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**WATERCOURSE REHABILITATION, MAINTENANCE AND
MANAGEMENT PLAN FOR THE PROPOSED 86 MW OYA WIND
ENERGY FACILITY (WEF), AND ASSOCIATED INFRASTRUCTURE
BETWEEN SUTHERLAND AND MATJIESFONTEIN IN THE
WESTERN AND NORTHERN CAPE PROVINCES**

Prepared for

G7 Renewable Energies (Pty) Ltd

November 2020

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Report Reference: FEN 20-0054
Date: November 2020



SAS Environmental Group of Companies

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GLOSSARY OF TERMS

Alien Invasive plant species:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: <ul style="list-style-type: none"> • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Delineation	To determine the boundary of a wetland based on soil characteristics, vegetation and hydrological indicators.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may, in turn, have an influence on the ecological characteristics and functioning of wetlands.



LIST OF ABBREVIATIONS

AIP	Alien and Invasive Plant
CAS	Conventional Activated Sludge
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EDRR	Early Detection and Rapid Response
EIS	Ecological Importance and Sensitivity
GA	General Authorisation
GN	Government Notice
MEA	Millennium Ecosystem Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Areas
NRCS	Natural Resources Conservation Service
NWA	The National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
RMO	Recommended Management Objective
RoD	Record of Decision
SACNASP	South African Council for Natural Scientific Professions
SAS	Scientific Aquatic Services
SDP	Site Development Plan
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WRMP	Watercourse Rehabilitation and Management Plan



1 INTRODUCTION

1.1 Background

FEN Consulting (Pty) Ltd was appointed to compile a Watercourse Rehabilitation and Management Plan (WRMP) in terms of the Section 21 (c) and (i) water uses as per the National Water Act, 1998 (Act No. 36 of 1998) and Appendix 6 of Government Notice (GN) 326 of 2017 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) to provide technical specialist input for the proposed Oya Wind Energy Facility (WEF), between Matjiesfontein and Sutherland in the Northern and Western Cape Provinces. Please refer to Section 2 for the project description. This report serves to provide mitigation measures within the rehabilitation process for the proposed activities associated with the various watercourses identified within the project site.

The purpose of this WRMP was prepared to include objectives to achieve the two (2) overarching targets (Figure 1), thereby ensuring negative impacts on the identified watercourses associated with the proposed Oya WEF development are rehabilitated, managed, and monitored.

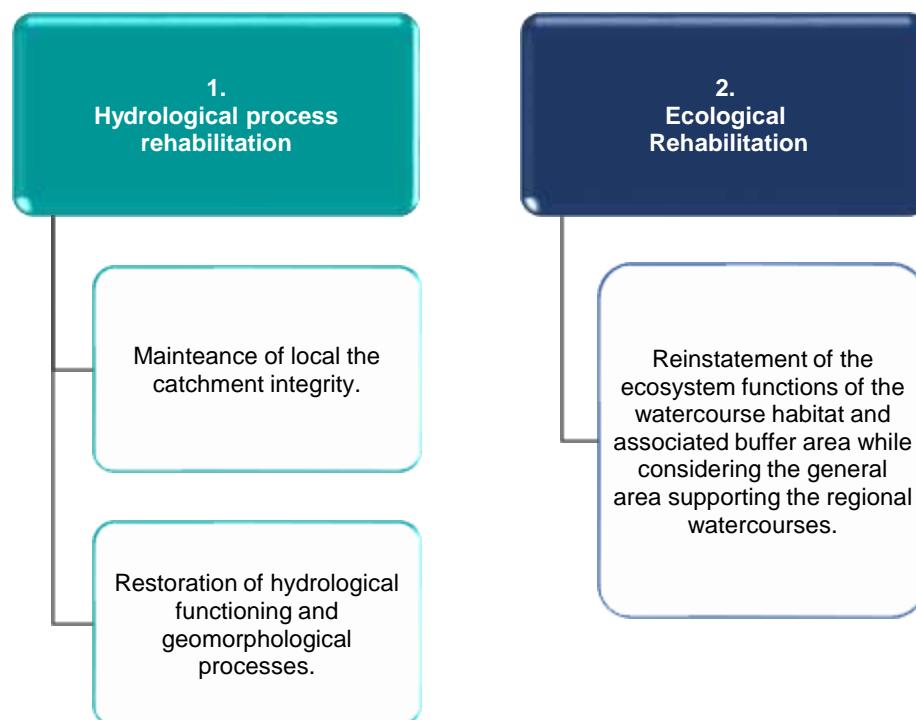


Figure 1: An illustration of the two (2) overarching targets - 1) hydrological process rehabilitation aiming to ensure the local catchment integrity is maintained, and hydrological function as well as geomorphological processes are restored and 2) ecological rehabilitation focus aimed to reinstate the ecosystem functions of watercourse habitat.

This WRMP is seen as a critical component of the project and should be implemented by the proponent as soon as it has been approved by the relevant authorities and once the proposed Oya WEF development has reached a stage rehabilitation activity become viable.



1.2 Structure of this report

This report investigates the need for rehabilitation and maintenance activities for the proposed Oya WEF development, from a watercourse management perspective. The report has been structured in the following way:

Chapter 1: Introduction

Provides an introduction, the structure of this report as well as the including the principles and objectives of this WRMP.

Chapter 2: Legislative Framework and Key Objectives

Provides all relevant legislation that was considered as part of the compilation of this report as well as the key objectives of this WRMP.

Chapter 3: Project Description

Provides the locality of the development and the proposed Oya WEF development plan.

Chapter 4: Receiving Freshwater Environment

This section includes a summary of the site assessment findings undertaken by FEN Consulting (Pty) Ltd during October and November 2020 and visually represents the watercourses.

Chapter 5: Watercourse Rehabilitation and Management Plan

This section comprises site specific details pertaining to the construction mitigation and rehabilitation measures that must be implemented. A list of the roles and responsibilities of all individuals involved in the implementation of this WRMP is provided.

Chapter 6: Conclusion and Recommendations

This section summarises the key findings and recommendations based on the recommended rehabilitation and management actions listed and the overall requirements in order to ensure the best rehabilitation of the watercourses as part of the proposed WEF development.

2 PROJECT DESCRIPTION

The proposed Oya WEF is located between Matjiesfontein and Sutherland, within the Northern and Western Cape Provinces (Figure 2 and 3), over a variety of farm portions. Technical information pertaining to the proposed Oya WEF development is provided in Table 1 below.

Table 1: Technical details pertaining to the proposed Oya WEF development.

Overall capacity	86MW
Number of turbines	20
Hub height	92 m about foundation
Rotor diameter	150 m
Blade length	75 m
Wind measuring lattice masts	2 x met masts (same as hub height)
Layout	Layout submitted for final approval
EMPr	Approve Final EMPr

Additional to the above, internal access roads, underground cabling and an overhead power line as part of the collector system and an onsite construction camp will be developed. The proposed access road will traverse several watercourses; however, all other infrastructure components will be located at least 32 m from the delineated extent of a watercourse. At the time of compilation of this report, no designs for the proposed watercourse road crossings were available. Once these designs become available it is recommended that the freshwater specialist review the designs to determine if the mitigation measures as presented in this report is adequate.



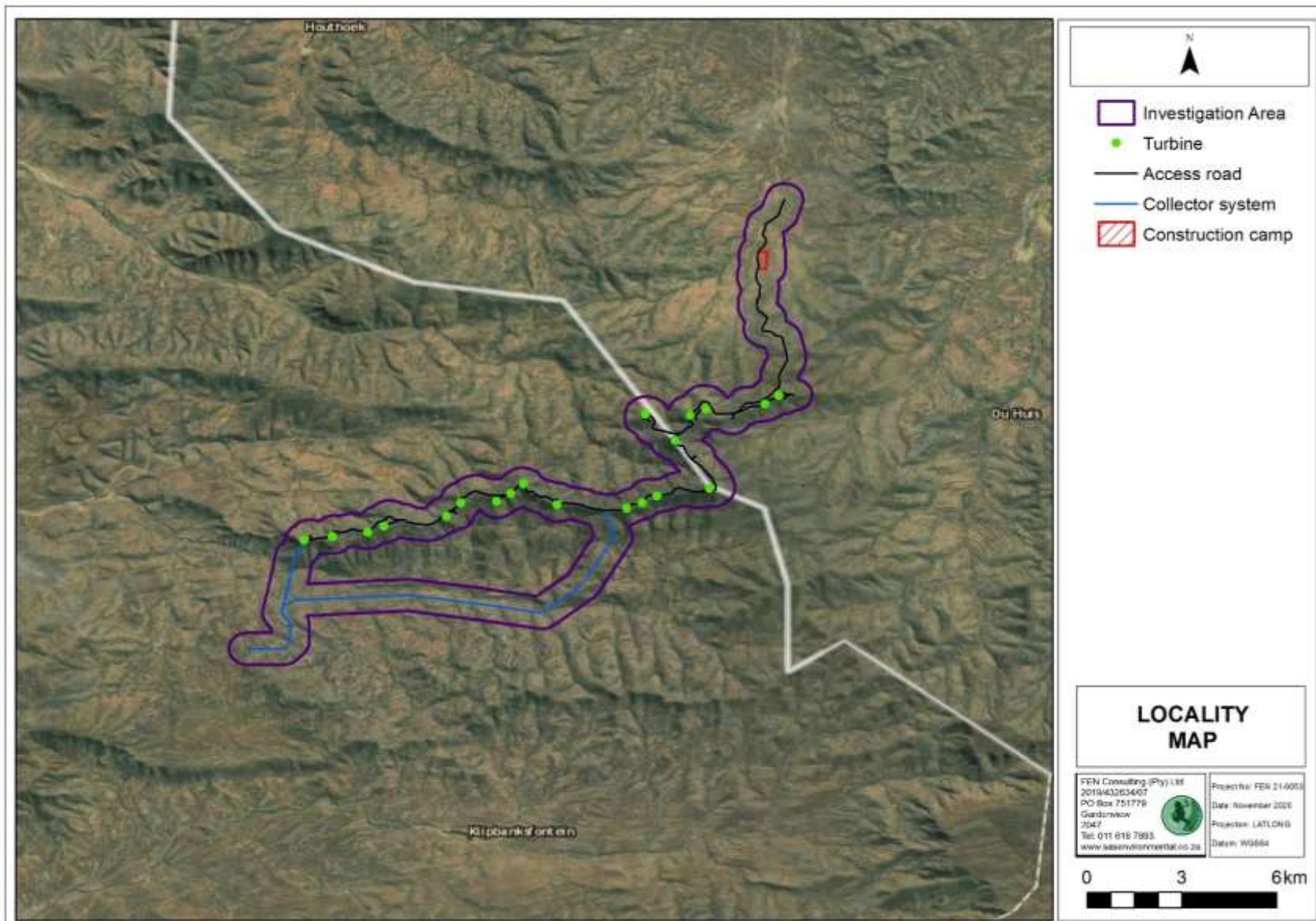


Figure 2: Digital satellite image depicting the proposed Oya WEF development in relation to the surrounding areas.



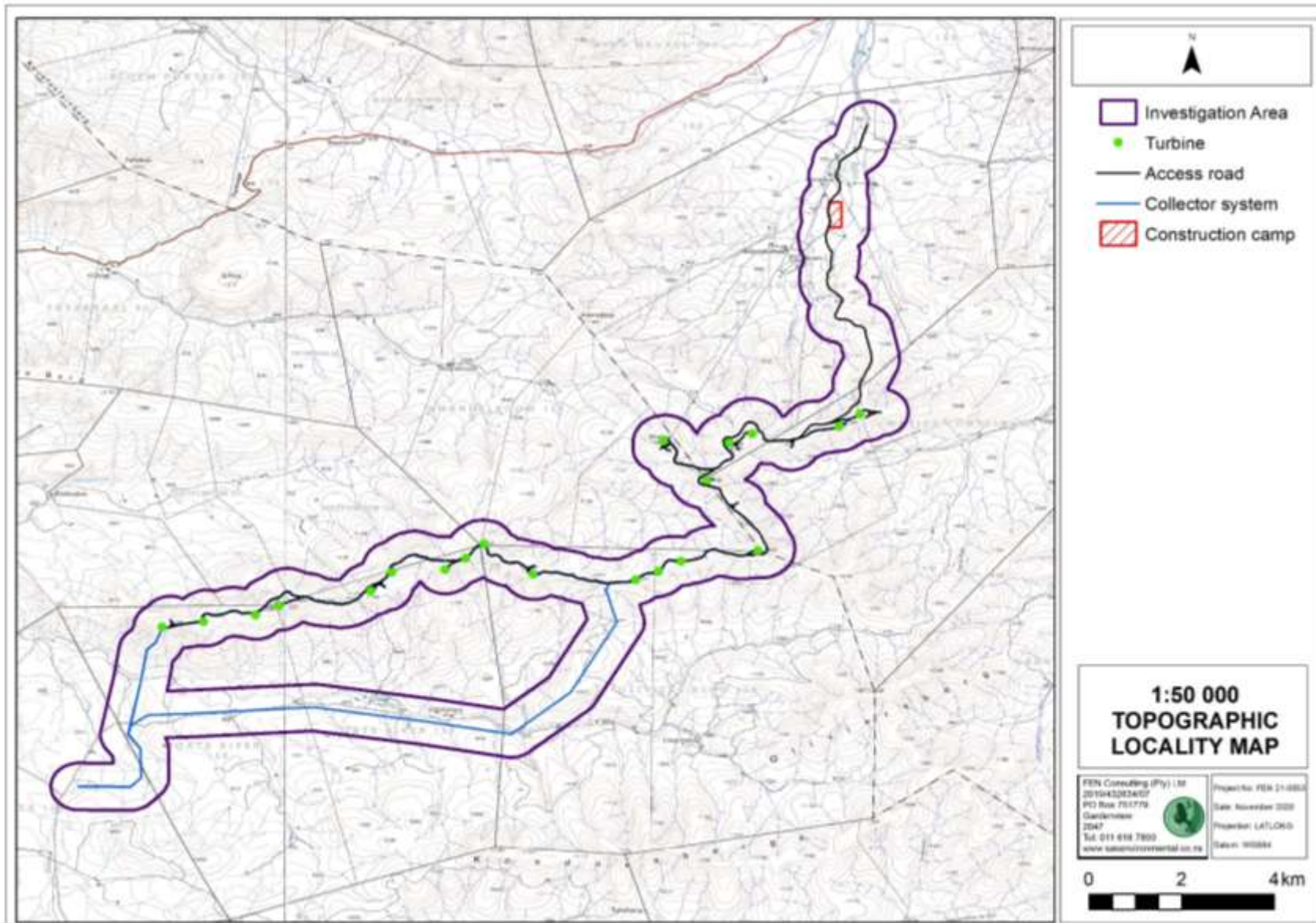


Figure 3: Location of the proposed Oya WEF development and investigation areas depicted on a 1:50 000 topographical map in relation to surrounding areas.



3 LEGISLATIVE FRAMEWORK AND KEY OBJECTIVES

The following legislative documents were considered and the aspects which are pertinent to watercourse management including the rehabilitation of disturbed areas, were utilised. Further details of each is provided in **Annexure B** as well as the WRMP principles and objectives framework.

- The Constitution of the Republic of South Africa, 1996¹;
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) lists the following activities as water uses:

- Section 21 (c): impeding or diverting the flow of water in a watercourse; and
- Section 21 (i): altering the bed, banks, course or characteristics of a watercourse.

4 RECEIVING FRESHWATER ENVIRONMENT

The following information on the ecological characteristics of the proposed Oya WEF development are taken from FEN Consulting (2020) entitled: “Freshwater Ecological Assessment as part of the water use authorisation process for the proposed 86 MW Oya Wind Energy Facility (WEF) and the 239 MW Kudusberg WEF and associated infrastructure between Sutherland and Matjiesfontein in the Western and Northern Cape Provinces” which also provides further information if required. Table 2 below provides an overview of the desktop database investigation while Table 3 presents the outcome of the freshwater ecological assessment. The delineations of watercourses associated with the proposed Oya WEF development are visually depicted in Figure 4 to 10.

Table 2: A summary of outcomes from the desktop database assessment as presented in FEN Consulting (2020).

Desktop database information	
Ecoregion	Great Karoo
Catchment	Olifants - Cape
Quaternary Catchment	E22B, E232, E23B, E23G, E23H
WMA	Olifants/Doorn
Wetland Vegetation Type (Mbona <i>et al</i> , 2015)	The investigation area is located in the Karoo Shale Renosterveld Wetland Vegetation type (least threatened) and the Rainshadow Valley Karoo (Skv) Wetland Vegetation type (critically endangered). The threat status of each wetland vegetation type is provided by Mbona <i>et al</i> . (2015).

¹ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the ‘Constitution of the Republic of South Africa, 1996’. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



<p>Western Cape Biodiversity Spatial Plan (2017)</p>	<p>According to the Western Cape Biodiversity Spatial Plan (2017), several areas within the most western and southern portions of the investigation area are classified as Critical Biodiversity Areas (CBA) 1, of watercourse and terrestrial ecological importance. CBAs are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure, in this case specifically for riverine environments. CBA 1 are areas likely to be in a natural condition.</p> <p>The headwaters of the regional drainage network as identified by the topographical map are considered to be Ecological Support Areas (ESAs) 1 (of aquatic importance). ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. ESA 1 are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. Small areas classified as ESA 2 are also located in the investigation area. ESA 2 are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas (PAs) or CBAs and are often vital for delivering ecosystem services.</p> <p>All other remaining areas in the investigation area are considered to be Other Natural Areas (ONAs). These are areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.</p>
<p>Importance of the investigation area according to the Critical Biodiversity Areas of the Northern Cape (2016)</p>	<p>According to the Critical Biodiversity Areas of the Northern Cape (2016), the investigation area is located within several areas classified as Ecological Support Areas (ESAs) and Other Natural Areas (ONAs). ESAs are areas that are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning in Critical Biodiversity Areas (CBAs). ONAs are areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem</p>

Table 3: A summary of outcome of the watercourse ecological assessment as presented in FEN Consulting (2020).

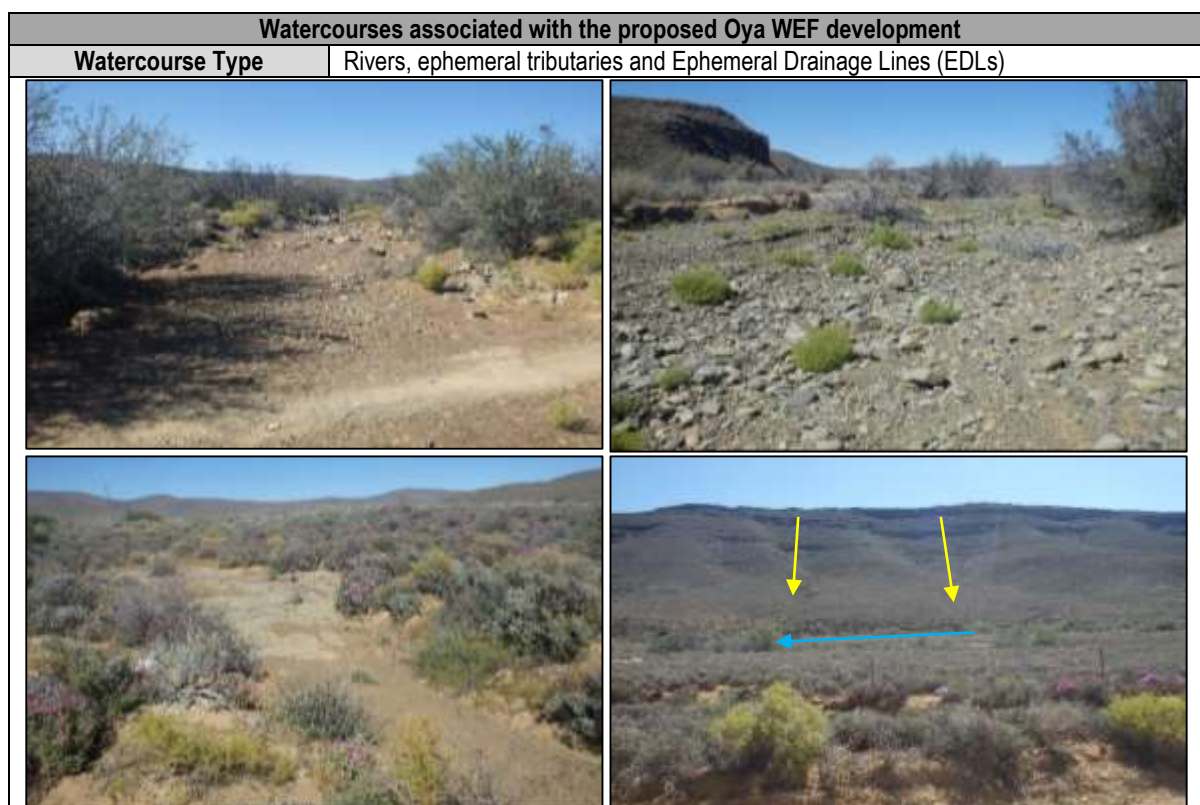


Figure 4: Representative photographs of the watercourses associated with the proposed Oya WEF development. (Top left) a photograph of the ephemeral tributary of the Windheuwels River located east of the proposed construction camp.



<p>The active channel of these tributaries consists of a shallow layer of alluvial soil; (Top right) a photograph depicting the Ongeluks River; (Bottom left) An EDL associated with the Windheuwels River drainage system. These drainage lines are clearly defined by an unvegetated channel of exposed bedrock. No significant change between the vegetation associated with the edge of the drainage line channel to that of the surrounding terrestrial area is evident. (Bottom right) Typical topographical setting of the project area, displaying the locality of the headwater drainage lines (yellow arrow) flowing into an ephemeral tributary (blue arrow).</p>	
<p>Aquatic IHI discussion (as per BlueScience (2018))</p>	<p>IHI Riparian PES Category: A/B (Largely natural with few modifications) Based on the assessment of the habitat integrity of the watercourses, BlueScience (2018) reports that the instream and riparian habitat integrity of the upper reaches of the watercourses are considered to be unmodified and natural. Their middle reaches and the middle reach of the Windheuwels River has seen some modification but is still reported to be in a largely natural ecological condition. The riparian habitat of the Windheuwels River is slightly more degraded as a result of direct habitat modification when compared to the reference conditions in both the marginal as well as non-marginal zones. Some disturbance from anthropogenic activity (informal road crossings and artificial instream impoundments) in the immediate surroundings of the watercourses were noted, which has resulted in some bank erosion, an increase in the presence of alien vegetation species and loss of tree diversity within the riparian zone.</p>
<p>Ecoservice provision</p>	<p>Ecoservice Provisioning: 1,5 (Intermediate) Due to the ephemeral nature of these watercourses, their capacity to provide certain ecological services is reduced, although this is counteracted by their relatively intact ecological integrity, which increases its overall functionality. These watercourses are considered important for biodiversity maintenance. As these are ephemeral watercourses, they are of seasonal importance for the supply of water for a variety of faunal species. The watercourses are not considered important for harvestable resources or cultivated foods, mainly due to them being located in a natural water scarce region.</p>
<p>EIS discussion (as per BlueScience (2018))</p>	<p>EIS Category: High (Windheuwels River & vernal pool) and Moderate (ephemeral tributaries and EDLs) The larger watercourses located primarily downgradient of the proposed Oya WEF development (such as the Muishond, Ongeluks, Jakkalshok, Brak, Windheuwels, Wilgebos and Kleinpoorts Rivers), have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a moderate ecological importance and sensitivity. The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries and drainage lines are less ecologically important but more sensitive to flow, water quality and habitat modification. Based on the outcome of the biodiversity assessment undertaken by Ekotrust CC (2018), the watercourses are also considered to be of 'High' sensitivity, due to the good ecological condition of the project site and minimal disturbance thereof. The high sensitivity ranking is attributed to the high level of protected species identified within the watercourses (Ekotrust CC, 2018).</p>
<p>REC Discussion (as per BlueScience (2018))</p>	<p>REC: Category B (Largely natural with few modifications) Considering the natural to largely natural ecological condition of the drainage systems associated with the proposed WEF development and their moderate to high ecological importance and ecological sensitivities, the Recommended Ecological Condition (REC) of these watercourses would be that they remain in a natural ecological condition. This is with the exception of the middle reaches of the Windheuwels and Ongeluks Rivers that are in a largely natural to moderately modified ecological condition as a result of direct habitat modification from the surrounding activities. These rivers should be maintained in their current ecological condition and should not be allowed to degrade further.</p>
<p>Watercourse characteristics:</p>	
<p>Hydraulic regime</p>	<p>Despite a relatively large drainage network associated with each drainage system identified, most of these watercourses only convey water during the wet season and do not consist of water bearing strata with the capacity to store and then to convey water to the downstream larger river systems. As such, discharge into the larger tributaries/rivers from the EDLs are highly variable due to the seasonal nature of the rainfall of the area. When flow occurs within the watercourses, it occurs as a high flow event, which can result in erosion of the stream banks. Notwithstanding the direct crossing of access</p>



	roads and smaller informal roads, the hydrological connectivity and functionality of the watercourses are considered intact.
Geomorphology and sediment balance	Most of the larger tributaries and rivers are characterised by rocky embankments and a shallow layer of alluvial soils over a solid rock bed. Erosion was noted in areas where a high drop has formed, where water drops into a section of the active channel not underlain by bedrock. The geomorphology of the upstream reaches of the EDLs are considered largely intact. Some erosion of the downstream reaches of the EDLs just below the instream impoundments (where applicable) and at road crossings were noted, however, it is not considered significant. Despite erosion noted within isolated areas of the EDLs, no significant deposition of sediment was observed. As surface water is only present during and after rainfall events, sand and sediment are only transported through the EDLs into the tributaries and rivers during high flood periods. Thus, the sediment load of the tributaries and rivers is deemed to be high during flood events.
Water quality	No surface water was present within the watercourses during the site assessment; thus, no water quality parameters could be measured. Nevertheless, due to the relatively remote locality the watercourses (with specific mention of the headwater EDLs) and the low degree of catchment transformation, it can be concluded that when surface water is present, the water quality is likely to be good, with limited impacts from pollutants.
Habitat and biota	The larger watercourses (tributaries and rivers) are characterised by riverine terraces and ridges supporting a variety of macrophytic vegetation, marginal reed belts as well as riverine thickets (comprising low growing trees and shrubs). Although not necessarily large enough by themselves to support significant populations of fauna, habitat along the EDLs remains largely intact and representative of the natural vegetation type. The vegetation associated with the EDLs are predominantly short growing shrubs, but no facultative vegetation species were identified within these EDLs. Overall, the vegetation component of the watercourses associated with the Oya WEF is considered intact (Ekotrust CC, 2018). Due to the seasonal nature of the watercourses, they do not retain water for a long enough period of time to provide breeding and foraging habitat for aquatic macro-invertebrates or avifaunal species. However, it does provide migratory connectivity as well as sheltered nesting habitat for terrestrial avifaunal species. Very few alien or invasive vegetation species were noted within the reaches of the watercourses verified during the site assessment, however within the footprint area of the Oya WEF of the existing informal road crossings, alien vegetation species were noted where disturbances (such as the road crossings) had occurred.

IHF= Index of Habitat Integrity; EIS = Ecological Importance and Sensitivity, RMO = Recommended Management Objective; WCBSP = Western Cape Biodiversity Spatial Plan

Table 4 below lists the proposed Oya WEF development infrastructure relative to the delineated extent of the watercourses as depicted in Figure 5 to 10.

Table 4: Summary of the distance the proposed surface infrastructure components are located relative to a watercourse.

Proposed surface infrastructure component	Approximate distance from the closest watercourse
Oya WEF	
Construction camp	32 m from ephemeral tributary of the Windheuwels River system
Turbine 5	60 m from episodic drainage line of the Ongeluks River system
Crane pad associated with Turbine 5	44 m from episodic drainage line of the Ongeluks River system
Access road crossings	
Access road towards Oya WEF construction camp	Traverses several tributaries and EDLs of the Windheuwels River system.
Access road north of Oya WEF Turbine 20	Traverse EDL of the Windheuwel River system.
Access road between Oya WEF Turbine 18 and 19	Traverse EDL of the Windheuwel River system.
Access road between Oya WEF Turbine 4 and 5	Traverse EDL of the Jakkalshok River system.
Oya WEF overhead collector system	
Overhead power line & associated pylons	Several watercourses associated with the Ongeluks River System are traversed by the overhead power line. It must be noted that all pylons will be constructed outside of the delineated extent of the watercourses and at least 32m from its delineated extent.



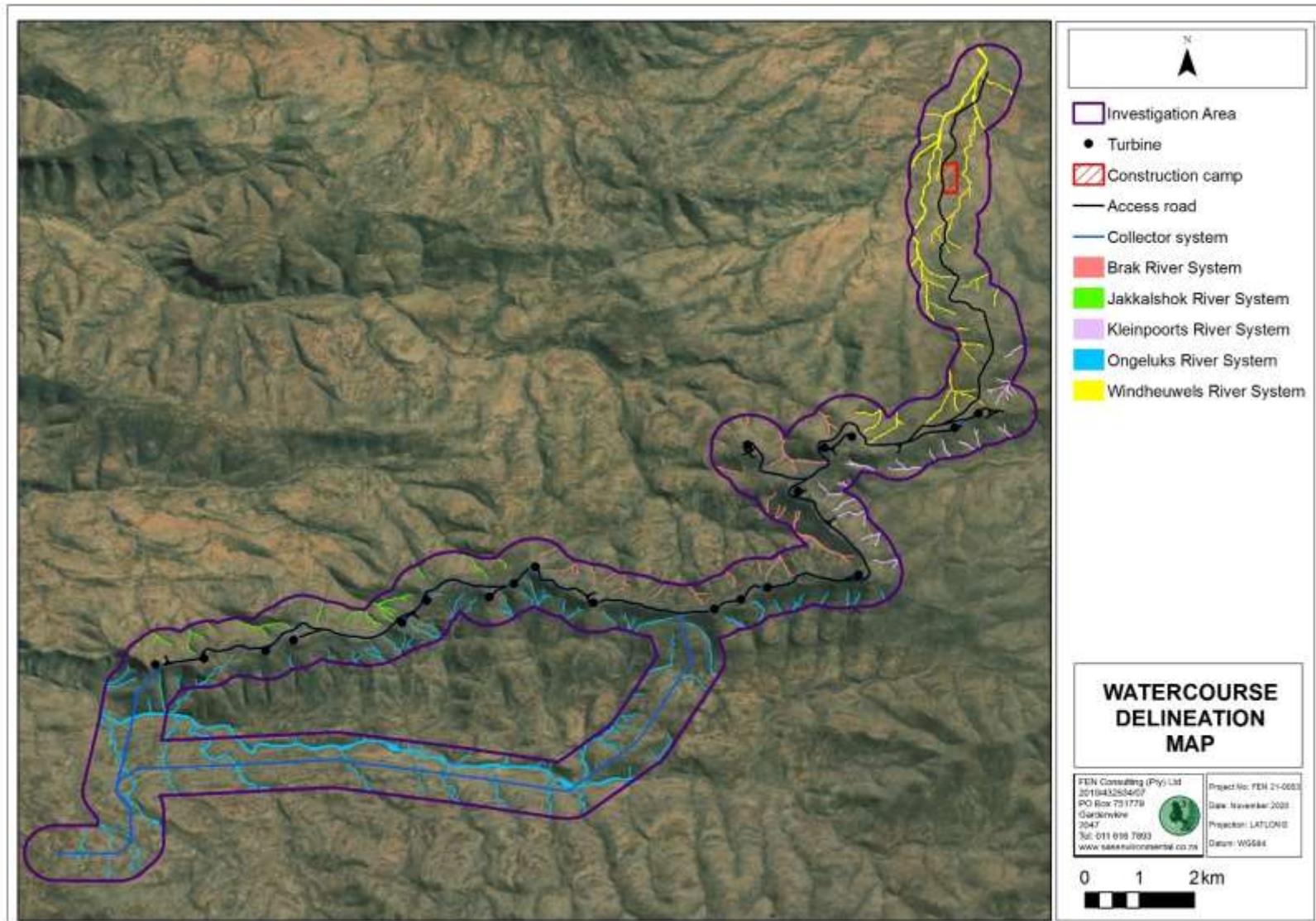


Figure 5: An overview map depicting the locality of the delineated watercourses associated with the proposed Oya WEF development.



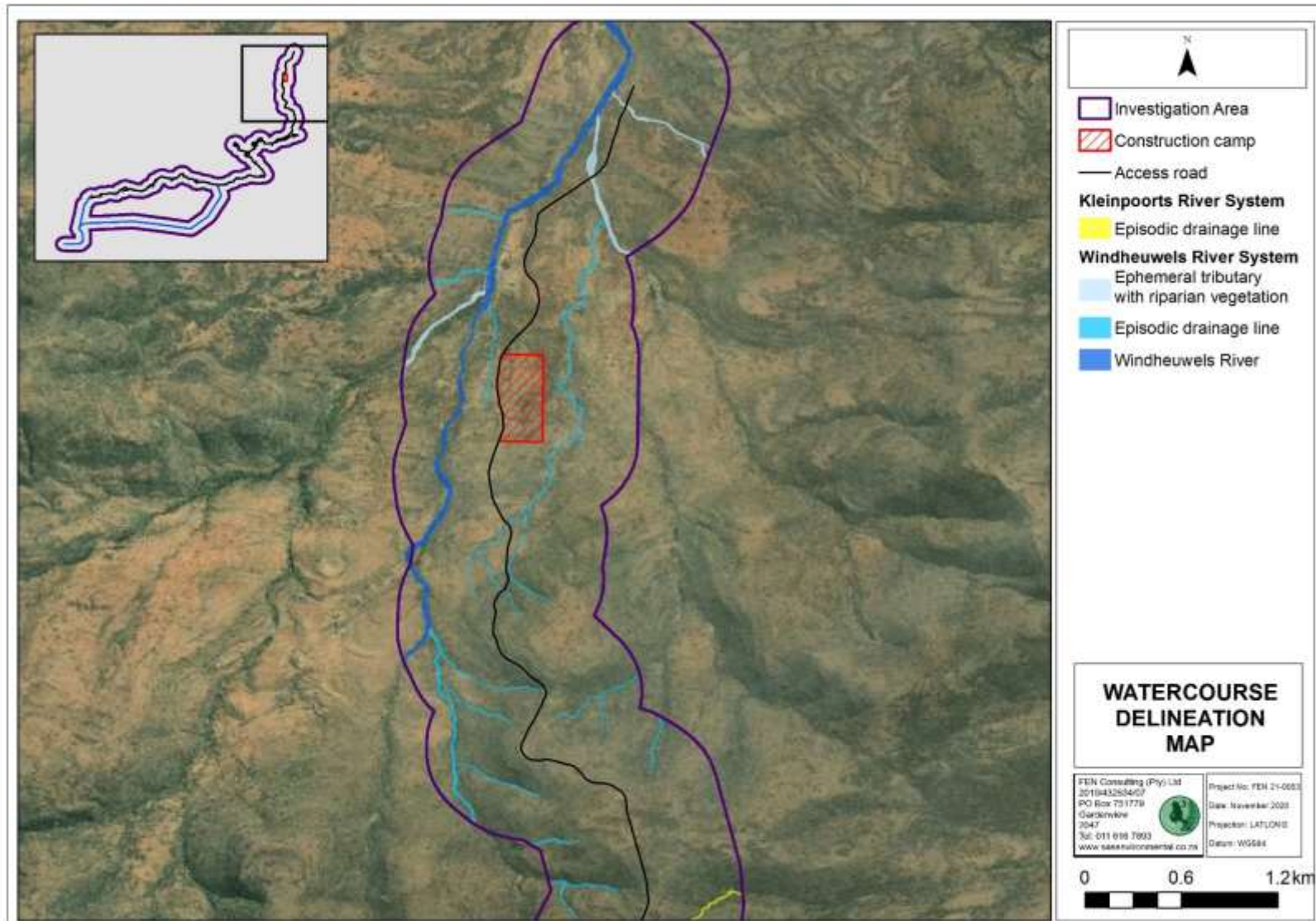


Figure 6: The locality of the delineated watercourses of the Windheuwels River system associated with the proposed access road and construction camp.



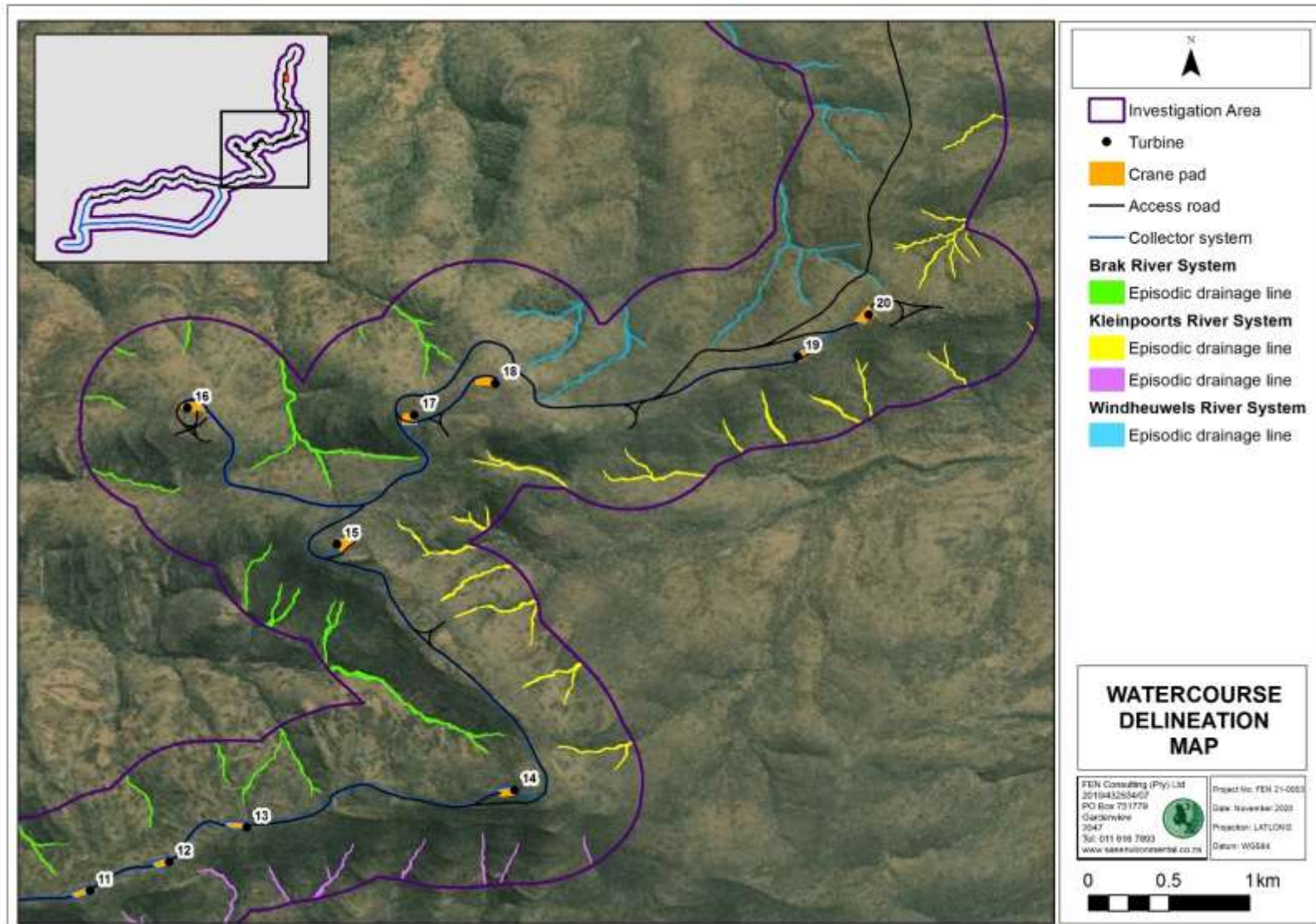


Figure 7: The locality of the delineated watercourses of the Windheuwels, Kleinpoorts, Brak and Ongeluks River system associated with the proposed internal roads, turbines and crane pads.



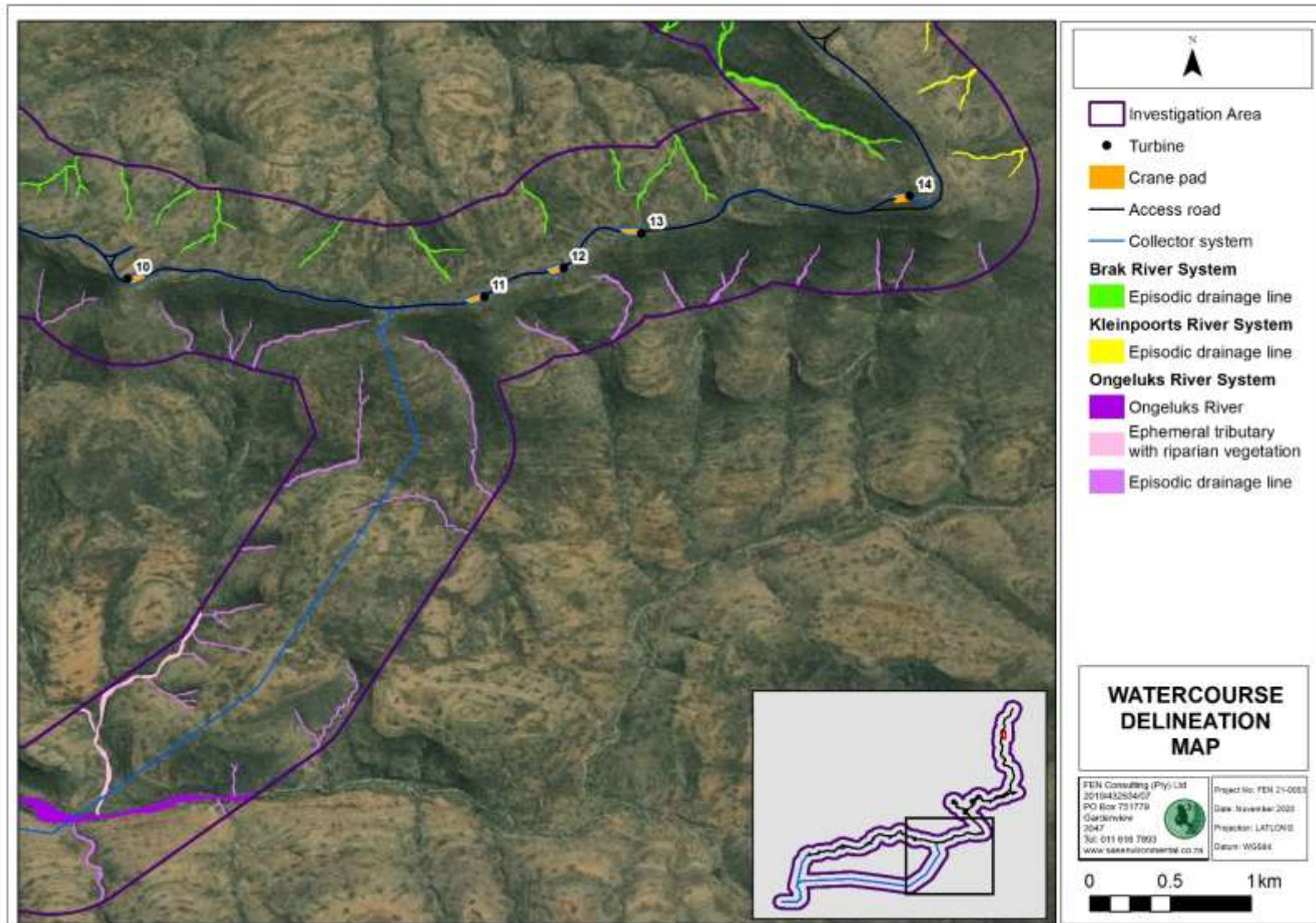


Figure 8: The locality of the delineated watercourses of the Kleinpoorts, Brak and Ongeluks River systems associated with the proposed internal roads, turbines and crane pads.



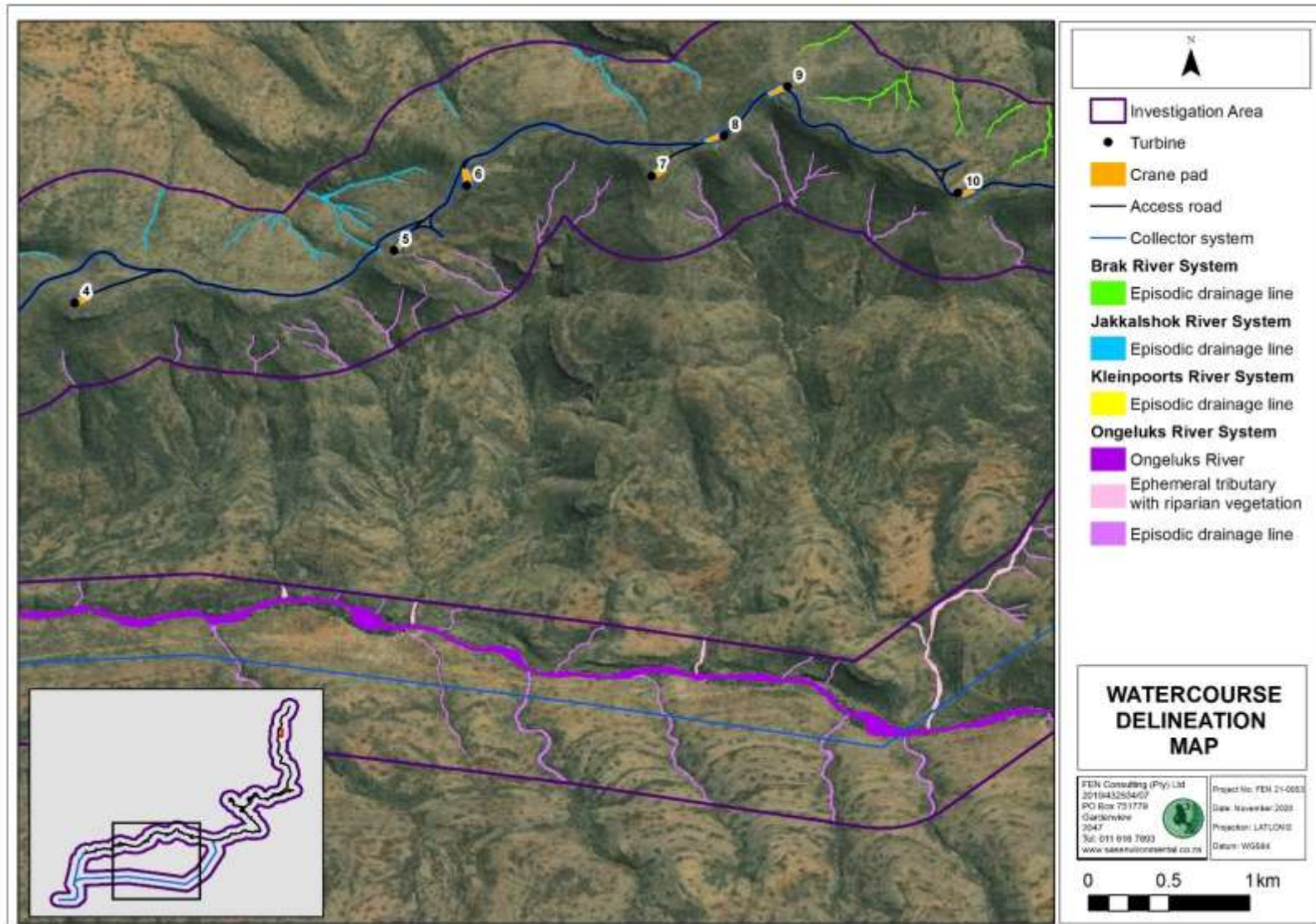


Figure 9: The locality of the delineated watercourses of the Kleinpoorts, Jakkalshok, Brak and Ongeluks River systems associated with the proposed internal roads, turbines and crane pads.



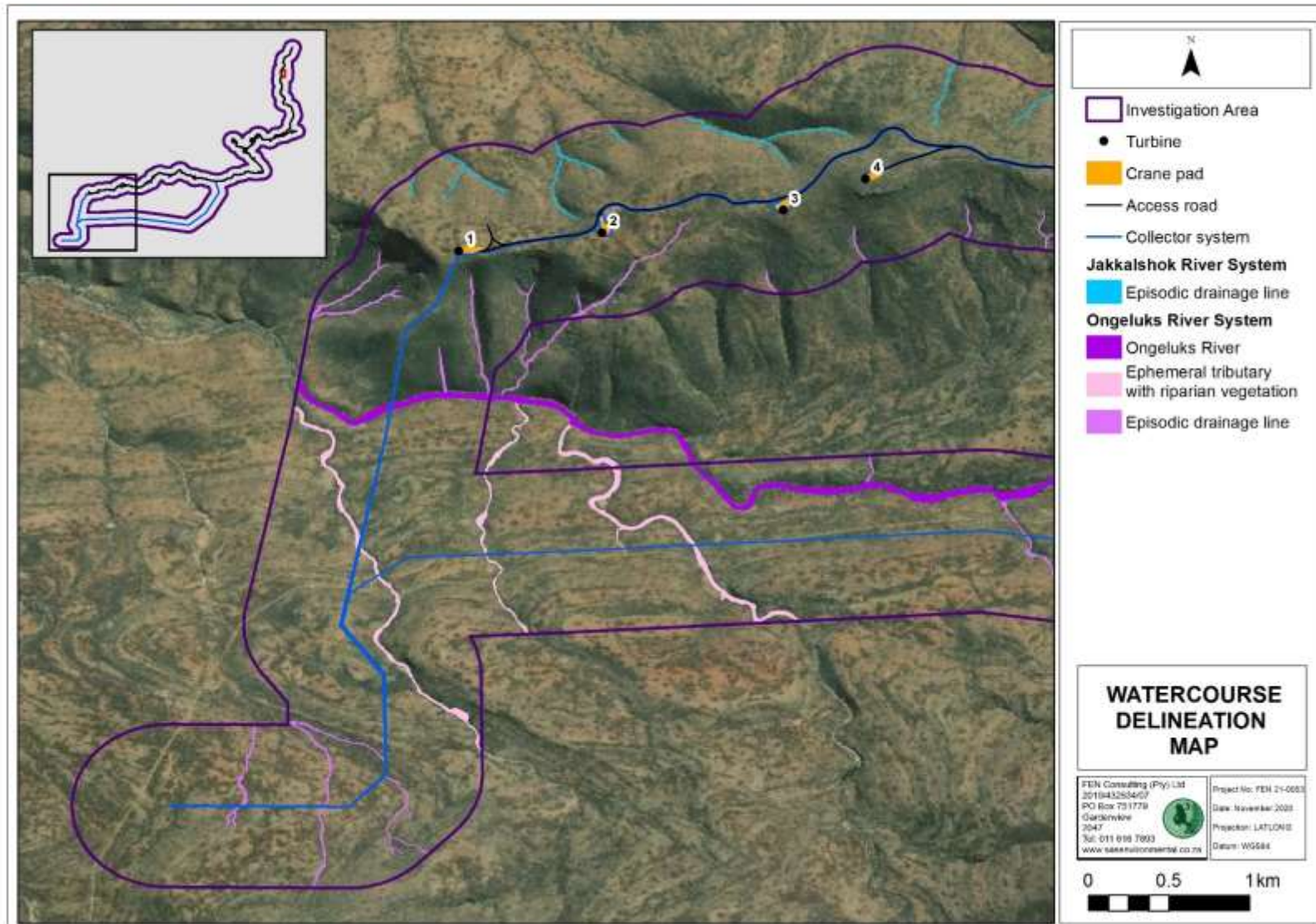


Figure 10: The locality of the delineated watercourses of the Ongeluks River and Jakkalshok River systems associated with the proposed internal roads, turbines and crane pads.



4.1 Assumptions and Limitations associated with the Freshwater Assessment

The following assumptions and limitations should be noted, as per FEN Consulting (2020):

- The ground-truthing and verification of the delineated extent of the watercourses identified by BlueScience (2018) are confined to a single site visit undertaken on the 22nd and 23rd of September 2020 (early spring season) and on the 22nd to the 24th of October (early summer season) of the proposed Oya WEF development. All watercourses identified within the investigation area were delineated in fulfilment of Government Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods with limited field verification including the use of topographic maps, historical and current digital satellite imagery and aerial photographs;
- It is proposed that new or existing boreholes will supply water to the on-site batching plant as part of the proposed Oya WEF development. These activities (abstraction of water, pipeline construction) will be applied for separately should it be required by the relevant authorities, and as such, were not considered or assessed as part of this assessment. It is however recommended that a geohydrological investigation be undertaken for the borehole to ensure sustainable abstraction that does not impact other water users or the water resources within the area;
- Due to the landscape in some areas being rugged and very undeveloped, some reaches of the identified watercourses were inaccessible. Therefore, verification points for watercourses were located at points as close to the watercourse to be verified as possible and, where necessary the conditions at the exact point required were inferred or extrapolated;
- Due to the majority of the watercourses being ephemeral within the region, very few areas were encountered that displayed more than one watercourse characteristic as defined by the DWAF (2008) method (such as containing alluvial or inundated soils, or hosts riparian vegetation adapted to saturated conditions). As a result, identification of the outer boundary of the temporary watercourse zones and marginal riparian zones proved difficult in some areas and, in particular, in the areas where watercourse conditions and riparian zones are marginal, and therefore delineations were augmented with the use of digital satellite imagery. Nevertheless, the watercourse delineations as presented in this report are regarded as a best estimate of the watercourse boundaries based on the site conditions present at the time of assessment and the results obtained are considered sufficiently accurate to allow informed planning and decision making to take place;
- At the time of this assessment, no designs for the proposed watercourse road crossings were available. As such, once these designs become available, they should be reviewed by a freshwater ecological specialist and the impact/risk assessment updated. It must be noted that the outcome of the risk assessment may thus change pending the outcome of the watercourse road crossing designs;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. However, the delineations as provided in this report are deemed accurate enough to fulfil the environmental authorisation requirements as well as the implementation of the mitigation measures provided;
- Watercourses and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the watercourses have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.



4.2 Risk Assessment Summary

The following table provides a summary of the anticipated risks associated with the proposed Oya WEF development, as undertaken as part of the Freshwater Assessment (FEN, 2020).

Table 5: A summary of the Risk Assessment outcomes

	Activities	Impacts	Risk Significance	Rehabilitation Objectives
Direct impacts	Construction of new road watercourse crossings and underground cables along the road crossings	In order to develop new watercourse road crossings, vegetation will need to be removed and where necessary, soil will need to be compacted. This will lead to potential increased run-off and sedimentation of the watercourses, increase dust generation which may smother riparian vegetation and result in a potential decrease in ecoservices.	Low Negative	<ul style="list-style-type: none"> • Manage vegetation removal and ensure it is disposed of correctly; • Mitigate and manage soil erosion and sedimentation within the watercourses; • Revegetation of footprint areas
Indirect impacts	Construction of construction camp, turbine crane pad, and overhead collector system power line over watercourses. All infrastructures and pylons will be located at least 32 m from the delineated extent of a watercourse but still within the 100m GN509 Zone of Regulation.	Due to the locality of the pylons, only terrestrial habitat will be directly impacted. Nevertheless, potential indirect impacts may be sediment laden runoff entering the watercourses due to reduced surface roughness as vegetation clearing has occurred. As the power line pylons are assumed to be concrete cast and the construction camp will host the batching plant, the potential of contaminated runoff entering the watercourses are also possible.	Low Negative	
		Increased impermeable surfaces within the vicinity of watercourses due to the compaction of soil associated with the proposed construction camp and turbine crane pads.	Low Negative	<ul style="list-style-type: none"> • Mitigate and manage potential stormwater runoff that may result in sedimentation and erosion.

The proposed Oya WEF development is expected to have a low risk significance on the watercourses (FEN Consulting, 2020), with the implementation of the set out mitigation measures. This can primarily be attributed to all surface infrastructure components being located at least 32 m from the delineated extent of the watercourses, with the exception of new road watercourse crossings.

5 WATERCOURSE REHABILITATION AND MANAGEMENT PLAN

This implementation of this WRMP is based on four (4) key actions illustrated in Figure 11 and discussed in detail in Section 5.1 to 5.4. These four actions should be considered as an ongoing process, where the WRMP is refined and improved if further information may become available, or if required by the competent authority.





Figure 11: The four (4) key actions of the WRMP implementation.

5.1 Roles and Responsibilities

Table 6 provides a summary of the various parties that are involved with the implementation of this WRMP as well as their responsibilities

Table 6: Summary of various parties involved with the implementation of this WRMP.

<p>1 Holder of EA (responsible for funding, appointments and project oversight)</p>	<p>2 Implementing Agent (responsible for following this implementation plan, all Contractors and appointed of relevant specialist consultants)</p>
<p>3 ECO (responsible for monitoring the implementing agent, in-house reporting of environmental concerns, monitoring)</p>	<p>4 Independent Auditor (responsible for environmental and financial audits as well as compliance with authorisation conditions)</p>
	<p>5 Provincial Authorities (including DEA and DWS- audit, review compliance findings, inform on any necessary issues)</p>
Party	Responsibility
Holder of EA	<ul style="list-style-type: none"> • The Holder of the EA must ensure sufficient funding for the implementation and long-term maintenance of the mandated rehabilitation requirements as stipulated in this WRMP; • The Holder of the EA will be responsible for the appointment of an environmental manager/ Environmental Control Officer (ECO) to monitor and audit the rehabilitation requirements, the implementing agent, as well as an independent auditor; • The Holder of the EA will be responsible for ensuring the implementing agent receives a copy of this document and understands its contents; • The proponent must ensure that suitable penalties are in place for non-conformance of the conditions of authorisations, licence as well as this WRMP by the implementing agent and any sub-contractors; • The Holder of the EA must give the authority to the environmental manager/ Environmental Control Officer (ECO) to stop works on site should he feels that there is a serious threat to or impact on the surrounding environment; and



	<ul style="list-style-type: none"> Should ownership of Oya WEF change, the role and responsibility for compliance with this WRMP as well as long-term maintenance must also be transferred.
<p style="text-align: center;">Implementing Agent</p>	<ul style="list-style-type: none"> An overarching contractor should be appointed as the implementing agent, to manage all sub-contractors and appoint specialists, as required; The implementing agent must ensure that all sub-contractor/s take full responsibility for each of his/her employees and any penalties imposed; The implementing agent must immediately inform the proponent and environmental manager if any changes to the project are envisaged and if any aspects of this WRMP cannot be complied with; It is the responsibility of the implementing agent to ensure that the measures stipulated within the Water Use Licence, Environmental Authorisation as well as this WRMP are adhered to; and Should the implementing agent require clarity on any aspect of this implementation plan, the implementing agent must contact the environmental manager for advice or alternatively, a suitably qualified specialist. <p>Training of Rehabilitation Workers</p> <p>The implementing agent is to facilitate an initial environmental induction to all sub-contractors and associated workers in environmental awareness, including minimisation of disturbance to areas of increased ecological sensitivity, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution. Furthermore, the implementing agent is to ensure that all operational workers have received basic training on fire management and prevention measures and be aware of any emergency protocols required.</p> <p>Contractor Performance</p> <ul style="list-style-type: none"> The implementing agent must ensure that the relevant sub-contractors adhere to the conditions of this WRMP. Should the contractor require clarity on any aspect of this WRMP, the contractor must contact the implementing agent directly, who, if needed can consult with the specialists involved in the preparation of the WRMP. Should the environmental manager feel that the requirements of this WRMP are not being met by the contractor(s), the environmental manager has been given the authority by the Proponent to stop work if in his/her opinion there is/may be a serious threat to or impact on the surrounding environment and instruct the contractor(s) on suitable rectification and remediation actions that must be implemented immediately.
<p style="text-align: center;">Environmental Control Officer (ECO)</p>	<ul style="list-style-type: none"> The ECO is the person responsible for the monitoring of the implementation of the WRMP during the implementation of the activities and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of construction activities and be responsible for ensuring that all rehabilitation activities are implemented. The ECO is mandated to do the following: <ul style="list-style-type: none"> Ensure that all contractors/ subcontractors/ employees/ construction workers are fully aware of their environmental responsibilities. This should take the form of an initial environmental awareness-training program in which requirements of this document will be explained; Monitor site activities on a regular basis to ensure that there is minimal environmental impact due to construction activities. A monitoring report should be submitted to the Contractor, the Civil Engineer (should there be any design changes required) and the Project Manager; Ensure that a 'hotline' exists for reporting incidents and resolving any problems rapidly; The ECO must regularly audit the operation and establish whether the measures in the WRMP are applied, where after the ECO reports to the lead project manager; All reports compiled by the ECO must be submitted to the relevant compliance office within the DWS and DEFF; The ECO has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the construction operations; and Conduct a final environmental audit and a review of management and rehabilitation measures. Should the appointed ECO not have any freshwater ecological experience, a suitably qualified Freshwater Ecologist should be appointed to assist the ECO as and when needed.
<p style="text-align: center;">Independent Auditor</p>	<p>The independent auditor must be suitably qualified with relevant experience to undertake external audits of the findings of the on-site ECO/Environmental manager, in line with the conditions stipulated within the Environmental Authorisation (EA) and relevant Water Use Authorisation (WUA). The independent auditor will:</p> <ul style="list-style-type: none"> Conduct all audits in line with the relevant authorisation requirements and a review of management and rehabilitation measures; Undertake a site visit to discuss the findings with the on-site ECO and ensure that the rehabilitation activities are complaint; and Compile a relevant audit and monitoring report which is to be submitted to the relevant provincial authorities.



5.2 Action 1: Site Investigation and Literature Review

A site investigation of the proposed Oya WEF development was undertaken by FEN Consulting 22nd and 23rd of September 2020 (early spring season) and on the 22nd to the 24th of October (early summer season) to determine site limitations and rehabilitation requirements. Available literature and scientific assessments referenced in Section 7 were also reviewed to further gain background and support the determination of the required rehabilitation activities and future monitoring needs.

The project site has remained relatively unchanged over the last few decades, being that its utilised for small scale farming activities, with minor land use changes overall. Existing risks to the watercourse noted during the site assessment and on review of the historical imagery is related to informal road crossings and instream impoundments (within the smaller episodic drainage lines). No other significant anthropogenic impacts were noted on the watercourses. Table 7 provides a summary of the existing risks identified to the watercourses associated with the proposed Oya WEF development.

Table 7: Existing and historical risks to the area associated with the proposed Oya WEF development.

1. Existing watercourse road crossings.

On review of the digital satellite imagery, distinct small informal watercourse road crossings are evident (Figure 12). During the site assessment, these watercourse road crossings were investigated (Figure 13). The road crossings are predominately over areas of the watercourse having a solid bed rock base, thus not causing any negative impacts to the active channel of the watercourse. Despite the road crossing resulting in the clearing of vegetation, the vegetation component directly adjacent to the road crossings are considered intact, with now extensive invasion of alien or invasive plant species. Due to the solid bed rock and rocky ridges associated with the watercourse vegetation is in some areas naturally sparse.



Figure 12: Digital satellite imagery depicting informal road crossings through watercourses. Image on the left displays a watercourse with a distinct solid rock bed base.





Figure 13: Various existing informal road crossings in and surrounding the proposed WEF development site through watercourses (blue dashed line), most of which are hosting a solid bed rock base. The orange arrow in the top left photograph depicts raised embankments, with minor erosion. Orange arrow in bottom right photograph depicts that despite not having any throughflow structures, the road crossing still allows for flow over the crossing.

2. Instream impoundments

Small instream impoundments can be identified on digital satellite imagery (Figure 14). Due to the ephemeral nature of the watercourses, it is assumed that these impoundments were created to collect surface water runoff for agricultural purposes. During the site assessments the presence of these impoundments were confirmed (Figure 15), however it is not considered to be used for any purposes than to collect water utilised by small game and sheep within the property.



Figure 14: Digital satellite images depicting small instream impoundments located within episodic drainage lines.





Figure 15: Photographs of instream impoundments identified within the proposed Oya WEF development site.

5.3 Action 2: Planning

The intention of this WRMP is to achieve the rehabilitation objectives as listed in Table 5 above in the most economical and feasible manner by maintaining the ecological condition and function of the watercourses associated with the proposed WEF development. In order to achieve the rehabilitation objectives and increase the rehabilitation success rate, cogent conceptual planning is essential to provide clear and concise requirements to orient the rehabilitation and management activities to achieve the desired final results. Table 8 provides requirements to be considered during planning and before implementing the WRMP.

Table 8: Planning requirements to be considered prior to the implementation of the WRMP measures.

Planning Requirements to be considered prior to the implementation of the watercourse rehabilitation and management measures.
<p>1.1 Obtaining all relevant authorisations and permits Before rehabilitation activities can commence all necessary permits and authorisations will be required, including but not limited to:</p> <ul style="list-style-type: none"> ➤ Environmental Authorisation (as applicable); and ➤ Water Use Authorisation (either through a Water Use License (WUL) or General Authorisation (GA), whichever is applicable to the project). <p>Note: If any plants or seeds will be harvested from the surrounding area for revegetation purposes, a permit may be required from the DEFF and/or CapeNature prior to plant harvesting.</p>
<p>1.2. Appointment of a Contractor and all required specialists During the planning phase certain aspects need to be considered in order to effectively implement this plan. This includes:</p> <ul style="list-style-type: none"> ➤ Appointment of a suitably qualified Contractor(s) to undertake the required work; ➤ Appointment of an Environmental Officer to audit and monitor the rehabilitation activities as well as to undertake the required post rehabilitation monitoring; ➤ Appoint any specialist consultants required for guidance, management and monitoring that may need to be retained; and ➤ The Environmental Officer is to compile a monthly audit report indicating all observations, actions and any remediation measures that were implemented and the reports are to be submitted to the competent authorities. <p>Note: Should the Contractor not have the appropriate expertise for implementation of this plan then it is the responsibility of the Contractor to retain a suitably qualified freshwater ecologist to oversee the implementation.</p>
<p>1.3 Budgetary Allowance A rehabilitation budget needs to be prepared prior to the commencement of rehabilitation activities. The preparation of a budget is a crucial step in planning of a project, as it allows for the prediction and calculation of all the costs related to</p>



Planning Requirements to be considered prior to the implementation of the watercourse rehabilitation and management measures.

implementation of the rehabilitation activities, including, but not limited to labour, material, expertise and post rehabilitation maintenance and management.

1.4 Timing

Rehabilitation of the watercourses should commence as soon as possible and should optimally be concurrent as work progress. Rehabilitation should have a fixed deadline for completion.

1.5 Planning for on-site requirements

Establishment and Access

- Site access must be gained only utilising the existing access roads. New road crossings may only be established where authorised.
- At no point should construction equipment/vehicles extend past the designated construction site (unless for the required rehabilitation works). All vehicles may only make use of the existing informal road up to the point where authorised roads and watercourse road crossings are established. No indiscriminate movement of vehicles will be tolerated in the delineated watercourses.
- Adequate signage (in the adequate various languages) must be placed around the watercourse crossings to indicate to the public and construction workers that access to the watercourses is prohibited (unless for authorised personnel).

Indigenous plant harvesting and propagation.

- As part of the proposed rehabilitation plans, indigenous species must be re-instated within the watercourses (if considered feasible by the ECO). As such, plans should be made for where the species are to be sourced and budgetary allowances made for the purchasing of various species.
- Availability of species needs to be secured before rehabilitation activities commence to ensure that plants are ready and available for re-vegetation (Action 3), so as not to leave areas exposed and vulnerable to erosion and incision.

1.6 Kick-off meeting/ Environmental Induction

Before commencing with the rehabilitation activities, a kick-off session associates all the responsible persons involved in the implementation of the WRMP. The key aims of the meeting are:

- Agreeing on the timeline for rehabilitation activities;
- Identifying the rehabilitation expectations and limitations; and
- Validating the WRMP rehabilitation strategies and the involvement of all the responsible persons in the implementation process.

1.5 Training of Contractors

All contractors involved in the implementation of this WRMP must receive basic training in environmental awareness, including minimisation of disturbance to areas of increased ecological sensitivity, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution.

5.4 Action 3: Watercourse Rehabilitation and Management Implementation

A site-specific WRMP has been developed to provide step-by-step implementation measures to rehabilitate direct disturbance to the watercourses due to the proposed road crossings as well as measures to mitigate any impacts arising from infrastructure components located at least 32 m from the delineated extent of the watercourses. The implementation of these measures is the core of the WRMP, as this entails putting rehabilitation and management activities into visible outputs. The success of the rehabilitation efforts is highly dependent upon cogent conceptual planning undertaken at the early stage of the construction activities associated with the proposed Oya WEF development (Section 5.2). The mitigation measures that must be adhered to during the construction and operational phases are listed in the tables that follow as well as the watercourse assessment undertaken by FEN Consulting (2020).



This WRMP includes practical rehabilitation and management methods to achieve rehabilitation objectives and a desired end result. The rehabilitation and management methods of this WRMP were grouped into three (3) tasks (Figure 16) and discussed in Section 5.3.1 – 5.3.3 to guide the implementation thereof.

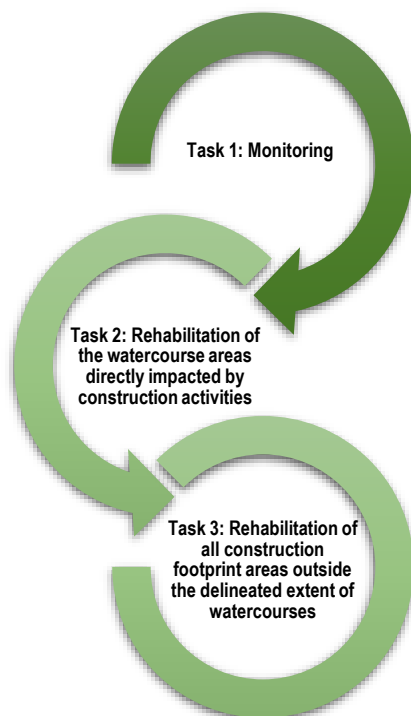


Figure 16: Grouped tasks for the rehabilitation and management method implementation.

Table 9: A summary of the description of each task, the responsible persons and applicable section of the WRMP.

Task	Description	Responsible persons	Section in the WRMP
Task 1a: Monitoring – soil erosion and siltation during all phases	Monitoring of soil erosion and siltation within watercourses.	ECO	Section 5.3.1
Task 1b: Monitoring –Alien and Invasive Plants (AIPs) (Operational & Rehabilitation phase)	Monitoring of soil erosion and siltation within watercourses or within the 32 m buffer. Monitoring of edge effects of alien and invasive proliferation from disturbed areas.	ECO	Section 5.3.2
Task 2: Rehabilitation of the watercourse areas directly impacted by construction activities.	Rehabilitation measures are provided for the construction and operational phases of the watercourse road and underground cable crossings, which entails: - Vegetation clearing as part of site preparation activities; - Excavation and subsequent compaction of soil - Concrete use (if applicable) - Rehabilitation of construction footprint area.	ECO	Section 5.3.3
Task 3: Rehabilitation of all construction footprint areas outside the delineated extent of the watercourses.	The requirements to be taken to manage edge effects resulting from construction activities outside the watercourses and 32 m from the delineated extent of the watercourses.	ECO	Section 5.3.4



5.4.1 Task 1a: Monitoring of Soil Erosion and Sedimentation

During the site assessment, minimal bank erosion was noted within the watercourses. Where bank erosion was noted e.g. within the riparian habitat of the Windheuwels River and smaller watercourses, due to informal road crossings and instream impoundments, it has resulted in the presence of alien vegetation species (albeit limited).

Removal of sediment may be required, specifically post-construction of watercourse crossings of roads and the overhead collector system powerline. Excessive sediment build-up will allow proliferation and dominance by Alien and Invasive Species (AIP) and may impact the ecology and function of the downstream reaches of the watercourses. A generalised sediment removal method statement is provided along with control measures that must be implemented during the sediment removal activities.

Although minimal erosion was noted, the following erosion control measures are deemed relevant.

Table 10: Method statement and management measures to be implemented for erosion and sediment control.

Responsible Persons	Proponent	Environmental Control Officer
	Implementing Agent	Independent Auditor
Objective/ Requirement	Control measures	
Monitoring of soil erosion and siltation within watercourses	<p><u>Erosion and revegetation</u></p> <ul style="list-style-type: none"> • Slope and stabilise banks of watercourse crossings to a 3:1 ratio; • Works should preferably be undertaken by hand; • Install suitable biodegradable materials, as recommended, to assist with vegetation growth, during revegetation activities within the watercourse; • Install protective structures, e.g. geotextiles; • Use vegetation plugs, rock packs or gabions where erosion is visible; • Only indigenous vegetation species may be utilised as part of the revegetation; and • Continual erosion monitoring should occur by a trained staff member. <p><u>Sedimentation</u></p> <ul style="list-style-type: none"> • Remove deposited material and soil from the crossing points that might cause a hinder or build-up and prevent flow of water; • Once all material has been removed, the watercourse embankments (where applicable) should be sloped to no greater than a 3:1 ratio, and soils ripped. It is important that the embankment of the upper and lower reaches of the watercourse tie into the resloped embankment to prevent future erosion and incision that may result; • Works should preferably be undertaken by hand; and • Dispose deposited material at a registered facility. 	

5.4.2 Task 1b: Alien and Invasive Plant Management

Only some Alien and Invasive Plants (AIPs) were noted at existing road crossings and at artificial impoundments (FEN Consulting, 2020). As the project site is relatively undisturbed, no significant areas infested with AIPs were noted.

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Section 73 requires every person to exercise a Duty of Care relating to invasive species within their property, and as such the landowner is responsible for AIP control. Category 1b species require compulsory control and must be removed and destroyed as they have high invasive potential. An AIP control plan was therefore developed as part of this WRMP, should such species establish within the project footprint area.


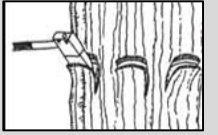







AIP control can be divided up into two phases, namely:

1. The initial control phase where AIPs are removed from the during the construction and post-construction phase; and
2. The follow-up control during the operational phase whereby AIPs (coppice, saplings, and seedlings) within the watercourses as well as all construction footprint area above the 32m NEMA Zone of Regulation but below the 100m GN509 Zone of Regulation must be done once a year during spring (September – November) for a minimum period of seven (7) years to ensure that new AIP infestation does not occur, after which the follow-up period should be re-assessed based on the need.

The following definitions (Table 11) are applicable to this section relating to AIP control:

Table 11: Definitions for terminology associated with AIP removal.

<p>Hand Pull</p> 	<p>Low or sparse infestations of saplings and seedlings can be pulled out by hand. All root material should be removed to avoid re-sprouting of the plant. Safe to use in the river as no chemicals are used. Hand pulling does create soil disturbance, but if the area is sparsely invaded such disturbances are unlikely to be ecologically damaging.</p>
<p>Frill</p> 	<p>The technique whereby an axe or cane knife is used to chip/cut around the base of a tree (± 2mm deep) in order to place herbicide into the cuts (cutting not to be as deep as to ringbark). Herbicide to be applied within 30 minutes from frilling. Suitable for mature trees in low/sparse infestation. No contamination of water with herbicides as these are applied directly to the tree.</p>
<p>Ringbark</p> 	<p>A cane knife or axe is used to remove the bark from the tree and cambium, in a horizontal band about 30cm wide (about 50cm from the ground). Ring barking interferes with the circulation of the tree and results in it slowly dying. No contamination of water with herbicides as these are applied directly to the tree.</p>
<p>Tree Felling</p> 	<p>Complete removal of the AIP down to a stump by means of a chainsaw, hand axe, brush-cutter. Suitable for clearing dense stands. Potential for pollution as a result of bar oil in equipment and may result in blockages to infrastructure due to debris build-up.</p>
<p>Slashing</p> 	<p>The seed stalks/branches of annual plants can be slashed with a cane knife, mattock, bill hook or slasher before the seeds have matured. No contamination of water with herbicides as these are applied directly to the tree.</p> <p>** Care should be taken to prevent plant material and propagules from ending up in the river. **Costs are generally low for controlling annuals in this way, as no herbicide is required.</p>
<p>Stumping</p> 	<p>The treatment of the remaining stump after felling with an appropriate herbicide (see recommended below). No contamination of water with herbicides as these are applied directly to the tree.</p> <p>**Stumping can also imply the treatment of the remaining stump after felling with an appropriate herbicide.</p>
<p>Foliar Spray</p> 	<p>The application of herbicides directly to the leaves. Foliar spraying can be done by using the following:</p> <ol style="list-style-type: none"> a) A hose and handgun spraying the solution from a herbicide tank; b) A backpack spray unit; or c) Splatter guns which allow for larger droplets at higher concentrations – suitable for regrowth. <p>**It must be ensure herbicide is being applied at the right concentration and rate to cover the foliage of the pest plant with fine droplets and avoid run-off. A flat-fan nozzle and low pump pressure will assist in reducing spray drift.</p>



Soil application	The application of herbicide (see recommended below) to the soil which is taken up by the plants roots.
Stump Coppice	New shoots that regenerate from the stumps of felled trees.
Root Suckers	New vertical regrowth that arises from the base of the trunk, a new stem arising away from the main, stumped stem.

The diagram (Figure 17) as well as Table 12 below indicates the recommended control measures to be implemented as part of this WRMP. All recommended herbicides and active ingredients are listed under species specific control. It is important to note that AIP control must be done from the outer sections inwards in order to contain the existing AIP and prevent further spread.

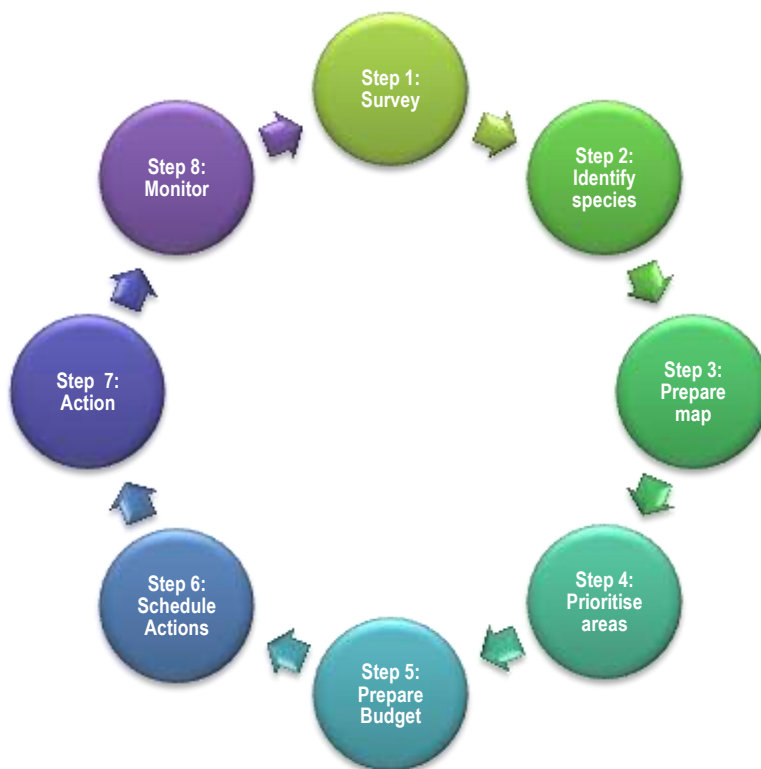


Figure 17: Schematic diagram if the required steps associated with an AIP plan.

Table 12: Relevant objectives and control measures to be implemented as part of the AIP clearing

Objectives or requirements	Control Measures
Initial Control	
General	<ul style="list-style-type: none"> AIP must be removed from the watercourse and surrounding terrestrial habitat (within 32 m thereof) to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as provided in Annexure B; AIP should be manually removed as far as feasibly possible and spot chemical treatment can be undertaken utilising products safe for use within the watercourse. All herbicides used must be approved by DEA and all directions as stipulated on the proposed herbicide must be strictly adhered to.
Chemical Control	<ul style="list-style-type: none"> Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle; Suitable dye must be used to limit over- or under spray of areas; Chemical control will entail limited usage of registered herbicides for a specific species and one must adhere to the measurements on the product label; and



	<ul style="list-style-type: none"> • Label instructions may not be exceeded due to negative impacts on surrounding flora and fauna for the use of herbicides containing Glyphosate, Diquat and Paraquat in the identified watercourses associated with the rehabilitated area.
Control within disturbed areas due to the construction of road crossings within watercourses.	<ul style="list-style-type: none"> • Proliferation of alien and/or invasive vegetation as a result of disturbances. Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically at the road crossings and surface infrastructures. Should alien and invasive plant species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation. • The removed vegetation must be stockpiled outside of the delineated boundary of the watercourse. The footprint areas of these stockpiles should be kept to a minimum, and may not exceed a height of 2 m. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site. • After upgrading of roads traversing watercourses, the area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring. • Post-closure monitoring of the watercourses (for a period of 3 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken. • The operational area should regularly be inspected for alien and invasive vegetation species which might have established due to the construction activity related disturbances.
Follow-up Control	
Follow-up AIP treatment	<ul style="list-style-type: none"> • Follow-up control is essential to control alien saplings, seedlings and coppice regrowth to achieve and sustain the progress that was made in the initial phase. If the follow up control phase is neglected, the alien infestation may become worse and denser than before the eradication process started; • Follow-up should be quarterly after the initial AIP clearing, thereafter, annually, within the growing season (September – November) for at least seven (7) years; • An annual assessment before mobilisation of the clearing crew should be undertaken to determine equipment and personnel requirements in order to secure the necessary funding; and • After initial control operations dense regrowth may arise as new regrowth will sprout in the form of stump coppice, seedlings and root suckers. The following should therefore be applied: <ul style="list-style-type: none"> ○ Plants that are less than 1 m in height must be controlled by foliar application; and ○ Areas with dense seedlings should not be uprooted or hoed out, as these areas will result in soil disturbance and will in return promote flushes and germination of alien seedling growth.

5.4.3 Task 2: Rehabilitation of the watercourse areas directly impacted by construction activities

The following section provides rehabilitation, mitigation and management measures for the proposed watercourse road crossings (those proposed to be upgraded and new road crossings) and associated underground cable crossings (direct negative impacts) associated with the proposed Oya WEF development.

Table 13: Rehabilitation interventions and control measures proposed for the direct impacts expected on the watercourses

Responsible Persons	Proponent	Environmental Control Officer
	Implementing Agent	Independent Auditor
Objective/ Requirement	Control measures	
General mitigation	<ul style="list-style-type: none"> • It is imperative that all construction works within any watercourses be undertaken during the driest period of the year when there is no flow within the watercourses, and thus no diversion of flow would be necessary; • The reaches of the watercourses where no activities are planned to occur must be considered no-go areas. These no-go areas can be marked at a maximum distance of 5 m upstream and downstream of the proposed road upgrade crossing. This 5 m buffer area would allow for construction personal, vehicles (if applicable) to enter the watercourse crossing where the road is proposed to be upgraded/developed; 	



Responsible Persons	Proponent	Environmental Control Officer
	Implementing Agent	Independent Auditor
Objective/ Requirement	Control measures	
	<ul style="list-style-type: none"> Material to be used (gravel – if applicable) as part of the upgrading of the existing roads must be stockpiled outside the 32 m NEMA ZoR of the watercourses to prevent sedimentation thereof and to avoid any other vegetation being impacted by the construction activities. These stockpiles may not exceed a height of 2 m and should be protected from wind using tarpaulins; Contractor laydown areas, vehicle re-fuelling areas and material storage facilities are to remain outside of the watercourses and at least 32 m from the delineated extent. 	
Construction phase	<ul style="list-style-type: none"> The removed vegetation must be stockpiled outside of the delineated boundary of the watercourses. The footprint areas of these stockpiles should be kept to a minimum, and may not exceed a height of 2 m. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site; Should low flow surface water be present in the watercourse, in order to prevent sedimentation of the downstream reach of the watercourses, silt traps (such as hay bales) should be installed downstream of the road crossing footprint, at 10 m intervals; Soils excavated from any trenching must be stockpiled immediately upstream of the trench. Once the cable is installed the trench must be infilled (backfilled to the natural ground level) with the removed material and suitably compacted to avoid any erosion and preferential flow paths from forming; Any remaining soils following the completion of backfilling of the trenches are to be spread out thinly in an area within the watercourses to aid in the natural reclamation process; and Should the road crossing need to be compacted, the footprint area must be kept as small as possible to avoid compacting adjacent watercourse areas. <p>No road crossing designs were available at the time of this assessment. However, it is assumed that formal culvert structures may be required at some of the watercourse crossings (specifically the rivers and ephemeral tributaries). Since concrete casting may potentially be required for such activities, the following is recommended:</p> <ul style="list-style-type: none"> No mixed concrete may be deposited outside of the designated construction footprint; Concrete spilt outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site; Mixing of cement must done within the construction camp, may not be mixed on bare soil, and must be within a lined, bound or bunded portable mixer; Consideration must be taken to use ready mix concrete; No mixed concrete shall be deposited directly onto the ground. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing; Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be suitably disposed of; and Spilled or excess concrete must be disposed of at a suitable landfill site. 	
Rehabilitation of construction footprint area	<ul style="list-style-type: none"> After upgrading of roads traversing watercourses, the area surrounding the road crossing must be ripped and be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring; Ripping and revegetation activities should include the road construction footprint area (5m buffer upstream and downstream of watercourse crossing). It is recommended that Ripping and vegetation be done by starting at the most upstream area towards the downstream area. This will minimise disturbance to the rehabilitated areas; Should watercourse embankments have been impacted by the road construction activities, the embankment must be suitably sloped (1:3) and revegetated to prevent any erosion and sedimentation; It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction; and All existing alien and invasive vegetation should be removed (if applicable). All material must be disposed of at a registered garden refuse site and may not be burned or mulched on site. 	
Operational Phase	<ul style="list-style-type: none"> Routine maintenance of the roads must be undertaken to ensure that no concentration of flow and subsequent erosion occurs due to the road crossings. Such maintenance activities must specifically be undertaken after high rainfall events, otherwise on every 3 months; 	



Responsible Persons	Proponent	Environmental Control Officer
	Implementing Agent	Independent Auditor
Objective/ Requirement	Control measures	
	<ul style="list-style-type: none"> Stormwater runoff from the road crossings should be monitored (by the Operation and Maintenance (O&M) Manager), to ensure it does not result in erosion of the watercourses. Stormwater should be allowed to diffusely spread across the landscape, by ensuring adequate surface roughness in the watercourse (through vegetation and rocky areas); <ul style="list-style-type: none"> The stormwater management measures as per the Stormwater Management Plan (NatureStamp, 2020) must be maintained to ensure that stormwater from the roads does not negatively impact on the watercourses; Maintenance vehicles must make use of dedicated access roads and watercourse road crossings and no indiscriminate movement in the watercourses may be permitted; During periodic maintenance activities of the roads/surface infrastructure, monitoring for erosion should be undertaken (see Section 5.4); and Should erosion be observed, caused by the road crossings, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation. Use can also be made of rocks collected from the surrounding area to infill any area prone to erosion, as a natural dispersal mechanism; Should alien and invasive vegetation species be noted, these species must be suitably removed/eradicated, preferably using manual labour, and disposed of in a suitable manner (may not be left within the watercourse area). 	

5.4.4 Task 3: Rehabilitation of all construction footprint areas outside the delineated extent of watercourses

Although no direct impacts are expected on the watercourses from the construction and operation of surface infrastructure components (related to the construction camp, wind turbines, crane pads and overhead power line pylons) located outside the 32m NEMA Zone of Regulation but still below the 100m GN509 Zone of Regulation, the following section lists rehabilitation measures to be applied to the areas surrounding the watercourses to prevent any edge effects from impacting on the watercourses that may contribute to the cumulative impacts of the proposed Oya WEF development. These control measures must be implemented post-construction and ongoing as part of the operational phase.

Table 14: Rehabilitation of construction footprint areas located outside the delineated extent of the watercourses

Responsible Persons	Proponent	Environmental Control Officer
	Implementing Agent	Independent Auditor
Objective/ Requirement	Control measures	
Revegetation of all construction footprint areas to ensure the smallest possible operational footprint areas (Post construction and Operational Phase)	<ul style="list-style-type: none"> All areas disturbed by construction activities must be ripped, and reprofiled to mimic the natural topography; All areas must be suitably revegetated with indigenous vegetation (terrestrial/freshwater pending on the area being rehabilitated); All Alien and Invasive Plant species must be removed (refer to Task 1b) from these areas and disposed of in a suitable manner, but may not be burned or mulched within the project site; All rehabilitated areas must be monitored to ensure successful establishment of vegetation and for the invasion of AIPs.; and Should AIPs be noted, these species must be removed as per the recommended methods in Section 5.3.2 and suitably disposed off. 	
Stormwater management	<p>Large, compacted areas (construction camp, turbine cane pads) will be located at least 32 m from the delineated extent of the watercourses, as such potential edge effects may arise from the construction and operation of thee areas. The following control measures are recommended:</p> <p><u>Construction phase:</u></p> <ul style="list-style-type: none"> The construction footprint areas of the construction camp and crane pads should be kept as small as possible and no vegetation should be removed beyond the footprint area. The vegetation 	



	<p>provides surface roughness to reduce the velocity of any stormwater flows that may potentially enter the watercourses;</p> <ul style="list-style-type: none"> • Silt fences must be installed on the downgradient side of the construction footprint where it is located on a steep slope close to the headwaters of a watercourse. This will prevent any sediment laden runoff from potentially entering the watercourse. Silt fences can be erected by means of a small firm plastic drift fence, pegged into the ground; and • No runoff from the construction footprint area may be released into any of the delineated watercourses. The control measures as specified in the stormwater management plan (NatureStamp, 2020) must be implemented. <p><u>Operational phase:</u></p> <ul style="list-style-type: none"> • Revegetation as per the requirements above • All stormwater management infrastructure must be regularly inspected to ensure optimal functioning. Should erosion be noted, the area must be infilled with in situ soil and suitably revegetated;
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5.4.5 Management methods post-rehabilitation

Once the rehabilitation measures have been implemented (as described in Task 2 and 3 above), periodic maintenance of the watercourses must be undertaken. This section provides generalised method statements and control measures for certain activities which must be implemented to insure ongoing ecological and hydrological functioning of the watercourses. Additionally, the control measures as prescribed for general activities, vegetation clearing and earthworks (where applicable) and revegetation activities must also be implemented during the maintenance.

Table 15: Method statement and control measures recommended for maintenance activities.

Activity 1: Sediment removal	
Removal of sediment may be required from road crossing sections, specifically after heavy rainfall events within various watercourses. Excessive sediment build-up will allow proliferation and dominance by <i>Typha capensis</i> , <i>Phragmites australis</i> or <i>Arundo donax</i> (Category 1b AIP) and may impact the hydrological functionality of the systems. A generalised sediment removal method statement is provided. Additionally, control measures that must be implemented during the sediment removal activities is also provided.	
Method Statement	Control measures
<ol style="list-style-type: none"> 1. Enter applicable maintenance site by means of the closest access point; 2. Remove any deposited material in the watercourses, adjacent to any road crossings from the upstream towards the downstream side; 3. Stockpile all removed material outside the watercourse; 4. Dispose of all material removed from the culvert from site. 	<ul style="list-style-type: none"> • Sediment clearing activities must preferably be undertaken in the drier summer season; • Should sediment clearing activities be undertaken in the raining winter period (specifically due to a blocked culvert after a heavy rainfall event), a sediment trap must be installed at the outlet side of the culvert. Sediment traps must be made from geotextile wrapped hay bales or may be a material drift fence; • Removal of sediment must preferably be done through manual labour and the use of heavy machinery must be avoided; • Personnel may only enter the applicable area of the watercourses where material needs to be removed. All other areas are considered a no-go areas; • Removed material must be disposed of at a registered disposal facility as soon as all the maintenance activities is concluded.



5.5 Action 4: Aftercare and Monitoring

Prudent monitoring of the watercourse directly impacted by the proposed Oya WEF development and potentially by edge effect are of the utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage the progress of the rehabilitation interventions and any arising issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- Site walk through surveys should be applied as the preferred method of monitoring (at specified frequencies) with specific focus on:
 - Erosion monitoring (every 3 months);
 - Sedimentation (every 3 months);
 - Alien and invasive vegetation proliferation (at the start and end of the growing season); and
 - Spills events (regularly at the direction of the relevant engineer)
- General habitat unit overviews should also be undertaken;
- Stability and appropriateness of stormwater controls;
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring actions should be repeatable;
- Data should be auditable; and
- Reports should present and interpret the data obtained.

The monitoring plan, as indicated in Table 15 below, comprises but is not limited to the following:

- Identification of areas of concern. These are areas that are affected by disturbances such as:
 - Erosion and sedimentation;
 - Alien vegetation species encroachment; and
 - Revegetation
- Ensuring that the management/rehabilitation measures as stipulated in Section 5 of this report are adhered to;
- Gathering all equipment required for the monitoring process; and
- Compiling a monitoring report.

Table 16: Monitoring actions proposed for the Oya WEF development

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting
AIP control	1. Screening of the watercourses where road crossings are located; and 2. Logging locations of any newly coppiced species to be treated/removed.	1. Before the initial AIP clearing a baseline assessment should be taken to indicate densities and species; 2. After the initial AIP clearing densities should be re-recorded, including all methods and chemicals used; 3. Quarterly assessment during the first year post rehabilitation. Densities and locations of newly coppiced AIPs to be recorded; and 4. Annually during the growing season for the second and third year, post rehabilitation to ensure long-term maintenance measures are effective.	1. Before and after AIP clearing report should be compiled; 2. Quarterly report during the first year post AIP clearing; and 3. Annually during each growing season, for at least three (3) years post rehabilitation – report should include information from before and after mobilisation of follow-up clearing teams.
Erosion	1. At watercourse road crossings; 2. All areas disturbed by construction activities, such as the entire road	1. Weekly during rehabilitation activities; 2. After every major rainstorm and / flood for the first wet season post rehabilitation.	Monthly monitoring report compiled by the appointed ECO.



Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting
	crossing footprint area		
Sediment deposit	1. Within the downstream reaches of the watercourses associated with road crossings	1. Weekly during rehabilitation activities; 2. After every major rainstorm and / flood for the first wet season post rehabilitation.	Monthly monitoring report compiled by the appointed ECO.
Re-vegetation	At all watercourse road crossings.	1. Monthly for 6 months after re-instatement of vegetation; 2. Annually during the growing season for at least three (3) years post rehabilitation to ensure plant survival and to ensure that no AIPs are outcompeting indigenous species.	1. Before commencement of rehabilitation activities, a report should be compiled listing existing species. Should the Contractor not have the expertise to undertake this list, they are to appoint a suitable botanist to assist; 2. Monthly for 6 months after the re-instatement; and 3. Annually during each growing season, for at least three (3) years post rehabilitation.

This monitoring plan must be implemented by a competent person and submit the findings to the responsible authority for evaluation.

6 CONCLUSION AND RECOMMENDATIONS

FEN Consulting (Pty) Ltd was appointed to compile a Watercourse Rehabilitation and Management Plan (WRMP) for the proposed Oya WEF development, located between Matjiesfontein and Sutherland in the Northern and Western Cape Provinces.

In accordance with the rehabilitation requirements proposed within this document, the rehabilitation actions proposed are relatively simple to implement. Although some rehabilitation activities, specifically those associated with road crossings area also located within the watercourses which may potentially also result in some type of impact to the watercourses, it must be noted that these activities are only for a short period and the long-term ecosystem provision and hydrological functioning of the watercourses will likely be maintained and, where possible, improved. These measures stipulated within this report will allow for long-term management and monitoring of the watercourses associated with the proposed Oya WEF development.

With the implementation of the WRMP procedures, the negative impacts of the proposed WEF Oya development on the watercourses can be adequately managed. This WRMP further assists in the adequate rehabilitation and erosion control within the projects site in general and to ensure the Present Ecological State of the watercourses are maintained. The information gathered through monitoring programs will assist in a better understanding of the ecology of the area in the vicinity of the proposed Oya WEF development infrastructure and ensure proactive management of risks to the watercourses.



7 REFERENCES

- Campbell P.J. (2000) *Rehabilitation Recommendations after Alien Plant Control*. Plant Protection Research Institute, Agricultural Research Council, Hilton.
- Department of Environmental Affairs and Tourism (1995). *Urban Open Space: Guidelines for effective management. Discussion document based on Agenda 21 and the RDP*, Technikon Pretoria
- Department of Water Affairs and Forestry. 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas*, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie & D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.
- FEN Consulting (2020). Freshwater Ecological Assessment for the proposed WEF development on erf 8892, southern Paarl, Western Cape Province. Report reference FEN 20 -0011.
- Mucina, L. & Rutherford, M.C. 2006.: The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Natural Resources Conservation Service. 2013. Pest Management – Invasive Plant Control Common
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and the associated Alien and Invasive Species Regulations (GN R598 of 2014).



ANNEXURE A – SPECIALIST DETAILS

1. (a) (i) Details of the specialist who prepared the report

Christel du Preez MSc Environmental Sciences (North West University)
 Kim Marais BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
 Stephen van Staden MSc Environmental Management (University of Johannesburg)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	SAS Environmental Group of Companies		
Name / Contact person:	Christel du Preez		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7539	Cell:	074 580 6823
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	christel@sasenvgroup.co.za		
Qualifications	MSc Environmental Sciences (North West University)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christel du Preez, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

C du Preez



1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Kim Marais, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Kim Marais





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTEL DU PREEZ

PERSONAL DETAILS

Position in Company	Senior Scientist (Watercourse ecology)
Joined SAS Environmental Group of Companies	2016

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
(SACNASP – Reg No. 120240/19)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Sciences (North West University)	2017
BSc Hons Environmental Sciences (North West University)	2012
BSc Environmental and Biological Sciences (North West University)	2011

Short Courses

Wetland and Aquatic plant Identification presented by Carin van Ginkel (Crispis Environmental)	2019
Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State	2018
Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2017
Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company Senior Scientist (Water Resource Manager)
 Joined SAS Environmental Group of Companies 2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions
 (SACNASP – Reg No. 117137/17)
 Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand) 2012
 BSc (Zoology and Conservation) (University of the Witwatersrand) 2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment) 2019
 Tools for Wetland Assessment (Rhodes University) 2018
 Certificate in Environmental Law for Environmental Managers (CEM) 2014
 Certificate for Introduction to Environmental Management (CEM) 2013

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes



SAS ENVIRONMENTAL GROUP OF COMPANIES



SPECIALIST CONSULTANT INFORMATION – CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing Member, Group CEO, Water Resource Discipline Lead, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SEGC	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018



CORE FIELDS OF EXPERTISE

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments



ANNEXURE B – LEGAL REQUIREMENTS

The sections below present each legislative document and the aspects, which are pertinent to water resource management including the rehabilitation of disturbed areas.

<p>The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)</p>	<p>The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.</p>
<p>The National Environmental Management Act, 1998 (Act No. 107 of 1998)</p>	<p>The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, refer specifically to biodiversity management in the following Clause: (4)(a) <i>Sustainable</i> development requires the consideration of all relevant factors including, (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.</p> <p>This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (as amended) (No. R. 327) where a "maintenance management plan" is defined as a management plan maintenance purposes defined or adopted by the competent authority. The following EIA Regulation triggers the need for this MMP:</p> <p>Activity 19, Listing Notice 1: The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving-</p> <ul style="list-style-type: none"> (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; <p>(N.B. Points (d) and (e) does not apply as these activities fall within the coastal zone).</p>
<p>The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)</p>	<p>The objectives of this act are (within the framework of the National Environmental Management Act) to provide for:</p> <ul style="list-style-type: none"> ➤ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➤ the use of indigenous biological resources in a sustainable manner; ➤ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➤ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➤ to provide for co-operative governance in biodiversity management and conservation; and ➤ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.



	<p>This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources.</p> <p>Furthermore, a person may not carry out a restricted activity involving either:</p> <ol style="list-style-type: none"> a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. <p>Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof.</p> <p>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Alien and Invasive Species Regulations, 2014)</p> <p>NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to:</p> <ul style="list-style-type: none"> ➤ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➤ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➤ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. <p>Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as:</p> <ol style="list-style-type: none"> (a) a species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. <p>Categories according to NEMBA (Alien and Invasive Species Regulations, 2014):</p> <ul style="list-style-type: none"> ➤ Category 1a: Invasive species that require compulsory control. ➤ Category 1b: Invasive species that require control by means of an invasive species management programme. ➤ Category 2: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➤ Category 3: Ornamentally used plants that may no longer be planted. <p>See Appendix C for further details pertaining to Alien and Invasive Vegetation control.</p>
<p>The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)</p>	<p>Amendments to regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) ensures that landowners are legally responsible for the control of invasive alien plants on their properties. The CARA legislation divides alien plants into weeds and invader plants, with <i>weeds</i> regarded as alien plants with no known useful economic purpose, while <i>invader plants</i> may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature.</p>
<p>The National Water Act, 1998 (Act No. 36 of 1998)</p>	<p>The purpose of the National Water Act, 1998 (Act 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled.</p>



	<p>The NWA, 1998 also provides for water use licenses which an operation will have to apply for, before commencing with any Section 21 water use activity. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use licenses will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues.</p> <p>Accordingly, and in terms of the <i>Guide to the National Water Act</i>, “water use” refers to doing something that has an impact on the water resource, for example:</p> <ul style="list-style-type: none"> ➤ The amount of water in the resource; ➤ The quality of water in the resource; and ➤ The environment surrounding the resource. <p>Section 4 governs the entitlement to use water and states that water may only be used if it is a Schedule 1 use, a continuance of an existing lawful use (ELU), or authorised in terms of a general authorisation (GA) or license. A water use may therefore not be implemented unless it is properly authorised through one of these types of authorisations.</p> <p>The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).</p> <p>A watercourse is defined as:</p> <ul style="list-style-type: none"> a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)</p>	<p>In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> ➤ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➤ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➤ A 500 m radius from the delineated boundary (extent) of any wetland or pan. <p>This notice replaces GN1199 and may be exercised as follows:</p> <ul style="list-style-type: none"> i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons’ existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. <p>A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA.</p>



Watercourse Rehabilitation and Management Plan Framework

Principles of this Wetland Rehabilitation, Implementation and Management Plan

To assist in achieving the objectives of a WRMP, a set of principles were applied which contributed to formulating action plans and specific management measures.

Loss of biodiversity puts aspects of the economy, human well-being and quality of life at risk, and reduces socio-economic options for future generations. The importance of maintaining biodiversity and intact ecosystems for ensuring the on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and is fundamental to the notion of sustainable development. In addition, international guidelines and commitments, as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa.

Impacts on biodiversity can largely take place in four ways:

- **Direct impacts:** are impacts directly related to the proposed WEF development including project aspects such as site clearing and soil compaction.
- **Indirect impacts:** are impacts associated with the proposed WEF development that may occur within the zone of influence associated with the proposed WEF development, such as the surrounding terrestrial areas.
- **Induced impacts:** impacts that directly attributable to the proposed WEF development but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries.
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous industrial/urban developments within the same drainage catchment.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted in the identification of spatial biodiversity priorities or biodiversity priority areas.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of anthropogenic activities. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level.

The mitigation hierarchy, as advocated by the Department of Environmental Affairs (DEA) *et al.* (2013) in general consists of the following in order of which impacts should be mitigated:

1. **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that recommended mitigations measures will not be adequate to limit environmental damage and eco-service provision to suitable levels;
2. **Minimise impact:** can be done through the utilisation of alternatives that will ensure that impacts on biodiversity and ecosystem services provision are reduced. Impact minimisation is considered an essential part of any development project;



- 3. Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable. As such, impacted areas must be returned to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation cannot, however, be considered as the primary mitigation tool as even with significant resources and effort of rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
- a. Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;
 - b. Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources associated with the project and its footprint supports the intended land uses. In this regard, special mention is made of the need to ensure the continued functioning and integrity of the wetlands throughout and after the rehabilitation phase.
 - c. Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community or community suitable for supporting the intended land use.
 - d. Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species reinstatement need only occur if deemed necessary.
- 4. Offset impact:** The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss of irreplaceable biodiversity, the residual impacts should be considered to be of a *very high significance* and offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.

Objectives of this Watercourse Rehabilitation and Management Plan

The objectives of this WRMP are to:

- Meet the requirements of relevant local and regional authorities;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts on the receiving environment to minimal or acceptable levels;
- Manage activities to maintain and/ or improve the ecological integrity of the watercourses associated with the proposed WEF development;
- Maximise the service provision of the watercourses through extensive rehabilitation;
- Re-introduce indigenous floral species;
- Provide improved and more suitable habitat for faunal species within an urban environment;
- Detail specific actions deemed necessary to assist in mitigating the potential environmental impact on the watercourses;
- Ensure as far as is practicable that the measures contained in the report are implemented; and
- Propose mechanisms for monitoring compliance with the WRMP and reporting thereon.

