Appendix H.15

WETLAND ASSESSMENT

Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY SPECIALIST ASSESSMENT- WETLANDS REPORT

Igolide Wind Energy Facility

OCTOBER 2023

PUBLIC

Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY SPECIALIST ASSESSMENT- WETLANDS REPORT

Igolide Wind Energy Facility

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Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY SPECIALIST ASSESSMENT- WETLANDS REPORT

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EXECUTIVE SUMMARY

WSP Group Africa (Pty) Ltd (WSP) was appointed by Igolide Wind (Pty) Ltd to undertake the necessary ecological baseline studies and impact assessment, in support of the scoping, baseline and impact assessment phases of the environmental regulatory process required to authorise the proposed development of the Igolide Wind Energy Facility located approximately 6 km northeast of Fochville within the Merafong City Local Municipality in the Gauteng Province.

The study area lies within the C23J quaternary catchment of the primary drainage region C within the Vaal Water Management Area (WMA). Two first order rivers, the Loopspruit and the Kraalkopspruit straddles the study area in the eastern and the western extent, respectively. The study area is located downstream of the Far West Karst Region Strategic Water Source Area and within an area mapped as Freshwater Ecological Priority Area catchment.

A total of seven wetland systems were identified within a 500m buffer of the proposed project development, these included two channelled valley bottom wetlands, and five hillslope seepage wetlands. The two Channelled Valley Bottom (CVBs) wetlands were associated with the Kraalkoopspruit in the west and the Loopspruit in the eastern extent of the study area. The hillslope seep wetlands were of a seasonal nature and were linked to the channelled valley bottom wetlands.

The wetlands were found to be in a Moderately Modified Present Ecological State as a result of the existing impacts, which included as headcut erosion within seep wetlands, impoundment of water at dams, interruption of surface hydrology, and alien invasive colonisation at road crossings as well as alien invasive vegetation along wetland edges, preferential flow paths along animal tracks, and crop farming at wetland edges. In terms of their Ecological Importance and Sensitivity, the seep wetlands were assed as having a low/marginal EIS, while the CVB wetlands were assessed as having a Moderate EIS. he Moderate EIS of the CVB wetlands was attributed to the hydrological functional importance of the CVBs, as these wetlands perform a role in landscape connectivity at the regional level, providing regulating and supporting benefits such as streamflow regulation and flood attenuation. Additionally, the CVB wetlands, especially CVB 1 is located within an active hunting range and thus has a direct human benefit in terms of recreational benefits. Similarly, the ecosystem services supplied by or demanded from the seep wetlands were considered low, while the CVB wetlands were considered as having a moderate ecoservices based on their function to regulate streamflow, trap sediment, assimilate phosphate, nitrate and toxicants, which benefits downstream users.

The Environmental Screening Tool rates the aquatic biodiversity theme as ‘Very High Sensitivity’ due to 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 moderately modified PES with moderate to low/marginal EIS function and WetEcoservices and are therefore rated to be in a ‘high Sensitivity’.

The earthworks and activities involved during the construction phase of the Project can exert negative impacts on sensitive ecosystems including loss of wetland habitat, changes in wetland

health/functioning, contamination of watercourses, formation of soil erosion and establishment and spread of alien invasive species. Without mitigation, these impacts are assessed as having a moderate impact significance on wetlands, however with the application of recommended mitigation measures such as limiting disturbance to the project footprint and keeping out of wetland habitat as far as possible these impacts can be reduced to a low/very low impact significance. If not mitigated, these impacts can progress into the operation and decommissioning phase of the project, which could lead to the wetlands being largely modified.

Provided that recommended mitigation measures are implemented, the proposed project development is not expected to result in any negative changes in the current PES and EIS of the wetlands.

In accordance with the outcomes of the impact assessment, and taking cognisance of the baseline conditions presented herein, as well as the impact management measures, the proposed Project, is not deemed to present significant negative ecological issues or impacts, and it should thus be authorised.

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1 INTRODUCTION

Igolide Wind (Pty) Ltd (hereafter 'Igolide Wind')is proposing the development of the Igolide Wind Energy Facility (WEF). The Igolide WEF (herein referred to as the Project) will be bid into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or a similar procurement program under the Integrated Resource Plan (IRP).

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

1.1 PURPOSE OF THE REPORT

This report describes the baseline aquatic biodiversity (wetland systems) of areas that will be impacted by the proposed infrastructure developments at the proposed WEF project footprint and documents the results of the baseline and impact assessment of the proposed Project on wetland ecosystems. The report also provides recommended measures for the mitigation of any negative impacts for inclusion in the project's Environmental Management Programme (EMPr).

2 PROJECT LOCATION AND DESCRIPTION

The proposed Project is located approximately 6 km northeast of Fochville within the Merafong City Local Municipality in the Gauteng Province (Figure 2-1). The proposed Project will be developed within a project area of approximately 680 ha. Within this project area, the extent of the Project footprint will be approximately 50 ha.

The proposed project will comprise of the following infrastructure:

- Ten (10) Wind Turbine Generators (WTGs) with a maximum capacity of up to 100 MW.
- Turbines with a hub height of up to 200 m, a rotor diameter of up to 200 m and tip height of up to 300 m.
- Turbine hardstand areas of approximately 1 ha per turbine.
- Temporary construction camp with a footprint of 1ha
- Medium voltage collector system will comprise cabling up to and including 33 kV that run underground, except where a technical assessment suggests that overhead lines are required, connecting the turbines to the on-site IPP substation.
- The 33/132kV on-site substation and Battery Energy Storage System (BESS) footprint will be up to 2.5 ha. The BESS storage capacity will be up to 100MW/400 megawatt-hour (MWh).
- Access and internal roads with a width of between 8 to 10 m, increasing up to 20 m for turning circle/bypass areas to allow for larger component transport. The access and internal roads will be placed within a corridor of up to 20m width to accommodate cable trenches, stormwater channels and turning circle/bypass areas of up to 20m. Existing access roads will be used where possible to minimise impact. Where required, the width of the existing roads will be widened to ensure the passage of vehicles.
- A temporary construction laydown/staging area of approximately 2 – 3 ha is envisaged.
- Temporary cement batching plant with a footprint of up to 1 ha.
- The Operation and Maintenance (O&M) building footprint is to be located near the on-site substation and will not exceed 0.5 ha.
- Grid (separate EA): A single or double circuit 132 kV overhead powerline and 132 kV switching station (adjacent to the on-site IPP substation) to feed the electricity generated by the proposed WEF into Eskom's Midas Main Transmission Substation via a 11 km overhead line.
- Supporting infrastructure.

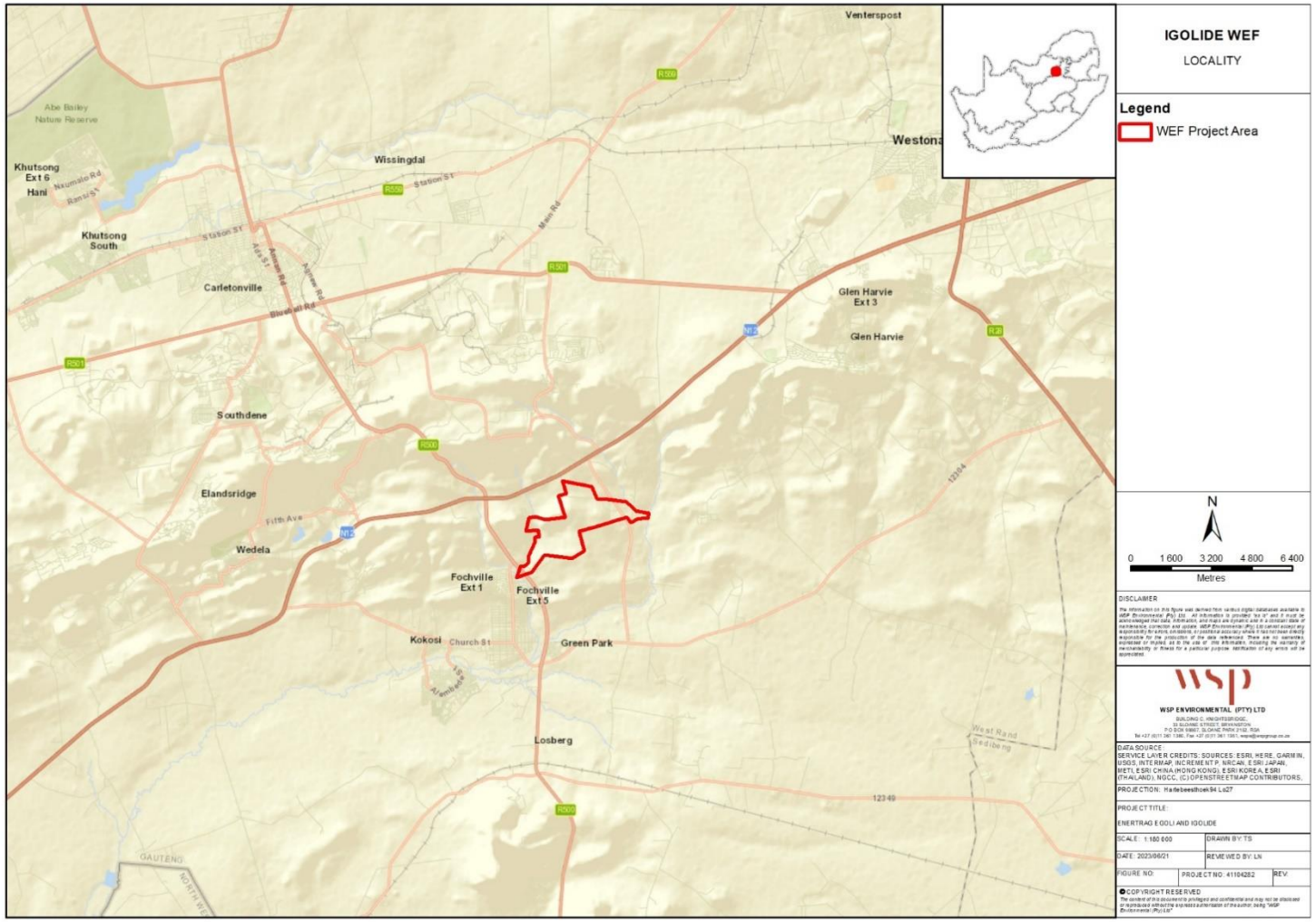


Figure 2-1 - Propose Project Locality Map

3 APPLICABLE LEGISLATION, POLICY AND STANDARD

Biodiversity-related South African legislation and policy 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).
- Gauteng Biodiversity Sector Plan.
- North West Biodiversity Sector Plan

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 21st June and the 18th July 2023. 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:

- Project Area: refers to the total extent of the affected properties, within which a development footprint (~50ha) has been identified where the WEF and associated infrastructure is planned to be constructed (Figure 4-1).
- Local Study Area; refers to the Project Area 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 watercourses could occur (Figure 4-1).

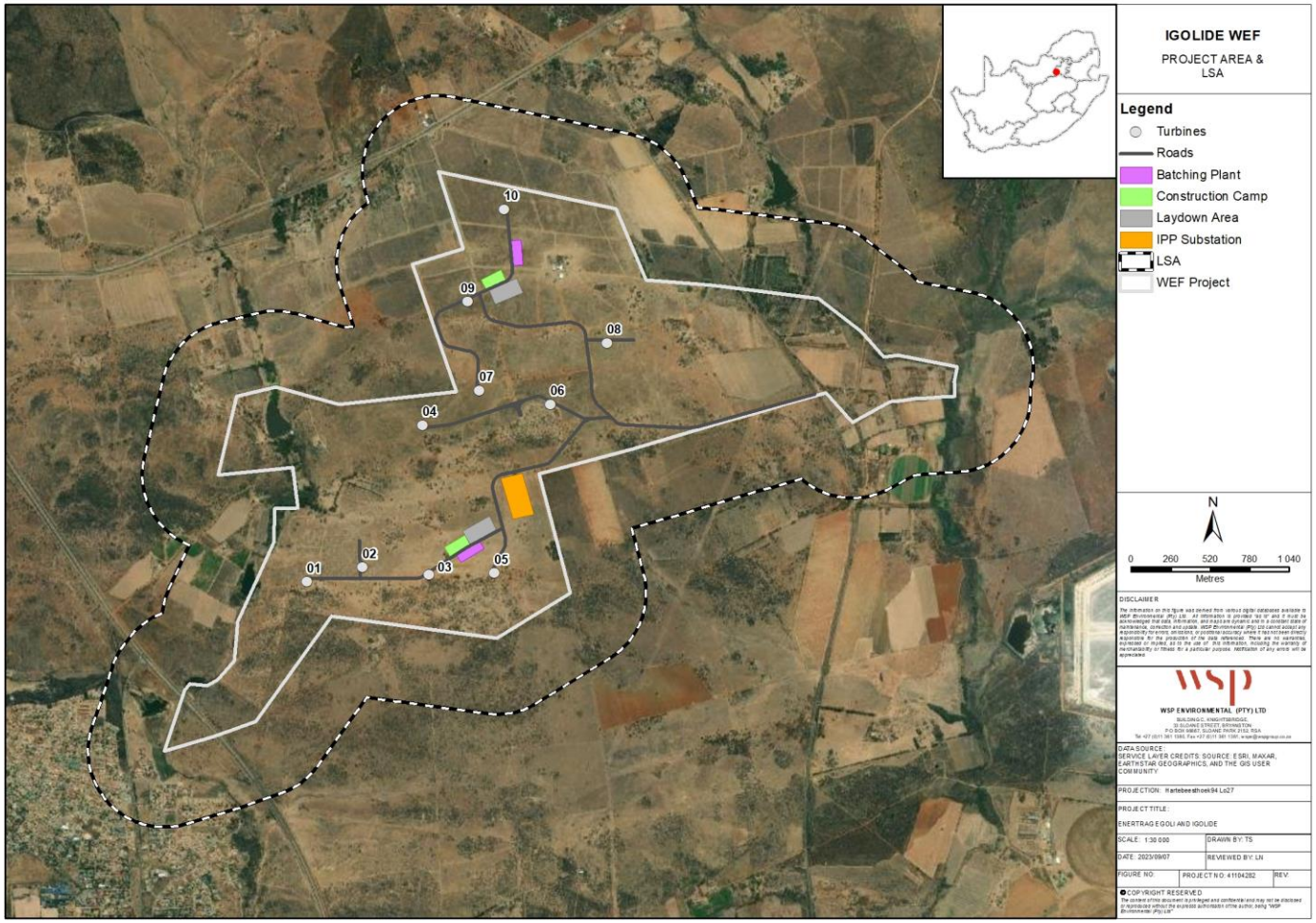


Figure 4-1 - Proposed Project Area and Study Area (LSA)

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 Project's area of influence, key wetland processes and function, and the likely composition and structure of the wetland communities.

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

1) Nationally available datasets which were consulted to inform the site sensitivity verification for wetland habitat include the South African National Wetland Map version 5 (NWM5) (Van Deventer *et al.*, 2019), and the National Freshwater Ecosystem Priority Area database; and

2) National spatial planning datasets, namely the Gauteng Biodiversity Sector Plan (freshwater), National Environmental Management Biodiversity Act (Act No 10 of 2004)) (NEMBA), Threatened Ecosystems, and national protected area expansion strategy, provide a regional/national context for assessing the biodiversity significance of the site.

4.3 WETLAND BASELINE ASSESSMENT

The methods used in the identification, delineation, classification and assessment of wetlands in the study area are described in the sections that follow.

4.4 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 also 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.	*/***	*/***

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

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 4-2).

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), is 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 (level 2) approach was applied, and the following services were examined and rated:

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

Each of the above-listed services was scored according to the following general level of service provided.

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

4.5 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 looks at five impact criteria as indicated in Table 4-5 below:

Table 4-5 – 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)	**Immediate:**	**Short term:**	**Medium term:**	**Long term:**	**Permanent:**

The length of permanence of the impact on the environmental receptor	On impact	0-5 years	5-15 years	Project life	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 4-6 – Environmental Significance Rating

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

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 in June and July 2023.
- The field survey for the aquatic biodiversity assessment was conducted between June and July 2023, which coincides with the dry season period; and therefore, the temporary zones that would have easily been mapped as part of the wetland boundary may be excluded in this delineation due to the drier state of wetlands in the dry season.

ASSUMPTIONS, UNCERTAINTIES, OR GAPS IN KNOWLEDGE

- Some wetland vegetation that would have been used in the delineation of the wetland boundary may have been dormant due to vegetation dry back in the dry season.

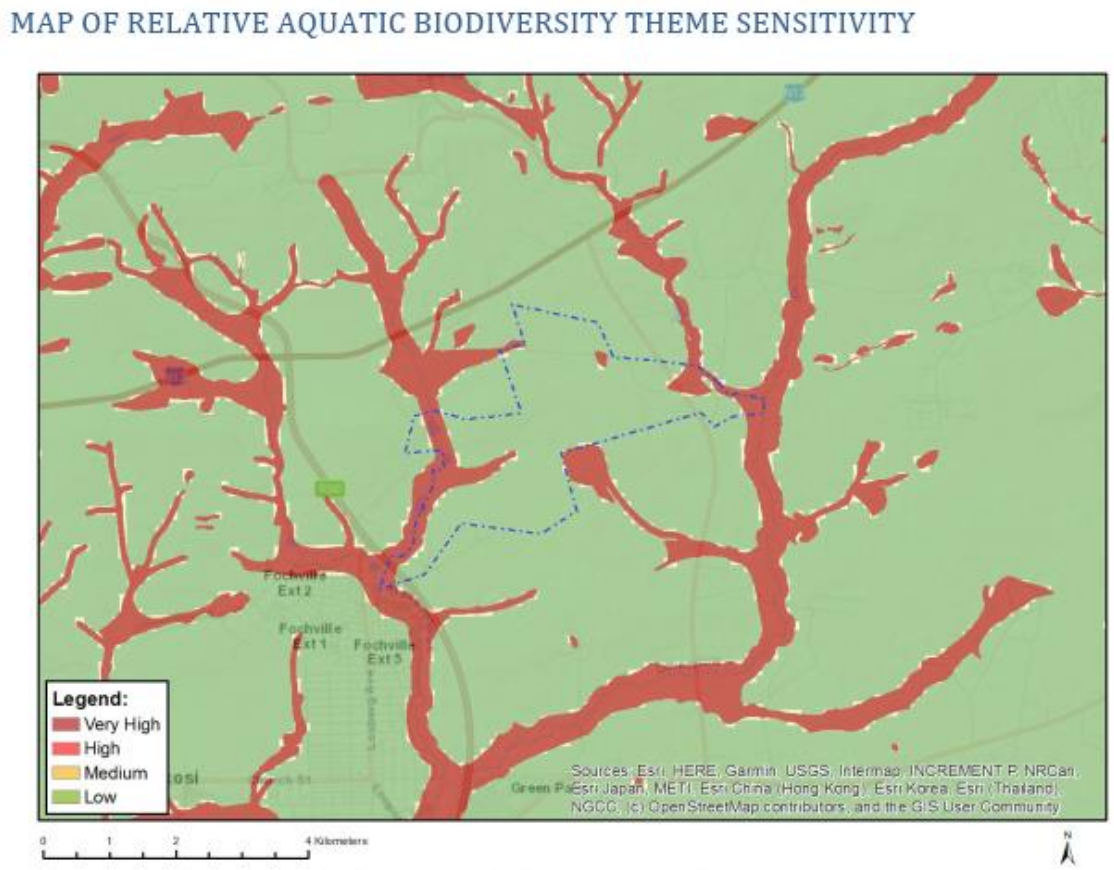
- Some wetlands identified at a desktop level using the NWM5 dataset could not be confirmed on site due to access restrictions. These relates mainly to wetlands associated with the eastern extent of the Loopspruit.

5 BASELINE DESCRIPTION

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

5.1 ENVIRONMENTAL SCREENING TOOL

The Project Area was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Aquatic Biodiversity Theme for the Project Area is rated 'Very High Sensitivity' due to the presence of wetland features and areas mapped as Aquatic Critical Biodiversity Areas (CBAs), in and around the Project Area (Figure 5-1).



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	Aquatic CBAs
Very High	Wetlands and Estuaries

Figure 5-1 - DFFE Screening Tool Results

5.2 REGIONAL BIODIVERSITY CONTEXT

The Study Area lies within the C23J quaternary catchment of the primary drainage region C within the Vaal Water Management Area (WMA). The Kraalkopspruit Sub-Quaternary Reach (SQR) C23J-01507 drains the Study Area to the west, while the perennial Loopspruit SQR C23J-01487 drains the Study Area on the east (Figure 5-2).

The Kraalkopspruit SQR is a first order stream which flows for approximately 10 km in a southward direction before joining the Loopspruit. The Loopspruit SQR is also a first order stream which flows for approximately 17 km in the southwest direction.

5.3 STRATEGIC WATER SOURCE AREAS (SWSAS)

The Study Area is located downstream of the Far West Karst Region Strategic Water Source Area (SWSA) (Figure 5-3). According to Le Maitre *et al.* (2019) SWSA is defined as land that either supply large volume of mean annual surface water runoff in relation to their size and so are considered nationally important or have relatively high groundwater recharge. A SWSA is one where the water that is supplied is considered to be of national or sub-national importance for water security (Le Maitre *et al.* 2019).

5.4 FRESHWATER ECOSYSTEM PRIORITY AREAS (FEPA) SUB-CATCHMENT

The Study Area in relation to FEPA sub-catchments and mapped National Freshwater Ecosystem Priority Areas (NFEPA) wetlands is illustrated on Figure 5-4 and Figure 5-5, respectively. FEPA sub-catchment areas provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. Areas mapped as FEPA sub-catchments provide guidance on which watercourses should remain in a natural or near natural condition to support water resource protection goals of the water act.

5.5 NATIONAL WETLAND MAP 5 WETLANDS

The South African National Wetland Map version 5 (NWM5) portrays the most up-to-date spatial data for the extent and types of estuarine and inland aquatic (freshwater) ecosystems of South Africa (Van Deventer *et al*., 2019). The proposed development footprint in relation to wetlands mapped as part of the National Wetland Map 5 project is illustrated on Figure 5-6. Based on NWM5 the Project area intercepts a number of wetland systems including a channelled valley bottom wetland, a hillslope seep, and an unchanneled valley bottom wetland as seen in Figure 5-6.

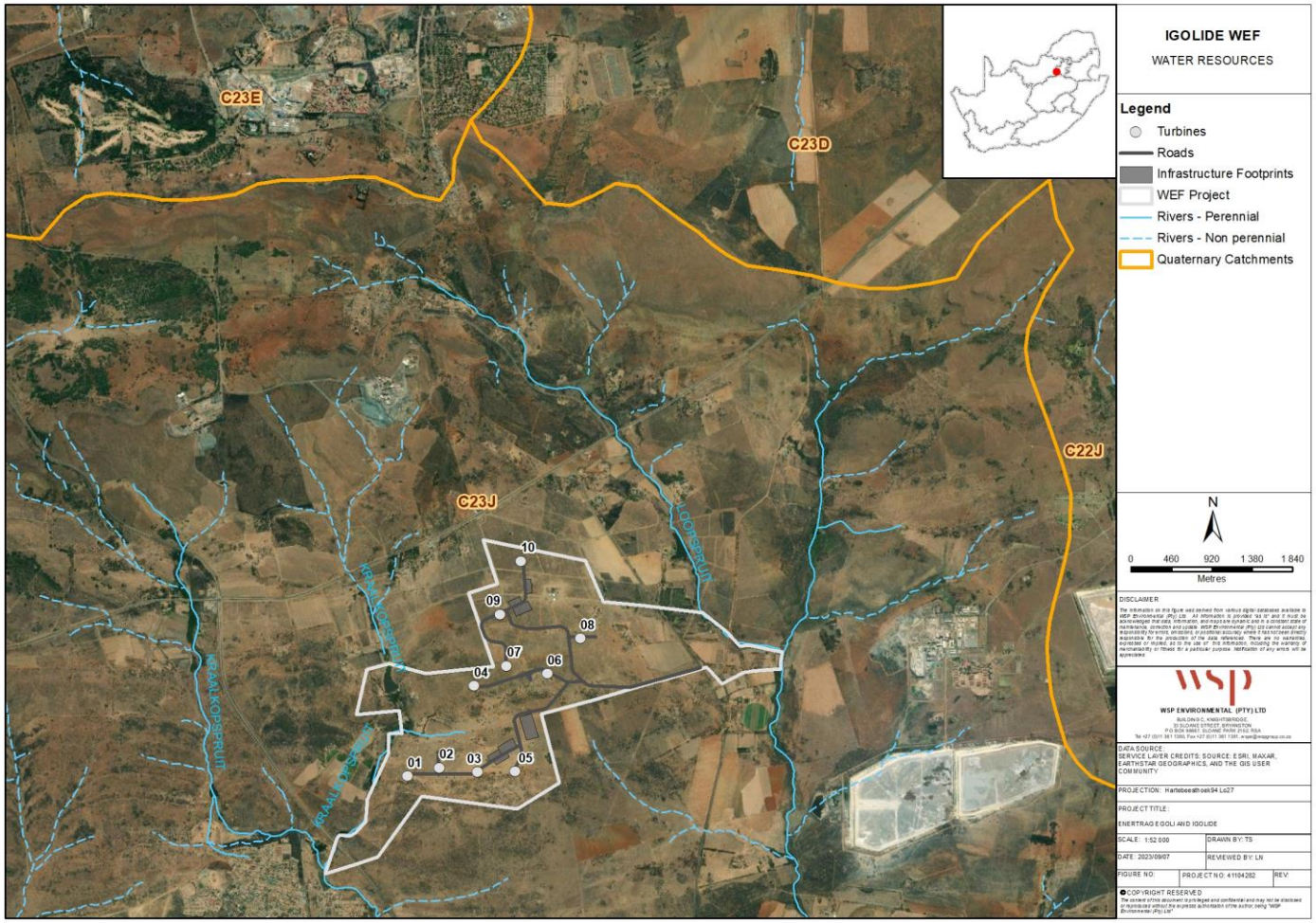


Figure 5-2 - Water Resources in the Study Area

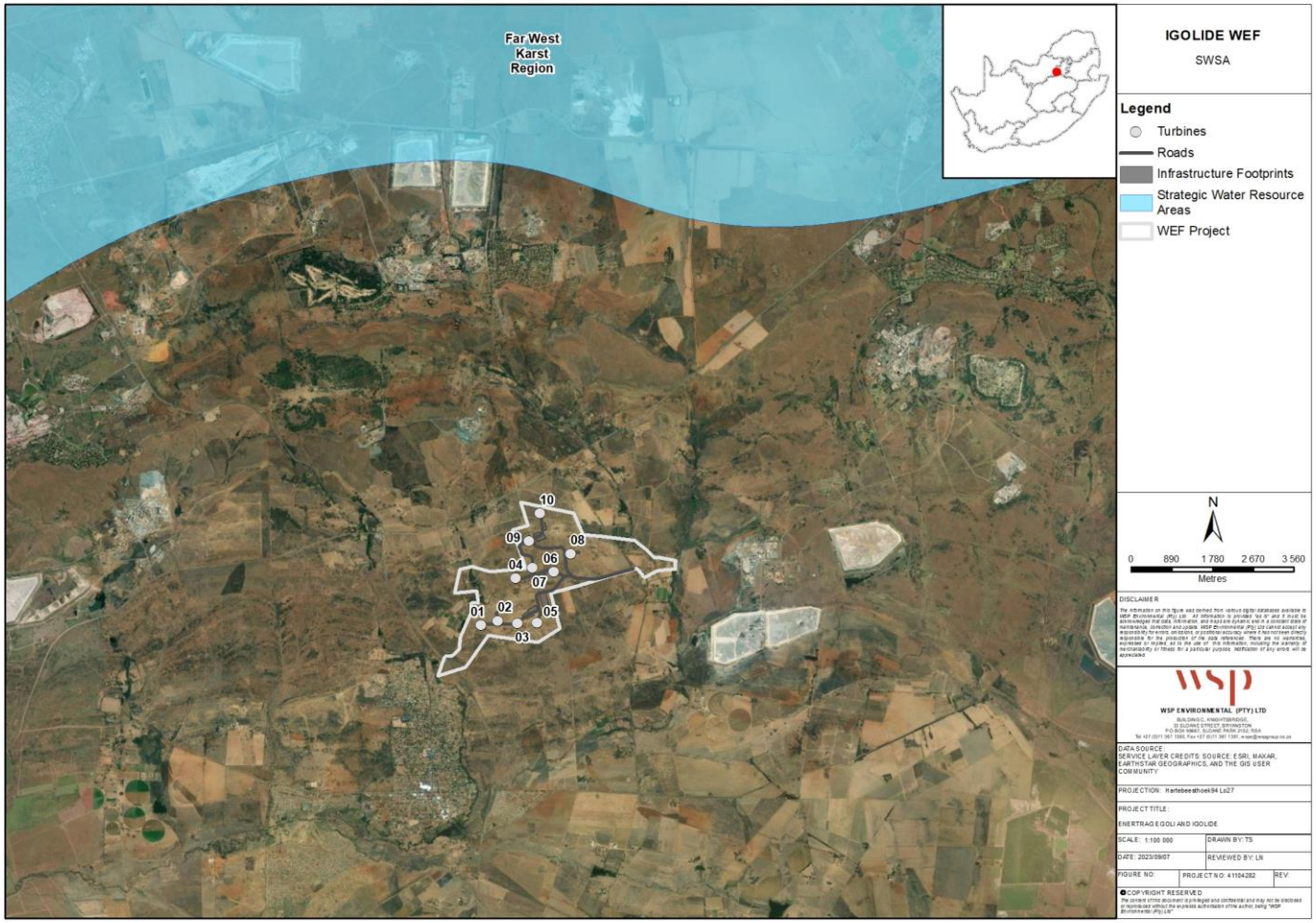


Figure 5-3 - Study Area in relation to SWSA

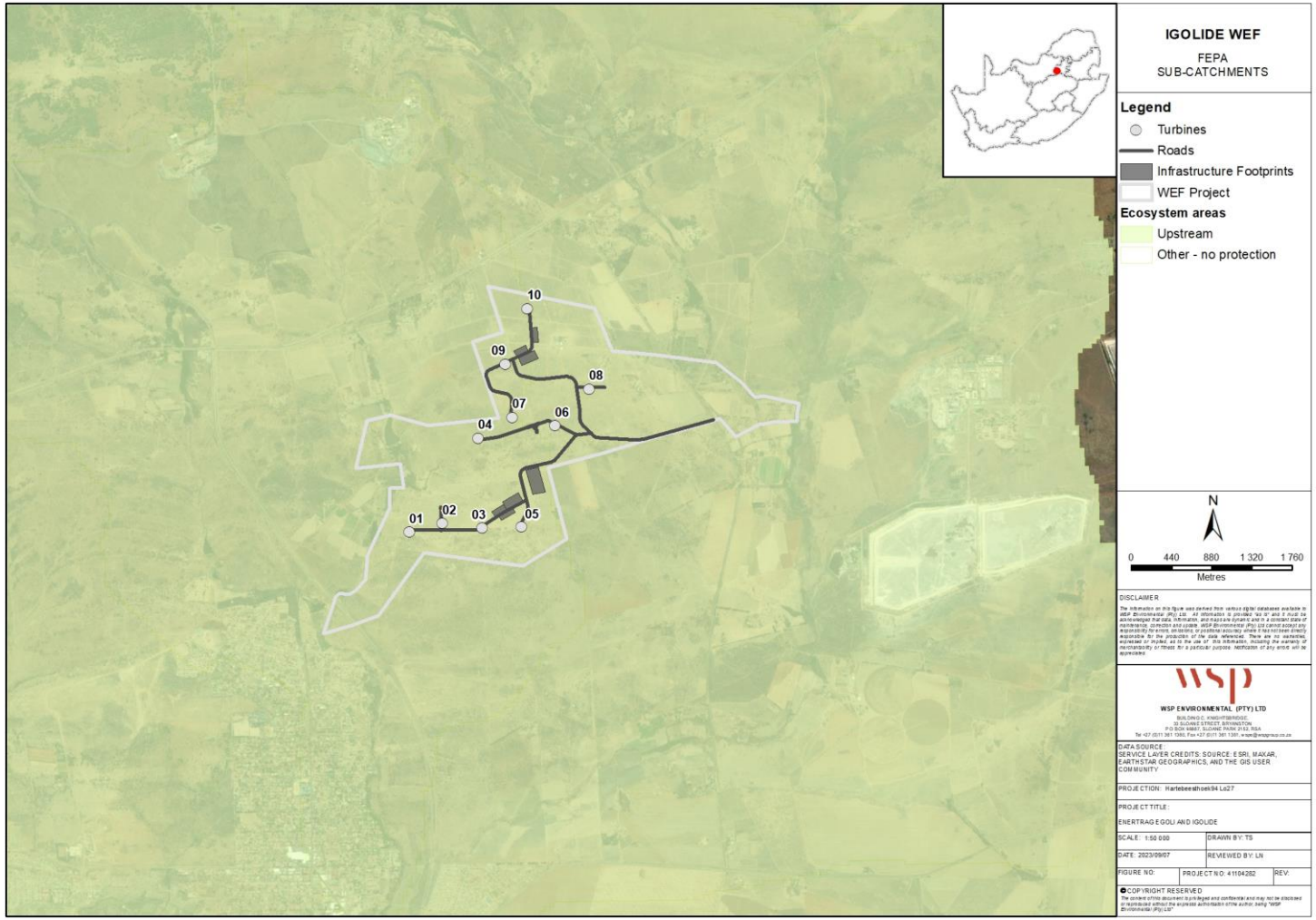


Figure 5-4 - FEPA Sub-Catchments in relation to the Study Area

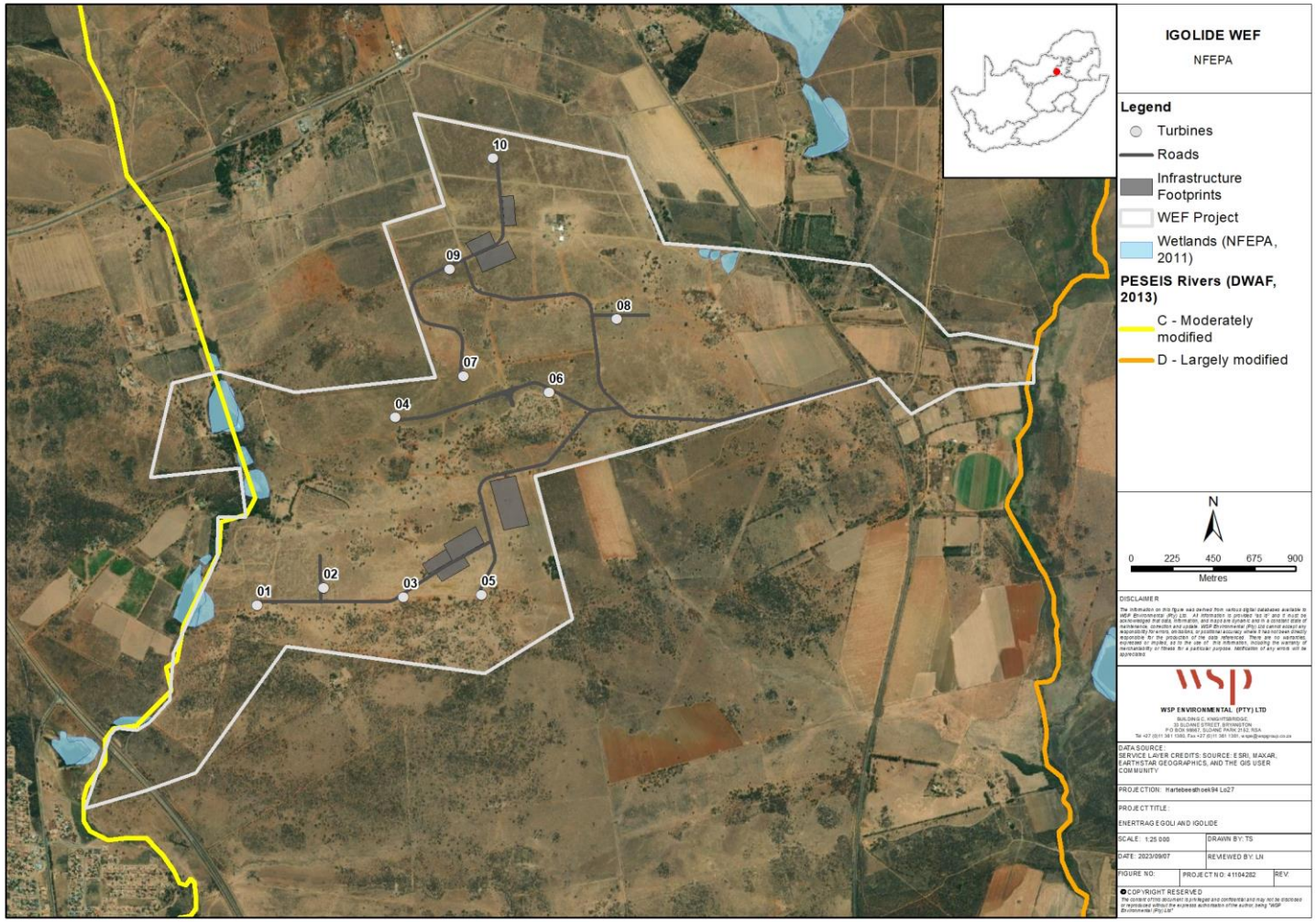


Figure 5-5 - NFEPA Wetlands and Rivers within the Study Area

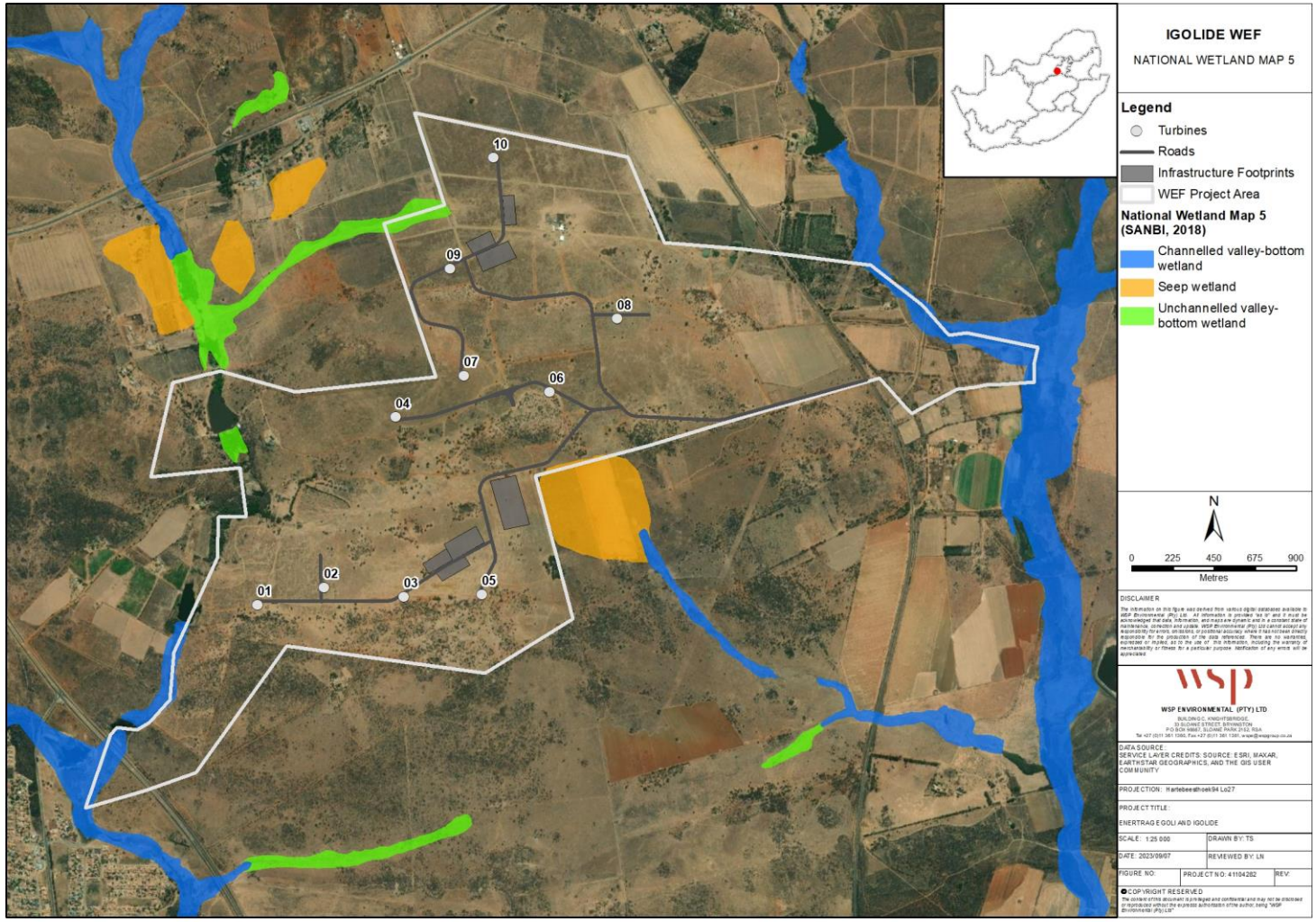


Figure 5-6 - National Wetland Map 5 Wetlands on site

5.6 WETLAND CLASSIFICATION AND ASSESSMENT

A total of seven wetland systems were identified within a 500m buffer of the proposed project development. The infield sampling of soil and vegetation in conjunction with the recording of diagnostic topographical /terrain indicators and features, enabled the delineation of the wetlands, which included two channelled valley bottom wetlands, and five hillslope seepage wetlands. These are discussed in detail below.

Channelled valley bottom wetlands

Two Channelled Valley Bottom (CVB) wetlands, one associated with the Kraalkoopspruit (CVB 1) and one with Loopspruit (CVB 2) occurs within the study area (Figure 5-7, Figure 5-8 and Figure 5-10). 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 wetlands on site. These systems receive water inputs from the main channel and from adjacent slopes (Kotze *et al.,* 2008).

The CVB wetlands were characterised by riparian vegetation along the channelised section of the wetland, species such as *Populus sp.* and *Salix sp*. (Weeping willow), were identified along the CVB wetlands. The permanent zone of the wetlands was dominated by the wetland sedges such as *Juncus oxycarpus, Juncus effuses* and the perennial grass *Phragmites australis,* while the seasonal zones were characterised by *imperata cylindrica.*

Figure 5-7 – A view of the CVB 1 wetland

Figure 5-8 – A view of the CVB 2 wetland

Hillslope Seep Wetlands

A total of five seasonal hillslope seepage (seep) wetlands were identified within the study area, these were connected to the CVB wetlands mentioned above (Figure 5-9 and Figure 5-10). Hillslope seepage wetlands are created and maintained by infiltration processes that occur in the surrounding non-wetland areas within the catchment. This type of system typically contributes to flow in the watercourses, even if this contribution is only on a seasonal basis. The hillslope seepage wetlands were dominated by hygrophilous grasses, with some wetter areas characterised by wetland plant species *Schnoplectus paludicola, Centella asiatica, and Cyperus marginatus.* Majority of the seep wetlands were also dominated by alien invasive species such as *Verbena bonarensis*, *Tagetes minuta*, *Datura ferox*, which colonised areas along road crossings and dam walls.

Seep 1

Seep 2

Seep 3

Seep 4

Seep 5

Figure 5-9 – Overview of the Seep wetlands within the study area

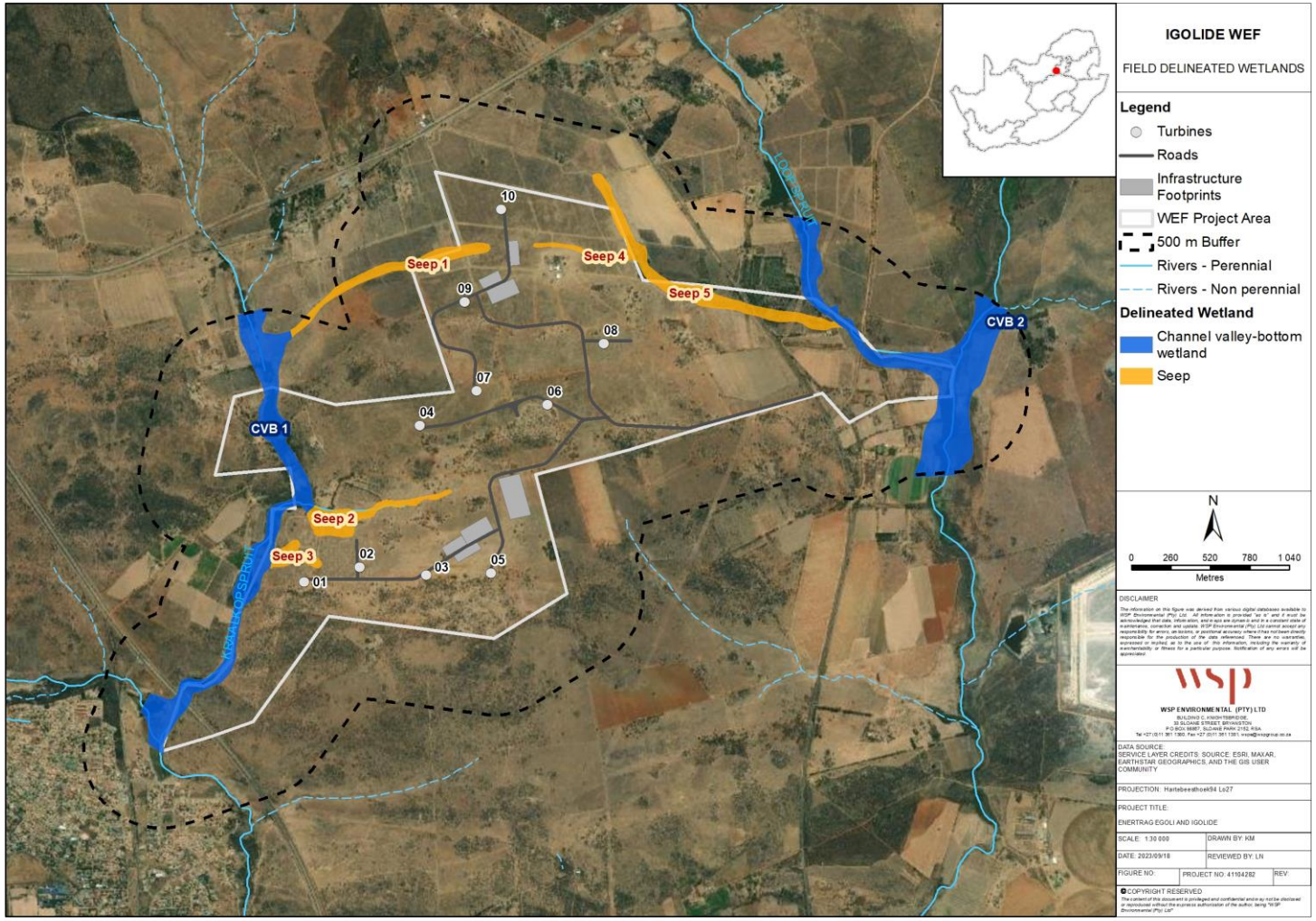


Figure 5-10 – Wetlandd identified within the study area

5.7 WETLAND ASSESSMENT

PRESENT ECOLOGICAL STATE

The wetlands on site were assessed to be in a Moderately Modified Present Ecological State (PES) (Table 5-1). This was attributed to the current impacts identified on site such as headcut erosion within seep wetlands, impoundment of water at dams, alien invasive species colonisation at road crossings as well as alien invasive vegetation (i.e. *Eucalyptus)*, preferential flow paths along animal tracks and crop farming at wetland edges *(*Figure 5-12 and Figure 5-11*).*

Based on the PES assessment scores, the hydrology and geomorphological impacts on the wetlands are the main contributing factor to their Moderately modified state. This is due to the presence of dams which interrupt the surface hydrology and impound surface flow, as well as presence of erosional features, particularly within the seep wetlands.

The Present Ecological State (PES) score for the wetlands in the study area are presented in Table 5-1.

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

Wetland Unit	Size (ha)	Hydrology Impact Category	Geomorphology Impact Category	Water Quality Impact Category	Vegetation Impact Category	Overall PES Category
CVB 1	42.2	D	C	B	C	C
CVB 2	47.9	D	C	B	C	C
Seep 1	8.8	C	C	A	B	C
Seep 2	7.8	C	D	A	B	C
Seep 3	3.2	C	C	A	B	C
Seep 4	1.9	C	D	A	B	C
Seep 5	15.03	C	D	A	B	C

Figure 5-11 - Major impacts identified at Channelled valley bottom wetlands

Figure 5-12 - Major impacts identified at Seep wetlands

ECOSERVICES

The importance scores for the ecosystem services provided by wetlands within the study area are illustrated in the spider diagrams presented in Figure 5-13 and Figure 5-14. Both the CVB wetlands and the seep wetlands were grouped and assessed as one CVB and one seep wetland system, based on homogenous condition and services supplied by and/or demanded from these wetlands.

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 wetlands which is also important in terms of streamflow regulation and flood attenuation. The wetlands also rated moderate for harvestable wood and occurrence of game for harvesting, since the study area is used mainly for game farming.

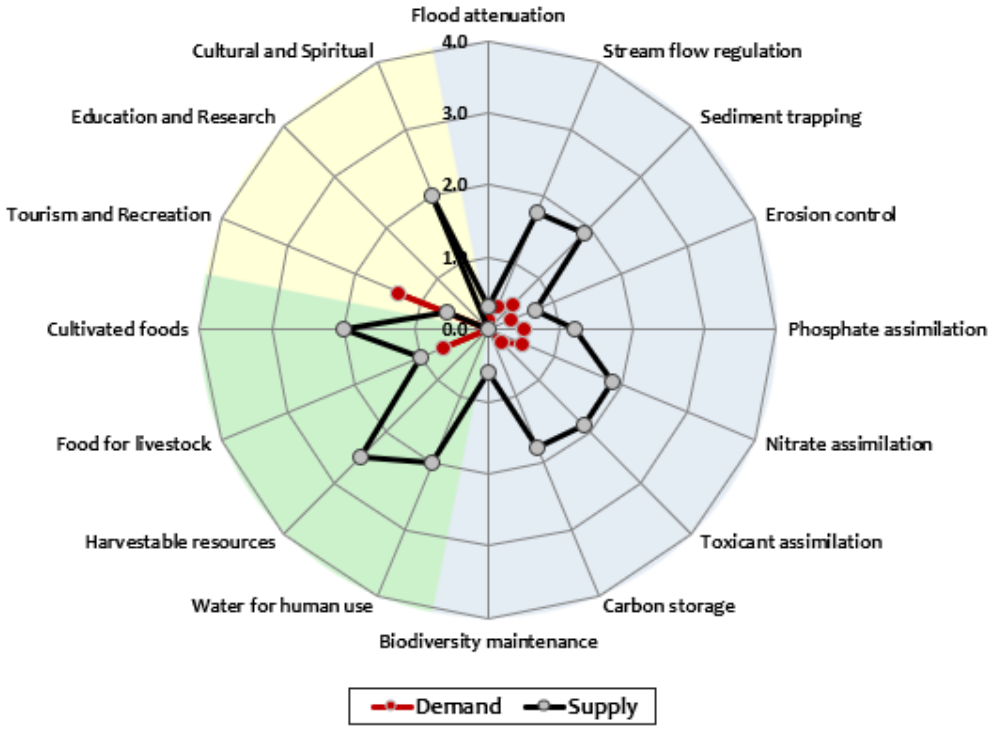


Figure 5-13 - Ecosystem Services supplied by/demanded from CVB wetlands

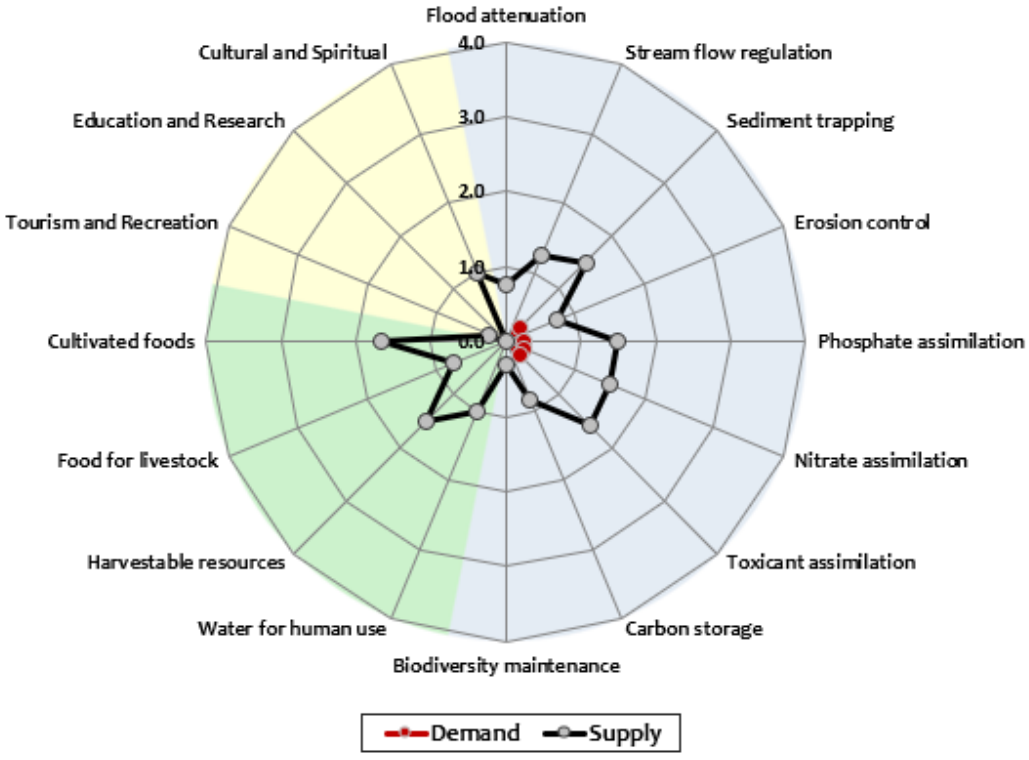


Figure 5-14 - Ecosystem Services supplied by/demanded from the seep wetlands

ECOLOGICAL IMPORTANCE AND SENSITIVITY

All wetlands in the study area were assessed as being of Low /Marginal EIS, with the exception of the CVB wetlands, which were assessed as being of Moderate EIS (Table 5-2). The moderate EIS of the CVB wetlands was attributed to its hydrological functional importance as these wetlands perform a role in landscape connectivity at the regional level, providing regulating and supporting benefits, such as streamflow regulation and flood attenuation. Furthermore, the CVB wetlands, especially CVB 1 which is located within an active hunting range, has direct human benefits in terms of recreational benefits.

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 PES Class
CVB 1	1.0	1.7	0.7	1.7	Moderate
CVB 2	1.0	1.8	0.5	1.8	Moderate
Seep 1	0.6	0.0	0.0	0.6	Low/Marginal
Seep 2	0.8	0.9	0.0	0.6	Low/Marginal
Seep 3	0.6	0.0	0.0	0.6	Low/Marginal
Seep 4	0.8	0.0	0.0	0.6	Low/Marginal
Seep 5	0.6	0.0	0.0	0.6	Low/Marginal

5.8 SITE VERIFICATION OUTCOME

The Environmental Screening Tool rates the aquatic biodiversity theme as 'Very High Sensitivity' due to the presence of wetland features and areas mapped as wetland CBA and FEPA sub-catchment in the study area. Based on the findings of this study, the Very High Sensitivity' was confirmed, due to the confirmed presence of wetland features on site, which were considered to be in a Moderately Modified PES with Moderate to Low/Marginal EIS, that are also mapped as CBA.

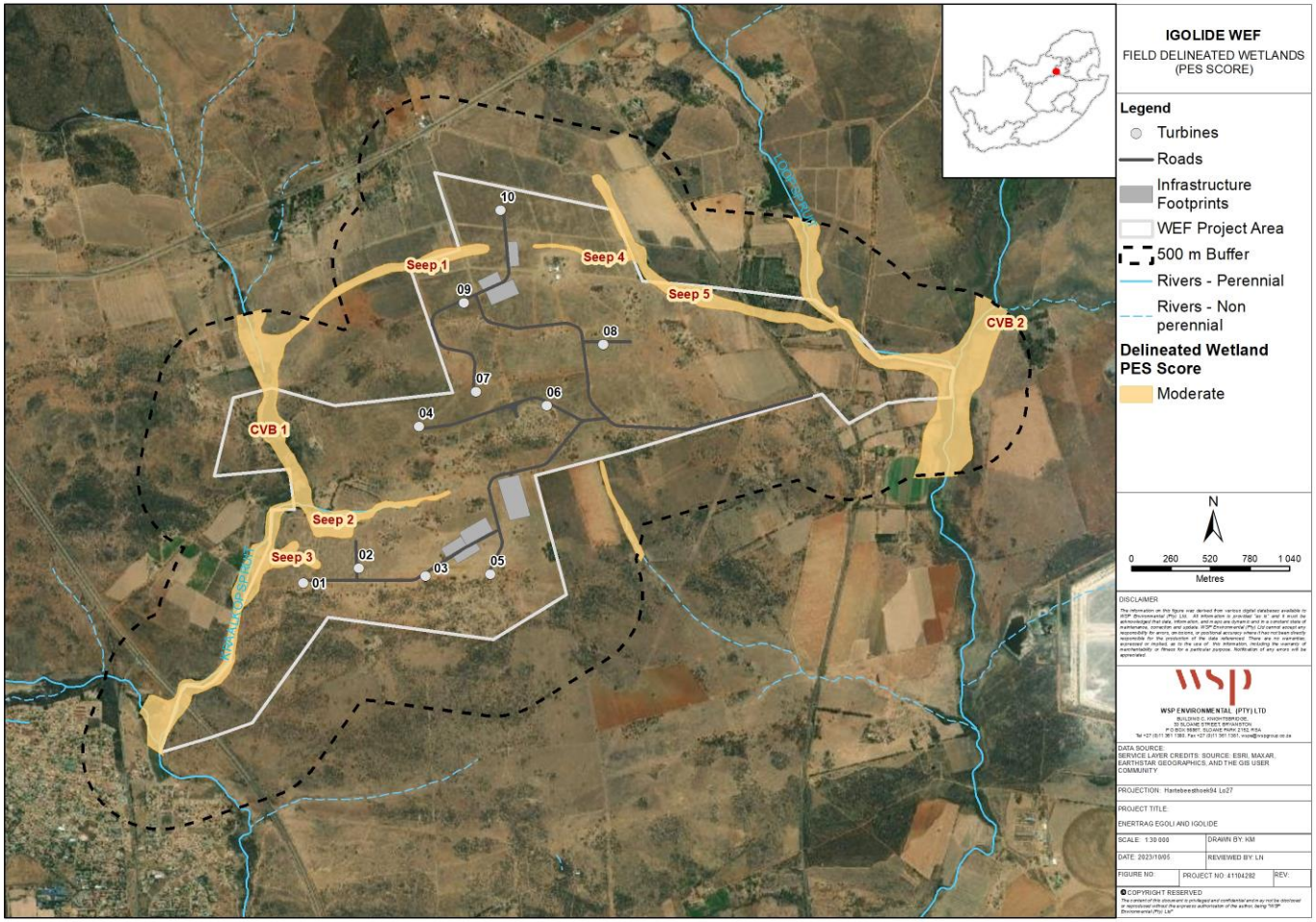


Figure 5-15 - Map showing the PES of wetlands on site.

6 IMPACT ASSESSMENT

Scenarios considered for impact assessment included the construction of the project as proposed (see Section 2) and the no-go scenario.

In the no-go scenario, the Project would not be developed and the existing status quo would likely be maintained, that being that the Moderately Modified PES (Table 5-1) ascribed to all assessed wetlands would persist, with long-term habitat degradation as a result of existing impacts, including headcut erosion within seep wetlands, impoundment of water at dams, alien invasive species colonisation at road crossings, development of preferential flow paths along animal tracks and crop farming at wetland edges.

The construction and operation of the proposed Project will result in the disturbance and/or loss of wetland habitat due to vegetation and topsoil removal near wetlands. 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).

Since no Project-specific impacts will occur in the no-go scenario, the following sections discuss the potential impacts of the construction and operation of the proposed WEF development on wetlands that are situated within 500 m of the planned infrastructure and activities.

6.1 CONSTRUCTION PHASE

Construction phase impacts on aquatic (wetland 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 biodiversity. The earthworks and activities involved during the construction phase of the Project can potentially exert negative impacts on sensitive ecosystems including loss of wetland habitat, catchment landcover changes resulting in increased sediment entry to downstream systems and contamination of water bodies by construction materials / vehicles (hydrocarbons etc).

The preliminary list of predicted construction phase impacts are outlined in the sections that follow, and summarised on Table 6-1.

LOSS OF WETLAND HABITAT

Site establishment and construction of the proposed project infrastructure, such as access roads, wind turbine foundations and temporary laydown infrastructure could lead to the permanent loss of wetland habitat within the Project footprint. Based on the current proposed layout of the wind turbines location, none of them are located within the wetland footprint, however, some are located in close proximity to the seep wetlands, particularly wind turbine 1 which is located approximately 124.43 m from Seep 03. As a result of the close proximity of the turbines to wetland habitat and the disturbances expected during the construction phase, the impact is expected to have a moderate impact magnitude during construction. The impact is expected to have a medium impact duration (ceasing with construction), with a local impact extent prior to mitigation, resulting in a **Moderate** impact significance. With the implementation of mitigation measures such as limiting disturbance to the project footprint and keeping out of wetland habitat as far as possible (100 m buffer), the impact magnitude can be reduced to low, the extent to site only and the impact can be recoverable with rehabilitation, while the impact

duration is that of a short-term duration. Post mitigation this impact can be reduced to **Low** impact significance.

CHANGES IN WETLAND HEALTH/FUNCTIONING

Bulk earthworks involved with 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 as a result of 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 WEF foundations and road crossing to affected downslope wetland systems, the impact significance can be reduced to a L**ow** impact significance.

CONTAMINATION OF WATERCOURSES

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 regional extent impact and a medium-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, particularly in proximity to the seep wetlands, which will lead to increased velocities of runoff, and 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, such as limiting vegetation removal to the project footprint and revegetating exposed soils immediately post construction, 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 in the area. 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 **Very Low**.

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 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.

6.3 CUMULATIVE IMPACTS

The landscape within which the proposed infrastructure is located consists of a mosaic of agricultural areas and grasslands, fragmented as a consequence of the existing surrounding land uses (i.e. mining, agricultural practices, residential areas, and informal settlement).

Changes in land uses have occurred within the wetlands and their catchments, which has resulted in the moderately modified PES category of the wetlands. The turbines and access roads have been sited to specifically avoid wetland habitat, therefore the Project will not contribute to cumulative rates of direct wetland habitat loss at the local or regional level.

The presence of the wind turbines and access roads within the wetland's catchments could contribute to an increased rate of changes in catchment hydrology and vegetation cover and thus an eventual change in PES score; however, assuming that the recommended mitigation measures are strictly applied, the residual impacts of the proposed development on wetlands have been determined to be Low or Very Low.

The effective implementation of the recommended mitigation measures will be key in ensuring that the Project's contribution to cumulative effects on wetlands (together with the existing drivers of change) are minimised. This may be achieved through protecting and conserving currently unprotected wetland habitat in the study area throughout the construction and operation phases of the Project, and rehabilitating targeted wetlands in the Project area to improve their condition and thus enhance their level of functioning; thereby addressing low-level residual impacts on wetlands as a result of the presence of turbines and access roads in their catchment.

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	Loss of wetland habitat	Construction	Negative	Moderate	3	2	5	3	4	**52**	**N3**	2	1	3	2	3	**24**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Wetland hydrology	Changes in wetland health/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	3	3	3	4	**48**	**N3**	2	1	1	1	3	**15**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
Impact 4:	Soil Erosion	Wetland soil erosion	Construction	Negative	Moderate	3	1	5	4	4	**52**	**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**						
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**						
DECOMISSIONING																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**		**Pre-Mitigation**							**Post-Mitigation**						

					Ease of Mitigation	(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Alien invasive species	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**						

7 MITIGATION MEASURES

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

IDENTIFICATION OF AREAS TO BE AVOIDED (INCLUDING BUFFERS)

- Areas of undisturbed, natural grassland and wetland habitat should be avoided. Areas of direct loss that cannot be avoided must be addressed via additional conservation actions/offsets as required.
- 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.
- The extent of disturbance should be limited by restricting all construction activities to the servitude as far as practically possible.
- Locate all laydown areas and temporary construction infrastructure at least 100 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 should take place in winter (during the dry season). Where summer construction is unavoidable, temporary diversions of the streams and stormwater management interventions might be required.
- Install erosion prevention measures as part of the stormwater management plan, prior to the onset of construction activities. Measures should include energy dissipating measures such as sandbags, Ecologs, or low berms on approach and departure slopes to crossings to prevent flow concentration. Sediment barriers such as silt fences or the placement of hay bales around the lower edge of bare soil areas, and active 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.

8 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.

9 CONCLUSION

The proposed Project development is located within a 500m buffer of seven wetland systems, including channelled valley bottom and hillslope seepage wetlands. The wetlands within the study area were found to be in Moderately Modified state (PES C), which was attributed to existing impacts such as headcut erosion within seep wetlands, impoundment of water at dams, interruption of surface hydrology, and alien invasive colonisation at road crossings as well as alien invasive vegetation along wetland edges, preferential flow paths along animal tracks, and crop farming at wetland edges.

The seep wetlands in the study area were assessed as being of Low /Marginal EIS, while the CVB wetlands were assessed as having a Moderate EIS. The Moderate EIS of the CVB wetlands was attributed to the hydrological functional importance of the CVBs, as these wetlands perform a role in landscape connectivity at the regional level, providing regulating and supporting benefits such as streamflow regulation and flood attenuation. Additionally, the CVB wetlands, especially CVB 1 is located within an active hunting range and thus has a direct human benefit in terms of recreational benefits. Similarly, the ecosystem services supplied by or demanded from the seep wetlands were considered low, while the CVB wetlands were considered as having a moderate ecoservices based on their function to regulate streamflow, trap sediment, assimilate phosphate, nitrate and toxicants, which benefits downstream users.

The Environmental Screening Tool rates the aquatic biodiversity theme as 'Very High Sensitivity' due to the presence of wetland features and areas mapped as wetland CBA and FEPA sub-catchment in the study area. Based on the findings of this study, the Very High Sensitivity' was confirmed, due to the confirmed presence of wetland features on site, which were considered to be in a Moderately Modified PES with Moderate to Low/Marginal EIS, that are also mapped as CBA.

The earthworks and activities involved during the construction phase of the Project can exert negative impacts on sensitive ecosystems including loss of wetland habitat, changes in wetland health/functioning, contamination of watercourses, formation of soil erosion and establishment and spread of alien invasive species. Without mitigation, these impacts are assessed as having a moderate impact significance on wetlands, however with the application of recommended mitigation measures such as limiting disturbance to the project footprint and keeping out of wetland habitat as far as possible these impacts can be reduced to a low/very low impact significance. If not mitigated, these impacts can progress into the operation and decommissioning phase of the project, which could lead to the wetlands being largely modified.

9.1 IMPACT STATEMENT

Provided that recommended mitigation measures are implemented, the proposed project development is not expected to result in any negative changes in the current PES and EIS of the wetlands.

9.2 SPECIALIST OPINION

In accordance with the outcomes of the impact assessment, and taking cognisance of the baseline conditions presented herein, as well as the impact management measures, the proposed Project, is not deemed to present significant negative ecological issues or impacts, and it should thus be authorised.

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