the National Water Act (36 of 1998), which defines a non-groundwater resource as a “watercourse, surface water or estuary,” The Act defines a watercourse as (inter alia):

- a river or spring
- a natural channel in which water flows regularly or intermittently
- a wetland, lake or dam into which, or from which, water flows

Thus for the purposes of this report, surface water resources have been defined as any natural stream, river, inland wetland, or estuary. Wetlands have been defined as a piece of land on which the period of saturation of water is sufficient to allow for the development of hydric soils, which in normal circumstances would support hydrophitic vegetation (i.e. vegetation adapted to grow in saturated and anaerobic conditions.

It should be noted that the Northern Corridor does not traverse any estuaries; hence all wetlands along the corridor are non-estuarine in character, being palustrine (marsh-like). Palustrine wetlands can be divided up into different hydrogeomorphic forms, based on their position within the landscape, hydrological connectivity and water input. Kotze *et al.* (2005) have described a number of different wetland hydrogeomorphic forms. A more detailed description of the hydrogeomorphic forms is provided in Appendix A. Seven different wetland hydro-geomorphic wetland forms were identified in the study area. These forms are listed below, and their location is discussed in further detail in the ensuing sections:

- Channel (river or drainage line, including the banks)
- Hillslope Seepage
- Valleyhead Seep
- Channelled Valley Bottom
- Un-channelled Valley Bottom
- Pan / Depression
- Floodplain

From a floristic point of view, wetlands in the study area are divided up into two types (Musina and Rutherford, 2006):

- Cape Inland Salt Pans
- Cape Lowland Freshwater Wetlands

Most palustrine wetlands found in the study area fall within the latter category, and can be sub-divided into different hydro-geomorphic forms as discussed above. These wetlands are typically dominated by sedges, restios and rushes, and occasionally grasses and shrubs. There are a few examples of Cape Inland Salt Pans in the study area, as described below.

1.2 Project Technical Description

1.2.1 Adjustment of Powerline Route and New Substation Site Alternatives

The proposed route alternatives that were put forward in the scoping phase have been altered based on stakeholder and landowner considerations. The currently proposed alternatives ultimately reflects input received during scoping phase and the public participation process. This means that there will be areas along the currently proposed powerline route alternatives that were not previously assessed that are addressed for the first time in this report. This also means that some of the previously identified wetlands that are not inlcuded in the current proposed alternative routes will fall away(i.e. they will no longer potentially be affected by the proposed power lines).

1.2.2 Technical Details

It is important to note that the proposed transmission line corridors (both Northern and Southern) are not alternatives to each other, as both are anticipated to be utilised by Eskom to carry a total of 5 X 400kV lines from the proposed nuclear power station. Eskom has identified the need to keep the proposed lines in two seaparate alignments as a *risk aversion factor*. Two separate and independently operated transmission line corridors are therefore proposed in order to guarantee the electricity supply from the proposed Thyspunt Nuclear Power Station. In the event that the transmission lines in one of the corridors become non-operational (for example, due to natural disasters), the electricity supply from the proposed power station via the operational lines in the other corridor would be guaranteed.

In terms of location alternatives assessment, the corridors provide adequate space for a number of potential alternative alignments to be located within them. In a section of the Northern

Corridor, three distinct alternatives were presented for assessment in the EIA phase. The location and route description of these alternatives are addressed in section 1.2.5 below.

The following technical details must be kept in mind:

- **Proposed Northern Corridor:** 3 x 400kV Transmission power lines
    a. 3x 400kV Transmission power line from Thyspunt past Uitenhage to Eskom's existing Grassridge Transmission Substation.
    b. 2x 400kV Transmission power lines from the Grassridge Substation to the Dedisa Transmission Substation.
- In terms of Eskom standards, a single 400kV line will require a servitude of 55m in width.
- Assuming the Northern Corridor has 3 Transmission lines in it – the servitude will be a total of 165m wide.
- In most cases, the land beneath the overhead lines can be used, as normal, by the landowners. Eskom, however, require that no dwellings or vegetation/crops higher than 4m be established within the servitude.
- Currently it is proposed (but not finalised) that the Cross Rope Suspension-type tower will be used (Figure 2). This tower is approximately 40m in height. The total footprint area required for each tower is 70m x 30m (including the tower supports). A diagram of the proposed tower and other potential tower types is indicated below.
- Self Support tower types will be used as strain towers (a strain tower is a larger tower utilised in bends and where reinforcement is required with regards to tower stability).

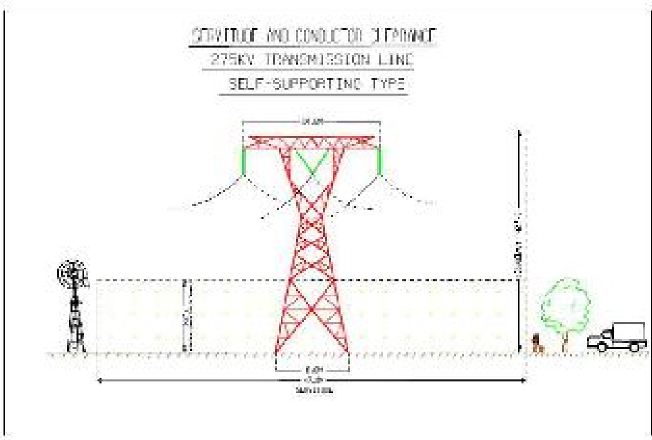

Figure 1: The Self-Supporting (Strain) Tower type

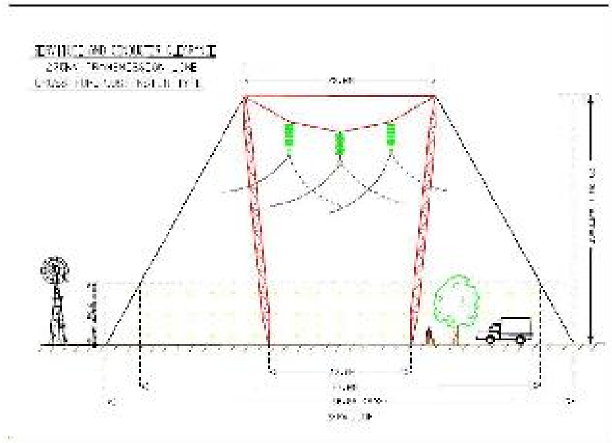

Figure 2: The Cross Rope Suspension Tower Type

Proposed upgrade of Eskom's existing Grassridge and Dedisa Transmission Substations

As part of this project, both the Dedisa and Grassridge Substations are proposed to be upgraded. The details of the proposed upgrading are provided below.

1.2.3 Dedisa Substation

At the Dedisa Substation the 400kV busbar system at needs to be extended and the feeder 3 needs to be fully equipped to deal with the new lines. Thus a fully equipped 400 kV feeder bay with double busbar selection and bypass capability needs to be constructed. Essentially this upgrading will entail the construction of new metal structures within the substation. The fence surrounding the substation will need to be extended and new operational lighting will need to be erected; lighting masts 24m high will need to be erected. No new roads will be required to be built as part of the upgrading.

1.2.4 Grassridge Substation

At Grassridge, similar new provisions for the lines need to be made. The set up is slightly different to Dedisa, and at Grassridge bringing in the fourth feeder will require that the busbar be sectionalised further to create a fourth zone. The busbar system will further have to be extended by two bays. No new fencing, extra roads or additional lighting will be required to be installed at the substation.

1.2.5 Route Description

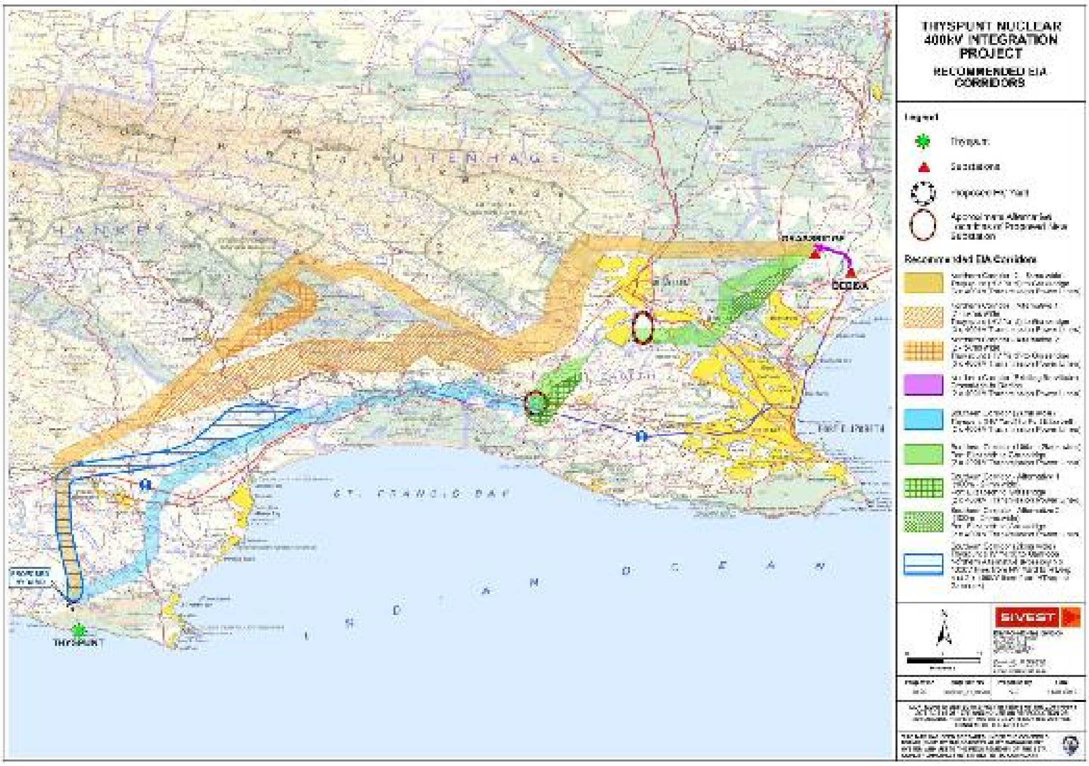

Figure 3: Map showing the location of the various transmission route alternatives for the Northern and Southern Corridors at the start of the EIA process

Thyspunt HV Yard to the Gamtoos Valley – The Northern Corridor exits the High Voltage (HV) yard associated with the proposed Thyspunt Power Station to the north of the transverse dunes and moves in a northerly direction towards Humansdorp. The corridor crosses the unsurfaced road between Oyster Bay and Humansdorp in the vicinity of the Farm Kleinrivier. The corridor crosses the steeply incised Krom River Valley at the Farm Elandsjagt (downstream of the Impofu Dam) and then crosses the Geelhoutboom River at the Farm Platjesdrift. The corridor crosses the R102 and then the Seekoei River in the vicinity of the farm Geelhoutboom and a small portion of the farm Platjesdrift to the west of Humansdorp. The corridor continues in a northerly direction further traversing the farm Geelhoutboom and across the N2 and some hilly terrain to the north of the highway and Pampoensland River. At the farm Pampoensland River, the Corridor turns in a north-easterly direction crossing the R332 and hilly ground at the farm Honeyville. From this section (around Honeyville farm) up to the area around Rocklands, the three alternatives split and rejoin at various points (described in detail below) along the Corridor. In terms of the major alternatives, Alternative 1 and 3 rejoin at the Elands River Valley. The remainder of the Northern Corridor runs from the Elands River Valley all the way to the end point at Dedisa Substation (also described in detail below).

***Northern Corridor Alternative 1*:** This alternative splits from Alternative 3 in the area of farms Weltevreden and Zuurbron. Alternative 1 traverses the Provincial Road R330 on the farm Weltevreden. It continues through the farm Zuurbron where it crosses the upper reaches of the Kabeljous River. The route alternative then traverses the Gamtoos River Valley in the vicinity of the farms Rooidraai, Bosch Bok Hoek and Spitsbak Estate. It continues in the easterly direction through hilly incised terrain on farms Buffels Hoek and Loerie River where it crosses the Provincial Road R331. The alternative then traverses the area around Loerie Dam and the Loerie Dam Nature Reserve to the north of the town of Loerie, crossing the farms Loerie River, Geelhoutboom Jagersfontein. Most of this portion of the route runs to the south of the boundary of Otterford State Forest and the Longmore State Forest, traversing the Longmore Forest offices, housing and saw mill (the Longmore Forest Station). To the east, the alternative crosses the farms Platberg, Klaarefontein before entering the Longmore State Forest to the north of the Van Stadens River Mountains. The corridor traverses forestry land (plantations) through this section, crossing the Van Stadens River. The alternative exits the Longmore area to the north of Van Stadensberg Natural Heritage Site Nature Reserve through the farm Boschfontein where it reconnects to the Northern Corridor - Thyspunt (HV Yard) to Grassridge alternative 3 (described below).

Northern Corridor Alternative 2 splits from the Northern Corridor - Thyspunt (HV Yard) to Grassridge alternative 3 in the vicinity of farms Klein Rivier, Gamtous Riviers and Wagendrift to the east of Hankey and northeast of the Gamtoos River. The route alternative continues in a north-easterly direction traversing R331 within the farms Klein Rivier, several cement works quarries in the farms Kleinfontein and Limebank as well as the Klein Rivier in the farm Limebank. In the vicinity of the farms Otterford and Hankey Forest Reserve and a small portion of the Stinkhoutberg Nature Reserve, the route curves towards the north-western direction through a very steep area within the Otterford State Forest. It continues north-westerly until it joins the Northern Corridor - Thyspunt (HV Yard) to Grassridge alternative 3 between the Rylstone farms and Hankey Forest Reserve. Almost three quarters of this route alternative falls within the Otterford State Forest.

***Northern Corridor Alternative 3*:** From the farm Weltevreden, the alternative heads in a north-easterly direction crossing Weltevreden dam, over a hilly landscape and then the Provincial Road R330 in the farm Zuurbron and Hankey pass in the farm Zoet Kloof. The alternative crosses several drainage systems including the Gamtoos Rivers southeast of Hankey. To the east of Hankey, the alternative crosses R331 in a hilly area. The alternative then traverses a paved road, several dirt roads and drainage systems in the Klein River Oude Bosch Kloof area and approaches the Otterford State Forest. Further northeast, the alternative crosses a small southern portion of the Stinkhoutberg Nature Reserve and then runs through the rest of the Otterford State Forest, along the MTO firebreaks in a very steep landscape. At the south-eastern boundary of the Stinkhoutberg Nature Reserve, alternative 3 turns in a south-easterly direction, still running along the MTO firebreaks within Otterford State Forest in a very hilly landscape for approximately 3.5km. Alternative 3 then turns in a north-easterly direction and stretches for about 2.7km (traversing a number of drainages in the farm Sand River Heights) then curves to the southeast. Running southeast, the alternative traverses steep landscapes, along the northern boundary of Otterford State Forest and Longmore Forest, to the south of Sandrivier dam, in the Elands River area. The alternative crosses the Bulk River dam in the Bulk River area and continues south-easterly through the Uplands area and Boschfontein. In the vicinity of the farm Boschfontein, the Northern Corridor - Thyspunt (HV Yard) to Grassridge alternative 1 and 3 join.

The Elands River Valley to Dedisa – From the point at which alternative 1 and 3 join, the corridor runs in a north-easterly direction, crossing the farms Boschfontein, Brakkefontein, Ruigtevlei and Burghley Hills through an un-inhabited hilly area to the north of Rocklands. The corridor heads north-eastwards along the eastern boundary of Groendal Wilderness Area, traversing the Elands River valley through the Wincanton Estate, Kruisrivier and Mimosadale West. The Corridor then crosses the Swartkops River in the Kruisrivier area east of Uitenhage, crossing a number of small farms on the valley. The corridor then climbs into uninhabited land to the west and north of Rosedale, turning to the east. The Corridor traverses uninhabited farm land to the north of Uitenhage, crossing a minor roads as well as a Provincial R75 Road, running between Levydale and the Springs Nature Reserve and Resort. To the east of the R75, the corridor then crosses farming land on the farms Sandfontein, Gras Rug, Longwood, Rietheuwel and Papenkuils Vley. The corridor crosses the farm Welbedachsfontein, crossing the R335 provincial road before feeding into the Grassridge Substation.

East of the Grassridge Substation the Northern Corridor (existing Servitude) Grassridge to Dedisa runs eastwards across largely natural thicket vegetation on the farm Brak River, then south-eastwards and finally southwards until it terminates at the Dedisa Substation which is located to the north of the R334 and R102.

It should be noted that a map of the latest corridors has been provided below as certain of the corridors have changed since the start of the EIA phase, and this has implications for whether surface water resources are affected by the Northern Corridor.

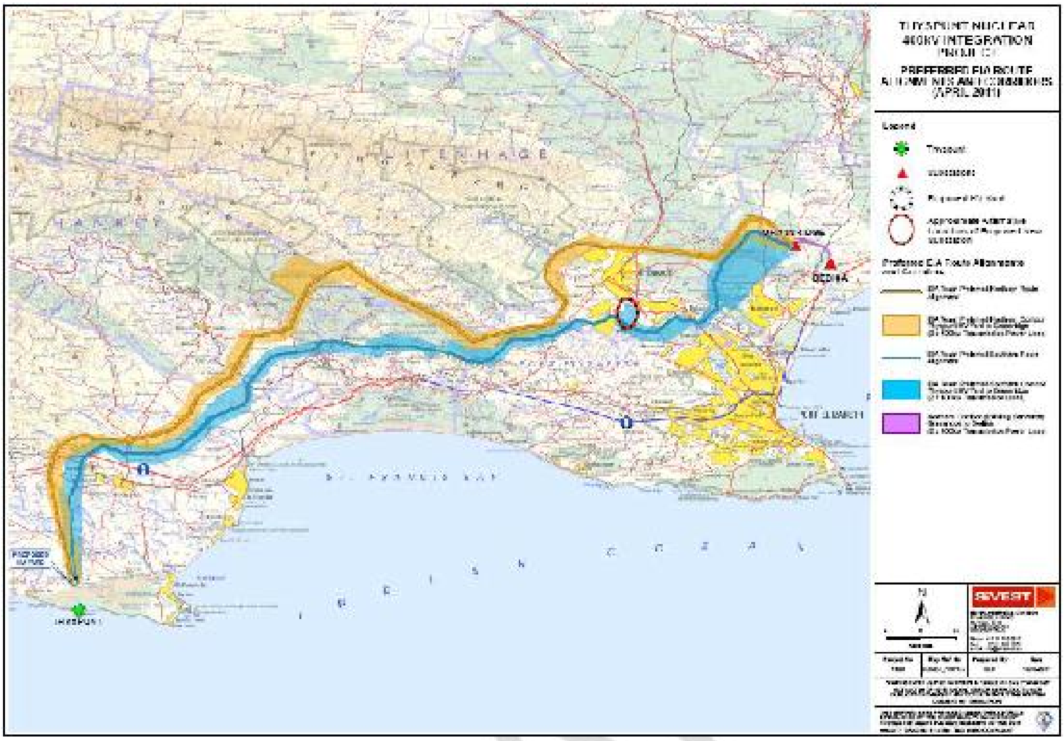

Figure 4 – EIA Team-preferred Routes

1.3 Assumptions and Limitations

This study has focused on the delineation of surface water resources along the respective adapted corridor alternatives. A full delineation and mapping of all surface water resources in the wider area has, therefore, not been undertaken.

Due to the scale of the project and budgetary constraints, an accurate and detailed field delineation of every surface water resource within the proposed alternative corridors has not been undertaken. Rather, a broad (desktop) level delineation exercise was undertaken to identify every surface water resource identified in each alternative at a desktop level. From this point, prioritised surface water resources (or "surface water hotspots") selected on the basis of certain criteria (see Section 2.1), that were likely to be affected by the placement of any powerline pylons were investigated in-field using the Department of Water Affairs (DWA), formerly known as the Department of Water Affairs and Forestry (DWAF), guidelines for the delineation of wetlands (DWAF, 2005). These guidelines subsequently cover rivers and streams in addition to wetlands encompassing the broader spectrum of surface water resources as defined in this report. Importantly, these guidelines were used as a general base from which to assess identified surface water resources. Once more, detailed delineations at ground level were not conducted except in a number of wetlands marked for further investigation.

1.4 Legislative Context

The National Water Act 36 of 1998 was created in order to ensure the protection and sustainable use of water resources in South Africa. The Act recognises that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users. Bearing these principles in mind there are a number of stipulations of the Act that are relevant to the potential impacts on surface water resources that may be associated with the proposed power lines. These stipulations are explored below and are discussed in the context of the proposed development.

It is important to note that water resources, including wetlands are protected under the National Water Act 36 of 1998 (NWA). Wetlands are defined as water resources under the Act. 'Protection' of a water resource, as defined in the Act entails:

- Maintenance of the quality of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource
- The rehabilitation of the water resource

In the context of the proposed powerlines and the identification of potential impacts on surface water resources in the construction, operation and decommissioning phase of the proposed development, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)-

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body, for example the excavation of a wetland or changes to the morphology of a water body can be considered to be pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to (inter alia):

- cease, modify, or control any act or process causing the pollution
- comply with any prescribed waste standard or management practice
- contain or prevent the movement of pollutants
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse

This stipulation has implications for the measures that will need to be identified to mitigate potential polluting impacts on surface water resources associated with the project.

Lastly, under section 21 of the Act, 'water use' is defined inter alia, as:
(a) taking water from a water resource;
(c) impeding or diverting the flow of water in a watercourse;
(i) altering the bed, banks, course or characteristics of a watercourse;

If the above activities occur as part of the construction, operation and decommissioning of the proposed Transmission power line, they will need to be licensed under the NWA, as water use is licensable under the Act.

The above stipulations of the Act have implications for the construction and operation of the proposed powerlines in the context of surface water resources and wetlands. Accordingly, the potential impacts of the proposed development on surface water resources have been scoped and identified in the impact section (section 5) of this report.

2 METHODOLOGY

2.1 Desktop Delineation of Wetlands

During the scoping phase, the presence of surface water drainage across the Northern Corridor was identified using GIS Spatial Analyst software, which was used to generate a spatial drainage layer based on a digital terrain model for the area. However, this approach contained data limitations in terms of identifying every wetland along the proposed alternative alignments and hence some wetlands were overlooked. Additionally, alternative routes that have been incorporated into the current proposed alignment of the Northern Corridor have not been previously identified and assessed. Hence, a more accurate delineation of the surface water resources in the current proposed Northern Corridor alternatives was undertaken in the EIA phase.

The first step desktop delineation process was to conduct a preliminary desktop analysis of the study area using available information. Primarily, this was undertaken using Geographic Information Software (GIS). The software ArcView (version 9.3) developed by ESRI was used. The basis of available digital information on wetlands was based on the RSA wetlands national database 2010. The use of colour satellite imagery as well as black and white aerial photography supplemented as additional data and information sources. A systematic approach was adopted whereby surface water features and drainage lines were delineated within the alternative corridors by means of remote sensing techniques undertaken at a desktop level.

On colour satellite imagery, wetland vegetation appears as a different hue (being darker or different in colour) than the grassy vegetation in the surrounding non-wetland grasslands, thus allowing wetland vegetation to be demarcated. The occurrence of wetland vegetation apparent on the images was primarily used to mark the boundaries of the wetlands. On colour satellite imagery, soil colour can additionally be used as a further means of delineating wetland boundaries through remote sensing, especially where agricultural activities have transformed the natural vegetation within the wetlands and within the surrounding wetland catchment. Wetland soil colours are often 'greyer' in hue, reflecting the gleyed soils that typically occur within wetlands. These can be differentiated from the orange / brown / yellow and more oxidised non-wetland soils that exist outside of the wetland. Lastly, rivers and other surface water features (such as man made impoundments or dams) can easily be identified with colour satellite imagery. A GIS shapefile was created to represent the boundaries of the delineated wetlands at a desktop level. The specific hydrogeomorphic wetland was also identified and entered into the shapefile attribute table.

Once all surface water resources were delineated, wetlands that may be affected by the proposed power lines were prioritised and identified as wetland "hotspots" on the basis of several criteria. The range of criteria includes the following:

- A conservation value associated with a particular surface water feature; this may include the presence of threatened flora and fauna. This may also include the surface water resource being important for the maintenance of ecological processes or functioning; e.g. if the surface water resource is important for the sustaining of a certain part of the life cycle of a species, or for certain aspects of behaviour – e.g. being a habitat for bird roosting or feeding.
- Related to the above, the surface water feature being a unique or rare type of surface water feature, or that supports a unique ecosystem, especially in the

context of the study area (e.g. pan / depression wetlands which are uncommon in the context of the study area)

- Hydrological value; i.e. importance of the surface water feature(s) for maintenance of stream flow, or for flood control
- Extensive size of the surface water feature which would entail that it would be very difficult for the surface water feature to be 'spanned' by the proposed powerlines, thus making it likely that towers would need to be located within the surface water feature if the power lines were to traverse this part of the corridor.

Having identified the wetland "hotspots", the imagery served a basis from which to identify, delineate and assess prioritised surface water resources utilising the field based wetland assessment technique (outlined in section 2.2 below). Conclusively, all prevailing surface water resources that were desktop delineated according to the consulted databases and by means of using remote sensing techniques were easily mapped and highlighted exclusively within the alternatives of the Northern Corridor.

2.2 Field-based Wetland Delineation and Assessment Techniques

The prioritised wetlands that were identified, assessed and delineated in-field were based primarily on soil wetness indicators. For an area to be considered a wetland, redoximorphic features must be present within the upper 50cm of the soil profile (Collins, 2005). Redoximorphic features are the result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils alternate between aerobic (oxygenated) and anaerobic (oxygen less) conditions over a suitably long enough period. Only once soils within 50cm of the surface display these redoximorphic features can the soils be considered to be hydric soils, and thereby belonging to a wetland. Redoximorphic features typically occur in three types (Collins, 2005):

- A reduced matrix - i.e. an in situ low chroma (soil colour), resulting from the absence of Fe3+ ions which are characterised by "grey" colours of the soil matrix.
- Redox depletions - the "grey" (low chroma) bodies within the soil where Fe/Mn oxides have been stripped from the soil particles resulting in iron depletions.
- Redox concentrations - Concentrated accumulations of iron and manganese oxides (also called mottles). These can occur as:

i) Concretions - harder, regular shaped bodies;

ii) Mottles - soft bodies of varying size, mostly within the matrix, with variable shape appearing as blotches or spots of high chroma colours;

iii) Pore linings - zones of accumulation that may be either coatings on a pore surface, or impregnations of the matrix adjacent to the pore. They are recognized as high chroma colours that follow the route of plant roots, and are also referred to as oxidised rhizospheres.

According to the DWAF guidelines for the delineation of wetlands (DWAF, 2005), soil wetness indicators (i.e. identification of redoximorphic features) are the most important indicator of wetland occurrence. This is mainly due to the fact that soil wetness indicators remain in wetland soils, even if they are degraded or desiccated. It is important to note that the presence or absence of redoximorphic features within the upper 50cm of the soil profile alone is sufficient to identify the soil as being hydric or non-hydric (non-wetland soil) (Collins, 2005).

The potential occurrence / non-occurrence of wetlands and wetland (hydric) soils along the proposed routings have been assessed according to the method contained within the DWAF guideline, “A practical field procedure for the identification and delineation of wetlands and riparian areas” (DWAF, 2005). Three other indicators (vegetation, soil form and terrain unit) were used in combination with soil wetness indicators to supplement wetland findings. Where soil wetness and/or soil form could not be identified, information and professional judgment was exercised using the other indicators to determine what area would represent the outer edge of the wetland.

In the actual delineation and assessment process, soil samples were drawn using a soil augur at depths between 0.50-1.5 metres in the soil profile to determine the soil types associated with the particular wetland and to generally establish where the outer edge of the wetland is located. The outer edge of the temporary zone (where present) will also usually constitute the full extent of the wetland, encompassing inner-lying, more saturated zones. Points were then recorded at these locations along the length of the wetland for each identified wetland zone. A conventional handheld Global Positioning System (GPS) was used to record the points taken in the field. The GPS points were then imported into a GIS system to map the identified zones. The GPS is expected to be accurate up to 5 metres.

Depending on the type of land use or development proposed, an appropriate buffer zone to protect the wetland should also be delineated (DWAF, 2005). Buffer zones are typically required to ensure that the ecotones between aquatic and terrestrial environments are protected. Ecotones are transitions in the landscape between two environments. Ecotones are ecologically significant especially for species that utilise contrasting habitats for different stages of their lifecycle. In this context, buffer zones are necessary where developments transform the landscape from the natural state. At present there are no official requirements for buffer zones in the Eastern Cape Province. In the case of power transmission lines, no physical continuous boundary will be established disrupting the transition from terrestrial landscape to aquatic environment and will therefore, not impact greatly on the habitat and movement in particular of species in and out of wetlands. The anticipated impacts for the proposed development relate primarily to the construction phase. Hence, at this stage of the assessment, the establishment of a wetland buffer is not deemed necessary. Should the need for buffers be required for wetlands investigated in the final surface water walk down assessment, these can be implemented for good reason at the discretion of the wetland specialist appointed to undertaken this task.

3 FINDINGS OF ASSESSMENT

3.1 Wetland Occurrence along the Northern Corridor and alternative sections

All the surface water features identified, assessed and delineated at the desktop level in the Northern Corridor with respect to all of the proposed alternatives are depicted in the figures below. It should be noted that the descriptions below refer to the corridor and alternatives at the start of the EIA phase. Maps of the delineated wetlands are to be found in Appendix C.

3.1.1 Thyspunt HV Yard to Gamtoos Valley

The start of the Northern Corridor (north from the Thyspunt HV Yard) is characterised by slightly undulating terrain. The surface water features in this area chiefly comprise of depression wetlands along seep lines and man-made impoundments located in and amongst the agricultural fields of the broader landscape. To the north of the HV Yard the corridor crosses a wide valley bottom located to the north which is constrained by a low but prominent ridge to the south of the Krom River valley. This wetland is relatively wide and may be problematic for the spanning of the proposed transmission lines as described in more detail below. Significantly, the Northern Corridor crosses the Krom River, Geelhoutboom River and Seekoei River along this section. These river valleys are highly incised, and are unlikely to contain extensive wetland habitat within them, only having narrow channelled valley bottom wetland habitat that is dominated by palmiet (*Prionium serratum*). Ephemeral drainage lines occur on the side slopes of the valleys.

Figure 5 – Palmiet (*Prionium serratum*) dominated valley bottom of the Geelhoutboom River

Where the Northern Corridor diverts to the north east, the topography reaches an altitude of approximately 400m.a.s.l as the corridor crosses the hills just to the north of Humansdorp. The corridor runs across incised terrain to the north-east of the town crossing a number of highly incised valleys in which ephemeral drainage lines run. The Rondebos and Diep Rivers that flow to the south-east are the major rivers in this area. These rivers are characterised by narrow valley bottoms with riparian vegetation and some wetland vegetation within them. Before reaching the edge of the Gamtoos River Valley the corridor traverses the upper catchment of the Kabeljous River over relatively flat terrain.

Figure 6 – A valley head seep leading down to the Rondebos River valley bottom north of Humansdorp

The western slopes of the Gamtoos Valley are very steep and the drop from the western plateau into the valley consisting of a series of deeply incised smaller valleys in which a dense network of ephemeral drainage lines are located.

Agricultural fields have completely transformed the valley; these line the banks either side of the Gamtoos which is likely to have historically (naturally) been a wide floodplain wetland.

3.1.2 Northern Corridor – Alternative 1

Please refer to the route description in the section above for the sections of the rest of the Northern Corridor which link to this alternative.

Alternative 1 of the Northern Corridor splits from Alternative 3 to the east of the Hankey Pass. This part of the alternative crosses the upper part of the Kabeljous River catchment over relatively flat terrain. Just west of the lip of the Gamtoos Valley the corridor crosses a shallow valley in which the associated wetland area can be described as a channelled valley bottom system, a relatively uncommon wetland type in the context of the study area. The alternative then descends into rugged, hilly and steep terrain on the western slopes of the Gamtoos Valley before meeting the Gamtoos River. A number of deeply incised drainage lines feed into the Gamtoos valley bottom in this area. The section of the Gamtoos Valley crossed by the Corridor is relatively narrow. The Gamtoos meanders here with its outer bend slowly eroding away the steep western side of the valley. Over thousands of years, fertile alluvial material was deposited on the inner bend and this area is now intensively cultivated. This valley bottom area of the river is likely to have naturally been a floodplain wetland, being periodically flooded.

From this point, the valley bottom ascends into a hilly and mountainous area on the eastern slopes of the valley containing a high density of drainage lines. The corridor traverses similar terrain characterised by thicket vegetation east of the Gamtoos crossing a number of steeply incised drainage lines that drain southwards. East of the R331 road an elaborate drainage network exists in the upper catchment of the Geelhoutboom River. The alternative incorporates one of the largest impoundments in the study area, the Loerie Dam, which is fed by the steep-sided valleys of the Loeriespruit and the Berg River (draining from the east). Riverine forest exists along both river systems. East of the dam the corridor runs parallel to the deep Berg River valley with its similarly incised tributaries draining north from the Longmore Forest.

East of the Longmore Forest Station the alternative crosses a deep gorge at the head of the Berg River catchment. The terrain to the south is much flatter, but the presence of intensive cultivation is likely to have transformed any naturally-occurring wetlands in this area. Beyond this area, the terrain becomes more mountainous in the Longmore Forest region in which the corridor incorporates the peaks of the Van Stadens Mountains. Perennially-flowing rivers drain the afforested mountain slopes and the corridor runs parallel to a relatively wide valley which feeds into the Van Stadens River which has cut a deep valley through the mountains. The corridor crosses the valley between the two Van Stadens Dams. Rivers and streams characterised by riparian vegetation such as Cape Chestnut (*Calodendrum capense*) rather than classical wetlands exist in this part of the route. As it exits the Longmore Forest Area before re-joining Alternative 3, Alternative 1 crosses the upper parts of the Brak River catchment. The main river channel itself is highly invaded by alien vegetation.

3.1.3 Northern Corridor – Alternative 2

Please refer to the route description in the section above for the sections of Alternative 3 and the rest of the Northern Corridor which link to this alternative.

Alternative 2 deviates from Alternative 3 a short distance from the Gamtoos River to the south east of Hankey. Being in close proximity to Alternative 3, Alternative 2 is similarly characterised by very hilly and mountainous terrain where hillslope seepages and ephemeral drainage lines enter into narrow valley bottom streams. The density of first order drainage lines in the part of the corridor which crosses the R330 east of Hankey here is intense. Drainage lines rather than wetlands therefore dominate the surface water features of this corridor.

The Klein River courses through the corridor, running through a very incised valley where extensive quarrying operations have degraded the area. The corridor then crosses highly mountainous terrain, crossing into the Otterford Forest area where plantations of exotic trees have been planted on the steep mountain slopes. The corridor crosses a series of first order stream valleys as it skirts the Stinkhoutberg Nature Reserve before rejoining with Alternative 3.

3.1.4 Northern Corridor – Alternative 3

On the eastern side of the river near Hankey, the topography rises once again and becomes very hilly, mountainous and steep where ephemeral and seasonal drainage lines and hillslope seepages were identified and delineated. These eventually lead into the low-lying streams/rivers that course through the terrain. The corridor (Alternative 3) crosses the Klein River Valley (a tributary of the Gamtoos). Like the larger Gamtoos Valley, the Klein River valley bottom is completely transformed by agriculture. North-east of the Klein valley, the corridor crosses into the Stinkhoutberg Nature Reserve, a highly mountainous area of natural thicket vegetation and forest vegetation in the valleys. The steepness of the terrain precludes any wetlands except for hillslope seepage wetlands. From this point, Alternative 3 enters into the Otterford (Longmore) State Forest. This area is characterised by the occurrence of pine plantations on the slopes and the ridge tops, although a good effort has been made to clear exotic and alien vegetation in the valley lines, leaving the natural riparian vegetation to recolonise the riparian zones. Alternative 3 of the Northern Corridor then diverts to the south east bisecting the watershed between the Klein and Elands Rivers. The terrain through this section is highly mountainous and drainage lines rather than wetlands occur. The corridor runs across the upper part of the small Sand River catchment (a tributary of the Elands River to the north) through similarly mountainous terrain.

Figure 7 – The river draining through the Heuningkloof to the north-east of Hankey. Note the riparian vegetation

Running south-east of the Sand River catchment, the corridor runs parallel to the southern ridge of the Elands River Valley. This section of Alternative 3 crosses several streams and river systems, many of which are tertiary and lower order streams in the river valleys and higher order drainage on the incised slopes. The terrain here is slightly less rugged, although, many ephemeral drainage lines and a few hillslope seepages generally make up the surface water features along this part of the alternative. A relatively large man-made impoundment (Bulk River Dam) stretches across the corridor in the steep Bulk River Valley, the primary river into which most surface runoff in this section of the corridor drains. . This part of the Alternative 3 follows along the boundary of, and partly crosses into the Longmore Forest located to the south. South-east of the dam, the corridor narrows and runs along the north-facing slopes of the Elands River Valley. The first-order streams and springs at the base of this southern ridge of the valley are important from a water supply perspective as many of the farmsteads in this area derive their water supply from these features.

Figure 8 – A stream in the northern part of the Longmore Forest

3.1.5 The Elands River Valley to Dedisa Substation

The remaining section of the Northern Corridor turns to cross the Elands River Valley west of Rocklands and enters an area of incised (mostly natural) terrain characterised by thicket vegetation, The ephemeral drainage lines in rocky rugged terrain feed into the lower Elands River. The nature of the soils and terrain largely preclude the existence of wetlands.

The corridor crosses the Elands River at Mimosadale. The Elands River valley is highly infested with exotic trees, especially eucalyptus. These trees have replaced the natural riparian vegetation. To the north the terrain flattens out and allows the cultivation of crops. The Elands River is thus highly transformed by cultivation until its confluence with the Swartkops River at Kruisrivier. Similarly to the south, the more rugged terrain in the surrounding foothills is drained by ephemeral drainage lines.

The Swartkops River, as it exits the Groot-Winterhoekberg mountain range at the eastern end of the Groendal Wilderness, opens up into a wide valley. The valley has been highly degraded by sand mining activities which have been established to mine the fluvial material that is deposited as the valley changes to a wider profile. The river system was likely to have been a wide valley bottom or even floodplain system, but very little natural wetland or riparian habitat remains.

The corridor climbs once again into hilly ground in the north-west of the outskirts of Uitenhage. At this point, there are several drainage lines which cut into the steep and hilly landscape of the foothills of the Groot-Winterhoek mountain range. The terrain north of Uitenhage is similarly hilly, characterised mainly by natural thicket vegetation with ephemeral drainage lines.

East of the R75 road the terrain changes slightly to become more undulating with isolated koppies. Mid-way through this final section of the corridor, the Coega River cuts diagonally across the corridor. The banks of this river accommodate agricultural fields either side. This river has suffered greatly from the recent drought, not having flowed for a number of years. The river bed has also been highly invaded by alien invasive vegetation. The thicket vegetation continues to Grassridge. The narrow servitude between Grassridge and Dedisa crosses the Brak River. The incised nature of the river and the presence of calcrete which outcrops at the surface prevent the formation of hydric soils along this section of the corridor. . In general, very few surface water features appear along the final part of the alternative. From a desktop level, valley bottom wetlands, a few man-made impoundments and drainage lines generally characterise this section.

Figure 9 – An ephemeral drainage line near the Dedisa Substation

3.2 Wetland Occurrence as it relates to Soils and Topography

Broader climatic controls influence the external dynamics of wetlands in terms of rainfall, temperatures and air pressure. Climatic controls ultimately represent the drivers of wetlands. The topography, geology and soils of the landscape, on the other hand, influence the drainage characteristics of a region, contributing to the type of wetlands / drainage that arise from the prevailing environment. When considering the underlying physical characteristics of a wetland, these three factors together can be said to represent the wetland template. Hence, the position of a wetland in the landscape, the underlying geology and type of soils help to give an indication of the drainage characteristics of a wetland. Fortunately, data is available that can assist with identifying these characteristics in the landscape (ENPAT). Utilising this data in conjunction with in-field sampling, one is able to understand the dynamics of the wetlands encountered along the various alternatives of the Northern Corridor.

Climate in the broader study area has a mild oceanic climate and lies between the summer and winter rainfall regions of South Africa. The study area receives moderate rainfall all year and has a Mean Annual Precipitation (MAP) of approximately 630 mm per year with an average of 9 rainfall days per month. A comparison between the Port Elizabeth, Jeffrey's Bay and Uitenhage areas indicates that precipitation and temperature do not vary significantly over the study area (see the tables below). Rainfall does however tend to decrease in a north-easterly direction and. as one moves inland). Winters are generally mild and summers are warm but considerably less humid and hot than the northern parts of the South African Coast. Average daily temperatures range from 25°C in summer to 20°C in winter. Average night time temperatures drop to around 8°C during winter.

Table 1: Mean monthly precipitation and daily maximum and minimum temperatures for Port Elizabeth (SAWS, 2010).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (mm)	36	40	54	58	59	62	47	64	62	59	49	34	**624**
Average Daily Maximum (°C)	25	25	25	23	22	20	20	20	20	21	22	24	**22**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Daily Minimum (°C)	18	18	17	14	12	9	9	10	11	13	15	16	**14**

Table 2: Mean monthly precipitation and daily maximum and minimum temperatures for Jeffrey's Bay (SA-Explorer, 2010).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (mm)	36	37	49	54	55	51	56	64	69	69	52	40	**631**
Average Daily Maximum (°C)	24	25	24	23	21	20	19	19	19	20	22	23	**22**
Average Daily Minimum (°C)	16	15	15	13	11	9	8	9	10	12	13	15	**14**

Table 3: Mean monthly precipitation and daily maximum and minimum temperatures for Uitenhage (SA-Explorer, 2010).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (mm)	23	29	40	34	19	17	19	23	29	38	33	27	**331**
Average Daily Maximum (°C)	27	27	26	24	22	20	20	21	21	22	24	26	**23**
Average Daily Minimum (°C)	16	16	15	13	10	7	7	8	10	12	13	15	**12**

In the context of the Study Area, climate is relatively uniform as discussed above, although rainfall varies across the study area. Despite this, topography and lithology are important drivers of drainage and in particular wetland occurrence in the area. Owing to its extent, there are many different types of landscape in the study area, from very flat coastal plains to steep mountain slopes. The study area also has a complex matrix of underlying geology, which in turn affects soils type. Soil type and near surface lithology has a very important effect on the potential occurrence of hydric (wetland) soils. The following section examines the topography and the soil type occurrence and relates these to the occurrence of wetlands across the study area.

3.2.1 Topography

As can be seen in Figure 4 above, drainage typology is spatially differentiated across the area. A basic distinction can be made between wetlands (where they occur) and drainage lines or rivers. Classical palustrine-type wetlands (marshes, depressions and valley bottom wetlands) occur patchily across the area and only in certain locations. These areas typically share one joint topographical characteristic; they are typically areas of flat to undulating topography. This type of topography is conducive to the formation and development of wetlands, allowing water to move slowly, with the resultant deposition of sediment and occurrence of wetland vegetation which further inhibits the flow of water through these systems. These areas are scattered across the study area and include:

- The area between the Thyspunt HV Yard and the Krom River
- The area to the north-east of Humansdorp
- The plateau to the west of the Gamtoos River Valley

Problematically for wetland protection, these 'flatter' parts of the study area are highly suitable for crop cultivation and it is expected that many wetlands have been significantly transformed by cultivation and drainage in the above areas and within the wide river valleys such as that of the Gamtoos. Wetland occurrence is not as simplistic as this however, and other factors such as sub-surface lithology can have a greater bearing on drainage typology. As an example, the relative scarcity of wetlands in the eastern part of the study area between Uitenhage and Grassridge is a good example. In this area the nature of the substrate is a limiting factor to wetland occurrence.

The occurrence of hydric soils is more widespread, and these can occur along drainage systems in mountainous areas, as explored in the in-field wetland assessment section below. Certain parts of the study area however have no wetland occurrence, for example in the hilly area east of the Gamtoos River valley. Steep topography and rocky substrate are a limitation to wetland development, and drainage typically occurs in the form of ephemeral drainage lines.

3.2.2 *Soils and Land types*

The underlying predominant soils and land types as they occur across the Northern Corridor are displayed in the figures below.

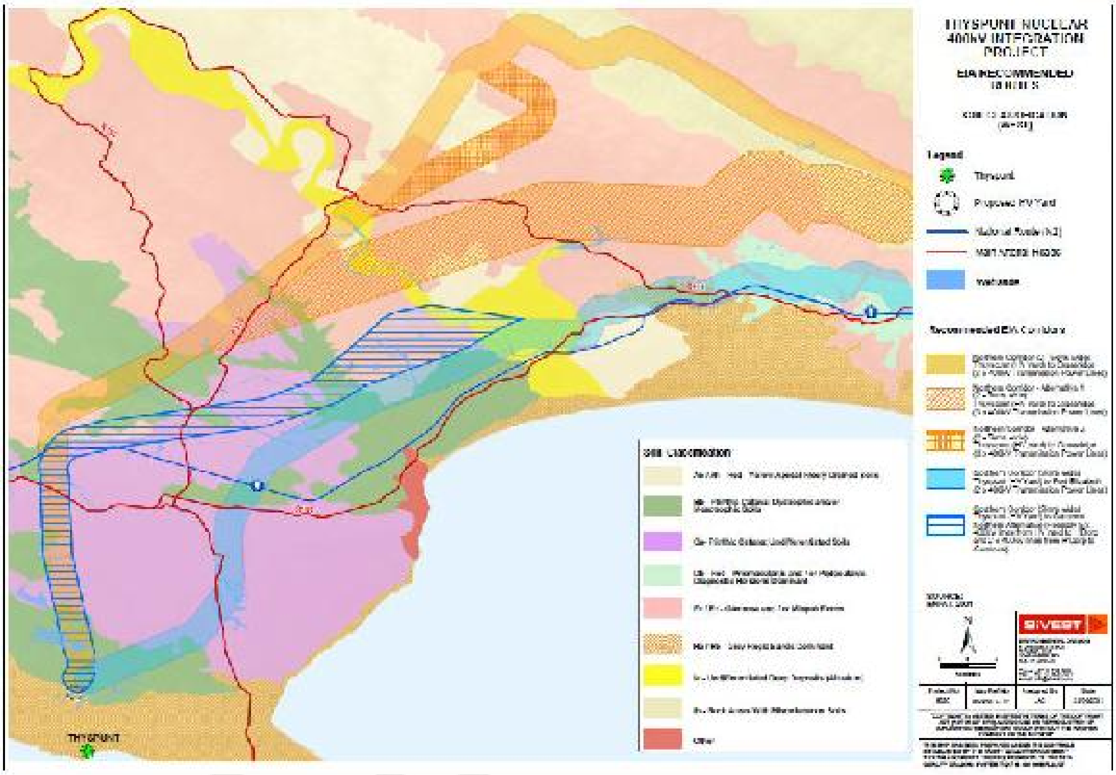

Figure 10 – Predominant Soils and Land types in the western part of the study area

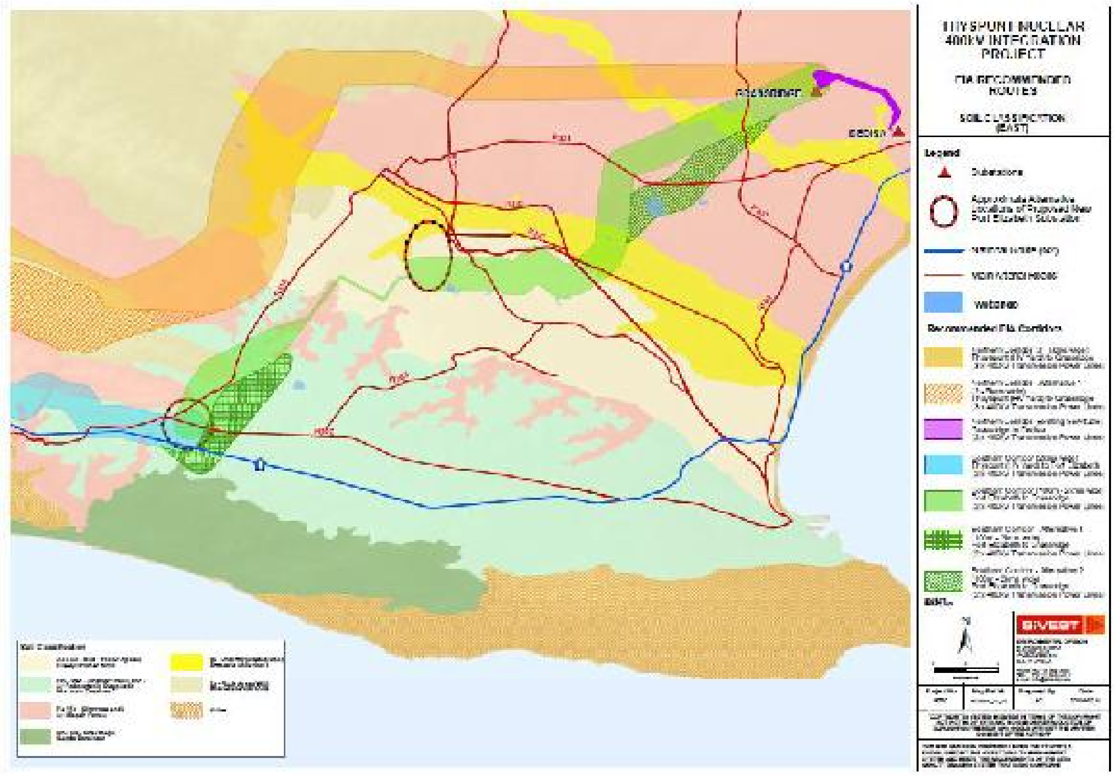

Figure 11 – Soils and land types in the eastern part of the study area

The first part of the Corridor between the HV Yard and the Krom River Valley is characterised by dystrophic/mesotrophic, apedal soils with plinthic subsoils that are derived from Quartzitic sandstone or Shale and sandstone. These types of parent material act as a source for the overlying substrate which is predominantly characterised by a plinthic catena. Plinthic soils typically express accumulations of iron and manganese oxides under conditions of a fluctuating water table which gives rise to distinct reddish brown, yellowish brown and/or black mottles with or without hardening to form sesquioxide concretions (SCWG, 1991). The presence of dystrophic and mesotrophic characteristics in the soils is important in a context of hydric soils; these soils have experienced marked leaching, i.e. the movement of water through the soil profile has caused the removal of soil material (often minerals) through solution (eluviation). Leached soils are typical grey in colour, as the minerals which give the soils their colour have been stripped out of the soil, leaving soil with a whitish / grey colour which is the colour of soil particles. Leached soils are often found in wetlands, with an "E" horizon (a soil horizon that has undergone significant leaching) being characteristic and indicative of soil saturation and thus hydric soils.

Additionally the presence of plinthic subsoils is very important from a wetland occurrence perspective. Many wetland soil types display plinthic characteristics. Plinthic soil horizons are often associated with the presence of perched water tables, and a ‘hard plinthic’ horizon at relatively shallow depth in the profile which is impermeable can result in the formation of hydric soils above it as the water in the soil cannot drain down into the profile, resulting in the overlying soils becoming waterlogged and saturated. The presence of plinthic characteristics on their own is often indicative of periodic saturation and development of anaerobic conditions associated with hydric soils.

The presence of this land type and its predominant soils would suggest that wetlands and hydric soils are relatively common in this part of the study area. This is borne out by the presence of a wide valley bottom wetland just to the south of the Krom River Valley which has been assessed in more detail in the section below. \

Soils forming part of this broad land type (Bb) are found in other parts of the study area and along the Northern Corridor; the area to the north-east of Humansdorp in the upper catchment of the Rondebos River, as well as in the upper catchment of the Kabeljous River to the west of the Gamtoos River Valley. In the latter example a valley bottom wetland occurs in the relatively shallow valley of the upper part of the Kabeljous River where hydric soils were found to occur. This demonstrates that wetlands and hydric soils are relatively common in this land type.

The Ca land type is dominant in other western parts of the study area, including the area south-west and north-east of Humansdorp and west of the Gamtoos Valley in the vicinity of the R330 road to Hankey. This land type is similar to the Bb land type in that it is characterised by the presence of plinthic catenas, but is not characterised by the presence of leaching within the soil profiles. As explained above the presence of plinthic catenas is likely to be associated with hydric soils. This factor would seem to explain the relatively common occurrence of wetlands in the area to the north of Humansdorp in the Zwartenbosch area.

To the contrary, large parts of the Northern Corridor are underlain by dominant soil types which are not typically associated with wetland occurrence. The “Fa” and “Fc” land types are characterised by shallow soils in which the Mispah or Glenrosa soil forms predominate. The Mispah soil form consists of a topsoil horizon underlain by bedrock, whereas the Glenrosa soil horizon consists of top soil underlain by a lithocutanic B horizon that is derived from and which is very similar to the underlying bedrock. Neither of these soils are wetland soil forms, and thus wetlands (hydric soils) are unlikely to be common in these areas. Large areas within the corridor are underlain by Fa and Fc land types, as well as the Ib land type where outcropping rocks makes up >60% of the land type. These land types occur extensively east of the Gamtoos River (in the areas of hilly, rugged terrain), and the Longmore Forest area is made up almost exclusively of these land types. The similarly rugged, hilly area along the Wincanton Road falls within the Fa land type and almost the entire length of the corridor east of Uitenhage (with the exception of the Coega River valley) falls within the Fc land type. The predominance of the Fc land type (along with the presence of calcrete that is present within the shallow lithology) in the area to the east of Uitenhage is an important factor in the relative scarcity of wetlands and hydric soils in this area. As indicated in the findings section below, the dominance of these soil forms in these parts of the study area does not necessarily completely preclude the existence of hydric soils and wetland habitat, but these are much less likely to be common.

Figure 12 – Hilly incised terrain in the Wincanton area. The topography and lithology are not suited for the development of wetlands and ephemeral drainage lines exist in the valley bottoms

Lastly, the larger river valleys in the area are typically characterised by deep, undifferentiated alluvial deposits. Alluvium is not necessarily associated with hydromorphism in soils, as alluvial deposits are young and hydromorphism within the soils may not necessarily have formed. Under natural conditions the seasonal flooding of these river valleys by spate flow events within the river system is likely to have allowed the development of wetland habitat within the areas adjacent to the river channels. As explained above, extensive cultivation in these areas has almost completely transformed any naturally-occurring wetland habitat within these river systems.

3.3 Comparative Assessment of Alternative Routes

A comparative assessment of the various alternatives was undertaken to ascertain the most environmentally suitable route associated with the least potential impact from a surface water resource perspective. Three alternative routes were assessed – these all occur within the Longmore section of the Corridor. Alternative 3 is the longest alternative within this part of the Corridor whilst Alternative 1 is the second longest. Alternative 2 however, only constitutes a smaller sub-alternative from Alternative 3. Importantly, the alternatives are only assessed where the respective alternatives branch off from one another and then rejoin. In other words, the first comparative assessment is between the alternative route for the Longmore Forest Northern Firebreak (Alternative 3) against the Longmore Forest Southern Firebreak (Alternative 1). The second comparative assessment is between the section of Alternative 3 near Hankey that extends into the Otterford State Forest and the relevant section of Alternative 2.

Each assessment is based on accounting for the number and presence of surface water features, the presence of sensitive biodiversity features, wetlands that are too wide to be spanned and any fatal flaws.

3.3.1 Comparative Assessment between Alternative 3 (Northern Longmore Firebreak Alternative) and Alternative 1 (Southern Longmore Firebreak Alternative)

Each alternative contains similar types of surface water resources including numerous rivers, seasonal and ephemeral drainage lines, a number of small man-made impoundments and a few channelled valley bottom wetlands No fatal flaws were identified for each of the comparatively assessed alternatives (Table 9). None of the alternatives have been identified to contain any wetlands that are too wide to be spanned, and this is greatly assisted by the incised and mountainous nature of the terrain across most of the Longmore Area.

In terms of biodiversity sensitive features, Alternative 2 traverses rivers and streams that contain suitable habitat for the *** Ghost Frog. For this reason and others, Alternative 3 was preferred from a biodiversity perspective. However with careful implementation of mitigation measures impacts on sensitive biodiversity features can be avoided. From a surface water perspective none of the routes is preferred and either could be developed without resulting in environmental impacts.

3.3.2 Comparative Assessment between a section of Alternative 3 (near Hankey to Otterford Forest) and Alternative 2 (near Hankey to Otterford Forest)

North-east from the Gamtoos River where the two alternatives split from one another, the section of Alternative 3 from the south east of Hankey stretching up to the Otterford State Forest does not contain any wetlands, containing only rivers as well as ephemeral and seasonal drainage lines.

Alternative 2 similarly contains a number of rivers as well as ephemeral and seasonal drainage but no wetlands. The absence of wetlands is due to the highly mountainous and steep terrain and absence of suitable soils. .

For this reason none of these 2 alternatives are preferred. From a conservation perspective Alternative 3 traverses the Stinkhoutberg Nature Reserve and it would thus be preferable to avoid it by taking Alternative 2. However neither will have a greater impact on surface water features as all of the drainage lines and rivers will be able to be spanned.

4 IN-FIELD ASSESSMENT OF SURFACE WATER FEATURES ALONG THE NORTHERN CORRIDOR

The findings of the in-field wetland assessment are based on a sample of wetlands that were identified above in the various alternative corridors. Primarily, the wetlands investigated in the field were limited to prioritised wetlands. The results are presented below.

4.1 Valley Bottom Wetland south of the Krom River

A valley bottom wetland system located to the west of the Humansdorp-Oyster Bay unsurfaced road was identified as a prioritised wetland due to potential issues with spanning the wetland, due to the wetland's width as delineated by desktop means. The wetland stretches across the width of the combined Southern and Northern Corridors in the part of the route where both corridors are proposed to run within the same corridor; the wetland is thus potentially crossed by all five proposed powerlines. The wetland was identified to be a channelled valley bottom wetland; it forms the upper-most parts of an eastward draining system that drains a small catchment that lies between two low ridges in the vicinity of the corridor. The system feeds into another wetland system emanating from the south-east before draining into the Krom River valley. The wetland tapers to a relatively narrow valley bottom as it is crossed by the Humansdorp – Oyster Bay road, but to the west (within the corridor), it is substantially wider, hence the potential spanning issues.

Field investigations were undertaken to determine the likely extend (width) of the wetland. A number of points were sampled across the wetland; a soil auger was used to examine the soils at sample points for signs of hydromorphism as described in the methodology section above. A rough transect across the wetland (from north to south) was walked and sampled at intervals (determined by any changes in micro-topography and vegetation) to determine the likely distribution of hydric soils

Soils in the wetland were generally found to be sandy in character. The dominant soil colour at all sample points was grey. Soils varied from light grey (likely leached) soils to a much darker grey that was encountered in the channel of the main valley bottom. Soils that were found to be non-hydric (i.e. out of the wetland) were a uniform grey to a depth of about 75-90cm to which the sample was taken. There were no signs of hydromorphism in the form of iron mottling or the presence of an E horizon (a distinctly leached horizon below the subsoil that was a grade lighter than the overlying soils). Where signs of hydromorphism were encountered, in most cases these were faint iron mottling in less saturated parts of the wetland to more extensive iron mottling in darker soils within the valley bottom. In one case close to the boundary of the wetland as delineated, an E horizon was encountered. The sample points where hydric and non-hydric soils were encountered varied across the wetland, but appeared to correspond very well to areas of darker hue (for wetland soils), and areas of areas of lighter hue (for non-wetland soils) on satellite imagery of the wetland.

Figure 13 – Soils taken from one of the sample points showing the difference between an Orthic A horizon and an E horizon (lighter colour)

Figure 14 – Highly clayey soils from within the valley bottom in the northern part of the wetland showing iron mottling (orange colours)

Examination of the satellite imagery for the wetland as it corresponds to the sample points appears to show a number of longitudinal ‘tongues’ of more saturated soils that extend out from the main valley bottom like a series of fingers. Vegetation within these narrow longitudinal features was different from the surrounding vegetation, being characterised by the presence of Restio sp. (Restios) as well as *Miscanthus capensis* grass. In parts of the wetland away from these ‘channels’ the vegetation changed to a much more sparse low fynbos type of vegetation. Not all areas away from these channels was non-wetland in character, and a number of what could possibly be areas of shallow groundwater occurrence or occasional groundwater seepage appear to be present. The non-wetland areas in some parts of the wetland appear to be surrounded on all sides by wetland habitat, forming ‘drier’ islands of non wetland soils within the wetland. In order to take the risk averse approach, these isolated areas of non-wetland soils, where thought to be present, were included within the boundaries of the wetland as delineated.

Figure 15 – Vegetation in the valley bottom in the northern part of the wetland

The results of the delineation are presented in figure 16 below. The figure indicates that the wetland area across most of the corridor (including the extended latest revision of the corridor that is associated with the EIA Team-preferred route) is too wide to be singly spanned, even taking into account the height advantage (for ground clearance) presented by the ridge immediately to the north of the wetland. Only in the eastern-most parts of the corridor, where the wetland narrows and becomes much more (naturally) channelised, is the wetland able to be singly spanned. The width of the wetland as traversed by the proposed 3 Northern Corridor lines in the EIA Team-preferred alignment is approximately 950m, while the width of the wetland as traversed by the proposed 2 Southern Corridor lines is approximately 750m. At least one set of towers (3 in total for the Northern Corridor lines) is likely to have to be placed within the wetland area. However it must be noted that across this stretch, there may be areas of isolated non-hydric soils where the towers could be placed without technically being within a wetland. For this reason it is highly recommended that should the lines for the Northern Corridor be developed, that a wetland specialist be appointed as part of the Construction EMP (CEMP) walk down team to investigate the proposed tower positions in the vicinity of the wetland for the presence of hydric soils. Should the towers have to be placed within the wetland (within an area of hydric soils), then Eskom will need to apply for and acquire a permit from the Department of Water Affairs for this activity.

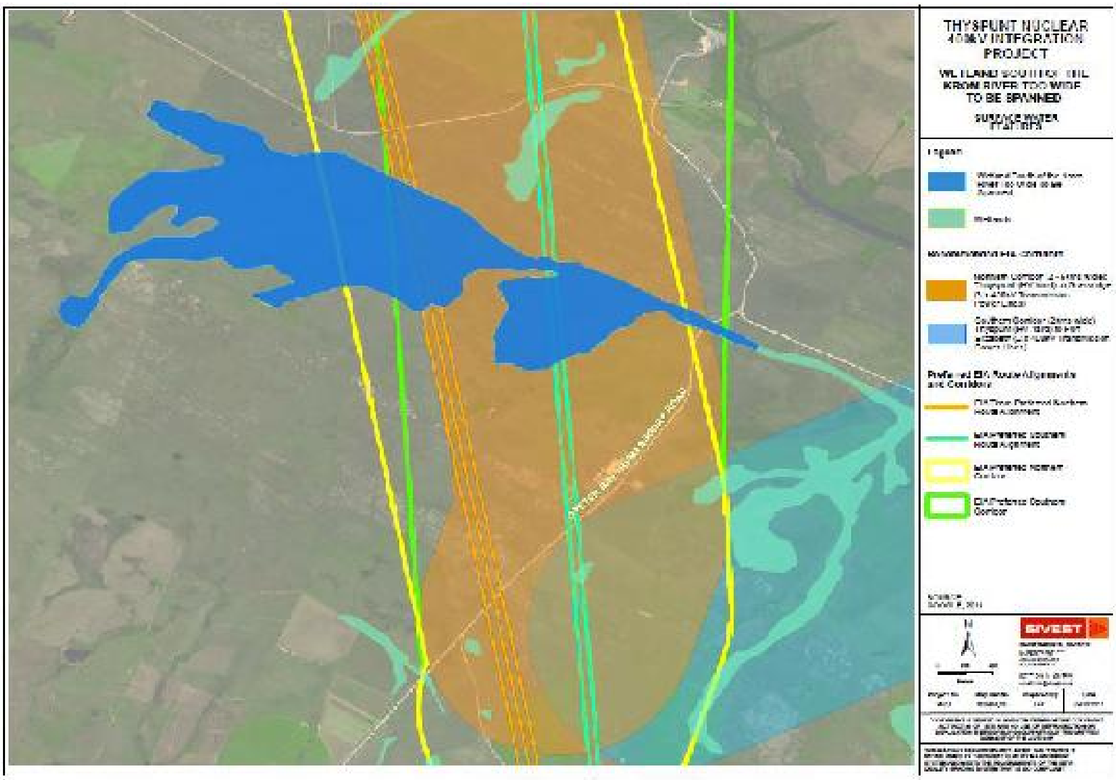

Figure 16 – The wetland south of the Krom river that is too wide to be spanned

4.2 Rivers along Alternative 1 of the Northern Corridor*

* - Please note that Alternative 1 of the Northern Corridor (the Longmore Southern Firebreak Alternative) has fallen out of the Northern Corridor and now forms part of the Southern Corridor under the latest corridor revisions.

The first river assessed in the field was the Berg River; it drains a mountainous area to the north-west of Thornhill. The river flows into the Lourie Dam and thus forms a tributary of the Loerie Spruit and ultimately the Gamtoos River situated to the west. Most of the catchment of this river falls within the Fc land type, with parts of the upper catchment falling within the Fa land type. As described in section ** above these land types consist mainly of Glenrosa and Mispah soil forms – shallow, rocky soils that are not typically associated with the presence of hydric soils. This is borne out by the nature of the terrain in this area; with very steep slopes and rocky ground that are not conducive to the formation of wetlands.

The main channel of the Berg River near the Berg Rivier tourism establishment was visited. The river has cut a deep gorge into the terrain and is located within a deeply incised valley. The river bed is flanked by riparian vegetation which can be classified as riparian forest, with the presence of large indigenous trees such as Yellowwoods. The riparian zone has however been highly invaded by alien exotic species such as wattles and bamboo.

Figure 17 – Channel of the river looking upstream

The bed of the river is approximately 20m across. The substrate in the river bed was noted to be highly alluvial in nature, with different-sized gravels that had been deposited within the channel bed. In spite of the drought conditions at the time of the assessment (December 2010), there was a slight flow within the river bed. A number of typical hydrophitic plants were noted within the bed of the channel; including the typical wetland grass species *Paspalum dilatatum*, *Agrostis lachnantha*, and *Miscanthus capensis*. A number of sedge species were noted as well as the reed *Typha capensis.* The substrate was not sampled due to its gravelly (alluvial) nature, however grey and likely leached soils were noted on the banks of the channel. Thus where soils exist, these are likely to display hydric characteristics.

Most importantly from a power line impact perspective, the entire valley is likely to be able to be spanned (in a single span) by the power lines, if they were to cross this valley. The river bed would thus not be affected by the power lines if they were to cross the river valley.

The Geelhoutboom River in the Loerie Dam area is very similar. A reach of the river upstream of the Loerie Dam (near the Loerie Field Centre) was visited. The riparian zone of the river is highly invaded by alien vegetation (tall Eucalyptus trees). The river was flowing, with an alternating series of pools and riffles occurring along the reach. Within the channel area, vegetation consisted of *Prionium serratum* (Palmiet) as well as small patches of the grass *Leersia hexandra* on the margins of the stream, as well as *Paspalum dilatatum*. Like the Berg River, this river system would be easily be able to be spanned, but the clearing of some indigenous riparian trees may be necessary if the proposed power lines were to cross this river.

Figure 18 – Palmiet reeds (*Prionium serratum*) and water lilies along the Geelhoutboom River

A tributary of the Berg River further upstream (within the Longmore Forest) was also examined. The river drains across outcropping of bedrock in this area, having cut a deep gorge into the landscape. Where isolated areas of deposited alluvium occurred along the channel sedges and the hydrophitic grass *Leersia hexandra* were noted to occur.

Figure 19 The tributary of the Berg River in the Longmore Forest. Note the gravelly nature of the substrate and the *Leersia hexandra* in the middle left of the picture.

4.3 Mountain Streams / drainage lines with the Longmore Forest

Similarly to the preceding section, these areas were found in / in the vicinity of the Northern Corridor Alternative 1, but now fall within the Southern Corridor under the latest alignment.

A number of streams / drainage lines within the Longmore Forest Area were investigated to determine their characteristics and to determine the potential presence of hydric soils. The Longmore Forest is extensively afforested, with predominantly pine plantations of varying age occurring in the area. The presence of hillslope seepages in these areas was thought to be possible in this highly mountainous area; however if present most of these would have been covered by plantations. Due to the nature of the lithology as described above, these parts of the study area are characterised by very rocky soils. Field investigations in this area appeared to validate this wider classification, with no distinct seepage areas identified within the forestry plantation. However as detailed below, drainage lines within the area were found to contain a different lithology which was more conducive to the presence of hydric soils.

Three streams / ephemeral drainage lines were investigated in the Longmore area. The first location was just to the north of Alternative 1 of the Northern Corridor (but falling within the latest Southern Corridor) to the south of the Cypherfontein farm within Longmore, The drainage line investigated occurred on relatively steeply sloping ground, within a mountainside valley on the slopes of one of the peaks within Longmore. The immediate catchment of the drainage line was completely afforested by pine, however it was very evident that the forestry company managing the area had cleared this drainage line of alien invasive vegetation (including pine trees that had established themselves in the vicinity of the drainage line), leaving only naturally-occurring indigenous vegetation along the drainage line.

A slight flow of water was noted within the drainage channel, with the presence of shallow pools along the reach examined. A very sandy substrate was noted in the vicinity of the channel, and the presence of erosion into the sides of the channel enabled two soil profiles to be examined.

Figure 20 – The first soil profile in the drainage line

The first soil profile consisted a pale grey A horizon (topsoil) underlain by a much darker grey B horizon which was underlain by saprolite (soil that consists of weathering bedrock and which thus has a number of affinities with the underlying bedrock). The next soil profile on the opposite bank (3m away) was different in nature, consisting of a pale grey A horizon, characterised by a B horizon which was lighter in colour (possibly leached), and importantly with the presence of significant iron mottling. The mottling was noted to disappear at about 50-60cm bgl. The B horizon in the first profile had affinities with a podzol B horizon (which is commonly found in fynbos areas in the Cape). The presence of distinct hydromorphism in the soils (as indicated by iron mottles) indicates the presence of hydric soils within the drainage line.

Figure 21 – Second soil profile – note the orange hue of the mottling in the middle of the profile

From a spanning perspective, this very narrow drainage system (~10m wide) is easily able to be spanned, however accesses to the servitude and tower positions within this landscape should be highly cognisant of the presence of this and similar drainage lines and the potential for erosion of soils, which due to the sandy nature of the terrain is high.

Figure 22 – The drainage line in which the sampling took place; note the incised valley and the steep slopes that limit the extent of the surface water feature

The second drainage line / wetland assessed was located close to the southern boundary of the Longmore Forest to the north of the farm Klaarefontein, roughly north-west of the Crossways Farm Development. This wetland is located at the head of the Berg River catchment, upstream of a few of the river sampling points listed above. The drainage line was located in a much more gently-sloping valley than the 1st drainage line, and thus the topography appeared to be more conducive to the formation of wetlands.

A number of soil profiles were examined within a part of the drainage line. The first exhibited an orthic A topsoil horizon, underlain by a soft plinthic B horizon that merged into a hard plinthic B horizon. The second nearby was very similar, but did not display the soft plinthic horizon. Another profile examined in the main gulley within the valley bottom was similar to the first, but did not display a hard plinthic B horizon to the depth examined. A soft plinthic B horizon is a diagnostic wetland horizon, and the presence of iron sesquioxide mottles is a distinctive feature of hydric soils that occur across the wetland.

Figure 23 – A soil profile showing a soft plinthic B horizon where the pen is located

The vegetation in this wetland was largely grassy with an unidentified wiry-leaved *Eragrostis* species dominating. The wetland was noted to be subject to erosion through a number of gulleys that were eating back into the wetland. As in all cases in the wetlands and river above in the Longmore Area, this wetland could easily be spanned, and would thus be unaffected by the proposed power lines, except if physically affected through construction access.

Figure 24 - Iron mottles within the soft plinthic B horizon

The last wetland / drainage line examined in the Longmore area is located at the eastern end of the plantation on the northern side of the Van Stadens Mountain, close to the Brak River that drains eastward out of Longmore. The drainage line consisted primarily of a relatively deeply incised (~2m deep), which was relatively well-vegetated. In some of the soil profiles examined on the banks of the channel / gulley, mottling was observed at about 40-50cm below ground level. An E horizon was noted lower down in the profile; hence it is thought that this is a Fernwood soil form, a typical wetland soil form.

The upper banks / sides of the channel were noted to be actively eroding, thus suggesting that the sandy soils in the wetland are highly dispersive and thus prone to erosion. As above the wetland would be able to be spanned, however the erodible nature of the soils poses a risk in terms of construction access across wetlands of a similar nature.

Figure 25 – The drainage line looking upstream

4.4 Implications for Development

The in-field sampling, along with the desktop delineation of wetlands within the Northern Corridor has identified only one wetland along the entire corridor that could be problematic from a spaning perspective. This is the wetland (as discussed above) to the south of the Krom River that runs across the entire corridor. This is the only wetland along the route in which towers may need to be placed, as it would be too wide to be spanned in a single stretch.

The remainder of the wetlands, drainage lines and rivers within the corridor are too narrow to pose a problem in terms of spanning, unless the lines were to run along the length of a wetland rather than perpendicularly across it. This however is unlikely, as the corridor typically runs across drainage systems in the area, rather than along them, which may pose problems in this context. The presence of incised topography in which many of the surface water features are located is a further beneficial factor, as the clearance (vertical distance) between the edge of the valley and the valley bottom would allow the span to be even longer than 400m in many cases. In this regard, and assuming the towers are carefully placed to avoid valley bottoms where the vast majority of the surface water features are located, then a negligible number of surface water features would be likely to be impacted by the proposed power lines.

As described in more detail below, other less direct features may however result in surface water features being affected. In less accessible and less inhabited parts of the study area (e.g. the Longmore Forest area) which are highly mountainous, the potential for erosion and concomitant siltation may pose a problem for water resources. Access to the tower positions is a critical issue, especially where the tower position is not located along or close to an existing access route. Construction accesses that are constructed across surface water features could lead to, or exacerbate, erosion within them. As demonstrated above, the sandy nature of soils in many parts of the study area aligned with steep slopes makes these areas particularly vulnerable to erosion. Erosion from the immediate catchment of the wetland also poses a risk of siltation to surface water resources that could adversely affect the resource quality of the resource or the biota within it. These issues and the associated mitigation measures are explored in more detail below.

5 NATURE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED DEVELOPMENT

There are a number of different types of impacts that may be associated with the proposed development. These impacts are rated in the impact rating table below. The determination of the effect of an environmental impact on an environmental parameter (in this instance, surface water resources) is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

5.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global) whereas intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence). A full explanation of the significance rating of potential impacts is contained in Appendix B.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

5.2 Surface Water Resource Transmission Impact Assessment Tables

The tables below represent the identified potential impacts assessed in the scoping phase as well as additional foreseen potential impacts. For this phase of the assessment (impact phase), the type of impact is highlighted according to the stage of the proposed development (construction and operation stage), the significance thereof is specified and lastly, the mitigation measures required to minimise the identified potential impact are stipulated in the context of the development.

In terms of impacts associated with the transmission lines, most impacts relate to the construction phase. With respect to the operation (maintenance) phase, minimal interaction with surface water features may be required relative to timeframe that the powerlines are anticipated to exist. Ultimately for this phase, interaction with surface water features will only be required for maintenance purposes.

It is very important to note that Eskom have a set of procedures to mitigate the above impacts. Should these procedures be followed as is stipulated in all Eskom transmission construction projects, the majority of these impacts will be avoided or reduced to acceptable levels.

5.2.1 Impact 1 – Foundation excavations of the Powerline Pylons

The first potential impact that is evaluated addresses the possible placement of the foundations for the powerline pylons within surface water resources encountered along the alignments. In order for the powerline towers to be constructed, excavations will need to be made. Remembering that three lines are proposed to be constructed for the Northern Corridor, three foundations will need to be constructed within the servitude. If pylons need to be placed into wetlands or other surface water resources (such as the banks of river and streams), the soils of these environments will need to be extracted in the foundation locations. This will involve impacts to the substrate of these environments as well as to the hydrology of these surface water features. Access of construction machinery into these environments could also damage the vegetation and underlying substrate. This action could be construed to be pollution under the

National Water Act as it would entail the disturbance of the physical and biological characteristics of the water resource. As discussed below this activity would need to be licensed under the Act.

It is likely that in most cases, any wetlands or surface water resources encountered are likely to be spanned by the proposed power lines. Should the spanning length (~400m) of the wetland be exceeded, foundations will need to be located in the affected surface water resource. From the analysis of this report, it is apparent that in the entirety of the Northern Corridor including the corridors at the start of the EIA phase and the latest revised corridors that are associated with the EIA Team-preferred alignment, 1 wetland is too wide to be spanned by the proposed transmission powerlines where any part of the wetlands extends farther than 400metres. Hence, it can be anticipated that this wetland may need to be impacted on by the placement of the foundation of the pylons for the proposed powerlines. This impact is evaluated below.

Importantly, the routing of the powerline should aim to avoid physically affecting water resources where possible. Where surface water resources are very wide, and thus not able to be spanned, the routing should aim to avoid these surface water resources or cross them at a point where the resource is narrower. Where this is not possible, a detailed set of mitigation measures to reduce impacts of the pylon construction on the surface water resource should be identified. In this instance, pylons should be placed within the 'drier' temporary zone of the wetland rather than in the more permanently inundated (and thus more sensitive) sections of the wetland.

Lastly, the placing and construction of a tower in surface water resources requires a licence from the Department of Water Affairs and Forestry. The specified activities fall under one of the defined water uses under Section 21 of the National Water Act. Potential uses may include, but not limited to, the following:

- (c) impeding or diverting the flow of water in a watercourse;
- (i) altering the bed, banks, course or characteristics of a watercourse;

The construction of pylon foundations therefore has water use licence implications that would need to be addressed before the construction of these structures take place.

Table 4 - Impact rating for impacts associated with the construction of the foundations for the powerlines pylons into surface water resources.

IMPACT TABLE	
Environmental Parameter	*Surface Water Resources (**Construction Phase**)*
Issue/Impact/Environmental Effect/Nature	Impact of pylon foundations being located within surface water resources
Extent	*Local*
Probability	*Possible*

Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resource*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative and medium. With appropriate mitigation measures, the impact can be minimized but only to a limited extent. Post mitigation impact rating will remain negative but low.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-28 (low negative impact)	-27 (low negative impact)
Mitigation measures	▪ The alignment should be planned to avoid crossing wide lengths of wetlands. ▪ When digging out the excavations the use and access of any vehicles (heavy or light) entering the affected surface water resource (for example wetlands) must be avoided where possible at all costs. ▪ Where this is not possible, access must be limited to prevent unnecessary impact. ▪ When the foundations are laid, the mixing of cement should not take place in or nearby any surface water resources. Appropriate measures (such as bunded cement mixing areas) need to be implemented. ▪ Worker access into these sensitive areas also needs to be controlled.	

5.2.2 Impact 2 – Inappropriate construction activities

The potential impacts that can be anticipated with general "inappropriate construction activities" that may need to take place either in or nearby surface water resources are addressed in Table 5. This umbrella term encompasses activities such as the physical destruction of surface water resources caused by humans, excavation and degradation of wetlands by construction machinery, leakage of oils and fuels from machinery, use of surface water resources for sanitary facilities and ablutions, unauthorized construction of access roads through surface water resources, extraction and destruction of vegetation in surface water resources and dumping of materials and litter into surface water resources. The cumulative impact of the above mentioned activities can result in significant negative effects and should be avoided at all costs where possible. The prevention of such inappropriate activities can be achieved in a number of ways. This is expanded on below.

Table 5 - Impact rating for impacts associated with inappropriate construction activities.

IMPACT TABLE		
Environmental Parameter	*Surface Water Resources (**Construction Phase**)*	
Issue/Impact/Environmental Effect/Nature	Impact of inappropriate construction activities	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Short term*	
Cumulative effect	*High cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low. Mitigation measures can adequately reduce this impact to negligible levels.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	4	1

Intensity/magnitude	2	1
Significance rating	-24 (low negative impact)	-7 (low negative impact)
Mitigation measures	▪ Where *surface water resources are encountered, the construction area should be demarcated and a boundary from the construction area should be delineated.* ▪ *No access should be allowed into surface water resource areas.* ▪ *Ideally, palisade fencing will adequately restrict unauthorized access in to surface water resources during the construction period.* ▪ *Oils and fuels must not enter or be stored in or nearby any surface water resources.* ▪ *Storage of fuels and oils should take place in the construction lay down area only. Moreover, re-fuelling must not take place in or nearby surface water resources.* ▪ *Vehicle maintenance is central to reducing the leakage of oils caused by construction machinery. Vehicles need to be inspected before going to undertake any construction activities.* ▪ *Limited sanitation and ablution facilities will be required for the relatively small task team responsible for the construction of the powerlines near or in surface water resources. These facilities must be sufficiently maintained and distanced from any surface water resource. An appropriate distance usually ranges from 100-200metres away from sensitive environments. Refuse bins must be available to accommodate any waste generated as a result of construction activities generated near surface water resources.*	

5.2.3 Impact 3 – Access through surface water resources

Access into surface water resources may be required. If a new access is required, this will need to be authorised by the relevant authorities (Department of Environmental Affairs and Department of Water Affairs etc.), where identified, prior to any activities taking place. However this should be avoided where possible. As a general principle, any access routes through surface water resources should be avoided as all costs, and these environmental features should be left undisturbed by the proposed project.

Relative to the points made above, should access be necessary as well as authorised, this activity should be limited to the smallest area possible to limit the impact footprint. Moreover, any accesses into wetlands to construct pylons will need to be removed and rehabilitated upon completion. The cumulative impacts of access into surface water resources are probably the most important aspect which should be prevented.

Existing access routes across water resources may need to be utilised. The Construction EMP should address all such surface water crossings, and the construction engineers and the construction environmental team should examine these crossings to assess whether they need to be upgraded to accommodate construction traffic or to reduce the potential for construction traffic to impact on the crossing. Mitigation measures are stipulated in Table 6 below.

Table 6 - Impact rating for impacts associated with access routes into surface water resources.

IMPACT TABLE		
Environmental Parameter	*Surface Water Resources (**Construction Phase**)*	
Issue/Impact/Environmental Effect/Nature	Impact of access through surface water resources	
Extent	*Site*	
Probability	*Unlikely*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*No loss of resource*	
Duration	*Short term*	
Cumulative effect	*High cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low. Mitigation measures can adequately prevent impact where implemented.*	
	Pre-mitigation impact	Post mitigation impact

	rating	rating
Extent	1	1
Probability	1	1
Reversibility	2	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	4	2
Intensity/magnitude	2	2
Significance rating	-20 (low negative impact)	-14 (low negative impact)
Mitigation measures	▪ *Where access routes into surface water resources are authorized, a planned access route should be approved by the relevant authorities prior to any access into sensitive areas being undertaken.* ▪ *Planned access route(s) must be direct or alternatively use existing routes to limit any potential or existing impact. Dirt roads are ideal, although in marshy conditions rafts may be required for vehicles and construction worker access. Rafts should only be used where absolutely necessary. Rafts will need to be removed once construction is complete.* ▪ *The exposed surfaces of the roads must be accompanied by supplementary mitigation measures. Storm water management measures will need to accompany roads leading into surface water resources. Such measures can include the use of soil stabilizers that prevent soil from washing away. Alternatively, gravel can be used for the access surface. This will have to be cleared once construction is complete will require rehabilitation (see below).* ▪ ***IMPORTANT:*** *The final wetland walk-down assessment report will need to identify wetlands where such access will be required for construction. Where the*	

	specialist anticipates significant structural damage to the surface water resource(s), a rehabilitation plan will be required and implemented upon completion of the construction activity to address the impacts caused. Additionally, the final walk-down assessment should identify where any sensitive vegetation species exist in the affected surface water resources. Should sensitive species be identified, plant translocation may be required and the relevant authority overseeing this operation will need to be contacted. Vegetation rehabilitation will be required to address the temporary damage. This can either form part of the rehabilitation plan referred to above or it can be a stand-alone assessment.

5.2.4 Impact 4 – Operational activity impacts

Potential impacts on surface water resources may result during the operational phase of the project. These would relate mainly to the residual impacts that arose during the construction phase, operational maintenance activities as well as the inadequate rehabilitation of construction-related access. It is vital that any surface water resources (relating mainly to affected wetlands), that have been damaged or degraded, are rehabilitated to an acceptable and functional level. Mitigation measures to address potential impacts that may result in the operational phase are elaborated on in Table 7 below.

Table 7 - Impact rating for impacts associated with the residual effects of the construction phase and inadequate rehabilitation of affected surface water resources.

IMPACT TABLE		
Environmental Parameter	*Surface Water Resources (**Operation Phase**)*	
Issue/Impact/Environmental Effect/Nature	Impact of operational activities	
Extent	*Site*	
Probability	*Unlikely*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Short term*	
Cumulative effect	*Low cumulative effect*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is negative but low*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-16 (low negative impact)	-7 (low negative impact)
Mitigation measures	▪ *Implementing an auditing process for the duration of the rehabilitation plan is critical towards safeguarding the integrity of any affected surface water resources. The audit process should be founded on rigorous procedures to maintain compliance with mitigation measures and rehabilitation goals and objectives.* ▪ *Eskom have a set of procedures and guidelines that are followed in order to mitigate any impact with regards to*	

	maintenance. Guidelines in terms of transmission vegetation management for example are available and must be implemented assist with the mitigation of any potential impact that could result from operational maintenance.

Potential Impacts associated with the upgrading of the Grassridge and Dedisa substations The upgrading of the Grassridge and Dedisa Substations are likely to be associated with the associated infrastructure required to integrate the proposed new substation into Eskom's Electricity Transmission grid (including the construction of service/access roads, the construction of extra lighting towers at the substation sites, etc). Additional feeder bays will also be required to accommodate additional lines. Importantly, it is understood that the footprint will remain that same. Therefore, no impact is expected to occur on the surface water features nearby the respective substations.

5.3 Mitigation Measures for Potential Areas of Impact and Sensitivity along the Northern Corridor

There are several surface water resource areas that could be affected by the proposed transmission powerlines should the route need to extend over these sensitive areas. This partly relates to the wetlands with an extent of >400metres that may pose a spanning problem to the transmission lines. Additionally, there are certain parts of the study area in which surface water resources are associated with important aquatic biodiversity features. Surface Water Resources may be affected by potential impacts related to power line construction and operation for example construction access across surface water bodies These are identified and discussed in the following sections below according to the proposed alternatives.

5.3.1 Northern Corridor – Alternative 1

Within the Northern Corridor that extends north of the Thyspunt HV Yard there is an extensive wetland that could potentially be affected by the transmission powerlines. This wetland is traversed by all five lines within the EIA Team-preferred routes of both the Northern and Southern Corridor and is highly likely to be affected should the proposed power lines be developed. As described above the wetland is up to 900m-wide as crossed by the proposed lines. Areas of drier 'non-hydric' soils exist within the wider wetland area, as the wetland consists of a number of ‘linear tongues’ of wetland habitat that stretch out southwards from the main valley bottom; these appear to be divided by non-wetland soils. It may be possible that the towers could be placed within these areas of non-hydric soils without thus having to affect the wetland and disturb the hydric soils, thus requiring a permit from the Department of Water Affairs.

It is thus highly recommended that a wetland specialist be appointed to undertake a wetland delineation of the tower locations within this wetland, to determine whether these occur within an area of hydric soils, and if so to recommend to the Eskom route planners where the towers could be placed without having to disturb the hydric soils by the excavation for the tower foundations.

5.3.2 Potential Wetland Occurrence between the Thyspunt HV Yard and the Gamtoos River

The western third of the corridor between the Thyspunt HV Yard and the Gamtoos River valley is the part of the corridor that is most likely to contain wetlands and hydric soils, due to a combination of relatively flat topography and land types containing predominant soil forms that display diagnostic wetland characteristics.

In this context it is recommended that a wetland specialist be appointed to investigate all tower positions in this part of the route for the occurrence of hydric soils. The first phase of this investigation would be a *desktop investigation* of the tower locations to determine whether any of these may be located within an area of hydric soils (i.e. within a wetland), or whether any may affect riparian habitat of a drainage line. The second phase may be a focussed field-based investigation of certain tower locations if any of these are marked for further investigation by the wetland specialist through the desktop examination of all tower locations. The process followed would be similar to the process described above for the wetland south of the Krom River that is too wide to be singly spanned.

5.3.3 Aquatic Biodiversity-sensitive wetlands within the Longmore Area

A number of rivers in the wider Longmore area are considered highly sensitive as they provide habitat for Red Data species. The Hewitt’s Ghost Frog (*Heleophryne hewitti*) which is considered Critically Endangered in terms of the IUCN Red Data List occurs in this part of the study area. The Hewitt’s Ghost Frog is restricted to the southern slopes of the Elands Mountains and has been encountered within the Diepkloof, Klein, Geelhoutboom and Martins Rivers. New populations have been discovered on the southern slopes of Cockscomb Mountain and new localities might be found on the rest of the Elands Mountains and Grootwinterhoek Mountains. The species has been recorded from the streams within the Longmore Forest. (pers comm., Werner Conradie - Bayworld). Very importantly the species is found in the upper reaches of clear, fast-flowing perennial mountain streams in the area.

In this context all rivers and streams within the Longmore Area must be treated as highly sensitive, as hitherto unidentified populations may occur in any of these water bodies. The disturbance of streams and rivers in the Longmore Area through the process of construction or operation of the proposed power lines could thus be highly detrimental to this species and could lead to significant impacts on the remaining population. The pollution of any river, stream or ephemeral drainage line in the Longmore area must be therefore avoided at all costs. Any watercourse must be treated as a strict no-go area for construction workers and there should be no interaction of any kind with such surface features. No storage area of any hazardous material should be stored closer than 200m from any watercourse or surface water feature. It is absolutely critical that no new construction vehicle accesses should be constructed across any watercourse, and the existing forestry operation access roads should be used. Where any tower location cannot be accessed by existing road / track access, the transport of construction materials by helicopters should be considered.

The creation of erosion and any resultant siltation into water courses must be avoided at all costs. Siltation and the creation of turbidity within these streams where suitable Ghost Frog habitat occurs could exert a significant adverse affect on the resource quality of the stream, and could lead to local population impacts. Erosion even in upstream catchments of suitable Ghost Frog habitat could have a downstream impact on frog populations. The geotechnical study for this EIA has highlighted the high risk of erosion in the Longmore area due to the combination of very steep slopes and shallow soils. The prevention and control of any erosion, in particular in the vicinity of a water course must be strictly monitored and enforced and the EMP for the project must place a very large emphasis on erosion control and avoidance of all surface water features by construction teams.

5.3.4 Aquatic Biodiversity Sensitive Surface Water Features in the area between Humansdorp and St Francis Bay

Cape Sand Toad (*Vandijkophrynus cf. angusticeps*) and Arum Lily Frog (*Hyperolius cf. horstockii*) populations had been found in the past in rivers and wetlands in the area between Humansdorp and Cape St. Francis (pers comm., Werner Conradie Bayworld). A number of rivers flow across the corridor in this part of the study area, and these should be treated as very sensitive in this context. All rivers in ravines such as those of the Seekoei and Geelhoutboom Rivers should be spanned.

6 CONCLUSIONS

Surface Water Resources across the Northern Corridor have been identified and mapped. Wetlands are concentrated in the western-most third of the study area as soils and topography in this part of the study area is most conducive to the formation of wetlands and hydric soils. In the other parts of the study area, lithologies and topography largely preclude the formation of wetlands, and drainage lines and rivers tend to predominate.

The in-field assessment conducted in the EIA phase of the study has focussed on a number of prioritised wetlands – wetlands that were either identified to be too wide to be singly spanned, or those that were identified to be very sensitive. A number of recommended mitigation measures in terms of routing and recommendations for further assessment in the Construction EMP phase with respect to these individual wetlands and certain surface water features along certain parts of the route have been made. Generic impacts that could result from the construction of the proposed power lines and associated infrastructure have been investigated and associated mitigation measures have been identified. With the implementation of these mitigation measures, the level of impacts of the proposed power lines and substation on surface water resources would be able to be kept to acceptable levels. It is thus strongly recommended that these mitigation measures be in the process of constructing and operating the proposed power lines.

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Appendix A:

DESCRIPTION OF WETLAND HYDROGEOMORPHIC (HGM) FORMS

(extracted from SANBI, 2009)

Channel (river, including the banks): an open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow (see unchanneled valley-bottom wetland). As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel13 banks.

Channelled valley-bottom wetland: a mostly flat valley-bottom wetland dissected by and typically elevated above a channel (see channel). Dominant water inputs to these areas are typically from the channel, either as surface flow resulting from overtopping of the channel bank/s or as interflow, or from adjacent valley-side slopes (as overland flow or interflow).

Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events. Small depressional areas within a channelled valley-bottom wetland can result in the temporary containment and storage of water within the wetland. Water generally exits in the form of diffuse surface flow and interflow, with the infiltration and evaporation of water from these wetlands also being potentially significant (particularly from depressional areas). The hydrodynamic nature of channelled valley-bottom wetlands is characterised by bidirectional horizontal flow, with limited vertical fluctuations in depressional areas.

Un-channelled valley-bottom wetland: a mostly flat valley-bottom wetland area without a major channel running through it, characterised by an absence of distinct channel banks and the prevalence of diffuse flows, even during and after high rainfall events. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional areas), but the outflow can be in the form of diffuse or concentrated surface flow. Infiltration and evaporation from un-channelled valley-bottom wetlands can be significant, particularly if there are a number of small depressions within the wetland area. Horizontal, unidirectional diffuse surface-flow tends to dominate in terms of the hydrodynamics.

Floodplain wetland: the mostly flat or gently sloping wetland area adjacent to and formed by a lowland or upland Floodplain river, and subject to periodic inundation by overtopping of the channel bank. For purposes of the classification system, the location adjacent to a river in the Lowland or Upland Floodplain Zone is the key criterion for distinguishing a floodplain wetland from a channelled valley-bottom wetland. Water and sediment input to floodplain wetland areas is mainly via overtopping of a major channel, although there could be some overland or subsurface flow from adjacent valley side-slopes (if present). Water movement through the wetland is dominantly horizontal and bidirectional, in the form of diffuse surface flow and interflow, although there can be significant temporary containment of water in depressional areas (within which water movement is dominantly vertical and bidirectional). Water generally exits as diffuse surface flow and/or interflow, but infiltration and evaporation of water from a floodplain wetland can also be significant, particularly if there are a number of depressional areas within the wetland.

Depression: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow. For 'depressions with channelled inflow', concentrated overland flow is typically a major source of water for the wetland, whereas this is not the case for 'depressions without channelled inflow' (as distinguished at Level 4D). Dominant hydrodynamics are (primarily seasonal) vertical fluctuations. Depressions may be flat bottomed (in which case they are often referred to as 'pans') or round-bottomed (in which case they are often referred to as 'basins'), and may have any combination of inlets and outlets or lack them completely. For 'exorheic depressions' water exits as concentrated surface flow while, for 'endorheic depressions', water exits by means of evaporation and infiltration.

Flat: a near-level wetland area (i.e. with little or no relief) with little or no gradient, situated on a plain or a bench in terms of landscape setting. The primary source of water is precipitation. Dominant hydrodynamics are bidirectional vertical fluctuations, although there may be limited multidirectional horizontal water flow in some cases. Water exits a flat through evaporation and infiltration.

Hillslope seep: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Water inputs are primarily from groundwater or precipitation that that enters the wetland from an up-slope direction in the form of subsurface flow. Water movement through the wetland is mainly in the form of interflow, with diffuse overland flow ('sheet wash') often being significant during and after rainfall events. Water leaves a 'hillslope seep with channelled outflow' mostly by means of concentrated surface flow, whereas water leaves a 'hillslope seep without channelled outflow' by means of a combination of diffuse surface flow, interflow, evaporation and infiltration.

Valleyhead seep: a gently-sloping, typically concave wetland area located on a valley floor at the head of a drainage line15, with water inputs mainly from subsurface flow (although there is usually also a convergence of diffuse overland water flow in these areas during and after rainfall events). Horizontal, unidirectional (down-slope) movement of water in the form of interflow and diffuse surface flow dominates within a valleyhead seep, while water exits at the downstream end as concentrated surface flow where the valleyhead seep becomes a channel.

Appendix B:

IMPACT RATING SYSTEM METHODOLOGY

Explanation of significance impact rating methodology.

NATURE		
Includes a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed		

activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative

		effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.** The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact Significance Rating**	**Description**

6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Appendix C:

MAPS

SiVEST Environmental Division
51 Wessels Road, Rivonia. 2128. South Africa
PO Box 2921, Rivonia. 2128. South Africa

Tel + 27 11 798 0600
Fax +27 11 803 7272
www.sivest.co.za

Contact Person: Paul da Cruz
Email: pauld@sivest.co.za