WETLAND, MAINTENANCE, MANAGEMENT AND REHABILITATION ACTION PLAN AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED PONGOLA (MBOZA) BRIDGE CROSSING, KWAZULU NATAL PROVINCE

Prepared for

Royal Haskoning DHV (Pty) Ltd

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GLOSSARY OF TERMS & ACRONYMS

Alien vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally
AV	Anthropogenic Value
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Areas
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EI	Ecological Integrity
EIS	Ecological Importance and Severity
ESA	Ecological Support Areas
HGM	Hydrogeomorphic
m	Meter
mm	Millimetres
MSDS	Material Safety Data Sheet
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NWA	National Water Act
PES	Present Ecological Status
QDS	Quarter Degree Square
REC	Recommended Ecological Category
SAS	Scientific Aquatic Services
SV	Service Value
WMU	Water management unit
WMMRP	Wetland, Maintenance, Management and Rehabilitation action Plan

1 INTRODUCTION

1.1 Project description

In order to ensure that future management of the resources takes place in a suitable manner, ensure future ecoservice provision and the achievement of the Recommended Ecological Category (REC) of the Pongola River system, Scientific Aquatic Services was appointed to develop a Wetland, Maintenance, Management Rehabilitation Action Plan (WMMRP) to guide the management of all activities and aspects which could affect the watercourses in the vicinity of the proposed bridge development. The WMMRP was developed in such a way as to address construction and operational phase impacts for the life of the development.

The proposed bridge and road crossing is located in the Lowveld Uplands Ecoregion and Usutu to Mhlatuze Water Management Area, KwaZulu-Natal Province. The study area assessment site (Mboza 1) is located on the Pongola River within the W45A quaternary catchment.

1.2 Key Design Criteria

1.2.1 Background and design criteria

In addition to the active rehabilitation and management of the Pongola River, the intention of the WMMRP was to incorporate the design criteria for the bridge crossing from an environmental perspective in order to assist in the design and operational requirements of the bridge development:

- The footprint of the crossing structure should remain as small as possible;
- A bridge spanning the entire river bed within the active channel banks should be considered as the ideal scenario;
- If a pier is required the following key design criteria should be considered:
  - The pier structure must be designed in such a way as to ensure that turbulent flow is minimised through the use of streamlined support column shapes;
  - The foundations of the pier must ensure that no changes to stream flow direction occur and that minimisation of turbulent flow is ensured.

Two design options are presented with these criteria in mind:

- Option 1: 4 pier; and
- Option 2: 3 pier.

The preferred option that was recommended in the Clarification of the administration of the approach roads for the proposed single lane vehicular bridge at Mboza, Pongola, KwaZulu Natal (Letter from Transport Infrastructure & Regional Service, 29 October 2015) was option 1 Figure 1 below.

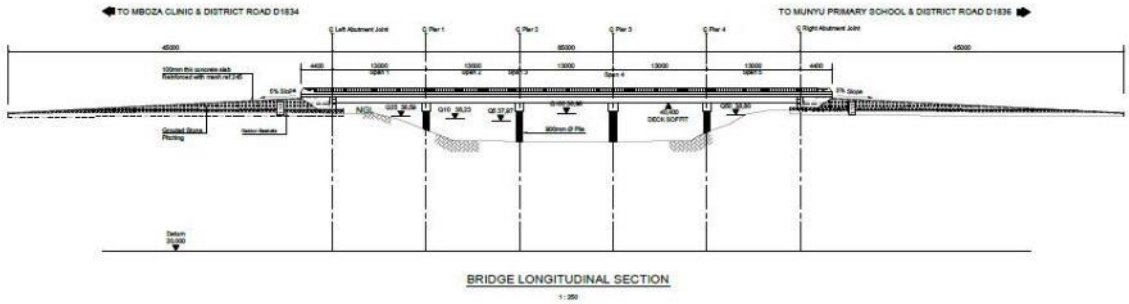

Figure 1: Proposed design of bridge crossing option 1. (Royal Hanskoning, 3513/P1).

Figure 2: Digital satellite image depicting the project footprint in relation to surrounding areas.

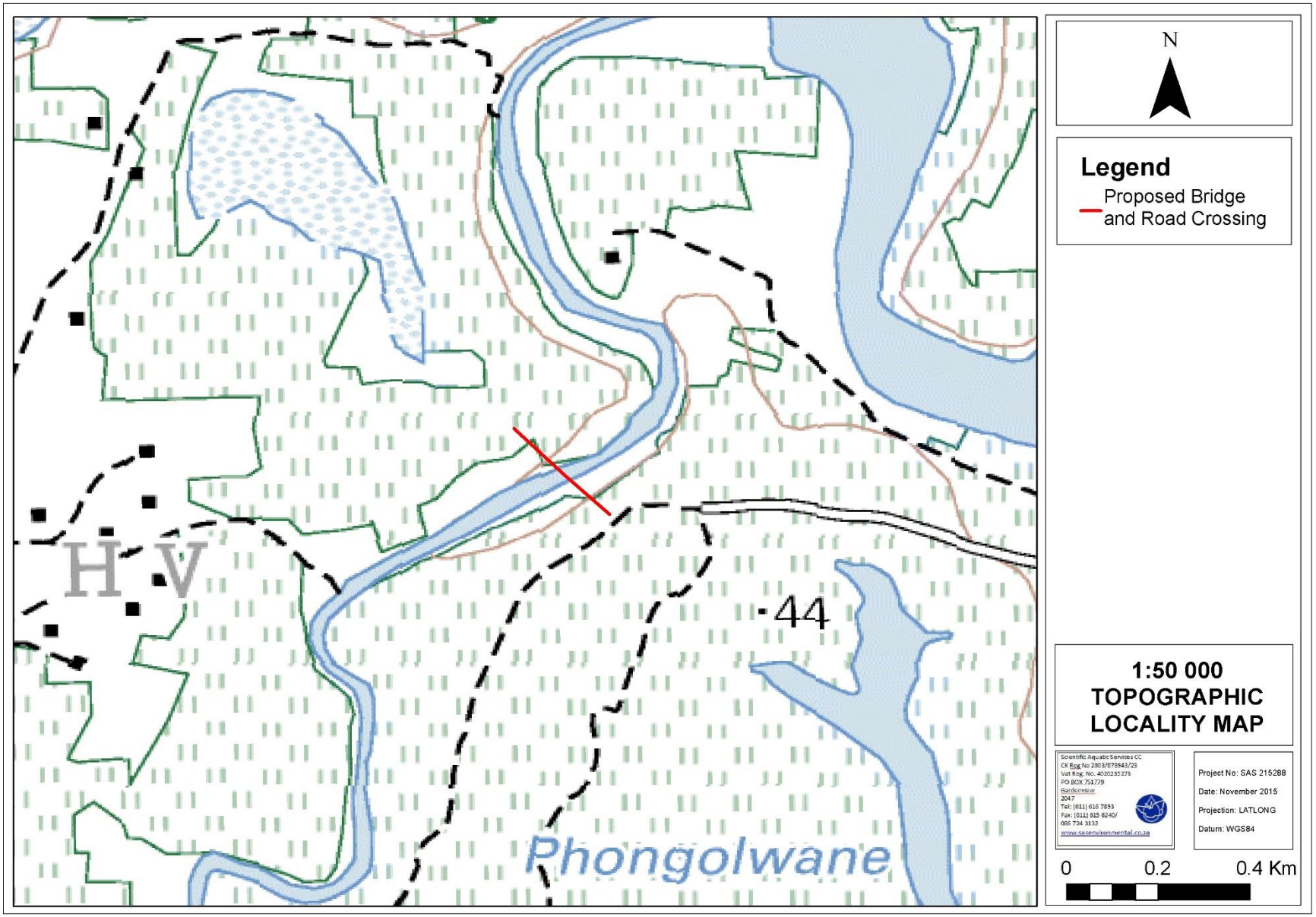

Figure 3: 1 50 000 Topographical map depicting the location of the project footprint.

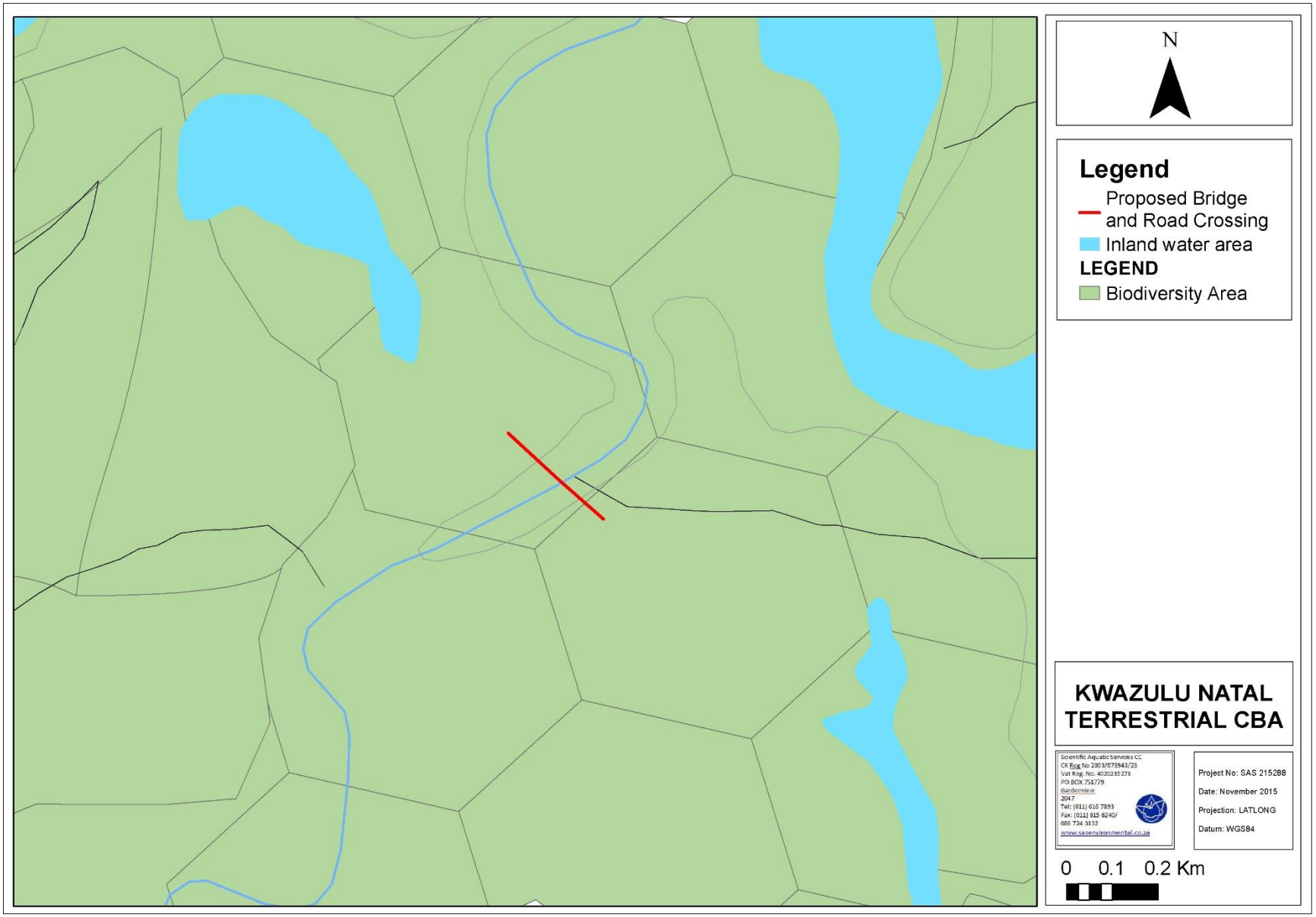

Figure 4: KwaZulu Natal terrestrial CBA.

Figure 5: Riparian zone delineation.

2 LEGAL FRAMEWORK

A legal overview was undertaken in order to identify legislation and policies that have a direct bearing on the water resource management of the project footprint. The sections below present each legislative document and the aspects, which are pertinent to water resource management including the rehabilitation of disturbed areas to a level that will promote responsible water resource utilisation.

National Environmental Management Act, (NEMA, Act 107 of 1998)

- The Environmental Impact Assessment (EIA) Regulations (2014) promulgated in terms of NEMA identifies a suite of activities, which "*could have a substantial detrimental effect on the environment*". The listed activities identified require an Environmental Authorisation (EA) from the environmental authority, the Department of Environmental Affairs (DEA), prior to commencement of the activity.

- This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (No. R. 982) where a "maintenance management plan" is defined as a management plan maintenance purposes defined or adopted by the competent authority.

National Environmental Management Biodiversity Act (NEMBA, Act 10 of 2004)

The objectives of this act are (within the framework of the National Environmental Management Act) to provide for:

- the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- the use of indigenous biological resources in a sustainable manner;
- the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources;
- to give effect to‘ ratified international agreements relating to biodiversity which are binding to the Republic;
- to provide for co-operative governance in biodiversity management and conservation; and
- to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources.

Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

Amendments to regulations under the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) ensures that landowners are legally responsible for the control of invasive alien plants on their properties. The CARA legislation divides alien plants into weeds and invader plants, with *weeds* regarded as alien plants with no known useful economic purpose, while *invader plants* may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature.

National Environmental Management Biodiversity Act (NEMBA) (Alien and Invasive Species Regulations, 2014)

The National Environmental Management Biodiversity Act (Act no 10 of 2004) (NEMBA) is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act (NEMA), 1998. In terms of alien and invasive species. This act in terms of alien and invasive species aim to:

- Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

Categories according to NEMBA (Alien and Invasive Species Regulations, 2014)

- **Category 1a:** Invasive species that require compulsory control.
- **Category 1b:** Invasive species that require control by means of an invasive species management programme.
- **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
- **Category 3:** Ornamentally used plants that may no longer be planted.

NWA (Act 36 of 1998)

- The NWA; Act 36 of 1998 recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be

conserved. No activity may therefore take place within a watercourse and no storage or abstraction of water may take place unless it is authorised by the Department of Water and Sanitation (DWS), formerly the Department of Water Affairs and Forestry (DWAF).

The Protected Areas Act (Act No. 57 of 2003)

To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

This Act as alludes to the fact that the conservation status of all river types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured.

3 SITE DESCRIPTIONS AND ASSESSMENTS

3.1 Ecological Characteristics of the Project Footprint

Vegetation associated with the project footprint comprises one-habitat unit, namely Wetland/riparian Habitat (Figure 6). The existing aquatic and wetland ecological assessment (SAS, 2015) was used to describe the habitat units.

3.2 Wetland Characterisation

The wetland features within the project footprint was categorised with the use of the *Classification System for Wetlands and other Aquatic Ecosystems in South Africa* (Ollis, *et. al.* 2013). Upon assessment single HGM Units, namely a floodplain wetland, was identified and will be assessed accordingly:

Table 1: Classification for the Floodplain Wetland (SANBI 2013).

Level 1: Inland System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: HGM Unit
An ecosystem that has no existing connection to the ocean but which is inundated or saturated with	The project footprint falls within the Lowveld Ecoregion and within the Lowveld Group 10 (endangered) (NFEPA WetVeg).	**Plain:** An extensive area of low relief, characterised by relatively level, gently undulating or uniformly	River: a linear landform with clearly discernible bed and banks, which are permanently or periodically carries a concentrated flow of

water, either permanently or periodically.		sloping land with a very gentle gradient that is not located within.	water. A river is taken to include both the active channel and the riparian zone as a unit.

3.3 General Wetland Assessment Results

During the field assessment, it was evident that the floodplain wetland is in a moderately degraded state due to the high levels of historical and current agricultural practices within the wetland system. It should be noted that the assessment was largely restricted to the portion of the Floodplain wetland and Pongola River in the immediate vicinity of the proposed road and bridge infrastructure, although cumulative impacts from the surroundings were also considered, where applicable. These areas are discussed in detail below. For the purposes of this investigation, a wetland and a riparian habitat are defined in the national water Act (1998) as stated below:

- A wetland is a 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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
- Riparian habitat is defined as including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

The banks of the Pongola River can best be defined as riparian habitat comprising of indigenous species such as *Ficus sycomorus* (Sycamore fig), *Trichilia emetica* (Natal mahogany), *Vachellia xanthophloea* (Fever Tree), *Sclerocarya birrea* (Maroela), *Vachellia kraussiana* (Scented-pod Thorn) and *Mangifera indica* (Mango). Alien vegetation comprising mainly of *Lantana camara* (Tickberry) was also present. The remainder of the floodplain vegetation has been severely altered as a result of current and historic agricultural practices. Significant invasion by alien vegetation associated with agricultural crop lands such as *Datura ferox* (Large thorn apple), *Tagetus minuta* (Tall khaki weed), *Argemone Mexicana* (Yellow-flower Mexican poppy) and *Xanthium Strumarium* (Large cocklebur). Although transformation of the wetland vegetation has occurred, the Pongola River is still considered to be of importance in terms of the provision of an ecological corridor through a significantly transformed area. Furthermore, the system is likely to provide important ecosystem services and function and may provide the habitat to support an increased abundance of fish species.

Being classified by the NFEPA database (2011) as a RAMSAR wetland as well as a WETFEPA with particular importance in being located within 500m of a threatened waterbird point locality, the wetland plays an important role in delivering ecosystem services, despite being in a moderately degraded condition.

Figure 6: The Pongola River (left) and the cultivated crop lands associated with the floodplain wetland (right).

4 MAINTENANCE, MANAGEMENT WETLAND REHABILITATION ACTION PLAN

All essential mitigation measures and recommendations as listed in this section of the report should be adhered to as to ensure the ecology within the proposed construction areas as well as surrounding zone of influence is protected or adequately rehabilitated in order to minimise the deviations from the Present Ecological State. Particular attention needs to be paid to the location and extent of wetland feature in order to ensure development related activities do not encroach unnecessarily into these zones and that ongoing functionality of these systems is maintained in order to ensure that habitat areas within the wetland resource downgradient of the proposed development activity are not adversely affected.

4.1 Principles of the WMMRP

To assist in achieving the objectives of the WMMRP, a set of principles was applied, which contributed to the formulating of action plans and specific management measures. The principles of the WMMRP are:

- Avoiding impacts by not performing environmentally detrimental actions;
- Minimising impacts by limiting aspects of an action which could lead to environmental damage;

- Rectifying impacts through rehabilitation, restoration, etc. of the affected environment;
- Minimising impacts by optimising processes, structural elements and other design features;
- Provide a framework for the required monitoring and management of environmental impacts of a development and documenting of any digressions /good performances; and
- The WMMRP, once approved for implementation by the relevant authorities, is a legally binding document that all parties involved in the project must be informed about the importance of the WMMRP.

4.2 Key Objectives of the WMMRP

The WMMRP aims to address current impacts associated with the operation of the proposed development as well as anticipated impacts that the development is likely to have on the Pongola River. Therefore, certain objectives were developed which guided the development of the WMMRP. The objectives of the WMMRP are to:

- Meet the requirements of relevant local and regional authorities;
- Ensure that the construction and operational phases of the proposed bridge continues within the principles of Integrated Environmental Management;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts on the receiving environment to minimal or acceptable levels;
- Ensure that the development does not negatively impact on the social environment and that clear communication channels are present through which concerns can be raised and addressed;
- Prevent the further degradation of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the Pongola River;
- Ensure that the Pongola River is rehabilitated appropriately in order to meet the Recommended Ecological Class (REC) of the resource and prevent further degradation of the wetland and riparian areas;
- Identify measures that could optimise beneficial impacts in order to improve the ecological value of the Pongola River, such as:
    - Assisting in the promotion of sustainable management and ongoing functioning of the Pongola River;
    - Encouraging riparian connectivity and preventing habitat fragmentation;
    - Maximise the service provision and hydrology of the Pongola River;

- Removal of alien and invasive plant species from the Pongola River and replacing these species with indigenous vegetation;
- Detail specific actions deemed necessary to assist in mitigating the potential environmental impact on the Pongola River;
- Controlling alien vegetation in a phased manner as to not encourage further erosion along the wetland area that falls within the proposed road upgrade footprint; and
- Prevent contamination of the Pongola River and no litter may be tolerated within the wetland/riparian areas.

- Stormwater control methods must be implemented to slow water velocity and prevent further incisions and erosion of the sandy soils;
- Ensure that appropriate solid waste disposal facilities are provided and adequate signage is provided for all solid, liquid and hazardous waste types;
- Ensure as far as is practicable that the measures contained in the report are implemented; and
- Propose mechanisms for monitoring compliance with the WMMRP and reporting thereon.

4.3 Roles & Responsibilities

4.3.1 Proponent

- The Proponent will be responsible for the appointing of a suitably qualified Environmental Practitioner as an independent Environmental Control Officer (ECO) for the construction phase of the project;
- A management body must be appointed to ensure compliance with the WMMRP during the operational phase;
- The Proponent will be responsible for ensuring all relevant contractors receive a copy of the WMMRP and understand its contents; and
- Should ownership of the property change, the role and responsibility for compliance with the WMMRP must also be transferred.

4.3.2 Environmental Control Officer (ECO)

The ECO is the person responsible for the monitoring of the implementation of the WMMRP during the construction phase and for reporting on the degree of compliance. The ECO should ideally be appointed at the start of the construction phase and is mandated to do the following:

- Ensure that all contractors/ subcontractors/ employees are fully aware of their environmental responsibilities. This should take the form of an initial environmental awareness-training program in which requirements of the rehabilitation plan will be explained;
- Monitor site activities on a regular basis to ensure that there is minimal environmental impact due to construction activities;
- Ensure that a 'hotline' exists for reporting incidents and resolving any problems rapidly;
- Ensure that there is a mechanism available for Interested and Affected Parties to raise concerns and a mechanism to ensure that all such concerns are addressed;
- The ECO has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the construction operations;
- Review or amend the WMMRP as necessary, and inform the relevant parties of the changes; and
- Conduct a final environmental audit and a review of management and rehabilitation measures.

4.3.3 Contractors

The Contractor must ensure that the conditions of the WMMRP are adhered to. Should the Contractor require clarity on any aspect of the WMMRP the Contractor must contact the Environmental Control Officer (ECO) for advice.

The ECO must regularly audit the operation and establish whether the measures in the WMMRP are applied, where after the ECO reports to the lead project manager. The lead project manager must ensure that the WMMRP is implemented and that suitable penalties are in place for non-conformance to the WMMRP by contractors. The ECO should be the designated authority to issue a stop work order if severe non-compliance is taking place by the contractor.

Points below serves as a summary of responsibilities of the Contractor:

- The contractor/s in this case refers to any contractor/s on site, including the building contractor/s and sub-contractors;
- Such contractor/s will take full responsibility for each of his/her employees and any penalties imposed; and
- It is the responsibility of the contractor/s to ensure that they adhere to the WMMRP.

- Construction workers must receive basic training in environmental awareness, including minimisation of disturbance to the Pongola River of increased ecological sensitivity, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution.

4.4 Training and Awareness

4.4.1 Training of Construction Workers

Construction workers must receive basic training in environmental awareness, including minimisation of disturbance to the Pongola River, as well as fauna and flora with a no poaching policy, management of waste and prevention of water pollution.

4.4.2 Contractor Performance

The Contractor must ensure that the conditions of the WMMRP are adhered to. Should the Contractor require clarity on any aspect of the WMMRP the Contractor must contact the ECO for advice.

The ECO must regularly audit the operation and establish whether the measures in the WMMRP are applied, where after the ECO reports to the lead project manager. The lead project manager must ensure that the WMMRP is implemented and that suitable penalties are in place for non-conformance to the WMMRP by contractors. The ECO should be the designated authority to issue a stop work order if severe non-compliance is taking place by the contractor.

4.5 Recommended Rehabilitation and Maintenance measures

The following rehabilitation measures must be undertaken in order to mitigate the impacts of the proposed bridge crossing traversing the Pongola River:

Table 2: Maintenance, Management and Wetland Rehabilitation Action Plan for Mboza proposed bridge crossing

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
Site management	Designated areas must be set out for storage material and also mixing of materials.	• Areas (beyond the riparian zone and 1:100 year floodline) should be designated for the storage of materials (e.g. building sand/ stockpiled topsoil) and mixing of materials (such as concrete). This reduces contamination of water resources from these materials/ activities. DWAF unknown date	Contractor, ECO, Proponent	Before construction phase commence
	Encourage good house-keeping	• One of the best and least-expensive ways to reduce pollutants in runoff is to limit the exposure and contact of materials to rainfall and runoff. An inventory of the items on a site that are exposed to rain and runoff a starting point for exposure-reduction activities. Landowners should be advised to keep dustbins and other containers securely closed, store containers under cover, and cover stockpiled materials, such as gravel, wood chips, and building materials with plastic sheeting. Fain, G.B., *et al*. 2000, USEPA 2005.	Contractor, ECO	Must be implemented throughout the construction phase.
	Construction work must be overseen by suitably qualified ECO.	• All construction work must be overseen by a suitably qualified ECO. The ECO should be delegated to stop work if deemed necessary and contractors should only hand over the site once the ECO has signed off on the work.	Contractor, Eco, Proponent	Throughout the construction phase
	Prohibiting construction workers to use any natural water source within the project footprint.	• No construction workers shall be permitted to use any river, stream, open water or natural source that is adjacent to or within the designated site for the following activities: o Washing of clothing; o Bathing; and o Any construction or related activity.	Contractor, ECO, Proponent	Throughout the construction phase
	Rescue and relocate amphibians.	• Rescue and relocate amphibian species to nearby wetland or riparian areas, if encountered.	Contractor, Eco, Proponent	Throughout the construction phase when amphibians are encountered.
Site planning	Site fingerprinting	• Areas on construction sites are often unnecessarily cleared. Site fingerprinting involves clearing only those areas essential for conducting construction activities, leaving other areas undisturbed. The proposed limits of land disturbance should be physically marked off to ensure that only the land area required for buildings, roads, and other infrastructure is cleared. Existing vegetation, especially vegetation on steep slopes, should be avoided and preserved through fencing, signage, and site plan notations. USEPA. 2005	Contractor, ECO	Area must only be cleared before construction will commence for the specific area.
	Sensitive area demarcation	• Maintain habitat connectivity, especially where the project footprint crosses wetland and riparian habitat. • The point where the road enters the floodline must also be defined so as to ensure that no unnecessary activities occur below the floodline.	Contractor, ECO	Before any construction work commences on site.
	Placement of contractors camp	• Contractor's camp, storage areas and sanitary areas must be agreed to by the Principal Agent, ECO, and Contractor prior to work commencement at the site. • These sites must be kept tidy, in good condition and sanitary throughout the whole project.	Contractor, Landowner, ECO	Before construction activity commences.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
		• Avoid damage to wetland or riparian areas that fall outside of the direct construction footprint e.g. through careful placement of laydown areas, construction camps, overburden dumps etc. on previously disturbed areas with a low ecological value above the floodline • The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas in order to minimise environmental damage. • A dedicated parking area for construction vehicles must be located away from sensitive areas above the floodline, and drip trays must be located beneath any leaking equipment and lubricant/fuel absorbing media (moss/peat type products) within drip trays must be used to contain spilled material. The absorbing material in the drip trays must be replaced regularly as to prevent over-saturation and potential spillage. This hazardous waste must be collected by an approved Contractor/delivered to an approved waste site (DWA. 2006a, DWA. 2008f)		
Sanitation	Provision of Portable Toilets	• Placement of the sanitary facilities are to be agreed with the ECO. This must be done prior to placement and all personnel must use the toilets supplied. • Portable lavatories should be provided where work is being done (e.g. construction), and should be located at least 50m away from water resources and riparian areas. DWA. 2006a, DWA. 2008a, DWA. 2008b, DWA. 2008f, FESA. 1999, FIEC. 2002, SANRAL. 2009e, SuSFarMs. 2008, USEPA. 2006 • Care must be taken to secure all lavatories are secured by not less than four separate cables, fastened at the top corners of the lavatory. This is done to assure that the lavatory cannot be accidently knocked over or be blown over by the wind.	Contractor, ECO	Before construction activity commences and designated areas must be approved by ECO. Sanitary areas must be maintained throughout the construction phase.
Site clearing	Minimise land-clearing/ grading and cut plants down to ground level rather than removing completely	• Clearing and grading should occur only where absolutely necessary to build and provide access to structures and infrastructure. Clearing should be done immediately before construction, rather than leaving soils exposed for extended periods of time. USEPA. 2005	Contractor, ECO	Site clearing must be done before construction commences on the specific area.
	Construction must NOT be undertaken in high rainfall months	• To prevent unnecessary sediment loading of waterbodies the construction of infrastructure should be carried out in the months without high rainfall (summer months). FIEC. 2002.	Contractor, ECO	Project planning phase and must be adapted during the construction phase if needs be.
	Use excavators during construction in sensitive areas	• Excavators should be used instead of bulldozers in areas sensitive to erosion (e.g. steep areas and unstable soils). FIEC. 2002.	Contractor, ECO	Throughout the construction phase.
	Remediation activities must be overseen by the ECO.	• All remediation activities must be approved through a meeting between the Principal Agent, ECO and Contractor to ensure that the site has been restored to a condition approved by the Principal Agent.	Contractor, ECO, Principal Agent	Remediation activities must be implemented after construction have taken place.
	Flatten backfill areas	• When excavated areas are backfilled the surface must be level with the surrounding land surface, to minimise changes in hydrology, soil erosion from the areas when the excavation is complete. MacFarlane, D.M.*et al*,2007	Contractor, ECO	Immediately when excavated area is backfilled.
	All rubble must be removed from construction footprint.	• Burying of any rubble on the site is prohibited and all rubble must be removed to an approved disposal site.	Contractor, Eco, Proponent	Throughout the construction phase.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
	Removal of demarcations associated with construction works.	• All demarcations associated with construction works must be removed from site, unless stipulated otherwise by Principal Agent when the decommissioning phase is complete.	Contractor, Eco, Proponent	When construction phase is complete.
Information signage	Multilingual signage	• To ensure that it reaches most people signs must be written in the languages of the area (Not just English). This ensures that non-English speakers can understand and will hopefully cooperate in reducing water pollution by the measures indicated on the sign. USEPA. 2005.	Contractor, Landowner, ECO	Signage must be displayed before and during the construction phase.
Construction management	Servicing and refuelling may only take place on platforms that can contain any spillage.	• Carry out all servicing and refuelling of construction vehicles on a concrete platform with runoff traps and containment. If refuelling takes place in the field use drip trays at all times	Contractor, Landowner, ECO	Throughout the construction phase.
	Minimise pollution from cement/ concrete use	• No mixed concrete shall be deposited directly onto the ground. A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing. Concrete spilled outside of the demarcated area must be promptly removed and taken to a permitted waste disposal site. Wash water from cement is not to be released into the environment. This water must be collected, stored and disposed of at an approved site. USEPA. 2006 • Concrete washouts are used to contain concrete and liquids when the chutes of concrete mixers and hoppers of concrete pumps are rinsed out after delivery. The washout facilities consolidate solids for easier disposal and prevent runoff of liquids. The wash water is alkaline and contains high levels of chromium, which can leach into the ground and contaminate groundwater. Washout should take place at a designated site outside of the 1:100 year floodline. • Concrete and cement-related mortars can be toxic to aquatic life. Proper handling and disposal should minimize or eliminate discharges into watercourses. Fresh concrete and cement mortar should not be mixed on-site, and both dry and wet materials should be stored away from water bodies and storm drains. These materials should be covered and contained to prevent contact with rainfall or runoff. A washout area should be designated outside of the 1:100 year floodline, and wash water should be treated on-site or discharged to the sanitary sewer. USEPA. 2005 • High alkalinity associated with cement, which can dramatically affect and contaminate both soil and ground water. The following recommendations must be adhered to: o Approved mixing areas must be defined on site by the ECO; o Mixing of cement on bare soil is not allowed, and lined bound or bunded portable mixer must be used. Consideration must be taken to use ready mix concrete; o Cement bags must be disposed of in the demarcated hazardous waste receptacles and the used bags must be disposed of through the hazardous substance waste stream; and • Spilled or excess concrete must be disposed of at a suitable landfill site. Chain of custody documentation must be provided.	Contractor, ECO, Landowner, Proponent	Throughout the construction and operational phases.
	Controlling airborne dust at construction sites.	• Reduce airborne dust at construction sites through: o Damping dust generation areas with freshwater;	Contractor, ECO, Proponent	Throughout the construction phase.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
		○ Use of cloth or brush barrier fences; and ○ Covering stockpiles with plastic sheets.		
	Repair any damage caused by drilling/blasting/demolition and must be overseen by ECO and Principal Agent.	• Any environmental damage that is caused by drilling/blasting/demolition must be repaired and/or rehabilitated at the contractors expense and must be overseen by the ECO	Contractor, ECO, Proponent	Throughout the construction phase when drilling/blasting/demolition have taken place.
	All waste from construction must be removed.	• All waste, with special mention of waste rock and spoils and remaining building material should be removed from the site on completion of the construction phase. Wherever possible waste rock and other material non-toxic material should be re-used in further construction of the entire precinct	Contractor, ECO, Landowner, Proponent	Throughout the construction phase.
Waste Management	Preventative measures for liquid waste (Liquid, solid) storage and removal.	• Material Safety Data Sheet (MSDS) must be kept on site at all times for all potential hazardous material used. • Storage areas that are used to store hazardous substances must be covered and bunded with an approved impermeable liner at all times or must have some form of secondary containment. • Solid waste (including hazardous and general waste) must be categorised and disposed of in a suitable manner. Suitable general waste receptacles must be provided throughout the construction site with a single hazardous waste collection point for the construction site. • Suitable waste receptacles must be provided for areas demarcated for specific activities including food consumption and must be collected on a frequency of once per week or such a frequency that the waste receptacles do not overflow. • Avoid dumping of spoil material on, or within 50m of wetlands or riparian areas. • Spills in bunded areas must be cleaned up, removed and disposed of safely from the area. This must be done as soon as possible to minimise pollution. • Care must be taken with disposal material that could be waterborne or wind-borne as to ensure minimal waste is release into the environment. • Recycling of waste must be implemented wherever possible.	Contractor, ECO, Landowner, Proponent	Throughout the construction phase.
Wet Environments Management	Prevent erosion and sedimentation of riparian feature.	• Adequate erosion management must be incorporated as to prevent erosion and sedimentation of the riparian feature. The following management measures may be used: soil traps, hessian curtains, berms, stormwater diversions away from areas that are susceptible to erosion. Care must be taken to avoid additional disturbances during the implementation of the above mentioned management measures, specific mention of the following: ○ Stormwater Management Plan must be developed to aid in the attenuation of stormwater; ○ Sheet runoff that is created by paved surfaces and access roads must be decreased; ○ When stormwater is released back into the system it must be at the same base height as to prevent head erosion; and ○ Consideration must also be given to use attenuation ponds to prevent further erosion when runoff is discharged into riparian areas. • All final rehabilitation and revegetation are to be signed off by the ECO.	Contractor, ECO, Landowner, Proponent	Throughout the construction and operational phases.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
	Ensure that the bridge design allows for wetland soil conditions to be maintained both upstream and downstream of the bridge to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained.	• Habitat connectivity must be maintained at all times, especially if the road is crossing an ecological corridor such as the Pongola River. • The design should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface; • U-shaped culverts, should be used with the disturbance created with the footings and associated foundations of the culverts kept to a minimum. The design should make use of culverts with as wide a span as possible to minimise the permanent footprint in the drainage lines; • The pioneer layer or other method of founding should be constructed out of a porous material or from material which is coarse enough to assist with the movement of water through the structure to allow wetting of the soils to occur on the downstream side of the crossing and prevent excessive upstream inundation; • The extent to which culverts are used in the system should reach as far as possible to ensure that during freshets the broadest possible area becomes inundated allowing for recharge of the wetland soils across the width of the wetland and must ensure: o no upstream ponding and no downstream erosion and scouring occur; o that wetting frequencies and patterns are maintained in the pre development condition and in such a way that permanent, seasonal and temporary wetland zonation are maintained; o no constriction of flow occurs which could lead to erosion and incision; and o no hindrance to terrestrial, wetland/riparian and aquatic fauna occurs; o No infilling in these areas may take place; • The design should ensure that the seasonal wetland zone should have water logged soils within 300mm of the soil surface at all times; • Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer season. • Inspection of the bridge and culverts must done after every heavy rainfall or flood to ensure that debris (trees washing down) are not blocking up the culverts. Culverts may also become silted up and need to be rectified as not to hamper stream flow under the bridge.	Contractor, ECO, Landowner, Proponent	Throughout the construction phase.
	Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the bridge	• The crossing structure must allow for sufficient dispersion of water through the wetland area to prevent the concentration of flow in preferential flow paths or the active channel, which could lead to scouring, and incision of the system. • During construction, the footprint areas of the construction activities must be kept to a minimum. All vehicles must use one single designated track and turn-around areas should be located outside of the wetland boundary. • The bridge wing walls are to be clad with rock to prevent erosion. • The pier structures must be designed in such a way as to ensure that turbulent flow is minimised through the use of streamlined support column shapes; • The foundations of the pier must ensure that no changes to stream flow direction occur and that minimisation of turbulent flow is ensured.	Contractor, ECO, Proponent	Throughout the construction phase.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
	Activities must be conducted in a manner that does not negatively affect catchment yield, hydrology and hydraulics.	• Flow through the river crossing must be reinstated and the temporary stream diversion must be backfilled. • It must be ensured that backfilled material and constructed stream banks are suitably compacted in layers of 500mm or less in order to prevent collapse or subsidence of the backfilled stream diversion and newly created stream banks. • The surface of the backfilled stream diversion has to be graded and levelled to tie in with the natural surroundings and to resemble pre-construction conditions as far as possible. A gently-sloping, free-draining topography should be achieved, whereby ponding is prevented. • The characteristics of the streambed are likely to be altered locally. In particular the rock and rubble created during the construction process is likely to have sharp edges, and not smooth surfaces that are typically associated with river rocks and pebbles. Therefore, all rock and rubble must be removed from the watercourse once construction is completed. Any rock placed in the watercourse to enhance the dissolved oxygen content of the water must adhere to the same criteria and have only smooth rock surfaces. • During the rehabilitation it should be kept in mind that upstream ponding and downstream sedimentation be prevented throughout. Ponding should only occur for a very short period (a few hours) after heavy rainfall events and can be prevented by ensuring that natural flow is maintained throughout the rehabilitation phase of the development. • Loss of stream continuity should be prevented during the rehabilitation phase of the development, through ensuring that no obstructions occur as a result of rehabilitation activities within and adjacent to the Pongola River.	Contractor, ECO, Proponent	Flow of the Pongola River must be reinstated as soon as the construction of the centre pier is finished.
	Prevent any discharge of effluents or polluted water.	• Avoid any discharge of effluents or polluted water into wetlands or riparian areas.	Contractor, ECO, Proponent	Throughout the construction and operational phases.
	Avoid washing vehicles close to riparian or wetland areas.	• Avoid washing of vehicles or machinery within 50m of wetlands or riparian.	Contractor, ECO, Proponent	Throughout the construction phase.
Road construction and maintenance	Restrict maintenance activities to the project footprint.	• Ensure that maintenance activities are restricted to the project footprint.	ECO, Contractor, Proponent	Throughout the construction and operational phases.
	Develop structures to direct runoff away from a road and to a sediment trap.	• The water velocity is slowed and the sediment deposited in the outlet, where it then passes through a constructed sediment trap (made of logs, rocks, branches or concrete to remove the remaining sediments before it is discharged to a suitable discharge area or water body. Walker, D. 199 *et al*, SANRAL. 2009b.	ECO, Contractor	Construction of culverts must be done during the construction phase.
Rehabilitation	Recommended rehabilitation for the project footprint.	Rehabilitation should be carried out in a phased approach throughout the construction and operational phase. The following are broad rehabilitation guidelines and may be adapted as necessary: • Rip to a depth of 100mm and profile soils to pre-construction conditions. This is to ensure suitable substrate for revegetation in areas, which have been compacted as a result of	Contractor, ECO, Landowner, Proponent	Rehabilitation must be implemented just after the construction phase and during the operational phase.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
		construction activities. Use indigenous grass species to the area must be used for rehabilitation; • Special attention should be paid to alien and invasive control within these areas; • Rehabilitate disturbed areas with the use of indigenous floral species in order to improve the PES of the vegetation; and • Planting should preferably be done in the riparian zone and must be undertaken during the months prior to the rainfall season in order to aid with establishment of individuals. No fertilisers or chemical soil ameliorants may be used due to close proximity to the river.		
To ensure that exposed soils and steep slopes are stable and not eroding.	Erosion control and rehabilitation in riparian areas and other disturbed areas.	• Identify activities which are causing erosion and incision of any of the riparian and wetland features in the project footprint; • Avoid the disturbance or removal of indigenous vegetation during any maintenance activity; • Undertake maintenance during the dry season, as far as possible; • Exposed slopes especially along the riparian area are highly prone to erosion, so drainage control features such as earth berm, perimeter berm/swales, diversions (see below) can be used to intercept and convey runoff from above disturbed areas to suitable dispersal areas or drainage systems. This helps to reduce the sedimentation from exposed areas**.** Walker, D. 199 et al. and USEPA. 2005 o **Brush layering** is when branches are placed perpendicular to the slope contour. This method is effective for earth reinforcement and mass stability. Brush layers break up the slope length, preventing surface erosion, and reinforce the soil with branch stems and roots, providing resistance to sliding or shear displacement. Brush layers also trap debris, aid infiltration on dry slopes, dry excessively wet sites, and mitigate slope seepage by acting as horizontal drains. Brush layers facilitate vegetation establishment by providing a stable slope and a favourable microclimate for growth of vegetation. USEPA 2005 o **Live gully repair** is a technique that is similar to branch packing but is used to repair rills and gullies. Live gully repairs offer immediate reinforcement and reduce the velocity of concentrated flows. They also provide a filter barrier that reduces further rill and gully erosion and must be used where gully erosion is taking place on the project footprint. USEPA 2005 Any gullies occurring in the project footprint must be repaired occurring in the riparian and wetland area. • If a site must be cleared (e.g. a firebreak) but is deemed unsuitable for burning then it can be slashed instead and the cuttings used for mulching to stabilise the soil. DOE. 2004 • Disturbed and compacted soil should be loosened to a depth of 100mm with handheld equipment to ensure suitable substrate for revegetation; • Seed any areas where earthworks have taken place to prevent further erosion. • Stream banks must be reprofiled to 1:3 slopes, covered with a geotextile product such as hessian, with commercially available products such as Geojute, which is to be staked to the surface of the slopes and reseeded with an indigenous veld grass mixture. Revegetation of all reprofiled areas with an indigenous Bushveld mixture should take place as soon as possible	Contractor, ECO, Landowner, Proponent	Exposed and steep slopes must be stabilised throughout the construction phase and must also be done during the operational phase when damage from heavy rainfall or flooding have occurred.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
		after soil reprofiling, levelling, top soiling and implementation of erosion control structures in order to minimise the amount of time during which soils are exposed and thus susceptible to erosion. With areas of particular concern, sandbags can be placed in such a way to slow the flow of water and keep the banks from degrading.		
Eradication of weed and invader species within the project footprint and especially within the sensitive riparian features.	Removing of alien and invasive species from wetland and riparian features.	• Remove alien and invasive species from wetland and riparian features and from the riparian areas that are being affected during all phases of the proposed bridge crossing. • Alien and invasive plant control must be implemented in a phased manner as to assure that bank stability is maintained and erosion and sedimentation is not promoted.	Contractor, ECO, Landowner, Proponent	After the construction phase and during the length of the operational phase
	Prohibit vehicles to drive in wetlands during eradication of weeds.	• Vehicles will not be allowed to drive in wetland and sensitive areas during the eradication of alien and weed species.	Contractor, ECO, Landowner, Proponent	When eradication of weeds are done after construction and during operational phase.
	Removal of alien vegetation species.	• Alien and invasive vegetation have a number of detrimental effects on water quality, from nutrient enrichment to increased erosion and excessive water use, which is especially relevant in dry areas or in important catchments. Invasive species are highly likely to colonise disturbed areas, even after rehabilitation and follow-up clearing must be done until healthy vegetation returns to the site. DWA.2008e, DWAF. Unknown date, MacFarlane, D.M., Wadeson. R *et al,* 2007. • Where possible, plants should be cut down to ground level and sprayed with appropriate herbicide instead of being removed completely to stabilise the soil during land-clearing operations. DWAF. Unknown date.	Contractor, ECO, Landowner, Proponent	Eradication of weeds must commence during the end of the construction phase but must be implemented during the whole of the operational phase.
Chemical / herbicide transport, storage and application	Safe storing hazardous chemicals	• Designated areas for chemical storage must be above1:100 floodline to prevent these substances entering water resources. • Fuels, chemicals and other hazardous substances must be stored in suitable secure weatherproof containers with impermeable and bonded floors to limit pilferage, spillage into the environment, flooding or storm damage. • Reactive materials, e.g. acids and alkalis, and fuel oil should be stored separately. • All storage facilities should also be inspected on a regular basis for the early detection of deterioration or leaks. Fuel and chemical storage facilities and storage tanks should not be located near water resources, sensitive environments or with areas subject to flooding. DOW. 2006, FESA. 1999, FIEC. 2002.	Contractor, ECO, Landowner, Proponent	Save storage facilities must be erected at demarcated areas before construction can commence.
	Do not transport toxic chemicals in bulk to limit potential spillages	• Do not transport chemicals (e.g. herbicides) in bulk as this gives the potential for serious accidents to occur. DWA. 2008a, DWA. 2008f, FIEC. 2002.	Contractor, ECO, Landowner, Proponent	Whenever Chemicals/herbicides are transported during the construction and operational phase.
	Ensure that properly trained personnel undertake application of chemicals.	• Many chemicals (e.g. herbicides) are harmful to human and environmental health so should only be applied by properly trained and equipped workers that are registered according to the statuary requirements. Barnard, C., FIEC. 2002, Hornsby, A.G. 1992.	Contractor, ECO, Landowner, Proponent	Every time chemicals/herbicides are applied during the

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
				construction and operational phase.
	Herbicide application best practices	• Herbicides have the same toxic effect on aquatic plants and organisms as they do on the terrestrial plants and organisms to which they were applied. Therefore when applying herbicides, landowners should strictly adhere to best practice guidelines (as indicated in the label instructions) to minimise spray drift or wash-off into water resources and the killing of aquatic organisms. These include application under suitable weather conditions (i.e. sufficiently dry and calm), seeking professional advice on the type and quantity of pesticides that should be applied and considering the environmental conditions and hazards at the site. Over application must NOT take place and spray plans should be continuously updated to prevent over application and contamination of water resources. Barnard. C *et al,* 1997, Hornsby, A.G. 1992, USEPA. 2006, USEPA. 2005.	Contractor, ECO, Landowner, Proponent	Throughout the construction and operational phase.
	Limit herbicide application when risk of spray drift is high	• Apply chemicals in cool, dry and non-windy weather to prevent drift from contaminating other plants and if drift from wind is a lot the correct dosage to kill the plant may not be achieved. Barnard. C *et al,* 1997, Fain, G.B *et al*. 2000. FIEC. 2002. Hornsby, A.G. 1992.	Contractor, ECO, Landowner, Proponent	Whenever Chemicals/herbicides are used during the construction and operational phase
	Cleaning of equipment used for chemical application, and disposing of empty containers	• Contaminated equipment should not be cleaned infield, but rather have a designated area at a workshop to clean equipment. Empty containers and used equipment must be thoroughly rinsed (min three times) to get all the herbicide out. Herbicide containers can be reused for the same contents, alternatively holes must be punched through them prior to disposal at a registered site, in order to prevent inappropriate reuse. DWA. 2006a, DWA. 2008f, FIEC. 2002.	Contractor, ECO, Landowner, Proponent	Whenever chemical application equipment is used during the construction and operational phase
	Remove contaminated soil	• If soil contamination occurs (such as due to a spill), the soil should be removed from the site and disposed of appropriately. FIEC. 2002., MacFarlane, D.M, *et al*. 2007	Contractor, ECO, Landowner, Proponent	Immediately after soil contamination has taken place.
Pollution control	Effective response and readiness planning	• An effective response plan must be in place and personnel must be ready to mobilise in the event of a spillage to reduce the environmental effects of an oil or chemical spill in the project footprint. Readiness Assessments. An IOSC Workshop Report	Contractor, ECO	Response plan must be in place before any construction can commence.
	Record all spills during all phases of the development.	• Any spills that occur during all phases of the development must be recorded in the Environmental Register. All clean-up actions must also be recorded that was used to remediate the spillage. All actions needs to be agreed in conjunction with the ECO prior to commencing any work.	Contractor, ECO, Landowner, Proponent	Immediately when a spill occurs during the construction and operational phases.

OBJECTIVE	ACTION	ACTIVITIES	RESPONSIBLE PARTY	TARGET DATE
	Old engine oil must be collected and recycled	• Old engine oil must NOT be thrown on the ground or down a storm water drain but rather collected in containers and recycled. FESA. 1999, FIEC. 2002, SANRAL. 2009e, SuSFarMs. 2008	Contractor, ECO	Must be implemented before construction starts and containers with old oil must be removed before it overflows.

5 MONITORING PLAN

For the purposes of this plan, Monitoring is defined as “the repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures” (DWAF, 2005).

Since the site is very remote, monitoring must take place during the construction phase, and for a period of three months after completion unless otherwise directed by the duly appointed ECO.

The water resource monitoring plan comprises the following monitoring programs:

- **Erosion**
  - Monitoring should take place after every rainstorm or flood that takes place and has an influence on the water flow of the river.
- **Wetland crossing infrastructure**
  - Monitoring should take place after every rainstorm or flood that takes place;
  - Special care must be taken to ensure that there is no hollowing out (incisions) caused by the water flow around or over river crossing infrastructure;
  - Culverts and bridge infrastructure must be inspected for any blockages or damage*;* and
  - Aquatic Biomonitoring must be done on a quarterly basis from three months prior to construction commencing to three months after completion of construction.
- **Alien Vegetation**
  - Identify priority species to control;
  - Seek guidance from a suitably qualified contractor prior to the removal of any living individual in order to establish the most species specific eradication method;
  - Develop protocols for the removal of all alien species that show recruitment;
  - Avoid the use of herbicides as far as possible. Should herbicides be used, only herbicides approved by the Department of Water and Sanitation (DWS) may be used and care should be taken with the choice of herbicide to ensure no additional impacts on the river areas or indigenous floral species occur due to the herbicide used. Removal of alien vegetation within the riparian zone must be preferably done manually; and
  - Foot print areas must kept as small as possible when alien and weed species are removed.
- **Water monitoring:**

- When constructions/operations are approved, water upstream and downstream of the proposed site must be tested at least once a month for a minimum of three months before construction commences. This ensures that base values for the comparison of water quality during the construction and operational phase are obtained, so that impacts can be detected early and mitigated.
- Aquatic Biomonitoring must be done on a quarterly basis prior to, during and post construction of the bridge and once after construction;
- Biomonitoring should take place using the SASS5, MIRAI and IHAS indices as a minimum along with sediment chemistry monitoring. All aquatic biomonitoring should be undertaken by a (South African River Health Program (SA RHP) accredited aquatic ecologist.

5.1 Monitoring philosophy and requirements

Prudent water resource monitoring in the project footprint is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage water resource related progress and issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- All data gathered should be measurable (qualitative and quantitative);
- Monitoring report should be repeatable and temporally and spatially comparable;
- Data should be auditable;
- Data gathered should be an accurate representation of the wetland/riparian PES of each monitoring site;
- Data, when compared to previous sets, should show spatial and temporal trends; and
- General habitat unit overviews should also be undertaken.

5.2 Wetland/Riparian Data Capturing Protocols

5.2.1 Monitoring/Sampling Frequency

A walk down must be done after heavy rain or a flood have surpassed to monitor for any new erosion and damage to infrastructure within the project footprint, in order to ensure that temporal comparisons can be made.

5.2.2 Monitoring/Sampling Technique

- Photos and GPS point locations must be taken of existing erosion in the riparian/wetland zone that falls within the project footprint;

- The riparian PES must be assessed according to the Resource Directed Measures (RDM) (Dini *et al*., *1999*). The results must be compared to the baseline assessment PES results to monitor any changes.

5.2.3 Monitoring/Sampling Equipment

- Camera
- Field sheets.
- GPS.

5.2.4 Information Generation Protocols

5.2.4.1 Reporting Frequency

A monthly monitoring report should be compiled by the appointed ECO during the construction phase of the bridge crossing development. During the operational phase of the development, monitoring must be done for one year after construction is complete.

5.2.4.2 Report Content

All documented erosion within the project footprint, which is recorded in relation to fixed points outside of the watercourse, or by means of a GPS point, must be photographed and a small description of the erosion must be added. Riparian crossing infrastructure needs to be inspected for hollowing (incisions) and stability problems. If any are present, the infrastructure must be photographed, and immediate remedial action must take place.

5.2.5 Data Base Entry and Backup

All data should be captured and stored electronically by the ecologist undertaking the monitoring. Hard copies of all field score sheets should also be kept.

6 WETLAND REHABILITATION AND MANAGEMENT PLAN REVIEW

The following points below must be adhered to for the implementation and compliance of the WMMRP

- The Environmental Consultants and ECO are authorised to change and re-issue the WMMRP;
- The provincial authority, the local authority, site supervisor, project manager and Environmental Site Officer are to be informed of any changes made by the Environmental Consultants;
- The site supervisor or contractor is responsible for ensuring construction personnel are complying with procedures, and for informing the work crew of any changes. The site supervisor is responsible for ensuring the work crew is aware of changes before starting any works; and
- If the contractor cannot comply with any of the activities as described above, they should inform the ECO, with reasons for non-compliance, within seven (7) working days.

7 CONCLUSIONS AND RECOMMENDATIONS

With the implementation of the WMMRP procedures outlined in this report, the potential negative impacts of the proposed bridge crossing on the surrounding environment should be reduced to an acceptable level. The information gathered through monitoring programs will assist in a better understanding of the ecology of the area in the vicinity of the project footprint. With the implementation of a rehabilitation plan, it is deemed possible that alien vegetation encroachment can be controlled until natural vegetation becomes established and self-sustaining.

Environmental audits help in assuring the accuracy and relevance of environmental monitoring (DWAF, 2005). The results of an audit are obtained by comparing the information gathered during interviews and from reports with the objectives that were originally identified as well as the actual on the ground situation (DWAF, 2005). An environmental audit must take place at least once during the construction period. The audit must be undertaken in order to ensure compliance with the monitoring plan, in order to determine whether monitoring is being undertaken correctly and in order to ensure that remediation actions are successful.

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