WETLAND DELINEATION & ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED LETHABO 4.5KM 132KV POWERLINE , FREE STATE PROVINCE

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EXECUTIVE SUMMARY

EnviroSHEQ Consulting (Pty) Ltd was appointed by DIGES Group (herein DIGES) to conduct a wetland assessment of the sites designated for construction of the Lethabo 4.5 km 132 kV powerline that will transmit power from the proposed Lethabo solar plant to the existing substation northeast of the Lethabo power station. The study focused on describing the present ecological status and ecological importance and sensitivity of the project area and its immediate surrounds to identify and assess possible negative impacts that may result from the proposed project. This document presents the findings of the study.

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

- Identify and delineate any wetland areas and/or watercourses within a 500m boundary around the proposed development site according to the Department of Water Affairs "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Determine the Present Ecological Status (PES) and Functional Integrity of identified wetlands using the WET-Health and Wet-EcoServices approach.
- Determine the Ecological Importance and Sensitivity (EIS) of identified wetlands using the latest applicable approach supported by the DWS.
- Identify possible impacts to wetlands or watercourses within the study area as well as recommend mitigation measures and rehabilitation measures for the proposed development.

Two site corridor alternatives were proposed for assessment. Corridor A refers to the corridor in close proximity to the road from the proposed solar power plant whereas Corridor B refers to the deviation of Corridor A from the existing substation. Of significance to note is the existence of powerlines that run within the same proposed two corridors i.e., Corridor A and B. The proposed powerline corridor alternatives run from the north-eastern side of the Lethabo power station (S260 44' 33.34" E 270 58' 32.62") site where the substation is located to the southern part of the power station under the jurisdiction of the Metsimaholo municipality, Free State Province. The project area is approximately 10km southeast of Vereeniging and 14km northeast of Sasolburg.

The Wetlands identified are moderately transformed and impacted by historical and ongoing anthropogenic activities. Wetland B is a small-scale wetland unit that interconnects to a larger wetland system to the south (Wetland A). The wetland located near the power station (Wetland C) was determined to be historically impacted by the construction and operation of the power station and associated stormwater infrastructure. The Present Ecological Status (PES) for wetlands B & C (seeps) scored moderate and high for wetland A (floodplain) respectively. The Ecological Importance and Sensitivity (EIS) falls in the mid-range and has high functionality in respect of hydrological functions. The Recommended Ecological Category (REC) for the wetlands were categorised as moderate. It will thus require some rehabilitation to enhance the ecological function of the system. Wetlands B and C are considered sensitive and important at a local and provincial scale, while wetland A is considered ecologically important and sensitive at a national scale, and also its biodiversity is sensitive to flow and habitat modifications. Wetland A plays a role in moderating the quantity and quality of water from major rivers. The impact assessment showed that the proposed powerline would minorly impact the identified wetlands.

In conclusion, both corridors are viable since they are located within the same environment, and as such, there is no advantage or disadvantage in proceeding with any of the two alternatives. In addition, no significant impacts are associated with the development of any of the proposed corridors that cannot be reduced to a manageable level through mitigation. It should also be noted that the work proposed at the existing RWB substation will have an insignificant impact. Provided the recommendations suggested in this report are followed, there is no objection to the proposed development in terms of the wetlands of the study area.

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LIST OF ABBREVIATIONS USED IN THIS ASSESSMENT

CARA	Conservation of Agricultural Resources Act (Act. No 34 of 1983)
CBA	Critical Biodiversity Areas
DAFF	Department of Forestry and Fisheries
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GPS	Global Positioning System
HGM	Hydrogeomorphic Unit
IAPs	Invasive Alien Plant species
IDP	Integrated Development Plan
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystems Priority Areas
NWA	National Water Act (Act 36 of 1998)
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SWMA	Sub Water Management Area

VEGRAI	Riparian Vegetation Response Assessment Index
WMA	Water Management Area
WULA	Water Use Licence Application

1. INTRODUCTION & BACKGROUND

1.1. Introduction

With South Africa being a contracting party to the Ramsar Convention on Wetlands, the South African government has taken a keen interest in the conservation, sustainable utilisation, and rehabilitation of wetlands in South Africa. This aspect is also reflected in various pieces of legislation controlling development in and around wetlands and other water resources, of which the most prominent may be the National Water Act, Act 36 of 1998. As South Africa is an arid country, with a mean annual rainfall of only 450mm about the world average of 860mm (DWAF, 2003), water resources and the protection thereof becomes critical to ensure their sustainable utilisation. Wetlands perform various important functions related to water quality, flood attenuation, stream flow augmentation, erosion control, biodiversity, harvesting of natural resources, and others, highlighting their importance as an irreplaceable habitat type. Determining the location and extent of existing wetlands, as well as evaluating the full scope of their ecosystem services, form an essential part of striving towards sustainable development and protection of water resources.

1.2. Rationale for this wetland assessment

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. South Africa is an extremely biologically diverse country and provides an important basis for economic growth and development. Ecosystems are particularly susceptible to anthropogenic activities such as urban and infrastructural developments. Due to their susceptibility, a holistic approach is required to effectively integrate the activity and the receiving environment sustainably and progressively. This includes the incorporation of the natural system into the layout and design of the development.

The implementation of legal frameworks coupled with wetland functionality and health assessments, facilitates the implementation of conservation initiatives. Appropriate management recommendations to lower the significance of the existing impacts on water resources will be provided in this assessment. This is achieved through a detailed wetland delineation process within the study site augmented by data and previous studies conducted within the region.

1.3. Scope of the assessment

As all wetlands are automatically designated as ecologically sensitive areas, they have to be delineated to enable appropriate conservation buffers to be allocated to each wetland associated with a proposed development area. This is to be done per DWAF guidelines for the delineation of wetlands and riparian zones (2005) by looking at the terrain, soil form, soil wetness and vegetation unit indicators to delineate permanent, seasonal and temporary zones of the wetlands. An obligatory conservation buffer is then to be allocated from the outer edge of the temporary zones of the wetlands.

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

- Identify and delineate any wetland areas and/or watercourses within a 500m boundary around the proposed development site according to the Department of Water Affairs "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Determine the Present Ecological Status (PES) and Functional Integrity of identified wetlands using the WET-Health and Wet-EcoServices approach.
- Determine the Ecological Importance and Sensitivity (EIS) of identified wetlands using the latest applicable approach as supported by the DWS.
- Identify possible impacts to wetlands or watercourses within the study area as well as recommend mitigation measures and rehabilitation measures for the proposed development.

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 ecosystem functions. As a result, these systems are protected under various legislation including the National Water Act, 1998 (Act No. 36 of 1998), National Biodiversity Act (10 of 2004) and the National Environmental Management Act, 1998 (Act No. 107 of 1998).

1.4. Assumptions and Limitations

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

- 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 wetlands and watercourses.
- Wetland boundaries are essentially based on GPS coordinate waypoints taken onsite of wetland indicator features. The accuracy of the GPS device, therefore, affects the accuracy of the maps produced. A hand-held Garmin Montana 680 was used to delineate the wetland boundaries.
- The assessment of the present ecological state (PES), the provision of ecosystem goods and services, and the ecological importance and sensitivity of the identified wetland systems were based on a one-day field investigation conducted on the 24th of February 2023. Site visits should ideally be conducted over differing seasons to better understand the hydrological and geomorphologic processes driving the characteristics of the water resource and the functional integrity of the wetland system. Once-off assessments such as this may potentially miss certain ecological information, thus limiting accuracy, detail, and confidence.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological issues arising from the field survey and based on the assessor's working knowledge and experience with similar development projects. No construction work methodology was provided.

1.5 Project Description & Locality

Project Description

The proposed works entail the construction and operation of the following;

- New ±4.5 km 132 kV line from Lethabo PV plant to the existing RWB Lethabo substation.
- 1 x additional 88 kV bay, inclusive of busbar extension and control plant extension at the existing Rand Water Board (Lethabo Substation).

Project Location

Two site corridor alternatives were proposed for assessment. Corridor A refers to the corridor in close proximity to the road from the proposed solar power plant whereas Corridor B refers to the deviation of Corriodor A from the existing substation.Of significance to note is the existance of powerlines that run within the same proposed two corridors i.e Corridor A and B. The proposed powerline corridor alternatives run from the north-eastern side of the Lethabo power station (S260 44' 33.34" E 270 58' 32.62") site where the substation is located to the southern part of the power station under the jurisdiction of the Metsimaholo municipality, Free State Province. The project area is approximately 10km southeast of Vereeniging and 14km northeast of Sasolburg. The area is depicted in Figures 1 and 2.

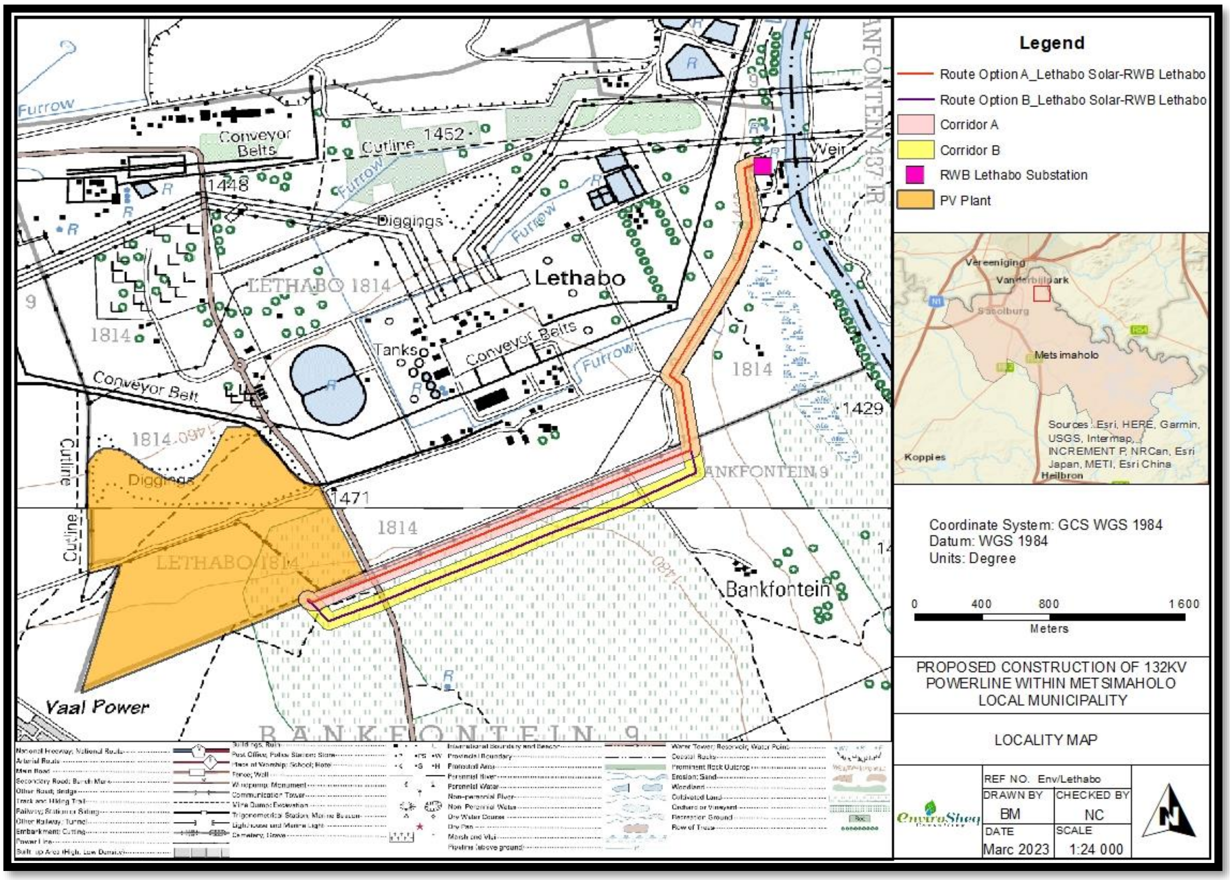


Figure 1 : Locality Map

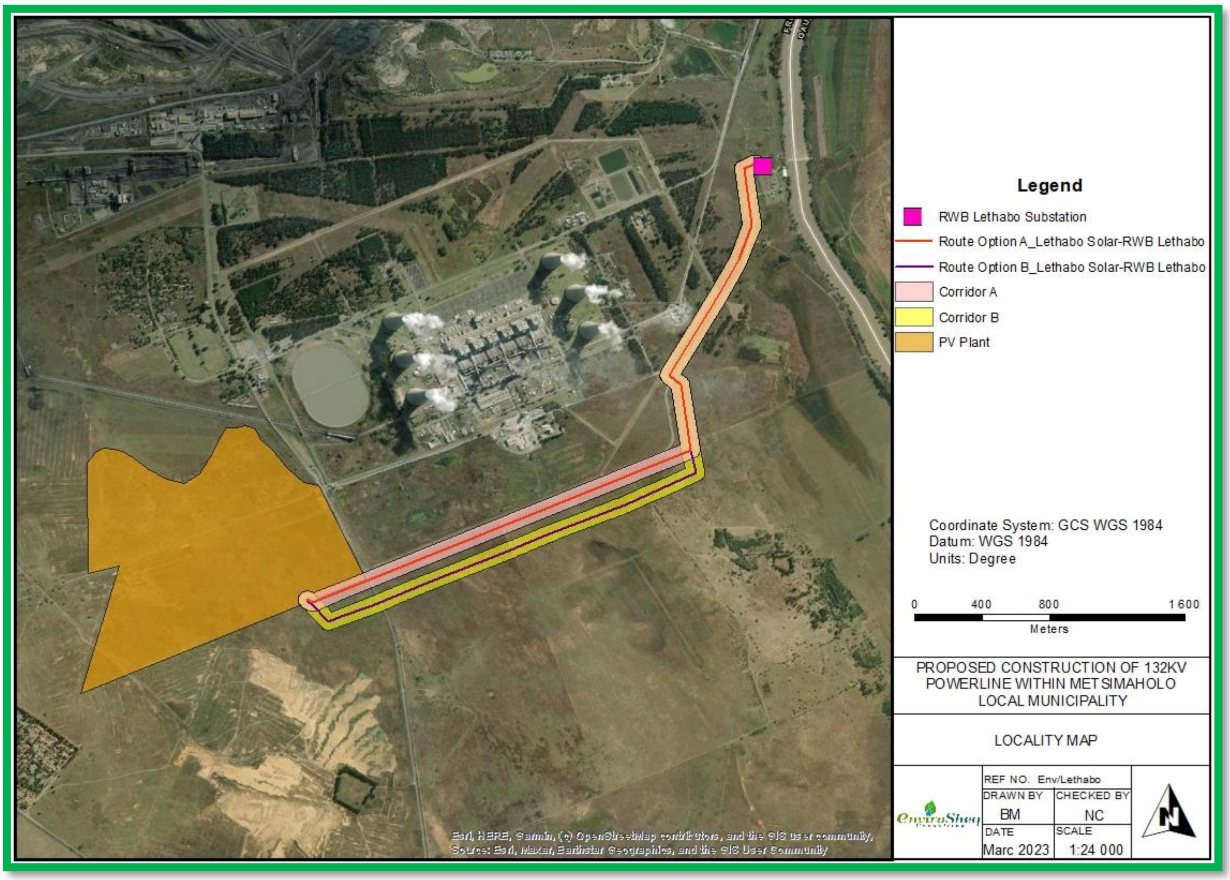


Figure 2 : Locality-Google Earth

2. LEGISLATIVE & CONSERVATIONAL PLANNING REQUIREMENTS

2.1 National Water Act,1998

This section outlines the definitions, key legislative requirements and guiding principles of wetland studies and the Water Use Authorisation process.

The National Water Act, 1998 (Act No. 36 of 1998) [NWA] provides for Constitutional water demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and are regulated by the Department of Water and Sanitation (DWS). The NWA sets out a range of water use-related principles that are to be applied by DWS when making decisions that significantly affect a water resource. The NWA defines a water resource as including a watercourse, surface water, estuary or aquifer. A watercourse includes a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, pan or dam, into which or from which water flows; any collection of water that the Minister may declare to be a watercourse; and were relevant its beds and banks.

The NWA defines a wetland 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." In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often performs important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river's footprint (DWAF, 2005). It is defined by the NWA as follows: "Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas".

Water uses for which authorisation must be obtained from DWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) apply to any activity related to a wetland:

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

Section 21(i): Altering the bed, banks, course, or characteristics of a watercourse.

GN R.1198: Any activity in a wetland for the rehabilitation of a wetland for conservation purposes.

GN R.1199: Any activity within 500 m from the boundary of a wetland.

These regulations also stipulate that these water uses must the registered with the responsible authority. Any activity that is not related to the rehabilitation of a wetland and which takes place within 500 m of a wetland is excluded from a GA under either of these regulations. Wetlands situated within 500 m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 1199). Such an activity requires a Water Use Licence (WUL) from the relevant authority.

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions, and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.982, R.983, R. 984 and R.985 of 2014 amended in 2017, promulgated under NEMA.
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA. Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002).

2.2 Protocols for Specialist Assessment (GN 320 of 20 March 2020).

Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Section 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 when applying for Environmental Authorisation including the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impact on Aquatic Biodiversity (GN 320 of 20 March 2020).

The Department of Forestry and Fisheries and the Environment (DFFE) has published several protocols for the specialist assessment and minimum report requirements for several specific aspects including:

- Agriculture.
- Avifauna (concerning solar and wind energy generation).
- Noise.
- Defence.
- Civil Aviation.
- Terrestrial Plant Species.
- Terrestrial Animal Species.
- Terrestrial Biodiversity; and
- Aquatic Biodiversity.

Of importance to this study is the latter, which provides the protocol for specialist assessment and minimum content requirements for environmental impacts on aquatic biodiversity. The protocol defines Aquatic as "*Inland aquatic and estuaries/estuarine systems where plants and animals live*" and as such both wetland and riparian habitats fall within this definition.

In terms of Section 2.3. of the Protocol, the assessment must provide (in summary):

- A description of the aquatic biodiversity and ecosystems on the site.
- The threat status of the ecosystem and species as identified by the screening tools.
- The national and provincial priority status of the aquatic ecosystem.
- A description of the ecological importance and sensitivity of the aquatic ecosystem.
- An assessment of alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.
- A detailed assessment of the potential impacts including:
- Consistency with maintaining priority aquatic ecosystems in their current state.
- Consistency with maintaining Resource Quality Objectives.
- Impact on fixed and dynamic ecological processes.
- Impact on the functioning of the aquatic feature.
- Impact on key ecosystem regulating and supporting services.
- Impact on community composition and integrity of faunal and vegetation communities.

3.0 STUDY METHODOLOGY

The following techniques and tools were used in the assessment:

3.1 Baseline Data / Desktop Assessment

The desktop study conducted for the proposed development involved the examination of aerial photography, GIS databases including the NFEPA and South African National Wetland maps as well as literature reviews of the study site, to determine the likelihood of wetland systems within the area. The study made use of the following data sources:

- Google imagery was used at the desktop level.
- Relief dataset from the Surveyor General was used to calculate the 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.
- Vegetation type dataset from (Mucina & Rutherford, 2006) was used in determining the vegetation type of the study area.
- In-field data collection was taken on the 24th of February 2023.

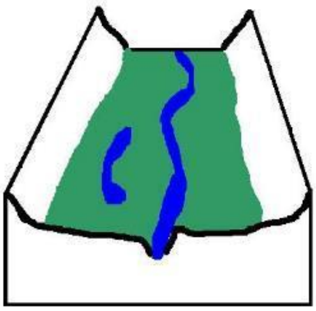
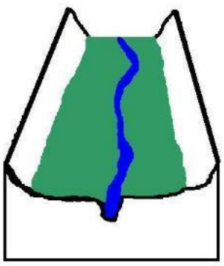
3.2 Wetland Delineation and Identification

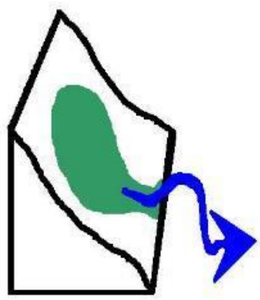
In accordance with the DWAF guidelines (DWAF 2005) the wetland delineation procedure considers four attributes to determine the limitations of the wetland. These attributes are discussed according to the DWAF guidelines in further detail later in this section. Further descriptions of the four attributes are presented in Appendix B. The four attributes are:

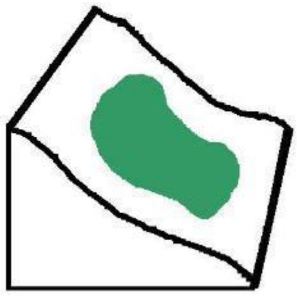
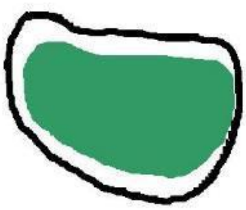
- Terrain Unit Indicator – helps to identify those parts of the landscape where wetlands are more likely to occur.
- Soil Form Indicator – identifies the soil forms, which are associated with prolonged and frequent saturation.
- Soil Wetness Indicator – identifies the morphological "signatures" developed in the soil profile because of prolonged and frequent saturation; and
- Vegetation Indicator – identifies hydrophilic vegetation associated with frequently saturated soils.

In accordance with the definition of a wetland in the NWA, vegetation is the primary indicator of a wetland, which must be present under normal circumstances; however, the soil wetness indicator tends to be the most important in practice. The remaining three indicators are then used in a confirmatory role. The reason for this is that the response of vegetation to changes in the soil moisture regime or management is relatively quick and may be transformed, whereas the morphological indicators in the soil are significantly more permanent and will hold the indications of frequent and prolonged saturation long after a wetland has been drained (perhaps several centuries) (DWAF 2005).

Table 1 Classification of wetland and riparian areas (adapted from Brinson, 1993; Kotze, 1999; Marneweck and Batchelor, 2002 and DWAF, 2005).

Hydro-geomorphic Settings	Description
Riparian Habitat	Linear fluvial, eroded landforms carry channelized flow on a permanent, seasonal, or ephemeral/episodic basis. The river channel flows within a confined valley (gorge) or an incised macro-channel. The "river" includes both the active channel (the portion which carries the water) as well as the riparian zone.
Floodplain 	Valley bottom areas with a well-defined stream channel stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
Valley Bottom with a Channel 	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.

Hydro-geomorphic Settings	Description
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs are mainly from the channel entering the wetland and from adjacent slopes. The valley floor is a depositional environment composed of fluvial or colluvial deposited sediment. These systems tend to be found in the upper catchment areas, or at tributary junctions where the sediment from the tributary smothers the main drainage line.
Hillslope seepage linked to a stream channel 	Slopes on hillsides, which are characterised by 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.
Depressional Pans	Small (deflationary) depressions which are circular or oval; usually found on the crest positions in the landscape. The topographic catchment area can usually be well-defined (i.e., a small catchment area following the surrounding watershed). Although often apparently endorheic (inward draining), many pans are "leaky" in the sense that they are hydrologically connected to adjacent valley bottoms through subsurface diffuse flow paths

Hydro-geomorphic Settings	Description
Isolated hillslope seepage 	Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.
Pan/Depression 	In areas with weakly developed drainage patterns and flat topography, rainfall may not drain off the landscape very quickly, if at all, due to the low relief. In such areas (commonly characterized by aeolian deposits or recent sea floor exposures) the wet season water table may rise close to, or above, the soil surface, creating extensive areas of shallow inundation or saturated soils. In these circumstances the seasonal or permanently high groundwater table creates the conditions for wetland formation.

3.3 Wetland Functionality, Status and Sensitivity

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. In the current assessment the hydrological, geomorphological and vegetation integrity was assessed for the offset wetland unit associated with the study site, to provide a Present Ecological Status (PES) score (Macfarlane et al, 2007) and an Environmental Importance and Sensitivity category (EIS) (DWAF, 1999). The functional assessment methodologies presented below take into consideration these recorded impacts in various ways to determine the scores attributed to each functional Hydro geomorphic (HGM) wetland unit. The aspect of wetland functionality and integrity that is predominantly addressed includes hydrological and geomorphological function and the integrity of the biodiversity component (mainly based on the intactness of natural vegetation).

Currently, no single integrity assessment methodology exists which can be used to determine the Present Ecological State of all the various HGM types for the construction period. Therefore, each HGM type should be evaluated by using the functional assessment best suited to its characteristics. In the current study the offset wetland found adjacent to the study site was assessed using WetEco Services (Kotze et al 2005), WET-Health (Macfarlane et al, 2007) and the Ecological Importance and Sensitivity (DWAF, 1999).

3.4 Present Ecological Status (PES)

WET-Health Version 2 consists of a series of three tools developed to assess the Present Ecological State (PES) or "ecological health" of wetland ecosystems of different hydrogeomorphic types at three different levels of detail/resolution. These tools build on previous assessment methods, including WET-Health Version 1 and Wetland-IHI, in response to the need that was identified to develop a refined and more robust suite of tools for the assessment of the PES of wetland ecosystems in South Africa. (Macfarlane *et al*, 2020).

WET-Health is designed to assess the PES of a wetland by scoring the perceived deviation from a theoretical reference condition, where the reference condition is defined as the un-impacted condition in which ecosystems show little or no influence of human actions. In thinking about wetland health or PES, it is thus appropriate to consider 'deviation' from the natural or reference condition, with the ecological state of a wetland taken as a measure of the extent to which human impacts have caused the wetland to differ from the natural reference condition. (Macfarlane *et al*, 2020).

Whilst wetland features vary considerably from one wetland to the next, wetlands are all broadly influenced by their climatic and geological setting and by three core inter-related drivers, namely hydrology, geomorphology, and water quality. The biology of the wetland (in which vegetation generally plays a central role) responds to changes in these drivers, and to activities within and around the wetland. The interrelatedness of these four components is illustrated schematically in Figure 1 below and forms the basis of the modular-based approach adopted in WET-Health Version 2. (Macfarlane *et al*, 2020).

Figure 3 : Diagram representing the four key components of Wetland PES considered in WET- Health Version 2. (Macfarlane et al, 2020).

In WET-Health, the natural reference condition of a wetland is inferred from conceptual models relating to the selected hydro-geomorphic (HGM) wetland type, the selected hydro-geological type setting and knowledge of vegetation attributes of similar wetlands in the region. PES is then assessed by evaluating the extent to which anthropogenic activities have altered wetland characteristics across the four inter-related components of wetland health, as follows:

Geomorphology in this context is assessed by assessing changes to (i) geomorphic processes and (ii) the geomorphic structure of the wetland. Geomorphic processes in this context, refer to those physical processes that are currently shaping and modifying wetland form and evolution, whilst geomorphic structure refers to the three-dimensional shape of sediment deposits on which wetland habitat is established. Whilst catchment drivers (similar to those assessed in the hydrology module) are integrated as part of the assessment, impacts are ultimately assessed based on a (minerogenic) sedimentation and those characterised by organic sediment accumulation (peat).

Water quality is defined as the physico-chemical attributes of the understanding of the degree to which within-wetland geomorphic processes and the associated structure of the wetland have been altered by anthropogenic activities. The module also accounts for differences in geomorphic processes in wetlands characterised by clastic water in a wetland. It is assessed based on considering both potential diffuse runoff from land uses within the wetland and from the areas surrounding the wetland, together with point-source discharges of pollution entering directly into the wetland and/or into streams that flow into that wetland.

Vegetation is defined in this context as the structural and compositional state of the vegetation within a wetland. This module evaluates changes in vegetation composition and structure because of current and historic on-site transformation and/or disturbance. Whilst the assessor needs to have some knowledge of vegetation in a particular region, the method does not require the assessor to be able to identify all wetland plant species. The emphasis is rather on identifying alien and ruderal (weedy) species that indicate disturbance and assessing their occurrence relative to common naturally occurring indigenous species, including those that are naturally dominant in the wetland. (Macfarlane et al, 2020).

Levels of Assessment

Three different levels of assessment have been developed to account for a broad range of user requirements, ranging from regional assessments involving thousands of wetlands to detailed site-based assessments used to identify specific stressors and impacts on a single wetland for management and rehabilitation planning. In each instance, the assessment is based initially on a landcover assessment that seeks to provide an initial indication of wetland condition based on a generic understanding of the impacts of different land uses on catchment and wetland processes and characteristics. The assessment is refined for more detailed assessments by integrating finer-scale mapping, and a combination of additional desktop and site-based indicators to refine and improve the accuracy of the assessments. The following three levels of assessment are catered for in the method:

• ***Level 1A (desktop-based, low resolution)***, is an entirely desktop-based assessment and uses only pre-existing landcover data (i.e. no interpretation of aerial imagery by an assessor is required) and for which default impact intensity scores have been allocated for each component of wetland PES. In many cases, particularly when applied at a national level, it is not possible to delineate the upslope catchment of each of the individual wetlands. Instead, the landcover types in a GIS buffer around a wetland and within a "pseudo-catchment" selected to represent the true catchment (such as a sub-quaternary catchment) are used as a coarse proxy of the impacts on the wetland arising from its upslope catchment. Impacts arising from the wetland and catchment are then integrated through structured algorithms to provide a coarse indication of wetland health.

• ***Level 1B (desktop-based, high resolution)***, is also largely desktop-based using pre-existing landcover data but makes a few finer distinctions than Level 1A in terms of landcover types and usually requires interpretation of the best available aerial imagery to do so. This also allows the pre-defined land-cover types to be mapped more accurately. Furthermore, the upslope catchment of each wetland can be individually delineated at this level, and land cover in this area is used as a proxy of the impacts on a wetland arising from its upslope catchment. As for Level 1A, impacts arising from within individual wetlands are inferred from land cover types occurring within the delineated wetlands.

• ***Level 2 (rapid field-based assessment)*** starts with landcover mapping but is refined by assessing a range of catchment and wetland-related indicators that are known to affect wetland health. Impacts arising from the upslope catchment of a wetland are inferred from landcover mapping but are refined based on additional information (e.g., for plantations, the user must indicate whether the trees making up the plantations are eucalypts or pines and/or wattle). Land cover types occurring within the wetland are used as the starting point for assessing human impacts arising from within the wetland. However, this initial assessment is refined considerably by sub-dividing the wetland into relatively homogenous "disturbance units" and answering a suite of site-based wetland questions which provide a more direct assessment of change (e.g. the density, depth and orientation of artificial drainage channels, and the texture of the soil in the wetland). (Macfarlane *et al*, 2020).

A level 2 wetland assessment was undertaken to determine the PES of the wetland system. The PES assessment is concluded by completing the following process:

Outline of steps involved in the Level 1 assessment (Macfarlane *et al*, 2020).

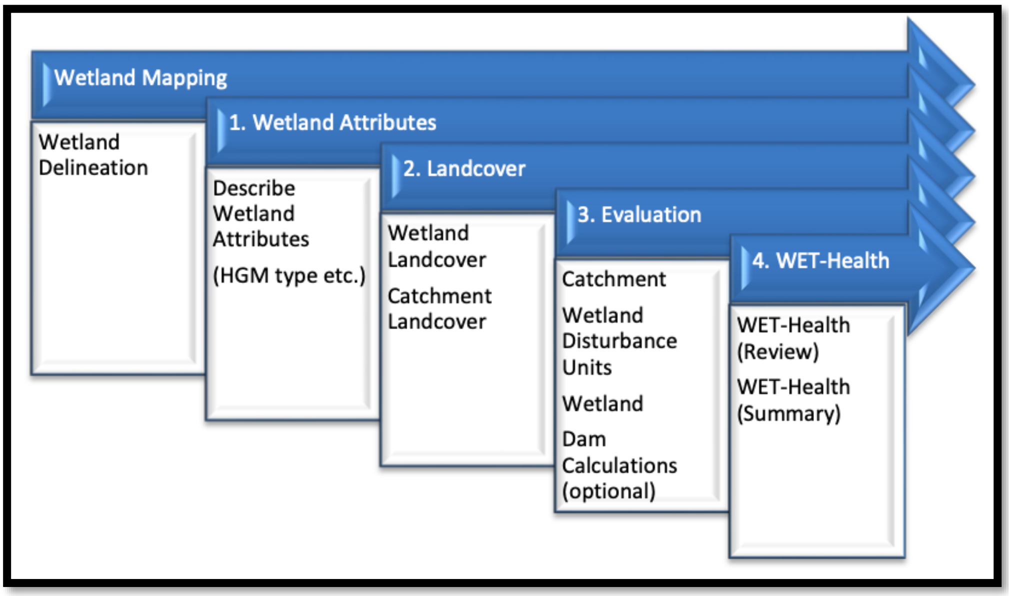


Figure 4: Outline of steps involved in the Level 1 assessment (Macfarlane et al, 2020

Table 2: Criteria and Attributes

Criteria and attributes	
Hydrologic	**Hydraulic/Geomorphic**
Flow modification	Canalisation
Permanent Inundation	Topographic Alteration
Water Quality	**Biota**
Water Quality Modification	Terrestrial Encroachment
Sediment load modification	Indigenous vegetation removal
	Invasive plant encroachment
	Alien fauna
	Over utilisation of biota

Each of the attributes was given a score according to the ecological state observed during the site visit, as well as a confidence score to indicate areas of uncertainty

3.4.1 Quantification of the Present State of the Wetland

WET-Health is a tool designed to assess the health (present state) or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition (Macfarlane et al. 2009). This tool is utilised to assess hydrological, geomorphological and vegetation health in three separate modules.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs because of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland. Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland. This assessment focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat). Vegetation is defined in this context as the vegetation's structural and compositional state. This module evaluates changes in vegetation composition and structure because of current and historic onsite transformation and/or disturbance.

The overall approach is to quantify the impacts of human activity or visible impacts on wetland health, and then convert the impact scores to a Present State score. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact.

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from "unmodified/natural" (Category A) to "severe/complete deviation from natural" (Category F) as depicted in Table 3

Table 3: Quantification of the Present State of the Wetland

PES categories (Macfarlane *et al*, 2020).

Impact Category	Description	Impact Score Range	Present State Category
None	Unmodified, natural	**0-0.9**	**A**
Small	Largely natural with few modifications. A slight change in ecosystem processes is discerninable and a small loss of natural habitats and biota might have taken place	**1-1.9**	**B**
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitats remain predominantly intact	**2-3.9**	**C**
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred	**4-5.9**	**D**
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable	**6-7.9**	**E**
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost loss of natural habitat and biota	**8-10**	**F**

An overall wetland health score is calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula: Overall health rating = [(Hydrology*3) + (Geomorphology*2) + (Vegetation*2)] / 7. This overall score assists in providing an overall indication of wetland health/functionality, which can in turn be used for recommending appropriate management measures.

Table 4: Scoring Guidelines

Scoring guideline		Relative confidence score	
Natural, unmodified	5	Very high	4
Largely natural	4	High	3
Moderately modified	3	Moderate	2
Largely modified	2	Low	1
Seriously modified	1		
Critically modified	0		

A mean score for all attributes was then calculated and the final score was then used in the PES category determination as indicated in Table 5.

Table 5: Present Ecological Status Category Descriptions

Score	Class / Category	Description
>4	A	Unmodified, or approximates natural condition.
>3 and<=4	B	Largely natural with few modifications
>2 and<=3	C	Moderately modified
2	D	Largely modified
>0 and <2	E	Seriously modified
0	F	Critically modified

3.5 Overall Health of the Wetland

Once all HGM units have been assessed, a summary of health for the wetland needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provides a summary of impacts, Present State, Trajectory of Change and Health for individual HGM units and for the entire wetland.

3.5.1 Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or from within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology, and vegetation, five potential situations exist depending on the direction and likely extent of change (Table 4).

Table 6: Assessing the Anticipated Trajectory of Change

Trajectory of Change classes, scores and symbols used to represent anticipated changes to wetland integrity (Macfarlane *et al*, 2008).

Change Class	Description	HGM Change Score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

3.6 Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity were determined by utilising a rapid scoring system. The system has been developed to provide a scoring approach for assessing the ecological/biological importance, hydrological functioning importance and the importance of direct human benefits of wetlands. These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al. (2007) on the assessment of wetland ecological goods and services from the WET-EcoServices tool

(Rountree, 2010). These aspects, which are assessed in terms of their importance/ sensitivity, are indicated in Table 5. A rating of zero (low sensitivity / low importance) to four (very high) is allocated to each aspect. An overall score is based on the highest score out of the three categories.

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed.

A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category. A confidence score is also provided on a scale of **0 to 4**, where **0** indicates low confidence and **4** high confidence.

Ecological / Biological	Hydrological /FunctionalImportance	Importance of Direct Human Benefits
Biodiversity support - Presence of Red Data species - Populations of unique species - Migration/breeding/feeding sites **Landscape scale** - Protection status of the wetland - Protection status of the vegetation type - Regional context of the ecological integrity - Size and rarity of the wetland type/s present - Diversity of habitat types **Sensitivity of the wetland** - Sensitivity to changes in floods - Sensitivity to changes in low flows/dry season - Sensitivity to changes in water quality	**Regulating and supporting benefits** - Flood attenuation - Streamflow regulation Water **Quality Enhancement** - Sediment trapping - Phosphate assimilation - Nitrate assimilation - Toxicant assimilation - Erosion control Carbon Storage	**Subsistence benefits** - Water for human use - Harvestable resources - Cultivated foods Cultural benefits - Cultural heritage - Tourism and recreation - Education and research

OVERALL IMPORTANCE *(highest of the three categories)*

Table 7: EIS Category Definitions

Ecological Importance and Sensitivity Categories (EISC)	Range of Median	Recommended Ecological Management Class (EMC)
Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	Very high >3 and <=4	A
Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water in major rivers	High >2 and <=3	B
Wetland that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	Moderate >1 and <=2	C
Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	Low/marginal >0 and <=1	D

3.7 Ecological Class and Management

Eco-Classification - the term used for the Ecological Classification process - refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of wetland relative to the natural or close to the natural reference condition. The purpose of the Eco-Classification process is to gain insight and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the wetland. The procedure of Eco-

Classification describes the health of a water resource and derives and formulates management targets/objectives/specifications for the resource.

The Recommended Ecological Category (REC) (i.e., management objectives) is a recommendation from an ecological viewpoint, which is considered within the decision-making process in the National Water Resource Classification System (NWRCS). This recommendation is based on either maintenance or improvement of the PES. The REC is based on ecological criteria only and considers the EIS, the restoration potential and the attainability thereof. According to DWAF (2007), the PES and EIS of water resources must drive management objectives when there is no water resource classification (eco-classification) available. Therefore, for water resources that do not have a REC allocated for the system, information contained in the Tables below may be utilise.

Table 8: Description of EMC classes

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

3.8 Wetland Functional Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class. The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines described by Kotze et al (2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

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

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

Table 9: Classes for determining construction and the extent to which a benefit is being supplied

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

3.9 Wetland Ecosystem Service

The supply of ecosystem goods and services of the offset wetland was assessed using an approach based on the WET-Eco-services assessment tool (Kotze *et al*., 2007). This approach relies on a combination of desktop and on-site indicators to assess the importance of a range of common offset wetland ecosystem services. A level 2 (detailed) assessment was conducted that assessed a host of benefits by assigning a score to each benefit based on a rating system that rates a range of pre-defined variables affecting the importance of benefits provided by the wetland system. The results are captured in tabular form as a list of benefits/goods with the level of supply and demand rated on a scale of 0 - 4. The rating shown in Table 9 is used to describe the level of importance of supply and demand:

Table 10: Rating table used to rate supply and demand scores

Score	Importance or level of supply/demand
<2	Low
2-3	Moderate
>3	High

3.10 Wetland Buffer Determination

The assessment procedure has been structured in an eight-step process as outlined in Figure 6. This provides a broad overview of the process followed:

- Step 1: Define Objectives and Scope to Determine the Most Appropriate Level of Assessment
- Step 2: Map and Categorise Water Resources in The Study Area
- Step 3: Refer to The DWA Management Objectives for Mapped Water Resources or Develop Surrogate Objectives
- Step 4: Assess the Risks from Proposed Developments and Define Mitigation Measures
- Necessary to Protect Mapped Water Resources in The Study Area
- Step 5: Assess Risks Posed by Proposed Development on Biodiversity and Identify Management Zones for Biodiversity Protection
- Step 6: Delineate and Demarcate Recommended Final Buffer Zone Requirements
- Step 7: Document Management Measures Necessary to Maintain the Effectiveness of Final Buffer Zone Areas
- Step 8: Monitor the Implementation of Buffer Zones

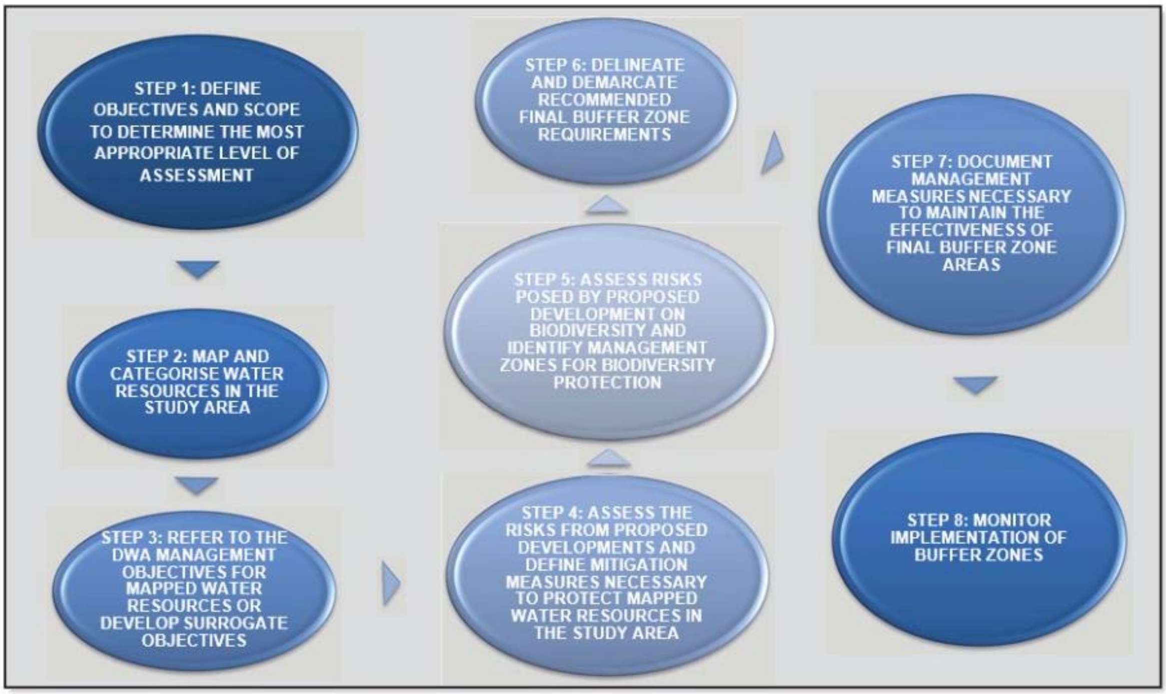


Figure 5 : Overview of the stepwise assessment process for buffer zone determination (Macfarlane, Bredin; 2017)

4. RESULTS OF THE ASSESSMENT

4.1 Eco-Region & Quaternary Catchment

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data to be made since reference information and representative species lists are often available on this level of assessment to guide the assessment. The study area is located within Vaal catchment and falls within Central Free State Grassland. This database was used as a reference for the catchment of concern to define the EIS. Table below indicates the aquatic ecoregion and quaternary catchments of the study area. The study area is located within the C22F quaternary catchment. This catchment is characterised by mean annual precipitation that is lower than the evapotranspiration. Wetlands located within this catchment area are sensitive to any changes in the volume and duration of the water supplied by regional hydrological features. The results of the assessment are summarised in the table and maps below.

Quaternary Catchment Number	River Name	Ecological Sensitivity	Confidence
C22F	Vaal	High	Medium

Source : www.dwa.gov.za/WAR/systems.html

Receiving Environment

Central Free State Grassland

Distribution - Free State Province and marginally into Gauteng Province: A broad zone from around Sasolburg in the north to Dewetsdorp in the south. Other major settlements located within this unit include Kroonstad, Ventersburg, Steynsrus, Winburg, Lindley and Edenville. Altitude 1 300–1 640 m, most of the area at 1 400–1 460 m.

Vegetation & Landscape Features - plains sup- porting short grassland, in natural condition dominated by *Themeda triandra* while *Eragrostis curvula* and *E. chloromelas* become dominant in degraded habitats. Dwarf karoo bushes establish in severely degraded clayey bottomlands. Overgrazed and trampled low-lying areas with heavy clayey soils are prone to *Acacia karroo* encroachment.

Geology & Soils-Sedimentary mudstones and sandstone mainly of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as those of the Ecca Group (Karoo Supergroup) found in the extreme north- ern section of this grassland, giving rise to vertic, melanic and red soils (typical forms are Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg)—typical of Dc land type (dominating the landscape). The less common intrusive dolerites of the Jurassic Karoo Dolerite Suite support dry clayey soils typical of the Ealand type.

Climate-Summer-rainfall seasonal precipitation region, with MAP 560 mm. Much of the rainfall is of convectional origin and peaks in December to January. The overall MAT around 15°C. Incidence of frost relatively high (43 days on average).

Important Taxa-*Graminoids: Aristida adscensionis (d), A. congesta (d), Cynodon dactylon (d), Eragrostischlo-romelas (d), E. curvula (d), E. plana (d), Panicum coloratum (d), Setaria sphace- lata (d), Themeda triandra (d), Tragus koelerioides (d), Agrostis lachnantha, Andropogon appendiculatus, Aristida bipartita, A. canescens, Cymbopogon pospischilii, Cynodon transvaalensis, Digitaria argyrograpta, Elionurus muticus, Eragrostis lehman- niana, E. micrantha, E. obtusa, E. racemosa, E. trichophora, Heteropogon contortus, Microchloa caffra, Setaria incrassata, Sporobolus discosporus. Herbs: Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Conyza pinnata, Crabbea acaulis, Geigeria aspera var. aspera, Hermannia depressa, Hibiscus pusillus, Pseudognaphalium luteo-album, Salvia steno- phylla, Selago densiflora, Sonchus dregeanus. Geophytic Herbs: Oxalis depressa, Raphionacme dyeri. Succulent Herb:*

Tripteris aghillana var. integrifolia. Low Shrubs: Felicia muricata (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregea- num, Melolobium candicans, Pentzia globosa.

Conservation Vulnerable. Target 24%. Only small portions enjoy statutory conservation (Willem Pretorius, Rustfontein and Koppies Dam Nature Reserves) as well as some protection in private nature reserves. Almost a quarter of the area has been transformed either for cultivation or by building of dams (Allemanskraal, Erfenis, Groothoek, Koppies, Kroonstad, Lace Mine, Rustfontein and Weltevrede). No serious infesta- tion by alien flora has been observed, but encroachment of dwarf karoo shrubs becomes a problem in the degraded south- ern parts of this vegetation unit. Erosion low (45%), moderate (30%) or very low (20%).

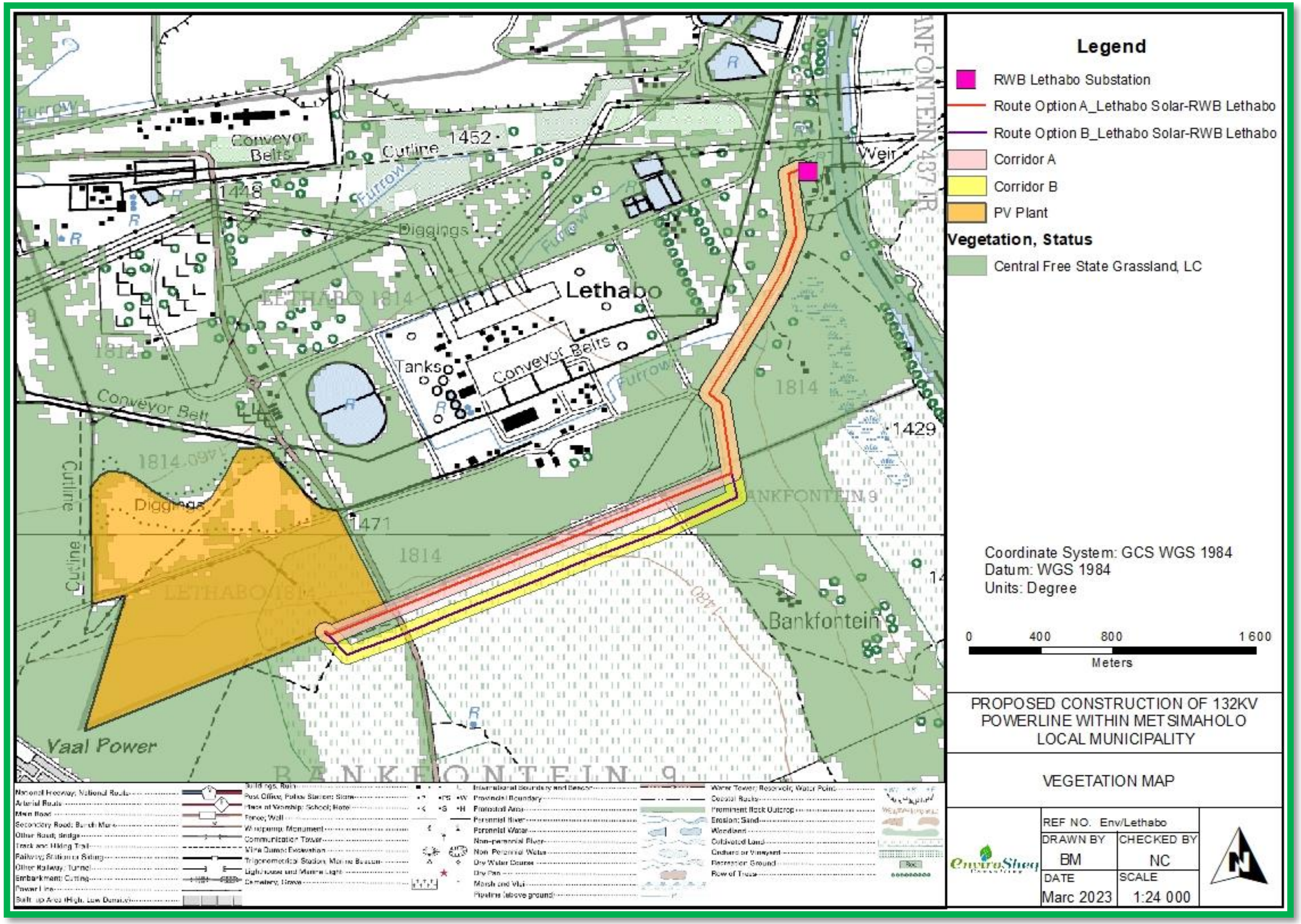


Figure 6 : Vegetation Type

For the purposes of this specific report, the sections are described as follows:

Section A- refers to Corridor A and Corridor B

Section B- refers to the section of the powerline from where Corridor A and B end to RWB substation.

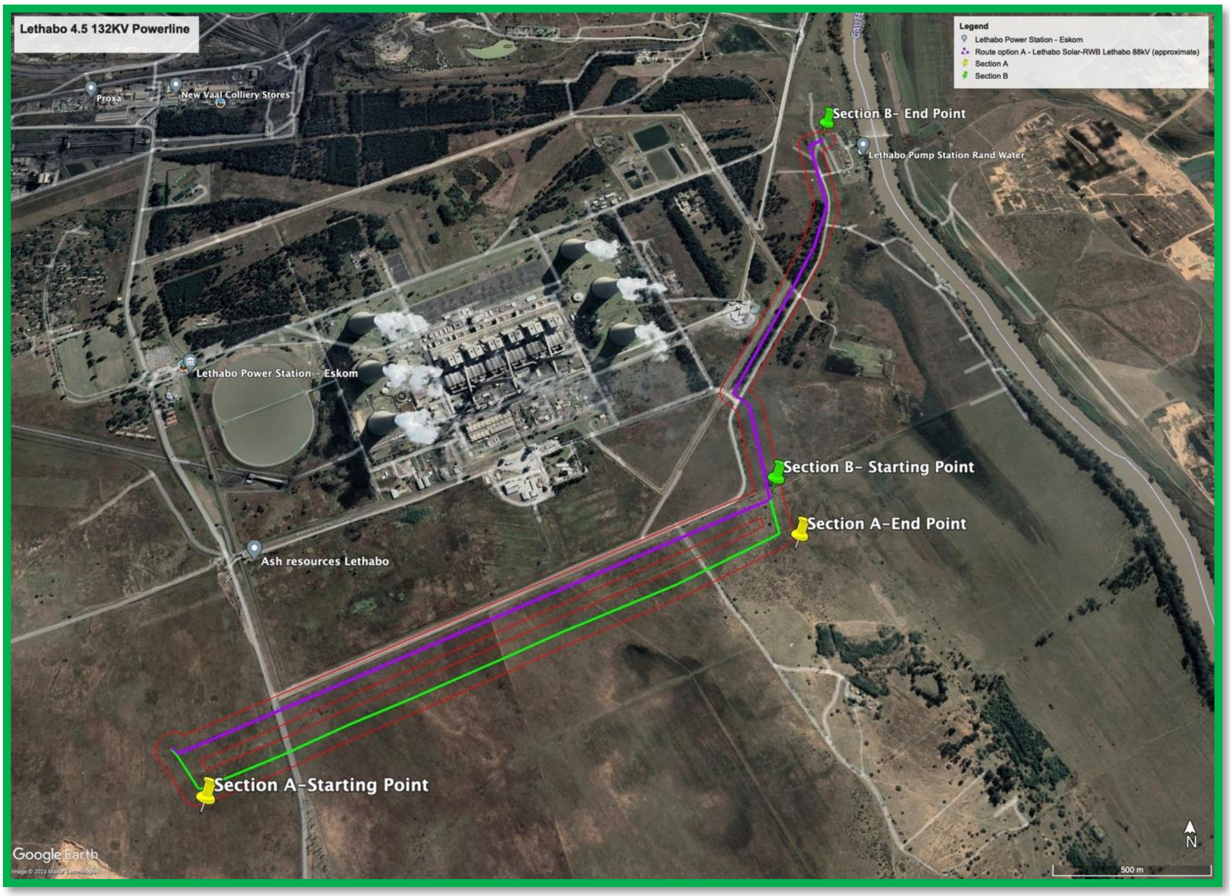


Figure 7 - Study area sections

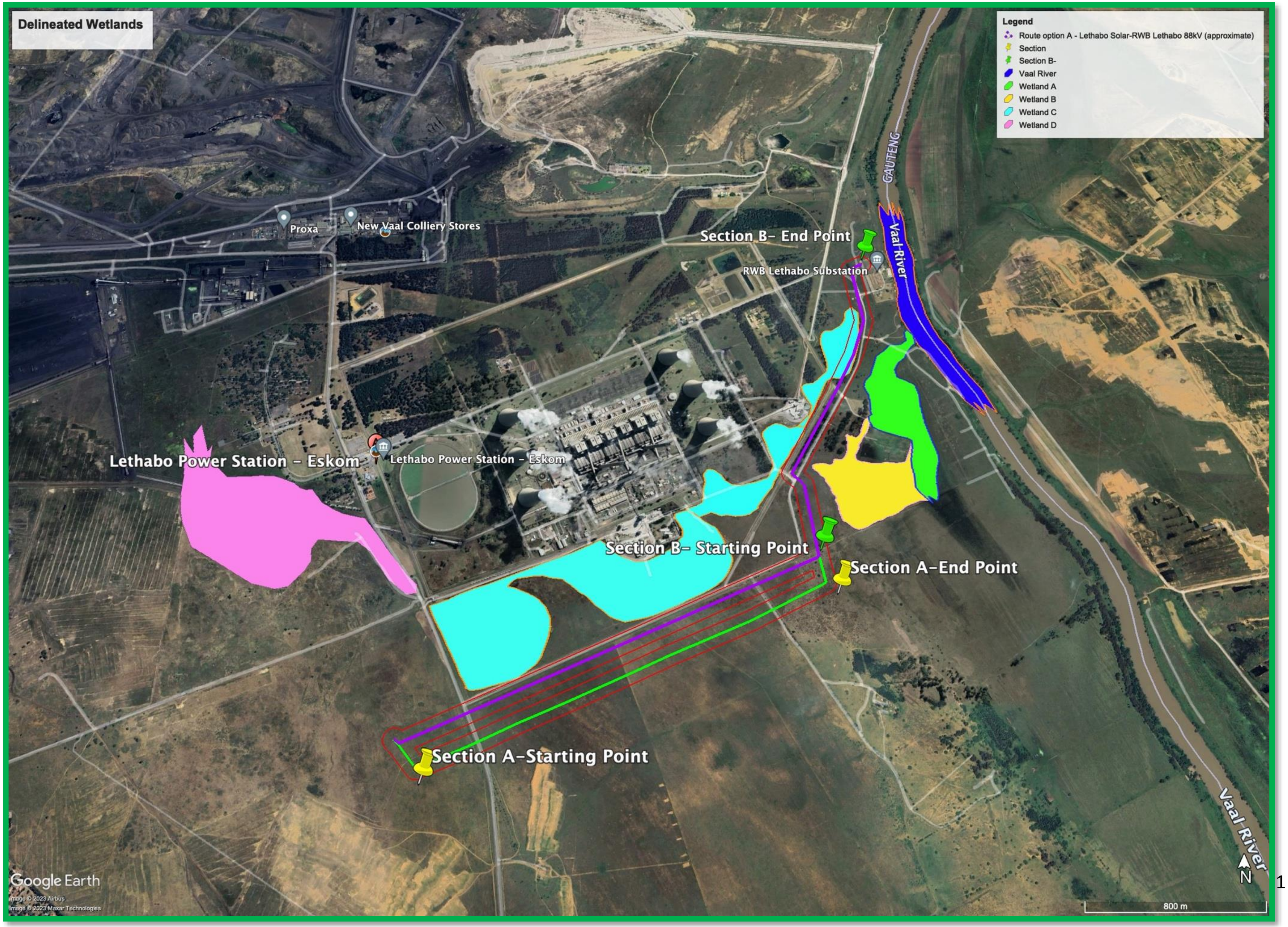

Delineated Wetlands
Legend
Route option A - Lethabo Solar-RWB Lethabo 88kV (approximate)
Section
Section B-
Vaal River
Wetland A
Wetland B
Wetland C
Wetland D
GAUTENG
Vaal-River
Section B- End Point
RWB Lethabo Substation
Proxa
New Vaal Colliery Stores
Lethabo Power Station – Eskom
Lethabo Power Station – Eskom
Section B- Starting Point
Section A-End Point
Section A-Starting Point
Vaal River
N
800 m
Google Earth
Image © 2023 Airbus
Image © 2023 Maxar Technologies

Figure 8: Aerial view of the wetland delineated on site

4.2 Soil Wetness and Soil Form Indicator

According to DWAF (2005), the permanent zone of a wetland will always have either Champagne, Katspruit, Willowbrook or Rensburg soil forms present, as defined by the Soil Classification Working Group (1991). The seasonal and temporary zones of the wetlands will have one or more of the following soil forms present (signs of wetness incorporated at the form level): Kroonstad, Longlands, Wasbank, Lamotte, Estcourt, Klapmuts, Vilafontes, Kinkelbos, Cartref, Fernwood, Westleigh, Dresden, Avalon, Glencoe, Pinedene, Bainsvlei, Bloemdal, Witfontein, Sepane, Tukulu, Montagu. Alternatively, the seasonal and temporary zones will have one or more of the following soil forms present (signs of wetness incorporated at the family level): Inhoek, Tsikamma, Houwhoek, Molopo, Kimberley, Jonkersberg, Groenkop, Etosha, Addo, Brandvlei, Glenrosa, Dundee (DWAF, 2005). The photographs below shows the saturated soils that were used as wetland indicators on the study site.

Soil erodibility in hydrologically transformed environments contributes to the difficulties to precisely determining wetland boundaries. This investigation focussed on the delineation of the wetland features based on soil hydro-morphology and landscape hydrology as observed in the catchment and on the site.

Soils were found to be of a low clay content in general. Mostly sandy soils were present especially in the top 150mm. The wetland seasonal and permanent zones reflected clayey soils. Typical wetland soils were observed (Figure 6.1).

Section A

- A1 and A2 show the saturated soils

Section B

- B1 shows the saturated soils of the permanent wetland zone

Caption: Photographs above show the saturated soils used as delineation indicators of the wetland

Several redoximorphic features were also present on the surface of the soils of the study area, including mottles and rhizospheres. Redoximorphic features shown in the photographs are the result of the reduction, translocation, and oxidation (precipitation) of iron and manganese oxides that occur when soils are saturated for sufficiently long periods to become anaerobic. 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 (See Photographs above).
- Redox depletions - the "grey" (low chroma) bodies within the soil where Fe- Mn oxides have been stripped out, or where both Fe-Mn oxides and clay have been stripped. Iron depletion and clay depletions can occur.
- Redox concentrations - Accumulation of iron and manganese oxides (also called mottles). These can occur as:
    - Concretions-harder, regular shaped bodies
    - Mottles - soft bodies of varying size, mostly within the matrix, with variable shapes appearing as blotches or spots of high chroma colours; and,
- 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 recognised as high chroma colours that follow the route of plant roots and are also referred to as oxidised rhizospheres.

According to the DWAF (2005), soil wetness indicators (i.e., identification of redoximorphic features) are the most important indicator of wetland occurrence since soil wetness indicators (redoximorphic features) remain in wetland soils, even if they are degraded or desiccated. It is important to note that redoximorphic features were present in the delineated wetland within the upper 500mm of the soil profile. The presence or absence of redoximorphic features within the upper 500mm of the soil profile alone is sufficient to identify the soil as being hydric (a wetland soil), or non-hydric (non-wetland soil) (Collins, 2005).

4.3 Wetland Vegetation Indicator

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands. Vegetation also forms a central part of the wetland definition in the National Water Act, Act 36 of 1998. Using vegetation as a primary wetland indicator, however, requires undisturbed conditions (DWAF, 2005) This indicator was used to delineate the wetland as the site under investigation had minimum disturbances. A cautionary approach was taken as vegetation alone cannot be used to delineate a wetland, as several species, while common in wetlands, can occur extensively outside of wetlands. When examining plants within the wetland, a distinction between hydrophilic (vegetation adapted to life in saturated conditions) and upland species was kept in mind.

Section A- Wetland A

Upon the assessment of the area, the various wetland vegetation components were assessed and recorded. Dominant species were characterised as either wetland species or terrestrial species. Hydrophytic vegetation species were observed. Predominantly grass, rushes and sedge species were recorded. This unit was predominantly utilised to delineate the wetland.

The site showed a typically well-defined 'wetness' gradient that was found to occur along the floodplain and the delineated seep wetlands. Hydrophytic vegetation species were observed. Predominantly grass, rushes and sedge species were recorded.

V1

V2

V3

V1 to V3 show a view of the hydrophytic vegetation found in the wetlands.

The following photographs show the hydrophytic vegetation e.g. *phragmites australis* that was found to dominate most of the wetland identified on site.

- A3 and A5 show the hydrophytic vegetation used to identify and delineate the wetland

Section B- Hillslope Seep

Vegetation plays a considerable role in identifying, classifying and accurately delineating wetlands (DWAF, 2005). During the site visit, various hydrophytic species were identified (including facultative species). Examples include *Cyperus spp., Juncus spp., Paspalum urvillei* and *Typha capensis*.

- B3-B5 shows the hydrophytic vegetation used to identify and delineate the wetland

4.4 Wetland Delineation Areas

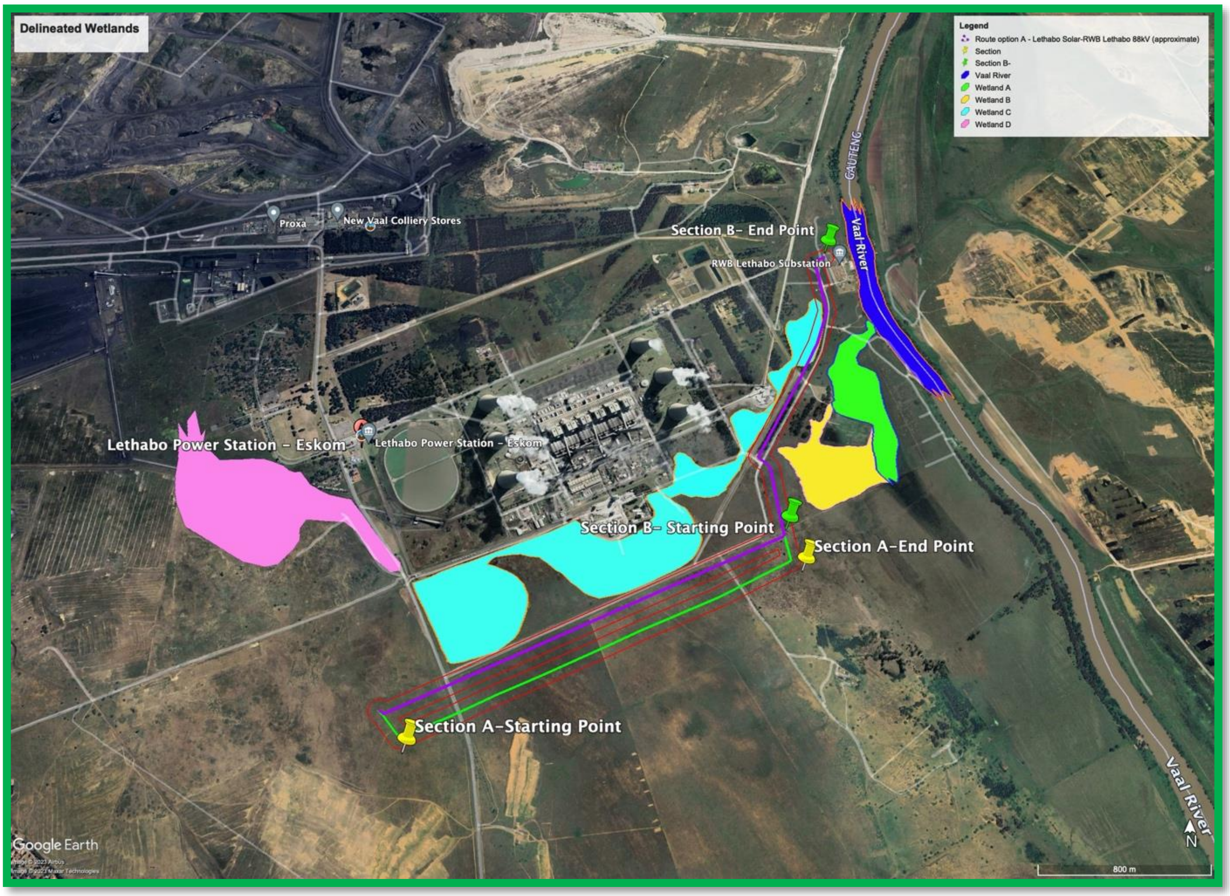
According to the National Water Act (Act no 36 of 1998) a wetland is defined as, "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*." Hydrophytes and hydric soils are used as the two main wetland indicators. The presence of these two indicators is symptomatic of an area that has sufficient saturation to classify the area as a wetland. The soil form indicator examines soil forms, as defined by the Soil Classification Working Group. Typically soil forms associated with prolonged and frequent saturation by water, where present, are a sign of wetland occurrence (DWAF, 2005). Terrain unit refers to the land unit in which the wetland is found. Wetlands can occur across all terrain units from the crest to the valley bottom. Many wetlands occur within valley bottoms, but wetlands are not exclusively found within depressions. Terrain unit is a useful indicator in assessing the hydro-geomorphic form of the wetland.

In the delineation and assessment of the wetland, all indicators were used and the presence of redoximorphic features was considered the most important, with the other indicators being confirmatory. An understanding of the hydrological processes active within the area was also considered important when undertaking the wetland assessment. These Indicators were then 'combined' to determine whether an area is a wetland and to delineate the boundary of a wetland. According to the DWS delineation guidelines, the more wetland indicators that are present the higher the confidence of the delineation. In assessing whether an area is a wetland, the boundary of a wetland or a non-wetland area should be the point where indicators are no longer present. As a result of the minimum disturbance of the wetland area, the confidence in the delineation was high, with a likelihood that the wetland habitat was much more extensive historically.

The wetlands located within the study area close to powerline corridors can be defined as floodplain and a hill slope seep within Section B and isolated seeps in Section A due to the location of the HGM. The identified wetland systems are described in the table and figure below.

- A5 shows the full view of the wetland area in a north eastern direction from the power plant

- A6- A8 Photograph showing the floodplain delineated within 500m of the proposed powerline corridor
- A9 and A11 shows a view of the hill slope seep wetland

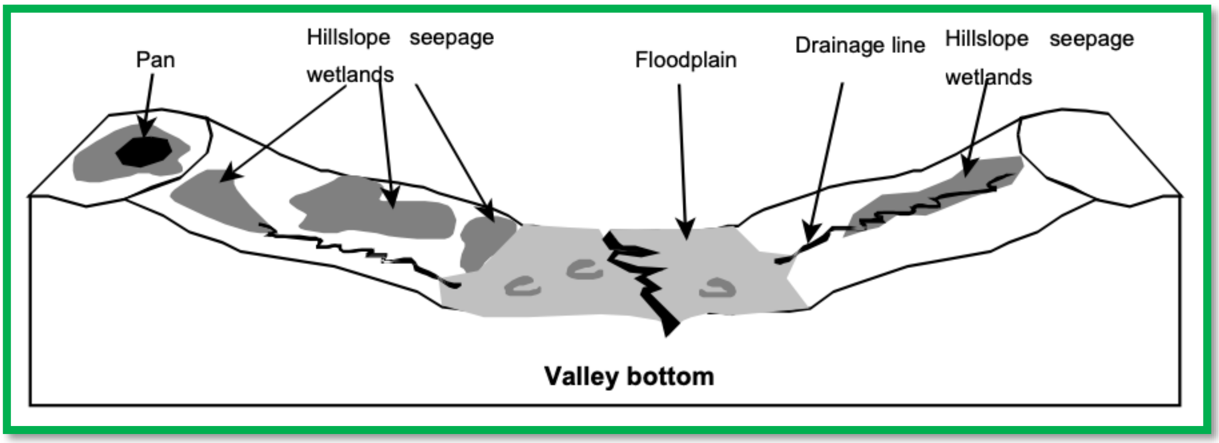


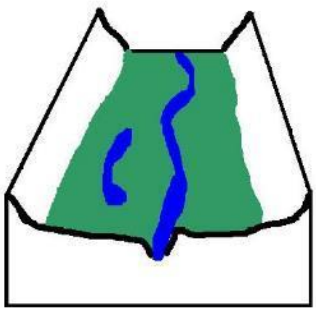
4.5 Wetland Unit Classification

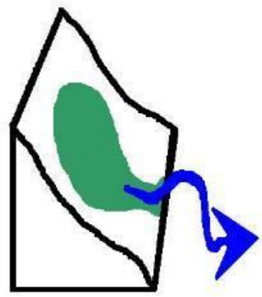
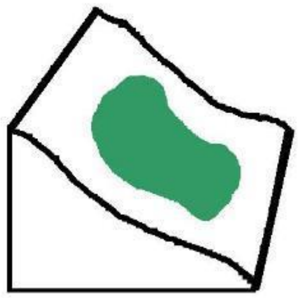
SANBI's "Further development of a proposed National Classification System for South Africa" was used to verify the classification of the wetlands within the study area (SANBI, 2009). The wetlands were classified up to level four, which includes the system, regional setting, landscape unit and hydrogeomorphic unit.

The wetland was classified as per the Table below.

Unit	System	Regional Setting	Landscape Unit	Hydrogeomorphic unit
Wetland A	Inland	Level 1	Plain	Floodplain
Wetland B	Inland	Level 1	Slope	Hillslope Seep
Wetland C	Inland	Level 1	Slope	Seep
River		Level 1	River	Floodplain



Wetland Identification	Hydro-geomorphic Settings	Description
Wetland A	Floodplain 	Valley bottom areas with a well-defined stream channel stream channel, gently sloped and characterised by floodplain features such as oxbow depression and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.

Wetland Identification	Hydro-geomorphic Settings	Description
Wetland B	Hillslope seepage linked to a stream channel. 	Slopes on hillsides, which are characterised by 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.
Wetland C & D	Isolated hillslope seepage 	Slopes on hillsides that are characterised by colluvial transport (transported by gravity) movement of materials. Water inputs are from sub-surface flow and outflow either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.

4.5.1 General Function of the identified wetlands

Hillslope seeps are well documented by Kotze et al., (2009) to be associated with sub-surface groundwater flows. These systems tend to contribute to flood attenuation given their diffuse nature. This attenuation only occurs when the soil within the wetland is not yet fully saturated. The accumulation of organic material and sediment contributes to prolonged levels of saturation due to this deposition slowing down the sub-surface movement of water. Water typically accumulates in the upper slope (above the seep). The accumulation of organic matter additionally is essential in the denitrification process involved with nitrate assimilation. Seeps generally also improve the quality of water by removing excess nutrients and inorganic pollutants originating from agriculture, industrial or mine activities. The diffuse nature of flows ensures the assimilation of nitrates, toxicants and phosphates with erosion control being one of the Eco Services provided very little by the wetland given the nature of a typical seep's position on slopes.

Floodplains generally are formed during high flow events which subsequently cause water to overspill its banks. Due to the topographic setting of floodplains, flood attenuation for these systems is very high, especially during seasons where the soil within the wetland is not yet saturated and before the oxbows are filled. Seeing that floodplains usually are characterised by clayey soils which retain water for long periods and are susceptible to vast amounts of evapotranspiration, very little streamflow regulation is expected for floodplains. In hindsight, floodplains with coarse soil types are ideal for regulating streamflow. Floodplains are excellent in assimilating phosphates due to the decrease in velocity during the overspill of banks. During this process, lateral deposition of sediment is prone to happen. Phosphorus tends to bind strongly to mineral particles which ensures that the phosphorus is retained on the floodplain after the deposition of these particles. Denitrification does occur to a lesser extent due to little exposure to large amounts of water seeing that these water masses are dependent on floods. Additionally, sub-surface flows are rare for floodplains which decreases the possibility of denitrification even more so.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique and therefore, the ecosystem services rated high for these systems on-site might differ slightly from those expectations.

4.6 Wetland Functionality

The function and service provision provided by the wetland referred to in this report as Wetland A & B provide features associated with a floodplain and a seep. It should be noted that wetland characteristics utilised during the calculation of function and service provision varied slightly from feature to feature. However, the use of the average condition is deemed sufficient to determine the overall importance of each of the features and guide decision-making on the utilisation of the resources in the vicinity of these areas and to determine management and mitigation measures to protect these resources. The results are presented in the table that follows.

Table 11: Functionality & PES

Function	Aspect
Water balance	Streamflow regulation
	Flood attenuation
	Groundwater recharge
Water purification	Nitrogen removal
	Phosphate removal
	Toxicant removal
	Water quality

Function	Aspect
Sediment Trapping	Particle assimilation
Harvesting of natural resources	Reeds, Hunting etc.
Livestock usage	Water for livestock
	Grazing for livestock
Crop Farming	Irrigation

Hydro-geomorphic units are inherently associated with hydrological characteristics related to their form, structure and particularly their position in the landscape. This, together with the biotic and abiotic character (or biophysical environment) of wetlands in the study area, means that these wetlands can contribute better to some ecosystem services than to others (Kotze et al. 2005) (Table 3).

Each wetland's ability to contribute to ecosystem services within the study area is further dependent on the wetland's Present Ecological State (PES) concerning a benchmark or reference condition. Present Ecological State scores were assigned for wetlands within the study area using WET-Health Level 2 assessment. Using a scoring system, the perceived departure of elements of each system from the "natural-state" was determined. The following elements were considered in the assessment:

- Hydrologic: Flow modification (has the flow, rates, volume of run-off or the periodicity changed).
- Geomorphic (Canalisation, impounding, topographic alteration, and modification of key drivers); and
- Biota (Changes in species composition and richness, Invasive plant encroachment, over utilisation of biota and land-use modification).

Table 12: Wetland Hydrological Benefits

Section A & B Wetlands

WETLAND HYDRO-GEOMORPHIC TYPE	HYDROLOGICAL BENEFITS POTENTIALLY PROVIDED BY THE WETLAND							
	FLOOD ATTENUATION		Stream flow regulation	Erosion Control	ENHANCEMENT OF WATER QUALITY			
	Early wet season	Late wet Season			Sediment trapping	Phosphates	Nitrates	Toxicants
Wetland A	++	++	++	++	++	++	++	++
Wetland B	+	+	+	+	+	++	++	++
Wetland C	++	++	+	++	++	++	++	++

Toxicants are taken to include heavy metals and biocides.

Rating of Benefit unlikely to be provided to any significant extent

+ Benefit likely to be present at least to some degree

++ Benefit very likely to be present (and often supplied to a high level

From the results of the assessment, it is evident that wetland features associated with the floodline, and the seeps can be considered of high importance in terms of function and service provision. Wetland features are likely to play a high role in the attenuation of floodwater entering the system. Sediment trapping and erosion control are also considered important services provided by the wetlands and watercourse system.

Wetland features associated with the watercourse are likely to trap sediment carried in stormwater. Furthermore, water which is spread across wetland features is slowed down and the erosive capability is therefore decreased. Assimilation of nitrates, phosphates and toxicants calculated moderately high scores. The delineated wetlands (A & B) are near a power station and are therefore likely to play a role in toxic assimilation before these substances enter the major rivers.

4.7 Present Ecological State (PES)

A summary of the Present Ecological Status (PES) based on results from the WET-Health Tool is provided in the table below. The health assessment of the wetland units within the project site indicates that the wetland units in section B are moderately modified owing to the various anthropogenic activities happening around them.

Wetland A and B was found to be moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. Wetland C shows that is seriously modified owing to its proximity to the power station. This wetland system is impacted by historical activities both in the catchment as well as directly on the wetland system where the impacts continue. It forms part of a larger wetland system. The trajectory of change for the wetland ecological status is predicted that conditions are likely to deteriorate slightly over the next 5 years without major intervention.

Table 13: Section A - Present Ecological Status (PES)

Wetland	Present Ecological Status Score	Present Ecological Status Class /Category	Description	Trajectory of Change
Wetland A	2.5	C	Moderately modified	↑
Wetland B	2.4	C	Moderately modified	→
Wetland C	2	D	Largely Modified	→

***S- Score & C- Confidence**

Scoring guidelines per attribute:

Natural, unmodified = 5; Largely natural = 4, Moderately modified = 3; Largely modified = 2; Seriously modified = 1; Critically modified = 0.

Relative confidence of score:

Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1.

The wetland score for PES for Wetland A and B shows that the delineated and assessed falls with class "C-Moderately Modified" reflecting that a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitats remain predominantly intact Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitats remain predominantly intact, and Wetland C scored Category D reflecting that the wetland is Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.

4.8 Ecological Importance & Sensitivity (EIS)

All wetlands, rivers, flood zones, and their riparian areas are protected by law and no development is allowed to negatively impact watercourses and associated vegetation. The vegetation in and around wetlands and drainage lines plays an important role in water catchments, assimilation of phosphates, nitrates, and toxins as well as flood attenuation. Quality, quantity, and sustainability of water resources are fully dependent on good land management practices within the catchment.

4.8.1 Importance according to Free State Conservation Plan

The Free State C-Plan is intended to guide land-use planning, environmental assessments, and land-use authorisations, as well as natural resource management, to promote the sustainable development agenda. The C-plan has been developed to further the awareness of the area's unique biodiversity, and the value this biodiversity represents to people and to promote management mechanisms that can ensure the protection and sustainable utilization of the region's biodiversity. The Vaal River and floodplain fall within Critical Biodiversity Area 2 north of the study site and Ecological Support Areas adjacent to the identified wetland A. Wetland B and C falls within Ecological Support Area 1.

NB: See attached map below.

Ecological Support Areas are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services.

Critical Biodiversity Areas are areas required to meet biodiversity targets for ecosystems, species, and ecological processes, as identified in a systematic biodiversity plan. Ecological Support Areas are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services.

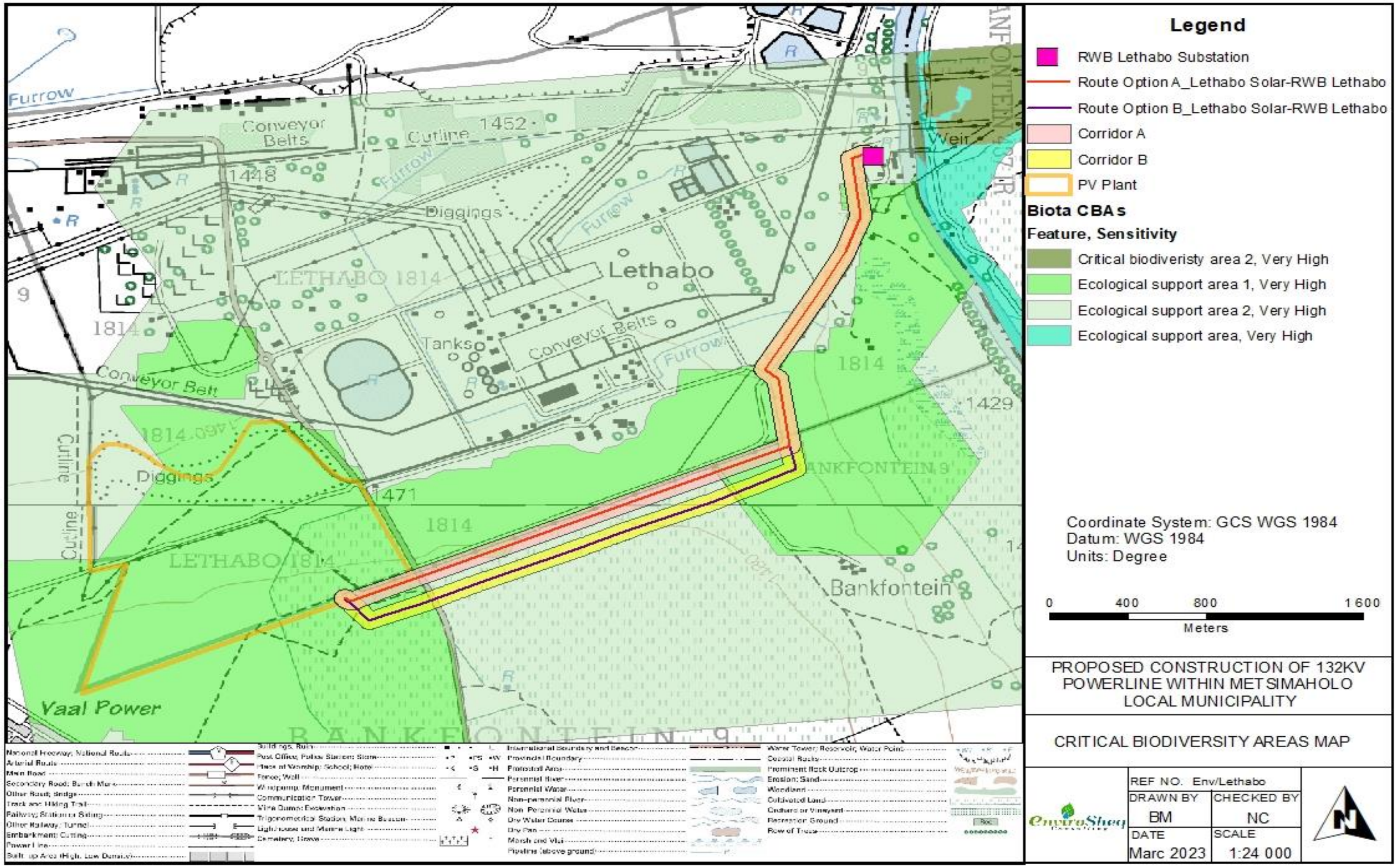


Figure 9: Free State Conservation Plan

4.8.2 Ecological Importance & Sensitivity Rating

The Ecological Importance and Sensitivity (EIS) assessment was undertaken to rank water resources in terms of:

- Provision of goods and services or valuable ecosystem functions which benefit people.
- Biodiversity support and ecological value; and
- Reliance of subsistence users (especially basic human needs uses).

Water resources which have high values for one or more of these criteria may thus be prioritised and managed with greater care due to their ecological importance (for instance, due to biodiversity support for endangered species), hydrological functional importance (where water resources provide critical functions upon which people may be dependent, such as water quality improvement) or their role in providing direct human benefits (Rountree, 2010). Degradation of wetlands through impacts in catchments or wetlands themselves is resulting in the reduction and loss of their functional effectiveness and ability to deliver ecosystem services or benefits to humans and the environment (Kotze et al., 2008). Please refer to Table 14 below.

Table 14: Ecological Importance Sensitivity (EIS)

<table>
<tr><th>Wetland</th><th>Ecological Importance & Sensitivity</th><th>Present Ecological Status Class /Category</th><th>Description</th><th>Trajectory of Change</th></tr>
<tr><td>Wet A</td><td>2.5</td><td>B</td><td>High</td><td>Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water in major rivers</td></tr>
<tr><td>Wet B</td><td>2.4</td><td>C</td><td>Moderate</td><td rowspan="2">Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.</td></tr>
<tr><td>Wet C</td><td>2</td><td>C</td><td>Moderate</td></tr>
</table>

Score guideline: 4= Very High; 3=High;2= Moderate;1= Marginal/Low; 0=None
4=Very High Confidence;3= High Confidence;2= Moderate Confidence;1= Marginal/Low Confidence

The "Very High" EIS and EMC of "B" of Wetland A and "Moderate" EIS and EMC of "C" for Wetland B and C respectively can be attributed to the classification of the study area to be an area of high sensitivity of Ecological Support Area 1 and 2 as per the conservation map.

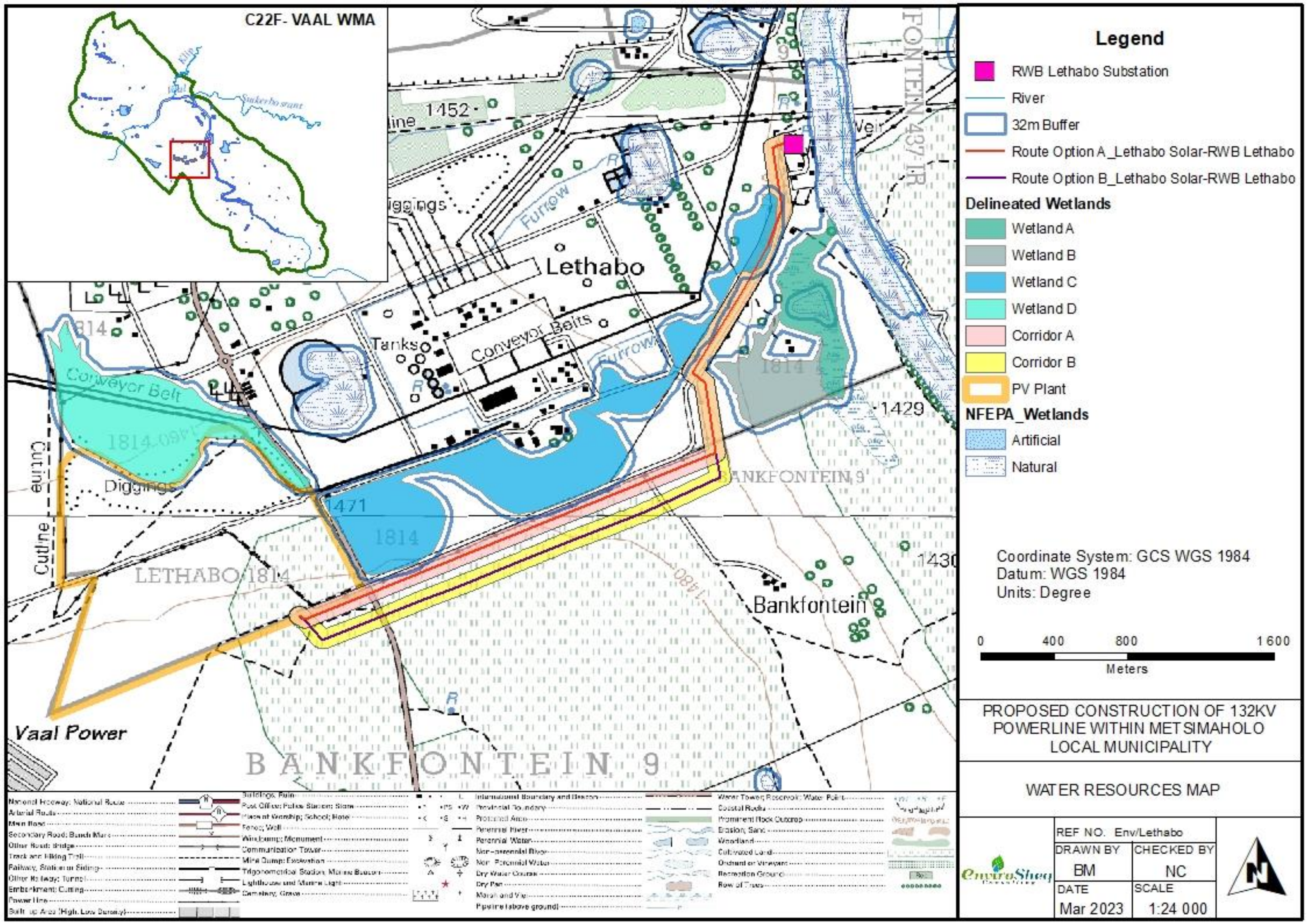


Figure 10: Wetlands

As previously discussed, the hydrology and functionality of the wetland has been impacted through various anthropogenic activities such as sand mining and agricultural activities i.e subsistence farming and livestock grazing along the delineated wetland areas and hence contributing to the low ecological sensitivity.

4.9 Buffer allocation

The National Environmental Management Act (Act 107 of 1998) stipulates that no activity can take place within 32m of a wetland without the relevant authorisation. In addition, the National Water Act (Act 36 of 1998) states that no diversion, alteration of bed and banks or impeding of flow in watercourses (which includes wetlands) may occur without obtaining a Water Use Licence authorising the proponent to do so. This prescribed 32m buffer zone is deemed sufficient to maintain and improve the PES and limit any further impact of the proposed development on the local wetland resources.

5. CONSIDERATION OF THE POTENTIAL IMPACTS ON THE WETLANDS AS A CONSEQUENCE OF THE PROPOSED POWERLINE CONSTRUCTION

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 assessment is to determine the significance of the potential impacts caused by the proposed development and to provide a description of the mitigation required to limit the identified impacts on the natural environment. Identified negative impacts are associated with soil erosion and sedimentation, alteration to the hydrological flow entering the wetland areas, i.e. increased flood peaks, pollution of depressions and soil as a result of construction and operational activities and the spread of alien invasive species.

The proposed development is an overhead powerline. It is important to state that if the towers are located outside of the wetland zones and the banks of the river, the construction impact will be greatly reduced. As a part of the impact assessment process, attention was given to the scores derived in the Ecological Importance & Sensitivity (EIS), the Present Ecological Status (PES) and the Ecological functionality in terms of service provision of the identified watercourses.

5.1 General management and good housekeeping practices

Latent and general everyday impacts, which may affect the wetland ecology and biodiversity, will include any activities which take place in the vicinity of the proposed study area that may impact the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the wetland systems identified in this report:

<u>Development footprint</u>

- The development footprint area should remain as small as possible and should not encroach onto surrounding areas beyond the proposed/approved route.
- Ensure that only essential activities must occur within the wetland features which are traversed by the proposed powerline route, all other non-essential activities should occur outside of the freshwater features; the wetland areas not indicated within the linear development’s footprint are off-limits to construction vehicles and personnel.

- Planning temporary roads and access routes should avoid natural areas and be restricted to existing gravel and tarred roads where possible.
- Appropriate sanitary facilities must be provided for the life of the construction and all waste removed to an appropriate waste facility.
- All hazardous chemicals should be stored in designated areas which are not located near freshwater feature areas.
- No fires should be permitted in or near the construction area.
- Restrict construction to the drier winter months, if possible, to avoid sedimentation of the wetland features and to minimise the severity of disturbance of the wetland habitat.
- Access to the construction site should be limited to a single-entry point to minimise compaction of soils, loss of vegetation and increased erosion; and
- Ensure that an adequate number of litter bins are provided and ensure the proper disposal of waste and spills.

Vehicle access

- It must be ensured that all hazardous storage containers and storage areas comply with the relevant South African Bureau of Standards (SABS) standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fueling must take place on a sealed surface area to prevent the ingress of hydrocarbons into the topsoil.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur should be immediately cleaned up and treated accordingly.

Soils

- As much vegetation growth should be encouraged to protect soils.
- Dumped soils should be removed and the area must be levelled to improve the flow of water.
- Monitor all areas traversed by the development for erosion and incision, during site clearing in the preconstruction phase and throughout the construction phase.

Rehabilitation

- Bare areas that resulted from vegetation clearing during site preparation, must be revegetated with indigenous species to protect the soils.
- Construction rubble must be collected and dumped at a suitable landfill site; and

- All alien vegetation in the construction footprint areas as well as the immediate vicinity should be removed upon completion of construction. Alien vegetation control should take place for a minimum period of two growing seasons after construction is completed.

The photo above shows concrete that was left on site probably after the construction of the existing powerline. This should be avoided as all areas must be rehabilitated back to a pristine state.

5.2 Impact ratings on the wetland ecology

The tables below serve to summarise the anticipated impacts that might occur throughout the development phases, as well as the mitigations that must be implemented to maintain and enhance the wetland features conditions.The abbreviation used in the table are as follows, Duration (D) , Extent (E) , Reversibility (R) , Magnitude (M) , Probability (P) , Consquence (C) , Significance (S) and Significance Post Mitigation (SPM).

Table 15: Impact Assessment

Issues or Activity	Direct / Indirect/ Cumulative	General Impact	D	E	R	M	P	C	S	Mitigation Measures	SPM
		WETLAND IMPACT ASSESSMENT – CONSTRUCTION PHASE									
Impact on Wetland Features, Habitat and Ecological Structure	Direct	• Site clearing and the removal of vegetation leading to increased runoff and erosion during rainfall events • Potential indiscriminate driving through wetland feature areas leading to soil compaction • Earthworks in the vicinity of the wetland feature system leading to loss of wetland feature habitat, erosion and altered runoff patterns • Spillage from construction vehicles and waste dumping leading to contamination of wetland feature soils • Changes to the wetland feature vegetation community due to alien invasion resulting in altered wetland feature conditions	2	2	3	3	2	10	Low (20)	• Ensure that all activities impacting the wetland features are managed according to the relevant DWS Licensing regulations (where applicable); and • As far as possible, all construction activities should occur in the low flow season, during the drier winter months. • The construction footprint must be surveyed and demarcated before construction commences.The development footprint is to be limited to what is absolutely essential in order to minimise environmental damage along the powerline corridor. • A site plan must be developed showing the location of the site camp lay-down area and the plan must be approved by the ECO before construction begins. • Make use of existing access roads as much as possible and plan additional access routes to avoid vegetation communities. • Ensure that vegetation clearing and indiscriminate vehicle driving do not occur outside of the demarcated areas. • Minimize construction footprints before the commencement of the construction and control the edge effects from construction activities; and	Low

Issues or Activity	Direct / Indirect/ Cumulative	General Impact	D	E	R	M	P	C	S	Mitigation Measures	SPM
										• Implement an alien vegetation control program within the wetland features.	
Impact on Wetland Hydrological Function and Sediment Balance	Direct	• Potential poor planning, resulting in continuous shifting of the linear development within wetland habitat, leading to altered habitat. Site clearing and further removal of vegetation resulting in increased runoff which leads to erosion and alteration of the geomorphology of the wetland features. • Disturbance of soils, topsoil stockpiling adjacent to the wetland features and runoff from stockpiles leading to sedimentation of the system. • Earthworks in the vicinity of the wetland features leading to incision, erosion and altered runoff patterns. • Movement of construction vehicles within the wetland features resulting in soil compaction.	2	2	3	3	2	10	Low (20)	• During construction use techniques which support the hydrology and sediment control functions of the freshwater features; and normal as soon as possible after construction. • Limit excavations to a limited extent to ensure that drainage patterns within the features return to pre-development status. Restrict construction to the drier winter months if possible to avoid sedimentation of the freshwater feature and to minimize the severity of disturbance of the features and hydraulic function.	Low
Impact on Wetland Geomorphology	Direct	• During the construction phase there will be excavations hence disturbing the soils of the site.	2	2	3	3	2	10	Low (20)	• Stringent controls must be put in place to prevent any unnecessary disturbance or compaction of alluvial soils. Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be	Low

Issues or Activity	Direct / Indirect/ Cumulative	General Impact	D	E	R	M	P	C	S	Mitigation Measures	SPM
										stabilized and any alien plants which establish should be cleared and follow up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). Topsoil should preferably be separated from the subsoil, and topsoil sections should be kept intact as deep as possible. • Do not allow surface water or stormwater 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. • Minimise the extent of the work footprint as far as possible. • 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, silt fences, retention or replacement of vegetation and geotextiles	

Issues or Activity	Direct / Indirect/ Cumulative	General Impact	D	E	R	M	P	C	S	Mitigation Measures	SPM
										such as soil cells which must be used in the protection of slopes.	
Changes to Ecological and Socio-Cultural Services Provision		• Potential poor planning, resulting in the placement of the linear development within wetland habitat, leading to altered habitat • Increased anthropogenic activity within the wetland feature leading to an increased impact on the biological structure of the wetland features and the associated effects that this will have on service provision • Loss of phosphate, nitrate, and toxicant removal abilities due to vegetation clearing • Inability to support biodiversity due to vegetation clearing and contamination of wetland feature soils and water because of waste rubble dumping, increased sedimentation, and alteration of natural hydrological regimes. • Earthworks within the wetland features leading to loss of flood attenuation abilities and streamflow regulation capabilities. • Unmanaged oil leaks from construction vehicles leading to water quality deterioration • Loss of vegetation resulting in a loss of breeding and foraging habitat and overall decreased biodiversity.	2	2	3	3	2	10	Low (20)	• During construction use techniques which support the hydrology and sediment control functions of the freshwater features; and normal as soon as possible after construction. • Limit excavations to a limited extent to ensure that drainage patterns within the features return to pre-development status. • 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	Low

Issues or Activity	Direct / Indirect/ Cumulative	General Impact	D	E	R	M	P	C	S	Mitigation Measures	SPM
										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.	

5.3 Cumulative Impact

Cumulative effects are commonly understood as the impacts which combine from different projects, and which result in significant change, which is larger than the sum of all the impacts. Cumulative effects can be characterised according to the pathway it follows. One pathway could be the persistent additions from one process. Another pathway could be the compounding effect from one or more processes. Cumulative effects can therefore occur when impacts are: (1) additive (incremental); (2) interactive; (3) sequential; or (4) synergistic. (DEAT, 2004). It is in this regard that this section seeks to address and assess the cumulative impact of the proposed project.

The proposed 132kV powerline will be 4.5km long and will traverse across transformed ecosystems. The ecosystem has been transformed from its pristine state due to various historical and current anthropogenic activities happening around the area which include power generation, road infrastructure development, farming and last but not least construction of a network of power transmission and distribution lines spanning thousands of kilometers from the Lethabo power station. Of significance to note is that within the proposed corridors there are existing power transmission lines that have been built over time and the observation has been that these lines apart from contributing to the nature of the transformed ecosystem due to clearance of vegetation at tower, there is no significant contribution to the degradation of the environment as compared to the other activities accruing around the area. A small section of the proposed powerline corridor will traverse through a delineated wetland. It is in this regard that there are low impacts expected to occur during the construction phase however the cumulative impact from the proposed powerline , the existing impacts from the existing activities around the proposed powerline corridor coupled with impacts anticipated from future projects in the area, the cumulative impact on the Present Ecological Status (PES), Environmental Importance & Sensitivity (EIS) and on provision of ecological and cultural services is expected to be moderate in nature.

6 CONCLUSION & RECOMMENDATION

The Wetlands identified are moderately transformed and impacted by historical and ongoing anthropogenic activities. Wetland B is a small-scale wetland unit that interconnects to a larger wetland system to the south (Wetland A). The wetland located near the power station (Wetland C) was determined to be historically impacted by the construction and operation of the power station and associated stormwater infrastructure. The Present Ecological Status (PES) for wetlands B & C (seeps) scored moderate and high for wetland A (floodplain) respectively. The Ecological Importance and Sensitivity (EIS) falls in the mid-range and has high functionality in respect of hydrological functions. The Recommended Ecological Category (REC) for the wetlands were categorised as moderate. It will thus require some rehabilitation to enhance the ecological function of the system. Wetlands B and C are considered to be sensitive and of importance at a local and provincial scale while wetland A was considered to be ecologically important and sensitive at a national scale and its biodiversity is sensitive to flow and habitat modifications. Wetland A plays a role in moderating the quantity and quality of water from major rivers. The impact assessment showed that the identified wetlands will in all likelihood be minorly impacted by the proposed powerline and will be low in nature however cumulatively the impact is expected to be moderate in nature.

Having taken the outcome of the assessment in consideration, it can be supported that the development may proceed and the wetland functionality can be preserved by implementing all mitigation measures. The project can be supported, should all the mitigation measures be implemented and monitored to ensure compliance. The preferred corridor is corridor A as it is within the servitude of the existing powerline.

Most preferred	Corridor A
Intermediate	Corridor B

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APPENDIX A- SPECIALIST DECLARATION

I, Frank Mhandu, declare that --

General declaration:

- I act as the independent specialists in this application.
- 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 Act, regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, regulations, and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I 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 form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company: *Envirosheq Consulting*

Date: 25 March 2023

APPENDIX B -IMPACT ASSESSMENT METHODOLOGY

The status of the impact		
Status		**Description**
Positive:		a benefit to the holistic environment
Negative:		a cost to the holistic environment
Neutral:		no cost or benefit
The duration of the impact		
Score	Duration	Description
1	Short term	Immediate/ short term (less than 3 months)
2	Medium term	Construction or decommissioning period
3	Long term	For the life of the operation
5	Permanent	Permanent
The extent of the impact		
Score	Extent	Description
1	Footprint	Within the site boundary
2	Site	Affects immediate surrounding areas
3	Local	Local area / district (neighbouring properties, transport routes and adjacent towns) is affected
4	Regional	Extends to almost entire province or larger region
5	National	Affects the country.
The reversibility of the impact		
Score	Reversibility	Description
1	Completely reversible	Reverses with minimal rehabilitation & negligible residual affects
3	Reversible	Requires mitigation and rehabilitation to ensure reversibility
5	Irreversible	Cannot be rehabilitated completely/rehabilitation not viable
The magnitude (severe or beneficial		
Score	Severe/beneficial effect	Description
1	Zero	Natural and/or social functions and/or processes remain unaltered.
2	Very Low	Natural and/or social functions and/or processes are negligibly altered.

3	Low	Natural and/or social functions and/or processes are slightly altered and are reversible with time.
4	Moderate	Natural and/or social functions and/or processes are notably altered and are reversible with rehabilitation.
5	High	Natural and/or social functions and/or processes are permanently altered.
The probability of the impact		
Score	Rating	Description
1	Unlikely	The chance of this impact occurring is zero (0%).
2	Possible	May occur. The chances of this impact occurring is defined as 25%.
3	Probable	Likely to occur. The chances of this impact occurring is defined as 50%.
4	Highly Probable	The chances of this impact occurring is defined as 75%.
5	Definite	Will certainly occur. The chance of this impact occurring is defined as 100%.
The Significance		= Magnitude + Extent + Duration + Reversibility.
		= Consequence x Probability.

Score out of 100	**Significance**
1 to 20	Low
21 to 40	Low to Moderate
41 to 60	Moderate
61 to 80	Moderate to high
81 to 100	High