Appendix G.4

AQUATIC IMPACT ASSESSMENT

Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY (RIPARIAN AND WETLAND SYSTEMS) SPECIALIST ASSESSMENT-SCOPING REPORT

Igolide Wind Energy Facility

JUNE 2023

PUBLIC

Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY (RIPARIAN AND WETLAND SYSTEMS) SPECIALIST ASSESSMENT- SCOPING REPORT

Igolide Wind Energy Facility

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 41104282

DATE: JUNE 2023

Igolide Wind (Pty) Ltd

AQUATIC BIODIVERSITY (RIPARIAN AND WETLAND SYSTEMS) SPECIALIST ASSESSMENT- SCOPING REPORT

Igolide Wind Energy Facility

WSP

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

Phone: +27 11 254 4800

WSP.com

QUALITY CONTROL

Issue/revision	First issue
Remarks	Final Scoping Report
Date	June 2023
Prepared by	Lufuno Nemakhavhani
Signature	
Checked by	Aisling Dower
Signature	
Authorised by	Ashlea Strong
Signature	
Project number	41104282
File reference	\\corp.pbwan.net\za\Central_Data\Projects\41100xxx\41104282 - Enertrag Egoli and Igolide WEF\41 BI\01-Reports\01-Draft\Updated

CONTENTS

TABLES

FIGURES

APPENDICES

No table of contents entries found.

1 INTRODUCTION

Igolide Wind (Pty) Ltd is proposing the development of the Igolode Wind Energy Facility (WEF), which will be operated under a Special Purpose Vehicle (SPV). The Igolide WEF (herein referred to as the Project), aims to bid the Project 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 (riparian and 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 scoping-level screening of the potential impacts of the proposed Project on riparian and wetland ecosystems. The report also provides a preliminary set of recommended measures for the mitigation of any negative impacts.

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 130 ha, subject to finalization based on technical and environmental requirements.

The proposed project will comprise of the following infrastructure:

- Twelve 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 ~0.5ha
- 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 Battery Energy Storage Systen (BESS) footprint will be up to 2 ha. The BESS storage capacity will be up to 100MW/400 megawatt-hour (MWh).
- Internal roads with a width of between 8 to 10 m will provide access to each turbine, the BESS, on-site substation, step-down substation and laydown area. The width will increase up to 15 m for turning circle/bypass areas to allow for larger component transport.
- A temporary construction laydown/staging area of approximately 2 – 3 ha is envisgaged.
- 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.

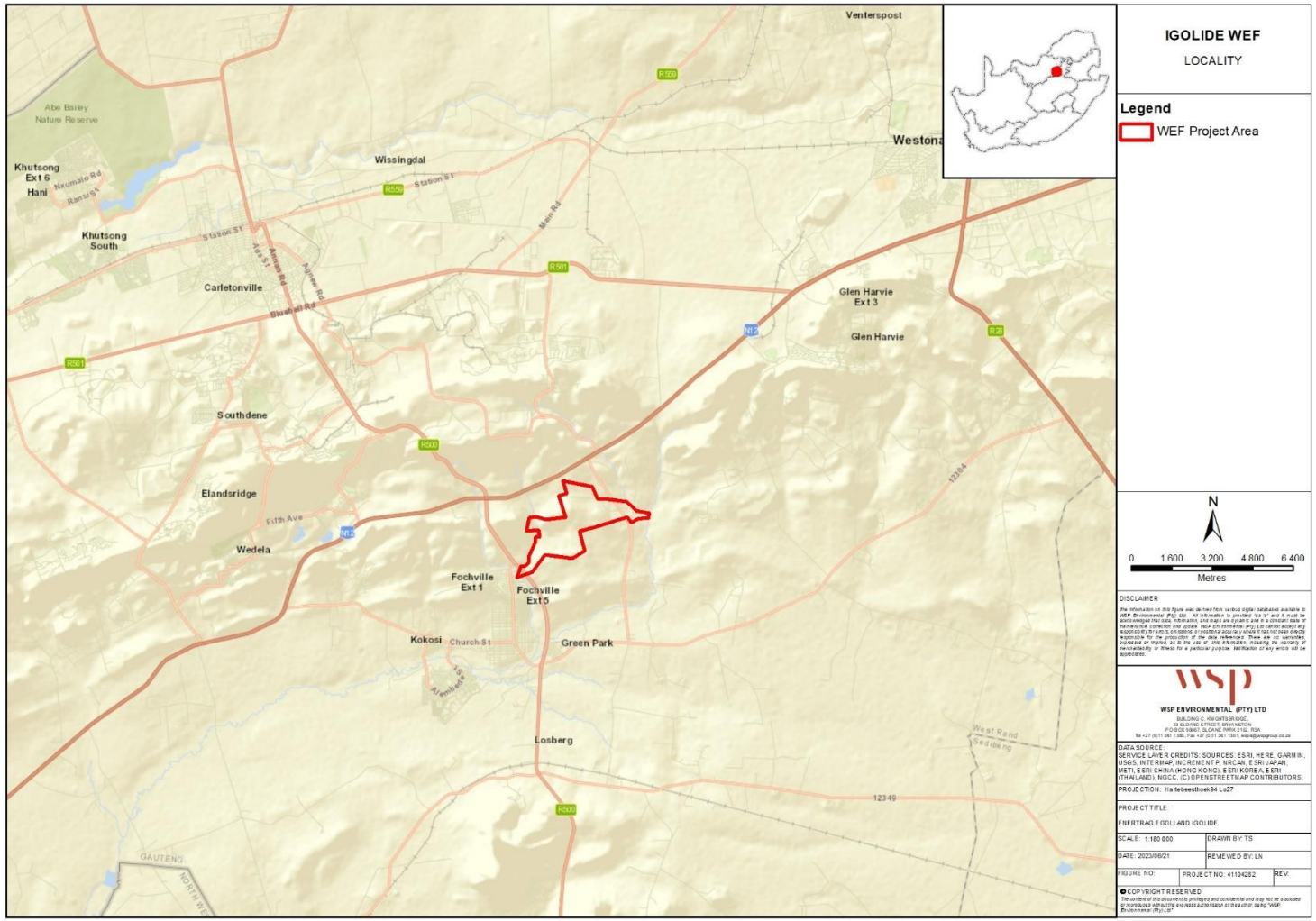

Figure 2-1 - Propose Project Locality Map

3 APPLICABLE LEGISLATION, POLICY AND STANDARD

Biodiversity-related South African legislation and policy requirements that were used to guide this scoping assessment 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.

4 METHODOLOGY

The aquatic biodiversity baseline description and preliminary 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 was compiled at a desktop level. A field survey of the study area is proposed during the impact assessment phase. The objective and tasks associated with the scoping phase is 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 (~130ha) has been identified where the WEF and associated infrastructure is planned to be constructed (Figure 4-1).
- Local Study Area (LSA); 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 biodiversity receptors (i.e. wetlands / aquatic ecosystems) could occur (Figure 4-1).

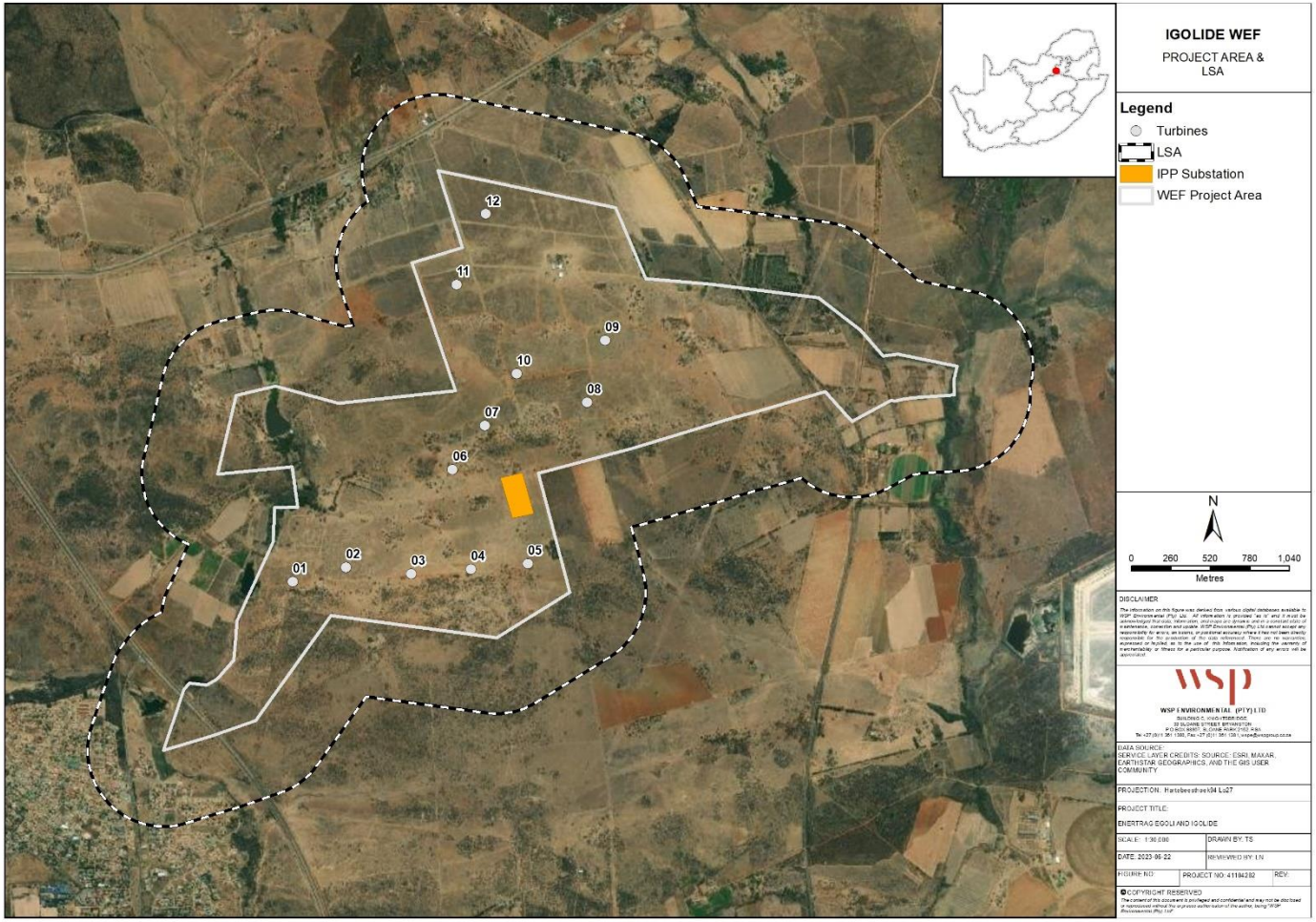

Figure 4-1 - Proposed Project Study Area and Project Area

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 Project's area of influence, key wetland processes and function, and the likely composition and structure of local riparian and 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 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; and

2) National spatial planning datasets, namely the Gauteng Biodiversity Sector Plan (freshwater), National Freshwater Ecological Priority Areas (NFEPA), National Wetland Map version 5 (NWM5), 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 taking into account 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), 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;
- Stream flow regulation;
- Sediment trapping;
- Erosion control;
- Toxicant assimilation;
- Carbon storage;
- Biodiversity maintenance;
- Water supply for human use;
- Food for livestock;
- Cultivated foods;
- Tourism and recreation;
- Education and research; and

- Phosphate assimilation;
- Harvestable resources;
- Cultural & spiritual significance.
- Nitrate assimilation;

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 SCOPING LEVEL SCREENING OF IMPACTS AND MITIGATION

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase (Table 4-5). The screening tool is based on two criteria; namely probability (Table 4-6) and consequence (Table 4-7), where the latter is based on general consideration to the intensity, extent, and duration.

Table 4-5 - Significance screening tool

	CONSEQUENCE SCALE				
PROBABILITY SCALE		**1**	**2**	**3**	**4**
	1	**Very Low**	**Very Low**	**Low**	**Medium**
	2	**Very Low**	**Low**	**Medium**	**Medium**
	3	**Low**	**Medium**	**Medium**	**High**
	4	**Medium**	**Medium**	**High**	**High**

Table 4-6 - Probability scores and descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 4-7 - Consequence score descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (Table 4-8) has been applied according to the nature and significance of the identified impacts.

Table 4-8 - Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	Positive Impacts (+ve)
Negligible	Negligible
Very Low	Very Low
Low	Low
Medium	Medium
High	High

4.6 STUDY ASSUMPTIONS AND LIMITATIONS

DATA USED FOR SPECIALIST ASSESSMENTS

- This scoping 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.
- The National Wetland Map 5 database was used to inform the desktop delineation of wetlands onsite. A site verification of these wetlands will be undertaken during the EIA phase.

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 LSA (Figure 5-1).

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

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 Project 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 Project Area to the west, while the perennial Loopspruit SQR C23J-01487 drains the Project 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 Project 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 Project 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-catchment 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.

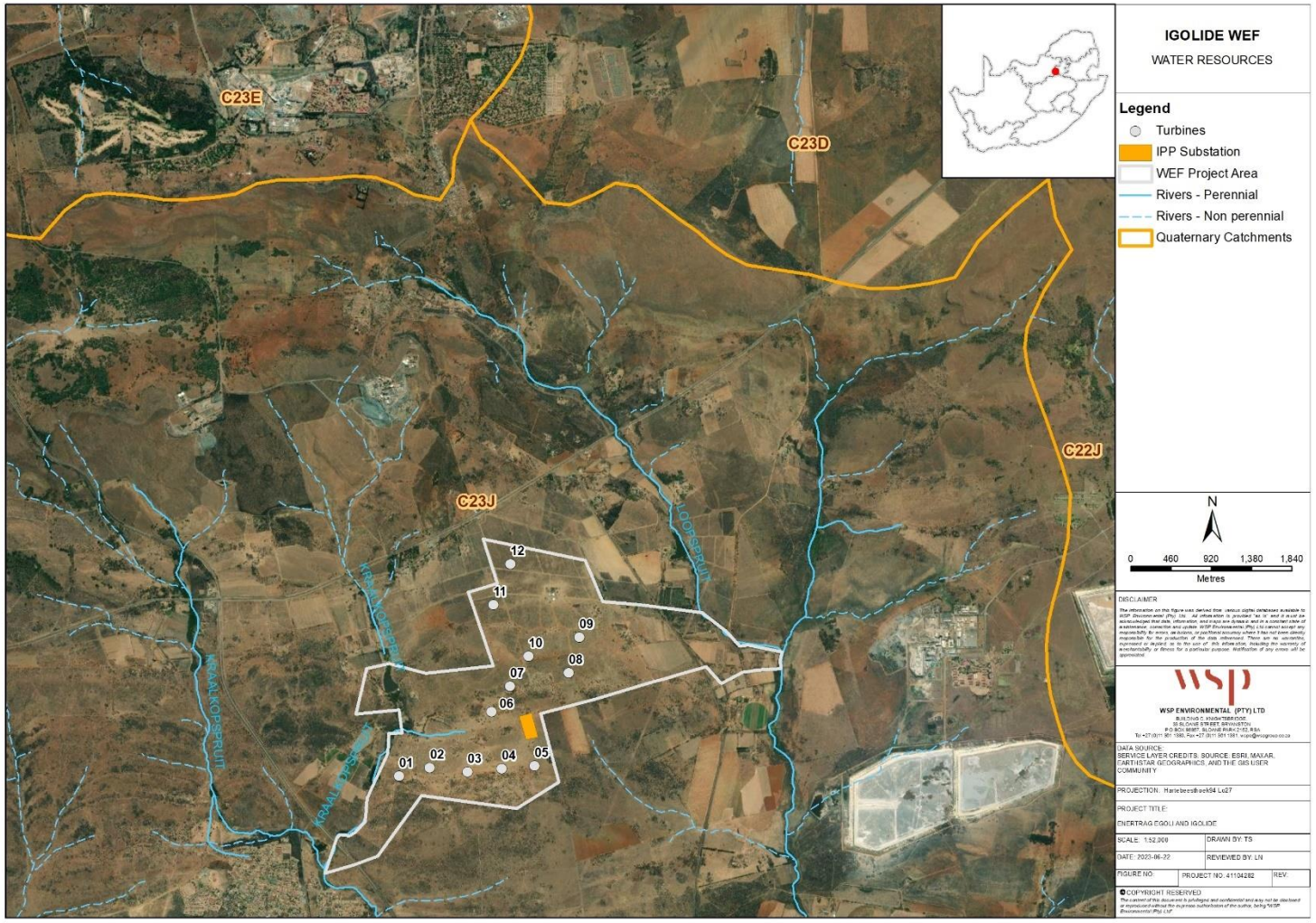

Figure 5-2 - Water Resources in the Study Area

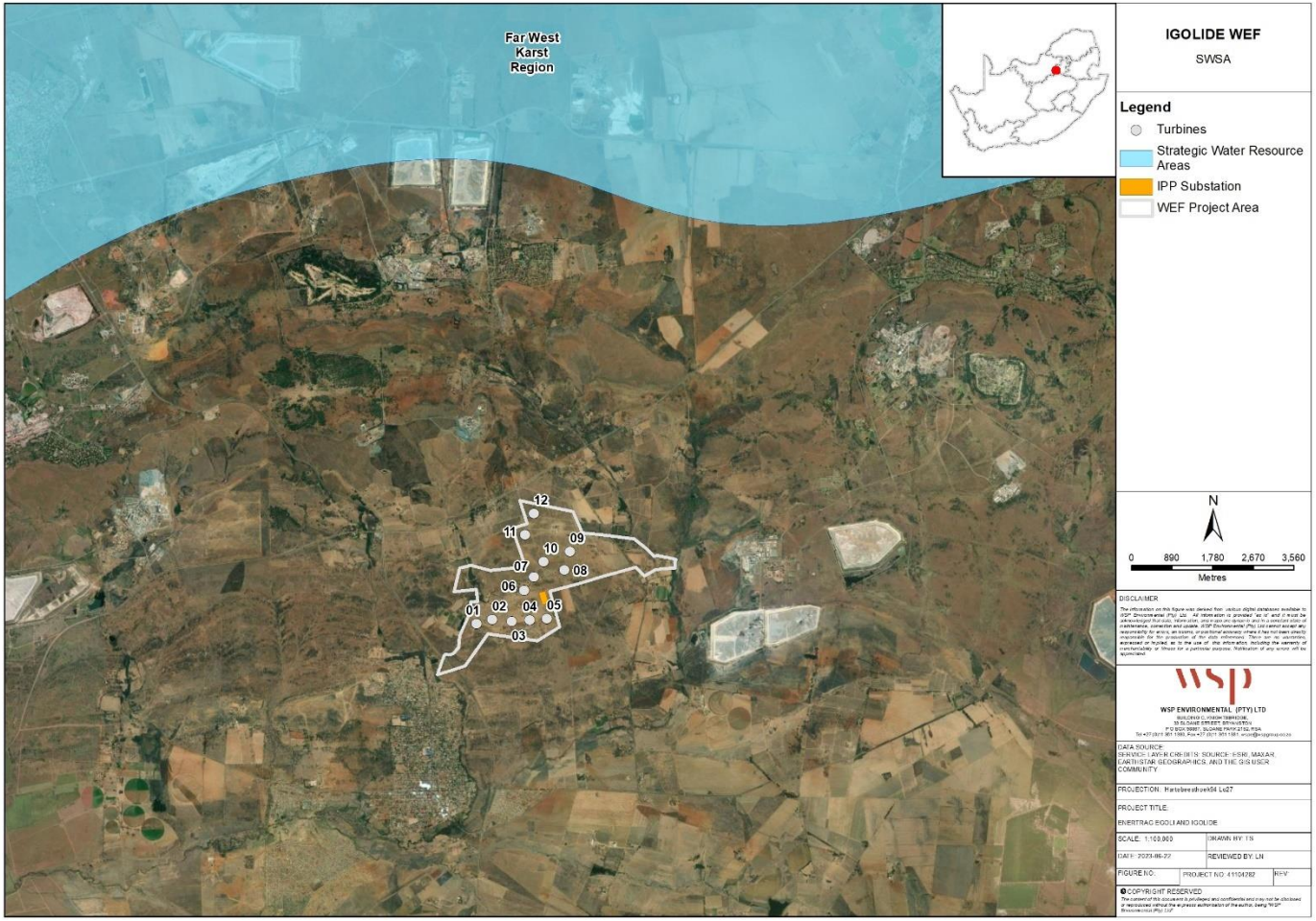

Figure 5-3 - Study Area in relation to SWSA

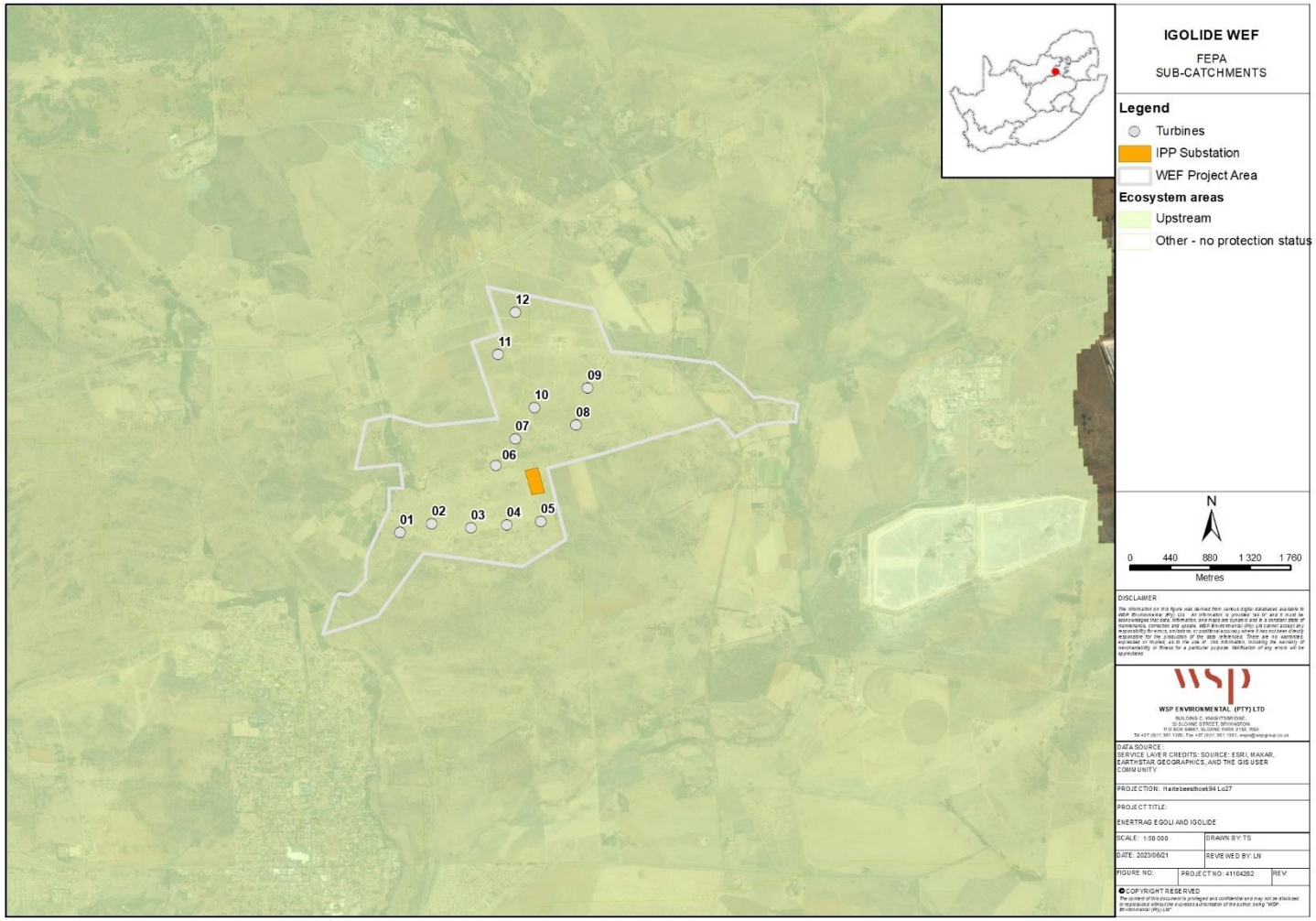

Figure 5-4 - FEPA Sub-Catchments in relation to the Study Area

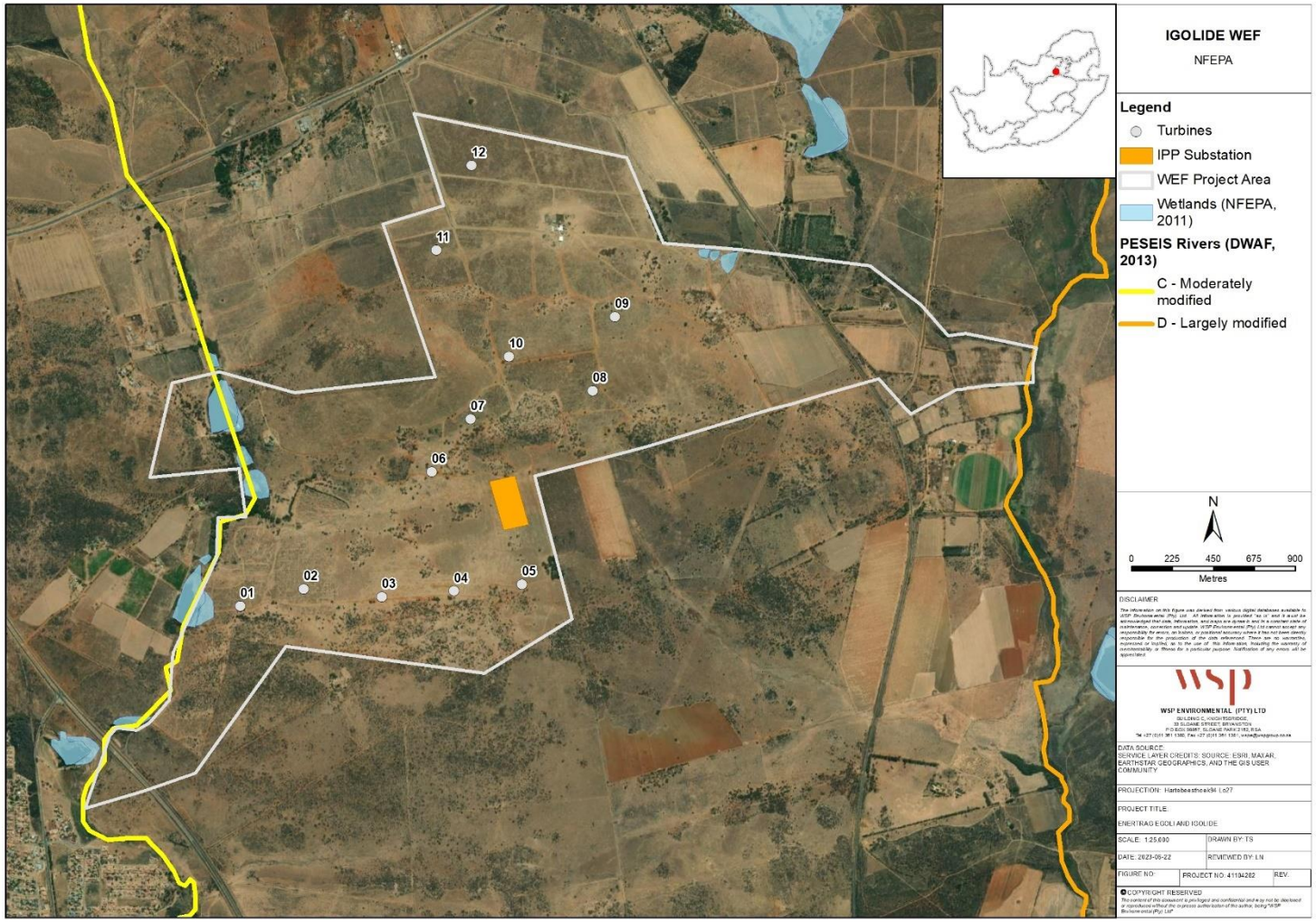

Figure 5-5 - NFEPA Wetlands and Rivers within the Study Area

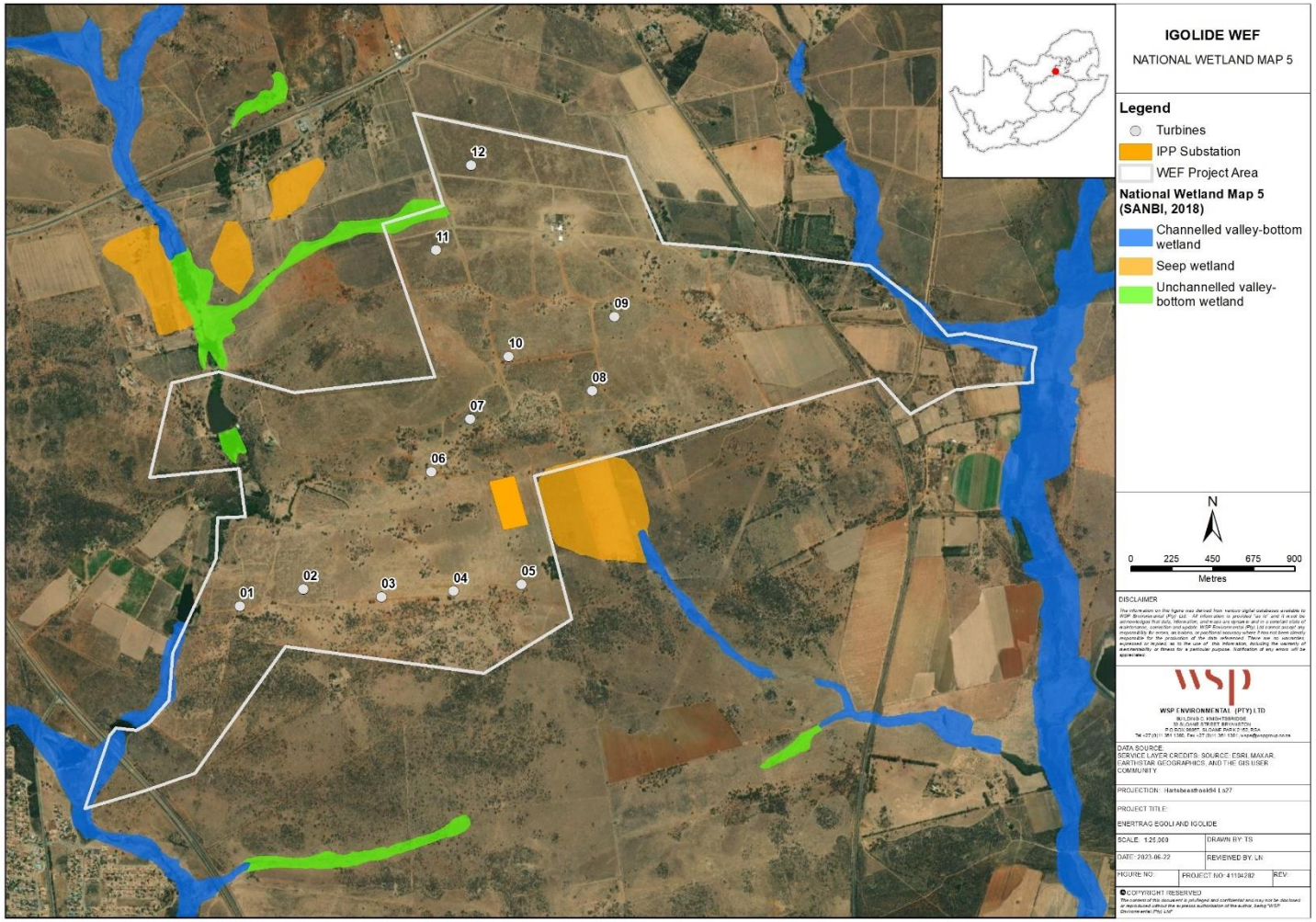

Figure 5-6 - National Wetland Map 5 Wetlands on site

5.6 BASELINE AQUATIC BIOMONITORING LOCATIONS

WETLANDS

At a desktop level 14 wetlands were identified and mapped within the Project Area, these are indicated in Table 5-1 and Figure 5-7. Although the wind turbines location avoids direct wetland habitat, they are still within a 500 m regulated buffer of a wetland (Figure 5-7). Based on the NWM5, majority of the wetlands on site are considered Largely Modified (PES-D), which means that a large loss of natural habitat and basic ecosystem has occurred as a result of land use impacts within the wetland and the catchment. Current impacts identified at a desktop level include, current and old farming activities, impoundment of flow at dams, hardened surfaces at road crossings and at residential settlement.

Table 5-1 – Summary of wetlands identified (NWM5, 2018)

Unit #	Wetland Unit	Area (Ha)	PES Category
1	SEEP	27.40	D- Largely Modified
2	SEEP	4.16	D- Largely Modified
3	SEEP	0.44	D- Largely Modified
4	SEEP	1.68	D- Largely Modified
5	SEEP	0.00	D- Largely Modified
6	Channelled Valley Bottom	4.98	D- Largely Modified
7	Channelled Valley Bottom	0.53	D- Largely Modified
8	Channelled Valley Bottom	1.16	D- Largely Modified
9	Channelled Valley Bottom	27.79	D- Largely Modified
10	Channelled Valley Bottom	7.88	C- Moderately Modified
11	Channelled Valley Bottom	13.15	D- Largely Modified
12	Unchanneled Valley Bottom	1.53	D- Largely Modified
13	Unchanneled Valley Bottom	15.09	D- Largely Modified
14	Channelled Valley Bottom	19.15	D- Largely Modified

FRESHWATER

The proposed Project monitoring points (Figure 5-8) have been selected based on the proposed positioning of WEF infrastructure and access roads, and the future need to measure and monitor potential impacts on the various surface water systems that coincide and interact with the proposed infrastructure and activities.

Present Ecological State, Importance and Sensitivity

According to the DWS (2016) desktop data, the Present Ecological State (PES) for the associated Kraalkopspruit and Loopspruit SQRs is *Moderately Modified* and *Largely Modified* respectively. The Ecological Importance and Sensitivity (EIS) for the Kraalkopspruit SQR is moderate and high respectively, and moderate for the Loopspruit SQR. The EIS categories are based on the diversity of fish and aquatic macroinvertebrate taxa expected to occur within these systems and their sensitivities to water quality modifications (Table 5-2 and Figure 5-5).

Table 5-2 - Desktop Present Ecological State, Importance and Sensitivity for the focus Sub-Quaternary Reaches

River	Kraalkopspruit	Loopspruit
SQR Code	C23J-01507	C23J-01487
Ecological Category	**C**	**D**
Category Description	Moderately Modified	Largely Modified
Ecological Importance (EI)	Moderate	Moderate
Ecological Sensitivity (ES)	High	Moderate
No. of fish species	5	4
No. of aquatic invert taxa	42	41

Expected Fish Species and Aquatic Macroinvertebrate Taxa

The expected fish species and aquatic macroinvertebrate taxa for the SQRs associated with the proposed project are presented in Table 5-3 and Table 5-4 respectively. Five fish species are expected, all of which are categorized as Least Concern (LC) according to the IUCN Red List of Threatened Species. The fish species tolerances to modified water quality and no-flow conditions vary between tolerant to moderately Intolerant.

A total of 42 aquatic macroinvertebrate taxa are expected within the study area. The community assemblage is predominantly comprised of taxa with a high preference for slow flows, and with very low sensitivities toward water quality modifications. Few taxa have a high requirement for fast flowing water (i.e., Ceratopogonidae, Chironomidae, Simuliidae, Tipulidae and Ancylidae).

Table 5-3 - Expected fish species, respective tolerance/intolerance to water quality modifications and no-flow conditions and IUCN conservation status

SQR		Fish Species	Tolerance		Conservation Status
			Modified Water Quality	No-Flow	
C23J-01507	C23J-01487	*Tilapia sparrmanii*	Tolerant	Tolerant	LC
		Enteromius anoplus	Moderately tolerant	Moderately tolerant	LC
		Enteromius paludinosus	Tolerant	Moderately tolerant	LC
		Pseudocrenilabrus philander	Tolerant	Tolerant	LC
		Enteromius pallidus	Moderately Intolerant	Moderately tolerant	LC

Table 5-4 – Expected aquatic macroinvertebrates

Family names		
Turbellaria	Gerridae	Chironomidae
Oligochaeta	Hydrometridae	Culicidae
Hirudinea	Naucoridae	Muscidae
Potamonautidae	Nepidae	Psychodidae
Atyidae	Notonectidae	Simuliidae

Family names		
Hydracarina	Pleidae	Syrphidae
Baetidae > 1 sp	Veliidae/mesoveliidae	Tabanidae
Caenidae	Hydropsychidae 1 sp	Tipulidae
Coenagrionidae	Hydroptilidae	Ancylidae
Aeshnidae	Leptoceridae	Lymnaeidae
Gomphidae	Dytiscidae	Physidae
Libellulidae	Gyrinidae	Planorbinae
Belostomatidae	Hydrophilidae	Corbiculidae
Corixidae	Ceratopogonidae	Sphaeriidae

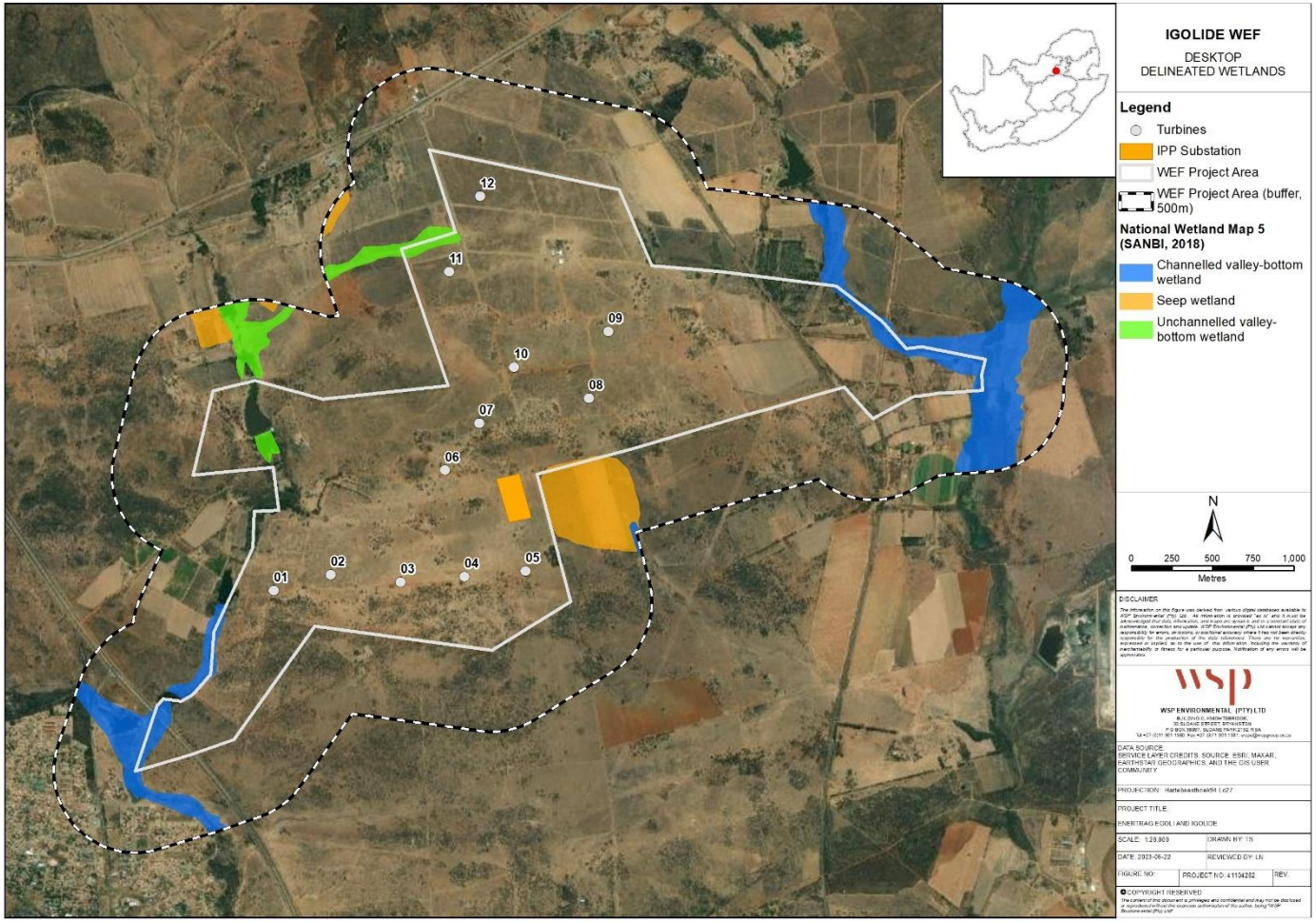

Figure 5-7 - Desktop Delineated Wetlands (NWM5)

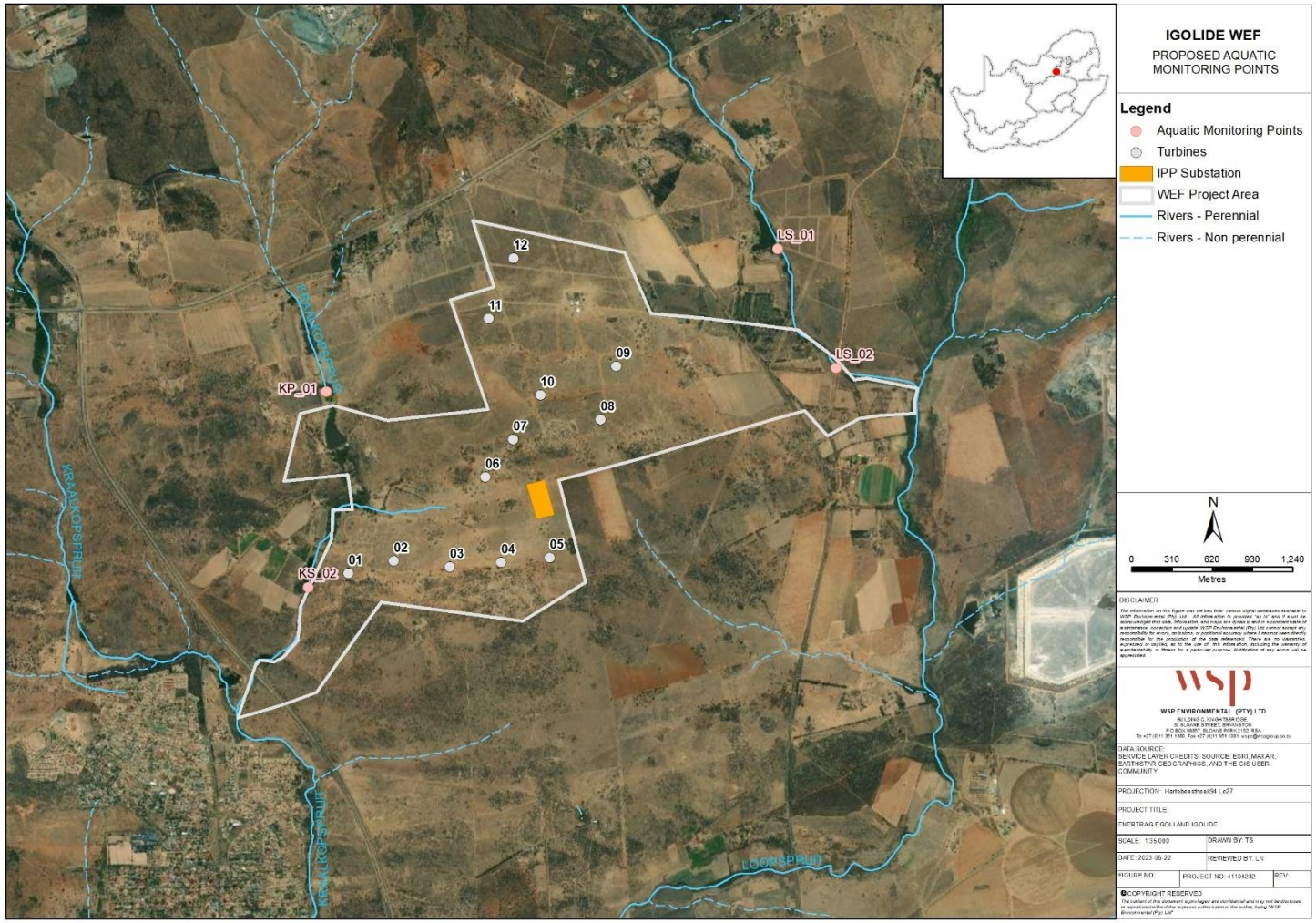

Figure 5-8 - Proposed Aquatic Biomonitoring Points

6 SITE VERIFICATION OUTCOME

The findings of the site sensitivity verification exercise, based on the data gathering activities conducted to date (review and consolidation of available desktop data) together with the anticipated reporting requirement as stipulated by the various protocols, are summarised in Table 6-1.

Table 6-1 - Site sensitivity verification results

Theme	Screening tool sensitivity	Site-based sensitivity	Motivation	Scoped report requirement
Aquatic biodiversity	Very high	High	Presence of wetland CBA and FEPA sub-catchment	Aquatic Biodiversity Specialist Assessments, covering wetland and riparian systems

7 SCREENING OF POTENTIAL IMPACTS

The construction and operation of the proposed new infrastructure is anticipated to result in the following key impacts on aquatic biodiversity receptors:

- Loss and disturbance of wetland habitat.
- Interuption of surface hydrology
- Establishment and spread of alien and invasive species.
- Contamination and disturbance of aquatic (riparian) ecosystems
- Increased potential for erosion of wetland soils
- Changed land-use in affected catchments.

The outcomes of the screening of the potential impacts are summarised in Table 7-1 and described in detail in the following sections.

7.1 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 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, construction of wetland/riparian system crossings causing impoundments/barriers to movement for aquatic species, 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 7-1.

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, which is outside of wetland habitat, this impact is expected to have a medium propobility of occurrence and a medium impact consequence, resulting in a Medium impact significance prior to the implementation of mitigation measures and can be reduced to a Low significance with the application of recommended mitigation measures.

Should any wetland habitat be lost this impact cannot be mitigated and wetland offset will be required.

CHANGES IN WETLAND HEALTH/FUNCTIONING

Bulk earthworks involved in site development in the immediate catchment of wetlands have the potential to cause indirect impacts on nearby 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, the potential impact could be moderately severe, and the likelihood highly probable, resulting in an impact of Medium significance. Mitigation measures to address the potentially reduced wetland functioning, such as distribution of flow around turbine foundations and road crossing to affected downslope wetland systems could reduce the consequence of the potential impacts and likelihood of occurrence of the potential impact.

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, is considered highly probable during the construction phase, and could be moderately severe, resulting in an impact of Medium significance. The residual impact can be reduced to Low significance with the application of the recommended mitigation measures, which would reduce the likelihood of the impact occurring as predicted.

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 could lead to increased runoff, ultimately resulting in soil erosion. The occurrence of soil erosion is considered moderately probable during construction and could have a moderate consequence on wetland soil, resulting in a Medium impact significance without mitigation. With the implementation of mitigation measures it is anticipated that the probability and consequence of this impact can be reduced, ultimately resulting in a residual impact of Low 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, the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium 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 probability of the impact occurring can be reduced, resulting in a residual impact of Low significance

7.2 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 consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium 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 operational phase, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance.

SOIL EROSION

The increased presence of hardened surfaces in the study area as a result of access roads could potentially exacerbate soil erosion, through increased and concentrated surface run off. This impact is assessed as having a medium probability of occurrence with a medium impact severity resulting in an impact of Medium significance prior to mitigation. With the implementation of the recommended mitigation measures, this impact may have a residual impact of Low significance on wetland soils.

Table 7-1 – Aquatic Biodiversity Impact Summary

ACTIVITY	POTENTIAL IMPACT	AFFECTED RECEPTORS	PHASE In which impact is anticipated	Probability	Consequence	Significance without Mitigation	Probability	Consequence	Significance with Mitigation
Bulk earthworks and clearance of vegetation in construction footprint	Direct loss of wetland habitat	Wetland habitats	Construction	3	3	Medium	2	2	Low
	Erosion	Wetland soils	Construction	3	3	Medium	2	2	Low
	Establishment and spread of AIS	Wetland habitat	Construction	3	2	Medium	2	2	Low
	Catchment land use changes and activities	Changes in wetland health/ functioning	Construction, operation	3	3	Medium	2	2	Low
		Contamination of riparian systems	Construction, operation	3	3	Medium	2	2	Low
Presence of new access roads and maintenance of WEF	Spread of AIS	Wetland habitat	Operation	3	3	Medium	2	2	Low
	Increased run-off, Erosion	Wetland soils	Operation	3	3	Medium	1	2	Low

8 MITIGATION MEASURES

Mitigation measures that are designed to avoid and minimise the loss and degradation of the wetland habitat and function 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 to the extent possible. 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 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 around the 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 Gauteng Biodiversity Sector Plan.
- 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.

9 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.
- Bi-annual aquatic ecosystem monitoring for duration of construction, and possibly during operation should significant impacts be predicted.

10 ADDITIONAL PLANNED STUDIES TO BE COMPLETED DURING ESIA

Field verification and data gathering surveys and impact assessments that will be conducted at ESIA phase and will include the following:

- Aquatic Biodiversity Specialist Assessment:
  - Update of the wetland and aquatic baseline description with scientifically-determined buffer zones, and assessment of the Present Ecological Status and Ecosystem Importance and Sensitivity, as required
  - Updated impact assessment, using NEMA-prescribed methods.
  - Finalised mitigation measures for inclusion in the Project EMPr.

11 REFERENCES

Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998.

DWAF (2008) Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa

DWAF (1999). Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems.

Kleynhans CJ, Louw MD., 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 329/08.

Kotze, D. C., Macfarlane, D. M. & Edwards, R. J., 2020. WET-EcoServices (Version 2): A technique for rapidly assessing ecosystem services supplied by wetlands and riparian areas. Final Report. WRC Project K5/2737., Pretoria, South Africa: Water Research Commission.

Kotze, D., Macfarlane, D., Edwards, R., Mander, M., Collins, N., Texeira-Leite, A., Lagesse, J., Pringle, C., Marneweck, G., Batchelor, A. and Lindley, D., 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.

Le Maitre, D.C., Seyler, H., Holland, M., Smith-Adao, L.B., Maherry, A., Nel, J.L. and Witthuser, K. (2019). Strategic water source areas: Vital for Souht Africa's Water, Food and Energy Security. Water Research Commission, SP 128/19.

Macfarlane, D., Holness, S.D., von Hase, A., Brownlie, S. & Dini, J., 2014. Wetland offsets: a best-practice guideline for South Africa. South African National Biodiversity Institute and the Department of Water Affairs. Pretoria.

Macfarlane, D. & Bredin, I., 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No. TT 715-1-17, South Africa: Water Research Commision (WRC).

Macfarlane, D.M., Ollis, D.J., and Kotze, D.C. (2020). WET-Health Version 2.0: A refined suite of tools for assessing the present ecological state of wetland ecosystems- technical guide. Water Research Commission. Report No. TT820/20

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, M. (2008). WETHealth: A technique for rapidly assessing wetland health. WRC Report No. TT 340/09. Water Research Commission, Pretoria.

Nel, J. L. & Driver, A., (2012) National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater Component. Council for Scientific & Industrial Research (CSIR) Report No. CSIR/NRE/ECO/IR/2012/0022/A., Stellenbosch: CSIR.

Rountree, M.W., Malan, H.L. and Weston, B.C. (2013). Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/13. Water Research Commission, Pretoria.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. (2013). Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Strategic Water Source Areas (SWSA) (2017) South African National Biodiversity Institute. Accessed at http://bgisviewer.sanbi.org.

van Deventer, H., van Niekerk, L., Adams, J., Dinala, M. K., Gangat, R., Lamberth, S.J., Lotter, M., Mbona, N., MacKay, F., Nel, J.L., Ramjukadh, C-L., Skowno, A. and Weerts, S. P. (2019). National Wetland Map 5 – An improved spatial extent and representation of inland aquatic and estuarine ecosystems in South Africa. bioRxiv preprint first posted online May. 17, 2019; doi: http://dx.doi.org/10.1101/6404.

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

wsp.com