BROAD SCALE WETLAND IMPACT ASSESSMENT

ESKOM INYANINGA 2 x 500 MVA 400/132 KV SUBSTATION, APPROXIMATELY 100KM INYANINGA – MBEWU 400KV POWERLINE AND ASSOCIATED INFRASTRUCTURE WITHIN THE JURISDICTION OF ETHEKWINI METROPOLITAN, ILEMBE AND UTHUNGULU DISTRICT MUNICIPALITIES IN THE KWAZULU-NATAL PROVINCE

DRAFT REPORT

September 2017

Malachite Specialist Services (Pty) Ltd

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Malachite Specialist Services (2017) Broad Scale Wetland Impact Assessment: Eskom Inyaninga 2 X 500 MVA 400/132 kV Substation, Approximately 100km Inyaninga – Mbewu 400kV Powerline and Associated Infrastructure within the Jurisdiction of Ethekwini Metropolitan, ILembe And UThungulu District Municipalities in The KwaZulu-Natal Province. Malachite Specialist Services (Pty) Ltd, Durban.

Declaration

I **Rowena Harrison,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the NEMA Act, regulations and all other applicable legislation;
- As a registered member of the South African Council for Natural Scientific Professions in terms of the Natural Scientific Professions Act, 2003 (Act No. 27 of 2003), I will undertake my professional duties in accordance with the Code of Conduct of the Council, as well as any other societies of which I am a member;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this report are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B-(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:
Date:

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EXECUTIVE SUMMARY

Malachite Specialist Services (Pty) Ltd was appointed by Nsovo Environmental Consulting to undertake a wetland impact assessment for the proposed development of the Eskom Inyaninga 2 x 500 MVA 400/132 kV substation, approximately 100km Inyaninga – Mbewu 400kV powerline and associated infrastructure within the jurisdiction of Ethekwini Metropolitan, iLembe and uThungulu District Municipalities in the KwaZulu-Natal Province.

The terms of reference for the study were as follows:

- Identify and delineate any wetland areas at a desktop level within the three corridor options and four substation locations according to the Department of Water Affairs[1] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Determine the Present Ecological Status (PES) of any identified wetlands using the WET-Health Level 1 (desktop) approach.
- Identify current and possible negative impacts on any identified wetlands from the proposed project. Recommend mitigation measures to lessen the impact of the proposed project on wetlands delineated within the study area and the implementation of suitable rehabilitation measures.

The wetland assessment involved desktop investigations for the presence of wetland systems within three proposed powerline corridors as well as four alternative substation sites. This investigation made use of aerial imagery, NFEPA wetlands data as well as a flyover of the study area. These wetlands were classified as channelled valley bottom systems, unchannelled valley bottom systems and seep systems.

The identified wetland systems were grouped as per their HGM classification and due to differences in the pattern of water flow through the different HGM types, the wetlands have been divided into distinct HGM units at the outset. The level 1 assessment was then conducted on the broad classification of each HGM type. This was undertaken to determine the general impacts on the wetlands within the study area and the effect these impacts have had on the wetland types. These impacts have generally given scores of largely modified (Pes Category D). The major modifications to the catchments associated with

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[1] Department of Water Affairs (DWA) is now named the Department of Water and Sanitation (DWS).

the wetland systems include: agricultural activities including sugarcane cultivation, subsistence agriculture and livestock grazing, infrastructural development, residential and urban development, erosion and the widespread encroachment of alien invasive species.

A 30m buffer has been calculated for the wetland systems and is considered appropriate for the protection of the ecosystem services provided by the wetlands' systems. The above buffer width is recommended during both the construction and operational phase of the proposed project, particularly with regards to the positioning of the towers associated with the powerline as well as the creation of any access roads. This buffer is based on a desktop analysis of the study area coupled with a flyover and must be refined once the final corridor has been chosen. This will be achieved through a walk down conducted to delineate and assess the affected wetland systems.

The impact assessment identified the following potential negative impacts associated with the proposed project on the wetland systems; (i) soil compaction leading to erosion, sedimentation and degradation of wetland systems; (ii) pollution of wetlands and soil as a result of the construction phase of the project and (iii) disturbance within the wetland systems thereby increasing the encroachment of alien invasive species and the loss of natural habitat for fauna and flora.

Several general and specific measures are proposed to mitigate these impacts on the receiving environment. Provided the mitigation measures specified in this report are implemented and the continued monitoring and rehabilitation of any disturbed areas is undertaken, the proposed project is expected to have a limited negative effect on the receiving environment and water resources. This will be ensured should the 30m buffer is adhered to and the use of existing access roads as far as possible is undertaken.

Due to the broad scale nature of the project, as well as the desktop approach to the wetland assessment, any of the three proposed corridors and four alternative substation sites can be utilised from a wetland perspective. Once a final corridor has been chosen, a walk down must be conducted to delineate any wetlands along the powerline corridor and the appropriate buffer applied to the wetland systems assessed. This buffer must be utilised in planning the position of the towers so that risks to the wetland systems can be minimised.

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PROJECT BACKGROUND AND LOCALITY

Malachite Specialist Services (Pty) Ltd was appointed by Nsovo Environmental to undertake a wetland impact assessment for the proposed development of the Eskom Inyaninga 2 x 500 MVA 400/132 kV substation, approximately 100km Inyaninga – Mbewu 400kV powerline and associated infrastructure (Nsovo Environmental Consulting, 2016).

The proposed development is located within the jurisdiction of the Ethekwini Metropolitan, iLembe and uThungulu District Municipalities. Three corridor options and four alternative substation localities form part of the assessment.

The wetland impact assessment forms part of the Environmental Assessment in compliance with the National Environmental Management Act (Act 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations, 2014, GN R. 983, R. 984 and R.985; as well as the Water Use Licence Application (WULA) in terms of the National Water Act (Act 36 of 1998).

The primary aim of the study is to provide a description of the current ecological integrity and impacts pertaining to any wetland systems that may be impacted as a result of the proposed project as well as providing appropriate management recommendations to mitigate any identified impacts on the delineated wetland systems.

RATIONALE FOR THE ECOLOGICAL ASSESSMENT

South Africa comprises a region of high biodiversity with high levels of endemism (Bates et al., 2014). According to the National Environmental Management: Biodiversity Act (NEMBA) (Act no.10 of 2004), biodiversity is defined as:

"the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems"

An ecosystem is a complex, self-sustaining natural system centred on the interaction between the structural components of the system (biotic and abiotic). Functional aspects of an ecosystem include productivity and energy flow, cycling of nutrients and limiting factors. Effective conservation of biodiversity is paramount for the provision of ecosystem services including clean water, food and medicinal properties. The degradation of the ecological integrity of a system has a direct negative impact on the system's ability to provide these essential ecosystem goods and services.

Ecosystems are particularly susceptible to anthropogenic activities such as urban and infrastructural developments. Due to their susceptibility, a holistic approach is required in order to effectively integrate the activity and the receiving environment in a sustainable manner.

According to the National Environmental Management: Biodiversity Act, 2004 (Act no.10 of 2004), the applicant is responsible for:

i. The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not solely by listed activities as specified in the EIA regulations);
ii. Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities; thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity;
iii. Limit further loss of biodiversity and conserve endangered ecosystems;
iv. A person may not carry out any restricted activity involving a specimen of a listed Threatened or Protected species without a permit issued in terms of Chapter 7; and
v. Such activities include any that are "of a nature that may negatively impact on the survival of a listed Threatened or Protected species".

SCOPE OF THE ASSESSMENT

The terms of reference for the current study were as follows:

- Identify and delineate any wetland areas at a desktop level within the three corridor options and four substation locations according to the Department of Water Affairs[2] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Determine the Present Ecological Status (PES) of any identified wetlands using the WET-Health Level 1 (desktop) approach.

[2] Department of Water Affairs (DWA) is now named the Department of Water and Sanitation (DWS).

- Identify current and possible negative impacts on any identified wetlands from the proposed project. Recommend mitigation measures to lessen the impact of the proposed project on wetlands delineated within the study area and the implementation of suitable rehabilitation measures.

Typically, surface water attributed to wetland systems, rivers and riparian habitats comprise an important component of natural landscapes. These systems are often characterised by high levels of biodiversity and fulfil various ecosystems functions. As a result, these systems are protected under various pieces of legislation including; the National Water Act, 1998 (Act No. 36 of 1998) and the National Environmental Management Act, 1998 (Act No. 107 of 1998).

ASSUMPTIONS AND LIMITATIONS

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following apply to this study:

i. The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the wetlands.
ii. Wetland mapping was undertaken at a very broad desktop level and did not involve any ground-truthing of wetland boundaries. The actual delineation exercise must be undertaken once the final powerline corridor and substation have been chosen.
iii. The assessment of the present ecological state (PES), was undertaken at a very broad desktop scale and does not represent individual wetland systems. The assessment of the PES, functional integrity and Ecological Importance and Sensitivity (EIS) must be undertaken once the final corridor and substation have been chosen and wetlands which will be affected by this route delineated and assessed.
iv. The assessment of impacts and recommendation of mitigation measures was based on the assessor's working knowledge and experience with similar development projects. No construction work methodology was provided.

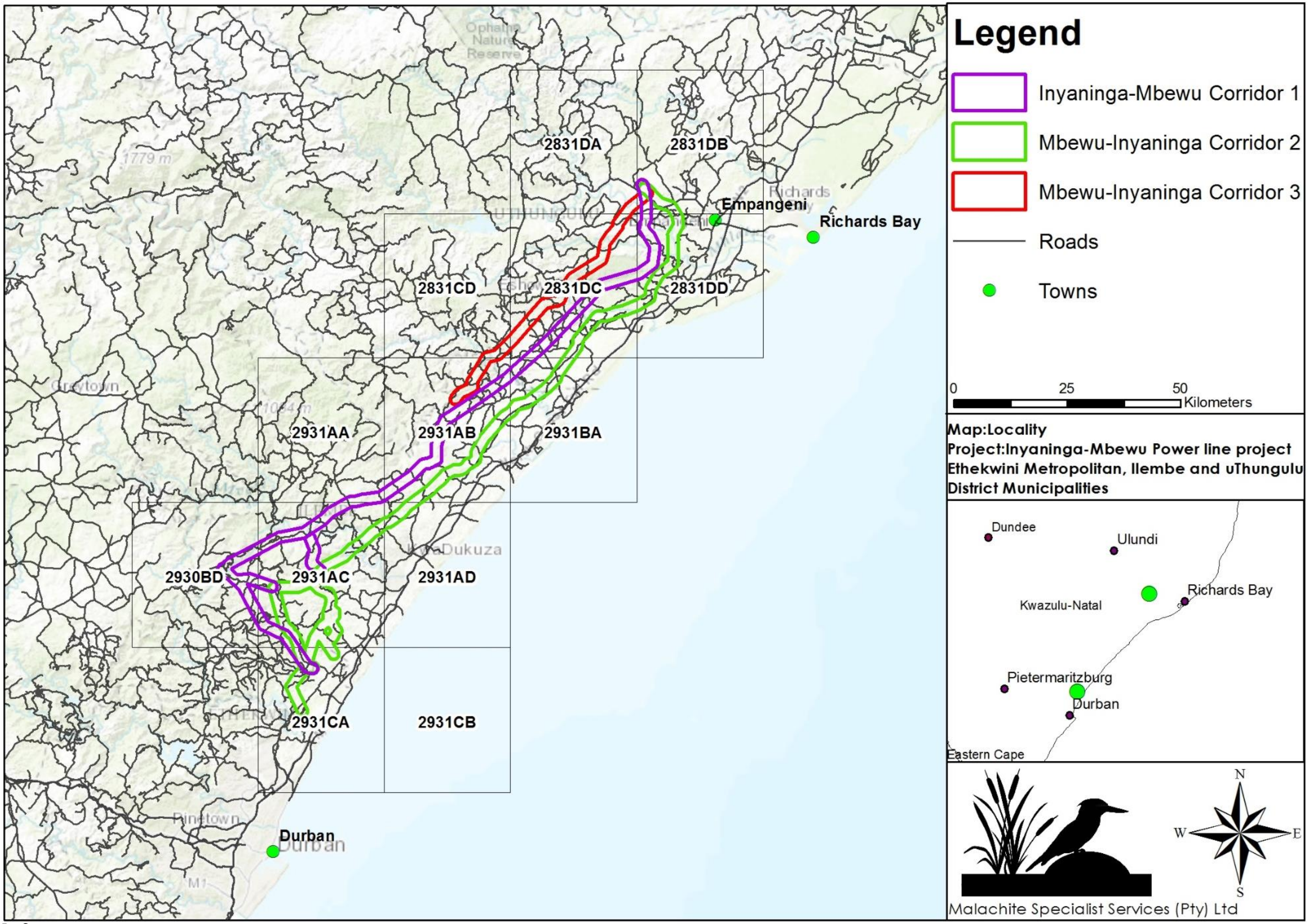


FIGURE 1. SITE LOCALITY OF THE PROPOSED IMYANINGA-MBEWU POWERLINE PROJECT

2. METHODOLOGY

Assessment techniques and tools

The following techniques and tools were used in the assessment.

Baseline data

The desktop study conducted for the proposed project involved the examination of aerial photography, Geographical Information System (GIS) databases including the National Freshwater Ecosystem Priority Areas (NFEPA) and South African National Wetland maps as well as literature reviews of the study site, to determine the likelihood of wetland systems within each of the proposed substation sites and powerline corridor areas. The study made use of the following data sources:

- Google Earth™ satellite imagery was used at the desktop level.
- Relief dataset from the Surveyor General was used to calculate slope and the desktop mapping of watercourses.
- The NFEPA dataset from (Driver, *et al*., 2011) was used in determining any priority wetlands.
- Geology dataset was obtained from AGIS[3].
- Vegetation type dataset from Mucina and Rutherford, 2006 and Scott-Shaw and Escott, 2011 was used in determining the vegetation type of the study area.
- A flyover of each of the three alternative corridors was undertaken on the 22nd to the 24th of May 2017.

Wetland Definition & Delineation Technique

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act as:

> *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

These habitats are found where the topography and geological parameters impede the flow of water through the catchment, resulting in the soil profiles of

[3] Land type information was obtained from the Department of Agriculture's Global Information Service (AGIS) January 2014 – www.agis.agric.za

these habitats becoming temporarily, seasonally or permanently wet. Further to this, wetlands occur in areas where groundwater discharges to the surface forming seeps and springs. Soil wetness and vegetation indicators change as the gradient of wetness changes (**Figure 2**).

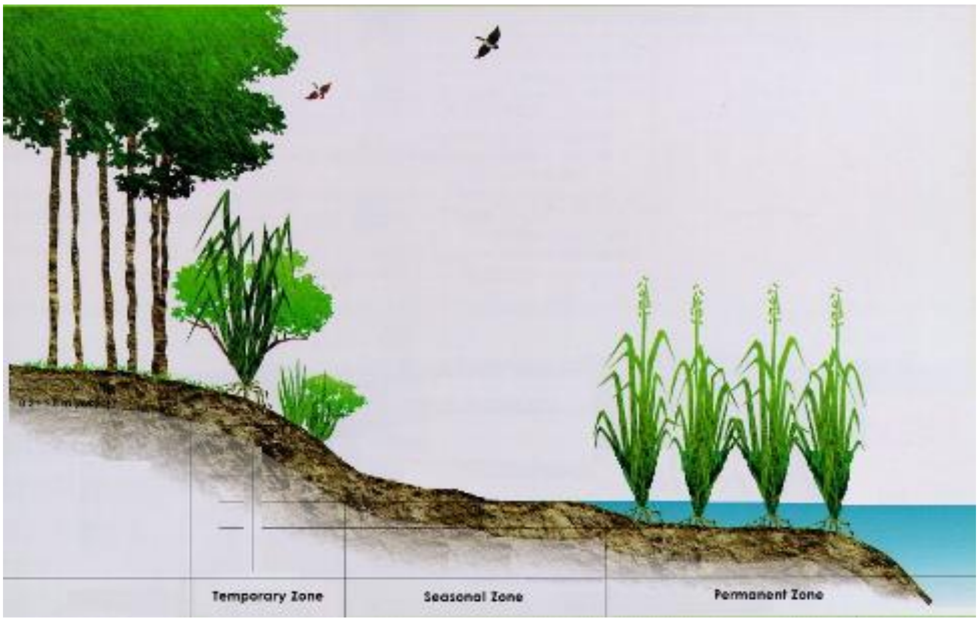


FIGURE 2. INCREASING SOIL WETNESS ZONES IDENTIFIED WITHIN VARIOUS WETLAND SYSTEMS

Based on definition presented in the National Water Act, three vital concepts govern the presence of a wetland namely:

i. Hydrology- Land inundated by water or displays saturated soils when these soils are biologically active (the growth season).
ii. Hydric soils- Soils that have been depleted of oxygen through reduction resulting in the presence of redoximorphic features.
iii. Hydrophytic vegetation- Plant species that are adapted to growing in saturated soils and subsequent anaerobic conditions (hydrophytes).

The conservation of wetland systems is vital as these habitats provide numerous functions that benefit not only biodiversity but provide an array of ecosystem services (Rebelo et al., 2015). These services are further divided into direct and indirect and are detailed in **Table 1**.

TABLE 1: DIRECT AND INDIRECT BENEFITS OF WETLAND SYSTEMS (KOTZE *ET AL.*, 2005)

WETLAND GOODS AND SERVICES	
DIRECT	**INDIRECT**
Hydrological Water purification Flood reduction Erosion control Groundwater discharge	*Socio-economic* Socio-cultural significance Tourism and recreation Education and Research
Biodiversity conservation	Water supply
Chemical cycling	Provision of harvestable resources

The study site was assessed with regards to the determination of the presence of wetland areas using available GIS data sources as well as the examination of aerial photography was used to identify wetland areas that could potentially be affected by the proposed powerline project.

WETLAND HEALTH AND FUNCTIONAL INTEGRITY ASSESSMENT TECHNIQUES

A Level 1 (Desktop Screening Level) Wet-Health Assessment and functionality was undertaken to determine the Functional Integrity of the broad scale classification of identified wetland units.

Detailed methodology for the health is given in Appendix A.

ASSESSMENT OF IMPACT SIGNIFICANCE

Significance scoring both assesses and predicts the significance of environmental impacts through evaluation of the following factors; probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. The significance of environmental impacts is then assessed taking into account any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required[4]. Each of the above impact factors have been used to assess each potential impact using ranking scales.

[4] *Impact scores given "with mitigation" are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken. Failure to implement mitigation measures during and after construction will keep the impact at an unacceptably high level.*

Unknown parameters are given the highest score (5) as significance scoring follows the Precautionary Principle. The Precautionary Principle is based on the following statement:

'When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.'

TABLE 2: SIGNIFICANCE SCORING USED FOR EACH POTENTIAL IMPACT

PROBABILITY	DURATION
1 - very improbable 2 - improbable 3 - probable 4 - highly probable 5 - definite	1 - very short duration (0-1years) 2- short duration (2-5 years) 3 - medium term (5-15 years) 4 - long term (>15 years) 5 - permanent/unknown
EXTENT	**MAGNITUDE**
1 - limited to the site 2 - limited to the local area 3 - limited to the region 4 - national 5 - international	2 – minor 4 – low 6 – moderate 8 – high 10 – very high

The following formula was used to calculate impact significance:

Impact Significance: (Magnitude + Duration + Extent) x Probability

The formula gives a maximum value of 100 points which are translated into 1 of 3 impact significance categories; Low, Moderate and High as per Table 3.

TABLE 3: IMPACT SIGNIFICANCE RATINGS

SIGNIFICANCE POINTS	SIGNIFICANCE RATING
0 - 30 points	Low environmental significance
31 - 59 points	Moderate environmental significance
60 -100 points	High environmental significance

The impact assessment is discussed in more detail in Section 5.

3. BASELINE BIOPHYSICAL DESCRIPTION

CLIMATE

The climate along the eastern coast of South Africa is subtropical and characterised by relatively stable temperatures all year round ranging from 16 $^{\circ}C$ to 25 $^{\circ}C$ in winter and 23$^{\circ}C$ to 33 $^{\circ}C$ in summer. The wettest time of the year is January with and the driest is June. The seasonality of precipitation is a driving factor behind the hydrological cycles of rivers, wetlands and drainage lines within the area. Typically, these water resources have a higher flow rate during the summer months.

VEGETATION STRUCTURE AND COMPOSITION

The study area is located within a wide variety of vegetation types within the Azonal Vegetation, Grassland, Forests, Indian Ocean Coastal Belt and Savanna Biomes (Mucina and Rutherford, 2006). The powerline will traverse through thirteen vegetation units (**Figure 3**) with the KwaZulu-Natal Coastal Belt Grassland being the most dominant vegetation type. The southern portion of the study area also passes through Eastern Valley Bushveld, while the northern sections pass through Zululand Coastal Thornveld. Patches of Scarp Forests are also present throughout the proposed corridors.

The KwaZulu-Natal Coastal Belt Grassland vegetation type is characterised by highly dissecting, undulating coastal plains and is comprised mainly of a mosaic of sugarcane fields, timber plantations, thickets, coastal thornveld and secondary *Aristida* grasslands. This topography supports natural, species rich grasslands punctuated with low shrub species and rocky outcrops. This vegetation type is considered endangered (Mucina and Rutherford, 2006). It is predicted that more than 50% of this vegetation type has been transformed due to cultivation, urban expansion and the development of road networks. Further to this alien invasive species including *Chromolaena odorata*, *Lantana camara*, *Melia azedarach* and *Solanum mauritianum* are common and have a detrimental impact on remaining patches of this coast vegetation.

The Eastern Valley Bushveld vegetation type dominates the lower Thukela River basin and is characterised by a mosaic of semidecidous savannah woodlands and thickets with steep mountainous topography, incised by the Thukela River. The majority of the river valleys within this vegetation type drain along the northwest-southwest axis. This results in an unequal distribution of rainfall, with the steep north facing slopes receiving less rain and subsequently increased xerophilous conditions along these slopes. The vegetation composition is dominated by *Euphorbia, Acacia* and *Aloe* species. This vegetation type is considered least threatened (Mucina and Rutherford, 2006).

Zululand Coastal Thornveld is located to the west of Mtubatuba in gentle rolling landscapes supporting wooded grassland dominated by *Themeda triandra*. Bush clumps are a common feature and are more numerous on deeper soils with *Phoenix reclinata* and *Gymnosporia senegalensis* dominant. This vegetation type is considered Endangered (Mucina and Rutherford, 2006).

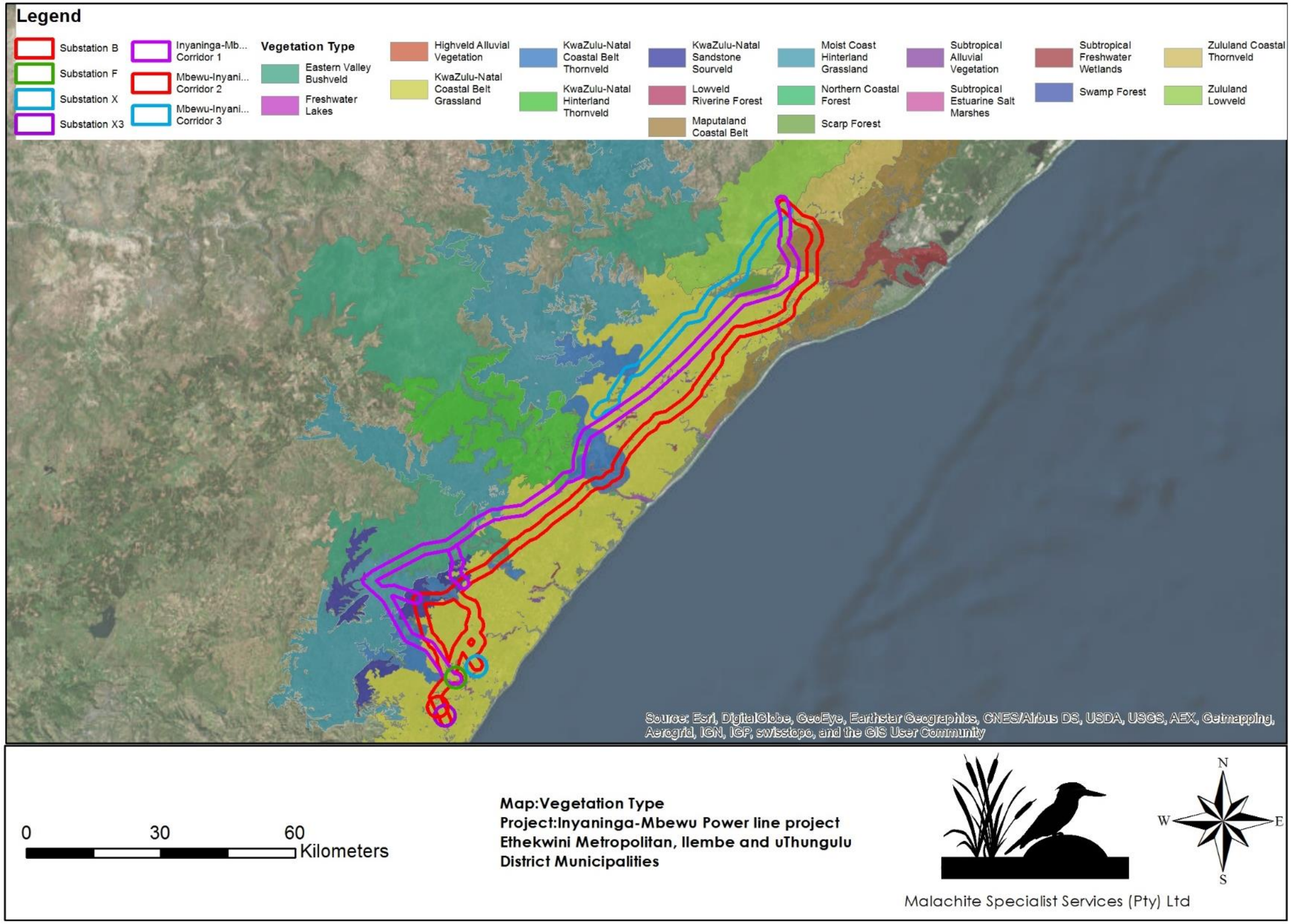


FIGURE 3: VEGETATION TYPES ASSOCIATED WITH THE STUDY AREA

GEOLOGY AND TOPOGRAPHY

The geology of the KwaZulu-Natal Coastal belt from Durban northwards to Mozambique generally consists of beach-derived aeolian sands which cover most of Maputaland and which are underlain by calcareous sediments of marine origin. This coastal plain is widest in Maputaland at approximately 75km wide and narrows in the vicinity of Mtunzini; where after it is a narrow strip down the north and south coasts of KZN (Camp, 1999). Further to this, parts of the corridor alternatives are situated within areas characterised by sediments of the Karoo Supergroup rocks with the mudstones and lesser sandstones of the Adelaide and Tarkastad Subgroups (Beaufort Group) comprising the dominant formations.

A variety of soil forms are supported by these geological features. Shallow soils are common over the harder older sandstones, while younger soils dominate the coastal belt. Alluvial soils are also located within the watercourses.

The broad scale topography of the study area consists of broken topography as a result of deeply incised rivers as well as undulating terrain.

CHARACTERISTICS AND WATERCOURSES

The three powerline corridor alternatives traverse the North Eastern Coastal Belt Ecoregion, the North Eastern Uplands Ecoregion and the Natal Coastal Plain Ecoregion (**Figure 4**). Further to this, the corridor alternatives are located within the following quaternary catchments:

- W12D
- W12E
- W12H
- W12F
- W13A
- W13B
- W11B
- W11C
- V50A
- V50C
- V50D
- U40J
- U40H
- U30B
- U30C
- U30D

- U30E

These quaternary catchments are located within three Water Management Areas, namely, the Usutu to Mhlathuze, the Thukela and the Mvoti to Umzimkhulu.

The Mvoti to Umzimkulu Water Management Area (WMA) lies along the South Africa's eastern coast, primarily within KwaZulu-Natal. The landscape is characterised by rolling terrain with the Drakensberg escarpment forming the main topographical feature (National Water Resource Strategy, 2004). The Mvoti to Umzimkulu WMA is comprised of a diverse economic sector with forestry, agriculture (both subsistence and commercial) and eco-tourism forming the primary land use activities.

The Thukela Water Management Area (WMA) consists of the entire catchment of the Thukela River. The Thukela River rises in the Drakensberg Mountains very close to the border with Lesotho and meanders through central KwaZulu-Natal and discharges into the Indian Ocean. The Upper Thukela lies in the upper reaches of the Thukela River, upstream of the confluence with the Bushmans River, and includes the towns of Bergville, Ladysmith, Colenso and Weenen (DWAF, 2004).

The Usutu to Mhlathuze Water Management Area (WMA) originates in the Drakensberg Mountain range and runs in a predominantly easterly direction draining 4209 km^2 of land before finally discharging into the Indian Ocean at Richards Bay (DWAF, 2004).

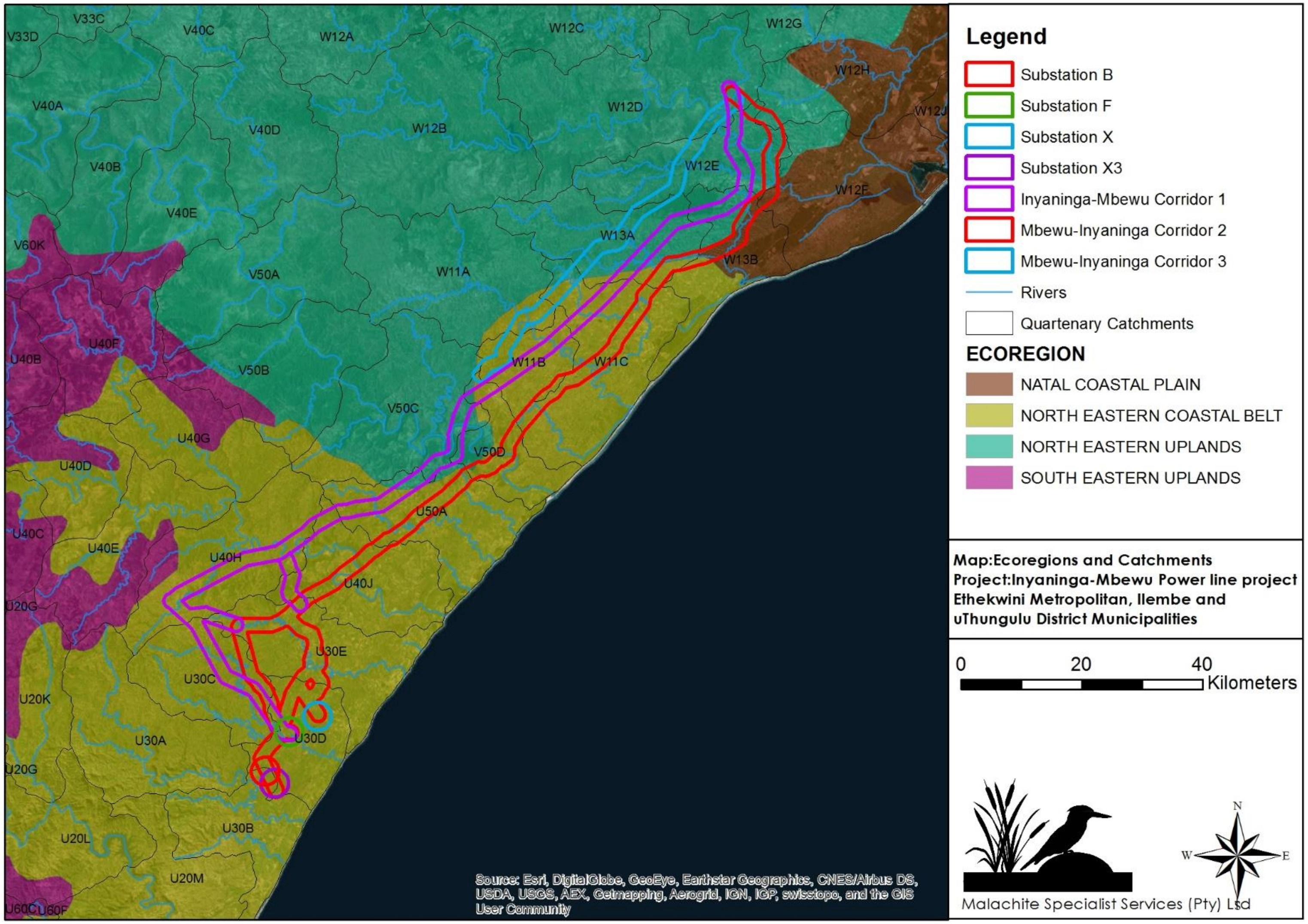


FIGURE 4: ECOREGIONS OF SOUTH AFRICA (DWAF 2005)

NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA)

The NFEPA project was developed to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs (Driver, et al., 2011).

An examination of the NFEPA database revealed that a number of FEPA wetlands were identified throughout the proposed corridors. These are discussed in more detail in Section 4.

4. ASSESSMENT RESULTS

WETLAND DELINEATION

The South African classification system categorises wetland systems based on the characteristics of different Hydrogeomorphic Units. An HGM unit is a recognisable physiographic wetland-unit based on the geomorphic setting, water source of the wetland and the water flow patterns (Macfarlane *et al*., 2008). There are five broad recognised wetland systems based on the abovementioned system and are depicted in the diagram below (**Figure 5**). The classification of these wetlands is then further refined as per the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis *et al*., 2013).

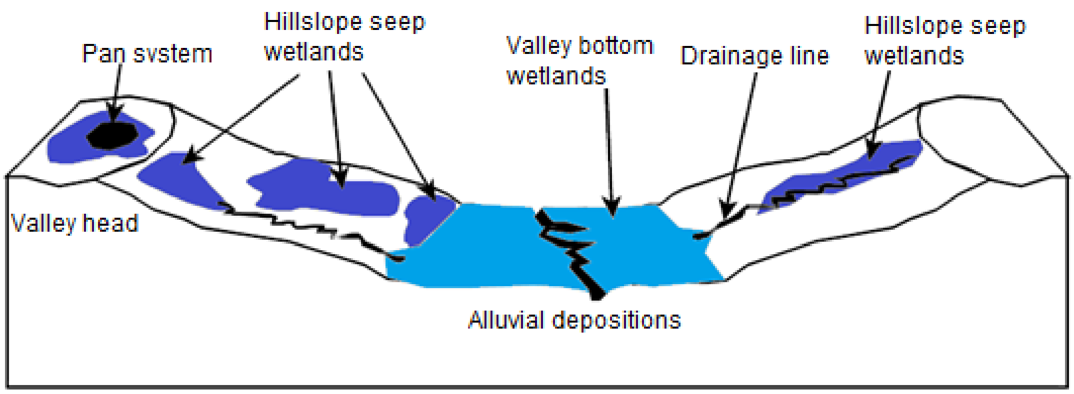


FIGURE 5: DIAGRAMMATIC REPRESENTATION OF COMMON WETLAND SYSTEMS IDENTIFIED IN SOUTHERN AFRICA (BASED ON KOTZE *ET AL*., 2007 AND OLLIS *ET AL*., 2013)

A desktop investigation into the presence of wetlands was undertaken for the three powerline corridor alternatives as well as the four alternative substation sites. This desktop assessment was based on the NFEPA data as well as a detailed study of the aerial imagery of these areas and a flyover of the study area. These wetlands have been classified as either being of the channelled valley bottom, unchannelled valley bottom or seep wetland type and are presented in **Figures 6 to 15.**

Channelled valley bottom wetlands are characterised by their location on valley floors and the presence of a river or stream channel flowing through the wetland. Dominant water inputs to these wetlands are derived from the channels flowing through the wetland either as surface flows resulting from flooding or as subsurface flow. Water generally moves through the wetland as diffuse surface flow although occasionally as short-lived concentrated flows during flood events (Ollis *et al*., 2013).

Unchannelled valley bottom wetlands are characterised by their location on valley floors and the absence of distinct channel banks and the prevalence of diffuse flows. These wetlands are generally formed when a river or stream channel loses confinement and spreads out over a wider area causing the concentrated flow, associated with a river channel, to change to diffuse flow (Ollis et al., 2013). Seepage wetlands are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze *et al.,* 2008; Ollis *et* al., 2013).

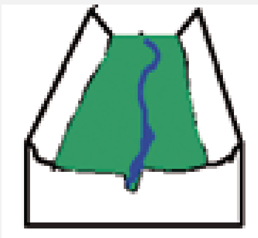
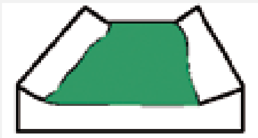
Seepage wetlands are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze *et al*., 2008; Ollis *et al*., 2013).

A description of the bench wetland type is given in **Table 4**.

TABLE 4: WETLAND HYDROGEOMORPHIC (HGM) TYPES (KOTZE *ET AL*., 2008; OLLIS *ET AL*., 2013)

HGM UNIT	DESCRIPTION	SOURCE OF WATER MAINTAINING THE WETLAND[5]	
		SURFACE	SUBSURFACE
Seep 	Slopes on hillsides, which are characterised by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***

[5] Precipitation is an important water source and evapotranspiration an important output in all of the above settings
Water source:
* Contribution usually small
*** Contribution usually large
*/ *** Contribution may be small or important depending on the local circumstances

Channelled Valley bottom 	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterised by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Unchannelled Valley bottom 	Valley bottom areas with no clearly defined stream channel usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***

Due to the large number of wetland systems identified along the three corridors as well as the substation sites, the aerial investigation of the areas was limited to the substation sites. The wetlands presented within the powerline corridors therefore reflect the FEPA wetlands identified.

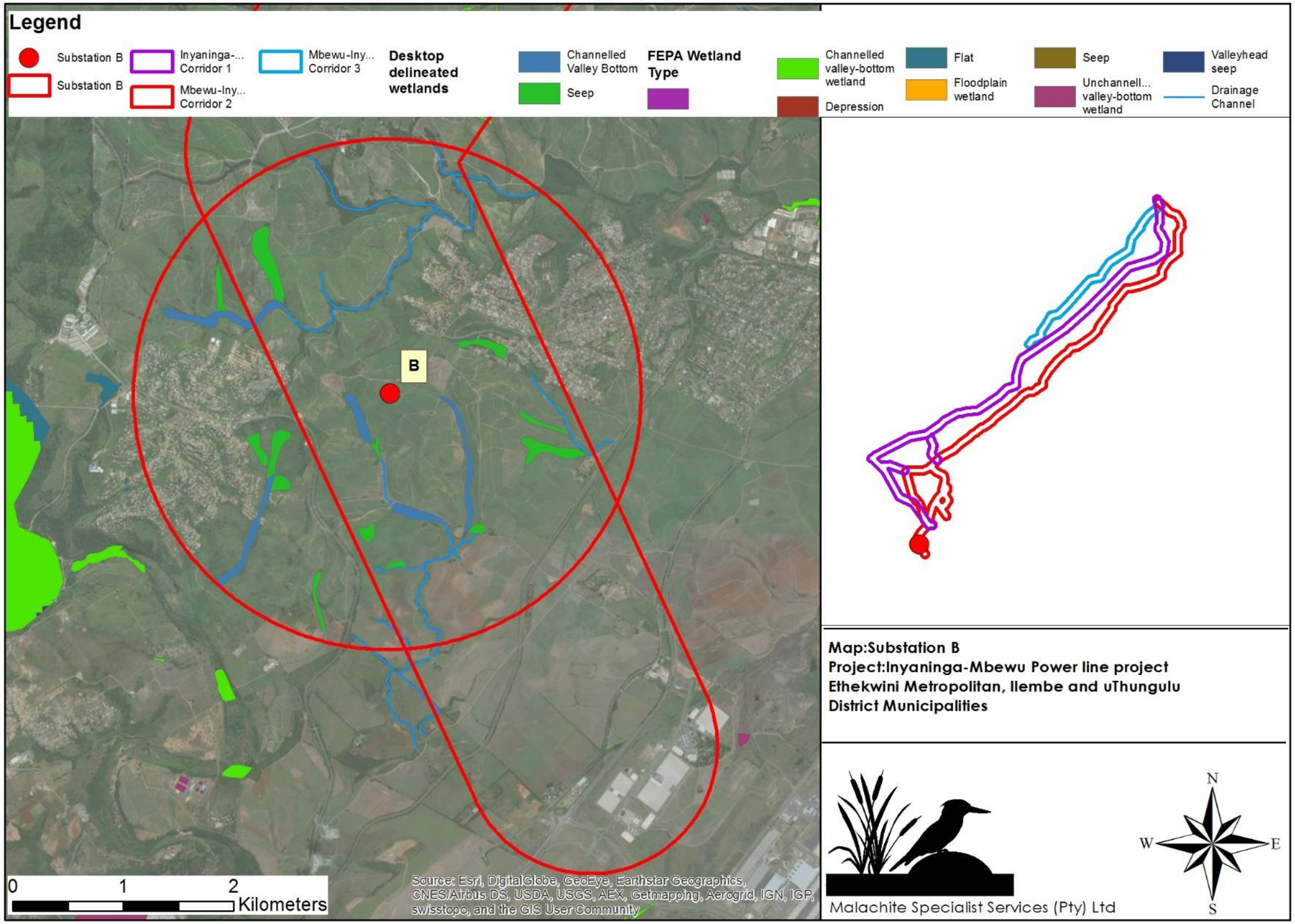


FIGURE 6: WETLANDS DELINEATED WITHIN SUBSTATION B SITE

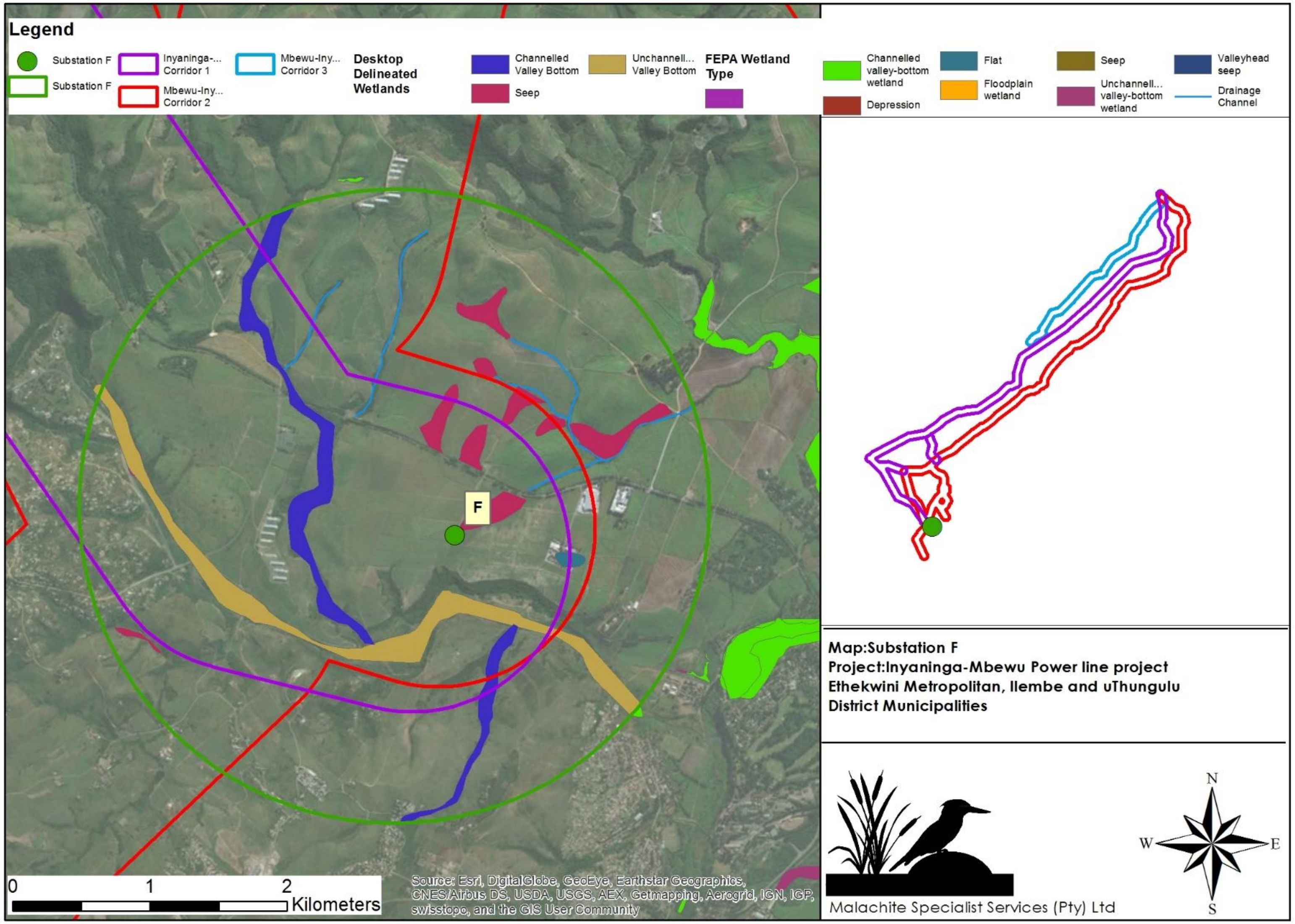


FIGURE 7: WETLANDS DELINEATED WITHIN SUBSTATION F SITE

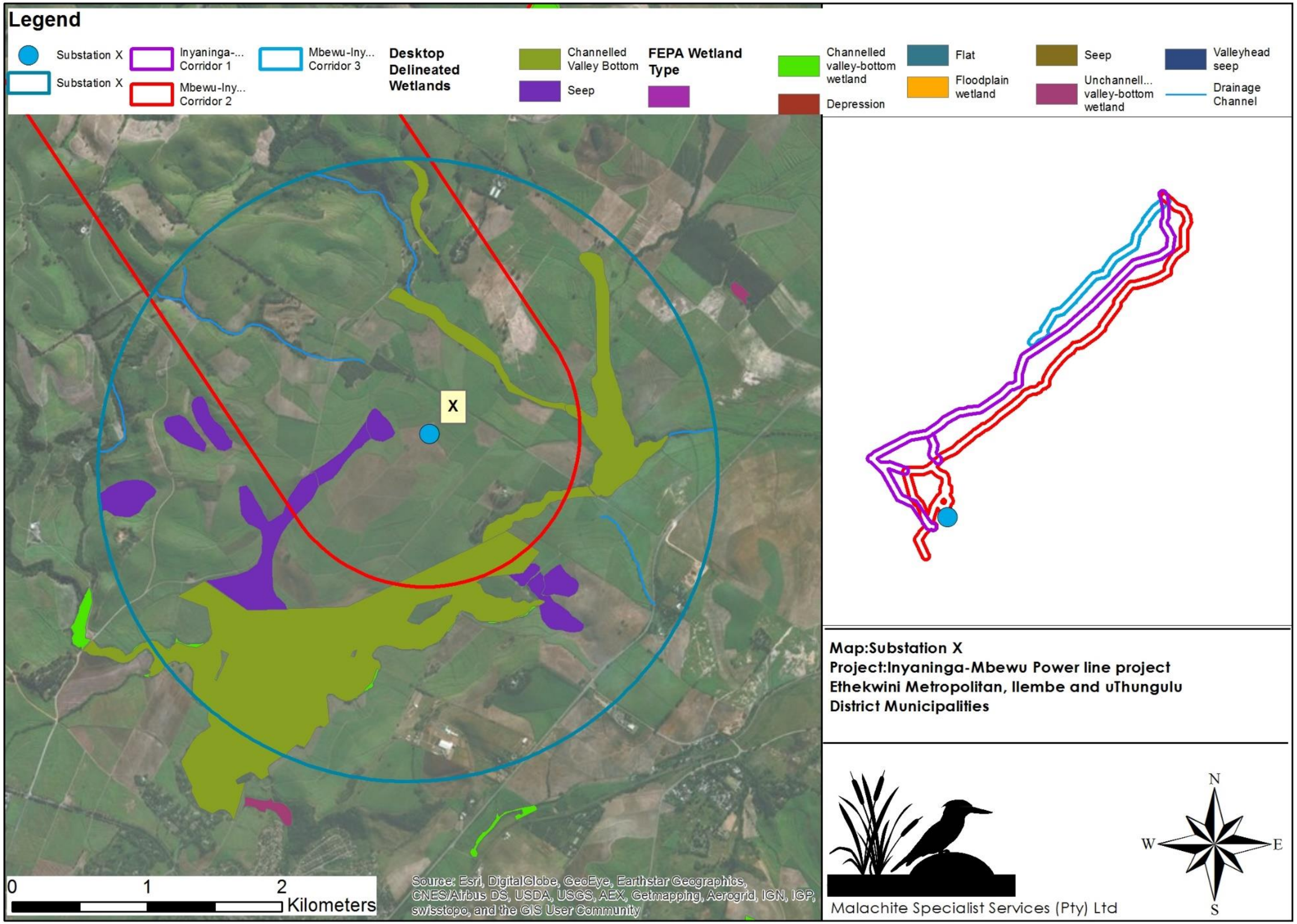


FIGURE 8: WETLANDS DELINEATED WITHIN SUBSTATION X SITE

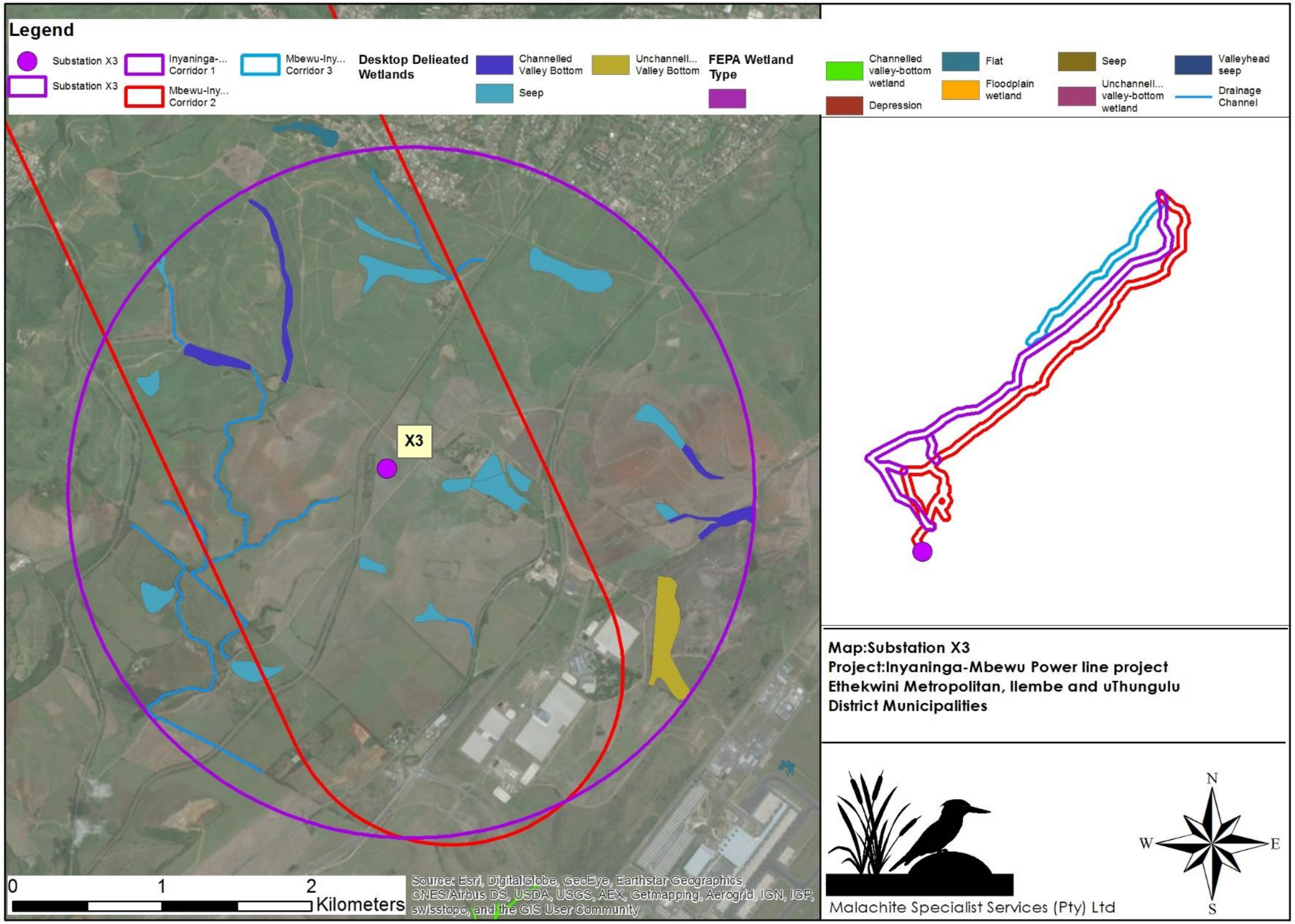


FIGURE 9: WETLANDS DELINEATED WITHIN SUBSTATION X3 SITE

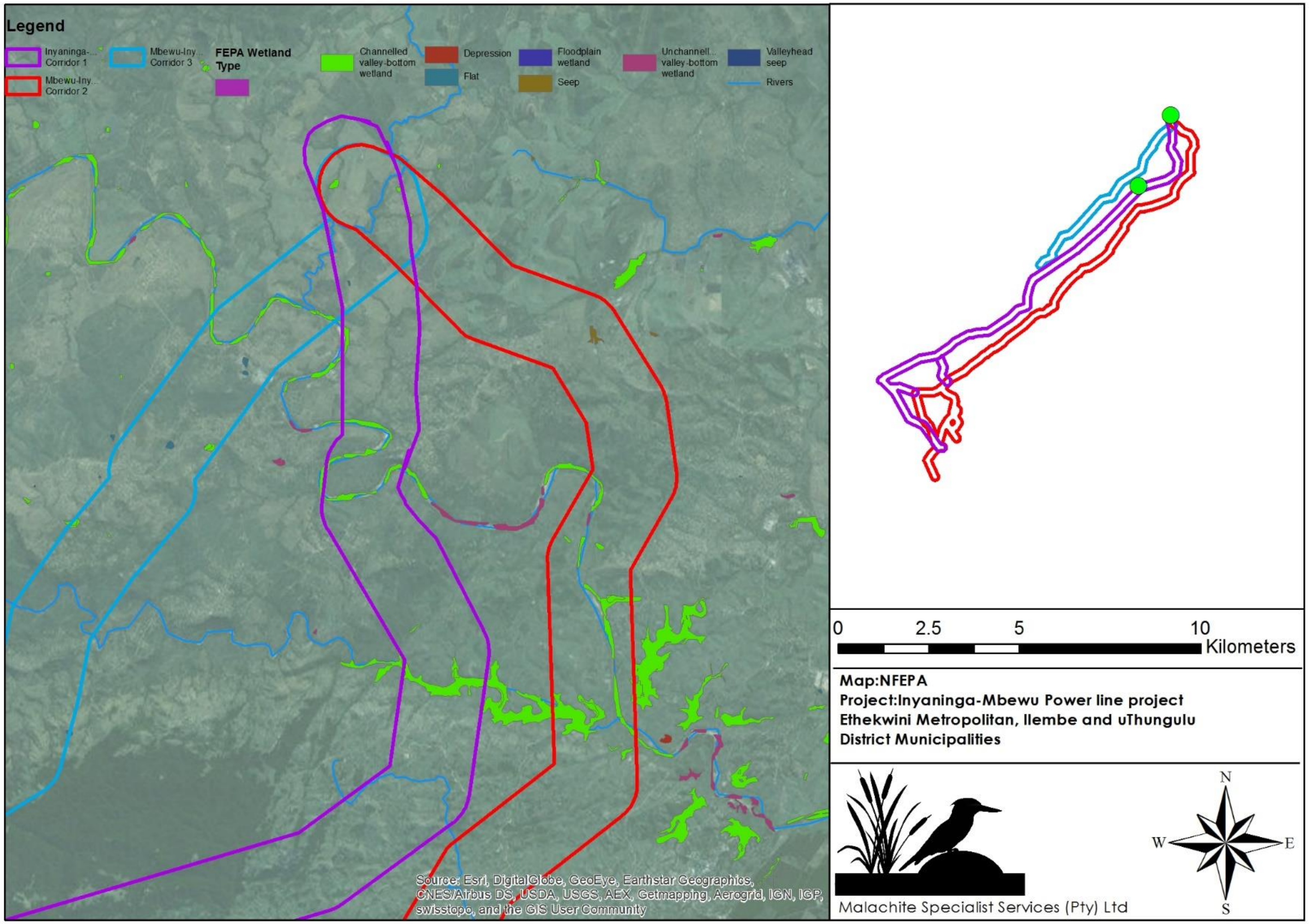


FIGURE 10: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

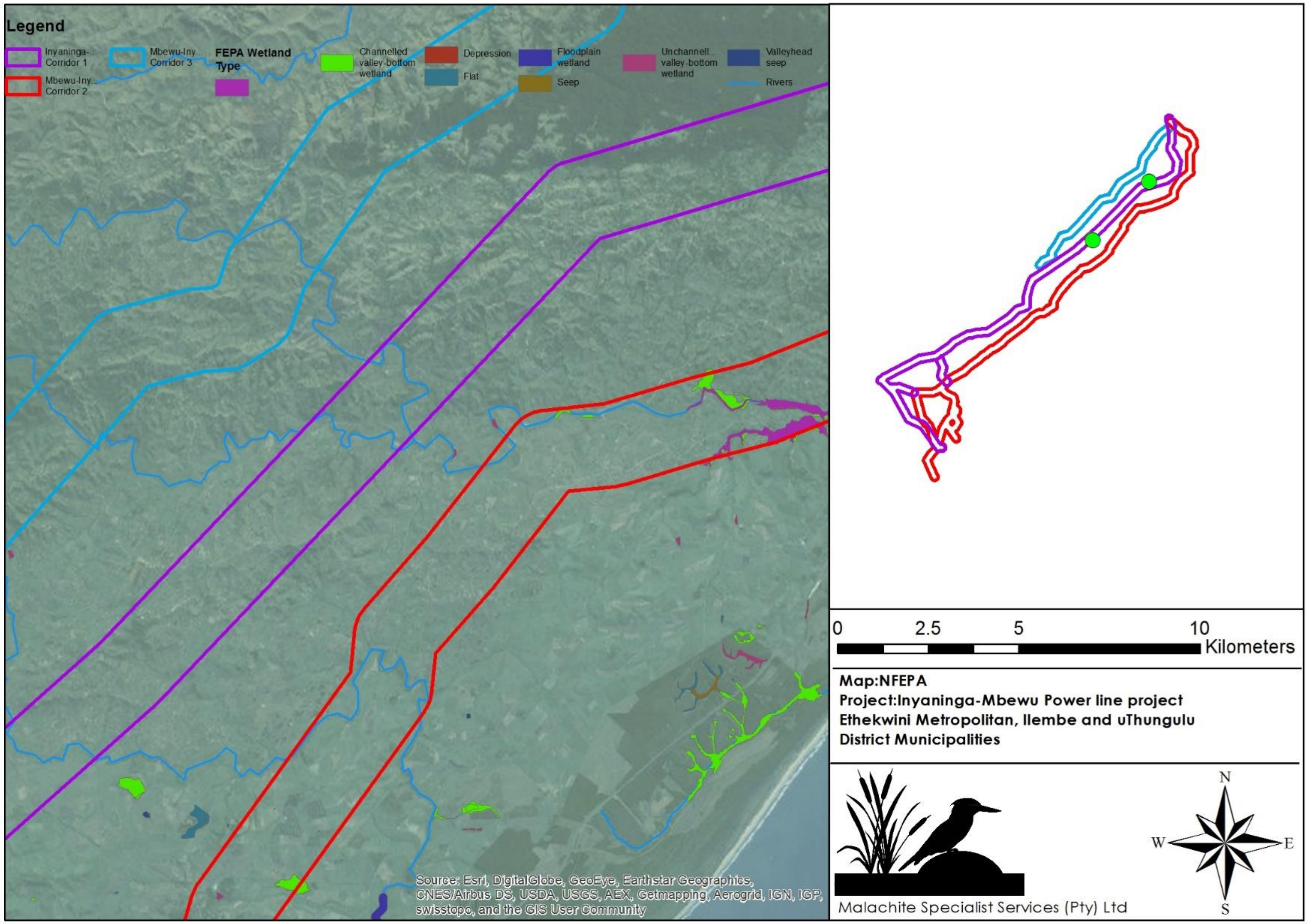


FIGURE 11: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

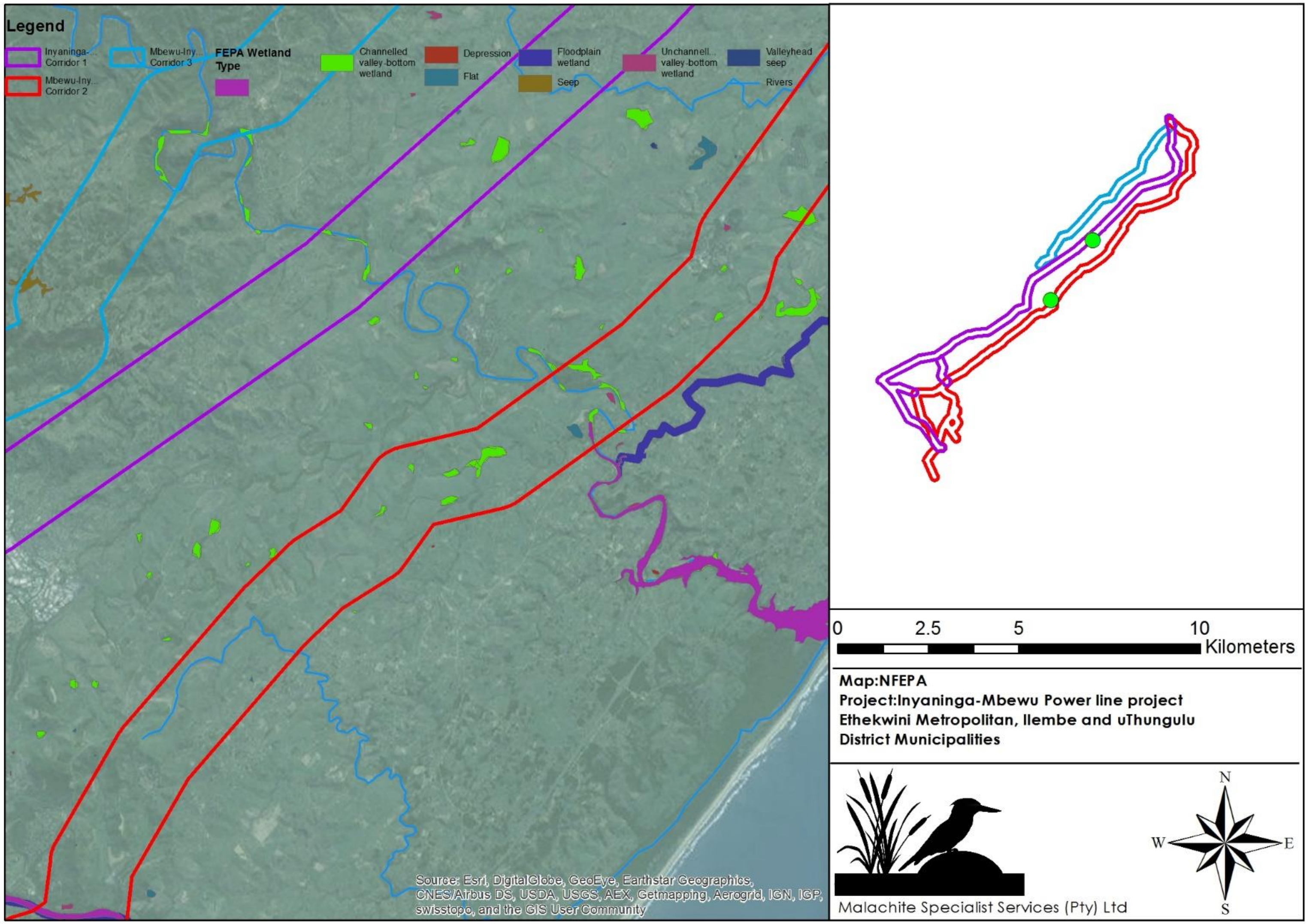


FIGURE 12: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

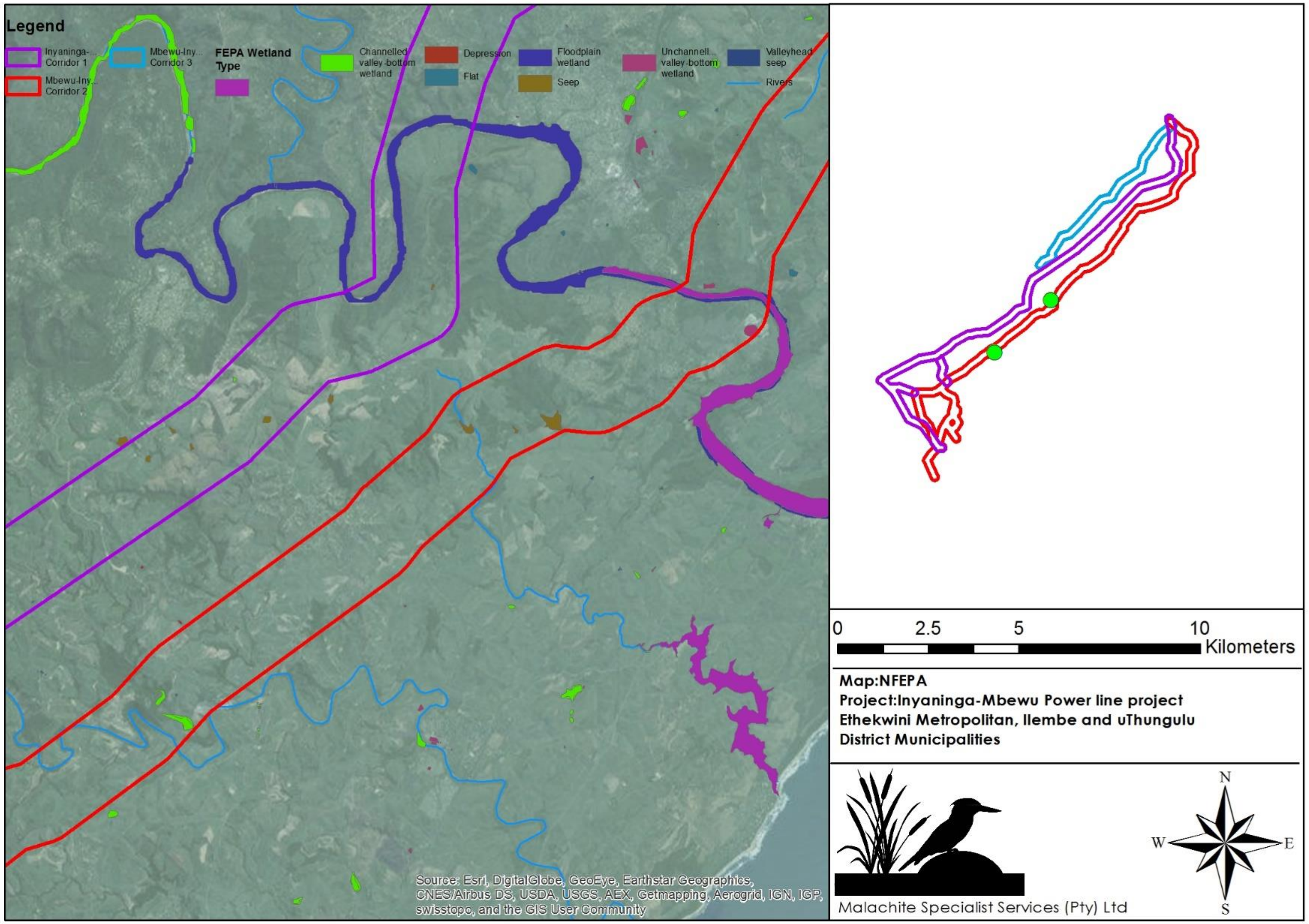


FIGURE 13: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

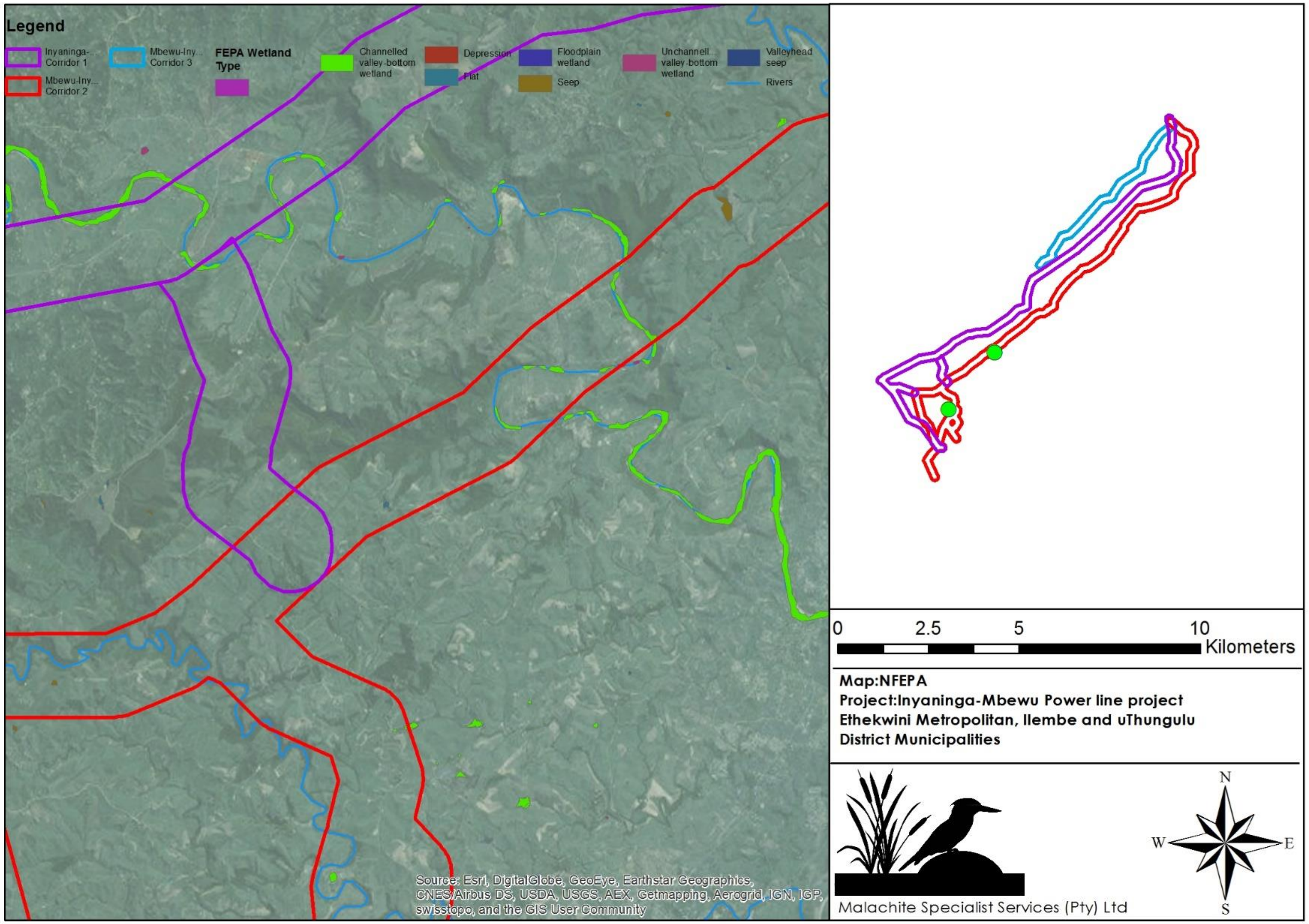


FIGURE 14: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

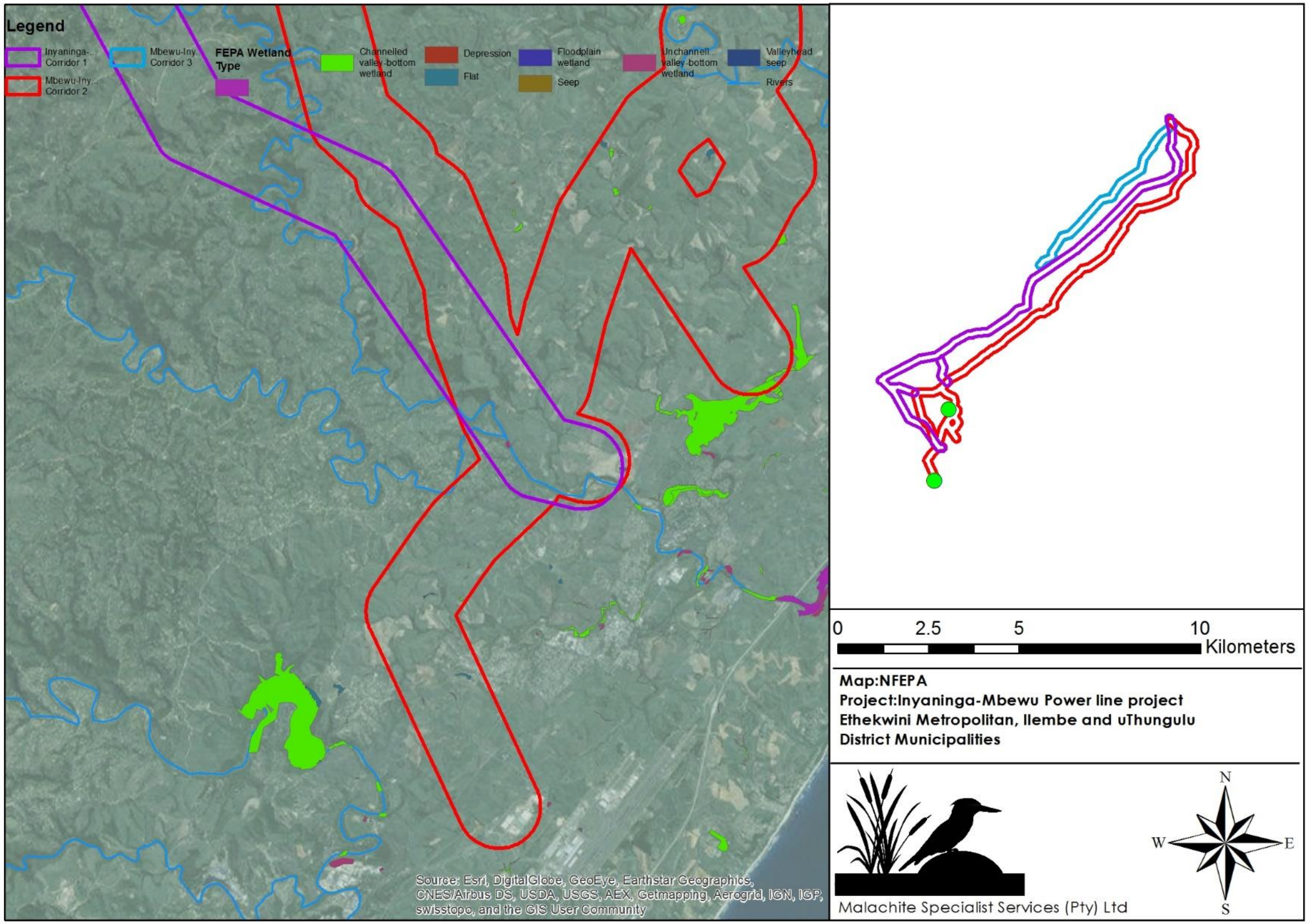


FIGURE 15: FEPA WETLANDS IDENTIFIED WITHIN THE POWERLINE CORRIDOR ALTERNATIVES

PHOTOGRAPH 1: SEEP SYSTEMS WHICH FLOW INTO CHANNELLED VALLEY BOTTOM WETLANDS

PHOTOGRAPH 2: CHANNELLED VALLEY BOTTOM SYSTEMS

PHOTOGRAPH 3: UNCHANNELLED VALLEY BOTTOM SYSTEM AS WELL AS A DAM

Present Ecological State (PES)

An assessment on the health and functional integrity of the identified wetland systems cannot be undertaken at this time, due to the large quantity of wetland systems identified within the three powerline corridor alternatives and four substation site alternatives. These assessments must be undertaken once a final corridor has been selected for the proposed powerline and a walk down conducted to delineated and assess the wetlands along this corridor.

Despite this, the identified wetland systems were grouped as per their HGM classification and due to differences in the pattern of water flow through the different HGM types, the wetlands have been divided into distinct HGM units at the outset. The level 1 assessment was then conducted on the broad classification of each HGM type. This was undertaken to determine the general impacts to the wetlands within the study area and the effects these impacts have had on the wetland types. These impacts have generally given scores of largely modified (Pes Category D; Table 5).

Table 5: Summary of PES score

HGM Wetland Type	Hydrology	Geomorphology	Vegetation	PES Score (Category)
Seep	6.5	5.0	5.6	(5.81) (D)
Channelled Valley Bottom	5	5.2	5.3	(5.14) D
Unchannelled Valley Bottom	5	4.8	5.2	(5.00) D

The major modifications to the catchments associated with the wetland systems include: agricultural activities including sugar can cultivation, subsistence agriculture and livestock grazing, infrastructural development, residential and urban development, erosion and the widespread encroachment of alien invasive species.

Seep systems are mostly affected by sugarcane cultivation of the North Coast of KwaZulu-Natal. The aerial investigation of the area shows a number of seep wetlands that have been drained to create more favourable conditions for sugarcane production. These drains are known as 'herring-bone' drains and are easily visible through the aerial photography. These drains largely affect the hydrological flow of the seepage systems, reducing the scores obtained for this HGM type. In a study conducted by Matavire, 2015, most farmers still drain wetlands despite advances in legislation since the 1950s. Channelled Valley Bottom systems are often used for subsistence agriculture as well as livestock grazing. This has a negative effect on both the hydrology and geomorphology of these systems (i.e. the movement of soil and water into, through and out of the wetland units).

Unchannelled Valley Bottom Wetlands are generally impacted upon by erosion, which transforms these slow velocity systems into faster moving systems with regards to hydrological flow and creating an unnatural channel.

Other impacts within the wetland's catchments include the conversion of the vegetation dynamics of the catchments to plantations including *Eucalyptus* spp., *Acacia mearnsii* and *Pinus* spp. plantations. Plantations that are planted adjacent to and within wetland systems have a significant impact on the water storage function of wetlands as these trees use more water than indigenous plants and their roots penetrate deeper into the water table. As a result, the species have a significantly greater loss of water through transpiration. These combination of factors alters the hydrological regime of the wetlands, often resulting in the system drying out. In addition, excessive numbers of trees, such as those associated with a plantation, create shaded conditions, inhibiting the growth of many wetland plant species. This facilitates the encroachment of alien plant species.

PHOTOGRAPH 4: LARGE SCALE SUGARCANE CULTIVATION WITHIN THE STUDY AREA.

PHOTOGRAPH 5: SUBSISTENCE AGRICULTURE AND RURAL RESIDENTIAL IMPACTS WITHIN THE WETLAND SYSTEMS

PHOTOGRAPH 6: INFRASTRUCTURAL AND RESIDENTIAL DEVELOPMENT ADJACENT TO AND WITHIN WETLAND SYSTEMS

5. BUFFERS REQUIREMENTS

Buffer zones outside the boundary of wetlands are required to ensure that the ecotones between aquatic and terrestrial environments are effectively managed and conserved. These ecotones have a high ecological significance and have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity (Macfarlane *et al*., 2016). These functions include:

- Maintaining basic aquatic processes through maintaining channel stability as well as regulating microclimate and water temperature;
- Reducing impacts on water resources from upstream activities and adjoining land uses through stormwater attenuation; sediment and toxicant removal;
- Providing habitat for aquatic and semi-aquatic species (species with a bi-phasic life cycle) through the
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

The buffer tool aims to provide a method for determining appropriate buffer widths for developments associated with wetlands, rivers or estuaries. It takes into account a number of different factors in determining the buffer width including the impact of the proposed activity on the water resource, climatic factors, topographical factors and the sensitivity of the water resource.

The results calculated show that a <u>30m buffer</u> is appropriate for the protection of the ecosystem services provided by the wetland systems. The above buffer width is recommended during both the construction and operational phase of the proposed project particularly with regards to the positioning of the towers associated with the powerline as well as the creation of any access roads. This buffer is based on a desktop analysis of the study area and can be refined once the final corridor has been chosen and a walk down conducted to delineate and assess the affected wetland systems.

4. CONSIDERATION OF ALTERNATIVES

SUBSTATION SITE B:

The buffer associated with substation alternative site B is situated within an area that has been largely transformed as a result of agricultural activities, predominantly sugarcane cultivation. Two main residential areas, are also present within the buffer zone. The substation site buffer overlaps with substation site alternative X3. A number of wetland systems were delineated at a desktop level including both seeps and channelled valley bottom wetlands. A number of drainage channels and riparian zones were also delineated. The 30m buffer would be placed around all these wetland systems. A number of open areas, particularly within the sugarcane sites are available for a potential substation site.

SUBSTATION SITE F:

The buffer associated with substation alternative F is situated to the north of substation alternative site B. A large unchannelled valley bottom system flows through the entire substation buffer site associated with the confluence of the Tongati and Mona Rivers. Further to this, several channelled valley bottom wetlands and seep systems were also delineated at a desktop level. The Tongati River forms a steeply incised valley through the substation buffer site, which is not suitable for development. Patches of sugarcane cultivated land are available for the development of the substation in areas outside of the seep systems.

SUBSTATION SITE X:

This site alternative buffer is the most northerly buffer site. It predominantly consists of sugarcane cultivation areas as well as road networks and a large dam, known as the Dudley Pringle Dam. A number of channelled valley bottom wetlands and seeps were delineated at a desktop level within the site.

SUBSTATION SITE X3:

This is the most eastern substation alternative buffer site. The area is used for the cultivation of sugarcane, as well as infrastructural development including the R102 road, local roads and a railway track. The delineated wetland and drainage channels are widely spaced, with a number of areas available for the development of the substation. Due to the positioning and number of wetlands identified at the desktop level, this is the preferred alternative.

Site Alternatives	Order of Preference
Site B	2
Site F	4
Site X	3
Site X3	1

Corridor Alternatives

Due to the broad scale nature of the project, as well as the desktop approach to the wetland assessment, any of the three proposed corridors can be utilised from a wetland perspective. Once a final corridor has been chosen a walk down must be conducted to delineate any wetlands along the powerline corridor and the appropriate buffer applied to the wetland systems assessed. This buffer must be utilised in planning the position of the towers so that risks to the wetland systems can be minimised.

5. IMPACT DESCRIPTION, ASSESSMENT & MITIGATION

Any development activity in a natural system will have an impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the impacts caused by the proposed powerline project and to provide a description of the mitigation required to limit the identified negative impacts on the receiving environment.

The impact assessment identified the following potential negative impacts associated with the proposed project on the wetland systems; (i) soil compaction leading to erosion, sedimentation and degradation of wetland systems; (ii) pollution of wetlands and soil as a result of the construction phase of the project and (iii) disturbance within the wetland systems thereby increasing the encroachment of alien invasive species and the loss of natural habitat for fauna and flora. Several general and specific measures are proposed to mitigate these impacts on the seep wetland system.

SOIL EROSION, SEDIMENTATION AND DEGRADATION WITHIN WATER RESOURCE SYSTEMS

IMPACTS ASSOCIATED WITH THE CONSTRUCTION PHASE OF THE ACTIVITIES										
Future Impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
Construction Phase										
Soil erosion and sedimentation	4	3	2	2	2	1	8	6	48 (moderate)	27 (low)
Operational Phase										
Degradation of water resources	2	1	5	5	2	1	4	2	22 (low)	8 (low)

Description of impact

Construction activities (i.e. excavations and vegetation clearing) expose soil to environmental factors including rainfall and wind. The exposure to these factors will result in the removal of topsoil and this subsequently leads to soil erosion and the deposition of sediment in the downslope watercourses. This increased high-suspended particulate matter within the wetlands can accumulate within the watercourses, particularly during the wetter months. Sedimentation poses a risk to the geomorphological/functional integrity of wetland and watercourse systems, reducing the ecological integrity of the water resource outside of the impacted area.

The risk and potential impact of soil erosion will be moderate during the construction (removal of vegetation and creation of excavations) phase and this impact will decrease significantly during the operational phase provided rehabilitation of impacted areas is undertaken.

Mitigation Options

- Whichever corridor alternative and substation site is authorised, the enforcement of the buffer and the placement of towers outside of wetland systems will significantly reduce the impact of the proposed powerline corridor on the wetland systems.
- The creation of access roads must take all wetlands and watercourses into consideration and these systems must be avoided.
- The development footprint is to be limited to what is absolutely essential in order to minimise environmental damage along the powerline corridor.
- No stockpiling of any materials may take place adjacent to any of the water resources. Erosion control measures must be implemented in areas sensitive to erosion, particularly in areas prone to erosion and where erosion has

already occurred. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.

- Do not allow surface water or storm water to be concentrated, or to flow down slopes without erosion protection measures being in place;
- The entire construction area must not be stripped of vegetation prior to commencing construction activities.
- All disturbed areas must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.
- Any channel banks that will be affected must be re-profiled as per the original soil horizon structure and re-vegetated with indigenous species;
- Make use of existing access roads as much as possible and plan additional access routes to avoid vegetation communities.
- Minimise the extent of the work footprint as far as possible.

POLLUTION OF WATER RESOURCES AND SOIL

IMPACTS ASSOCIATED WITH THE CONSTRUCTION PHASE OF THE ACTIVITIES										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
Construction Phase										
Pollution of water resources and soil	5	4	2	2	2	1	8	4	60 (moderate-high)	28 (low)
Operational Phase										
Pollution of water resources and soil	2	1	5	5	2	1	6	4	26 (low)	10 (low)

<u>Description of the impact</u>

Sediment release from a construction site into the downstream aquatic environment is one of the most common forms of waterborne pollution. Furthermore, mismanagement of waste and pollutants including hydrocarbons, construction waste and other hazardous chemicals will result in these substances entering and polluting the sensitive natural downstream environments either directly through surface runoff during rainfall events, or sub-surface water movement.

Further to this, the linked nature of the wetlands and associated watercourses will result in pollutants being carried downstream from the construction site having consequences on further downstream users including aquatic faunal species. An increase in pollutants will lead to changes in the water quality of the wetlands, affecting their ability to act as ecological corridors in the larger landscape and reducing their ability to maintain biodiversity.

Mitigation Options

- Do not locate the construction camp or any depot for any substance which causes or is likely to cause pollution within a distance of 100m of the delineated water resources.
- All waste generated during construction is to be disposed of at an appropriate facility and no washing of paint brushes, containers, wheelbarrows, spades, picks or any other equipment adjacent to the watercourses is permitted.
- Proper management and disposal of construction waste must occur during the construction of the development.
- No release of any substance i.e. cement, oil, that could be toxic to fauna or faunal habitats within the watercourses.
- Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using proper solid/hazardous waste facilities (not to be disposed of within the natural environment). Any contaminated soil must be removed and the affected area rehabilitated immediately.
- A spill contingency plan must be drawn up for the construction phase.

ALIEN INVASIVE SPECIES

Impacts associated with the encroachment of alien invasive species											
Impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	Without	With	Without	With	Without	With	Without	With		
Construction Phase										
Spread of Alien invasive species	5	4	2	2	2	1	8	6	60 (high)	36 (moderate)
Operational Phase										
Spread of Alien invasive species	5	4	5	4	2	2	8	6	75 (high)	48 (moderate)

Description of the impact

The removal of vegetation along the powerline corridor and substation site will lead to disturbance within the area having a negative impact on the functionality of the vegetation community associated with the wetland systems. Alien invasive species occur throughout the study area and these species will further encroach into disturbed areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches (Bromilow, 2010). Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs (Zedler, 2004).

Mitigation Options

- Protect as much indigenous vegetation as possible.
- An alien invasive management programme in terms of the National Environmental Management: Biodiversity Act must be incorporated into an Environmental Management Programme for both the construction and operational phase as extirpation of alien invasive vegetation is an on-going activity. Areas which have been disturbed will be quickly colonised by invasive alien plant species

6. CONCLUSION

The wetland assessment involved desktop investigations for the presence of wetland systems within three proposed powerline corridors as well as four alternative substation sites. This investigation made use of aerial imagery, NFEPA wetlands data as well as a flyover of the study area. These wetlands were classified as channelled valley bottom systems, unchannelled valley bottom systems and seep systems.

The identified wetland systems were grouped as per their HGM classification and due to differences in the pattern of water flow through the different HGM types, the wetlands have been divided into distinct HGM units at the outset. The level 1 assessment was then conducted on the broad classification of each HGM type. This was undertaken to determine the general impacts to the wetlands within the study area and the effects these impacts have had on the wetland types. These impacts have generally given scores of largely modified (Pes Category D). The major modifications to the catchments associated with the wetland systems are: agricultural activities including sugar can cultivation, subsistence agriculture and livestock grazing, infrastructural development, residential and urban development, erosion and the widespread encroachment of alien invasive species.

A 30m buffer has been calculated for the wetland systems and is considered appropriate for the protection of the ecosystem services provided by the wetlands' systems. The above buffer width is recommended during both the construction and operational phase of the proposed project particularly with regards to the positioning of the towers associated with the powerline as well as the creation of any access roads. This buffer is based on a desktop analysis of the study area and can be refined once the final corridor has been chosen and a walk down conducted to delineate and assess the affected wetland systems.

The impact assessment identified the following potential negative impacts associated with the proposed project on the wetland systems; (i) soil compaction leading to erosion, sedimentation and degradation of wetland systems; (ii) pollution of wetlands and soil as a result of the construction phase of the project and (iii) disturbance within the wetland systems thereby increasing the encroachment of alien invasive species and the loss of natural habitat for fauna and flora.

Several general and specific measures are proposed to mitigate these impacts on the receiving environment. Provided the mitigation measures specified in this report are implemented and the continued monitoring and rehabilitation of any disturbed areas is undertaken, the proposed project is expected to have a limited negative effect on the receiving environment and water resources. This is particularly so, if the 30m buffer is adhered to and the use of existing access roads as far as possible is undertaken.

Due to the broad scale nature of the project, as well as the desktop approach to the wetland assessment, any of the three proposed corridors and four alternative substation sites can be utilised from a wetland perspective. Once a final corridor has been selected and substation site chosen, a walk down must be conducted to delineate any wetlands along the powerline corridor and the appropriate buffer applied to the wetland systems assessed. This buffer must be utilised in planning the position of the towers so that risks to the wetland systems can be minimised.

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8. APPENDICES

APPENDIX A – WETLAND AND RIPARIAN ASSESSMENT METHODOLOGY

WETLAND DELINEATION TECHNIQUE

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act as:

> *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

The desktop study conducted during the initial Scoping Phase assessment involved the assessment of aerial photography, GIS databases including the NFEPA and South African National Wetland maps as well as literature reviews of the study site in order to determine the likelihood of wetland areas within the area.

ASSESSMENT OF THE WETLAND'S PRESENT ECOLOGICAL STATE (PES)

The Present Ecological State (PES) for wetlands which is defined as '*a measure of the extent to which human impacts have caused the wetland to differ from the natural reference condition*' is also an indication of each wetland's ability to contribute to ecosystem services within the study area. This was assessed according to the methods contained in the Level 2 WET-Health: *A technique for rapidly assessing wetland health* (Macfarlane, et al., 2009)

This document assesses the health status of a wetland through evaluation of three main factors -

- ***Hydrology:*** *defined as the distribution and movement of water through a wetland and its soils.*
- ***Geomorphology:*** *defined as the distribution and retention patterns of sediment within the wetland.*
- ***Vegetation:*** *defined as the vegetation structural and compositional state.*

The WET-Health tool evaluates the extent to which anthropogenic changes have impacted upon the functional integrity or health of a wetland through assessment of the above-mentioned three factors. The deviation from the natural condition is given a rating based on a score of 0-10 with 0 indicating no impact and 10 indicating modifications have reached a critical level. Since hydrology, geomorphology and vegetation are interlinked their scores are then aggregated to obtain an overall PES health score These scores are then used to place the wetland into one of six health classes (A – F; with A representing completely unmodified/natural and F representing severe/complete deviation from natural as depicted in **Table 6**.

TABLE 6: HEALTH CATEGORIES USED BY WET-HEALTH FOR DESCRIBING THE INTEGRITY OF WETLANDS

DESCRIPTION	IMPACT SCORE	HEALTH CATEGORY
Unmodified, natural.	0 – 1.0	A
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1.1 - 2.0	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2.1 - 4.0	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4.1 - 6.0	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6.1 - 8.0	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.1 - 10.0	F

Due to differences in the pattern of water flow through various hydro-geomorphic (HGM) types, the tool requires that the wetland is divided into distinct HGM units at the outset. Ecosystem services for each HGM unit are then assessed separately. A Level 1 WET-Health assessment was undertaken for the wetlands identified. A Level 1 assessment is a desktop assessment and is undertaken at a broad scale to determine the overall impacts on wetland systems.