Appendix F.9

AQUATIC BIODIVERSITY ASSESSMENT

Public

Eskom Holding SOC

ESKOM KOMATI - AQUATIC BIODIVERSITY (RIPARIAN AND WETLAND SYSTEMS) SPECIALIST ASSESSMENT

Komati Power Station

DECEMBER 2023

PUBLIC

Eskom Holding SOC

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Komati Power Station

WSP

Building 1, Maxwell Office Park
Magwa Crescent West, Waterfall City
Midrand, 1685
South Africa

Phone: +27 11 254 4800

WSP.com

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Prepared by	Lufuno Nemakhavhani
Signature	
Checked by	Aisling Dower
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EXECUTIVE SUMMARY

Eskom Holdings SOC (Ltd) (Eskom) is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station, which is situated in Mpumalanga, about halfway between Middelburg and Bethal.

Eskom plans to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS), for which authorisation at a national level, and financing at an international level, must be sought. WSP Group Africa (Pty) (Ltd) was appointed to undertake the necessary ecological baseline studies and impact assessments, in support of the environmental and social impact assessment process, required to authorise development-related activities.

The proposed Project development intercepts two seepage wetlands (herein referred to as Seep 1 and Seep 2) and is located within a 500 m buffer of a channelled valley bottom wetland to the north and a depression wetland to the south. The wetlands within the study area were found to be in Largely Modified state (PES D) with the exception of the depression wetland located outside of the project development boundary.

All wetlands in the study area were assessed as being of Low /Marginal EIS, with the exception of the channelled valley bottom wetland which was assessed as being of Moderate EIS. The moderate EIS of the channelled valley bottom was attributed to its hydrological functional importance as this wetland performs a role in landscape connectivity at the regional level, providing regulating and supporting benefits such as streamflow regulation and flood attenuation. Although largely modified the channelled valley bottom wetland and the seep wetland that crosses the northern boundary of the site were considered to still support biodiversity and deliver ecological services to an extent that enables them to still be considered ‘Natural habitat’ as defined by the lender standards.

According to the diatom assessment, the diatom assemblages were generally comprised of species characteristic of fresh brackish, acidic water and eutrophic conditions. The pollution levels indicated that there were low levels of pollution present at the stie, while the presence of some taxa point to a slightly acidic condition. According to the ecological water quality, the site showed high conditions with low levels of organic pollution.

The proposed project infrastructure will be situated in close proximity to the existing power generation facilities and activities. All areas visited are currently experiencing some level of impact from the surrounding agricultural and industrial activities primarily through habitat transformation, and disturbance arising from power generation facilities and activities. The most significant drivers of change currently present in the study area include industrial operations (seepage from ash dam, increased water inflow from Eskom operations) impoundment of water at dams, road crossings, mining operations in the catchments, spread of alien invasive species as well as formal and informal settlements within the wetland's catchment.

Construction of the proposed Project will result in the direct loss of wetland habitat due to vegetation clearing within wetlands and in their catchment in advance of the project development. The earthworks and activities involved during the construction phase of the Project can exert negative impacts on sensitive ecosystems including loss of wetland habitat, catchment landcover changes resulting in increased sediment entry to downstream systems, construction of wetland/riparian system crossings causing impoundments/barriers to movement for aquatic species, contamination of water bodies by construction materials / vehicles (hydrocarbons etc), increased potential of erosion due to surface runoff and soil disturbances and the establishment and spread of alien and invasive species (AIS). Provided that recommended mitigation measures are not implemented some of these impacts such as the establishment and spread of AIS, soil erosion and surface water and soil contamination are likely to carry on into the operational phase. The proposed Project development is considered to have a Moderate impact significance prior to mitigation, with the exception of the loss of wetland habitat impact, which is considered high and cannot be mitigated. With the implementation of recommended mitigation measures and monitoring measures the moderate impact significance impacts can be reduced to a Low or Very low impact significance.

Contact name Lufuno Nemakhavhani

Contact details +27 11 313-1121 | lufuno.nemakhavhani@wsp.com

1 INTRODUCTION AND BACKGROUND

Eskom Holdings SOC (Ltd) (Eskom) is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station, which is situated in Mpumalanga, about halfway between Middelburg and Bethal (Figure 2-1).

Eskom plans to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS), for which authorisation at a national level, and financing at an international level, must be sought, supported by an Environmental and Social Impact Assessment (ESIA) that is aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector;; Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

WSP Group Africa (Pty) (Ltd) was appointed to undertake the necessary ecological baseline studies and impact assessments, in support of the environmental and social impact assessment process, required to authorise development-related activities.

1.1 PURPOSE OF REPORT

This report describes the baseline aquatic biodiversity (riparian and wetland systems) of areas that will be impacted by the proposed infrastructure developments at Komati Power Station and documents the results of the baselines and the impact assessment of the proposed Project on aquatic ecosystems (riparian and wetland).

The report also provides recommended measures for the mitigation of any negative impacts for inclusion in the updated EMPr for the Project, to ensure that the lender objectives of No Net Loss (NNL) of Natural Habitats, and Net Gain (NG) of Critical habitats, as well as South African biodiversity legislation and policy requirements, are satisfactorily met.

2 PROJECT LOCATION AND EXTENT

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa (Figure 2-1).

2.1 CURRENT OPERATION

The station has a total of nine units, five 100MW units on the east (Units 1 to 5) and four 125 MW units on the west (Units 6 to 9), with a total installed capacity of 1000 MW. Komati Power Station is expected to have reached its end-of-life expectancy in September 2022, the time Unit 9 is planned to have reached its dead stop date (DSD). Units 1 to 8 have already reached its DSD.

2.2 PROPOSED INFRASTRUCTURE AND ACTIVITIES

Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS). The parcels of land in Komati for the proposed development are owned by Eskom. The proposed infrastructure that are the subject of the current application process are illustrated in Figure 2-2.

PROJECT COMPONENTS

The specifications of the Solar PV and BESS project including aspects of construction and operation are outlined below:

- The total site area for PV installation is approximately 200-250 hectares to allow for the construction of a PV facility with capacity up to 100 MW and BESS up to 150 MW.
- Solar PV modules, up to a total of approximately 720,000 m2, that convert solar radiation directly into electricity. The solar PV modules will be elevated above the ground and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the boundaries, and O&M access roads in between the PV module rows.
- Inverter stations, each occupying a footprint up to approximately 30 m2, with up to 100 Inverter stations installed on the identified sites. Each Inverter station will contain an inverter step-up transformer, and switchgear. The Inverter stations will be distributed on the site, located alongside its associated Solar PV module arrays. The Inverter station will perform conversion of DC (direct current) to AC (alternating current), and step-up the LV voltage of the inverter to the appropriate voltage to allow the electricity to be fed into the appropriate substation / grid point of connection (PoC). Inverter stations will connect several arrays of Solar PV modules and will be placed along the internal roads for easy accessibility and maintenance.
- Below ground electrical cables with trenching for connecting PV arrays, Inverter stations, O&M buildings, and Combiner Substations.
- Above ground overhead lines for connecting Combiner Substations to grid PoC.
- Adequately designed foundations and mounting structures that will support the Solar PV modules and Inverter stations.
- Access roads that provide access to the Komati PV sites.
- Perimeter roads around the PV sites.
- Internal roads for access to the Inverter stations.

- Internal roads/paths between the Solar PV module rows, to allow access to the Solar PV modules for operations and maintenance activities.
- Infrastructure required for the operation and maintenance of the Komati PV installations:
  - Meteorological Station
  - O&M Building – comprising control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities (including water supply and sewage infrastructure)
  - Spares Warehouse and Workshop
  - Hazardous Chemical Store – approx. 30 m2
  - Security Building
  - Parking areas and roads
- Small diameter water supply pipeline from existing supply infrastructure.
- Fire water supply during Construction and Operation.
- Sewage interconnection to existing infrastructure.
- Stormwater channels.
- Perimeter fencing of the Komati PV sites, with access gates.
- Temporary laydown area, occupying a footprint up to approx. 10 hectares. The laydown area will be used during construction and rehabilitated thereafter.
- Temporary concrete batching plant, occupying a footprint up to approx. 1 hectare. The concrete batching plant area will be used during construction and rehabilitated thereafter.
- Temporary site construction office area, occupying a footprint up to approx. 1 hectare. This area will accommodate the offices for construction contractors during construction and rehabilitated thereafter.

SOLAR PV CONSTRUCTION

It is estimated that approximately 200-300 construction workers will be required on the site. During the construction phase of the project the following activities are anticipated:

- Site Preparation - Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.
- Transportation of Equipment - All equipment to site will be transported by means of national, provincial and district roads. This includes but is not limited to, transformers, solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- Site Establishment Works - The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g. use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- Construction of the Solar PV Facility
- Trenches would need to be excavated for underground cabling to connect Solar PV arrays, Inverter stations, and Combiner Substations.
- Foundations for the solar PV array mounting structures and Inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be utilised at the PV site.

- Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- Water consumption during construction phase - The water consumption during the construction phase is estimated as 15,000 kilolitres (total for construction period estimated as 24 months).
- Construction of Electrical Interconnection Line - Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- Storage of diesel and oil for construction activities.
- Once all the construction activities are completed the site will be rehabilitated where possible and practical. All temporal structures and facilities will be removed from site and the area rehabilitated
- Solar glare reflection – proximity to air strip.
- End of life waste management for both solar panels and batteries.

SOLAR PV OPERATION

The solar PV plant has a minimum design life of 25 years.

- During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant.
- In addition, there will be periodic cleaning and washing of the solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur 2-4 times a year.
- The water consumption during operation - estimated water required per year during operation is 10,000 kilolitres (total per year for design life of plant).

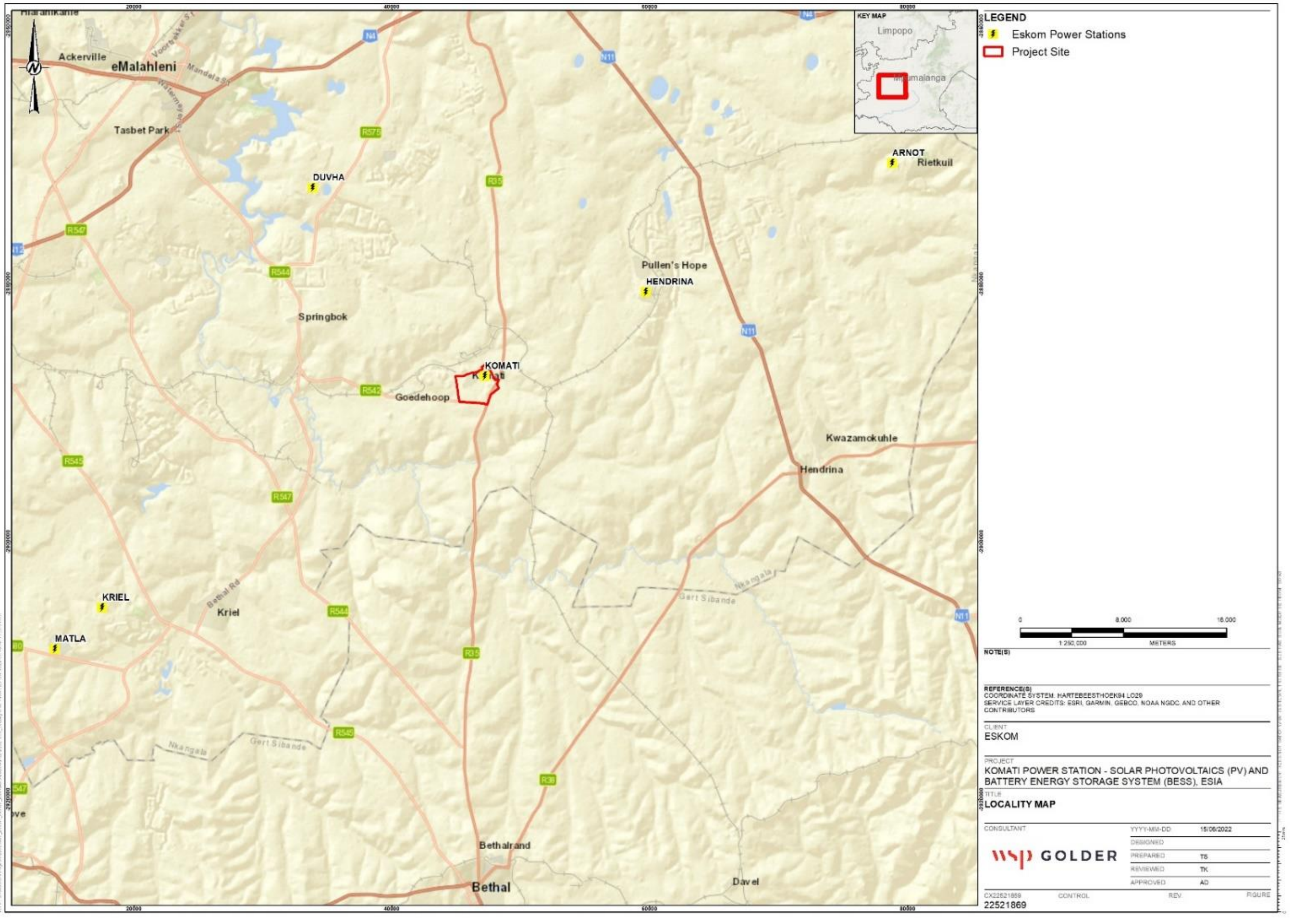


Figure 2-1 - Locality Map - Eskom Komati Power Station

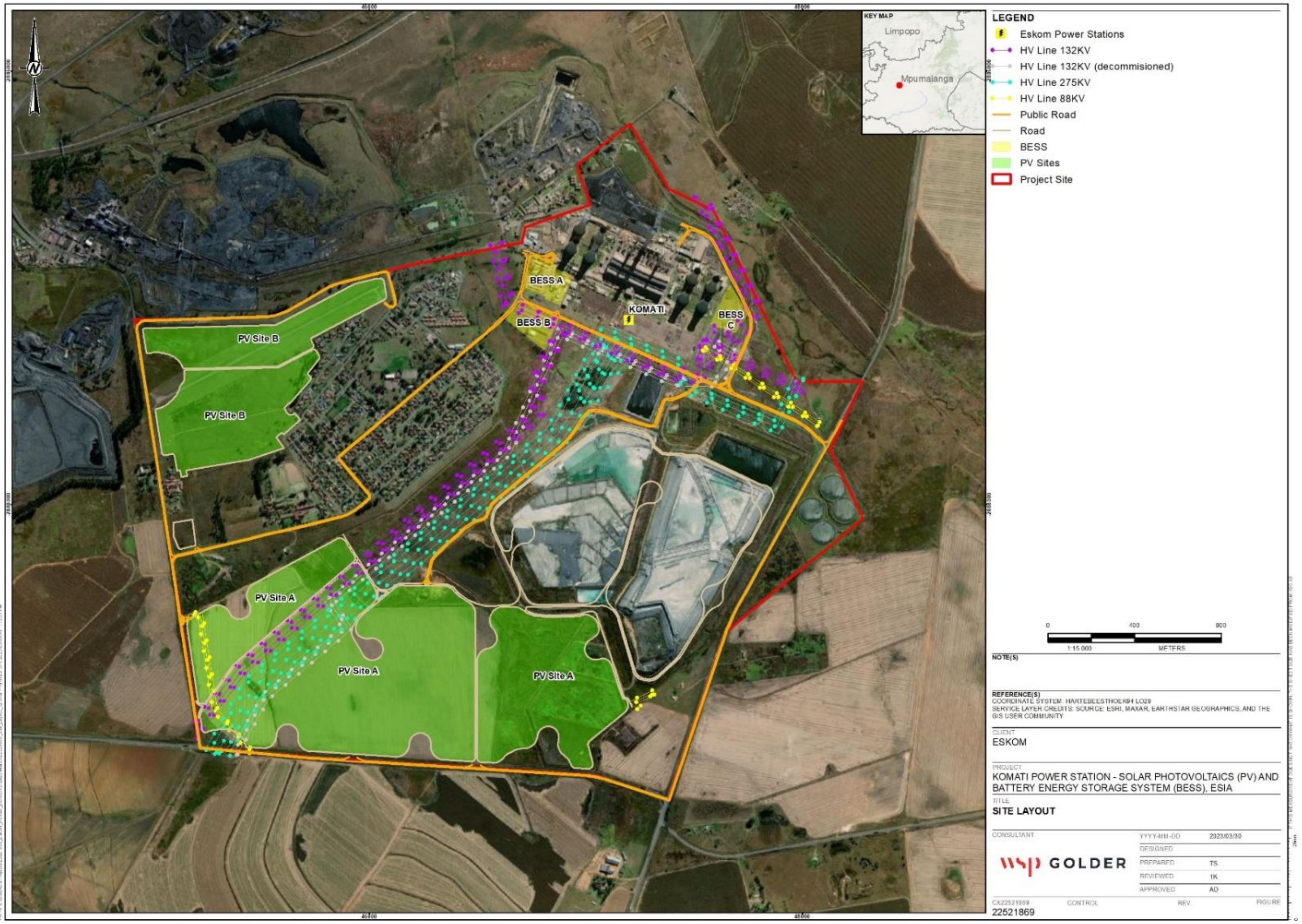


Figure 2-2 - Proposed infrastructure overview

3 APPLICABLE LEGISLATION, POLICY AND STANDARDS

The ESIA must be aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; and Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

Biodiversity-related South African legislation and policy, and international lender standard requirements that were used to guide this study are summarized as follows.

3.1 SOUTH AFRICAN LEGISLATION AND POLICY

Applicable national and provincial legislation, associated regulations and policies that are pertinent to wetlands, which were used to guide the EIA, include:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998) including Section 24, concerning Procedures for the assessment and minimum criteria for reporting on identified themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, when applying for environmental authorisation;
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity;
- National Water Act (Act No. 36 of 1998);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998);
- Mpumalanga Biodiversity Sector Plan (Lötter, 2015).
- National Protected Area Expansion Strategy (2016).

3.2 LENDER REQUIREMENTS

The ESIA must be aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; and Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

WORLD BANK ENVIRONMENTAL AND SOCIAL STANDARD 6

The World Bank's (WB) Environmental and Social Standard 6 (ESS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources (World Bank, 2016) separates habitat into four categories for the purposes of implementing a differentiated risk management approach to habitats based on their sensitivity and values. The categories include 'Modified habitat', 'Natural habitat', 'Critical Habitat' and 'Legally protected and internationally and regionally recognized areas of biodiversity value'; each of which have varying levels of Borrower obligation in terms of biodiversity mitigation and management, and offset requirements.

Whilst the assessment of Modified and Natural habitats is largely based on the establishment of the ecological condition of mapped habitat/vegetation units, and the boundaries of legally protected and/or internationally recognised areas of high biodiversity value are generally defined; the identification and assessment of Critical Habitat requires additional, focussed effort – usually focussed on the presence of Critically Endangered, Endangered, range-restricted or migratory/congregatory species in significant numbers.

3.3 GOOD INTERNATIONAL INDUSTRY PRACTICES (GIIP)

Best practice guidelines that were taken into consideration in the development of the ESIA report are listed below. These guidelines are generally accepted as the best practice standards for usage in wetland and riparian habitat assessment in South Africa:

- A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas", DWAF (2005) and updated by DWAF (2008),
- WET-Health Version 2.0: A refined suite of tools for assessing the present ecological state of wetland ecosystems- technical guide. Report No. TT 820/20 (Macfarlane, et al., 2020)
- WET-EcoServices Version 2.0: A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas. WRC Report No. TT 833/20. Water Research Commission, Pretoria, South Africa (Kotze, D., Macfarlane et al., 2020)
- Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/13. Water Research Commission, Pretoria (Rountree et al., 2013).

4 METHODOLOGY

The aquatic biodiversity baseline description and impact assessment took cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning 'Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation'.

In line with the assessment and reporting requirements set out in the protocol, the aquatic ecology assessment included two main study components; a desktop literature review, supplemented by a wetland delineation and assessment field survey conducted on the 31st of May and the 01st of June 2022. The objectives and tasks associated with these components are described below.

4.1 STUDY AREA

The study area for the Aquatic Specialist Assessment was defined at two levels:

- Local study area: The proposed development footprint plus a 500 m buffer, so that the project interaction with any watercourses and their 'regulated zone' as defined by the National Water Act can be identified, since this is the area within which direct impacts on biodiversity receptors (i.e. wetlands / aquatic ecosystems) could occur (Figure 4-1);
- Regional study area: The catchment within which the proposed development is situated, which is considered to be an ecologically appropriate area of analysis within which indirect impacts on aquatic receptors (e.g. downstream water quality deterioration, alteration of sub-catchment hydrology, soil erosion, hydrological changes) could occur (Figure 4-2).

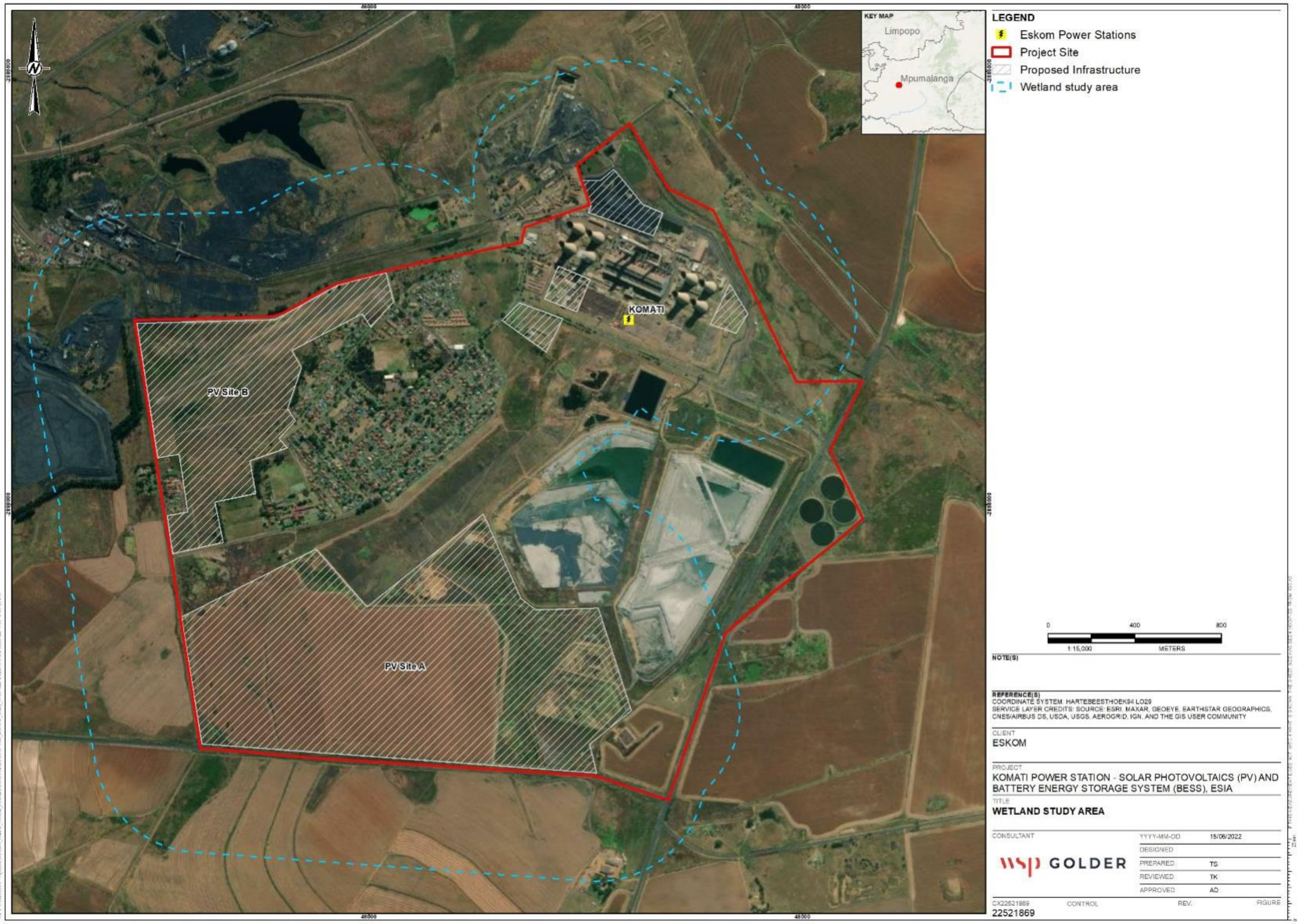


Figure 4-1 - Aquatic biodiversity local study area

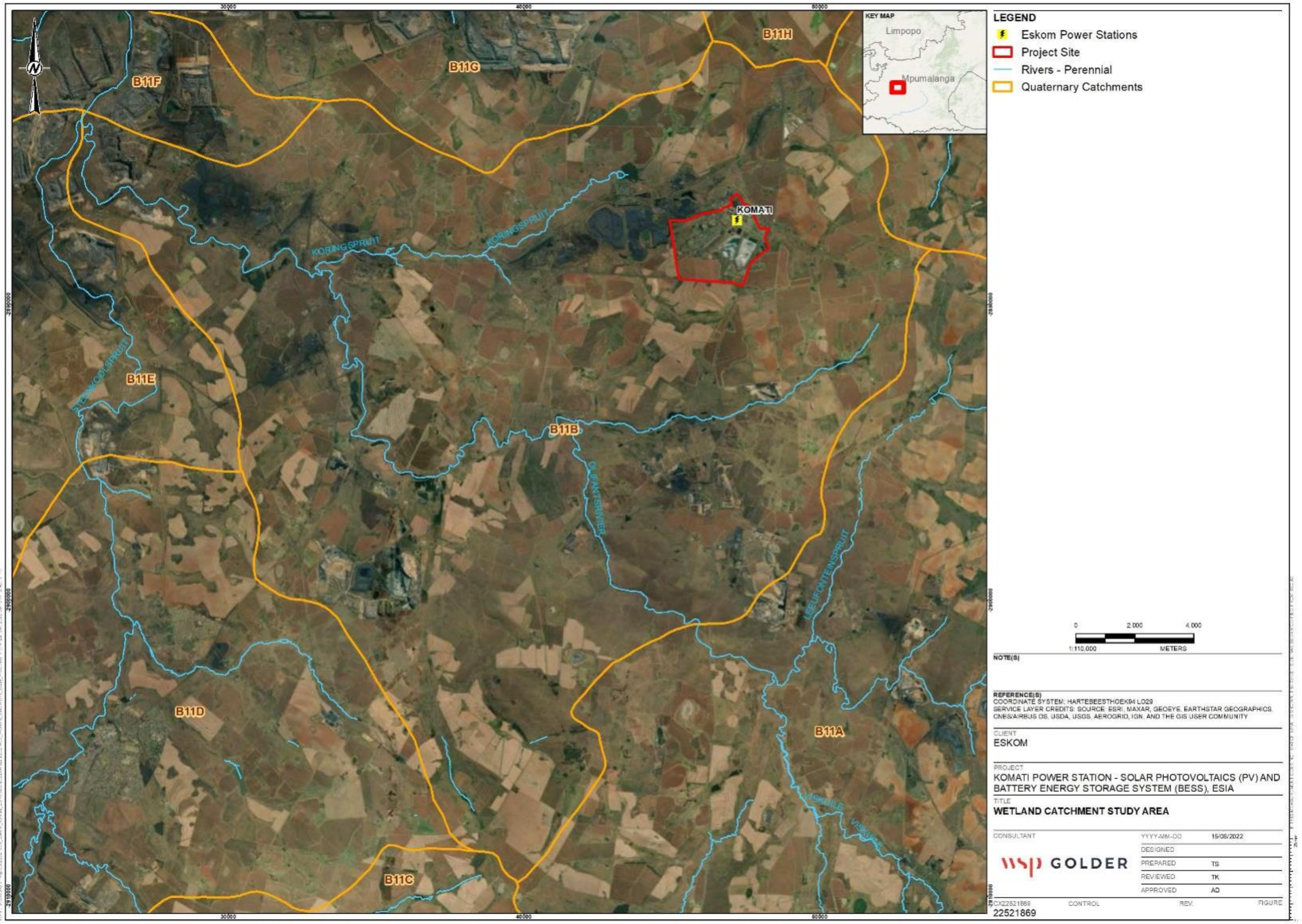


Figure 4-2 - Aquatic biodiversity regional study area as defined by the quaternary catchment B11B

4.2 LITERATURE REVIEW

The aim of the desktop literature review component was to collate and review the extensive available ecological information related to important aquatic biodiversity features in the Eskom Komati power station area of influence, key wetland processes and function, and the likely composition and structure of local riparian and wetland communities.

The existing comprehensive specialist reports that were reviewed and consolidated to assess aquatic biodiversity include:

- Komati Power Station Hydrological & Geohydrological Baseline Study December 2008 (GHT Consulting Services, 2009)
- Construction and Operation of Ash Dam Extension 3 & The Deviation of Transmission and Distribution Lines at Komati Power Station, Mpumalanga (Synergistics Environmental Services 2008).

Other sources that were used in the description of the regional aquatic resources included:

- Nationally-available datasets which were consulted to inform the site sensitivity verification for wetland and riparian habitat include the South African National Wetland Map version 5 (NWM5) (Van Deventer et al., 2019), and the National Freshwater Ecosystem Priority Area database;
- The formal conservation context of the region at a provincial and national level was established based on the Mpumalanga Biodiversity Sector Plan (2019), the National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011), the South African Protected Areas Database (SAPAD), the South African Conservation Areas Database (SACAD) and the national protected area expansion strategy, provide a regional/national context assessing the biodiversity significance of the site;

4.3 WETLAND BASELINE ASSESSMENT

A field survey to identify and delineate the wetlands within 500 m of the proposed Project infrastructure footprint was conducted on 31 May and 01 June 2022. The methods used in the identification, delineation, classification and assessment of wetlands in the study area are described in the sections that follow.

WETLAND DELINEATION

The delineation procedure originally set out in “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas”, DWAF (2005) and updated by DWAF (2008), describes the following four indicators of wetland presence that can be used to define the boundary of a wetland:

1) The position in the landscape, which helps identify those parts of the landscape where wetlands are more likely to occur;
2) The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
3) The presence of wetland vegetation species, and
4) The presence of redoxymorphic soil features, which are morphological signatures that appear in soils with prolonged periods of saturation (due to the anaerobic conditions which result).

These indicators were used in the field to delineate the outer boundary of wetland systems encountered within the study area.

WETLAND CLASSIFICATION

To allow for the differentiation between wetland systems and the prioritisation of systems either for conservation or management purposes, the wetlands were classified in accordance with each hydrogeomorphic (HGM) unit for assessment purposes according to (Kotze et al., 2008). Six major inland HGM types are recognised for the purposes of wetland classification (Table 4-1), and these criteria were applied to the current assessment.

Table 4-1 - Wetland Hydrogeomorphic Units (after Kotze et al., 2008)

Wetland Hydro-geomorphic type	Description	Source of water maintaining the wetland1	
		Surface	Sub-surface
Floodplain	Valley bottom areas with a well-defined stream channel, gently sloped and characterised by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Channelled valley bottom	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterised by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/***
Unchannelled valley bottom	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and from adjacent slopes.	***	*/***
Hillslope seepage with channelled outflow	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Hillslope seepage without channelled outflow	Slopes on hillsides, which are characterized by the colluvial movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes pans)	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e., it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/***	*/***

PRESENT ECOLOGICAL STATE (PES)

WET-Health (Macfarlane et al., 2020) provides an appropriate framework for undertaking an assessment to indicate the ecological integrity of each of the wetland systems being assessed. The outcome of the assessment also highlights specific impacts, therefore highlighting issues that should be addressed through mitigation and rehabilitation interventions. A level 2 Wet-Health approach was applied for this study, which assesses wetlands using four characteristics, namely hydrology, geomorphology, vegetation and water quality. Each of these modules follows a broadly similar approach and is used to evaluate the extent to which anthropogenic changes have an impact on wetland functioning or condition.

The purpose of WET-Health is to aid users in understanding the ecological condition of the wetland and to identify the causes of degradation. The four drivers are assessed by considering the extent, intensity and magnitude of an impact which then produces a health score. Evaluation scores within each driver are then combined to produce an overall impact of activities on the wetland system which corresponds to a Present State health category that provides an impact score scale of 0-10 and associated health category (ecological state) from A-F (Table 3).

Table 4-2 - Impact scores and categories of Present Ecological State used by WET-Health for describing the integrity of wetlands (Macfarlane *et al.,* 2020)

Impact Category	Description	Impact Score Range	Present Ecological State Category
None	Unmodified, or approximates natural condition	0 – 0.9	A
Small	Largely natural with few modifications, but with some loss of natural habitats	1 – 1.9	B
Moderate	Moderately modified, but with some loss of natural habitats	2 – 3.9	C
Large	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred	4 – 5.9	D
Serious	Seriously modified. The losses of natural habitat and ecosystem functions are extensive	6 – 7.9	E
Critical	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat	8 – 10.0	F

WETLAND ECOSYSTEM SERVICES

Wetlands are specialised systems that perform ecological functions vital for human welfare and environmental sustainability. The WET – Ecoservices tool (Kotze et al., 2020), a technique for rapidly assessing ecosystem services supplied by wetlands, was used to determine the key ecological services provided by each wetland in the study area. The rapid field assessment (version 2) approach was applied, and the following services were examined and rated:

- Flood attenuation;
- Toxicant assimilation;
- Food for livestock;

- Stream flow regulation;
- Sediment trapping;
- Erosion control;
- Phosphate assimilation;
- Nitrate assimilation;
- Carbon storage;
- Biodiversity maintenance;
- Water supply for human use;
- Harvestable resources;
- Cultivated foods;
- Tourism and recreation;
- Education and research; and
- Cultural & spiritual significance.

Each of the above-listed services was scored according to the following general level of service provided (Table 4-3)

Table 4-3 - Ecosystem services classes and descriptions (Kotze *et al*., 2020).

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

ECOLOGICAL IMPORTANCE AND SENSITIVITY

The EIS was determined using the methodology developed by Rountree et al. (2013). It is a rapid scoring system to evaluate:

- Ecological Importance and Sensitivity;
- Hydrological Functions; and
- Direct Human Benefits.

The scoring assessment incorporates:

- EIS score derived using aspects of the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999);
- Hydro-function importance score derived from the WET-EcoServices tool for the assessment of wetland ecosystem services Kotze et al. (2020); and
- Direct human benefits score derived from the WET-EcoServices tool for the assessment of wetland ecosystem services Kotze et al. (2020).

The highest score of the three derived scores (each with range 0 – 4) was then used to indicate the overall importance category of the wetland (Table 4-4).

Table 4-4 - Ecological importance and sensitivity categories

Ecological Importance and Sensitivity Category Description	Range of EIS score
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems 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	> 3 and ≤ 4
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	> 2 and ≤ 3
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems 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	> 1 and ≤ 2
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems 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.	> 0 and ≤ 1

DIATOM ASSESSMENT

Diatoms are the unicellular algal group most widely used as indicators of river and wetland health as they provide a rapid response to specific physico-chemical conditions in the water and are often the first indication of change. The presence or absence of indicator taxa can be used to detect specific changes in environmental conditions such as eutrophication, organic enrichment, salinisation and changes in pH.

A diatom sample is collected from a watercourse by removing the biofilm from the upper surface of sever small rocks lying in the surface water by scrubbing vigorously with a brush. The contents are then placed into a bottle, preserved with ethanol and sent to Ecotone Freshwater Consults for analysis.

Diatom laboratory procedures are carried out according to the methodology described by Taylor *et al*. (2007). Diatom samples are prepared for microscopy by using the hot hydrochloric acid and potassium permanganate method. Approximately 300 to 400 diatom valves were identified and counted to produce semi-quantitative data for analysis. Prygiel *et al*. (2002) found that diatom counts of 300 valves and above were necessary to make correct environmental inferences.

The taxonomic guide by Taylor et al. (2007) was consulted for identification purposes. Environmental preferences were inferred from Taylor et al. (2007) and various other literature sources, as indicated in the discussion section, and used to describe the environmental water quality of a watercourse.

Two indices, namely the Specific Pollution Sensitivity Index (SPI; CEMAGREF, 1982) and the Biological Diatom Index (BDI; Lenoir & Coste, 1996) is used in the diatom assessment. The SPI has been extensively tested in a broad geographical region and integrates impacts from organic material, electrolytes, pH, and nutrients. In addition, the Percentage of Pollution Tolerant Values (% PTV; Kelly and Whitton, 1995) is used to indicate organic pollution. All calculations were computed using OMNIDIA ver. 4.2 program (Lenoir & Coste, 1996).

The limit values and associated ecological water quality classes adapted from Eloranta & Soininen (2002) is used for interpretation of the SPI and BDI scores (Table 4-5). The SPI and BDI indices are based on a score between 0 – 20, where a score of 20 indicates no pollution and a score of zero indicates an increasing level of pollution or eutrophication. The %PTV has a maximum score of 100, where a score above 0 indicates no organic pollution and a score of 100 indicates definite and severe organic pollution (Table 4-6)

Table 4-5 - Class values used for the SPI and BDI indices in the evaluation of water quality (adapted from Eloranta & Soininen, 2002)

Interpretation of SPI scores	
Index score	**Class**
>17	A (high quality)
13 - 17	B (good quality)
9 - 13	C (moderate quality)
5 - 9	D (poor quality)
<5	E (bad quality)

Table 4-6 - Interpretation of the %PTV scores (adapted from Kelly, 1998)

%PTV	Interpretation
<20	Site free from organic pollution.
21 - 40	There is some evidence of organic pollution.
41 - 60	Organic pollution likely to contribute significantly to eutrophication.
>61	Site is heavily contaminated with organic pollution.

4.4 ENVIRONMENTAL IMPACT ASSESSMENT

The significance of identified impacts was determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates looks at five impact criteria and indicated in Table 4-7 below

Table 4-7 – Impact Criteria Scores used for wetland impact assessment (Based on impact significance criteria determined by DEAT, 1998)

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	**Very low**	**Low**	**Medium**	**High**	**Very high**
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	**Site:** Site only	**Local:** Inside activity area	**Regional:** Outside activity area	**National:** National scope or level	**International:** Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	**Reversible:** Recovery without rehabilitation		**Recoverable:** Recovery with rehabilitation		**Irreversible:** Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	**Immediate:** On impact	**Short term:** 0-5 years	**Medium term:** 5-15 years	**Long term:** Project life	**Permanent:** Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	**Improbable**	**Low Probability**	**Probable**	**Highly Probably**	**Definite**
ENVIRONMENTAL SIGNIFICANCE = (MAGNITUDE + EXTENT + REVERSIBILITY + DURATION) x PROBABILITY					
TOTAL SCORE	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
ENVIRONMENTAL SIGNIFICANCE RATING	**Very low**	**Low**	**Moderate**	**High**	**Very High**

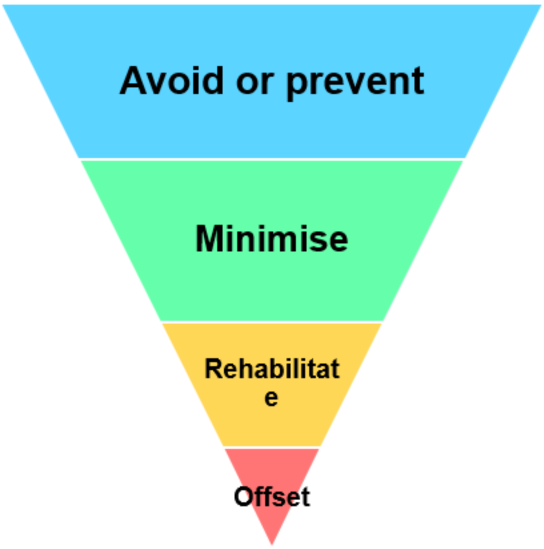
Table 4-8 – Environmental Significance Rating

Negative	Positive
Very Low	Very Low
Low	Low
Moderate	Moderate
High	High

Very High	Very High

4.5 IMPACT MITIGATION AND MANAGEMENT HIERARCHY

According to the National Environmental Management Act (No. 107 of 1998) (NEMA), sensitive, vulnerable, highly dynamic or stressed ecosystems (such as wetlands and rivers) require specific attention in management and planning procedures, especially where they are subject to significant resource and development pressure. A risk-averse and cautious approach which considers the limits of current knowledge about the consequences of decisions and actions is therefore required, and the precautionary principle of 'no-net-loss' therefore applies. Cost-effective measures must be implemented to pro-actively prevent degradation of the region's water resources. The protection of ecosystems and associated biodiversity predictably begins with the mitigation of risks and avoidance of negative impacts, and where avoidance is not feasible; to apply appropriate and practical actions that minimize or reduce impacts. Mitigation therefore requires proactive planning that is enabled by following the mitigation hierarchy (Figure 4-3).



Refers to considering options in project location, sitting, scale, layout, technology and phasing **to avoid impacts** on biodiversity, associated ecosystem services, and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts mining should not take place. In such cases it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation process.

Refers to considering alternatives in the project location, siting, scale, layout, technology and phasing that would **minimise impacts** on biodiversity and ecosystem services. In cases where there are environmental and social constraints every effort should be made to minimise impacts.

Refers to **rehabilitation** of areas where impacts are unavoidable, and measures are provided to return impacted areas to near-natural state or an agreed land use after mine closure. Although rehabilitation may fall short of replicating the diversity and complexity of a natural system.

Refers to measures over and above rehabilitation to compensate for the residual negative effects on biodiversity, after every effort has been made to minimise and then rehabilitate impacts. **Biodiversity offsets** can provide a mechanism to compensate for significant residual impacts on biodiversity.

Figure 4-3 - Diagram illustrating the 'mitigation hierarchy' (DEA et al., 2013)

4.6 STUDY ASSUMPTIONS AND LIMITATIONS

DATA USED FOR SPECIALIST ASSESSMENTS

- This ESIA report was prepared on the basis of the site sensitivity verification process undertaken in response to the national web-based screening report. The site sensitivity verification was completed via desktop analysis of the existing baseline knowledge of riparian or wetlands systems in the study area, supplemented by the findings of the field survey conducted on 31 May – 01 June 2022.

- The field survey for the aquatic biodiversity assessment was conducted on 31 May – 01 June 2022, which coincides with the dry season period; however, following a summer of exceptional rainfall, flows in the channelled valley bottom wetland remained high, and dominant wetland vegetation was discernible.
- It is therefore considered that there are no sampling or information limitations pertaining to riparian or wetlands systems impacting on this assessment and the recommendations contained in this report.

ASSUMPTIONS, UNCERTAINTIES, OR GAPS IN KNOWLEDGE

- Since the watercourses in the study area are wetland systems, no assessment of macroinvertebrates or fish is included in the baseline description, apart from the diatom assessment results.

5 BASELINE DESCRIPTION

This section summarises the baseline biodiversity environment of the local and regional study areas. It draws upon existing studies, published information, local knowledge and site visits.

5.1 REGIONAL BIODIVERSITY CONTEXT

The study area is located within the B11B quaternary sub-catchment of the upper Olifants Water Management Area (WMA) (Figure 4-2). An unnamed tributary of the Koringspruit passes immediately to the north of the study area, while a small drainage line runs through the centre of the study area, eventually reporting to the Koornfontein River via the Gras Dam, and ultimately draining into the Olifants River (Synergistics Environmental Services, 2008).

ENVIRONMENTAL SCREENING TOOL

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Aquatic Biodiversity Theme for the study area is rated 'Very High Sensitivity' due to the presence of wetland features in and around the study area (Figure 5-1). Since the watercourses in the study area are wetland systems, no assessment of macroinvertebrates or fish is included in the baseline description.

FRESHWATER CRITICAL BIODIVERSITY AREAS (CBAS) AND ECOLOGICAL SUPPORT AREAS (ESAS)

The proposed development site was compared to available relevant spatial biodiversity planning datasets in order to assess the local and regional biodiversity context of the site. The following datasets were considered:

- Mpumalanga Biodiversity Sector Plan Freshwater Assessment (2011).

The MBSP (2011) freshwater assessment spatial dataset includes various areas mapped as 'other natural areas' throughout the local study area (Figure 5-2), as well as part of the channelled valley bottom wetland associated with the Koringspruit which was classified as 'Ecological Sensitivity Area (ESA): wetland'.

It is important to note that the MBSP freshwater assessment was based largely on remotely sensed imagery, and thus some wetlands are not included (e.g. historic wetlands lost through drainage or ploughing); similarly, some features have been mapped as wetlands, which, once examined in the field, are not in fact wetlands. The most up-to-date spatial dataset at the national level is now considered to be the National Wetland Map 5 (see Figure 5-5), which displays a more accurate desktop derived coverage of wetlands in South Africa, and which indicates wetland habitat is located on the site.

STRATEGIC WATER SOURCE AREAS (SWSAS)

No strategic water source areas occur in the region of the proposed development footprint; as such these are not included as receptors for the current scoping impact assessment or considered further here.

FRESHWATER ECOSYSTEM PRIORITY AREA (FEPA) SUB-CATCHMENTS

The proposed development footprint in relation to FEPA sub-catchments and mapped National Freshwater Ecosystem Priority Areas (NFEPA) wetlands is illustrated on Figure 5-3 and Figure 5-4 respectively. As mentioned above, the National Wetland Map version 5 (NWM5) (Van Deventer et al., 2019), is the most up-to-date representation of the spatial extent and type of inland wetland ecosystem types at desktop level in South Africa. The NWM5 dataset indicates the presence of channelled valley bottom and seep wetland habitat within the study area (Figure 5-5); these systems were prioritised for infield verification, and site based assessments of wetland health and ecological importance, during the field survey.

Figure 5-1 - Map of relative Aquatic Biodiversity Theme Sensitivity (Environmental Screening Tool, 2022)

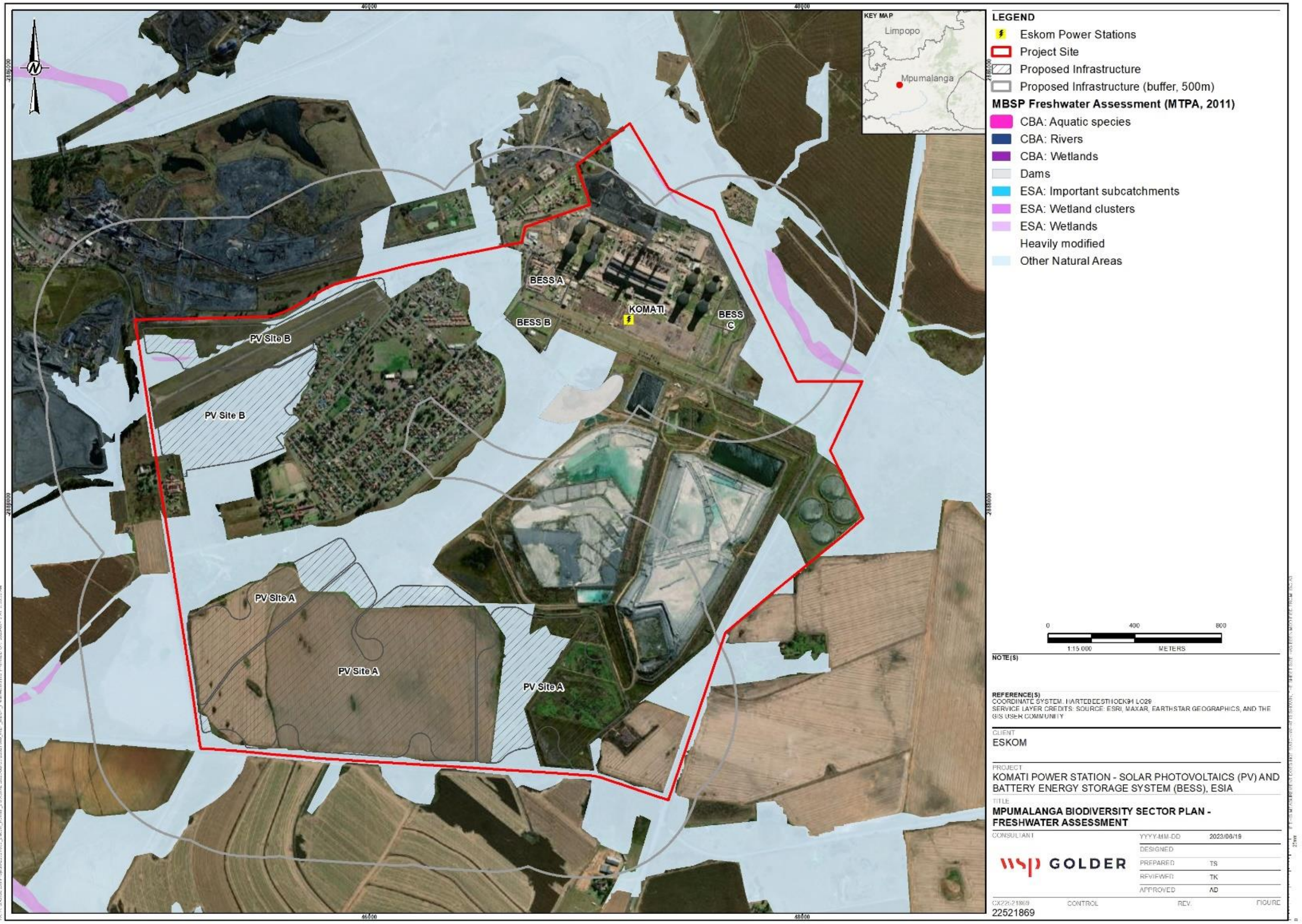


Figure 5-2 – Study area in relation to MBSP Freshwater Assessment (MTPA, 2011)

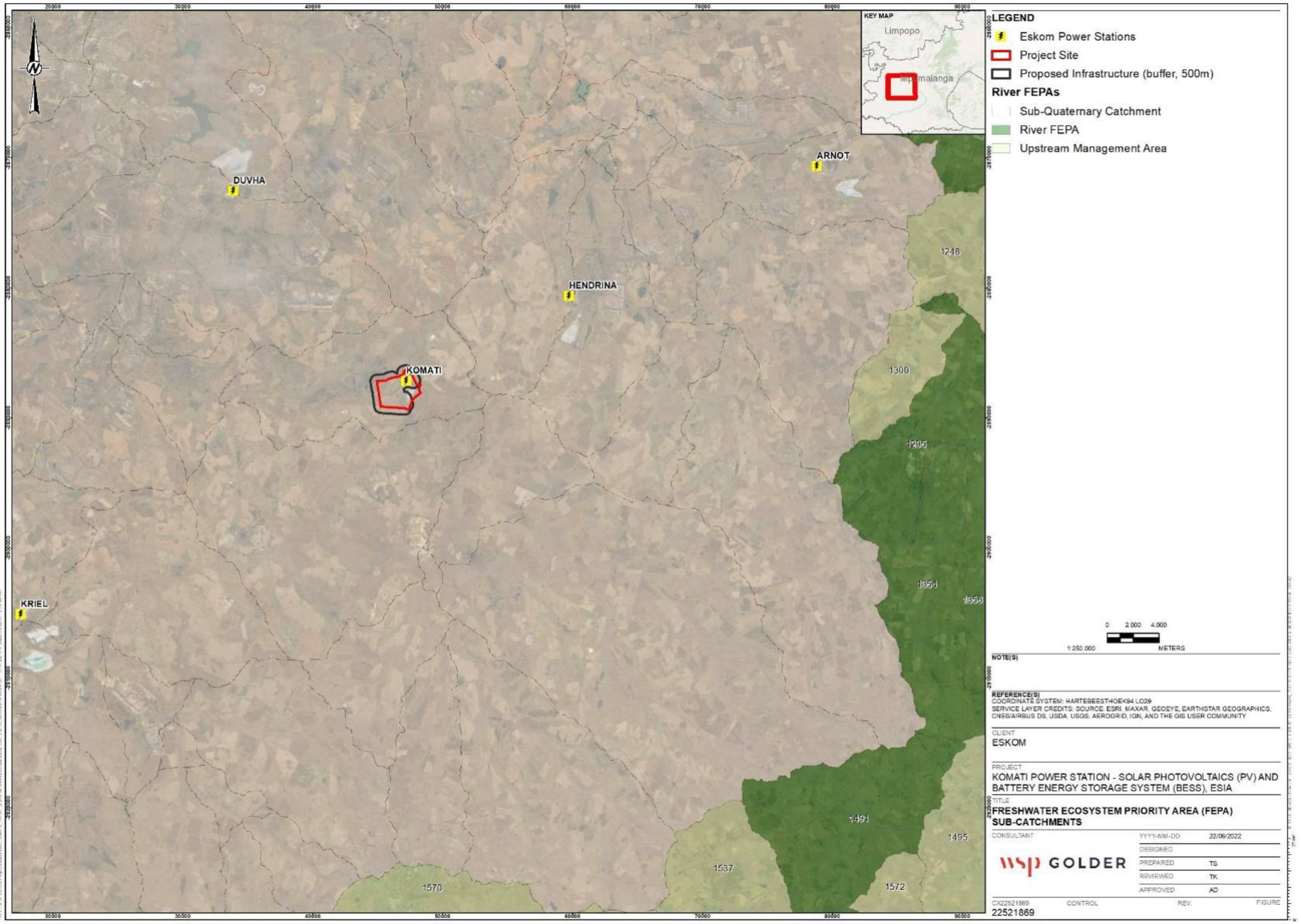


Figure 5-3 – Study area in relation to FEPA sub-catchments

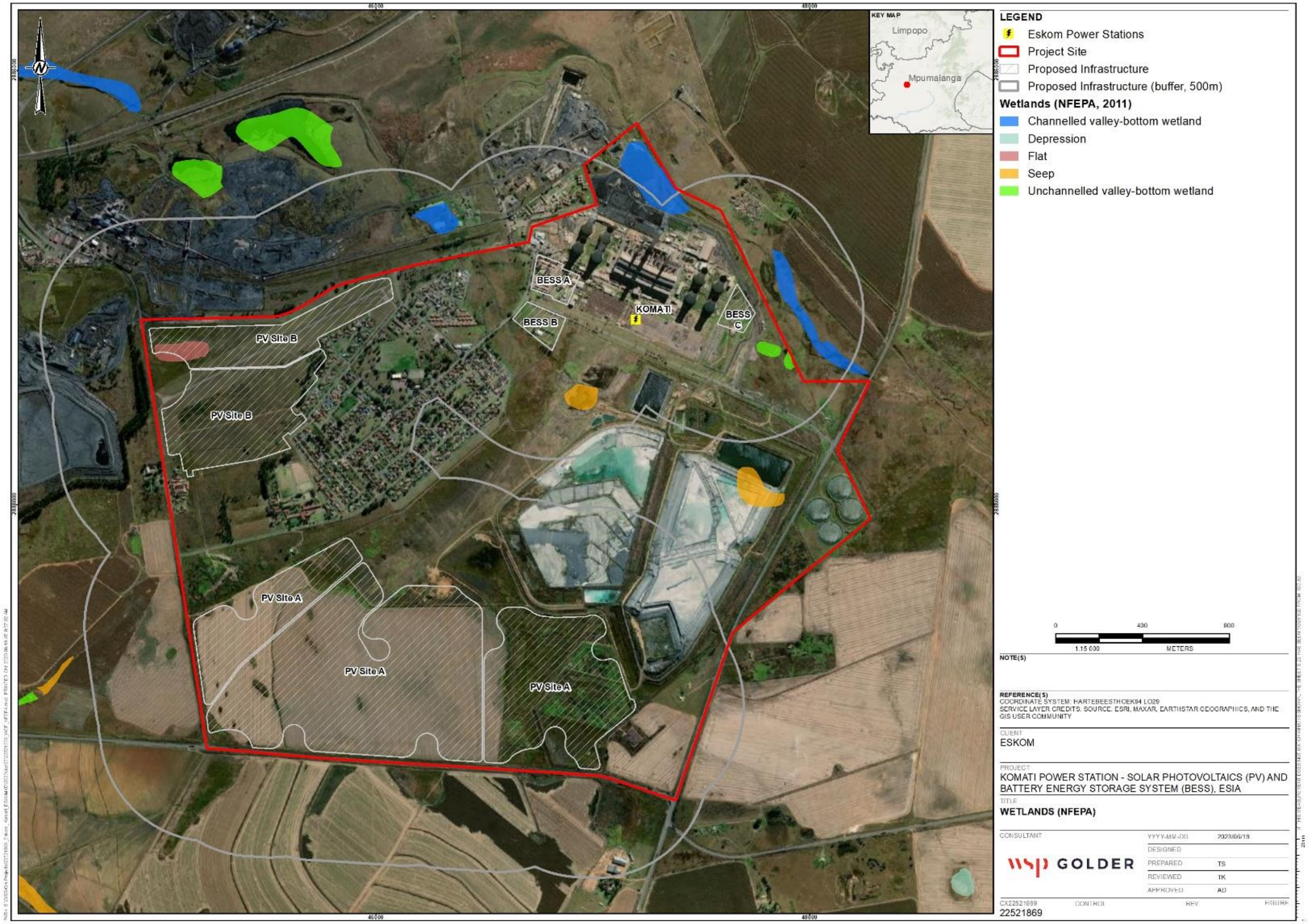


Figure 5-4 - Proposed development in relation to NFEPA wetlands (NFEPA, 2011)

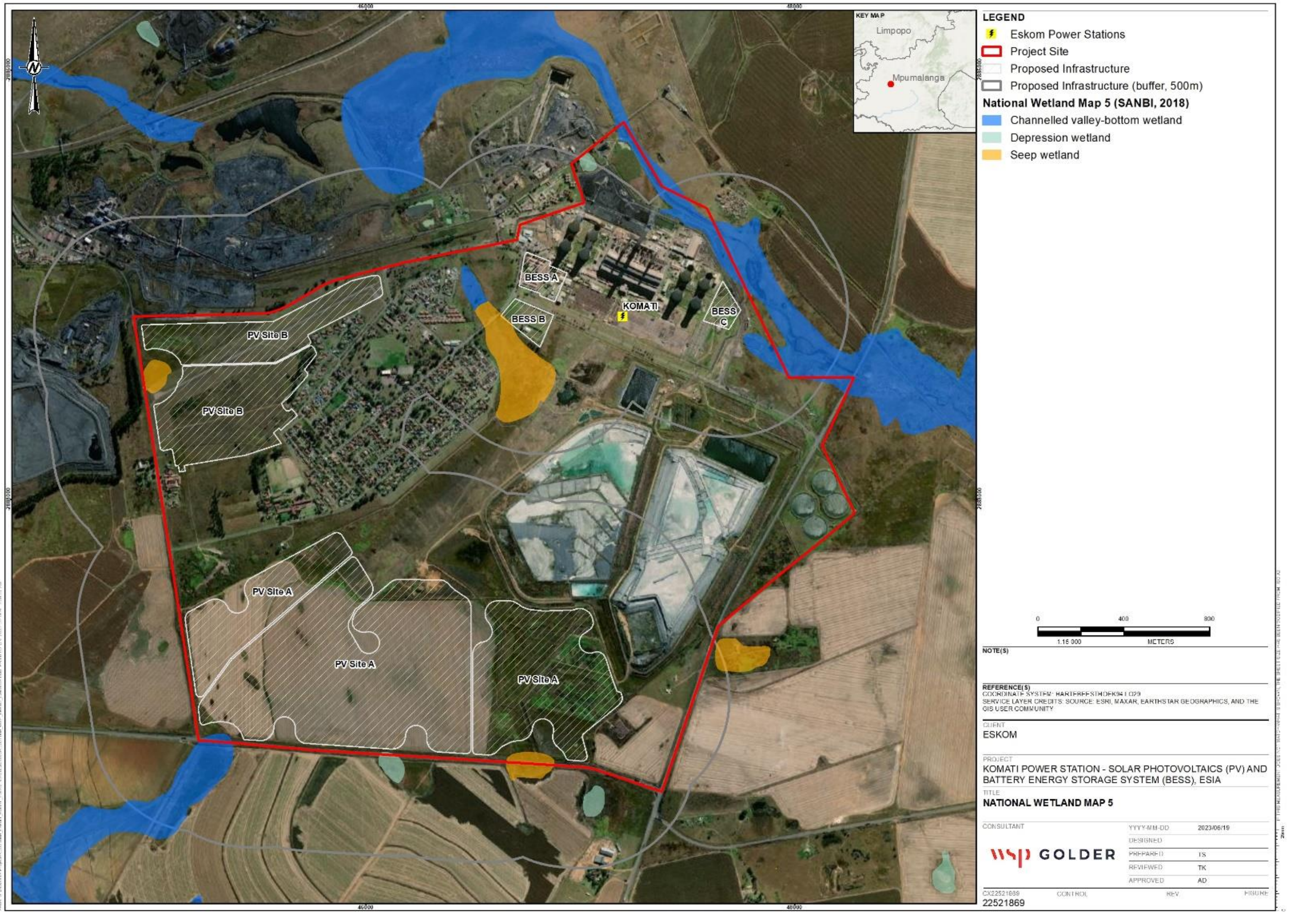


Figure 5-5 - Proposed development in relation to NWM5 wetlands (2018)

5.2 WETLANDS

DELINEATION AND CLASSIFICATION

Four wetlands have been identified to occur within a 500m of the proposed Project development (Figure 5-11). The infield sampling of soil and vegetation in conjunction with the recording of diagnostic topographical /terrain indicators and features, enabled the delineation of the following distinct watercourse units:

- A channelled valley bottom wetland (CVB),
- Two isolated seepage wetlands (Seep 1 and Seep 2), and
- Depression wetland

Several areas of highly disturbed grassland were also identified within the study area. Excavations and earthworks in these areas have resulted in high levels of disturbance of the soil profile, with some ephemeral accumulation of water during periods of high rainfall enabling *Imperata cyclindrica* (which although it occurs in wetlands, is not a reliable wetland indicator, since it can proliferate in disturbed terrestrial areas with high rainfall) to proliferate; however water is not retained in these disturbed soils for long enough to sustain hydrophytic plant species, or soil form indicators to develop. These areas were therefore not classified as wetland habitat.

Channelled Valley Bottom wetland

A channelled valley bottom wetland associated with the Koringspruit occurs within the study area (Figure 5-6 and Figure 5-11). Channelled valley bottoms wetlands (CVB) are characterised by having a well-defined stream channel but lacking characteristic floodplain features, which was the case for the CVB wetland on site. These systems receive water inputs from the main channel and from adjacent slopes (Kotze et al., 2008). The CVB wetland was dominated by permanent and seasonal wetland plant species including *Typha capensis, Phragmites australis, Schoenoplectus paludicola, and Cyperus latifolius* as well as hygrophilous grassland community such as *Eragrostis rotifer*. The wetland was also characterised by temporary and seasonal hydromorphic soil characteristics (Figure 5-7), indicating brown wetland soils.

The wetland is highly impacted and appears to receive effluent discharge from the Power Station. The wetland channel shows signs of extensive flows during large storm events and also lateral inputs from surrounding land uses. The CVB is situated adjacent to the proposed Battery Energy Storage System (BESS) footprint.

Figure 5-6 - An overview of the Channelled Valley Bottom wetland (upstream)

Figure 5-7 - Soil Sample taken at 50-60 cm in the seasonal zone of the wetland

Seep 1

A seep wetland of approximately 24.5 ha traverses the eastern extent of the proposed PV site A footprint. The wetland is bordered by the Ash dam facility towards the north-east and crop fields to the south-west (Figure 5-11). The hydrology of the seep wetland is largely impacted by flow input from surrounding activities, particularly the seepage from the Ash dam, as evidenced by the soil sample taken at the permanent zone of the wetland (Figure 5-8). Furthermore, a dam which has been excavated in the wetland HGM, has resulted in impounding and pooling of water in the wetland (Figure 5-8). Dominant wetland vegetation at this site includes *Typha capensis, Phragmites australis* which dominated the permanent wet area, and *Imperata cylindrica*, which dominated much of the seasonal zone.

Figure 5-8 - a) An overview of Seep 1 wetland and pooling of water at small dam, b) Soil sample taken in the permanent zone of the seep wetland indicating signs of soil contamination from the Ash dam

Seep 2

A second seep wetland of approximately 20 ha in extent was identified in the northern extent of the study area (Figure 5-11). This wetland is located downslope of Eskom's pollution control dams and is bordered by the Komati village to the west. The wetland is dominated by seasonal to permanent hydromorphic soil characteristics (Figure 5-10), with sedges and obligate wetland vegetation including *Typha capensis, Phragmites australis* and *Cyperus latifolius* occurring in the permanent zone, and *I. cylindrica* occurring in temporary-seasonally wet areas. Evidence of significant levels of disturbance in the form of small drains and berms diverting the water from the Eskom property into the receiving environment was observed in the Seep.

Figure 5-9 - An overview of the seep wetland: upstream and downstream

Figure 5-10 - Soil sample taken at the permanent zone of the wetland

Depression

A shallow depression wetland is located within a crop field in the southern extent of the study area, outside of the Project site boundary. The wetland is approximately 3 ha in extent and is cut off from the Project site by the tarred R542 (Figure 5-11). The wetland appears to be geomorphologically intact (other than loss likely sustained to the R542 construction) and driven entirely by rainfall accumulation. The wetland is considered to be ephemeral in nature.

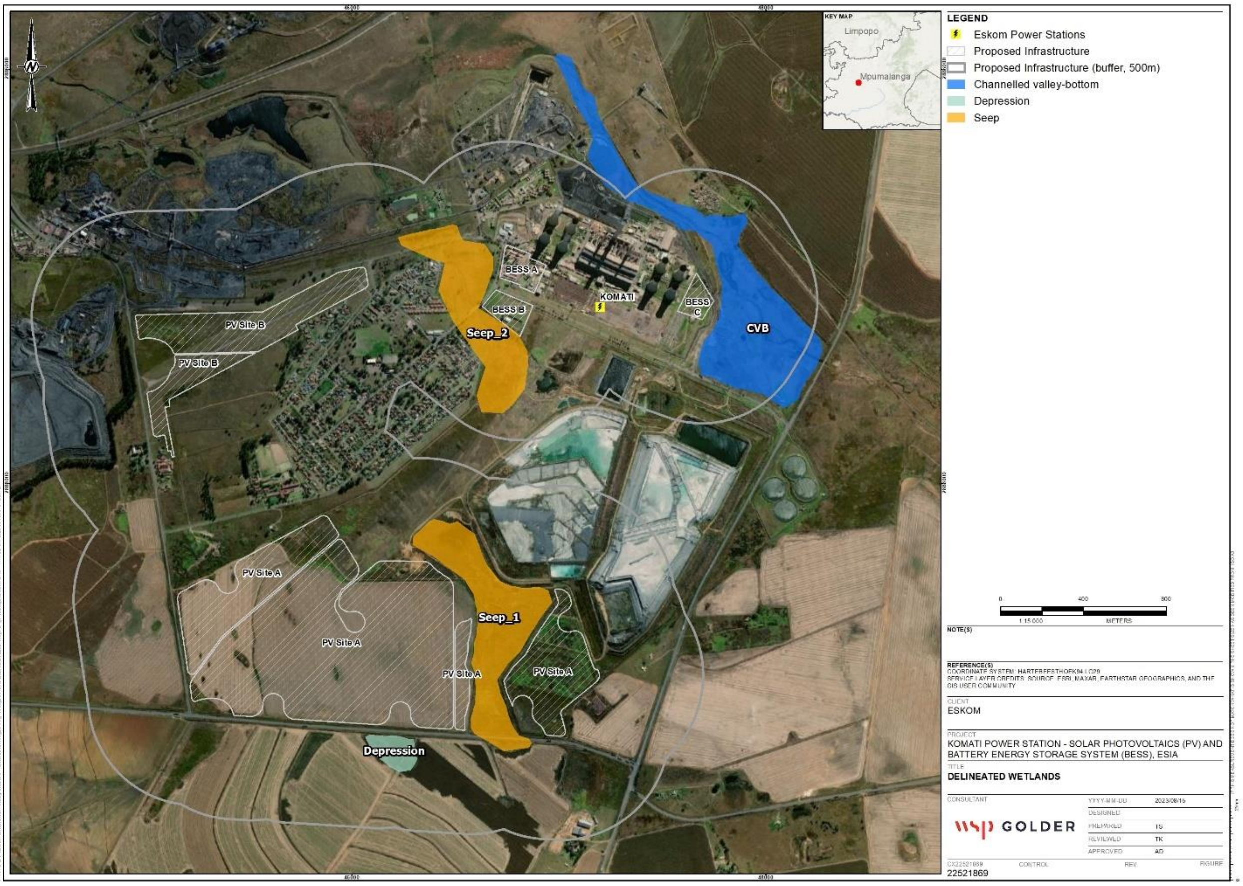


Figure 5-11 - Wetland delineation and classification

PRESENT ECOLOGICAL STATE

The most significant drivers of change currently present in the study area include industrial operations (seepage from ash dam, increased water inflow from Eskom operations) impoundment of water at dams, road crossings, mining operations in the catchments, spread of alien invasive species as well as formal and informal settlements within the wetland's catchment. The Present Ecological State (PES) score for the wetlands in the study area are presented in Table 5-1, and discussed in greater detail in the paragraphs that follow.

Table 5-1 - Summary of Impact Scores and PES Class

Wetland Unit	Hydrology Impact Score	Geomorphology Impact Score	Water Quality Impact Score	Vegetation Impact Score	Overall PES score and Class	
CVB	4.8	3.8	6.0	4.0	4.6	D
Seep 1	5.0	3.9	6.0	3.5	4.6	D
Seep 2	5.0	4.2	5.8	5.0	5.0	D

Depression	3.0	3.0	4.6	4.0	3.5	C

Channelled Valley Bottom

Major impacts identified within the channelled valley bottom wetland include head cut erosion, impoundment of flow in dams and at road crossings, cattle farming and crop farming, and effluent discharge from industrial operations (Power Station). These impacts resulted in a Largely Modified Impact category (PES D), with the hydrology and water quality component contributing substantially to the modified state of the wetland.

Figure 5-12 - Impacts: a) Soil Erosion at CVB main channel; b) pooling of water in dam; c) effluent discharge into the wetland; d0 crop farming and cattle grazing in the wetland

Seep 1

The Present Ecological Status of the Seep 1 wetland was considered Largely Modified (PES D), on account of the hydrological state and the water quality of the wetland. The wetland appears to be substantially impacted by the adjacent infrastructure and activities, particularly the ash dam facility. As seen in Figure 5-8 the wetland soils are contaminated by sediment inputs from the ash dam.

Furthermore, the increased surface water input from the ash dam facility and the impoundment of flow in the excavated dam (Figure 5-13) have changed the hydrological regime of the wetland.

Figure 5-13 - Ash dam facility and pooling of water at dam

Seep 2

Major impacts identified in the Seep 2 wetland include increased water inputs into the wetland system from the PCD, spread of alien invasive species, impoundment of flow along roads and dams, and the presence of drains and trenches. These disturbances, together with the likely impact on water quality as a result of seepage from the PCDs, have contributed to the Largely Modified state (PES Category D) of the wetland.

Figure 5-14 - Impacts: a) pooling of water at dam; b) trenches and berms in wetland; c) effluent discharge into the wetland from a leaking pipe; d) impoundment of water at roads in wetland

Depression

The present ecological state of the depression wetland was considered Moderately Modified (PES category C), largely due to the presence of surrounding crop farming and the tarred R542 road in close proximity to the system.

ECOLOGICAL IMPORTANCE AND SENSITIVITY

All wetlands in the study area were assessed as being of Low /Marginal EIS, with the exception of the CVB wetland which was assessed as being of Moderate EIS (Table 5-2). The moderate EIS of the CVB was attributed to its hydrological functional importance as this wetland performs a role in landscape connectivity at the regional level, providing regulating and supporting benefits such as streamflow regulation and flood attenuation.

Table 5-2 - Summary of wetland EIS scores and ratings.

Wetland Unit	Ecological Importance and Sensitivity Score	Hydrological Functions Score	Direct Human Benefits Score	Integrated EIS Score	Overall EIS score and Class
CVB	1.2	1.0	0.0	1.2	Moderate
Seep 1	0.8	0.9	00	0.9	Low/Marginal
Seep 2	0.8	0.9	0.0	0.9	Low/Marginal
Depression	0.8	0.9	0.0	0.9	Low/Marginal

ECOSERVICES

The importance scores for the ecosystem services provided by wetlands within the study area are illustrated in the spider diagrams presented in Figure 5-15, Figure 5-16 and Figure 5-17. The majority of the ecosystem services were rated as very low in terms of their overall importance. Regulating and supporting services such as sediment trapping, phosphate assimilation, nitrate assimilation and toxicant assimilation were determined as moderate, particularly for the CVB wetland which is also important in terms of streamflow regulation and flood attenuation.

The CVB was also assessed as having a Moderately High importance in terms of the biodiversity maintenance (Figure 5-15). This was attributed to the likelihood of the African Grass Owl (*Tyto capensis*) to occur on site, based on the site sensitivity report generated by the national screening tool as well as the results of the avifauna survey undertaken on 17 June 2022 which confirmed suitable habitat for Grass Owl on site. Furthermore, the MBSP freshwater assessment (2011) maps the CVB wetland as an ecological support area.

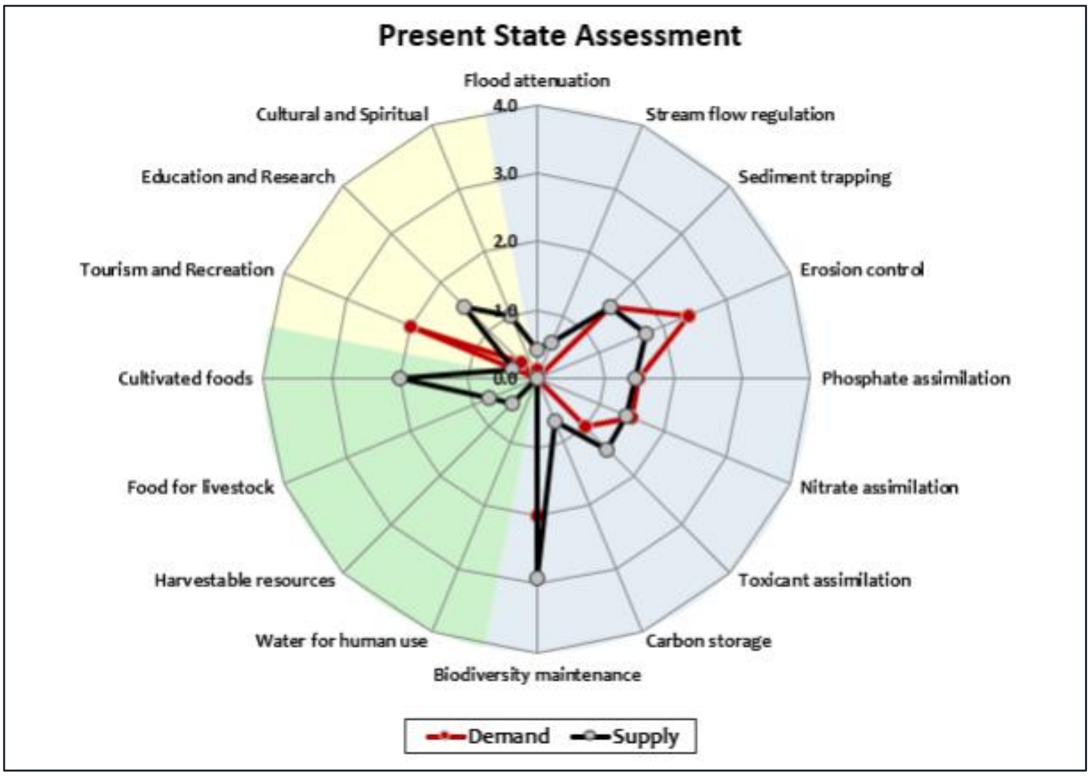


Figure 5-15 - Ecosystem Services supplied by/demanded from the CVB wetland

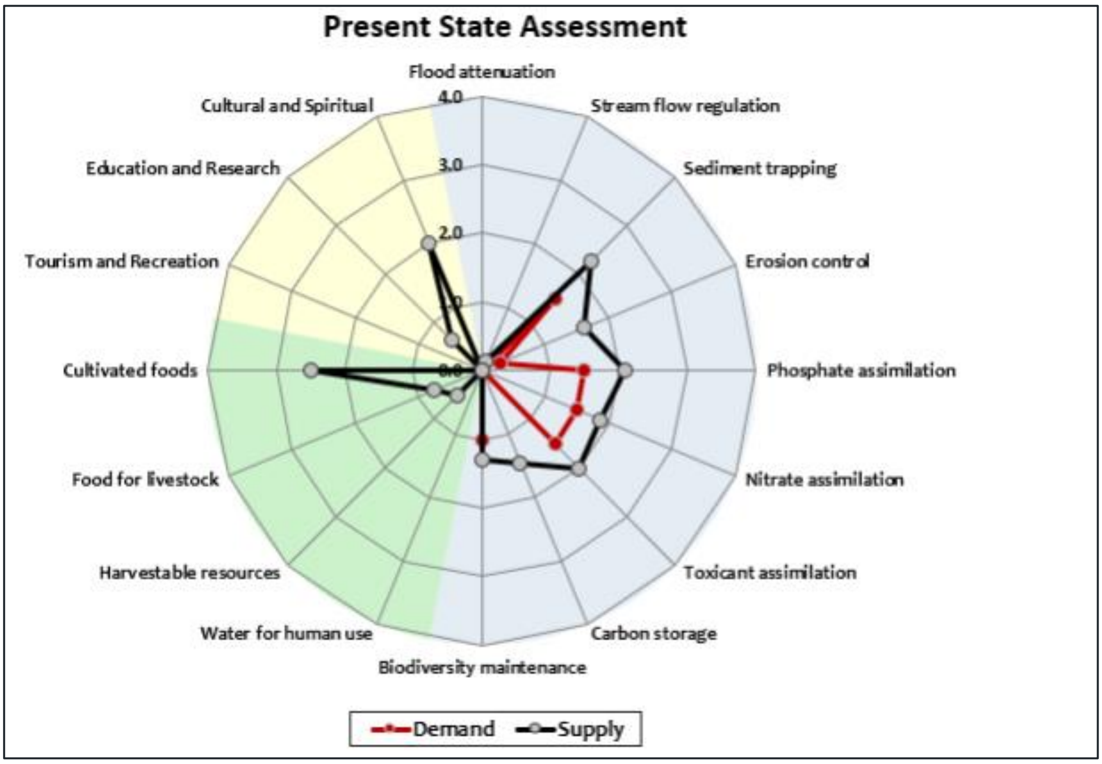


Figure 5-16 - Ecosystem Services supplied by/demanded from seep wetlands

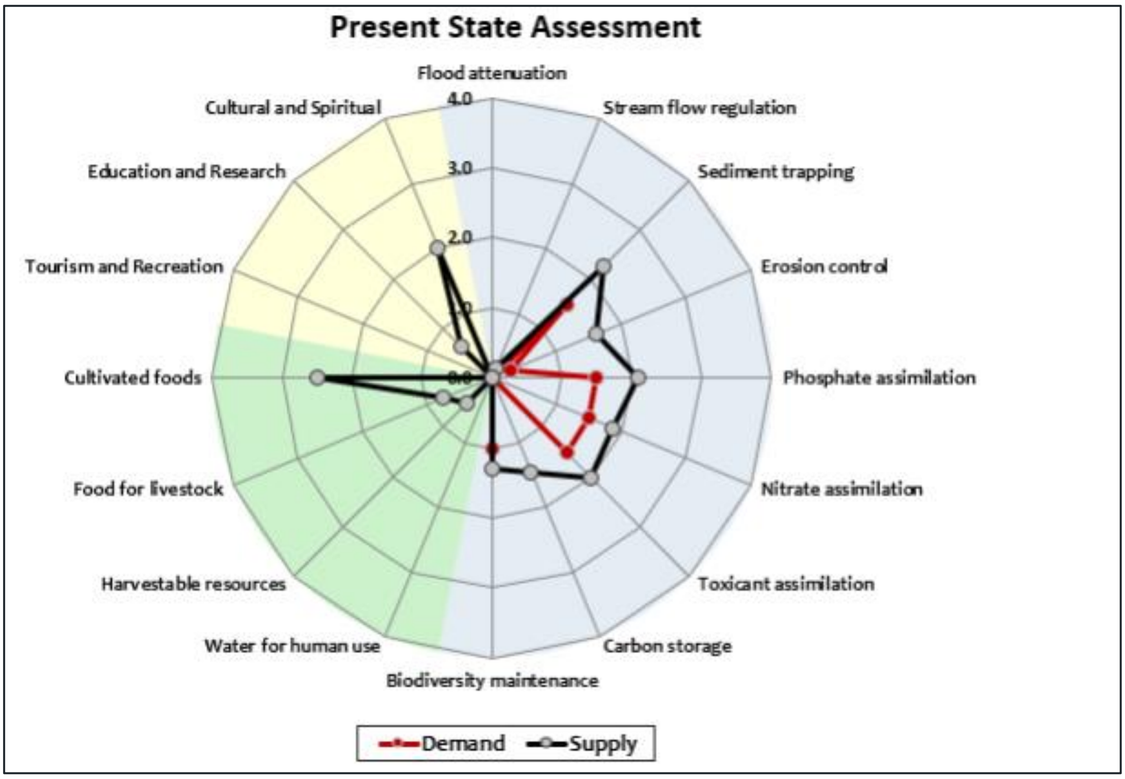


Figure 5-17 - Ecosystem Services supplied by/demanded from Depression wetland

5.3 EXISTING IMPACTS ON BIODIVERSITY AND DRIVERS OF CHANGE

The proposed project infrastructure will be situated in close proximity to the existing power generation facilities and activities. All areas visited are currently experiencing some level of impact from the surrounding agricultural and industrial activities primarily through habitat transformation, and disturbance arising from power generation facilities and activities.

The presence of the existing facilities within close proximity to the proposed development footprint is expected to have an exacerbating effect on nearby wetlands through the interruption of surface hydrology, and erosion as a result of increased surface water runoff due to the increased area of hardened surfaces in the study area.

5.4 NATURAL, MODIFIED AND CRITICAL HABITATS

The study area is dominated by agricultural cultivation, power station infrastructure and residential/industrial areas, interspersed with some remnant wetland habitat. While some very disturbed wetland habitat has been identified in the eastern extent of PV Site A, it is no longer considered to constitute 'Natural' habitat as defined by WB ESS6, due to its heavily degraded state and loss of ecological function. The channelled valley bottom wetland to the north east of the site, and the seep wetland that crosses the northern boundary of the site, while moderately modified/disturbed, still support biodiversity and deliver ecological services to an extent that enables them both to be considered 'Natural' habitat (Figure 22) as defined by the lender standards.

At present, no areas of potentially Critical Habitat, as defined by WB standards, have been identified within the study area.

5.5 DIATOMS

The assessment of diatoms was incorporated into this aquatic assessment study to provide further insight into the health and integrity of the watercourses in the study area. Diatoms have a rapid response to specific physico-chemical conditions in the water and are thus often the first indicator of environmental change. A sample was collected from the Koringspruit associated with the channelled valley bottom wetland and was submitted to Ecotone Freshwater Consultants cc for analysis. A comprehensive diatom report received from Ecotone Freshwater Consultants is included in Appendix A.

A total of 11 diatom species were recorded at this site during the June 2022 assessment, and the dominant species recorded included *Sellaphora sp., Navicula sp.,* and *Nitzschia sp*. These taxa are cosmopolitan in nature and have wide ecological amplitudes and thus caution must be taken when analysing the predominance of these species at specific sites. Diatom communities reflect ecological conditions over a period of 2-3 weeks and thus establishment of communities requires enough time to establish to reflect these conditions. Ecological information is provided below for the dominant and sub-dominant species in order to make ecological inferences for this site (Table 5-3; Taylor et al., 2007, Cantonati *et al*., 2017):

- The ecological water quality at this site reflected High quality with very low to no organic pollution (Table 5-3;):
  - The dominant diatom taxa pointed to well-oxygenated waters and eutrophic conditions with moderate to high electrolyte content.
  - The presence of some taxa pointed to brackish conditions. These taxa are tolerant to slightly polluted conditions.
  - The %PTV score indicated that there were low levels of organic pollution present at this site.

Table 5-3 – Diatom analysis results and ecological water quality results

Site	%PTV	SPI	Ecological Category	Class
CVB (Koringspruit)	9.6	20.7	A	High

Figure 5-18 - Natural, modified and critical habitat

6 IMPACT ASSESSMENT

Construction of the proposed Project will result in the direct loss of wetland habitat due to vegetation and topsoil removal during construction. Additional impacts include interruption in hydrology, effects on water quality in affected systems during construction, sediment deposit into wetlands and wetland soil erosion as well as the establishment and spread of alien invasive species that could last through to the operational phase (Table 6-1).

6.1 CONSTRUCTION PHASE

Construction phase impacts on aquatic (wetland and riparian systems) largely arise as a result of direct impacts on the receiving environment due to clearing of land within wetlands or their immediate catchments in advance of project development, and resultant loss of wetland habitat. The earthworks and activities involved during the construction phase of the Project can exert negative impacts on sensitive ecosystems including loss of wetland habitat, catchment landcover changes resulting in increased sediment entry to downstream systems, construction of wetland/riparian system crossings causing impoundments/barriers to movement for aquatic species, contamination of water bodies by construction materials / vehicles (hydrocarbons etc), increased potential of erosion due to surface runoff and soil disturbances and the establishment and spread of alien and invasive species (AIS).

Impacts envisaged during the construction phase are outlined in the sections that follow and are summarised on Table 6-1.

LOSS AND DISTURBANCE OF WETLAND HABITAT

Site establishment and construction of the proposed project infrastructure, particularly PV Site A which is located at the boundary of Seep 1, will lead to the destruction and disturbance of wetland habitat within the project footprint. Based on the optimised project layout, the proposed project infrastructure layout avoids the direct loss of wetland habitat. The magnitude of impact is therefore expected to be medium due to the close proximity of the proposed project infrastructure and the destructive nature of the construction phase around wetlands. The impact will be of site-based extent, having a permanent impact duration. The impact significance prior to mitigation is considered **Moderate.**

Although the impact magnitude, reversibility and probability may be reduced with the implementation of mitigation measures, the destruction and disturbance of wetlands habitat during the construction phase of the project is still expected to be of **Moderate** significance to wetlands.

CHANGES IN WETLAND HEALTH/FUNCTIONING

Bulk earthworks involved in site development in the immediate catchment of wetlands can cause indirect impacts on wetland habitat through compaction/removal of recharge or interflow soils, as well as increased sediment deposition to downslope wetland ecosystems in stormwater runoff. If not carefully managed, this impact can result in a medium impact magnitude, having a local impact scale and lasting for the duration of the construction phase, resulting in a **Moderate** impact significance prior to mitigation.

With the implementation of recommended mitigation measures to address reduced wetland functioning, such as diffuse distribution of clean stormwater runoff around the PV and BESS foundations and road crossing to affected downslope wetland systems, the impact significance can be reduced to a L**ow** impact significance.

CONTAMINATION OF RIPARIAN SYSTEMS

Stripping of topsoil and civil works activities, resulting in a decrease in water quality due to erosion, sedimentation and the alteration in the distribution and quantity of surface water runoff, will have a medium impact magnitude with a local extent impact and a short-term impact duration. The impact significance prior to mitigation is **Moderate**, with the implementation of recommended mitigation measures, this impact can be reduced to a **Very Low** impact significance.

SOIL EROSION

The removal of wetland vegetation for the construction of the proposed development could result in an increase of bare soil/surfaces in the study area which will lead to increased runoff, ultimately resulting in soil erosion. The impact on soil erosion is considered to have a medium magnitude, with local impact extent and a long-term impact duration, resulting in a **Moderate** impact significance pre mitigation. With mitigation, the impact can be reduced to a **Low** impact significance.

ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE SPECIES

Disturbances caused by vegetation clearing and earth works during construction will exacerbate the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing, or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of wetland biodiversity. Consequently, this impact is considered to have a medium impact severity, with a local impact extent and a long-term impact duration, resulting in a **Moderate** impact significance prior to mitigation. With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the construction phase, the impact significance can be reduced to a **Very Low**.

CHANGES IN THE EXTENT AND CONDITION OF ECOSYSTEMS SUPPLYING ECOSYSTEM SERVICES

Ecosystem services supplied in the study area include biodiversity maintenance, and regulating and supporting services. Since the project infrastructure will not cause any changes to the watercourse's ability to regulate streamflow or its assimilation of pollutants, no impacts on the supply/provision of regulating and supporting services is predicted. However, some loss of wetland habitat will occur due to the construction of project infrastructure (i.e BESS) which will reduce the available area of habitat for the African Grass Owl (Tyto Capensis). This impact was assessed as having a medium impact magnitude due to the already disturbed nature of the study area. The impact is of local extent and lasting for the duration of the project life resulting in a **Moderate** impact significance. With the implementation of mitigation measures the magnitude can be reduced to a low, extent to site only and the duration to short term, resulting in a **Low** impact significance.

6.2 OPERATIONAL PHASE

Operational phase impacts relate to the possible exacerbation of the construction-phase impacts, including soil erosion, surface water and soil contamination and ongoing risk of spread of the alien and invasive plant species that may have colonised new areas during the construction phase.

SPREAD OF ALIEN AND INVASIVE SPECIES

The potential establishment of alien invasive species in, and immediately adjacent to, wetlands in the vicinity of the proposed development footprint will continue to be an impact of concern during the operational phase. Without mitigation, the impact significance is considered **Moderate** impact.

With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the operational phase, the impact significance can be reduced to a **Very Low** impact.

SOIL EROSION

The increased presence of hardened surfaces in the study area can exacerbate soil erosion, through increased and concentrated surface run off. This impact is assessed as having a medium impact magnitude, with a long-term impact duration and a high probability of occurrence. Without mitigation this impact will have a **Moderate** impact significance on wetland soils and with mitigation it can be reduced to a **Low** impact significance.

WATER QUALITY DETERIORATION AND CONTAMINATION OF WETLAND SOILS

Quarterly washing and maintenance of the PV panels could potentially have a negative impact on water quality and wetland soils, due to inputs of detergents, and possible erosion paths forming in the soils of adjacent wetland areas, should large amounts of water be discharged to the environment. This impact will have a medium impact magnitude with a long-term impact duration resulting in a **Moderate** impact significance prior to mitigations. With mitigation, the impact can be reduced to a **Very Low** impact significance.

6.3 DECOMISSIONING PHASE

Decommissioning phase impacts on aquatic (wetland and riparian systems) largely arise as a result of demolishing and/or removal of project's infrastructure. Similar to construction impacts, the earthworks and activities involved during the decommissioning phase of the project can exert negative impacts on sensitive ecosystems including the potential increase of the spread and establishment of alien invasive species.

ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE SPECIES

Disturbances caused by the demolishing and/or removal of project's infrastructure will facilitate the establishment and spread of alien invasive vegetation. Before mitigation, this impact , is considered to have a medium impact severity, with a local impact extent and a long-term impact duration, resulting in a **Moderate** impact significance. With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the construction phase, the impact significance can be reduced to a **Very Low**v

Table 6-1 – Wetland Impact Assessment Table

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Wetland habitat	Disturbance of wetland habitat	Construction	Negative	Moderate	3	1	5	5	4	**56**	**N3**	2	1	3	4	4	**40**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 2:	Wetland hydrology	Changes in wetland healht/functioning	Construction	Negative	Moderate	3	2	3	3	4	**44**	**N3**	2	1	3	2	3	**24**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 3:	Water quality	Contamination of riparian systems	Construction	Negative	Moderate	3	2	3	2	4	**40**	**N3**	2	1	1	1	2	**10**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 4:	Soil Erosion	Wetland soil erosion	Construction	Negative	Moderate	3	1	3	4	4	**44**	**N3**	2	1	3	2	3	**24**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 5:	Alien invasive species	Spread of AIS	Construction	Negative	Moderate	3	2	3	4	4	**48**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 6:	Ecosystem services	Changes in the extent and condition of ecosystems supplying ecosystem services	Construction	Negative	Moderate	3	2	3	5	4	**52**	**N3**	2	1	3	2	2	**16**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

OPERATIONAL

Impact number	Receptor	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Alien Invasive Species	Spread of AIS	Operational	Negative	Moderate	3	2	3	4	4	**48**	**N3**	2	1	1	1	2	**10**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						

Impact 2:	Soil Erosion	Wetland soil erosion	Operational	Negative	Moderate	3	1	3	4	5	**55**	**N3**	2	1	3	1	3	**21**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 3:	Water Quality	water quality deterioration and contamination of wetland soils	Operational	Negative	Moderate	3	1	3	4	4	**44**	**N3**	2	1	1	1	2	**10**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
DECOMISSIONING																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+	**E+**	**R+**	**D)x**	**P=**	**S**		**(M+**	**E+**	**R+**	**D)x**	**P=**	**S**	
Impact 1:	Alien invasive speices	Spread of AIS	Decommissioning	Negative	Moderate	3	2	3	4	4	**48**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						

6.4 MITIGATION MEASURES

Mitigation measures that are designed to avoid and minimise the loss and degradation of the wetland habitat and function on the site are summarised in the sections that follow. significance.

IDENTIFICATION OF AREAS TO BE AVOIDED (INCLUDING BUFFERS)

- Areas of undisturbed, natural grassland and wetland habitat should be avoided to the extent possible. Such areas should be marked as' no go areas'
- A loss/disturbance buffer zone of at least 100 m should be maintained between the maximum extent of construction works and the outer boundary of wetlands and riparian zones.

MINIMISATION

- To prevent loss of natural habitat in wetlands beyond the direct disturbance footprint, prior to any vegetation clearing, the development footprints should be clearly marked out with flagging tape/posts in the field.
- Vegetation clearing should be restricted to the proposed project footprints only, with no clearing permitted outside of these areas.
- All bare areas, as a result of construction activities, should be revegetated with locally occurring species to bind the soil and limit erosion potential.
- The extent of disturbance should be limited by restricting all construction activities to the servitude as far as practically possible.
- Locate all stockpiles, laydown areas and temporary construction infrastructure at least 50 m from the edge of delineated wetlands.
- Wetland/river crossings should be constructed utilizing designs that ensure that hydrological integrity of the affected wetlands is preserved, and natural flow regimes are maintained (i.e. no impoundment upstream of crossings, or flow concentration downstream of crossings.
- Ideally construction activities within wetlands should take place in winter (during the dry season).
- Where summer construction is unavoidable, temporary diversions of the streams might be required.
- Install erosion prevention measures prior to the onset of construction activities. Measures should include low berms on approach and departure slopes to crossings to prevent flow concentration, sediment barriers along the lower edge of bare soil areas, placement of hay bales within wetland construction areas, and re-vegetation of disturbed areas as soon as possible.

ALIEN AND INVASIVE SPECIES MANAGEMENT

- An alien and invasive species management plan should be developed for the Project, which includes details of strategies and procedures that must be implemented on site to control the spread of alien and invasive species. A combined approach using both chemical and mechanical control methods, with periodic follow-up treatments informed by regular monitoring, is recommended.

BIODIVERSITY MANAGEMENT PLAN

- Specific provision for biodiversity conservation, including details of any required offsets, should be made in the project BMP/BAP, in alignment with the objectives of the MBSP (2011).
- Inclusion of a practical framework and schedule, details of key performance indicators, and recommended monitoring protocols for the delivery of existing and currently recommended mitigation measures in the BMP is recommended.

6.5 MONITORING REQUIREMENTS

The following monitoring requirements are anticipated:

- Monitoring of wetland health to be conducted within one year of completion of construction, to measure any changes to the baseline status and ensure that recommended mitigation measures are sufficient to address any significant impacts.
- Follow up monitoring of wetland health PES/EIS every three years throughout the operating period.

6.6 CUMULATIVE IMPACTS

- The landscape within which the proposed infrastructure is located is almost completely modified and fragmented as a consequence of the existing surrounding land uses (i.e. power station, mining, agricultural practices, residential areas, and informal settlement).
- While the currently proposed project infrastructure largely avoids the loss of significant areas of natural habitat due to active avoidance of these areas as part of the ongoing planning process, vegetation clearing would result in loss of additional 24.5 ha of moderately/largely modified seep habitats (Seep 1), contributing to cumulative impacts in terms of direct loss of seep wetlands at the landscape level.

7 CONCLUSION

The proposed Project development intercepts two seepage wetlands (herein referred to as Seep 1 and Seep 2) and is located within a 500m buffer of a channelled valley bottom wetland to the north and a depression wetland to the south. The wetlands within the study area were found to be in Largely Modified state (PES D) with the exception of the depression wetland located outside of the project development boundary.

All wetlands in the study area were assessed as being of Low /Marginal EIS, with the exception of the channelled valley bottom wetland which was assessed as being of Moderate EIS. The moderate EIS of the channelled valley bottom was attributed to its hydrological functional importance as this wetland performs a role in landscape connectivity at the regional level, providing regulating and supporting benefits such as streamflow regulation and flood attenuation.

Although largely modified, the channelled valley bottom wetland and the seep wetland that cross the northern boundary of the site support biodiversity and deliver ecological services to an extent that enables them to be considered 'Natural habitat' as defined by the lender standards, as such, these areas should be regarded as 'no go areas' for development.

The Environmental Screening Tool rates the aquatic biodiversity theme as 'Very-High Sensitivity' based on the presence of wetland features in and around the study area. Based on the findings of this study, the presence of wetland features on site was confirmed, however, these wetlands were considered to be in a largely modified PES with low/marginal EIS function and WetEcoservices and are therefore rated to be in a 'Medium Sensitivity'. Notwithstanding this, any development within any of the areas mapped as wetland systems, should be avoided were possible. Where avoidance of such systems is not possible a wetland offset will be required in accordance with the Biodiversity Offset Guideline (2023).

According to the diatom assessment, the diatom assemblages were generally comprised of species characteristic of fresh brackish, acidic water and eutrophic conditions. The pollution levels indicated that there were low levels of pollution present at the stie, while the presence of some taxa point to a slightly acidic condition. According to the ecological water quality, the site showed high conditions with low levels of organic pollution.

The proposed project infrastructure will be situated in close proximity to the existing power generation facilities and activities. All areas visited are currently experiencing some level of impact from the surrounding agricultural and industrial activities primarily through habitat transformation, and disturbance arising from power generation facilities and activities. The most significant drivers of change currently present in the study area include industrial operations (seepage from ash dam, increased water inflow from Eskom operations) impoundment of water at dams, road crossings, mining operations in the catchments, spread of alien invasive species as well as formal and informal settlements within the wetland's catchment.

The earthworks and activities involved during the construction phase of the Project can exert negative impacts on sensitive ecosystems including loss of wetland habitat, catchment landcover changes resulting in increased sediment entry to downstream systems, construction of wetland/riparian system crossings causing impoundments/barriers to movement for aquatic species, contamination of water bodies by construction materials / vehicles (hydrocarbons etc), increased potential of erosion due to surface runoff and soil disturbances and the establishment and spread of alien and invasive species

(AIS). Provided that recommended mitigation measures are not implemented some of these impacts such as the establishment and spread of AIS, soil erosion and surface water and soil contamination are likely to carry on into the operational phase.

The proposed Project development is considered to have a Moderate impact significance prior to mitigation, with the exception of the loss of wetland habitat impact, which is considered high and cannot be mitigated. Since lender standards require no net loss of natural habitat, a suitable offset that addresses the predicted loss of wetland habitat will need to be designed and implemented, in agreement with the relevant authorities – principally the Department of Water and Sanitation. However, if wetland habitat is avoided and regarded as a 'no-go area', then the wetland offset requirement can be avoided. With the implementation of recommended mitigation measures and monitoring measures, the significance of all other impacts can be reduced to Low or Very low.

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Appendix A

DIATOM ANALYSIS REPORT

Building 1, Maxwell Office Park
Magwa Crescent West, Waterfall City
Midrand, 1685
South Africa

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