

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

REHABILITATION OF WETLANDS IDENTIFIED IN THE KUSILE WETLAND OFFSET PLAN

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PREPARED FOR: Zitholele Consulting



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REGULATIONS

Requirements according to GNR 326 of 7 April 2017- Compiling an EMPr.

1. An EMPr must comply with section 24N of the Act and include—
 - a. details of—
 - i. the EAP who prepared the EMPr; and
 - ii. the expertise of that EAP to prepare an EMPr, including a curriculum vitae;
 - b. a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;
 - c. a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;
 - d. a description of the impact management, **objectives and** outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including—
 - i. planning and design;
 - ii. pre-construction activities;
 - iii. construction activities;
 - iv. rehabilitation of the environment after construction and where applicable post
 - v. closure; and where relevant, operation activities;
 - e. a description and identification of impact management outcomes required for the aspects and contemplated in paragraph (d);
 - f. a description of proposed impact management actions, identifying the manner in which the impact management **objectives and** outcomes contemplated in paragraph (d) **and e** will be achieved, and must, where applicable, include actions to —
 - i. avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
 - ii. comply with any prescribed environmental management standards or practices;
 - iii. comply with any applicable provisions of the Act regarding closure, where applicable; and
 - iv. comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;
 - g. the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
 - h. the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
 - i. an indication of the persons who will be responsible for the implementation of the impact management actions;
 - j. the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
 - k. the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
 - l. a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;
 - m. an environmental awareness plan describing the manner in which—
 - i. the applicant intends to inform his or her employees of any environmental risk which may result from their work; and

- ii. risks must be dealt with in order to avoid pollution or the degradation of the environment; and
 - n. any specific information that may be required by the competent authority.
- 2. Where a government notice *Gazetted* by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.

ACRONYMS

ASD	Assistant Director: Wetlands Programme
BAR	Basic Assessment Report
CEMP	Construction Environmental Management Programme
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EO	Environmental Officer
EMPr	Environmental Management Programme
EPWP	Expanded Public Works Programme
GPS	Global Positioning System
OEMP	Operational Environmental Management Programme
OHS	Occupational Health and Safety
NEMA	National Environmental Management Act (Act 107 of 1998)
NRM	Natural Resource Management
PIP	Project Implementation Plan
PDP	Professional Driving Permit
PPE	Personal Protective Equipment
PPR	Project Progress Report
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SETA	Sector Education and Training Authority
SOP	Standard Operating Procedure

DEFINITIONS

Basic Assessment Report (BAR): A report as described in regulation 23 of the EIA regulation, 2006 that describes the proposed activities and their potential impacts.

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation.

Environmental Assessment Practitioner (EAP): The individual responsible for the planning, management and coordination of the environmental impact assessments, strategic environmental assessments, environmental management plans and/or other appropriate environmental instruments introduced through regulations of NEMA.

Eco-log: A cylindrical wire mesh sleeve filled with organic material and/or soil used to prevent and/or repair minor erosion.

Ecosystem Services or 'eco services': The services such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem). Formally referred to as the Provincial Coordinator. Working for Wetlands Rehabilitation Programme Construction Environmental Management Programme

Environmental Impact Assessment (EIA): A study of the environmental consequences of a proposed course of action via the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

Interested and Affected Parties (I&APs): People and organizations that have interest(s) in the proposed activities.

Environmental Impact: An environmental change caused by some human act.

Implementer: The person or organisation responsible for the construction of rehabilitation interventions.

Intervention: An engineered structure such as a concrete or gabion weir, earthworks or revegetation that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

Mitigation: Actions to reduce the impact of a particular activity.

Maintenance: The replacement, repair or the reconstruction of an existing structure within the same footprint, in the same location, having the same capacity and performing the same function as the previous structure ('like for like').

Public Participation Process (PPP): A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NEMA refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific project matters.

Project: An area of intervention generally defined by a quaternary catchment or similar management unit such as a national park in which a single implementer operates.

Quaternary Catchment: *"A fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit"* and that is also the *"principal water management unit in South Africa"* (DWS Groundwater Dictionary. Available online:

http://www.dwaf.gov.za/Groundwater/Groundwater_Dictionary/index.html?introduction_quaternary_cache.html).

Rehabilitation: Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers. Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Standard Operating Procedure (SOP): Ten SOPs have been developed to ensure that all operating instructions/ procedures and guidelines used by and within the Working for Wetlands Programme are documented in a coherent and comprehensive manner and are written in such a way that anyone reading them can perform the tasks described with minimal supervision.

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils."* (SA Water Act of 1998) **and** *"Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there"* (Wetland Management Series: WETOrigins, WRC Report TT 334/08, March 2008).

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1. INTRODUCTION AND OVERVIEW OF THE EMPr

In 2015, The Kusile Wetland Offset Strategy was developed in support of the water use license application (WULA) for the proposed 60 year Ash Dump Facility (ADF) for Kusile Power Station in Mpumalanga, South Africa (Prime Africa 2015- See Appendix D of the BAR). The purpose of the strategy was to quantify the size of the wetland offset required as a result of the loss of 225 ha of wetlands directly related to the construction of the 60 Year ADF. Furthermore, the Strategy identified possible wetland areas on both Eskom and privately-owned land which could be utilised as a possible receiving areas to achieve offset targets. The Strategy was in accordance to the Wetland Offset Guidelines and calculator developed by SANBI and DWS in 2014.

Prime Africa was since been appointed by Zitholele Consulting (Pty) Ltd on behalf of Eskom Holdings (Pty) Ltd, for the purposes of compiling a Consolidated Wetland Offset Plan for the Kusile Power Station 60 year ADF. A key purpose of the appointment was the design of wetland rehabilitation interventions within the identified receiving areas as well as the subsequent application for the requisite environmental authorisations (EA) for the implementation of the rehabilitation interventions.

For implementation of the wetland rehabilitation activities, a Basic Assessment (BA) is required as per the activities listed in Regulations 544 and 546 of 18 June 2010 of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended.

This document represents the Environmental Management Programme (EMPr) that is required as an appendix of the BAR to obtain the EA from the Department of Environmental Affairs (DEA). This document is inserted in the BAR as part of the submission requirements for environmental authorisation.

The EMPr is largely based on that of the Working for Wetlands Rehabilitation Programs approach to CEMP development (Updated November 2015). The objectives and approach to rehabilitation is largely based on achieving the objectives of the Kusile Wetland Offset Strategy (Prime Arica 2015- See Appendix D of the BAR).

This EMPr must be read together with the site specific EMPr included in the Wetland Rehabilitation Plan (WRP).

The EMPr serves as a guideline for the management of the site by the Environmental Control Officer (ECO). The purpose of this Environmental Management Programme (EMPr) is to ensure the project implemented by Eskom adopts an effective and appropriate approach to wetland rehabilitation and that all activities are compliant with relevant legislation. This includes, as top priority, ensuring that the safety of people involved in the projects is not compromised at any time, that rehabilitation interventions are sustainable. This EMPr has therefore been compiled as a guideline to organise and co-ordinate environmental mitigation, rehabilitation and monitoring during the preparation and construction of engineering interventions such that positive impacts are enhanced and negative impacts are avoided/ minimised.

Furthermore, these guidelines include measures in line with best practice management. This document forms part of the agreement between Eskom and each project Implementer. It outlines areas in which compliance is required and serves as a reference against which practices shall be audited. Given that each project will operate under specific conditions, innovation by the Implementers, and modification of the EMPr, where appropriate, are encouraged within the framework of the prescripts. The role of ECO will be undertaken by an independent wetland specialist. This role is further detailed in Section 1.3.1.3

THE EMPr MUST REMAIN ON SITE FOR THE ENTIRE DURATION OF THE PROJECT AND MUST BE READ IN CONJUNCTION WITH THE FOLLOWING DOCUMENTS:

- Basic Conditions of Employment Act, 1997: Code of Good Practice for Employment (Appendix 1.1);
- General Authorisation for water use (Appendix J in the BAR);
- Project Wetland Rehabilitation Plan (WRP); and
- Basic Assessment Report (BAR).

1.1. Project Overview

1.1.1. Project Location Description and Map

The project location has been a result of outcomes in the Kusile Wetland Offset Strategy (Prime Africa 2015 – See Appendix D of the BAR). The strategy was developed together with wetland specialists and ecologists towards compliance with the conditions of the Water Use Licence as authorised by DWS. The wetland systems targeted for rehabilitation have been prioritised based on the requirements to offset residual impacts of the 60 year ADF.

The project is, as a result, located in the same sub-quaternary catchment as the proposed 60 year ADF for Kusile Power Station. This catchment is in the region east of Bronkhorstspuit along the border of Gauteng and Mpumalanga province in South Africa (Figure 1-1). The region falls within the Olifants River Catchment (Primary Catchment B) but more specifically within quaternary catchment B20F and is directly linked to the Wilge River (sub-quaternary B20F-01150), which flows north and forms a tributary of the larger Olifants River (Figure 1-2). Two key tributaries of the Wilge River form the focal sites in this catchment are the Klipfonteinspruit and the Holspruit, both of which extend past the north and southern extents of the Kusile Power Station (Figure 1-3).

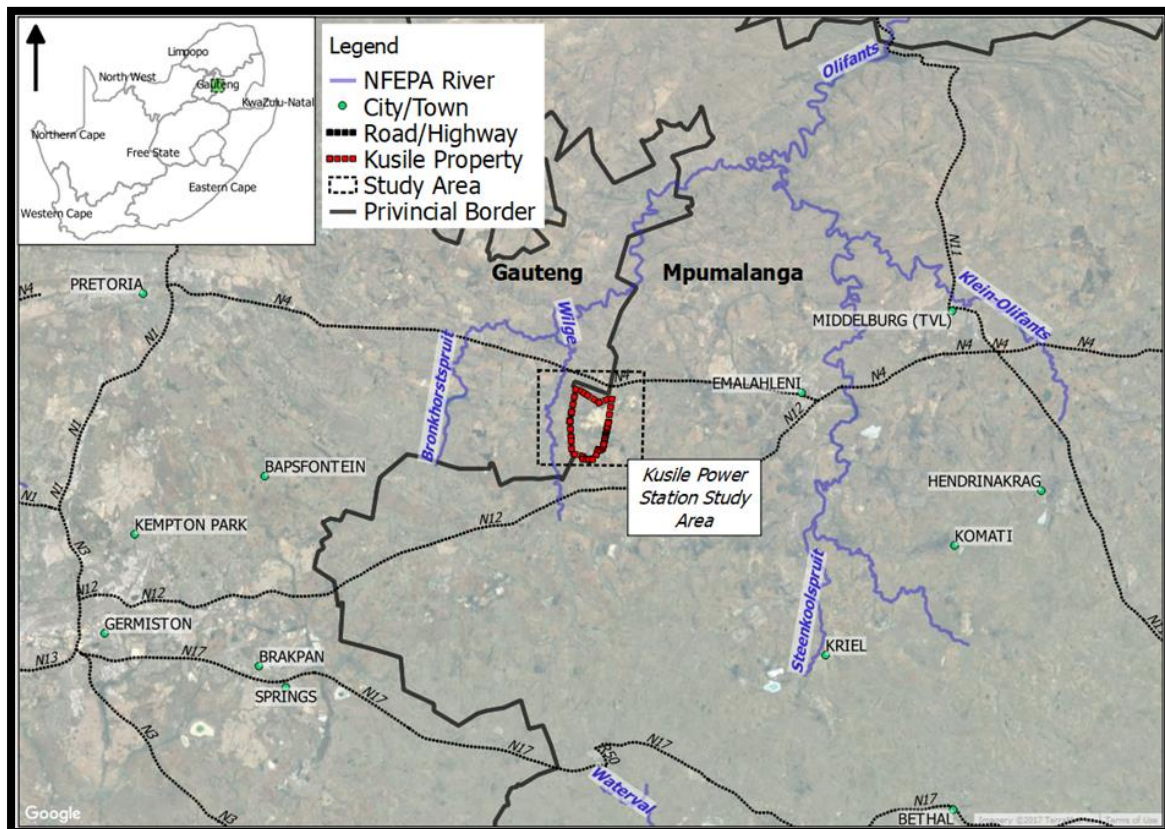


Figure 1-1: Project location

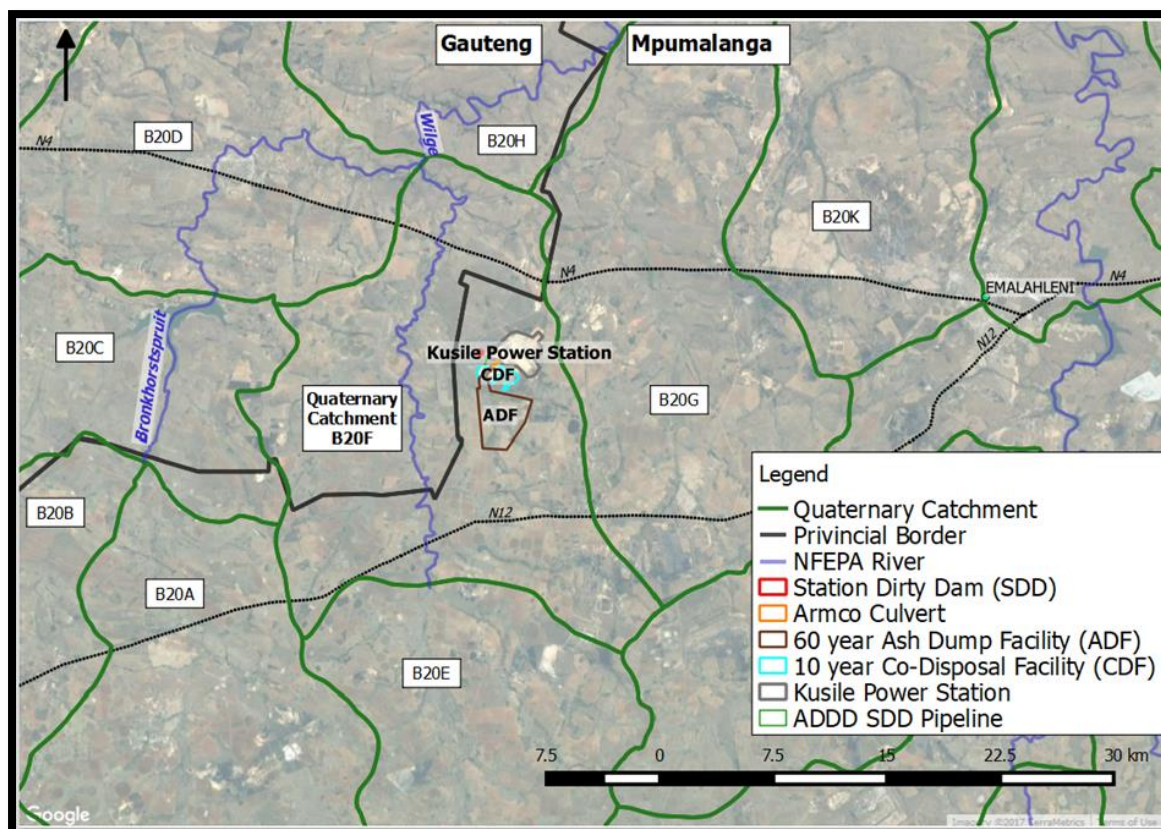


Figure 1-2: Project location with respect to quaternary catchments

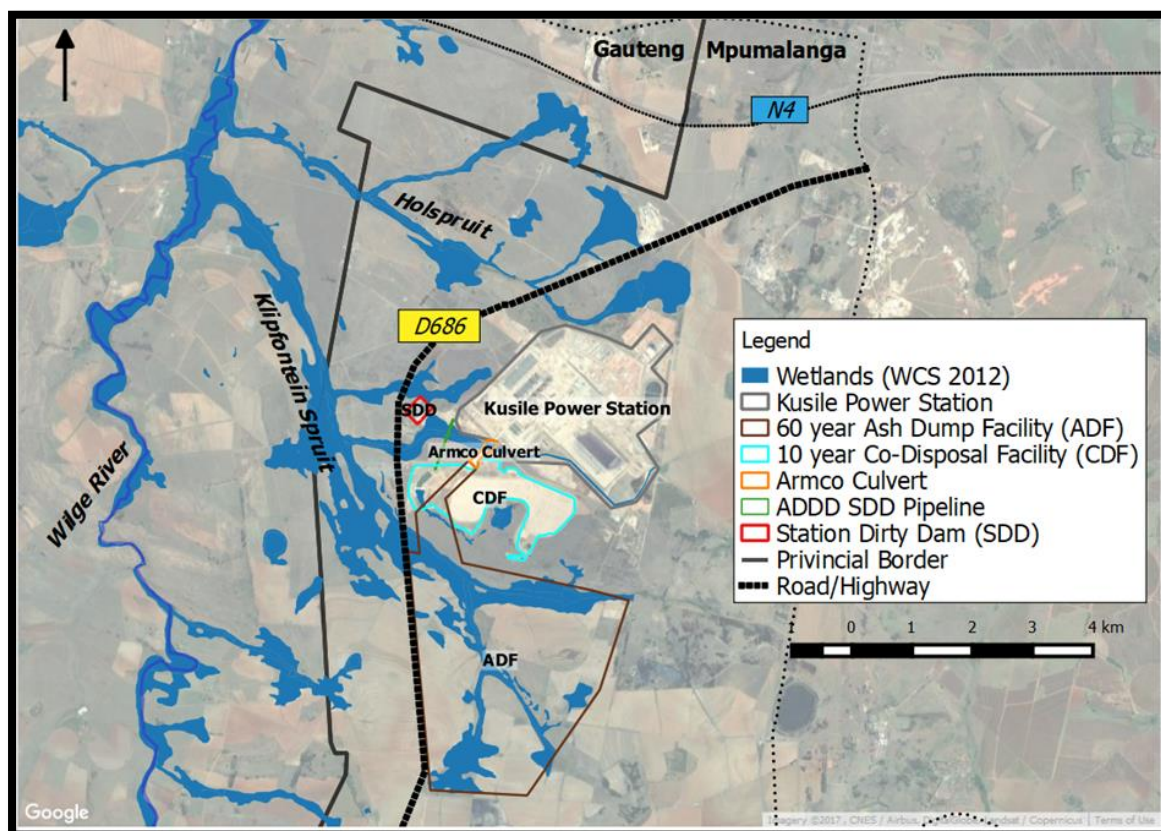


Figure 1-3: Project location with respect to associated wetland resources, river systems and associated infrastructure

An A3 locality map, as per requirements, of the target wetlands for rehabilitation has been provided in Appendix A of the BAR. Refer to the relevant section in the site specific WRP for detailed maps.

1.1.2. Project and Associated Construction and Operational Activities

The objectives of the proposed activities include the following:

- The restoration of the hydrological regime of impacted wetlands; and
- The promotion and restoration of natural wetland habitats

Two key approaches are utilised to achieve these objectives. These include a) the construction of (Hard) interventions, b) the application of non-constructed (Soft) interventions and the management of wetlands, buffers and, where possible, adjacent terrestrial areas.

Six constructed (Hard) intervention types will be utilised for the rehabilitation of the stream beds where bed incisions and changes to the natural flow regime have occurred. These include the following:

- In-stream drop-structures (to halt stream bed incision and to raise water levels);
- Stream diversion structures (to re-direct stream flow back to its natural course);
- Flow distribution systems (to spread the stream flow from a single bed channel to a wider flow regime);
- Stream plugs, simple gabion plugs in minor streams or entry channels (to prevent erosion of the side channel);
- Mac Mat soil protection systems (to stabilise embankments); and
- Flow dispersion structure (to divert high flows onto flood plains).

The non-constructed (Soft) interventions and management approaches proposed to be part of the overall rehabilitation and management of the target wetlands and terrestrial zones include the following:

- Removal and control of alien invasive plant species
 - This includes management approaches for both annual and perennial species;
 - Reduce abundance of alien species in wetlands and grasslands, improve natural species composition and habitats and promote growth of grasses or wetland plants in heavily invaded areas.
- Rehabilitation of anthropogenic scars, terraces, canals and agricultural disturbances
 - Identified areas will be landscaped to match expected and surrounding profiles.
- Management of past and present agricultural fields
 - Current agricultural activities will be ceased within wetlands in order to promote the establishment of secondary grassland. This will reduce favorable conditions for alien weed species, which in turn will reduce their abundance, will promote infiltration of precipitation (important for seeps) with a concurrent reduction in erodibility, and will retard the loss of topsoil. All artificial mounds will be levelled and eroded areas rectified. Where fields are completely denuded indigenous grass seed may be collected from surrounding areas and spread onto the soil surface during the rainy season. Crops that may arise from seed banks will be treated as alien species.
- Removal of rubble and debris
 - All rubble and debris removed offsite.
- Removal of old / unnecessary fences
 - The removal of all internal fences is so that grazers are not restricted to an area other than the entire area.

- Grazing regime management
 - A reduction in grazing pressure in places and an increase in others, but not complete removal.
- Fire regime management
 - It is unlikely that fire will be used as a management tool (due to risks on existing infrastructure), this approach to management however will be considered as a valuable option for management.
- Land Management Philosophy
 - Once interventions have been installed, both constructed and non-constructed, the focal areas will be managed according a specific management strategy that will outline appropriate management, monitoring and review.

For detailed site-specific descriptions and localities of activities please refer to the relevant project chapter of the Wetland Rehabilitation Plan.

A description of listed activities triggered as per the National Environmental Management Act (Act 107 of 1998) (NEMA) is given in **Error! Reference source not found.** 1.1.4 of the BAR.

1.1.3. Affected Environment

The wetlands in the area are generally moderately modified, denoted as a PES category of C (WCS 2012) with a few HGMs that are largely modified (PES category of D). The predominant cause of this deviation from the reference state is historical and current agricultural activities, both within and adjacent to wetland delineated areas. The hillslope seepage wetlands especially have been impacted by historical cultivation activities. Furthermore, significant channel erosion and incision has occurred within some of the valley bottom wetlands associated with the Holspruit and Klipfonteinspruit. Storm water runoff from the Kusile Power Station has increased erosion and turbidity in many of these wetlands and is encroaching many of the delineation boundaries. Poor grazing management such as livestock over-grazing or under-grazing also occurs within many of the wetlands and buffer zones. This has drastically altered floral species composition along many of the wetlands and alien plant species, particularly annual weeds, are plentiful. The Wilge River itself has been assessed as a category C river (DWS, 2014; applicable to the entire SQ of 44km length) with agricultural encroachment, abstraction, damming and alien vegetation cited as the main determinants.

Measures of ecological importance and sensitivity for wetlands in the area were taken from the 2012/2013 study by WCS (2013) for all wetlands and tributaries associated with the Wilge River and from the nation-wide PES-EI-ES study conducted by DWS including the Wilge River itself (2014; SQ B20F-01150). With the exception of a few channelled valley bottom wetlands that have an integrated ecological importance and sensitivity (EIS) of High, the majority of the wetlands, not including the Wilge River itself, have an EIS of Moderate. This was defined as “Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers” (WCS, 2014). The Wilge River itself has been assigned a High ecological importance and a Very High ecological sensitivity (DWS, 2014; applicable to the entire SQ of 44km length), with an integrated EIS of High.

The main problems identified in these systems relate to altered hydrology, geomorphology and vegetation with specific impacts including the following:

- Hydrology

- Increased runoff from upstream resulting in flows tending to be increased with greater energy for disruption, including erosive capacity and lack of retention.
- Geomorphology
 - Alterations to flow contribute to the deterioration of the geomorphic template, which together with resultant effects of overgrazing and high trampling pressures, has been altered to an incised, more confined channel with a higher ability to dissipate flows and lower probabilities of flooding beyond the channel.
 - In places, direct intervention and disturbance has re-routed the main channel and in so doing altering the hydrological, geomorphic and vegetative characteristics of remaining wetlands. In addition, several farm dams have completely altered geomorphological characteristics in such localised areas.
 - Notable disturbances within seep wetlands includes canals and excavations designed to more rapidly drain seepage areas and dissipate what should be slow infiltrating and overland flows.
- Vegetation
 - Wetland vegetation has been notably altered in areas where alien plant species have invaded (e.g. Poplars within the wetlands) and where overgrazing and trampling have denuded areas to various degrees.
 - Overgrazing has promoted the establishment of unpalatable and unwanted plant species, thereby altering species composition, but has also increased vulnerability to erosion and hence altered infiltration processes.
 - Less notable alterations to vegetation include a shift in species composition and abundance as channels incise and surrounding areas become drier. This is especially notable along active channels of channelled valley bottom wetlands, but is also discernible in some places within seep wetlands where canals have been excavated to drain such areas.

To address these issues the following rehabilitation objectives have been identified:

- To address channel incision of main active channels as much as is practically possible;
- To re-route channel diversions back to the original alignment/s;
- To promote dispersal and retention of flow in areas where this is beneficial to wetlands;
- To remove perennial alien invasive plants species;
- To restore water retention and seepage functionality to hillslope seep wetlands;
- To promote grazing regimes that are beneficial to wetland and buffer condition;
- To protect wetlands from the upstream environment; and
- To address non-functional dams where these have failed and promote wetland restoration in such vicinities.

The selection of project activities (described above) has been directly driven by the aim of successfully achieving these objectives.

For site-specific descriptions of the receiving environment please refer to the relevant project chapter of the site-specific Wetland Rehabilitation Plan.

1.1.4. Specific Recommendations Identified during the Impact Assessment in the BAR

The following key recommendations were identified in the BAR (See Section D of the BAR)

1. Vegetation will be trampled to access sites and removed in demarcated areas to facilitate construction. Both disturbance and removal must be strictly controlled and minimised to as small an area as is required.
2. Site demarcation to follow accepted best practice (see Appendix 1, DWA, 2005) and to be done by a suitably qualified person before the construction phase.
3. Aggregates and construction materials brought to site should be laid down in pre-construction demarcated areas outside of the wetland boundary or on Geo textile to minimize footprint and impact.
4. Area to be trenched must be clearly demarcated before commencement and activities confined to these areas. Trenching to be done by hand (i.e. with pick and shovel) and not by heavy plant (such as TLBs).
5. The timing of trenching is to be co-ordinated such as to not have open trenches for long periods of time, and where possible is to proceed in the non-rainy season.
6. The top 300mm layer of wetland soil is to be kept separate from other substrates for reuse after construction. Soil will be replaced on top, post construction to promote revegetation within the wetland.
7. Should distinct layering be present in sub-soils, these different soil types must be stockpiled separately and not mixed with different types. Replacement of sub-soil must be in reverse order of when they were excavated and be as close to the original as possible in both layering and compaction. Compaction when replaced is to be done by hand using stampers or wackers.
8. Dewatering of a channel or wetland typically involves the installation of a partial or total impoundment or coffer dam (e.g. sandbag structure), followed by pumping out of the surface water from the upstream side of the impoundment, preferably to the downstream side of the Works. The coffer dam's function is temporary and must not be in place longer than is necessary to complete the Works. Cofferdams should be constructed with material easily removed e.g. sand bags, and its placement must be supervised by the ECO or other suitably qualified person. Water pumped from the coffer dam should be returned to the channel to continue downstream and should not be removed from site or utilised for other purposes. Flow diverted to the downstream environment must be secured and monitored to make sure that blockages are prevented, and that the downstream environment does not cease to flow. Flow outlet downstream of the works must be as close to the works as possible to minimise the longitudinal length of the section that does not receive flow. The flow outlet should be managed in such a way so as not to cause or exacerbate incision, erosion or bank and bed destabilisation.
9. Backfilling of the earthworks must make use of material removed from the same site and layering must reflect pre-disturbance structure. The use of foreign material is not permitted.
10. Aggregates brought to site for construction purposes must be screened for alien plant species propagules and discarded if these are present.
11. After completion of the Works the site should be monitored for the presence of alien plant species and managed if present.
12. Woody species are to be sawn off at ground level by hand (saws or chain saws) and spot-poisoned with a pre-approved toxin. Soil profiles should not be disturbed. Plant material is to be removed from site. Annual weeds are to be mown (with for example a weed eater) in order to prevent successful reproduction i.e. mowing is best done during peak flowering.
13. Design specifications must be strictly adhered to, especially with regards to mixing proportions, concrete strengths and tie-in depths and lengths. Backfilling around constructed interventions should be compacted by hand (stampers or wackers) to pre-construction conditions.

14. Backfilling upstream of constructed interventions is particularly important and should be revegetated using the top layers of plant-containing soils from the site.
15. Sites must be monitored for any form of erosion once the coffer dam has been removed and after flood events. Any ensuing erosion must be addressed immediately and in the correct manner. Professional guidance should be sought if required.
16. Ensure that all employees are aware of the potential for fires and the damage that could be caused.
17. Smoking and cooking to be prohibited on site and must take place at designated times at designated sites that have been approved as fire safe. Ensure that a fire response procedure is in place and that all dry season work is organized in liaison with the landowners so that it fits into their firebreak/fire protection programme.
18. All mixing of mortar or concrete to take place in mixing trays with underlying plastic as well.
19. Contaminated water is not to be discarded on site, into the wetland or into the channel. All waste and excess material is to be removed from site daily and dumped at a pre-determined site specifically for this purpose.
20. All site employees to undergo environmental induction training.
21. Landowners should be consulted regarding the placement of stockpile sites and toilets as well as access routes.
22. All site employees must ensure that closed gates are kept closed and open gates open.
23. The EMPr must be followed with regards to sanitation facilities, waste management, noise and site management.
24. Consult with landowners and the local community to ensure that they are aware of, and educated in, the ecological values and sensitivity of the wetland environments, as well as the exact location of the intervention structures to be implemented.
25. Ensure that the required workers are sourced from local communities and that maximum employment numbers are maintained throughout the project duration. Project implementers to support local businesses (e.g. local quarry owners to obtain rock for gabions) where possible.
26. Structures must be monitored annually and after large floods or rainfall events to check for undercutting or erosion associated with the structure. Any sign of erosion or destabilisation must be rectified immediately. Consultation with the design engineer is encouraged.

The following limitations apply to proposed wetland rehabilitation:

- 1) Land ownership precludes a completely holistic approach in that not all of the wetlands associated with the Holspruit and Klipfonteinspruit are available for rehabilitation efforts. This limits rehabilitation to portions of drainage systems and while this remains beneficial, it does introduce added risk to the effort.
- 2) The proposed ADF is directly upstream of many of the proposed rehabilitation interventions on the Klipfonteinspruit. This increases the risk to downstream rehabilitation success, especially since uncertainty exists concerning the nature of water delivery to the downstream environment. If high flows to the Klipfonteinspruit are increased in magnitude and frequency, the danger of continued incision is increased as is the risk of intervention structure failure. If flows are reduced to a point where perennality is compromised or lost (i.e. zero flows in the dry season), ecological functionality and integrity will be placed at risk. The ideal situation would be to store water in such a way so as to facilitate its slow release, especially during the dry season so that zero flows do not occur, and so that flood flashiness is not significantly increased in the wet season.

- 3) There are proposed mining activities upstream of the ADF site which is upstream of a portion of the target wetlands. The uncertainty in terms of the nature and extent of downstream impact pose a risk to rehabilitation activities.
- 4) There is a possibility that prospecting, and mining rights are granted for areas identified for rehabilitation. Preliminary investigations have resulted in this not being a risk, however difficulty in obtaining specific information on the matter has resulted in this being a risk;
- 5) There are uncertainties around the rehabilitation plans for the B&E Quarry. The locality of the B&E quarry within the buffer of the wetlands has resulted in the associated rehabilitation requirements and associated activities potentially posing a risk to the activities proposed here.

1.2. Phases of the project

The process which was followed in compiling this EMP is in compliance with requirements according to GNR 326 of 7 April 2017, and applies the principles of Integrated Environmental Management (IEM). The purpose of this EMP is to formulate mitigation measures that are made binding on all contractors during the construction phase as well as during the operational phase. The point of departure for this EMP is to take a pro-active route by addressing potential problems before they occur. This should limit corrective measures needed during the construction and operational phases of the development. Additional mitigation will be included throughout the project's various phases, as required and if necessary. This EMP deals with the following phases as detailed below:

1.2.1. Planning/ Design Phase

Planning and design phase includes initial site visits for the purposes of developing the necessary baseline requirements towards obtaining environmental authorisation for the proposed activities.

1.2.2. Pre-construction Phase

This phase involves the finalisation of assessments and investigations of the target wetland sites directly prior to construction phase. Examples of activities include the collection of final B&E data per wetland.

1.2.3. Construction Phase

The construction phase commences with the installation of the first intervention and is complete once rehabilitation of the construction site has taken place.

The bulk of the impacts during this phase will have immediate effects (e.g. vegetation removal, noise, dust and water pollution). If the site is monitored on a continual basis during the construction phase, it is possible to identify these impacts as they occur. These impacts can then be mitigated through the contingency plans identified in the planning phase, together with a commitment to sound environmental management from Eskom.

1.2.4. Operational Phase

The operational phase refers to the period after completion and installation of rehabilitation activities and interventions. This phase largely includes the long-term management of target sites and the monitoring and evaluation of rehabilitation activities and objectives. By taking pro-active measures during the planning and construction phases, potential environmental impacts emanating during the operational phase will be minimised. This, in turn, will minimise the risk and reduce the monitoring effort, but it does not make monitoring obsolete. The operational phase will coincide with the lifespan of Kusile Power Station.

1.2.5. Closure Phase

The closure phase does not play a large role in wetland rehabilitation activities. The closure phase however refers to the point where objectives have been achieved and sustainable management is taking place. The closure phase is expected to coincide with the closure of Kusile Power Station.

1.2.6. Phase Timelines

Phase	Activities	Commence	Estimated Time Period
Planning/ Design Phase	Investigation of study area and preparation of requirements	Upon contract signature	1 year
Pre-construction Phase	Pre-construction planning, collection of baseline data	Once EA has been approved and WRP has been reviewed by DEA	2 months
Construction Phase	The installation of proposed rehabilitation activities and site rehabilitation	The initiation of construction	5 years
Operational Phase	The management, monitoring, maintenance, reporting and evaluation of objectives.	After all construction activities have been completed and the site has been rehabilitated	60 years (The lifespan of the Kusile Power Station)
Closure Phase	The finalisation of activities	Once the obligation by the proponent for continuous management and evaluation is complete	1 year

This EMPr offers an ideal opportunity to incorporate pro-active environmental management measures with the goal of attaining sustainable development. While there is still the chance of accidental impacts taking place; however, through the incorporation of contingency plans (e.g. this EMPr) during the planning phase, the necessary corrective action can be taken to further limit potential impacts.

1.3. Management Procedures

1.3.1. Organisational Structure and Responsibility

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Proponent (Eskom), the contractor, the Environmental Control Officer (ECO), the implementer and DEA for the construction phase of this project are as detailed below. Figure 1-4 illustrates the organisational framework of communication between all parties involved.

1.3.1.1. The Proponent

The Proponent (Eskom) is the ultimate responsible party for the development and all aspects and phases thereof. Eskom or an appointed representative must communicate all issues raised in this EMPr with all personnel undertaking any work on the site. Should any non-compliance with this EMPr take place, Eskom will ultimately be held liable. Eskom shall appoint the Contractor, Implementer and a suitably qualified ECO and ensure that they are well versed in the contents of this EMPr. Eskom should include the EMPr as a specific condition within any contract that is to be signed between him/her and any other party involved in the construction of the development. Eskom is responsible for identifying which local / provincial environmental authority has jurisdiction over the project. Eskom shall obtain and comply with all the necessary approvals, permits, authorisations and requirements set by the relevant National and Provincial Departments and Local Authority for the construction of engineering interventions for the rehabilitation of wetlands before any site preparation activities are undertaken.

1.3.1.2. The Contractor

The Contractor is responsible for complying with the EMPr during the construction phase of the development on a day-to-day basis and for ensuring that his/her contractors, Participants and subcontractors appointed by him/her are familiar with the EMPr and that they abide by it. The Contractor will be responsible for any non-compliance with the EMPr and will pay for any remedial work that may result from non-compliance resulting directly from his/her negligence. Failure to comply with the EMPr is addressed in Section 2.5. Furthermore, the Contractor shall:

- Ensure that the works on-site are conducted in an environmentally sensitive manner and in accordance with the requirements of the EMPr at all times. Special care shall be taken by the Contractor to prevent irreversible damage to the environment.
- Prepare the site in accordance with the conditions set out in this EMPr ensuring that all work areas, stockpiles and boundaries are located in a manner that complies with the requirements of this EMPr.
- Assist the ECO in providing environmental awareness training to all on-site staff prior to the commencement of any environmentally disturbing activity.
- Ensure that all staff are adequately informed of the requirements of the EMPr pertaining to their site role, and that they have attended an environmental training session (this session must be in the form of an on-site talk and / or a written code of conduct that is clearly explained to and understood by the team).
- Ensure that all sub-contractors or visitors to the site are conversant with the EMPr or relevant sections of the EMPr pertaining to their role on site.
- Supply method statements for any activities that are proposed as variations to the SOP's.

1.3.1.3. The ECO

The ECO is responsible for communicating environmental issues associated with the site to the Contractor, and therefore must have adequate environmental knowledge, and specifically experience in the field of wetland rehabilitation, to understand the detailed environmental issues associated with the project and be well versed in the contents of the EMPr. Should any non-compliance with the EMPr take place, the ECO must communicate this with the party responsible for the non-compliance as well as the Contractor and Eskom. If the non-compliance continues after written request by the ECO to rectify the situation, the ECO must inform DEA in writing. The ECO is responsible for the explanation of environmental issues contained in this EMPr to anyone working on the site. Should any issues arise on the site of an environmental nature or concern, the ECO will be responsible for taking the appropriate action. In terms of specific tasks, the ECO shall:

- Communicate all aspects of the EMPr to the site staff with the assistance of the Contractor prior to the commencement of excavation or any other environmentally disturbing activity. Basic environmental awareness training must be carried out for all Participants and should be included in safety training (See Section 2.4 and Appendix 1.1).
- Undertake all auditing activities to ensure compliance with the EMPr.
- Inspect the intervention site prior to any preparation activities commencing; at least once per month (but more frequently for sensitive sites) during construction, on completion of construction and rehabilitation of site.
- Shall liaise closely with the Contractor and Implementer and shall provide guidance on any environmental management issues, incidents or emergencies that are brought to their attention. Should the ECO be unable to proficiently address an issue, the ECO must seek advice from a person or persons that are educated and experienced in the relevant field.
- Shall assist in providing recommendations for remedial action in the event of any non-compliance.

1.3.1.4. The Environmental Officer/ Environmental Manager

An Environmental Officer (EO) (also referred to as the Environmental Manager) will be responsible for assisting the ECO with his/her duties. The EO will take a hands on approach and remain on site and ensure communication between the contractor and ECO is sufficient. The EO will be appointed by the contractor.

1.3.1.5. The Implementer

The Implementer (playing the role of the Project Manager) is responsible for communicating any issues or concerns of the surrounding community regarding the development to the ECO or other responsible party and visa-versa.

1.3.1.6. DEA

DEA is responsible for taking action against any non-compliance with the EMPr by the Contractor and/or any of his/her subcontractors. DEA can request a compliance audit to be undertaken on the site at any time during the construction phase of the project.

1.3.1.7. Advisory Committee

Active Participant and Contractor participation in project management will be encouraged through the use of an advisory committee. The Environmental Management Committee (EMC) at Kusile Power Station will provide the forum for communication of progress and outcomes of the rehabilitation activities. Furthermore the EMC must consider that:

- The EMC should represent all communities from which Participants are drawn and in which work is being done.
- The EMC shall assist in the identification of potential contractors and target groups for employment.
- Community-based forums should participate in the EMC in order to contribute to the prioritisation and implementation of social development activities.
- Minutes of EMC meetings will be forwarded to the relevant Social Development Manager on completion. No reporting on the Project Progress Reports (PPRs) will be accepted without the written minutes, or a site inspection by the landowner and advisory committee.

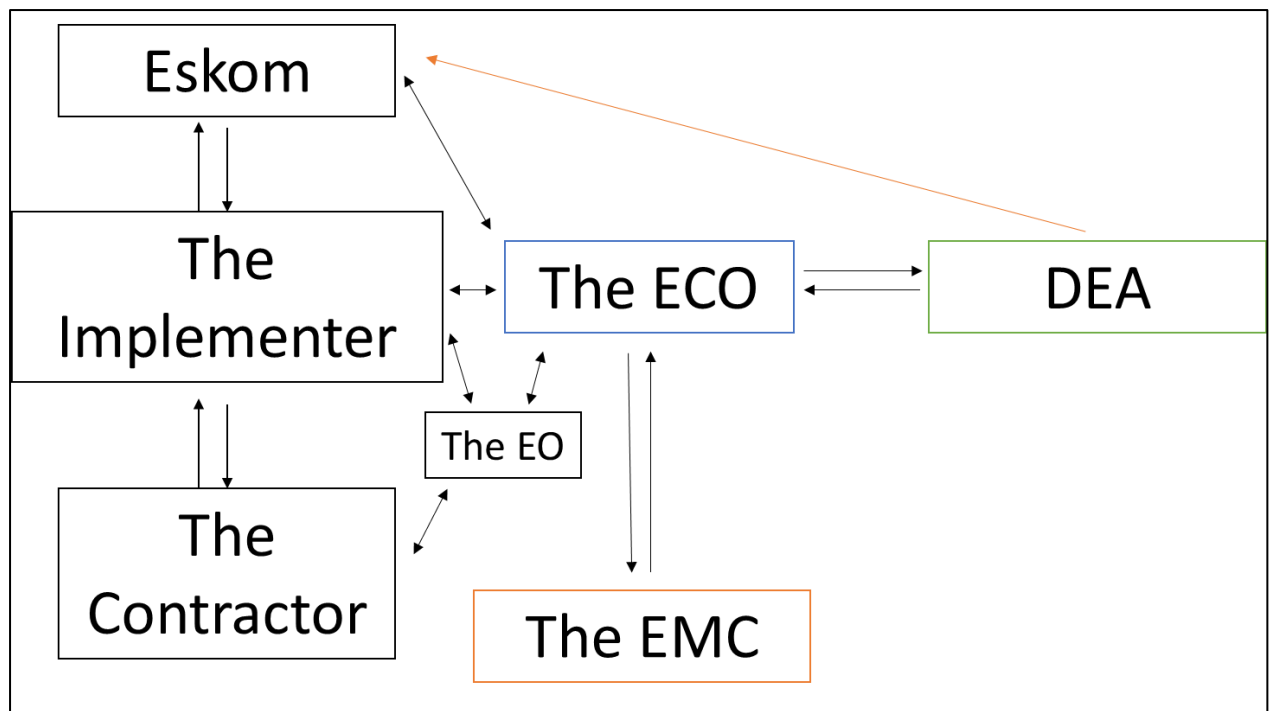


Figure 1-4: Organisational structure of the EMPr implementation

2. THE EMPr

The EMPr is intended for use on site by Eskom, the Implementer, Contractor and the ECO. This EMPr is legally binding. The EMPr provides specifications and regulations that must in all instances be adhered to. It is however the responsibility of all people involved committing themselves with the implementation of the EMPr in all phases of the project, or in those instances where specific instructions are provided. The Implementer will be responsible for ensuring compliance of the Contractors with the EMPr, and will rely on the ECO to monitor compliance. The Contractor must in turn monitor his Participants to ensure their compliance with the provisions of the EMPr. The main Contractor shall receive a copy of the EMPr from the client on which he/she will be given the opportunity to clear any misconceptions and uncertainties. The EMPr will form part of the contract and will therefore be a legally binding document. In the event of discrepancy with regard to environmental matters or environmental specifications this document shall take precedence. The mitigation presented in this section is based on an understanding of typical impacts that the proposed rehabilitation activities would have. Additional impacts will thus likely be included in the WRP once a site specific assessment has been done. The information included in the WRP must thus be read together with that present in this document.

2.1. Appointment and Planning of the EMPr

The following tables form the guidelines of this EMP for the construction and operational phases of the development. These tables should be used as a checklist on site, especially during the construction phase. Compliance with this EMP must be audited monthly during the construction phase and once immediately following completion of construction. This must be followed up with annual audits for the entirety of the operational phase.

Activity/ Issue	Action Required	Responsible Party	Frequency
Planning	The construction must conform to both the applicable conditions of the EA and the Minimum Requirements associated with the site classification.	Eskom	Continuous
	There must be sufficient facilities (plant materials) and resources (trained labour force) to ensure that the planned activities can conform to both the permit conditions and relevant Minimum Requirements. For example, there should be sufficient trained staff to monitor, control and record incoming waste where required.	Eskom	Continuous
	All construction activities within the landfill must be limited to daylight hours. Should there be a need to undertake construction at night, such will require approval from the implementer and the ECO must be notified of such intentions.	Contractor	Continuous
Appointment and duties of ECO	Eskom must appoint an independent Environmental Control Officer (ECO) who must monitor (Audit) the contractor's compliance with the environmental management plan.	Eskom	Once-Off
	The ECO must monitor (Audit) the contractor's compliance with the environmental management plan.	ECO	Continuous
	The Eskom must provide the ECO and contractor with a copy of the EMPr.	Eskom	Once-Off
	The priority of the ECO is to maintain the integrity of the development conditions outlined in the EMPr and must be enforced and adhered to at all time.	ECO	Continuous
	The contractor must ensure that the construction crew attend an environmental briefing and training session presented by the ECO prior to commencing activities on site.	ECO	Continuous
Appointment and duties of EO	The contractor must appoint an Environmental Officer (EO). This person will be required to monitor the situation with a direct hands on approach, and ensure compliance and co-operation of all personnel. He should be fluent in the languages of the employees.	Contractor	Once-Off
EMPr	This EMPr must be made binding to the main contractor as well as individual contractors and should be included in tender documentation for the construction contract.	Eskom, ECO	Once-Off
Permits and Permissions	The Contractor shall ensure that all pertinent permits, certificates and permissions required for the project have been obtained prior to any activities commencing on site and ensure that they are strictly enforced/adhered to. This includes, for example, licence for storage of flammable liquids and	Contractor, Eskom	Continuous

	hazardous materials (obtained from Victor Khanye Municipality, if applicable) and other permits and legislative requirements applicable to the project.		
	The Contractor shall maintain a database of all pertinent permits and permissions required for the contract as a whole and for critical activities for the duration of the contract.	Contractor, Eskom, ECO	Continuous
Method Statement	<p>The Contractor shall submit written Method Statements to the proponent (Site Manager) for the activities identified by the Site Manager or ECO. Activities that will require method statements include:</p> <ul style="list-style-type: none"> • Concrete pre-cast and batching operation; • Crushing plant operation; • Storage facilities for any hazardous substances; • Emergency procedures; • Site establishment; • Removal and clearing of vegetation; • Materials, equipment and staffing requirements (camp establishment); • Transporting the materials and/or equipment to, from and within the site; • The storage provisions for the materials and/or equipment; • The proposed construction procedure designed to implement the relevant Environmental Specifications • Other information deemed necessary by the ECO. <p>Method Statements shall be submitted at least ten working days prior to the proposed commencement of work on an activity to allow the ECO time to study and approve the method statement.</p>	Contractor, ECO	As necessary
	The Contractor shall not commence work on that activity until such time as the Method Statement has been approved in writing by the Proponent (Site Manager).	Contractor, Site Manager, ECO	Continuous
	The Contractor shall carry out the activities in accordance with the approved Method Statement.	Contractor, Site Manager, ECO	Continuous

	Under certain circumstances, the ECO may require changes to an approved Method Statement. In such cases the proposed changes must be agreed upon in writing between the Contractor and the ECO, and appropriate records retained.	Contractor, Site Manager, ECO	Continuous
	Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. Approval of the Method Statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the EMPr specifications.	Contractor, Eskom	Continuous
Existing Service and Infrastructure	The Contractor shall ensure that existing services (e.g. roads, pipelines, powerlines and telephone services) are not damaged or disrupted unless required by the contract and with the permission of the land owner (Eskom).	Contractor, Site Manager, ECO	Continuous
	The Contractor shall be responsible for the repair and reinstatement of any existing infrastructure that is damaged or services which are interrupted.	Contractor	As Necessary
	Such repair or reinstatement will be to the Contractor's cost and shall receive top priority over all other activities.	Contractor	Continuous
	A time limit for the repairs may be stipulated by the Site Manager in consultation with the Contractor	Contractor, land owner , ECO	Continuous
Environmental Incidents	The contractor must take corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves.	EO, ECO, Contractor	Continuous

2.2. EMPr: Basic Code of Conduct

Action Requires	Responsible Party (Phase)	Frequency
<ul style="list-style-type: none"> Private property access is only permitted on previous agreement with the affected landowner, or will be considered trespassing. Trespassing on adjacent properties shall be subject to disciplinary and legal action. Ensure that closed gates are kept closed. When in doubt, the landowner should be consulted. Teams working outside of the active site, or requiring access to private properties are to carry identification on their persons that includes their name, position, company of employ, and reference to the Working for Wetlands Project. Similarly, such information shall be displayed on vehicle dashboards/exterior. All work shall be based on an approved Wetland Rehabilitation Plan (WRP). Any deviations from the planned specification need to be approved by the ECO and the relevant Engineer. A construction supervisor shall be appointed. The appointment letter shall be made available on site. All persons, including visitors, shall comply with the OHS Act and wear the required PPE. Work sites shall be properly planned and marked out, preferably in collaboration with the Contractors. Areas shall be demarcated for vehicle access and parking, off-loading, mixing etc. (See Section 2.9). No unauthorised person may enter the work site. The location and position of all rehabilitation interventions shall be precisely demarcated by the Engineer and the Implementer, according to the WRP. Dimensions of rehabilitation interventions shall also be marked out where appropriate (e.g. depth of an excavation). Any excavation deeper than 1.8m shall comply with the relevant sections of the OHS Act. Implementation of all interventions will be done with a focus on cost-effectiveness and efficiency, while maintaining quality and appropriateness. 	All Parties (All Phases)	Continuous

2.3. EMPr: Roles, Responsibilities and Timeframes

Action Requires	Responsible Party (Phase)	Frequency
The overall responsibility to ensure that the EMPr is implemented rests with Eskom, who shall appoint appropriate engineering, environmental and contracting teams to undertake the work.	Eskom (All Phases)	Continuous
The ECO and Contractors on site are responsible for ensuring compliance with the EMPr.	ECO, Contractors (Construction)	Continuous
The ECO shall inspect the site prior to commencement of any construction activity, at least once per month during construction and on completion of construction to establish the level of compliance with this EMPr. At sensitive sites, bi-weekly inspections shall take place as a minimum. Monthly site audits shall be undertaken by the ECO. The annual Compliance Audit Report shall be submitted to the DEA collating the year's completed checklists.	ECO (Construction)	Continuous
It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the DEA. Furthermore, the contract between the Implementer and the Contractor shall be readily accessible to the ECO and Contractors.	ECO (Construction)	Continuous
The Implementer (i.e. the Project Manager) shall ensure that the Contractor and Participants understand the contract. Each contract shall be allocated a unique identity number.	Implementer (Construction)	Continuous
<p>The following shall form part of the contract between the Implementer and Contractors:</p> <ul style="list-style-type: none"> • Rehabilitation specifications; • Technical drawings of the structures, including a list of the material required; • EMPr; • Site plans; • Environmental Authorisation and/ or Approval; and <p><i>All site setting out documents as supplied by the Engineer.</i></p>	Eskom (Construction)	Once Off
<p>The following guidelines and recommended templates will be made available to all Implementers by Eskom:</p> <ol style="list-style-type: none"> 1. Guidelines for completing the project implementation plans. 2. The risk assessment framework as included in the BAR. 3. Project management tools including: <ul style="list-style-type: none"> • Daily attendance register • Vehicle check sheet • Production sheet • Implementer's inspection sheet • Incident report for near misses 	Eskom (All Phases)	Continuous

<ul style="list-style-type: none"> • Format for toolbox talk minutes • Receipt of goods • Consumables used sheet • Pay sheet • Personnel update sheet • Contractor's invoice • Filing of information • Safety plan and emergency numbers • Tender document • Contractor safety policy • Risk assessment • Registration form for Compensation for Occupational Injuries and Diseases Act • OHS Act notification of construction work • Construction supervisor appointment letter • Health and safety construction representative appointment letter • First aid officer appointment letter • First aid kit contents • Training matrix • Record of completed training • Grievance procedure and grievance form • PPE matrix • Record of PPE issued • Disciplinary procedure • Contractor and Participant contracts 		
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2.4. EMPr: Environmental Training

Action Required	Responsible Party (Phase)	Frequency
Within seven days of the commencement date, the Contractor's site staff including foremen and site management staff shall attend an environmental awareness training course, of a minimum of one-hour duration (which shall be extended in areas of high sensitivity). Provision should also be made for quarterly refresher courses to be undertaken during the course of the contract. The Contractor shall ensure that all attendees sign an attendance register, and shall provide the Implementer with a copy of the attendance register the day after each course. The training shall address, but not be limited to, basic environmental awareness, basic health and safety awareness, prevention of water, soil, and air pollution, prevention of soil erosion and sedimentation, basic principles of materials handling and storage, fire risks, protection of fauna and flora, removal of invasive alien species (if relevant), basic wetland do's and don'ts emergencies and incident responses, spill response provisions, social responsibility, and administrative and reporting procedures.	Contractor (Construction phase); Eskom (Operational Phase)	When necessary
All project personnel shall be trained in basic wetland awareness, including a basic understanding of the components of wetlands, how wetlands function, the benefits they provide, why they need to be conserved and used sustainably, and the importance of rehabilitation in contributing to wetland conservation and sustainable use. Wetland sensitivity to disturbance shall expressly be outlined, in order to curb unnecessary activity or disturbance within wetlands during the execution of the Works. Training shall take place as a minimum once a month.	Contractor (Construction phase); Eskom (Operational Phase)	Once off (for each employee)
Where work takes place in areas containing dangerous wildlife. Participants shall receive training in basic animal behaviour. In these areas, before work commences each day, the site shall be checked for dangerous animals. A person trained in dangerous animal behaviour shall be present and suitably equipped to deal with such threats at all times. Wherever possible, first aid training shall include current treatments for snakebites.	Contractor (Construction phase); Eskom (Operational Phase)	When necessary
The following minimum levels of training are required with respect to health and safety: <ul style="list-style-type: none"> • All Participants and Contractors must successfully complete phase 1 health and safety training. • All Implementers must successfully complete phase 2 health and safety training. • All Implementers need to have at least one person trained as an Incident Investigator. • Two first aid officers will be trained per team. 	Implementer, Contractor (Construction phase);	Once off

<ul style="list-style-type: none"> • All Participants shall receive basic fire-fighting training in areas where this is appropriate. 	Eskom (Operational Phase)	
<ul style="list-style-type: none"> • Training attendance records shall be kept by the Implementer. • The Implementer shall be responsible for obtaining all Contractor and Participant training information. • The Implementer shall conduct skills audits for all project beneficiaries. 	Implementer (Construction phase); Proponent (Operational Phase)	Continuous

2.5. EMPr: Auditing, Compliance, Monitoring, Evaluation

Action Required	Responsible Party (Phase)	Frequency
<p>Daily tasks shall be set and actual production shall be measured and recorded.</p> <ul style="list-style-type: none"> Each Contractor shall maintain an up-to-date timesheet of daily work attendance. Details of new appointments shall be submitted to the Implementer. Timesheets shall be available for inspection by Eskom. A record shall be kept of equipment and consumables issued against the contract document. 	Contractor (Construction)	Continuous
A quality control sheet completed by the Implementer shall record on-going quality checks and the final check before payment. This shall certify that work done complies with contract specifications.	Implementer (Construction)	Continuous
Monitoring		
Baseline monitoring data must be recorded in a "Management and Monitoring Plan" prior to construction starting. The minimum requirements for baseline monitoring data collection are presented in Section 2.13. The proponent will be responsible for developing this plan prior to construction of which will be included as an appendix in the site specific WRP .	Eskom (Pre-Construction Phase)	Once off
The execution of mitigation measures identified in the impact assessment will fall on the contractor however the monitoring of compliance of all activities identified in the construction phase will be the responsibility of the ECO. See Section 2.13 for minimum requirements of the Management and Monitoring Plan of which will be further developed in the site specific WRP .	Contractor, ECO (Construction)	Continuous
The management team appointed by Eskom during the operational phase must utilise the Management and Monitoring Plan towards continuous management of target areas, maintenance of installed interventions and monitoring and evaluation of rehabilitation outcomes. Section 2.13 for minimum requirements of which will be further developed in the site specific WRP .	Eskom (Operational)	Continuous
Actual work done (volumes and areas) shall be verified and recorded by the Implementer, who is responsible for ensuring that Contractors' invoices correspond to actual production.	Implementer (Construction)	Continuous
All structures (gabion and concrete) need to be clearly marked for future identification. The use of a stamped galvanised sheet (10cm x 10cm) for gabions is recommended and for concrete structures the number can be etched on top of the key wall.	Implementer (Construction)	Once Off
Compliance		
Environmental issues shall be put on the agenda as a discussion point during progress meetings. The Implementer, or a designated person involved with environmental issues on the project, shall attend the progress and/or site meetings on a regular basis to provide feedback on any outstanding or contentious environmental matter.	Implementer (Construction)	Per progress meeting

	Eskom (Operational)	
Eskom, as the holder of the Environmental Authorisation, is responsible for ensuring compliance with the conditions by any person acting on their behalf including an agent, sub-contractor, Participant or any person rendering a service to the holder. The holder shall notify the DEA in writing, within 24 hours thereof, if any condition in the Environmental Authorisation is not being complied with.	Eskom (All Phases)	Continuous
<p>The ECO may order the Contractor to suspend part or all of the works if the Contractor causes damage to the environment by not adhering to the specifications set out below.</p> <p>Failure to show adequate consideration to the environmental aspects of the EMPr as well as the conditions of approval by DEA will result in the suspension of all work until such time as the offending actions or procedures are corrected. No extension of time will be granted for such delays and all costs will be borne by the Implementer.</p>	ECO (Construction)	Where necessary
<p>The Contractor shall be deemed to have not complied with the EMPr if:</p> <ul style="list-style-type: none"> • Within the boundaries of the site, there is evidence of contravention of the EMPr and its associated reports. • Environmental damage ensues due to negligence. • The Contractor fails to comply with corrective or other instructions issued by the Implementer, ECO or Competent Authority within a specified time. • The Contractor fails to respond adequately to complaints from the public. The disciplinary action shall be determined according to the nature of the non-compliance or crime and exact penalties are to the discretion of the ECO, Proponent and DEA according to the severity of the incident. Record of the instructions issued to correct deficiencies shall be kept. 	Contractor (Construction)	When necessary

2.6. EMPr: Public Participation

Action Required	Responsible Party (Phase)	Frequency
Public participation was undertaken as a component of the BAR (refer to Appendix E: Public Participation of the BAR). The links to the community that have been established must be maintained and utilised to the mutual benefit of all parties.		
The ECO is responsible for addressing any environmental problems or queries that are raised by the community and therefore must maintain close contact with the representatives of the immediate community.	ECO (Construction)	Continuous
This EMPr shall be made available, on request, for the public to peruse. They have the right to monitor specific aspects of the EMPr (e.g. noise regulations, working hours stipulated) in conjunction with the Contractor in a reasonable and formal manner, without unreasonably disrupting construction activities.	ECO (Construction) Eskom (Operational)	Continuous
No member of the public may, however, enter the building site without prior approval from the Contractor. An issues register must be recorded should any member of the public raise a concern. These complaints must be addressed and mitigated within reason. Records relating to the compliance/non-compliance with the conditions of the EMPr as well as audits reports shall be kept in good order and shall be made available to DEA within seven days after a written request has been received.	Public	Continuous
It is suggested that all records be kept for at least two years following construction activities for reference purposes.	Eskom (All Phases)	Continuous for Two years

2.7. EMPr: Emergency Reporting and Procedures Environmental Planning

Action Required	Responsible Party (Phase)	Frequency
The Contractor must ensure that all emergency procedures are in place prior to commencing work. The nearest emergency service provider shall be identified and the up-to-date contact details of this emergency centre, as well as the police and ambulance services shall be displayed on a notice board and shall be made available to staff on-site. Emergency equipment including fire-fighting equipment shall be positioned at accessible locations near to areas where such emergencies may arise.	The Contractor (Construction) Eskom (Operation)	Once Off
The Contractor shall ensure that his Participants are aware of the procedure to be followed for dealing with emergencies, which shall include notifying the Implementer and relevant authorities of the event. All site staff shall be briefed regarding the requirements for dealing with potential emergencies including fires, accidental leaks and spillage of pollutants (also see Section 2.10), as well as accidents to Participants. Education of site staff shall focus not only on the prevention of emergencies but also on proactive and appropriate interventions where such emergencies occur.	The Contractor (Construction) Eskom (Operation)	Once Off (repeated if necessary)
The Contractor shall keep an Environmental Incident Report File, which shall document any environmental emergencies, accidents or incidents (including near misses). The ECO shall monitor that the necessary procedures and responses are followed to close out any entries in the Environmental Incident Report File.	The Contractor (Construction) Eskom (Operation)	Continuous
The Contractor must take all reasonable measures to ensure that fires are not started as a result of construction activities on site, and shall also ensure that their operations comply with the Occupational Health and Safety Act (Act No. 85 of 1993). Where possible, all work done in the dry season shall be organised in liaison with the landowners so that it fits into their firebreak/ fire protection programme. No large open fires are permitted on site. Smoking on site shall only be permitted in designated areas and in the presence of a fire extinguisher. Measures to address planned fire management are included in Section 2.10. Basic functional fire-fighting equipment (one back pack and at least five beaters) shall be made available at each work site at all times. In forestry areas there must also be two rake hoes per team.	The Contractor (Construction)	Continuous
The Contractor shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. Where fuels and machines are used on site, the prescribed fire extinguishers in working condition must be made available by the Contractor. Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. Such precautions include having an approved fire extinguisher immediately available at the site of any	The Contractor (Construction)	Once Off

such activities. The Contractor is to ensure that he/ she has the contact details of the nearest fire station in case of an emergency.		
Hydrological Impacts: The construction of interventions within watercourses is likely to have difficulties associated with the presence of water, under both normal and/or wet conditions. In the event that the planned interventions are located within the seasonal and permanent zones of the wetland, diversions may need to be put in place to temporarily divert water away from the work site.		
<p>In order to reduce the requirements to divert water from the construction site, implementation of the rehabilitation activities within seasonal and permanent wetness zones shall take place within the dry season:</p> <ul style="list-style-type: none"> • Winter rainfall areas - November to March • Summer rainfall areas - May to September in those cases where working in wet conditions is unavoidable the following shall be implemented: <ul style="list-style-type: none"> ○ Water shall be diverted away from the intervention site during the implementation of rehabilitation activities. ○ Diversions shall be temporary in nature (e.g. sand bags, eco-logs). ○ Upon completion of the rehabilitation activities at the site, the diversions shall be removed to restore natural flow patterns. ○ In those instances where the impact of the diversions are negligible and removal may result in further disturbance, diversions structures shall be left <i>in situ</i> (this shall be decided in consultation with the ECO) Water courses are subject to unanticipated flooding and adequate precautions shall be taken to avoid damage to facilities, equipment and wetland habitat such as: <ul style="list-style-type: none"> ○ Ensuring storage areas are located outside of floodable areas; and ○ Minimising the extent of disturbed/exposed areas to reduce extensive damage during flood events. 	<p>Contractor, ECO (Construction)</p> <p>Eskom (Operation)</p>	Continuous
Disturbances to Vegetation		
<p>Disturbance of indigenous plants within the wetland and surrounding catchment shall be minimised. In the event that vegetation needs to be removed during construction, the vegetation shall be stored in a shaded and moist area, for use in re-vegetation. Re-vegetation of all exposed soil must be done before the team leaves the site (refer to Section 2.12 on Site Rehabilitation).</p> <p>RED DATA SPECIES</p> <p>Should any Red Data species be encountered, <i>in situ</i> conservation shall be undertaken if at all possible. Should this not be considered possible, then a specialist shall be consulted for possible relocation.</p> <p><i>Note that additional permits may be required to transport and/ or relocate the species.</i></p>	<p>Contractor, ECO (Construction)</p> <p>Eskom (Operation)</p>	Continuous

<p>Bio-engineering methods involving the re-vegetation or planting of specified areas shall, as far as possible, use local plant species obtained from the following sources:</p> <ul style="list-style-type: none"> • Vegetation removed during excavation, • Local 'borrow' sites, or • Locally sourced seed mixes. <p>This should limit the threat of introducing genetically-modified and genetically different species into the area. Non-invasive alien plant species shall not be used for re-vegetation. The collection of indigenous plant or parts thereof shall only take place if the following guidelines are followed:</p> <ul style="list-style-type: none"> • Obtain the required collection and/ or transport permits; • Limit habitat destruction; and • Implement 'mosaic' (i.e. checkerboard) collection to ensure limited disturbance and adequate recovery of the 'borrow' site. 		
<p>Disturbances to Fauna/ Species</p>		
<p>Disturbance of faunal species within the wetland and surrounding catchment shall be minimised. This includes minimising:</p> <ul style="list-style-type: none"> • Disruptions to the movements/migration of species; • Interruptions of breeding activities and behaviour; and • Disturbance of feeding and breeding sites. <p>The presence of species of conservation importance shall be known prior to the commencement of rehabilitation activities. In those instances where these species are present, work shall be scheduled to reduce the impacts on the abovementioned activities. This information shall be determined by means of consultation with specialists. Where required, input from the relevant authority and/or conservation body shall be obtained to inform the design. The construction of interventions within wetlands and watercourses necessitates the planning of these interventions taking into consideration the migration of fish species where applicable. All in-stream structures shall take into consideration the migration of fish species.</p> <p>RED DATA SPECIES</p> <p>Should any Red Data species be encountered, <i>in situ</i> conservation shall be undertaken if at all possible. Should this not be considered possible, then a specialist shall be consulted for possible relocation.</p> <p><i>Note that additional permits may be required to transport and/ or relocate the species.</i></p> <p>Any bird nests encountered should not be interfered with, and if unable to be avoided, should be relocated by a suitably qualified individual. No pesticides of any description may be used during the construction or operational</p>	<p>Contractor, ECO (Construction)</p> <p>Eskom (Operation)</p>	<p>Continuous</p>

phase. If wildlife is found in the site area, species may not be killed or otherwise deliberately disturbed. It is however anticipated that as a result of the construction activities, the remaining wildlife species will take shelter in neighbouring areas and reserves. Although highly unlikely, construction Participants should be encouraged not to catch or kill any wild animals in the area, including snakes.		
Local Resources		
<p>In some instances locally available resources may be utilised in the implementation of wetland rehabilitation activities. This would primarily be rocks for the construction of gabion structures. Prior approval of the ECO shall be obtained, with respect to:</p> <ul style="list-style-type: none"> • Suitable rock types, • Suitable areas for collection, and • Appropriate collection methods. <p>All purchased rock shall be from registered and approved crushers. Copies of the certificates shall be kept on file by the Implementer. Any rock that is collected from old quarries or mine dumps shall have the necessary documentation from the landowner.</p>	Contractor, ECO (Construction)	Continuous
Compaction: The storage of materials and access to the site is likely to result in the compaction of the soil around the site. This increases the risk of erosion and sediment generation originating from the site.		
All impacted areas shall be rehabilitated (loosen soil and re-vegetate) once work has been completed and prior to the team leaving the site (refer to Section 2.12). These activities shall include the closure and rehabilitation of temporary access routes and addressing any potential erosion risks.	Contractor, ECO (Construction)	Continuous
Sediment Mobilisation: The construction of interventions within watercourses is likely to have impacts on downstream habitat associated with the presence of sediment within runoff water.		
<p>In order to reduce impacts associated with sediment from the construction site, implementation of the rehabilitation activities should take place within the dry season:</p> <ul style="list-style-type: none"> • Winter rainfall areas - November to March • Summer rainfall areas - May to September <p>In those instances where the toes of structures are designed to be flooded by the downstream structures work shall commence from the top of the system down. This shall ensure that work occurs in drier conditions and less sediment would be mobilised during excavation. The impacts associated with sediment generated during earthworks shall be minimised by constructing temporary sediment traps downstream, preferably at the location of the next intervention, to reduce disturbance footprints. In those instances where structures are not designed to be flooded by downstream structures, the interventions shall be constructed from the bottom of the system up, so that each structure then serves as a sediment trap for the construction upstream. Further measures to reduce sediment generated from</p>	Contractor, ECO (Construction)	Continuous

construction activities include ensuring that soil is not deposited into a watercourse and the re-vegetation of the exposed areas as soon as possible as per Section 2.12.		
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2.8. EMPr: Site Establishment

Action Required	Responsible Party (Phase)	Frequency
Site Plan		
The Implementer shall design a site plan for each site that identifies suitable locations for all work, storage, parking, toilet, processing and other areas, prior to site establishment.	Implementer (Construction)	Once Off
The Contractor shall erect and maintain boundary markers of the type and in the locations directed by the Implementer. Such markers, e.g. orange snow netting (preferable)/ danger tape, or suitable equivalent, shall be erected before undertaking designated activities.	Contractor (Construction)	Once Off (Repeat when necessary)
No-Go Areas		
The construction site shall be contained in an area required to undertake the works. Any area beyond shall be considered “no-go” areas. The Contractor shall ensure that, in so far as he/she has the authority, no unauthorised entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated “no-go” areas. “No-go” areas shall be clearly demarcated with commercially available orange snow netting (preferable)/ danger tape or suitable equivalent. The Contractor shall maintain the construction site boundary for the duration of construction and ensure that the orange snow netting/ danger tape does not become dislodged.	Contractor (Construction)	Continuous
Site Clearance		
Prior to any site clearance, a basic search and rescue should be conducted if deemed necessary by the ECO. The plant species rescued shall be appropriately relocated to an undeveloped natural area of the site (see Section 2.4).	ECO (Construction)	Prior to clearing
The Contractor shall ensure that the clearance of vegetation is restricted to that which is required to facilitate the execution of the works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be to the ECO’s approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.	Contractor (Construction)	Continuous
The Contractor shall strip the topsoil material within the working areas. The top-material shall be stockpiled separately from subsoil and used for subsequent rehabilitation and revegetation. Top-material stockpiles shall not be compacted. Should fauna be encountered during site clearance, earthworks shall cease until fauna have been safely relocated.	Contractor (Construction)	Once Off
Waste Removal		

The site must be cleared of all waste prior to any construction related activities and the waste must be disposed of at a registered waste disposal facility. This is to ensure that no waste is incorporated into the environment during the construction process.	Contractor (Construction)	Once Off
Vegetation Clearing		
Vegetation on the site shall be removed prior to commencement of construction activities. However, care must be taken to confine removal of vegetation during construction activities to within the boundaries of the construction area. The removal, damage or disturbance of any flora and fauna outside the construction area is not permitted. Burning or burying of cleared vegetation is not permitted. No areas may remain cleared (bare soil exposed) for longer than three weeks. Efficient construction planning must ensure that all relevant materials, construction equipment and manpower are available upon commencement of construction in an area. Thereafter, the cleared areas must be suitably revegetated (See Section 2.12).	Contractor (Construction)	Once Off
Biodiversity		
Disturbance of indigenous plants and animals shall be minimised. Relocation of indigenous plants, parts of plants or animals may only take place with the appropriate permits (see Section 2.7). Bio-engineering methods that involve re-vegetation will, as far as possible, use individuals of local species taken from surrounding areas, in order to avoid or reduce genetic pollution. Relocation must not lead to habitat destruction. Alien species may not be used for re-vegetation.	Contractor (Construction)	Continuous
Removal of Topsoil		
Prior to the commencement of construction activities, topsoil (i.e. the top 30 cm of soil) that is removed must be stockpiled for re-use in subsequent landscaping activities. It must be ensured that the topsoil is stockpiled separately from the subsoil and construction materials. The Contractor shall ensure that no remnants of stockpiles have been left in positions or states that may be eroded during and after construction. Stockpiled soil used during landscaping should be enriched with dilute concentrations of organic fertiliser to reinstate nutrients and encourage biological activity within the soil.	Contractor (Construction)	Once Off
The Contractor shall temporarily stockpile excavated materials (e.g. soils and rocks) and construction materials in such a way that the spread of materials is minimised. The stockpiles may only be placed within the demarcated stockpile area, which must fall within the demarcated construction area. The Contractor must, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. Stockpiles of construction materials must be clearly separated from topsoil stockpiles in order to limit any contamination of the topsoil. Stockpiles must be located away from sensitive hydrological features (including but not limited to dams, wetlands, watercourses, ponds, pans, drainage channels, etc.). Stockpiles shall not exceed 1.5m in height. Stormwater runoff from the stockpile sites and surrounding areas should be directed into the storm water system and may not run freely into the surrounding streets, or create	Contractor (Construction)	Once Off

<p>“ponding” or accumulation of water. Stockpiles are to be stabilised if signs of erosion are visible. Erosion control measures such as silt fences must be placed around the stockpiles.</p>		
Defacement of Natural Features		
<p>Trees, natural vegetation, or any other natural features outside the work area, which will not be cleared for construction purposes, shall not be defaced, painted for benchmarks or otherwise damaged, even for survey purposes. Any feature defaced by the contractor shall be reinstated to the satisfaction of the ECO at the cost of the Contractor.</p>	<p>ECO, Contractor (Construction)</p> <p>Eskom (Operational)</p>	<p>Continuous</p>
Heritage Sites and Features		
<p>No significant heritage resources within the wetlands were identified during interactions with interested and affected parties or during the site visit. However, if archaeological or heritage sites are exposed during construction work, work must be halted and the area shall be cordoned off until the necessary remedial steps have been implemented and authorisation has been obtained to resume activities. The ECO, South African Heritage Resource Agency (SAHRA) and relevant provincial heritage authority shall be notified (see Below), and arrangements made for the discovery to be examined by an appropriate heritage specialist.</p> <p>BOX 1: HERITAGE AGENCY CONTACT INFORMATION⁴</p> <p>National: SAHRA Office in Cape Town Tel: 021 462 4502 Fax: 021 462 4509 Email: info@sahra.org.za</p> <p>Provincial Heritage Resources Authority Gauteng Office in Johannesburg Tel: 011 355 2574 Email: grant.botha@gauteng.gov.za</p> <p>Mpumalanga Heritage Resources Authority Office in Nelspruit Tel: 013 766 5196 Email: bmoduka@mpg.gov.za</p>	<p>ECO (Construction)</p>	<p>Continuous</p>

Reasonable precautions shall be taken to prevent any person from removing or damaging any fossils, coins, articles of value or antiquity, structures and other remains for archaeological/ palaeontological / historical interest discovered within or adjacent to any of the proposed sites during construction activities.		
Stabilising Steep Slopes		
The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface runoff. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion. The rehabilitation measures listed in Section 2.12 must be implemented in the rehabilitation of steep slopes. The appropriate provincial authority should be contacted as a first step. Should the provincial authority not have capacity, contact SAHRA.	Contractor (Construction)	Once Off
Removal of Alien Vegetation		
Species that are declared invasive species (according to the Conservation of Agricultural Resources Act (Act 43 of 1983) and the National Environmental Management: Biodiversity Act (Act 10 of 2004)) must be recorded and polygons of the affected area must be submitted to the Working for Water national alien invasive plant database.	Eskom (Construction)	Once Off
Prior to construction, the Contractor shall ensure that invasive alien vegetation is cleared from the entire site in accordance to the applicable Working for Water guidelines and policies. Follow up clearing may be necessary if the species re-establish following the initial clearing. No trees within the environmentally sensitive areas may be removed, whether alien species or not, unless permitted by the ECO. Other alien species (non-listed) occurring on site may not be used in the landscaping and should be removed from site where possible.	Contractor (Construction)	Once Off
Working in Peatlands		
<p>Some of the wetlands identified for priority rehabilitation may occur in soils with a high organic composition, known as peat. These soils hold huge importance globally due to their nature to hold high levels of carbon (known as carbon sequestration). The following considerations should be made for site clearance in peatlands:</p> <ul style="list-style-type: none"> • Work should only be done in periods with low rainfall. • Disturbance to in-stream boulders must be minimised. Boulders should not be collected for use in structures unless specifically authorised by a Wetland Specialist and ECO. • Rock from the side slopes shall not be utilised where the slope is unstable and shall only be used with the express approval of the Wetland Specialists, ECO and landowner as required. • Compaction of the soil shall be prevented to avoid potential channelling and erosion. Driving into the wetland is forbidden. • No foreign vegetable matter (e.g. mulch) may be brought into the wetland area (especially from alien species). • When entering the wetland: 	Contractor (Construction)	Continuous

<ul style="list-style-type: none"> ○ Vehicles shall not be allowed to drive into the wetland. Should it however be required, walkways, boardwalks, geotextiles etc. shall be required to prevent compaction. ○ Construction Participants and wheelbarrows shall also use these enforced paths. ● Topsoil shall be removed specifically in the form of sods (20 to 40cm (length) x 20cm (width) x 20cm (depth)): <ul style="list-style-type: none"> ○ The first sod layer shall include the Rhizome layer. ○ The sods shall be stored in a wet area, on site, in their original orientation and order. ○ Vegetation can be cut short if it will make it easier to handle the sods. ○ Cut vegetation shall be used for mulch. ○ Soil shall be stockpiled according to the different soil layers (i.e. in separate stockpiles) as per the soil profile. Where possible, soils shall be stockpiled as high as possible to retain moisture. <p>Stockpiles shall be covered with mulch or cloth (geotextile) to ensure 40% moisture content.</p>		
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2.9. EMPr: The Construction Site

Action Required	Responsible Party (Phase)	Frequency
Restriction to Working Area		
It is important that activities are conducted within a limited area so as to facilitate control and to minimise the impact on the existing natural environment and disturbance to the neighbouring communities. Working areas are defined as those areas required by the Contractor to undertake the works as agreed with the ECO.	Contractor (Construction)	Continuous
Contractors Camp		
The Contractor's camp, offices and storage facilities shall be located within the demarcated site boundaries. No person shall be allowed to stay on the neighbouring site. Any temporary structures erected during construction will be restricted to the construction campsite. The fencing will include that of a 10m buffer zone between the site and the 1:100 year flood line of any watercourse and/ or dam. No site staff, other than security personnel and skeleton staff shall be housed on site. Security personnel and skeleton staff shall be supplied (by the Contractor) with adequate protective clothing, ablution facilities, water and refuse facilities (with regular collection) and facilities for cooking and heating. These measures will ensure that open fires are not necessary.	Contractor (Construction)	Continuous
The Contractor shall provide water and/ or washing facilities at the construction camp for the site staff. All Contractor vehicles will be stored in a location where an oil trap will be installed to prevent soil pollution. The ECO will advise the Contractor on a suitable area on the site.	Contractor, ECO (Construction)	Continuous
Stores and Workshop		
Stores buildings and containers shall be secure and provide safe storage space where equipment and materials will not deteriorate. All stores and workshops shall comply with the OHS Act and shall show a high standard of housekeeping.	Implementer (Construction)	Continuous
Refuse: Refuse refers to all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc.		
The Contractor shall be responsible for the establishment of a refuse control and removal system that prevents the spread of refuse within and beyond the construction site.		Continuous
The Contractor shall ensure that all refuse is disposed of by him and his sub-contractors' Participants in refuse bins which he shall supply and arrange to be emptied on a daily basis. These bins must be adequate in number and accessibility. Waste shall be separated into recyclable and non-recyclable waste, and shall be further separated as follows:	Contractor (Construction)	Continuous

<ul style="list-style-type: none"> • Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but are not limited to) oil, paint, diesel, batteries etc. • General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused, and food waste. • Reusable construction material, which can be used at other construction sites. • Where possible, glass, metal and hard plastic waste should be separated and removed from site for recycling purposes. <p>Refuse bins shall be watertight, wind-proof and scavenger proof and shall be appropriately placed throughout the site and shall also be conspicuous (e.g. painted bright yellow). Refuse must also be protected from rain, which may cause pollutants to leach out. Particular caution is to be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. The utmost care must be taken to ensure that no waste is able to enter wetlands and/or dams on or near to the site. The Contractor or the appointed Waste Removal Company shall truck refuse collected out of the construction site. Refuse must be disposed of at a registered site, which is also approved of by the Contractor and the local authority. Refuse may not be burned or buried on or near the site. The Contractor shall provide cleaning services to clean up the Contractor's camp and construction site on a daily basis. These areas shall then be inspected by the contractor to ensure compliance with this requirement. A litter patrol around the construction area is to take place twice weekly to ensure that all litter is cleared up.</p>		
The Contractor shall be warned, in writing, by the ECO of any infringement and will be expected to clear the litter within 24 hours of the notification. The Contractor shall be responsible for cleaning the Contractor's camp and construction site of all structures, equipment, residual litter and building materials at the end of the contract and where necessary and appropriate, the ground scarified, topsoil restored and indigenous vegetation re-established.	ECO (Construction)	When necessary
The Contractor will be responsible for removal of rubbish, which may wash into watercourses as a result of litter. The Contractor will also be responsible for any litter in the sensitive areas, which is dumped or left there by the construction crew.	Contractor (Construction)	When necessary
Ablution Facilities		
The Contractor shall be responsible for provision of sanitation for his and the sub-contractor's staff. Where possible, a minimum of one pit latrine shall be provided per 15 persons. Toilets may not be located within 50m of a watercourse. Should toilets be needed elsewhere, their location must first be approved by the ECO.	Contractor (Construction)	Continuous
The ECO is responsible for ensuring that any toilets placed are suitably situated and comply with requirements stated below. The toilets shall be provided with doors and locks and shall be secured to prevent them from falling over. Toilets shall be placed outside areas susceptible to potential flooding.	ECO (Construction)	When necessary

The Contractor shall supply toilet paper at all toilets at all times The Contractor shall ensure that the labourers make use of the toilets provided. The Contractor shall be responsible for the cleaning, maintenance and servicing of the toilets. The Contractor shall ensure that the toilets are protected from vandals. No litter or general waste shall be placed in the toilets. Upon completion of the contract, the pit latrines shall be filled in and all structures shall be removed from site. Washing areas with soap and sufficient clean water shall be provided for hand washing after use of ablutions.	Contractor (Construction)	Continuous
Eating Areas		
The Contractor shall, in conjunction with the ECO, designate restricted areas for eating. The Contractor shall provide adequate refuse bins that must be cleaned on a daily basis. These bins shall be reinforced to prevent scavengers. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.	Contractor (Construction)	When necessary
Fuel and Chemical Management		
The Contractor shall ensure that fuels and chemicals (e.g. drums of fuel, grease, oil, brake fluid, hydraulic fluid) are stored and handled carefully so as to prevent spillage. In the event of a spill, appropriate steps must be undertaken to prevent widespread pollution. These liquids shall be confined to specific and secured areas within the contractor's camp and shall be clearly marked. The liquids will be stored in a bounded area with adequate containment (at least 1.5 times the volume of the fuel) with an impermeable floor beneath them for potential spills or leaks, in such a way that does not pose any danger of pollution even during times of high rainfall. In addition, the Contractor shall ensure that Participants do not smoke or take part in any activity that may result in sparks in the vicinity of fuels and other flammable substances to prevent ignition. Refuelling of vehicles shall only take place at a predetermined area, where adequate pollution prevention measures are in place to, such as a smooth impermeable floor (concrete or 250µm plastic covered in sand). Appropriate signage shall be erected indicating the refuelling and storage areas. Mixing of lubricants will be on the non-previous layer at least 20m from the wetland area. A specialist waste contractor shall dispose of any hazardous waste off-site at a licensed hazardous waste disposal site. The Contractor shall be responsible for ensuring that any party delivering potentially dangerous chemicals and oil to site is aware of the appropriate storage and drop-off locations and procedures. Transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential leakage and prevent spillage onto the soil.	Contractor (Construction)	Continuous
Vehicles		
Site vehicles are only permitted within the demarcated construction camp, as required, to complete their specific task. All construction vehicles should be in a good working order to reduce possible noise pollution. Local and Provincial Noise Regulations shall be complied with at all times. On-site vehicles must be limited to approved access routes and areas (including turning circles and parking) on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site. Servicing and maintenance of vehicles on-site shall take place over drip	Contractor (Construction)	Continuous

trays and must be avoided as far as possible. Construction will be limited to normal working hours (as described in Section 2.10), in order to limit disturbance from vehicles and construction activity.		
Hand Tools		
<p>The contractor will ensure the following:</p> <ul style="list-style-type: none"> • Hand tools shall be suited to the nature of the work. • Tools shall have correct, properly secured handles and will be in safe working order. • Tools shall be properly maintained and sharpened regularly. • Tools shall be used in the correct and safe manner. • Tools shall be locked in a safe place when not in use. 	Contractor (Construction)	Continuous
Concrete Mixers, Compactors and Other Machinery		
<p>The contractor will ensure the following:</p> <ul style="list-style-type: none"> • All machinery shall have the required machine guards. • All nip points, pulleys, fan belts and revolving parts shall be suitably closed. • Power take offs shall be provided with suitable covers in good condition. Covers shall be chained to non-revolving machinery. • Only trained operators may operate machinery, and must wear the required PPE. • Participants, other than machine operators, may not be within two spade lengths of operating machinery. • Concrete mixers may only operate on a stable, level site. • Concrete shall be mixed on trays or other suitable lining material to prevent contamination of the soil and/ or waterbodies. • Cement and empty cement bags shall be stored in a sealed container. • Machinery must be in good working order. If owned by the Implementer or Contractor there shall be a maintenance schedule and record for the machinery. • Machinery will be used safely and efficiently at all times. • Correct re-fuelling procedures are to be followed and proper containers used for fuel. 	Contractor (Construction)	Continuous
Stock Control		
The receipt and issue of all equipment and supplies will be adequately controlled. All issues and receipts will be recorded. The balance of stock recorded will correspond at all times with stock in the stores. Designated managers shall verify stock periodically and on a bi-annual basis, stocktaking shall be done. The proper procedures will be followed in disposing of unserviceable or surplus items. Where Contractors cannot make use of proper dedicated stores, all equipment and supplies will be safely and securely stored with controlled access.	Contractor (Construction)	Continuous

2.10. EMPr: Environmental Control Measures

Action Required	Responsible Party (Phase)	Frequency
Control Of Working Hours		
Working hours for all operations shall be limited to between 08h00 and 17h00 during weekdays. No work may take place on a Saturday, Sunday or Public Holidays. Any deviations to these work hours must be cleared with the ECO prior to implementation.	Contractor (Construction)	Continuous
Control of Pollution Runoff: Pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, wastewater containing organic kitchen waste, detergents, solid waste, litter and other such substances.		
The Contractor shall ensure that rainwater does not run into areas containing cement, oil, diesel and other such substances as this could result in a pollution threat to sensitive environmental areas. Storage areas for these substances must be placed on high lying ground and contain a bounded area in case of a spill. The bounded area shall be covered if deemed appropriate by the ECO.	Contractor (Construction)	Continuous
Runoff from the site itself must be free from oil, waste and litter before joining the storm water system or streams. This must be ensured by securing any containers containing hazardous substances, in order that it cannot enter runoff, and by cleaning up any refuse and construction material from the site on a regular basis. Litter management in the storm water system or channels that lead to streams and or wetland must be implemented. It is outside the scope of this document to prescribe litter trap designs, but the important aspect is that it should be incorporated into the design of the development. Personnel may not use natural hydrological features for any purpose, including recreation. These areas must be considered “no-go” areas.	Contractor (Construction)	Continuous
In the event of any pollution entering an environmentally sensitive area and/or buffer zone as a result of the Contractor’s actions, the Contractor shall be responsible for all costs incurred to assist in pollution control and/or to clean up the polluted area. Damage to the wetland as a result of the project operations shall be for the Contractor’s account. The responsibility of the remediation of the pollution/erosion event will ultimately lie with the Contractor.	Contractor (Construction)	When necessary
Fire Management Control		
No fires shall be started on site or be used as a management intervention during construction phase Fires in peatlands are prohibited.	Contractor (Construction)	Continuous
Pollution Control		
The Contractor/s shall ensure that pollution of surface and/or groundwater does not occur as a result of site activities. In the event of pollution caused as a result of construction activities, the Contractor, according to section 20 of the National Water Act (Act No. 36 of 1998), shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas.	Contractor (Construction)	Continuous

The public shall not call upon any organisation to assist with clean-up activities before the matter has been discussed with the Contractor.	General Public	
The ECO must be notified immediately following any pollution event.	Contractor (Construction)	When necessary
The ECO shall ensure that the Contractors are aware that shallow groundwater is susceptible to contamination from spills. Therefore good management practices (in accordance with local bylaws) are required to reduce the impact of the waste generation potential.	ECO	Once off
Builders' rubble and other debris must be confined to the building site and may not be stored/discarded on any open space outside the development area.	Contractor (Construction)	Continuous
The status of the hydrological features on or near to the site must be monitored by the ECO to ensure that pollution does not occur in these areas.	ECO	Continuous
Erosion Control		
The Contractor shall take reasonable measures (to the satisfaction of the ECO) to prevent erosion caused by work, operations and activities undertaken during excavation and construction activities. The Contractor shall ensure that disturbance on steep slopes is kept to a minimum, thus reducing the potential for erosion.	Contractor (Construction)	Continuous
The Contractor is responsible for rehabilitating all disturbed areas in such a way that no future erosion will occur. Erosion may occur in the event of rain during the excavation and construction period. Any erosion that occurs during a heavy rainfall event must be remediated at the expense of the project budget. This shall include clean-up of the silt deposited and filling up of erosion channels that may form. Construction in sensitive areas should be undertaken during the dry season if possible.	Contractor (Construction)	Continuous
Dust Control		
The Contractor shall take into consideration that there may be residential areas surrounding the building site and that dust could be a major disturbance, especially during the dry seasons.	Contractor (Construction)	Continuous
The Contractor shall take appropriate and reasonable measures to minimise the generation of dust as a result of his/her works, operations and activities. Particular attention must be given to preventing dust. Participants must report any excessively dusty conditions to the Contractor or responsible representative.	Contractor (Construction)	When necessary
Corrective and preventative measures shall include (but not be limited to) regular and effective treatment of working areas using water sprays or shade netting screens and appropriate scheduling of dust-generating activities.	Contractor (Construction)	When necessary
The Contractor shall ensure that no transported materials escape from the construction vehicles by providing adequate covering for all load beds.	Contractor (Construction)	Continuous
Noise Control: Probably the two most important concepts in the regulation of noise are those of <i>disturbing noise</i> and <i>noise nuisance</i> . <ul style="list-style-type: none"> A disturbing noise is one that exceeds the zone sound level set by the local authority. 		

<ul style="list-style-type: none"> A noise nuisance means any sound, which disturbs or impairs or may disturb or impair the convenience or peace of persons. <p>Some of the activities that could constitute a noise nuisance are power tools, driving, loading and hooters. All of these elements could be connected with building activities.</p>		
<p>Activities that could constitute a noise nuisance are power tools, driving, loading and hooters. All of these elements could be connected with building activities.</p> <p>Each province has its own noise regulations, while Local Municipalities also often have by-laws specific to their area. The Contractor shall obtain and familiarise him/her with these regulations and ensure that he/she abides by these regulations at all times. The Contractor shall familiarise him/her with, and adhere to, any by-laws and regulations regarding the control of noise in their municipal areas. All noise generated on site shall comply with the relevant SANS codes and standards.</p>	Contractor (Construction)	Continuous
<p>Every effort must be made to limit exceedingly noisy activities. Construction vehicles must be in good working order such that they do not create a noise nuisance. Appropriate directional and intensity setting shall be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant.</p>	Contractor (Construction)	Continuous
<p>No amplified music shall be allowed on site. The use of radios, tape recorders, compact disc players, television sets etc. shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor may not use sound amplification equipment on site, unless in emergency situations.</p>	Contractor (Construction)	Continuous
Hazardous Materials Control		
<p>All relevant national, regional and local legislation with regard to the transport, use and disposal of hazardous materials must be strictly complied with. The Contractor shall obtain the advice of the manufacturer (Material Data Sheet) with regard to the safe handling of hazardous materials.</p>	Contractor (Construction)	Continuous
<p>The Contractor must supply the ECO with a list of all hazardous materials that would be present on site during the construction period. The same applies to any sub-contractor that must provide the Contractor with this information.</p>	C Contractor (Construction)	Once Off
<p>The Contractor must ensure that there is an emergency procedure in place to deal with accidents and incidents (e.g. spills) arising from hazardous substances.</p>	Contractor (Construction)	Continuous
<p>The Contractor must ensure that all personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances.</p>	Contractor (Construction)	Continuous
<p>The Contractor must report major incidents to the ECO immediately. Any spill incidents must be cleaned up immediately and in according with the emergency procedure.</p>	Contractor (Construction)	Continuous

2.11. EMPr: Minimum Standards for Construction and Maintenance

Action Required	Responsible Party (Phase)	Frequency
Please Note: The generic construction and maintenance standards of interventions is given in Appendix 1.2. Where necessary, site specific construction and maintenance standards will be included in the site specific WRP.	Contractor (Construction) Eskom (Operational)	

2.12. EMPr: Site Rehabilitation

Action Required	Responsible Party (Phase)	Frequency
All working areas shall be rehabilitated once work has been completed and before the team leaves the site. This includes closure and rehabilitation of temporary access routes. All foreign material not utilised in the rehabilitation activities shall be removed from the site. Re-vegetation of all exposed soils, and measures to address any potential erosion risk shall be done before the team leaves the site. Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to.	Contractor (Construction)	Once Off
All rehabilitated areas shall be considered “no-go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas.	Contractor (Construction)	Continuous
Specific Site rehabilitation measures have been included in the site specific WRP and should be referred to for site closure. Due notice of the conditions of Environmental Authorisation and requirements of the General Authorisation for water uses must be complied with.	Eskom (Operation)	Continuous
Removal of Materials		
After construction, any area cleared or disturbed (as a result of the activity) within and outside the boundaries of the construction site shall be rehabilitated to a state as agreed by DEA and according to the specifications of the ECO.	Contractor (Construction)	Once Off
All construction equipment and excess aggregate, gravel, stone, concrete, bricks, temporary fencing and the like shall be removed from the site upon completion of the work. No discard materials of whatsoever nature shall be buried on the site, or on any vacant or open land in the area and shall only be disposed of at the appropriate registered waste disposal site.	Contractor (Construction)	Once Off
Landscaping and Preparation for Planting		
Topsoil that is disturbed or removed during construction and excavation must be replaced, preferably using topsoil stockpiled prior to excavation activities, or with topsoil sourced from elsewhere. However, where possible, soils from different areas should not be mixed. Care must be taken not to mix the topsoil with the subsoil during shaping operations.	Contractor (Construction)	Once Off
Stabilising measures shall be put in place on steep and unstable slopes to prevent collapse of the slopes or soil erosion. Slope stabilisation and soil erosion prevention measures include the placement of silt fences, staked grass sods and rows of sawdust filled onion bags.	Contractor (Construction)	Once Off
Local indigenous plants shall be used in the landscaping of the site. Plants that are proclaimed as problem plants or noxious weeds are to be excluded from the landscaping plan and these should be removed immediately, should they occur on site.	Contractor (Construction)	Continuous

The relevant landscaping contractors and excavation contractor must be in consultation with each other and the ECO so as to prevent misunderstandings and therefore prevent potential negative environmental impacts.	Contractor (Construction)	Continuous
An ecological approach to landscaping is recommended. Plants introduced into the project sites must be guided by ecological rather than horticultural principles. For example ecological communities of indigenous plants provide more biodiversity and habitat opportunities and would blend with natural vegetation. This approach is also less costly to maintain and is sustainable in the long term.	Contractor, ECO (Construction)	Continuous
Rehabilitation of Peatlands		
Upon rehabilitation, the removed sods and soil stockpiles shall be placed back into the system in the original order/layers (i.e. deeper layers shall be placed first with the rhizosphere layer at ground level), and orientation (according to the natural slope). Should the moisture content of the sods be less than 90% moisture, the Implementer shall be required to peg them with wooden stakes. The site shall be mulched (alternatively cloth/geotextile may be used) and livestock shall be fenced out for at least two seasons. Alternatively brush packs can be used to keep livestock and/or game away from the site.	Contractor (Construction)	Once Off
If compaction took place, the Implementer shall loosen the soil with a fork on flat surfaces, and create small contour berms on paths with slopes.	Implementer (Construction)	Once Off

2.13. EMPr: Operational Phase Specifications

Action Required	Responsibility	Frequency
<p>The proponent will be responsible for undertaking the operational phase requirements of the EMPr. These requirements include:</p> <ul style="list-style-type: none"> • Management of target wetlands and buffers during operational phase; • Monitoring of interventions and indicators; • Maintenance of installed interventions; • The evaluation and reporting of results. 	Eskom (Operational)	Continuous
Management, Monitoring and Maintenance		
A management team must be employed by Eskom for overall management, monitoring and maintenance. This team will utilise the Management and Monitoring plan to perform their duties	Eskom (Operational)	Once Off
Evaluation and Reporting		
Eskom must produce an annual evaluation report to be presented at the EMC and sent to DEA. The report must outline the trends in the changes to baseline data (collected in the pre-construction phase) and assess the extent to which objectives have been achieved. The approach to evaluation and overall objectives are presented below.	Eskom (Operational)	Annually

2.13.1. Minimum Standards for the Management and Monitoring Plan

The Management and Monitoring Plan will be included in the site specific **WRP**.

2.13.1.1. Minimum Management Activities and their Implications

Management of target areas (Wetlands, Buffers, terrestrial land and installed interventions) will be outlined in the Management and Monitoring Plan of which will be inserted as an appendix in the site specific **WRP**. Management activities will be geared towards achieving the objectives set out in the BAR as well as the Kusile Wetland Offset Strategy (Prime Africa 2015) and will therefore promote wetland health, improve wetland ecological status, integrity and connectivity, improve habitat and species diversity and protect wetlands from upland and upstream impacts so that wetland functionality (flood attenuation, maintenance/Improvement of water quality and quantity (provision for base flow), provision of habitat) is secured. Table 2-1 includes a summary of minimum management considerations and duties with resulting implications for achieving the objectives.

Table 2-1. Proposed management duties (activities) and their implications for achieving rehabilitation objectives

Management Activity	Implications for Rehabilitation
The maintenance (including monitoring) of installed rehabilitation (intervention) structures at selected points	Saturate upstream wetlands, stabilise banks, promote vegetation of open areas, reverse and prevent erosion or incision, improve water quality, secure provision of flow contribution

along wetlands. Structures must be inspected regularly for the accumulation of debris, blockages, instabilities and erosion with concomitant remedial and maintenance actions.	towards base flow (especially in the Wilge), improve wetland species diversity and abundance, improve wetland PES scores and habitat intactness.
Weed control	The control of mostly annual alien species will improve natural species composition in both wetlands and buffer zones, promote grass cover and improve the ecological category of wetlands. Fewer weeds in the buffer zone prevents this area acting as a source of alien species to adjacent wetlands. Weeds control may be managed by controlling grazing pressure, mowing weed stands when in flower so as to prevent reproduction or by using fire as a management tool.
Removal of perennial alien plant species	Removal of Wattle, Gum, Poplar and other alien invaders will promote overall system health, improve the ecological status of wetlands and prevent the future expansion of aliens with resultant habitat loss.
Revegetation of open areas in the buffer zone	Promoting a high degree of grass cover throughout the buffer zone will promote infiltration of precipitation (which supports hillslope seeps), reduce erosion and prevent the colonisation of alien weeds.
Control grazing (types and numbers of grazers and grazing area, including fence integrity)	A natural grazing pressure will help maintain cover, species diversity, promote primary production and prevent species dominance or vegetation in a moribund state.
Rehabilitate areas of erosion	Promotes vegetation cover, bank stabilisation, prevents loss of soils and maintains water quality.

2.13.1.2. Minimum Monitoring Activities

The baseline monitoring data and monitoring requirements during operational phase will be outlined in the Management and Monitoring Plan. Minimum consideration requirements to be included in the Management and Monitoring Plan are given below.

Phase	Monitoring Activity	Time	Frequency	Method of Assessment	Responsible Party
Level 1 Monitoring					
Construction	Implementation of rehabilitation interventions	n/a	Weekly / monthly	The quantity of each material type used in the project will be recorded for each wetland. Information that must be captured will include those materials that were purchased and the amount of material used during the construction phase of the rehabilitation activities. Often the quantity of materials used during a project cannot be assessed on completion of the project. This is primarily due to the concealment of many material types in the construction phase of the project. Site visits would therefore need to take place at specific stages of the construction to ensure the correct usage and quantity of materials on site.	ECO, Technical Advisors, Engineer, Soil Conservation Technician
	Productivity/ Efficiency	n/a	Weekly	The amount of time required to complete each task during the construction phase of the wetland rehabilitation will be identified and recorded. Tasks would include activities such as packing gabions, erecting shuttering or mixing concrete. The collection of these data will be an ongoing process until such time as the information that is available covers all possible situations and environmental conditions experienced during construction. This information will be appropriately stored to make it readily accessible for the evaluation process.	ECO
	Contractor's performance	n/a	Weekly / monthly	Project management meetings, with minutes to assess schedules and performance, including staying within budget.	ECO
Level 2 Monitoring					
Pre-const	Wetland assessments	Wet season	Once-off per intervention site	Assessment of overall wetland health using WET-Health for Hydrology, geomorphology and Vegetation	Eskom (Wetland specialist)
	Erosional features	Dry season	Once-off per intervention site		Eskom (Technical advisors)

	Water level / Inundation	Wet season	Once-off per intervention site	The elevation of the water table in the target wetlands is a rehabilitation objective. The reason for wanting to elevate water levels is to increase the inundation extent or wetted area of the wetland upstream of the installed structure. Since water depths will likely change as sedimentation occurs, it is not an adequate measure of inundation extent. Rather, the area that is inundated upstream of the installed structure should be measured and monitored directly. This can be done by walking the wetted perimeter with a GPS device and using the spatial data to calculate the area of inundation. The edge is defined by the presence/absence of surface water. It is critical that baseline measurements be taken prior to the construction phase. Measurements should be done monthly at the same time each month. This will ensure that seasonal variation is captured, an important aspect of wetlands, and can be evaluated.	Eskom (Technical advisors)
	Vegetation	Growing season	Once-off per intervention site	Define vegetation types (sedge meadow, wet grassland) within the wetland; conduct field assessments of each vegetation type detailing the composition and relative contribution of the species present within communities; and describe the invasive status of alien species. The different vegetation types within the wetland will be mapped onto the available aerial imagery. The boundaries of these broad vegetation types (sedge meadow, wet grassland, open water, emergent reeds for example) will be verified using a GPS device on site. A fixed-point photograph will be taken of each vegetation group in the direction of the adjacent wetland group. The photograph points must be permanently identified by iron fencing standards firmly planted in the ground. Sampling will be conducted by recording the information along the length of each vegetation type. The following information will be recorded within each vegetation type: linear length of the different vegetation types perpendicular to wetland orientation; dominant species per vegetation type; life form of the represented species; and percentage aerial cover.	Eskom (Technical advisors)
	Fixed point photographs	n/a	Once-off per intervention site	Take fixed-point photographs at each position for proposed interventions. Mark and record position	Eskom (Technical advisors)
	Satellite imagery	n/a	Once-off per intervention site	Download and save the latest imagery that is available at the time	Eskom (Technical advisors)
	Water flow	n/a	Once off	Record water flow (m ³ /s) at key sample points to ensure the flow remains within the RQO's set for catchments. (See RQO's)	Eskom (Technical advisors)

	Water Quality (Compulsory TDS, TSS, pH)	n/a	Once off	Record water quality parameters (specifically TDS, TSS, conductivity and pH at key sample points to ensure the flow remains within the RQO's set for catchments (See RQO's)	Eskom (Technical advisors)
O p Construction	Implementation of rehabilitation interventions	n/a	Weekly / monthly	The quantity of each material type used in the project will be recorded for each wetland. Information that must be captured will include those materials that were purchased and the amount of material used during the construction phase of the rehabilitation activities. Often the quantity of materials used during a project cannot be assessed on completion of the project. This is primarily due to the concealment of many material types in the construction phase of the project. Site visits would therefore need to take place at specific stages of the construction to ensure the correct usage and quantity of materials on site.	ECO, Technical Advisors, Engineer, Soil Conservation Technician
	Productivity/Efficiency	n/a	Weekly	The amount of time required to complete each task during the construction phase of the wetland rehabilitation will be identified and recorded. Tasks would include activities such as packing gabions, erecting shuttering or mixing concrete. The collection of these data will be an ongoing process until such time as the information that is available covers all possible situations and environmental conditions experienced during construction. This information will be appropriately stored to make it readily accessible for the evaluation process.	ECO
	Contractor's performance	n/a	Weekly / monthly	Project management meetings, with minutes to assess schedules and performance, including staying within budget.	ECO
	Erosion associated with intervention structures	Dry season	Monthly until the operational phase	Check all intervention structures for failure, especially erosion around tie-in sides and undercutting.	Eskom (Technical advisors)
	Water flow	n/a	Weekly	Record water flow (m ³ /s) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments.	Eskom (Technical advisors)
	Water Quality (Compulsory TDS, TSS, pH)	n/a	Weekly	Record water quality parameters (specifically TDS, TSS, conductivity and pH) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments	Eskom (Technical advisors)
O p	Wetland assessments	Wet season	Once every 3 years	Assessment of overall wetland health using WET-Health for Hydrology, geomorphology and Vegetation	Wetland specialist

	Erosional features	Dry season	Annually	The following dimensions will be measured for identified gully and headcut erosion: Gully Erosion (Depth, Width, Length, Steepness of the gully sides, Vegetation cover (% cover) on gully sides and Vegetation cover (% cover) on gully floor); Headcuts (Vertical drop, Percentage slope and Vegetation cover (% cover)). Field markers will be placed at a fixed distance of 2 m from the edges of identified gully and headcut erosion points. A GPS position will be recorded for each field marker as well as the bearing and distance to the edge of the headcut/gully erosion. These distances will then be monitored annually to accurately establish that stabilisation of the erosion has occurred. Monitoring will be scheduled during the dry season, when active progression of erosion is unlikely.	Eskom (Technical advisors)
	Sedimentation	Dry season	Annually	Erosion upstream of wetland systems can often result in the 'burying' of these wetland systems, and erosion within the active channel results in unnatural incision. The accumulation of sediment upstream of structures within the wetland, in this case, is a major objective of the wetland rehabilitation project and is intended to counteract incision and promote vegetation cover. The depth and extent of sediment accumulation within the wetland will thus be monitored. Monitoring will be scheduled annually during the dry season, when active progression of erosion is unlikely.	Eskom (Technical advisors)
	Water level / Inundation	Same time each month	Monthly	The elevation of the water table in the target wetlands is a rehabilitation objective. The reason for wanting to elevate water levels is to increase the inundation extent or wetted area of the wetland upstream of the installed structure. Since water depths will likely change as sedimentation occurs, it is not an adequate measure of inundation extent. Rather, the area that is inundated upstream of the installed structure should be measured and monitored directly. This can be done by walking the wetted perimeter with a GPS device and using the spatial data to calculate the area of inundation. The edge is defined by the presence/absence of surface water. It is critical that baseline measurements be taken prior to the construction phase. Measurements should be done monthly at the same time each month. This will ensure that seasonal variation is captured, an important aspect of wetlands, and can be evaluated.	Eskom (Technical advisors)

	Vegetation	Growing season	Annually	Define vegetation types (sedge meadow, wet grassland) within the wetland; conduct field assessments of each vegetation type detailing the composition and relative contribution of the species present within communities; and describe the invasive status of alien species. The different vegetation types within the wetland will be mapped onto the available aerial imagery. The boundaries of these broad vegetation types (sedge meadow, wet grassland, open water, emergent reeds for example) will be verified using a GPS device on site. A fixed-point photograph will be taken of each vegetation group in the direction of the adjacent wetland group. The photograph points must be permanently identified by iron fencing standards firmly planted in the ground. Sampling will be conducted by recording the information along the length of each vegetation type. The following information will be recorded within each vegetation type: linear length of the different vegetation types perpendicular to wetland orientation; dominant species per vegetation type; life form of the represented species; and percentage aerial cover.	Eskom (Technical advisors)
	Water flow	n/a	Monthly	Record water flow (m ³ /s) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments.	Eskom (Technical advisors)
	Water Quality (Compulsory TDS, TSS, pH)	n/a	Monthly	Record water quality parameters (specifically TDS, TSS, conductivity and pH) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments	Eskom (Technical advisors)
	Grazing pressure	n/a	Annually	Record grazing numbers by type and fenced area	Eskom (Management team)
	Fences and firebreaks	n/a	Monthly	Drive boundary fences to check for integrity, fix where necessary. At the same time firebreak status to be checked.	Eskom (Management team)
	Fixed point photographs	n/a	Annually	Take fixed-point photographs at each intervention.	Eskom (Technical advisors)
	Satellite imagery	n/a	Monthly	Conduct a monthly check to ascertain whether new satellite imagery is available. If so, download and save to database	Eskom (Technical advisors)
	Erosion associated with intervention structures	Dry season	Annually	Check all intervention structures for failure, especially erosion around tie-in sides and undercutting.	Eskom (Technical advisors)

The following table indicates typical data requirements for the monitoring and evaluation of objectives:

Level 2 Database Type	Data group	Data type	Determinants
Baseline Database	1) Photographic data	Fixed point photographs	Several photographs at each intervention site linked to coordinates and vegetation types
		Satellite imagery	Google Earth © imagery as new data become available - starting point
	2) Specialist wetland assessment	Mixed (spreadsheet based)	1 WET-Health output
	3) Numerical (time T0) baseline	Erosion	Physical specification (length, depth, slope etc) of erosional features
		Sedimentation	Depth and extent of new sediment deposits.
		Water level / Inundation	Aerial extent (m ²) of wetted zone; are of inundation
		Vegetation	Biodiversity description and measurement of vegetation types, plot-based, stratified by environmental zonation
		Flow (m ³ /s)	See catchment RQO's
		Water Quality	See catchment RQO's

Operational Phase Monitoring	1) Photographic data	Fixed point photographs	Changes in vegetation structure (stature, cover, composition), mostly qualitative but can be quantitative
		Satellite imagery	Google Earth © imagery as new data become available - changes in aerial vegetation cover (%)
	2) Specialist wetland assessment	Mixed (spreadsheet based)	Wetland Ecological Status (Hydrology, Geomorphology, Vegetation) - WET-Health
	3) Numerical ongoing monitoring data	Erosion	Physical specification (length, depth, slope etc) of erosional features
		Sedimentation	Depth and extent of new sediment deposits.
		Water level / Inundation	Aerial extent (m ²) of wetted zone; are of inundation
		Vegetation	Biodiversity description and measurement of vegetation types, plot-based, stratified by environmental zonation
		Flow	Record water flow (m ³ /s) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments.
		Water Quality	Record water quality parameters (specifically TDS, TSS, conductivity and pH) upstream and downstream of interventions to ensure the flow remains within the RQO's set for catchments
	4) Management	Technical	Fence integrity and firebreak status

2.13.1.3. Evaluation and Reporting

Project success will be evaluated on the basis of outputs and outcomes. Outputs refer to the interventions that would need to be implemented to achieve the intended outcomes of the project. Outputs are therefore a reflection of the achievement of the rehabilitation project's execution and survival objectives.

Outputs

This component of the evaluation examines the level to which the outputs specified in the **WRP** have been completed to design specifications. It will draw primarily on the results of the **Level 1 monitoring**.

If the planned outputs were not achieved, it will be important to ask the question: Why did this happen? To answer this question the results of the evaluation of the process will be examined, towards determining an answer. The evaluation of outputs will be important from a financial accountability point-of view by checking that the work completed is commensurate with that in the plan and for which expenditure has been incurred. If, for example, only half of the structures that had been planned and paid for are physically present on the ground then this would be revealed by an evaluation of outputs.

Outcomes

The level to which the intended outcomes of the project have been achieved will be assessed against the extent to which the indicators have fallen within the predefined performance thresholds (This will draw directly on the results of the **Level 2 monitoring**). The overall objectives will provide a critical point of reference against which the level of success of the project is gauged. The following comprise the rehabilitation objectives for wetlands after project closure:

- 1) To address channel incision of the main active channel as much as is practically possible.
- 2) To re-route channel diversions back to the original alignment/s.
- 3) To promote dispersal and retention of flow in areas where this is beneficial to wetlands.
- 4) To remove perennial alien invasive plants species and to manage annual alien plant infestations.
- 5) To restore water retention and seepage functionality to hillslope seep wetlands.
- 6) To promote grazing regimes that are beneficial to wetland condition.
- 7) To protect wetlands from the upstream environment.
- 8) To address non-functional dams where these have failed and promote wetland restoration in such vicinities.
- 9) To prevent erosion and sediment input from storm water pipes

Appendix 1.1: Prescripts

2.14. Health and Safety

All Health and Safety measures as directed by the following subsections, must be in line with Standard Operating Procedure (SOP) (specifically the SOP 10: Checklist) of the OHS Act Provisions.

2.14.1. Medical Examinations

- Prior to employment, all Participants shall undergo a medical examination performed by a registered occupational health practitioner.
- Specific job classes shall have annual medical examinations or other tests as specified in the Occupational Health and Safety Act (Act 85 of 1993) (OHS).
- Records of all medical examinations shall be kept by the Implementer.
- Whenever possible, team members that resign need to undergo a medical examination and the results must be kept on record.

2.14.2. First Aid Kit

- An adequately equipped first aid kit shall be easily accessible at all work sites.
- The first aid kit shall be kept fully stocked according to the stock list.
- All first aid treatment and usage of stock shall be recorded in the dressing book kept on site.
- The first aid kit shall be under control of a trained and competent first aid officer with a current certificated.
- Each team shall have at least one trained first aid officer and one alternate.
- The first aid officer will be appointed in writing by the Contractor (construction first aid officer form)

2.14.3. Personal Protective Equipment (PPE) and Clothing

- The PPE prescribed in the agreement between the Implementer and Contractor shall be worn at all times during work.
- PPE shall meet the minimum prescribed standards of quality (South African Bureau of Standards (SABS) approved).
- PPE provided must be maintained and kept in an acceptable condition and shall be replaced when it becomes ineffective through wear and tear.
- The issue of PPE will depend on the hazards and risk identified in a Workplace Risk Assessment. Consideration must be given to the *source of energy* and the *part of the body* involved.
- PPE requirements must be included in the Implementers Health & Safety Plan.
- A Participant shall wear his/her PPE at all times on premises.
- Participants issued with PPE shall undergo training on the safe use, limitations, cleaning, maintenance, storage, replacement and disposal of PPE.
- PPE must be worn and used correctly in accordance with the training standards as mentioned above.
- Records must be kept of all issues of PPE.
- Regular checks must be carried out by the contractor/supervisor on the correct use of PPE. The ECO shall ensure this requirement is complied with during monthly site visits.
- Contractors/supervisors must ensure that Participants are in possession of their PPE before commencing their daily activities.
- No Participant is allowed at the workplace without the correct PPE.
- PPE should be worn at all times where hazards and risk are present, even when a work activity is not performed.

- In order to maintain consistency within the programme, Eskom shall provide designs to be used on the t-shirts worn by the Participants.
- All foot wear, including water boots must be steel capped.

2.14.4. Occupational Health and Safety

- Each Implementer and Contractor shall have a copy of the OHS Act.
- All relevant OHS standards shall be fully implemented.
- In terms of the OHS Act, the provincial director shall be notified of planned construction work.
- The designated health and safety officer shall also be appointed as the construction safety officer. The appointment letter shall be available on site.
- Incident reports shall be up to date and available
- All incidents shall be reported within 24 hours to the ECO.
- All incidents shall be investigated by a trained incident investigator within 7 days of the incident.
- All near misses shall be recorded and shall be reported to the relevant ECO on a quarterly basis.
- Health and safety meetings shall be held for all Implementers at the quarterly national implementers' forum.
- Each project will have one health and safety meeting per month, minutes should be made available at the project office.
- Health and safety representatives shall carry-out monthly site inspections, necessary forms should be kept at project office.
- Toolbox talks shall be done on a weekly basis.
- The Implementers and ECO shall intervene and suspend operations at projects where clear violations of health and safety legislation and the best management practices are observed, and where these violations constitute a clear health and safety risk.

2.14.5. Compensation for Injuries and Diseases

- A Participant must report any work-related injury or occupational disease to their employer or manager.
- The employer must report the accident or disease to the Compensation Commissioner.
- The employer (Contractor) shall pay a Participant who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer shall be refunded this amount by the Compensation Commissioner.
- This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

2.14.6. Water Quality

In wetlands with a high risk of pollution, such as those in urban areas, the Implementer shall take steps to ensure that he/she is aware of changes in water quality. If water quality is found to be so poor that it is a threat to health, the following steps must be taken:

- Participants shall be made aware of it immediately.
- If unable to supply appropriate PPE, work shall cease.
- Participants shall not be allowed to drink water directly from the wetland.
- ECO's shall be informed of poor water quality.

2.14.7. Water and Flooding

Teams working near open water shall have life jackets on site. Consideration shall be given to the safety of team members working near water who are unable to swim. Given the nature of the work, Implementers and Contractors shall be sensitive to the potential dangers of floods. A highly risk averse approach shall be followed whenever dealing with an actual or potential flood event. Rainfall in the catchment above the wetland, and flow within the wetland shall continually be visually monitored by the Implementers and Contractors. In high rainfall events where there is an increased risk of sudden floods, Participants shall be withdrawn from the site.

2.14.8. Substance Abuse

- The use of any narcotic substances is prohibited on site.
- The Implementer and Contractors shall ensure that Participants do not perform their duties under the influence of any narcotic or alcoholic substances.
- Participants who are under the influence during work hours shall be dealt with in terms of the appropriate disciplinary procedures.
- Participants shall be made aware of the potential dangers of drug use.

2.15. Transport

2.15.1. Compliance of Vehicles

All vehicles (including trailers) used by projects shall comply with all legal requirements in terms of roadworthiness and licensing and shall display a valid license at all times. The following vehicles shall display a valid Certificate of Fitness:

- Any truck, bus or minibus where the gross vehicle mass exceeds 3500kg.
- Any vehicle designed or adapted to convey 12 persons or more, including the driver; and Vehicles used in transporting persons for reward.

Vehicle size shall be suitable for the number of passengers to be transported. For bakkies, the minimum space required per person translates to the following capacity, including driver and passengers in the front and back:

- Short wheelbase bakkie 0,25m² per person standing = 15 persons 0,35m² per person seated = 11 persons
- Long wheelbase bakkie 0,25m² per person standing = 17 persons 0,35m² per person seated = 13 persons.

Minibus taxis shall not carry more than the number of people for which they are certified. Re-treads shall not be fitted to the front wheels of vehicles used for carrying passengers. Wheels on the same axle must be of the same size and be fitted with the same type of tyre. Canopies will be fastened to at least six points using a suitable and effective method e.g. nuts and bolts. In the absence of a canopy the vehicle should be equipped with suitable legal labour railing

2.15.2. Daily Vehicle Checklist

- A daily pre-trip vehicle check shall be done and recorded by the driver on a suitable checklist.
- The checklist shall be up to date and be kept in the vehicle. Trailers shall form part of the daily checklist.
- The Implementer shall verify and sign the checklists weekly.
- Faults affecting the roadworthiness of the vehicle shall be repaired immediately or alternative transport must be used.

2.15.3. Drivers' Licenses and Permits

- All drivers shall have a valid driver's license for the vehicle category used. The competence of all drivers shall be verified by the Implementer.
- All contractor drivers shall be in possession of a valid Professional Driving Permit (PDP) for the category of vehicle.
- Drivers shall undergo an annual medical check and the results must be filed with the Implementer.
- Driver's licenses shall be verified annually by the local traffic authority and copies of this verification must be kept on file.

2.15.4. Passenger Safety

Vehicles used for transporting Participants shall have suitable passenger facilities, including, as a minimum:

- Sufficiently strong railings to a height of 350mm above seat surface or 1000mm above standing surface.
- If installed, benches must be properly secured.
- If installed, canopies or tarpaulins shall be properly secured and ventilated.
- Tools, equipment and containers shall be suitable secured and isolated from passengers.
- Participants and materials, such as rock, cement etc. shall not be transported in the same vehicle at the same time.
- Bakkie-drawn trailers may under no circumstances be used for transporting people.
- Participants using project vehicles will comply with vehicle and passenger safety regulations.

2.16. Social Development

2.16.1. Primary Health

- An HIV/Aids information session will be held with each team in conjunction with an approved institution at least once every six months.
- There will be a minimum of two peer educators per team, one male and one female; project
- HIV/Aids committees should be established, meeting on quarterly basis – partnership establishment with local clinic and or Department of Health , Community Based Organisations and Non-Governmental Organisations .
- Measures aimed at reducing the spread of HIV/Aids, including condoms, literature and posters, should be available to all Participants.
- Access of Participants to local clinics should be facilitated wherever possible.
- Training will, where possible, include other aspects of primary health, including nutrition, reproductive health and hygiene.

Appendix 1.2: Minimum Standards for Construction and Maintenance

Please Note: Where the minimum standards (detailed below) are not appropriate, site specific construction and maintenance standards will be included in the site specific **WRP**.

2.17. Cement and Concrete Batching

- Concrete shall be mixed according to the correct MPA as specified in the rehabilitation plan.
- Manufacturer's directions for mixing, consistency and treatment after pouring shall be complied with.
- Cement shall be stored in dry conditions for no longer than six weeks after delivery
- When cement is stored temporarily infield it shall be kept on a dry waterproof base with a waterproof cover.
- The batching site shall be located on a smooth impermeable surface (concrete or 250µm plastic covered with 5cm of sand). The area shall be bunded and sloped towards a sump to contain spillages of substances. All wastewater resulting from batching of concrete shall be disposed of via a contaminated water management system and shall not be discharged into the environment.
- Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented.
- A demarcated site at least 20m away from water/wetland edge shall be used for cement mixing. No batching activities shall occur directly on unprotected ground.
- Empty cement bags shall be stored in weather proof containers to prevent windblown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives.
- The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.
- The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.
- Construction using shuttering shall not take place at more than 1m height increments. Reinforcing shall be used according to specification.
- Concrete will be mixed and used on the same day.
- The haul distance may not be greater than 150m where sand, stone and cement are transported to their point of placement by means of wheel barrows.
- Where applicable, the location of the batching site (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the Engineer. The concrete/cement batching plant shall be kept neat and clean at all times.
- Water used for mixing purposes will be of suitable non-potable quality and may not be obtained from natural water resources.

2.18. Concrete Structures:

- Concrete mix design to follow the specification.
- Concrete to be placed in 300mm layers and vibrated using a concrete vibrator.
- Minimum 50mm cover required on all concrete reinforcing and mesh unless otherwise specified.
- 250µm plastic sheets to be placed under structure.
- All concrete walls to be fully supported until they are backfilled to the designed level.
- All mesh reinforcing to have 500mm overlaps between sheets.
- Buttresses and walls to be cast monolithically with footing.
- Construction joints to be used wherever new concrete is cast against previously cast concrete.
- If rebar or mesh crosses a construction joint, it should be continuous through the joint and extend 600mm into each side.
- Foundation improvement to be constructed from 70kg sandbags made of BIDIM A4 and filled with sand or well graded gravel, where indicated.

2.19. Gabions

- Gabion work shall be done according to design specifications.
- Minimum 2.5mm double galvanised wire shall be used, with a mesh size that is appropriate to the size of the rock being used.
- Support and binding wire shall be a minimum 2.2mm. Lacing shall be done according to specification.
- Support wires shall be in place (bracing).
- All adjoining baskets shall be laced together.
- Geotextile shall line all faces of the gabion baskets that are exposed to earth and certain water exposed sides.
- Water corrosivity shall be determined at each site; if necessary PVC coated gabions shall be used.
- Soil dispersivity shall be determined at each site. If dispersive soils are detected, the ECO / Engineer shall be contacted.
- Density of fill material shall satisfy the gabion design. Clay bricks, weathered rock and sandstone and shale shall not be used as fill material. Any unconventional fill material shall be approved by the ECO / Engineer.
- Fill material shall not be smaller than mesh size.
- Where fill material is hauled to its point of placement by means of wheelbarrows, the haul distance shall not be greater than 150m.
- Participants shall be trained in gabion construction by an accredited organisation.

2.20. Stone Masonry Structures:

- Stone to be packed and mortared in place using concrete.
- Concrete mix design to follow the specification
- 100mm - 200mm stone to be used in all stone masonry, gabions and reno mattresses. Stone fill must be non-friable & insoluble e.g. Granite, basalt, limestone or sandstone.

2.21. Geo Cells

- Geo cells shall not be used in conditions that exceed their design specifications.
- Geo cell material shall be UV resistant.

- Geo cells shall be anchored in by the "trench" method and in such a way that prevents undermining of the cells.
- Fill material shall conform to the design specifications. The following general rules shall be applied:
 - If soil is used to fill the cells, it shall be re-vegetated immediately.
 - If concrete is used to fill the cells, some degree of permeability of the structure shall be permitted. If concrete is used as fill, concrete baffles shall be inserted. Rock is not suitable for this purpose.

2.22. Rock Packing

- Stone must be non-friable and insoluble, e.g. Granite, basalt, limestone or sandstone
- Rock packs placed across a stream to be tied min 1m into each bank.
- The ECO must approve the source of rocks
- The haul distance may not be greater than 150m where rocks are transported to their point of placement by means of wheel barrows
- The size of rocks must comply with the specifications shown on the designs and must be handled in a safe manner particularly during offloading/placing. Heavy duty gloves to be worn when handling rocks.

2.23. Earth Works

- Excavations may not exceed 1.5m depth without shoring and reinforcement.
- Excavation and compaction must comply with design specifications.
- The ECO / Engineer must be consulted for work undertaken in dispersive, unstable and organic soils.
- Backfilling in trenches must be done in layers of thickness not exceeding 100mm before compaction. Each layer shall be compacted using hand compactors or mechanical rammers.
- Where excavation material is hauled by means of wheelbarrows, the haul distance shall not be greater than 150m. All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer.

2.24. Ecologs

- Wooden pegs used to anchor ecologs are to be no less than 40mm diameter and 1000mm in length.
- Pegs should protrude no less than 600mm from the soil @ 1000 c/c.

2.25. MACMAT / MACMAT-R

- MACMAT / MACMAT-R to be installed to manufacturers specifications.

2.26. Working with Wire (Ecologs, fencing, silt traps)

- Wire used must comply with the engineer's specifications.
- The appropriate tools are to be used for safe handling of wire.
- Heavy duty gloves must be worn when handling wire.

- No loose wire/sharp edges are to remain on completed interventions.
- All excess wire must be removed from the site.
- Stakes used for pegging should not present a tripping/piercing risk (as far as practically possible).

Appendix 1.3: Details of the EAP

The following details are for the EAP who compiled the BAR (including this EMPr document) as well as his expertise to perform the Basic Assessment process. The declaration of interest can be found in Appendix 1.5.

Joseph Alexander Mülders

Work Experience Report

Profession:	Systems Ecology
Highest qualification:	M.Sc. Environmental Management
Professional Registration:	Pr.Sci.Nat 118063/17
Current firm:	Prime Africa Consultants (Since 2014)



Summary

A systems ecologist with 3 years of professional experience in the environmental management industry, including socio-economic investigations and classifications towards sustainable use and development of the natural environment.

Joseph completed his undergraduate studies in zoology (2006-2008) before deciding to pursue a career within the more holistic scope of the socio-environmental sector. I completed my honours (2009) in environmental management and analysis and my masters (2012-2015) in environmental management. During my honours year I focused on environmental impact assessment and auditing, environmental change, systems ecology, South African environmental law (EMI training) and completed a research study investigating the trends in use of mammalian criteria in environmental impact assessments. My masters concentrated more on applied environmental management including subjects such as environmental paradigms and development, environmental law, systematic conservation planning and monitoring, integrated environmental management systems (ISO 14001), strategic environmental management, and Geographic Information Systems (GIS). My research study explored freshwater resource management and the effects that land use intensity have on the health of ecosystems. I was closely supervised by Dr Matthys Dippenaar (SACNASP member).

I started at Prime Africa in 2014 owing to my experience with ecological systems monitoring and geographic information systems (GIS) of which I received during my masters. Prime Africa is an environmental and resource economics consulting firm offering clients services in a range of natural resource management fields. I was permanently employed by the company in the beginning of 2016 as a systems ecologist. Since then, I have worked on multiple projects including biodiversity assessments and water monitoring, research studies, compliance with South African legislation, ecosystem valuations, workshop facilitation and spatial operations.

Key professional experience and skills include:

- Environmental assessment, compliance and monitoring;
- Wetland impact mitigation, rehabilitation and offset;
- Environmental risk assessments and due diligence;
- Strategy development and implementation;
- Resource accounting and modelling (Environmental, social and economic);
- Socio-economic evaluation;
- Socio-ecological classification; and

- Ecosystem service valuation;
- Natural resources management;
- Management and policy development towards improving socio-economic wellbeing through sustainable environmental use.
- Biological assessment development;
- Workshop development and facilitation
- Stakeholder engagement and interaction;
- Research and analysis;
- Operational time management; and
- Geographic Information Systems (QGIS, ArcGIS) which include:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.

Work Experience

Name of company: Prime Africa Consultants

Position occupied: Systems Ecologist and Spatial Technician

Period of employment: November 2014-Present (2 years and 8 months)

My job responsibilities as a systems ecologist at Prime Africa have been to perform duties required in the inception, operation and finalisation of a range of multidisciplinary projects. The extent of my responsibilities on various projects has increased positively with my level of experience. Through close supervision by Dr Jackie Crafford (SACNASP member 400143/05) and Mr Kyle Harris I have developed the skills and approaches necessary to be responsible for the entire lifespan of various projects. To clarify, this lifespan includes the procurement, budgeting, client engagement, team management, compilation, implementation and finalisation of projects.

Key work experience gained during this time are listed chronologically per project below:

Project	The Kusile Wetland Offset Implementation Plan
Period	2017-Current
Client	Eskom
Subject	Environmental Authorisation and Implementation
Background	<p>Zitholele Consulting appointed Prime Africa on behalf of Eskom Holdings cc to develop an implementation plan for the Kusile Wetland Offset Strategy.</p> <p>The project focusses on converting the findings of the Kusile Offset Strategy into an implementation plan that would successfully implement the offset as required by conditions of DWS.</p> <p>An additional key purpose of the project is for the development of a Basic Assessment Report (BAR) required for the application for Basic Assessment (BA) for Wetland Rehabilitation Activities to occur during the implementation of the Kusile Wetland Offset Plan (KWOP).</p> <p>The process towards developing the BAR involves the stepwise compilation of various reports / assessments. The first, the Phase 1 Planning Report required a broad scale assessment of wetlands in the study area, or area of influence. This exercise was essentially a scoping study whereby characteristics of the landscape were identified, wetlands were contextualised and prioritised, and landowners were consulted. The second, the Phase 2 Rehabilitation Design Report, was a detailed assessment of wetland condition and identification of rehabilitation interventions where necessary. The final report, the BAR (This document), represents a compilation of all findings, specialist results, proposals, stakeholder engagements and final sign offs. Finally the KWOP will consolidate all findings and be submitted to form the primary technical document for implementation</p>

My role

My role on the project team is as the Environmental Assessment Practitioner (EAP) of which roles include systems ecologist and spatial technician. Other team members include a wetland specialist, civil engineer and a legal expert.

Responsibilities include the following:

- Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice;
- Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR);
- Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines;
- Planning, preparation and conducting of field work, logistically and administratively;
- Management of team members in the field, ensuring all requirements are met in a timely manner;
- Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product.
- Communication with relevant holders of data and appropriate acquisition thereof;
- Assessment of the suitability of data acquired for the appropriate needs of the project;
- Management of time and team members and making appropriate allocations of workloads;
- Drive projects forward utilising scientific best practice approaches and methodologies;
- Appropriate use of the scientific method when data is being collected and results are being discussed;
- Research, analysis and write-up of report content in a scientifically appropriate manner;
- Management and manipulation of both input and output databases;
- Development, compilation and presentation of spatially required outputs;
- The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.
- Review and editing of writeups done by team members;
- Presentation of progress and outputs to relevant steering committees and stakeholders;
- Presentation and explanation of results and outcomes to the client;
- Workshop development and facilitation towards capacity building and data collection;
- Conducting and implementing environmental assessments and monitoring strategies and plans;
- Environmental assessments include alien species assessment; Present Ecological State (PES) determination (WET-Health); and wetland delineation;
- Conducting and implementing wetland impact mitigation, rehabilitation and offset strategies and plans;
- Conducting environmental risk assessments and due diligence assessments;
- Environmental management strategy development and implementation;
- Spatial land management strategies and planning;
- Conducting socio-economic evaluations;
- The development of regional socio-ecological classification; and
- Natural resources management planning;
- Management and policy development towards improving socio-economic wellbeing through sustainable environmental use.
- Assisting the team in providing meaning to the results towards quantifying the relationships between the health of the environment and the socio-economic wellbeing of associated communities;

Project	Impact of Ecological Degradation on Water Resources, Ecosystems and Socio-Economic Development
Period	2014-2017
Client	Water Research Commission (WRC)
Subject	Research: Environmental management
Background	<p>The WRC appointed Prime Africa to conduct a 4 year study which included 8 deliverables. The project developed approaches for assessing the casual effects of degraded water resources, resulting from catchment land uses, on socio-economic development.</p> <p>This was done by reviewing the real challenges related to water resource and environmental management; developing and refining approaches and tools needed to analyse the impacts of environmental degradation on socio-economic development; investigating the impacts of ecological degradation on the livelihoods and well-being of communities (specifically rural and peri-urban communities); and applying the relationships between the degraded water resources and socio-economic development to a case study and critically analysing the results with specific attention to the implications for policies, the opportunities presented for environmental and water resource management and the threats posed to dependent communities and the South Africa as a whole.</p>
My role	<p>My role on the project team was a dual one, as the ecologist and spatial technician. Other team members included the project manager, a water chemist, a resource economist, a geneticist and an economist.</p> <p>Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Planning, preparation and conducting of field work, logistically and administratively; • Management of team members in the field, ensuring all requirements are met in a timely manner; • Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product. • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Conducting environmental assessments of which include: <ul style="list-style-type: none"> ○ Alien species assessment; ○ Present Ecological State (PES) determination (WET-Health); ○ The development of the Rapid Habitat Assessment Method (RHAM); ○ Wetland delineation; • Development, compilation and presentation of spatially required outputs; • Presentation of progress and outputs to relevant steering committees and stakeholders; • Review and editing of writeups done by team members; • Presentation and explanation of results and outcomes to the client; • Environmental management strategy development and implementation; • Management and policy development towards improving socio-economic wellbeing through sustainable environmental use.

Project	Ecosystem Service Valuation of the Groenkloof Nature Reserve
Period	2015
Client	City of Tshwane (CoT)
Subject	Environmental Management
Background	<p>The CoT appointed Prime Africa to conduct a year study towards the valuation of ecosystem services provided by green nodes within City of Tshwane municipality.</p> <p>The study estimated the economic value (Rand value) of a range of pre-identified ecosystem services provided by the Groenkloof Nature Reserve, Pretoria. This provided an ecosystem services evaluation</p>

	where the conservation costs and benefits of the Reserve were compared to other potential uses through assessing all green nodes throughout the CoT.
My Role	<p>My role as spatial analyst was to collate distributional data towards quantifying benefits provided by green nodes. The project team consisted of a project manager, resource economist and myself. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Management and manipulation of both input and output databases; • Presentation of progress and outputs to relevant steering committees and stakeholders; • The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as: <ul style="list-style-type: none"> ○ Spatial data analysis; ○ Geoprocessing (Layer creation manipulation and analysis); ○ Data Management (Entry, conversion and maintenance); and • Presentation and explanation of results and outcomes to the client; and • Ecosystem service valuations.

Project	Turbidity Management Strategy for Kusile Power Station
Period	2015
Client	Eskom
Subject	Compliance
Background	Prime Africa was appointed by Eskom Kusile in November 2014 to develop a turbidity management action plan to reduce turbidity levels in the Wilge River and adjoining tributaries due in part to the construction activities at Kusile Power Station. The monitoring was implemented to determine if there was a decrease in turbidity/TSS across the Kusile site as a result of the interventions implemented.
My role	<p>My role on the project team as systems ecologist and spatial analyst was to assist with project design and implementation of monitoring. Furthermore, my spatial background allowed an approach that considered the project footprint in its entirety. Other team members included the project manager and water chemist. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR); • Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines; • Planning, preparation and conducting of field work, logistically and administratively; • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Compilation of mitigation and rehabilitation plans and strategies; • Development, compilation and presentation of spatially required outputs; • Management and manipulation of both input and output databases; • Presentation of progress and outputs to relevant steering committees and stakeholders; • The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as: <ul style="list-style-type: none"> ○ Spatial data analysis; ○ Geoprocessing (Layer creation manipulation and analysis); ○ Data Management (Entry, conversion and maintenance); and

<ul style="list-style-type: none"> <ul style="list-style-type: none"> ○ Cartography and graphic design. • Review and editing of writeups done by team members; • Presentation and explanation of results and outcomes to the client; • Environmental management strategy development and implementation; • Spatial land management strategies and planning; and • Natural resources management planning.

Project:	The National Wetland Monitoring Program
Period:	2015-2016
Client:	Water Research Commission (WRC)
Subject	Research: Environmental Management
Background	<p>The WRC appointed Prime Africa to conduct a 2 year study. The study consisted of 4 members of which I was the spatial technician and advisor on ecological issues.</p> <p>The key outcome of this project was the Implementation Manual for the NWMP, provided the processes, procedures and methods required to report indicators, to prioritize wetlands for various levels of assessment, and to carry out assessment and monitoring at each level. Another output was the consolidated technical report, which included the consolidation of all deliverables of the assignment, providing the starting framework, indicators, methods, tools and procedures for implementing the NWMP in South Africa.</p>
My role	<p>My role as spatial analyst and ecologist was to development of methods necessary for preparation and operational phases of the program. This included a wetland prioritization tool at broad and fine scales. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Development, compilation and presentation of spatially required outputs; • Management and manipulation of both input and output databases; • The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as: <ul style="list-style-type: none"> ○ Spatial data analysis; ○ Geoprocessing (Layer creation manipulation and analysis); ○ Data Management (Entry, conversion and maintenance); and ○ Cartography and graphic design. • Review and editing of writeups done by team members; • Presentation and explanation of results and outcomes to the client; • Environmental management strategy development and implementation;

Project:	Wetland offset strategy for Kusile Power Station
Period:	2015-2016
Client:	Eskom
Subject	Compliance
Background	Eskom appointed Prime Africa as per water use license compliance regulations to develop a strategy to offset damages caused by the proposed ash dump. The team members included an engineer, a wetland expert and two ecologists (myself included).

My role

This study explored and developed a wetland offset strategy in response to residual impacts caused by proposed activities. Activities included: the quantification of the required offset targets; the identification of possible offset receiving sites for implementation of the strategy; a detailed description of potential offset activities at target sites and evaluation of resultant change to wetland and buffer zone condition/integrity; the quantification of potential gains of offset activities at receiving areas; and the exploration of scenarios in order to optimize potential gains in to meet target requirements.

My role as ecologist and spatial analyst included field investigations and assessment, stakeholder engagement and report compilation. Responsibilities included the following:

- Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice;
- Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR);
- Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines;
- Planning, preparation and conducting of field work, logistically and administratively;
- Management of team members in the field, ensuring all requirements are met in a timely manner;
- Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product.
- Communication with relevant holders of data and appropriate acquisition thereof;
- Assessment of the suitability of data acquired for the appropriate needs of the project;
- Management of time and team members and making appropriate allocations of workloads;
- Drive projects forward utilising scientific best practice approaches and methodologies;
- Appropriate use of the scientific method when data is being collected and results are being discussed;
- Research, analysis and write-up of report content in a scientifically appropriate manner;
- Development, compilation and presentation of spatially required outputs;
- Management and manipulation of both input and output databases;
- The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.
- Review and editing of writeups done by team members;
- Presentation of progress and outputs to relevant steering committees and stakeholders;
- Presentation and explanation of results and outcomes to the client;
- Conducting and implementing environmental assessments and monitoring strategies and plans;
- Conducting and implementing wetland impact mitigation, rehabilitation and offset strategies and plans;
- Conducting environmental risk assessments and due diligence assessments;
- Environmental management strategy development and implementation; and
- Natural resource management planning.

Project:

Period

Client

Subject

Background

National Biodiversity Economy Strategy: Biodiversity Delivery Lab
2016
Department of Environmental Affairs (DEA)
Socio-economic development
DEA appointed Prime Africa to assist them with a 12 week workshop process towards the implementation of the NBES. We were the ideal candidate as Prime Africa was highly involved in the compilation of the NBES. The process involved 6 members (including myself) assisted with the facilitation of data collection and stakeholder interaction.

My role	This project worked towards the implementation of the National Biodiversity Economy Strategy. It involved both the preparation of baseline data and facilitation of a 6 week workshop towards the development of an implementation plan. This was done through the facilitation of industry leaders in the wildlife, bioprospecting and tourism industries in South Africa.
	<p>My role was as a co-facilitator to the workshops process and as lead spatial analyst, I was also responsible for all spatial outputs and analysis prior, during and post workshop. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR); • Management of team members in the field, ensuring all requirements are met in a timely manner; • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Management of time and team members and making appropriate allocations of workloads • Research, analysis and write-up of report content in a scientifically appropriate manner; • Management and manipulation of both input and output databases; • Development, compilation and presentation of spatially required outputs; • The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as: <ul style="list-style-type: none"> ○ Spatial data analysis; ○ Geoprocessing (Layer creation manipulation and analysis); ○ Data Management (Entry, conversion and maintenance); and ○ Cartography and graphic design. • Review and editing of writeups done by team members; • Presentation of progress and outputs to relevant steering committees and stakeholders; • Presentation and explanation of results and outcomes to the client; • Workshop development and facilitation towards capacity building and data collection;

Project	Valuation of South African Peatlands
Period	2015-2016
Client	Water Research Commission (WRC)
Subject	Research: Environmental Management
Background	<p>The WRC appointed Prime Africa to conduct a 2 year study. The study consisted of 2 members of which I was the lead project planner and systems ecologist working with a resource economist.</p> <p>The aim of this study was to demonstrate the socio-economic value of peatlands in South Africa, based on the concepts of ecological infrastructure and ecosystem services delivered (including carbon sequestration, other regulating services, provisioning services and cultural services). This was done through the quantification and economic valuation of ecosystem services provided by South African peatlands. Responsibilities included the following:</p>
My role	<p>My role as project manager and systems ecologist was the investigation and compilation of the report through understanding and describing the relationship between the socio-economic climate and the contribution by ecosystem services by route of market value linkages. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR); • Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines; • Planning, preparation and conducting of field work, logistically and administratively;

- Communication with relevant holders of data and appropriate acquisition thereof;
- Assessment of the suitability of data acquired for the appropriate needs of the project;
- Drive projects forward utilising scientific best practice approaches and methodologies;
- Appropriate use of the scientific method when data is being collected and results are being discussed;
- Research, analysis and write-up of report content in a scientifically appropriate manner;
- Development, compilation and presentation of spatially required outputs;
- Management and manipulation of both input and output databases;
- The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.
- Presentation of progress and outputs to relevant steering committees and stakeholders;
- Presentation and explanation of results and outcomes to the client;
- Workshop development and facilitation towards capacity building and data collection;
- Environmental management strategy development and implementation;
- Spatial land management strategies and planning;
- Ecosystem service valuation; and
- Natural resources management planning.

Project	Kusile Wetland Rehabilitation Intervention Plan
Period	2015-2016
Client	Eskom
Subject	Compliance
Background	<p>Eskom appointed Prime Africa to develop rehabilitation, mitigation and monitoring plans for impacted wetlands in the Kusile Power Station footprint. I was the project manager working together with another ecologist and a water chemist.</p> <p>The project included the development of wetland rehabilitation interventions for wetlands at the Kusile Power Station, Mpumalanga. The purpose of the rehabilitation interventions were to prevent the further deterioration of affected wetland systems and restore and rehabilitate the functioning of the wetlands to an improved ecological state.</p>
My role	<p>My role as project manager and lead systems ecologist was to assess the present ecological state (PES) of the wetlands, propose rehabilitation interventions that addressed cumulative historic and future impact on associated wetlands and develop an estimated cost and implementation timeline for the proposed interventions. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines; • Planning, preparation and conducting of field work, logistically and administratively; • Management of team members in the field, ensuring all requirements are met in a timely manner; • Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product. • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project • Management of time and team members and making appropriate allocations of workloads;

	<ul style="list-style-type: none"> • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Development, compilation and presentation of spatially required outputs; • Management and manipulation of both input and output databases; • The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as: <ul style="list-style-type: none"> ○ Spatial data analysis; ○ Geoprocessing (Layer creation manipulation and analysis); ○ Data Management (Entry, conversion and maintenance); and ○ Cartography and graphic design. • Review and editing of writeups done by team members; • Presentation of progress and outputs to relevant steering committees and stakeholders; • Presentation and explanation of results and outcomes to the client; • Conducting and implementing environmental assessments and monitoring strategies and plans; • Environmental assessments include alien species assessment; Present Ecological State (PES) determination (WET-Health);and wetland delineation; • Conducting and implementing wetland impact mitigation, rehabilitation and offset strategies and plans; • Conducting environmental risk assessments and due diligence assessments; • Environmental management strategy development and implementation; and • Spatial land management strategies and planning.
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Project:	Forestry and Macroeconomic Accounts of Nigeria: The Importance of Linking Ecosystem Services to Macroeconomics
Period:	2016-2017
Client:	United Nations Environmental Programme (UNEP)
Subject	Environmental Management
Background	<p>UNEP appointed Prime Africa to conduct a forest accounting study. The study consisted of 4 members of which I was the lead ecologist and spatial technician. Other team members included a resource economist, an economist and a risk analyst.</p> <p>The project required linking drivers of economic behaviour, as it relates to deforestation, to the benefits of forest ecosystem services. Our approach was to develop a user –friendly decision support model that was able to integrate natural accounts (forest and water resources) with their provision of ecosystem services that had a final impact of the macro-economy and sustainable development goals.</p>
My role	<p>My role was to quantify the productivity of forests and their carbon sequestration ability. This information was used to demonstrate the value to the economy of different policy options. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines; • Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product. • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Management of time and team members and making appropriate allocations of workloads; • Drive projects forward utilising scientific best practice approaches and methodologies; • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Development, compilation and presentation of spatially required outputs;

- Management and manipulation of both input and output databases;
- The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.
- Presentation of progress and outputs to relevant steering committees and stakeholders;
- Presentation and explanation of results and outcomes to the client;
- Conducting environmental risk assessments and due diligence assessments;
- Resource accounting and modelling (Environmental, social and economic);
- Conducting socio-economic evaluations;
- Ecosystem services Valuation; and
- Management and policy development towards improving socio-economic wellbeing through sustainable environmental use.

Project:	An Ecosystem Services Assessment of the Molopo-Nossob Basin
Period:	2017
Client:	International Union for Conservation of Nature (IUCN)
Subject	Environmental Management
Background	<p>The IUCN appointed Prime Africa to conduct a study that assessed the value of ecosystems to communities in the Molopo-Nossob Basin. The study consisted of 3 team members of which I was the project manager joined by another ecologist and a water chemist.</p> <p>The aim of this study was to analyse the economic value of the ecosystems present in the Molopo-Nossob Basin, and recommend policy instruments that would alleviate pressure on the natural systems. The methodology followed included a macro level mapping and categorisation of ecosystems, including an overview of the states and trends of ecosystems; an inventory of ecosystem services per ecosystem and prioritisation of valuation; categorisation of rangelands in the Molopo-Nossob Landscape; preliminary Valuation of prioritised ecosystem services; and policy recommendations to inform management of key ecosystems.</p>
My role	<p>My role team leader and lead ecologist was to, drive the process and ensure outcomes were developed in line with requirements in a timeous manner. My expertise in socio-economic modelling and spatial analysis were utilised throughout the process. Responsibilities included the following:</p> <ul style="list-style-type: none"> • Attending meetings with reference groups and stakeholders to ensure the approaches, methods and results are in line with scientific best practice; • Communicating with the client to ensure the project is outcomes focussed and adequately addressed the original Terms of Reference (ToR); • Ensuring a transparent process through management of client expectations and achievement of predetermined deadlines; • Planning, preparation and conducting of field work, logistically and administratively; • Management of team members in the field, ensuring all requirements are met in a timely manner; • Communicating and effectively working together with a multidisciplinary team towards completing a single integrated product. • Communication with relevant holders of data and appropriate acquisition thereof; • Assessment of the suitability of data acquired for the appropriate needs of the project; • Management of time and team members and making appropriate allocations of workloads; • Drive projects forward utilising scientific best practice approaches and methodologies; • Appropriate use of the scientific method when data is being collected and results are being discussed; • Research, analysis and write-up of report content in a scientifically appropriate manner; • Development, compilation and presentation of spatially required outputs; • Management and manipulation of both input and output databases;

- The application of appropriate techniques required for spatial extrapolation i.e. through the use of tools such as:
 - Spatial data analysis;
 - Geoprocessing (Layer creation manipulation and analysis);
 - Data Management (Entry, conversion and maintenance); and
 - Cartography and graphic design.
- Review and editing of writeups done by team members;
- Presentation of progress and outputs to relevant steering committees and stakeholders;
- Presentation and explanation of results and outcomes to the client;
- Assisting the team in providing meaning to the results towards quantifying the relationships between the health of the environment and the socio-economic wellbeing of associated communities;
- Conducting environmental risk assessments and due diligence assessments;
- Environmental management strategy development and implementation;
- Spatial land management strategies and planning;
- Resource accounting and modelling (Environmental, social and economic);
- Conducting socio-economic evaluations;
- The development of regional socio-ecological classification; and
- Ecosystem service valuation;
- Natural resources management planning; and
- Management and policy development towards improving socio-economic wellbeing through sustainable environmental use.

Courses and Conferences

2009: Short Course in Environmental Law Presented by the Department of Public Law, University of Pretoria. Topics covered include:

- Environmental law principles and norms;
 - Environmental governance;
 - Environmental assessment;
 - Administrative justice;
 - Mining and energy law;
 - Biodiversity law;
 - Air quality;
 - Waste management;
 - Water law; and
 - Compliance and enforcement of environmental law.

2012: Short Course in ISO 14001:2004. Environmental Management Systems: Auditor/Lead Auditor Training to develop the skills to audit environmental management systems. Presented by SGS

2013: Short Course in SPSS. Introduction to SPSS. University of Pretoria.
Short Courses in Geographic Information Systems (GIS) including:

- Getting Started with GIS, Esri-Web course;
- Getting Started with the Geodatabase, Esri-Web course;
- Learning ArcGIS Desktop, Esri-Web course;
- Basics of Raster, Esri-Web course; and
- Using Raster Data for Site Selection, Esri-Web course.

2016: National Wetland Indaba (NWI), 2016, Blythe River Canyon, Forever Resorts Conference Centre Mpumalanga, South Africa. Presented results of the study that demonstrated the socio-economic value of South African peatlands (see key projects for more details).

Publications

Dippenaar, M. A., Van Rooy, J. L., Breedts, N., Huisamen, A., Muravha, S. E., Mahlangu, N. S. and Mulders, J. A. (2014). Vadose Zone Hydrology: Concepts and Techniques. Water Research Commission report TT 584/13, project K5/2052. Pretoria.

SACNASP Registration



Appendix 1.4: EAP Declaration

DETAILS OF EAP AND DECLARATION OF INTEREST

Application for integrated environmental authorisation in terms of the-
National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the
amended Environmental Impact Assessment Regulations, 2017.

PROJECT TITLE

Rehabilitation of Wetlands Identified in the Kusile Wetland Offset Plan

Bar EMP 

Environmental
Assessment
Practitioner (EAP):
Contact person:
Postal address:
Postal code:
Telephone:
E-mail:
Professional affiliation(s)
(if any)

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SACNASP (Professional Natural Scientist) No: 118063/17		

Project Consultant:
Contact person:
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Prime Africa Consultants		
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0042	Cell:	072 754 2603
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J.mulders@primeafrica.net		



The Environmental Assessment Practitioner

I, Joseph Mulders, declare that:

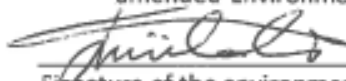
General declaration:

- I act as the independent environmental practitioner 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 environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity; -
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the Regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act



Disclosure of Vested Interest:

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the amended Environmental Impact Assessment Regulations, 2017;



Signature of the environmental assessment practitioner:

Prime Africa Consultants

Name of company:

27/11/2017

Date: