

REPORT

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED UPGRADE OF DANGO BRIDGE (B1372) AND BEDLANE BRIDGE (B1330) SITUATED ALONG THE P393 (R34) ROAD BETWEEN NKWALENI PASS (KM0.0) AND EMPANGENI (KM 24.0) IN KWAZULU-NATAL-NATAL PROVINCE

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GLOSSARY OF TERMS

TERM	DESCRIPTION
BUILDING AND DEMOLITION WASTE	Building and demolition waste means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any building structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.
CONSTRUCTION PROJECT MANAGEMENT TEAM	The key team members for implementation of the Environmental Management Programme include a Project Manager, Site Engineer, Safety and Health Officer and an Environmental Control Officer.
CONTRACTOR-OR SUB-CONTRACTOR	Companies and or individual persons appointed on behalf of the KwaZulu-Natal Natal Department of Transport to undertake construction activities.
CORRECTIVE ACTION	A plan created by management to address, correct or eliminate a non-conformance that has occurred.
DEVELOPMENT	Means the building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint; Carrying out any works on or over or under a place; Constructing or putting up for display signs or boards; Any change to the natural or existing condition or topography of land; and Any removal or destruction of trees, or removal of vegetation or topsoil.
DEGRADATION	The lowering of the quality of the environment through human activities e.g. river degradation, soil degradation, atmospheric degradation.
DEMOLITION	Demolition is the tearing-down of buildings and other structures, the opposite of construction. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use.
DOMESTIC WASTE	Domestic waste means waste, excluding hazardous waste, that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes generated directly by the consumption of products

TERM	DESCRIPTION
	for domestic use.
ENVIRONMENT	<p>Environment means the surroundings within which humans exist and that are made up of, including:</p> <ul style="list-style-type: none"> • The land, water and atmosphere of the earth; • Micro-organisms, plants and animal life; • any part or combination of (i) of (ii) and the interrelationships among and between them; and • The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
EMERGENCY	An undesired event that results in a probable significant environmental impact and requires the notification of the relevant statutory body such as a local or provincial authority.
ENVIRONMENTAL CONTROL OFFICER	An individual nominated through the KwaZulu-Natal-Natal Department of Transport to monitor and audit the implementation of the EMPr conditions on a monthly basis.
ENVIRONMENTAL IMPACT	A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.
ENVIRONMENTAL ASSESSMENT REPORT	Document developed during the initial planning stages of a project. The document highlights specific environmental issues which may impact on the project throughout its lifetime and includes mitigation measures which must be implemented by the Contractor during the construction phase.
ENVIRONMENTAL SITE OFFICER	An individual appointed by the Contractor to be present on site, to act on behalf of the Contractor in matters concerning the implementation of and day to day monitoring of the EMPr.
ENVIRONMENTAL MANAGEMENT PROGRAMME	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive environmental impacts and limiting or preventing negative environmental impacts are implemented during the life-cycle of the project. This EMPr focuses on the planning phase, construction phase, operation (maintenance) phase and decommissioning phase of the project.
GENERAL WASTE	<p>Refers to waste that does not pose an immediate hazard or threat to health or to the environment, and includes:</p> <ol style="list-style-type: none"> (a) Domestic waste; (b) Building and demolition waste; (c) Business waste; and

TERM	DESCRIPTION
	(d) Inert waste.
GROUNDWATER	All subsurface water that fills voids between highly permeable ground strata comprised of sand, gravel, broken rocks, porous rocks, etc. and move under the influence of gravitation.
HAZARDOUS WASTE	Refers to any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles.
HERITAGE RESOURCES	This means any place or object of cultural significance, including all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources, as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people.
IMPACT	A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.
INCIDENT	An undesired event which may result in a significant environmental impact but can be managed through internal response.
INTEGRATED ENVIRONMENTAL MANAGEMENT (IEM)	Is a philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).

TERM	DESCRIPTION
INTERESTED AND AFFECTED PARTY	A person, group of persons or organisation interested in or affected by a development.
METHOD STATEMENT	A method statement is a written submission by the Contractor to the Engineer in response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.
MITIGATION	Measures designed to avoid, reduce or remedy adverse impacts.
POLLUTION	Any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
PROJECT MANAGER	A person appointed by the KwaZulu-Natal Natal Department to oversee the overall project management and the management of the professional project team.
RECYCLE	A process where waste is reclaimed for further use, this involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.
REHABILITATION	Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (wherever possible) which it was before disruption.
RE-USE	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
SCREENING	Is the process that determines whether or not a development proposal requires environmental assessment and the level of assessment required. Screening is therefore a decision-making process that is initiated during the early stages of the development of a proposal

TERM	DESCRIPTION
SUSTAINABLE DEVELOPMENT	According to World Commission on Environment and Development (1987), this is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
TOOLBOX TALK	Short talks that focus on a specific topic e.g. manual handling, working at heights etc. It explores the risks of specific health and safety issues and ways to deal with them. It helps inform inexperienced workers and provide reminders to experienced workers of correct control measures.
WASTE	<p>Waste means any substance, whether or not that substance can be reduced, re-used, recycled and recovered -</p> <p>That is surplus, unwanted, rejected, discarded, abandoned or disposed of;</p> <p>Which the generator has no further use of for the purposes of production;</p> <p>That must be treated or disposed of; or</p> <p>That is identified as a waste by the relevant Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but a by-product is not considered waste; and any portion of waste, once re-used, recycled and recovered, ceases to be waste.</p>
WASTE DISPOSAL FACILITY	Waste disposal facility means any site or premise used for the accumulation of waste with the purpose of disposing of that waste at that site or on that premises.
WATERCOURSE	Can be a) a river or spring; b) a natural channel or depression in which water flows regularly or intermittently; c) a wetland, lake or dam into which, or from which, water flows; and/or d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.
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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
WORKFORCE	The entire project team including people employed by the KwaZulu-Natal Natal Department of Transport directly, the Principal Agent or the Contractor, persons involved in activities related to the project, or person present at or visiting the construction area, including permanent contactors and casual labour.

1 INTRODUCTION

The KwaZulu-Natal-Natal Department of Transport (KZN DoT) is proposing to improve the Provincial Road P393 (R34) from P47-4 at Nkwaleni Pass (km 0.0) to P230 at Empangeni (km 24.0) within the King Cetshwayo District Municipality in KwaZulu-Natal-Natal Province (KZN). The project starts at the intersection of P47-4 (R66) with P393 (R34) at Nkwaleni Pass (km 0.0) and ends at P230 (km 24.0) towards Empangeni (refer to **Figures 1-3**).

The Bedlane River Bridge (B1334) is situated at km 2.6 from Nkwaleni Pass and the Dango River Bridge (B1372) is situated at km 3.9 from Nkwaleni Pass. The existing P393 road is 8 m wide and the proposed road geometry for the rehabilitation is 10.0 m wide including shoulders. The proposed footway at river crossings and embankments is 1.5 m wide.

The proposed rehabilitation comprises the bulk earthworks, layerworks, surfacing, drainage, ancillary works and upgrade of the Bedlane and Dango bridges. ***The upgrade of Bedlane and Dango bridges require an Environmental Authorisation and Water Use Authorisation prior to the upgrade being implemented.***

1.1 Applicable Documentation

The following documents are applicable to this project application, and must be read in conjunction with and appended to this EMPr:

- Basic Assessment Report for the Proposed Project;
- The Water Use Authorisation once issued by the KwaZulu-Natal-Natal Department of Water and Sanitation (KZN DWS) and;
- The Environmental Authorisation once issued by the KwaZulu-Natal-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DDEDTEA).

1.2 Structure and Phases of the EMPr

The EMPr provides mitigation and management measures for the four phases namely planning, construction, operation and decommissioning as depicted in **Figure 5**.



Figure 1: Locality Map

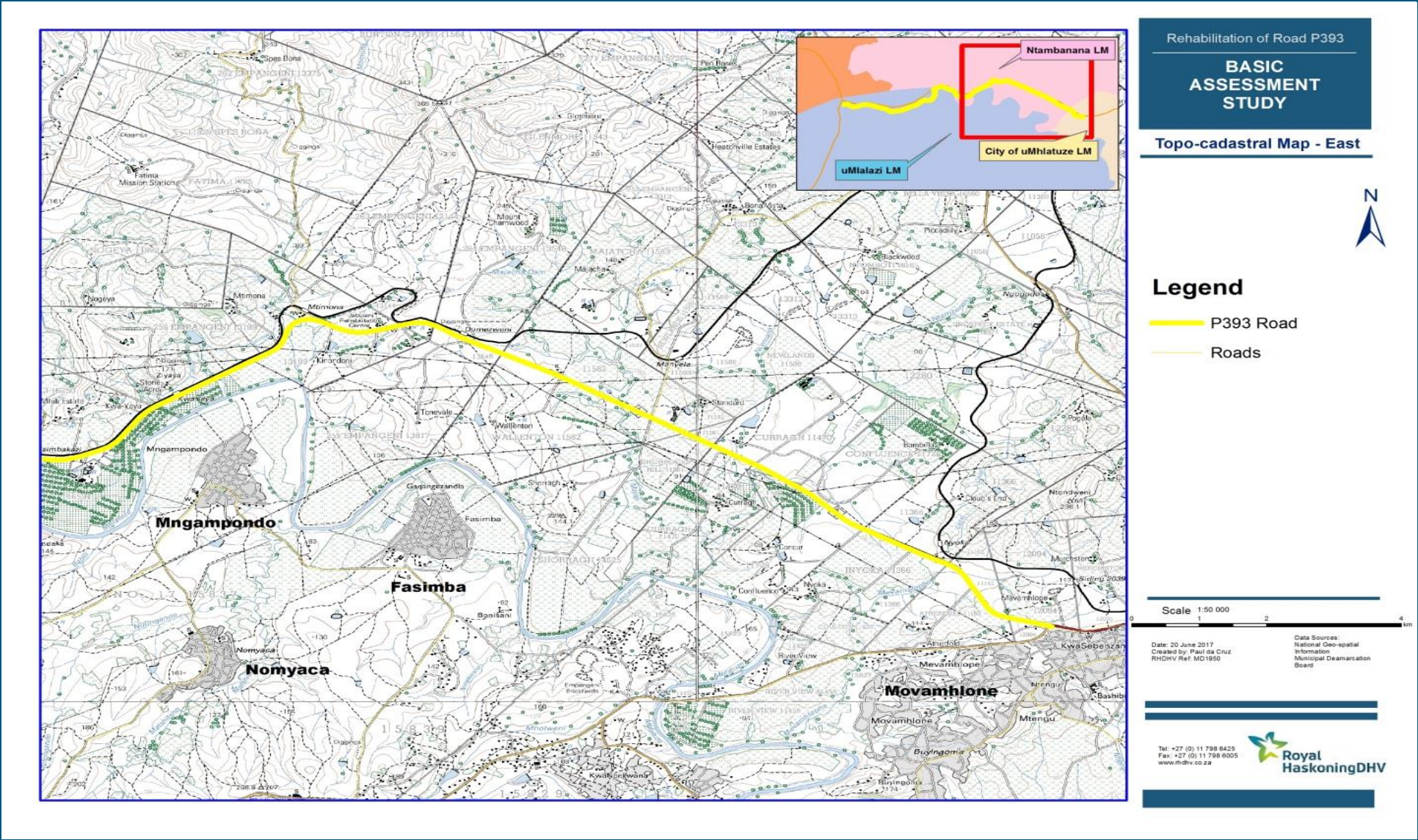


Figure 2: Location of the Study Area (Easterly Direction)

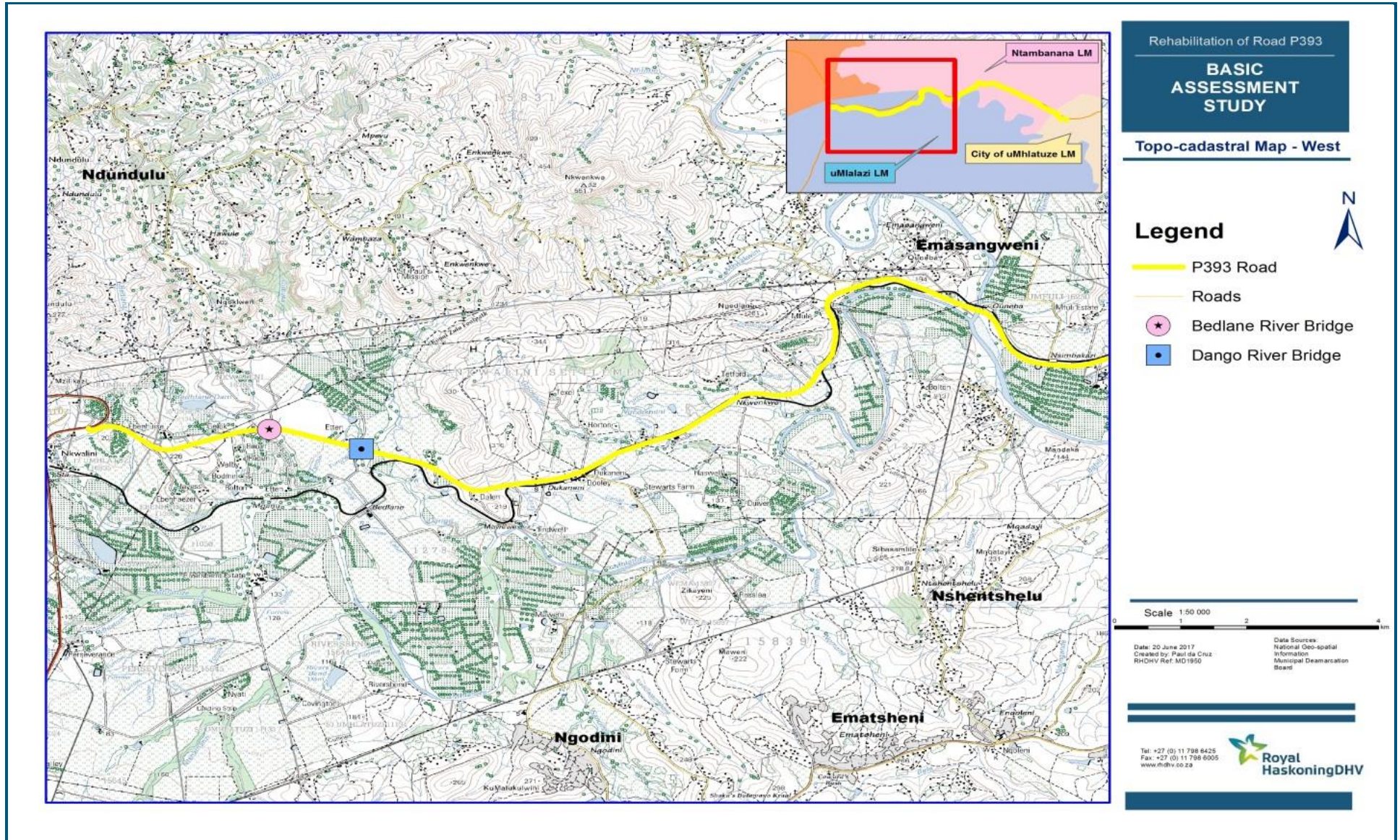


Figure 3: Location of the Study Area (Westerly Direction)

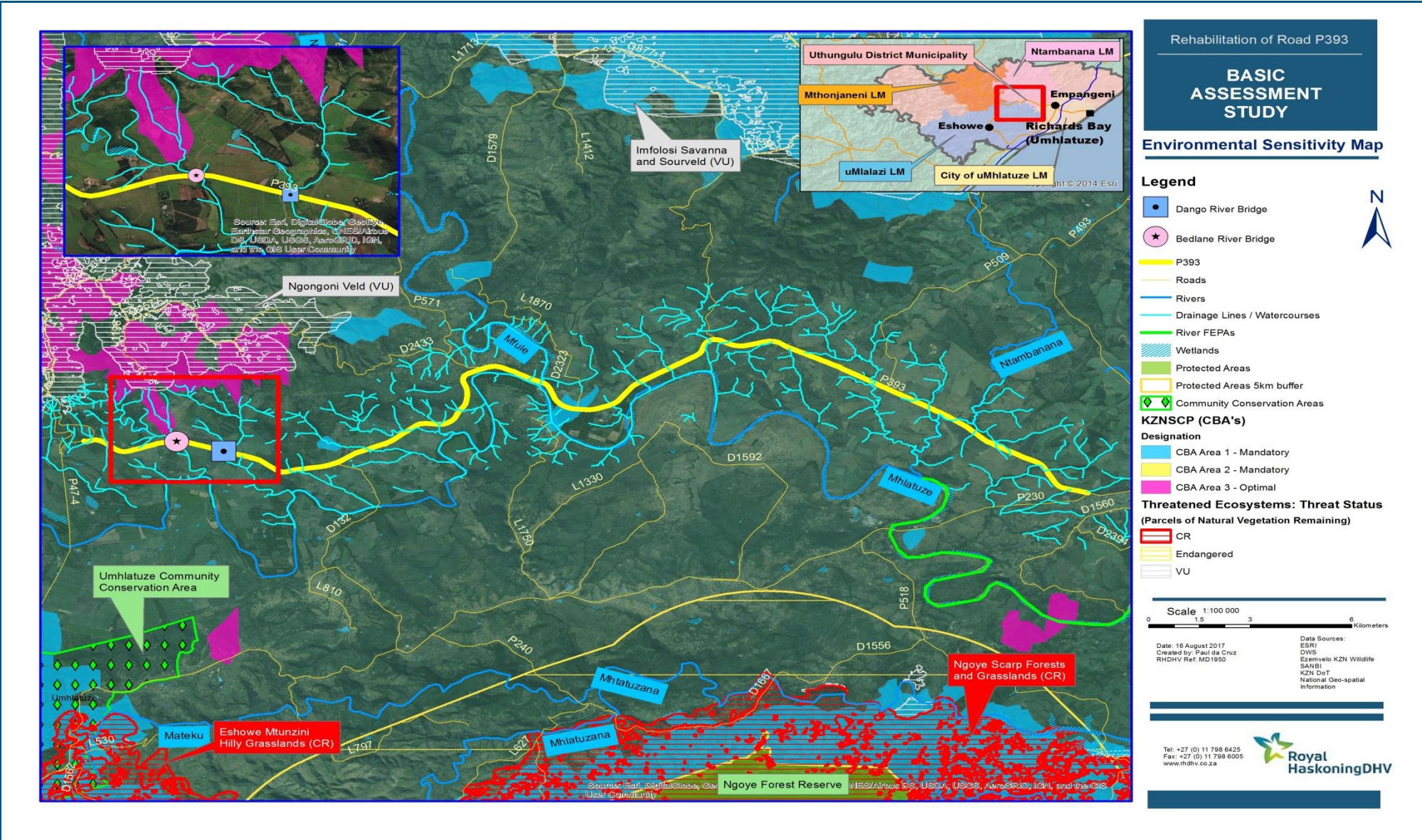


Figure 4: Sensitivity Map

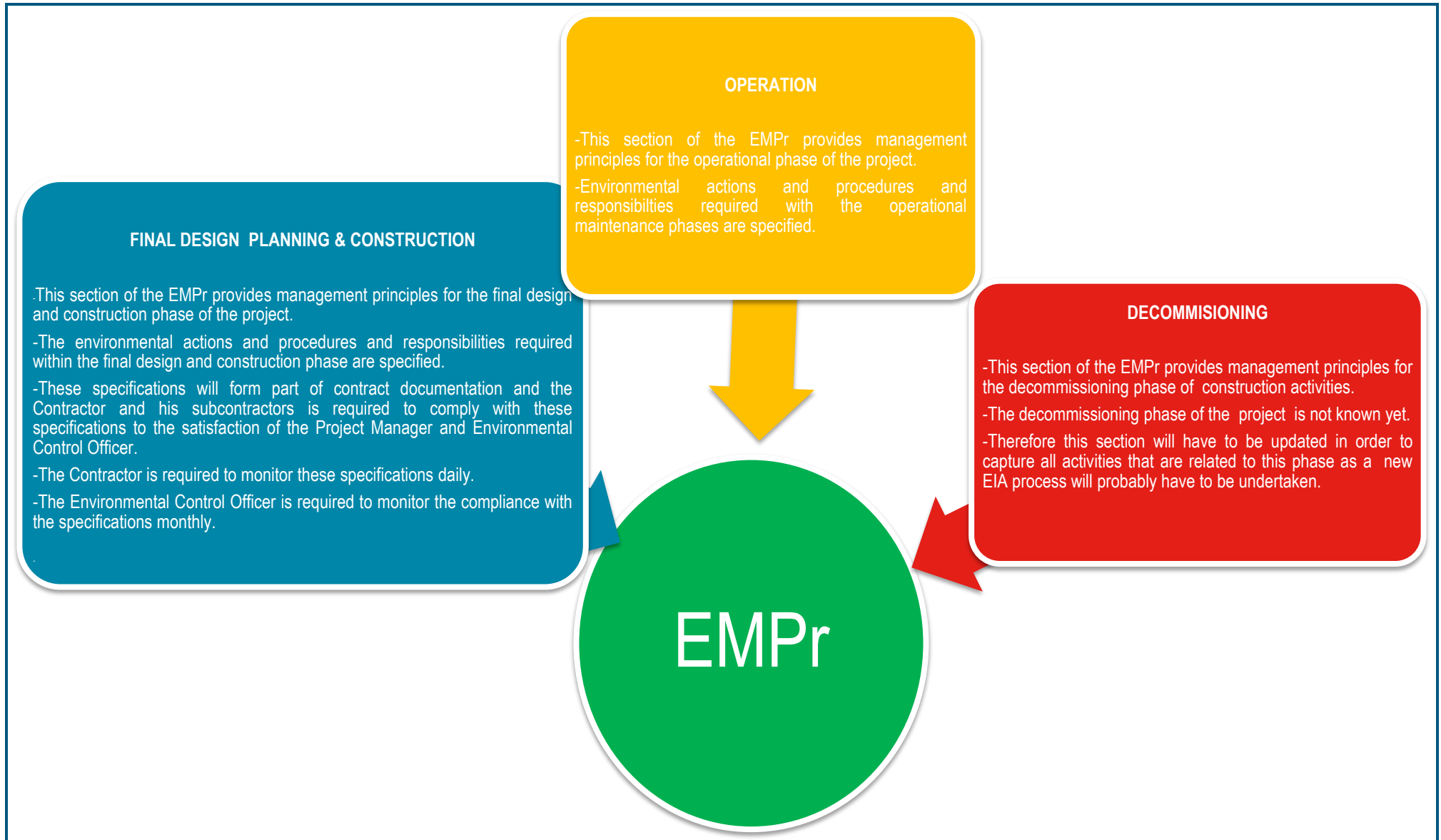


Figure 5: Different Phases of the Project Life-Cycle and EMPr

2 ENVIRONMENTAL LEGISLATION

Table 1 outlines pieces of legislation that the proposed project will need to comply with.

Table 1: Summary Table of Relevant Environmental Legislation

Acts/Guideline/Policies/Environmental Management Instruments	Considerations	Responsible Authority
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Right Section 24 – Environmental Rights	National, Provincial and Local Government.
National Environmental Management, Act (No 107 of 1998)(as amended), and the EIA Regulations 2014 (as amended in 2017)	Control/prevention of pollution; combating of noise; activities which may have a detrimental effect on the environment, preparation and contents of environmental impact reports; Activities requiring Environmental Authorisation	National and Provincial Environmental Departments
National Environment Management: Waste Management Act (No 59 of 2008)	Regulation of the waste management and disposal.	National and Provincial Environmental Departments
National Environmental Management: Air Quality Act (No 39 of 2004)	Control and prevention of odour and dust and noise.	National Department of Environmental Affairs and Metro or District Municipalities
National Environment Management: Biodiversity Act (10 of 2004)	Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.	National and Provincial Environmental Departments.
National Water Act (36 of 1998)	To ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all. Regulation of Section 21 Water Uses	National and Provincial Department of Water and Sanitation.
National Heritage Resources Act (No 25 of 1999)	Provides general principles for governing heritage resources management throughout South Africa including national and provincial heritage sites, burial grounds and graves; archaeological and palaeontological sites, and public monuments and memorials.	South African Heritage Resources Agency, and AMAFA

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Acts/Guideline/Policies/Environmental Management Instruments	Considerations	Responsible Authority
Conservation of Agricultural Resources Act (No 43 of 1983)	Control and prevention of veld fires, soil conservation, control, control of weeds and invader plants.	National and Provincial Department of Agriculture
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	Protection of indigenous plants, animals and general ecosystem.	Ezemvelo KZN Wildlife
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) - NEMPAA	Creates a legal framework and management system for all protected areas in South Africa as well as establishing the South African National Parks (SANParks) as a statutory board. Each conservation area will have its own set of land use restrictions or regulations that stem either from generic restrictions under NEMPAA, or customized regulations for individual protected areas.	National and Provincial Environmental Departments., SANParks, Ezemvelo KZN Wildlife
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Control and Protection of Minerals Resources in South Africa.	National and Provincial Department of Mineral Resources.
Occupational Health and Safety Act (Act No. 85 of 1993)	Provides the guidelines on general duties of employers to their employees. Controls the exposure of Employees and the public to dangerous and toxic substances or activities.	National and Provincial Department of Labour
Construction Regulations (2014)	Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.	National and Provincial Department of Labour
Municipal By-laws		Local Authority
King Cetshwayo District Municipality IDP (2016 – 2017) King Cetshwayo District-Reviewed Spatial Development Framework (2015/2016) UMhlathuze Local Municipality IDP (2016 – 2017)		Local and District Authority

3 ENVIRONMENTAL MANAGEMENT PROCEDURES

3.1 Functions and Responsibilities

Figure 5 below provides an indication of the organisational and team structure for the project.

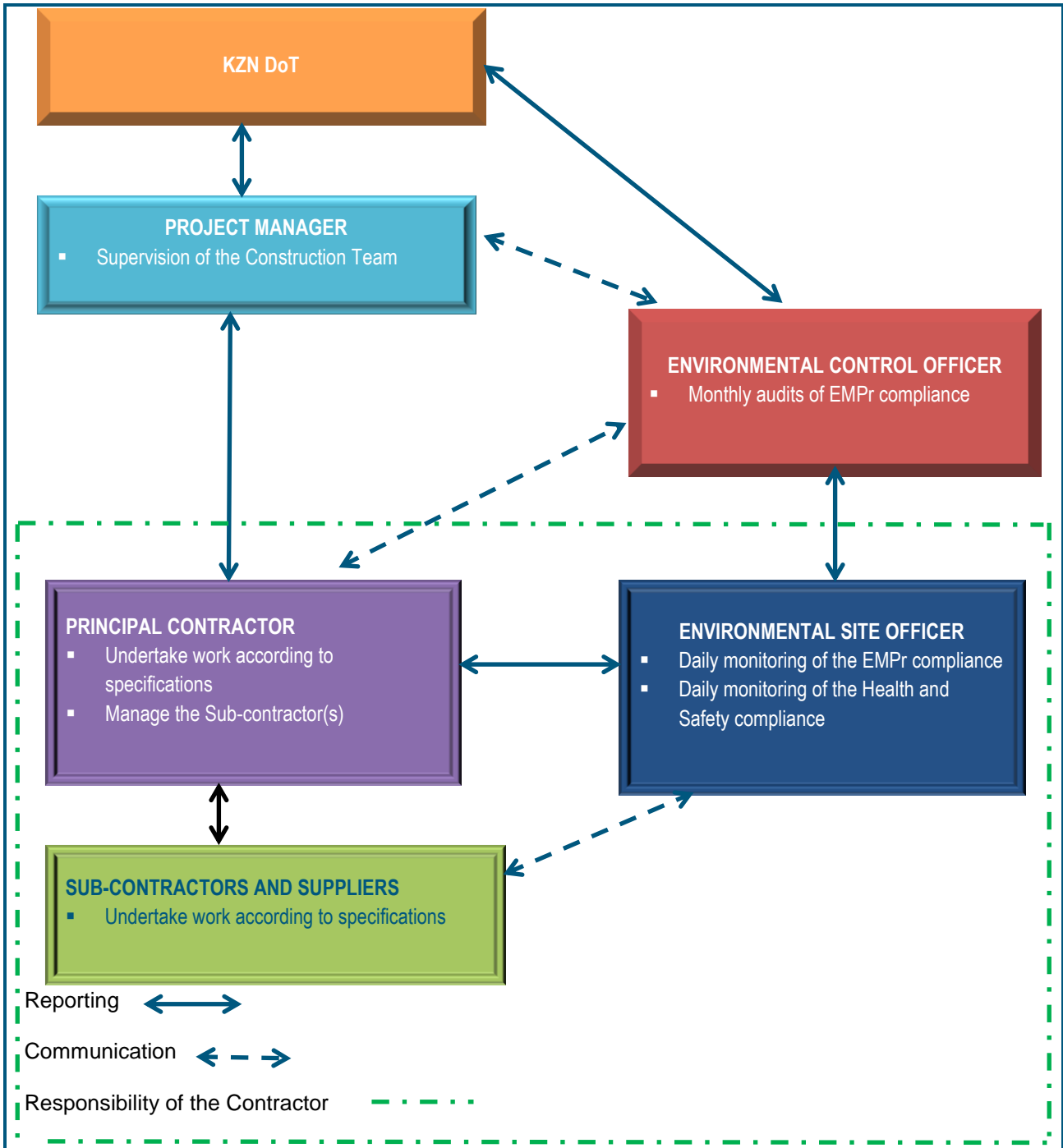


Figure 6: Project Organisational Structure

Table 2 below provides an indication of the project team and their responsibilities.

Table 2: Project Team and Responsibilities

Role	Responsibilities
<p>KZN DoT Project Manager</p>	<p>The following responsibilities are to be fulfilled by the project manager.</p> <ul style="list-style-type: none"> ▪ Inform the design engineers for the project about the EMPr so that they can incorporate any recommended mitigation measures that may affect the final design ▪ Arrange information meetings for or consultations with stakeholders about the impending construction activities; ▪ May on the recommendation of the Environmental Officer order the Contractor to suspend any or all works on site if the Contractor or his Sub-Contractor/Supplier fails to comply with the said specifications; ▪ Be aware of and assist with the management of the register of complaints and queries that are made by members of the public at the site office. ▪ Enforce the environmental specification on site; ▪ Monitor compliance with the requirements of the specification; ▪ Assess the Contractor's environmental performance in consultation with the Environmental Officer from which a brief monthly report of environmental performance is drawn up for record purposes and to be reported upon at project meetings; and ▪ Ensure the documentation (photographic evidence and reports), in conjunction with the Contractor, regarding the state of the site prior to construction activities commencing. This documentation will be in the form of photographic record.
<p>Contractor and Sub-contractors</p>	<p>The Contractor and Sub-contractors are required to:</p> <ul style="list-style-type: none"> ▪ Provide information on previous environmental management experience in terms of the relevant forms contained in the Contract Document; ▪ Supply method statements timeously for all activities requiring special attention as specified and / or requested by the Environmental Site Officer for the duration of the Contract; ▪ Be conversant with the requirements of this EMPr. Brief all their staff about the requirements of the environmental specification; ▪ Comply with requirements of the Environmental Site Officer

Role	Responsibilities
	<p>in terms of this specification and the project specification, as applicable, within the time period specified;</p> <ul style="list-style-type: none"> ▪ Ensure any Sub-Contractors / Suppliers who are utilised within the context of the contract comply with the environmental requirements of the project, in terms of the specifications. The Contractor (holder of the contract) will be held responsible for non-compliance on their behalf; ▪ Bear the costs of any damages / compensation resulting from non-adherence to the said specifications or written site instructions; ▪ Comply with all applicable legislation; and ▪ The Contractor will conduct all activities in a manner that minimizes disturbance to the natural environment as well as directly affected residents and the public in general.
Environmental Site Officer (ESO)	<p>The ESO will be responsible for undertaking of the following:</p> <ul style="list-style-type: none"> ▪ Compilation of a comprehensive project Health and Safety Risk Assessment (HSRA); ▪ Compilation of health and safety specifications based on risks identified; ▪ Reviewing and approval of health and safety plan(s) submitted by appointed Contractor(s); ▪ Conducting daily inspections; ▪ Compiling daily reports and monthly safety, health and environment audit reports; ▪ Assisting the Contractor in the investigation of major accident / incidents; ▪ Monitoring of site activities for compliance to the occupational health and safety standards and EMPr conditions; ▪ Monitoring the Contractor(s') environment, health and safety performance; ▪ Be fully conversant with the EMPr and all relevant environmental legislation applicable to the project, and ensure compliance with them; ▪ Compilation of Method Statements together with the Contractor that will specify how potential environmental impacts in line with the requirements of the EMPr will be managed, and, where relevant environmental best practice and how they will practically ensure that the objectives of the EMPr are achieved; ▪ Convey the contents of this EMPr to the construction site staff and discuss the contents in detail with the Contractor;

Role	Responsibilities
	<ul style="list-style-type: none"> ▪ Take appropriate action if the specifications contained in the EMPr are not followed; ▪ Ensuring that the list of transgressions issued by the ECO is available on request; and ▪ Maintain an environmental register which keeps a record of all environmental incidents which occur on the site during construction.
Environmental Control Officer (ECO)	<p>The ECO will:</p> <ul style="list-style-type: none"> ▪ Be fully conversant with the EMPr; ▪ Be familiar with the recommendations and mitigation measures of the associated EMPr for the project; ▪ Monitor the implementation of the EMPr during the construction and rehabilitation phases; ▪ Ensure site protection measures are implemented on site; ▪ Monitor that the Contractor, Sub-Contractors, construction teams and KZN DoT are in compliance with the EMPr at all times during the construction and rehabilitation phases of the project; ▪ Monitor all site activities monthly for compliance; ▪ Conduct monthly audits of the site according to the EMPr, and report findings to the project Manager and Contractor; ▪ Recommend corrective action for any environmental non-compliance at the site; ▪ Compile a monthly report highlighting any non-compliance issues as well as progress and compliance with the EMPr conditions; ▪ Conduct once-off training with the Contractor on the EMPr and general environmental awareness. <p>It must be noted that the responsibility of the ECO is to <u>monitor</u> compliance and <u>give advice</u> on the implementation of the EMPr and <u>not to enforce compliance</u>. Ensuring compliance is the responsibility of the Contractor and the Environmental Site Officer.</p>

3.2 Contractor Management

During the procurement process, an environmental briefing (**Figure 6**) is required that alerts the Contractor to the environmental management expectations during the project. A copy of the EMPr must be provided to the Contractors who will be bidding for the construction work for the project. The EMPr will form a component of the tender documentation and therefore is material to said document and legally binding. This is to ensure that the Contractors are made aware of the EMPr requirements and budget accordingly in their bids. The appointed Contractor is required to develop method statements indicating

how he / she is going implement and ensure compliance with the conditions of the EMPr. The method statement document must be approved by KZN DoT Project Manager and Site Engineer before the Contractor mobilises. When the construction activities have been completed, the KZN DoT Project Manager and Site Engineer are required to conduct a site inspection in order to sign-off the site in terms of the EMPr prior the Contractor leaving the site.

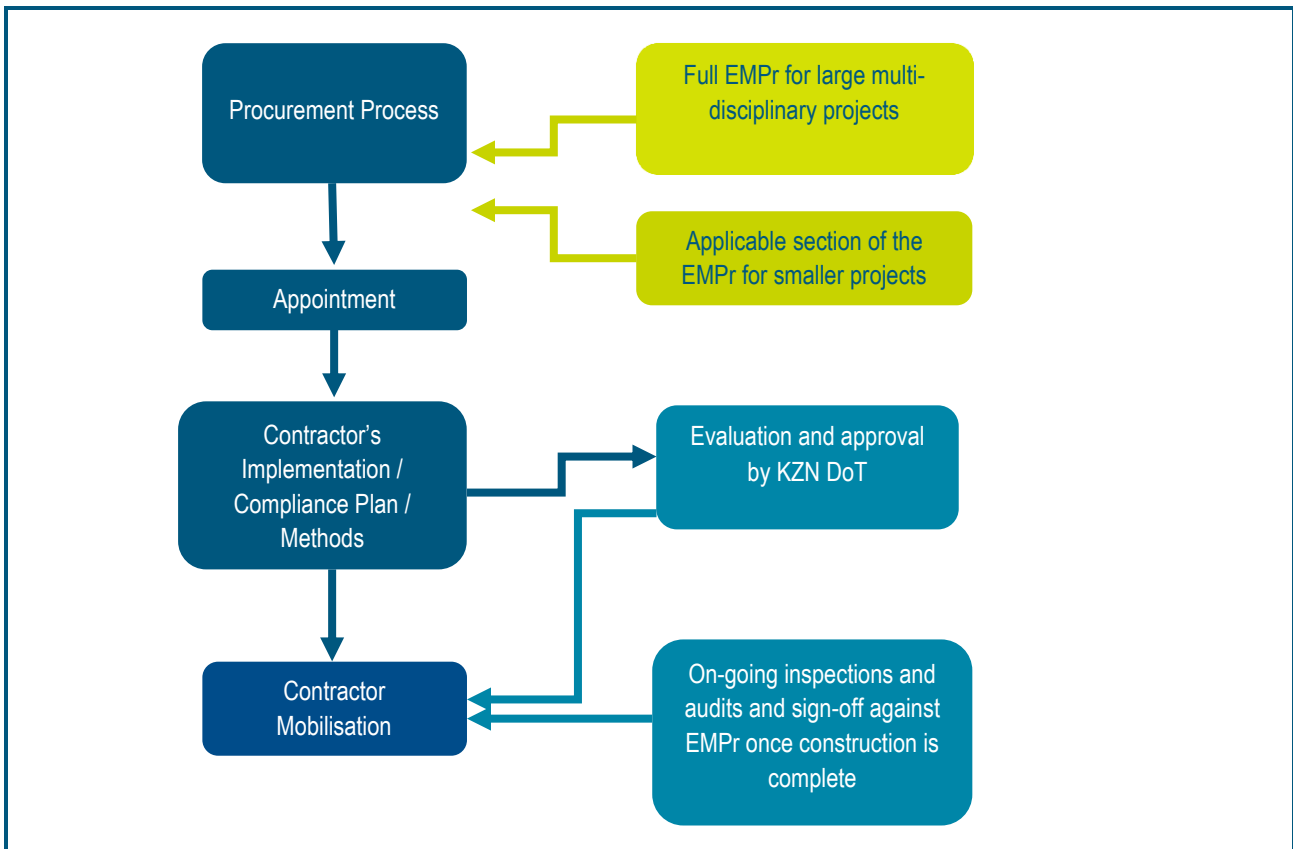


Figure 7: Diagram Illustrating the Contractor Management Process

3.3 Training and Environmental Awareness

It is important to ensure that the Contractor has the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. Training needs must be identified based on the available and existing capacity of site personnel (including the Contractors and Sub-Contractors) to undertake the required EMPr management actions and monitoring activities. It is vital that all personnel are adequately trained to perform their designated tasks to an acceptable standard. The environmental training is aimed at:

- Promoting environmental awareness;
- Informing the Contractor of all environmental procedures, policies and programmes applicable;
- Providing generic training on the implementation of environmental management specifications; and
- Providing job-specific environmental training in order to understand the key environmental features of the construction site and the surrounding environment.

Training will be done in a verbal format and facilitated by the Environmental Control Officer. The training will be a once-off event; however the Contractor must make provision for weekly training or Toolbox Talks

which can be correlated with construction activities undertaken in particular week. In addition to training, general environmental awareness must be fostered among the project's workforce to encourage the implementation of environmentally sound practices throughout its duration. This is to ensure that environmental accidents are minimised and environmental compliance maximized.

3.4 Reporting Procedures

3.4.1 Documentation

The following documentation must be kept on site in order to record compliance with the EMP:

An Environmental Site File which includes:

- Copy of the EMP;
- Copy of Environmental Authorisation;
- Copy of all other licences / permits;
- Copy of all rehabilitation plans;
- Copy of the Stormwater Management Plan;
- Environmental Method statements compiled by the Contractor;
- Non-conformance Reports;
- Environmental register, which must include:
 - Communications Register—including records of Complaints, and, minutes and attendance registers of all environmental meetings;
 - Monitoring Results – including environmental monitoring reports, register of audits, Non-Conformance Reports (NCR); and
 - Incident book – including copies of notification of Emergencies and Incidents, this must be accompanied by a photographic record.
- Safe disposal certificate for all types of waste disposed of site;
- Environmental training records;
- Waste disposal Receipts;
- Material Safety Data Sheets for all hazardous substances;
- Dust suppression register;
- Water Quality Monitoring reports (if necessary);
- Written Corrective Action Instructions;
- Method Statements; and
- Notification of Emergencies and Incidents.

3.4.2 Public Complaints Register

- Contain environmental complaints and correspondence received from the public to the Contractor;
- Nature of complaint;
- Cause of complaint;
- Party / parties in responsible for complaint;
- Immediate actions undertaken to stop / reduce / contain the causes of the complaint;
- Additional corrective or remedial action taken and / or to be taken to address and to prevent reoccurrence of the complaint;
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions.

3.4.3 Environmental Incidents Register

- Nature of incident;
- Causes of incident;
- Party / parties responsible for causing incident;
- Immediate actions undertaken to stop / reduce / contain the causes of the incident;
- Additional corrective or remedial action taken and / or to be taken to address and to prevent reoccurrence of the incident;
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions; Copies of all correspondence received regarding incidents; and
- Detail the control measures which will be implemented to ensure sound environmental management.

3.4.4 Non-Conformance Report

A Non-Conformance Report (NCR) will be issued to the Contractor as a final step towards rectifying a failure in complying with a requirement of the EMPr. This will be issued by the ECO to the Contractor in writing. Preceding the issuing of an NCR, the Contractor must be given an opportunity to rectify the non-conformance issues.

Should the ECO assess an incident or issue and find it to be significant (e.g. non-repairable damage to the environment), it will be reported to the relevant authorities and immediately escalated to the level of a NCR. The following information must be recorded in the NCR:

- Details of non-conformance;
- Any plant or equipment involved;
- Any chemicals or hazardous substances involved;
- Work procedures not followed;
- Any other physical aspects;
- Nature of the risk;
- Actions agreed to by all parties following consultation to adequately address the non-conformance in terms of specific control measures and must take the hierarchy of controls into account;
- Agreed timeframe by which the actions documented in the NCR must be carried out; and
- ECO must verify that the agreed actions have taken place by the agreed completion date, when completed satisfactorily; the ECO and Contractor must sign the Close-Out portion of the Non-Conformance Form and file it with the contract documentation.

3.4.5 Environmental Emergency Response

The Contractor's environmental emergency procedures must ensure appropriate responses to unexpected / accidental actions / incidents that could cause environmental impacts. Such incidents may include:

- Accidental discharges to water (i.e. into the watercourse) and land;
- Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- Accidental toxic emissions into the air; and
- Specific environmental and ecosystem effects from accidental releases or incidents.

The Environmental Emergency Response Plan is separate to the Health and Safety Plan as it is aimed at responding specifically to environmental incidents and must ensure and include the following:

- Construction employees must be adequately trained in terms of incidents and emergency situations;
- Details of the organisation (i.e. manpower) and responsibilities, accountability and liability of personnel;
- A list of key personnel and contact numbers;
- Details of emergency services (e.g. the fire department / on-site fire detail, spill clean-up services) must be listed;
- Internal and external communication plans, including prescribed reporting procedures;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures to be implemented; and
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.

The Contractor and their Sub-Contractor(s) must comply with the environmental emergency preparedness and incident and accident-reporting requirements as per the relevant legal requirements.

3.4.6 Method Statements

It is a statutory requirement to ensure the well-being of employees and the environment. To allow the mitigation measures in this document to be implemented, task-specific method statements must be developed for each set of tasks. A Method Statement details how and when a process will be carried out, detailing possible dangers / risks, and the methods of control required. As a minimum the following information need to be included in the method statement:

- Type of construction activity;
- Timing and location of the activity;
- Construction procedures;
- Materials and equipment to be used;
- Transportation of the equipment to / from site;
- How equipment/material will be moved while on site;
- Location and extent of construction site office and storage areas;
- Identification of impacts that might result from the construction activity;
- Methodology and/or specifications for impact prevention / containment;
- Methodology for environmental monitoring;
- Emergency / disaster incident and reaction procedures (required to be demonstrated); and
- Rehabilitation procedures and continued maintenance of the impacted environment.

The Contractor will be accountable for all actions taken in non-compliance of the approved Method Statements and the following Method Statements are required to be generated:

- Bunding;
- Blasting (if required);
- Cofferdams (if required)
- Construction site and office / laydown area establishment;
- Cement mixing / concrete batching / bentonite mixing;
- Contaminated water management;
- Dust management ;
- Environmental awareness course(s);

- Environmental monitoring;
- Erosion control;
- Fire, hazardous and / or poisonous substances including their storage;
- Personnel, public and animal safety;
- Rehabilitation of modified environment(s);
- Solid and liquid waste management;
- Sources of materials (including Material Safety Data Sheets (MSDSs));
- Top-soil management;
- Stormwater management; and
- Wash areas.

3.4.7 Public Communication and Liaison with I&APs

KZN DoT must ensure that the adjacent landowners are informed and updated throughout the construction phases. Sufficient construction signage must be erected around the site (including at the entrance), informing the public of the construction activities taking place. The signboards must include the following information:

- The name of the Contractor; and
- The name and contact details of the site representative to be contacted in the event of emergencies or complaint registration.

4 ENVIRONMENTAL CODE OF CONDUCT

One of the objectives of the EMPr is to ensure that all the workforce, contractors, sub-contractors and construction staff have an understanding of environmental issues and potential impacts on-site activities. This environmental code of conduct provides the basic rules that must be strictly adhered to.

It is the responsibility of the Site Environmental Officer, the Environmental Officer and independent ECO (as appointed) to ensure that each contractor, sub-contractor and workforce understand and adhere to the Code of Conduct.

ENVIRONMENTAL RULES

- All persons are obliged to keep to the rules of this Code of Conduct
- Ignorance, negligence, recklessness or a general lack of commitment resulting in environmental degradation or pollution must not be tolerated!

- Do not waste electricity, water or consumables;
- Only use authorised accesses;
- Do not litter;
- Dispose of solid waste to the correct waste containers provided;
- Prevent pollution;
- Use the toilet facilities provided;
- Do not dispose contaminated wastewater to the stormwater or the environment;
- Immediately report any spillage from containers, plant or vehicles;
- Do not burn or bury any waste;
- Do not trespass onto private properties;
- Strictly leave all animals alone. Never tease, catch or set devices to trap or kill any animal;
- Never damage or remove any trees, shrubs or branches unless it forms part of working instructions;
- Do not deface, draw or cut lettering or any other markings on trees, rocks or buildings in the area;
- Know the fire fighting procedure and locations of fire fighting equipment; and
- Know the environmental incident reporting procedures.

5 ENVIRONMENTAL MANAGEMENT PROGRAMME

5.1 Purpose of the EMPr

An Environmental Management Programme (EMPr) is a stand-alone document used to prescribe management mechanisms/methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits of a development. An EMPr bestows a 'Duty of Care' on those who causes, have caused or may in future cause pollution or degradation of the environment. It must be noted that this EMPr is a dynamic document which must be updated as required on a continuous basis. This may be of particular importance once the preferred final alternative alignment has been authorised, as at this stage it may be possible to add more 'site specific' management measures. Any amendments made must be submitted to the Environmental Control Officer (for comment), the Project Manager and the Competent Authority (KZN DEDTEA) for approval prior to implementation.

5.2 Objectives of the EMPr

The EMPr has been compiled to provide recommendations and guidelines for environmental monitoring throughout the construction, operational and decommissioning phase of the proposed project. This is done to ensure that all relevant factors are considered, and to ensure for environmentally responsible development. This EMPr informs all relevant parties KZN DoT, Contractor, the Environmental Control Officer (ECO) and all other staff employed for the project as to their duties in the fulfilment of the legal requirements for the construction, operation and decommissioning phases of the project with particular reference to the prevention and mitigation of anticipated potential environmental impacts. The objectives include the following actions:

- Identifying construction activities that might have detrimental impacts on the environment;
- To outline mitigation measures and environmental specifications which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the proposed project;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
- To identify measures that could optimize beneficial impacts;
- To create management structures that addresses the concerns and complaints of the Interested and Affected Parties with regards to the development;
- To establish a method of monitoring and auditing environmental management practices during all phases of the development;
- Ensure that the construction and operational phases of the project continues within the principles of Integrated Environmental Management (IEM);
- Ensure that safety recommendations are complied with;
- Provide an outline of the legal requirements;
- To assign roles and responsibilities to parties involved regarding the implementation of this EMPr;
- To identify measures that could optimize beneficial impacts;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project; and

- Specify time periods within which the measures contemplated in the environmental management programme must be implemented, where appropriate.

5.3 Environmental Monitoring

A monitoring programme must be in place not only to ensure compliance with the EMPr through the construction activities, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. A monitoring programme must be implemented for the duration of the construction phase of the project. This programme must include:

- Daily site visits and monitoring must be conducted by the Environmental Site Officer to ensure daily implementation of the EMPr conditions and provide corrective actions where required;
- Monthly site audits that must be conducted by the external Environmental Control Officer for the duration of the construction phase; and
- Compilation of a monthly audit report which must document findings and recommend corrective action to be taken. Subsequent reports will provide feedback on whether previous non-conformance raised has been resolved, thereby ensuring continual improvement of the site's environmental performance.

5.4 Checking and Corrective Action

Checking and corrective action form part of the environmental management function and are aimed at ensuring that the necessary environmental management activities are being implemented and that the desired outcomes are achieved.

6 EMPR: PLANNING AND DESIGN

6.1 Project Planning and Design Mitigation Measures

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Implementation of the incorrect project design will result in exorbitant costs that will have to be spent in the implementation of the project.	1. The best design option which will be cost effective must be implemented.	Project Manager	Prior Construction
Displacement of the nearby farmers and litigation	2. The best design option which will result in minimal environmental and social impacts must be implemented.	Project Manager	Prior and During Construction

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
processes due to the expropriation process resulting from the encroachment of the project outside the servitude.			
Incorrect location of construction site camp and associated infrastructure will result in significant environmental impacts (water quality, disturbance of flora and fauna, visual and air quality).	3. The location of the site camp must be carefully planned and affected landowners be notified well in advanced in writing. An Environmental Control Officer must be appointed to guide and advise the project on environmental matters prior construction activities. Care must be taken that the construction camp does not trigger any EIA Regulation 2014 (as amended) listed activities	Project Manager	Prior Construction
Riots by the local communities as a result of the Contractor employing people which are not from the area.	4. The Client and the Contractor must abide by the Labour Law and also liaise with appropriate structures of the local community such as Tribal Authorities and Councillors in affording opportunities of employment to unskilled community members.	Project Manager	Prior and During Construction
Delays of the construction activities due to the Contractor not having the necessary tools and employees.	5. The Client must include all the necessary documentation in the Tendering Process, including the EMPr and EA. This will allow the appointed Contractor to cost appropriately for all the components required during the construction process as well as personnel.	Project Manager	Prior Construction
Impact on watercourses	6. The design of the bridge infrastructure will need to seek a balance of economic, technical and safety requirements whilst also ensuring that risks and	Project Manager	Prior Construction

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>impacts to the wetland and riverine environment are minimised as far as possible.</p> <p>7. It is recommended that instream structures such as piers are limited as far as practically possible without compromising the structural integrity and safety of the bridge structure and taking into consideration technical / engineering limitations and financial constraints.</p> <p>8. The base of any instream pier structures receiving almost constant flows must be designed to deflect debris and sediment / other natural substrate (stones, rock and boulders) around these structures in such a way as to avoid accumulating these materials behind and/or around the piers. This may be achieved through the use of narrow and/or convex piers that deflect flows around these structures, thus reducing turbulence and therefore scouring and sedimentation (see image below for a basic example of pier design to encourage deflection of water flows and fluxes of transported debris/sediment</p> <p>9. Importantly, bridge infrastructure will need to be designed to be appropriately protected and robust enough in the long-term to withstand a significant flood event and designed bearing in mind the dynamic nature of large perennial rivers (i.e. fluctuating flows and sediment loads, bank erosion and undercutting, constant redistribution of river substrate potential for the river channel, river banks and terraces to adjust to flood conditions, etc.).</p> <p>10. The extent of infilling within in-stream aquatic and riparian habitat must be minimised as far as possible where the road-bridge crosses the riparian zone and must remain within existing disturbed areas as far as possible.</p>		

7 EMPR: CONSTRUCTION PHASE

7.1 Site Clearing

Site clearing must take place in a phased manner, as and when required. Areas which are not to be maintained within two months of time must not be cleared to reduce erosion risks. The area to be cleared must be clearly demarcated and this footprint strictly maintained. Spoil that is removed from the site must be removed to an approved spoil site or licensed landfill site. The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent, viz steep areas.

7.2 Site Establishment

Site establishment must take place in an orderly manner and all required amenities must be installed at the camp site before the main workforce move onto site. The construction camp must have the necessary ablution facilities at the commencement of construction activities. The Contractor must inform all site staff to make use of supplied ablution facilities and under no circumstances must indiscriminate sanitary activities be allowed other than in supplied facilities.

The Contractor must supply waste collection bins where such is not available and all solid waste collected must be disposed of at a licensed landfill site. A certificate of disposal must be obtained by the Contractor and kept on file. Under no circumstances may solid waste be burnt on site.

7.3 Environmental Training

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Impacts on site due to the lack of knowledge</p>	<ol style="list-style-type: none"> 1. Staff environmental induction must take place prior to construction commencing and any sub- contractors utilised must be inducted before starting work on-site. All contractor employees must receive basic environmental awareness training and must be educated on the requirements of the EMPr and relevant method statements. 2. Environmental training must include topics like: <ul style="list-style-type: none"> ▪ What is meant by “Environment”; ▪ Why the environment needs to be protected and conserved; ▪ How construction activities can impact on the environment; ▪ The sensitivity of constructing within aquatic environments; ▪ Potential incidents should be highlighted and training should be provided to the workers to prevent a recurrence of similar incidents; ▪ What can be done to mitigate against such impacts; ▪ Awareness of emergency and spills response provisions; and ▪ Social responsibility during construction of the powerline and substation e.g. being considerate to local residents. 3. It is the Contractor’s responsibility to provide the site foreman with environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff. 4. Training must be provided to the staff members in the use of the appropriate fire-fighting equipment. Translators are to be used where necessary. 5. The need for a “clean site” policy also needs to be explained to the workers and enforced. 6. Staff operating equipment (such as excavators, loaders, etc.) must be adequately trained and sensitised to any potential hazards associated with their tasks. <p>Monitoring of Environmental Training</p> <ol style="list-style-type: none"> 7. The Contractor must monitor the performance of construction workers to ensure that the points relayed during their introduction have been properly understood and are being followed. If necessary, the ECO and / or a translator must be called to the site to further explain aspects of environmental or social behaviour that are unclear. Toolbox talks are essential. 	<p>Contractor, ESO</p>	<p>Daily</p>

7.4 Construction Traffic and Access

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Impact that construction traffic and access has on the site and surrounds</p>	<p>Construction Traffic</p> <ol style="list-style-type: none"> 1. Construction routes must be clearly defined. 2. Access of all construction and material delivery vehicles must be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure. 3. Wheel washing and damping down of un-surfaced roads must be implemented to reduce dust. 4. Vehicles and equipment must be serviced regularly to avoid the contamination of soil from oil and hydraulic fluid leaks etc. 5. Servicing must be done off-site. 6. Oil changes must take place on a concrete platform or on a drip tray. 7. Soils compacted by construction must be deeply ripped to loosen compacted layers and re-graded to even running levels. <p>Access</p> <ol style="list-style-type: none"> 8. Temporary access roads that might be required must be rehabilitated prior to the Contractor leaving the site. 9. Access road alignment must be commented upon by the ECO and approved by the Engineer. 10. Strategic positioning of entry and exit points must be undertaken to ensure as little impact / effect as possible on the traffic flow and local communities. 11. The main routes to the site must be clearly signposted. <p>General</p> <ol style="list-style-type: none"> 12. The Contractor must meet safety requirements under all circumstances. All equipment transported must be clearly labelled as to their potential hazards according to specifications. All the required safety labelling on the containers and trucks used must be in place. 13. The Contractor must meet these safety requirements under all circumstances. All equipment transported must be clearly labelled as to their potential hazards according to specifications. All the required safety labelling on the containers and trucks used must be in place. 14. The Contractor must ensure that all the necessary precautions against damage to the environment and injury to persons are taken in the event of an accident. 	<p>Contractor, ESO</p>	<p>Daily</p>

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>Defining the Construction Servitude / Working Area</p> <p>15. The construction servitude must be limited to the proposed development footprint and a reduced (10 m) working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc.</p> <p>16. The outer edge of the construction servitude / working area (as defined above) must be clearly demarcated for the entire construction phase using a brightly coloured hazard fence or danger tape with steel droppers.</p> <p>17. Maintain site demarcations in position until the cessation of construction works.</p> <p>18. The demarcation work must be signed off by the Environmental Control Officer (ECO) before any work commences.</p> <p>19. The location of stockpile areas, site camps and equipment lay down areas must be agreed to and demarcated to the satisfaction of the ECO prior to the clearing. A 30 metre set-back distance from the active river channel must be adhered to.</p> <p>20. No soil stockpile areas must be located within 30 m of any delineated watercourse, including those not affected by the bridge development.</p> <p>21. Construction materials must only be brought to the equipment laydown area 3 days prior to use and must not be kept for more than 2 weeks. Timing of delivery is critical.</p> <p>22. No equipment laydown or storage areas must be located within 30 m of any delineated watercourse and / or within the 1:100 year floodline.</p> <p>23. Access to and from the existing bridges must be <u>only</u> via existing roads or within the construction servitude itself (as defined above) unless alternative access is essential to the project, commented upon by the ECO and approved by the Engineer</p> <p>24. If for practical reasons additional access road be required to and from site and construction site camps / equipment lay-down areas, these must be agreed upon by the Environmental Control Officer (ECO) and the outer edge of the access route must be staked out by the contractor using brightly coloured stakes prior to the access route being used by machinery. The Engineer must approve said alternate accesses.</p> <p>Demarcations and 'NO-GO' Areas:</p> <p>25. All areas outside (including up-stream and downstream) of this demarcated construction servitude must be considered 'NO-GO' areas.</p> <p>26. Vegetation removal / stripping must be limited to the construction footprint. No areas outside</p>		

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>the construction footprint may be cleared.</p> <p>27. Watercourses (wetlands and rivers) outside of the demarcated construction area (i.e. water resources downslope of the development) are strictly 'NO-GO' areas. These areas may not be accessed by machinery or workers for any reason. This includes water resources originally rated as of low to very low risk during the desktop mapping and risk screening section of the report.</p> <p>28. Any contractors found working inside the 'NO-GO' areas (areas outside the working servitude) must be fined as per fining schedule/system setup for the project.</p> <p>29. Do not paint or mark any natural feature. Marking for surveying and other purposes must be done using pegs, beacons or rope and droppers.</p>		

7.5 Security

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Issues associated with security during construction for workers and surrounding land users.</p>	<ol style="list-style-type: none"> 1. Access to the construction site must be strictly controlled. 2. No person must enter the site unless authorised to do so by the Contractor, project manager and ESO. 3. If any fencing interferes with the construction process, such fencing must be deviated until construction is completed. The deviation of fences must be negotiated and agreed with the landowner in writing, prior to any removal 4. Trespassing on private / commercial properties adjoining the site is forbidden. 5. Secure the site in order to reduce the opportunity for criminal activity in the locality of the construction site. 	<p>Contractor, ESO ,</p>	<p>Daily</p>

7.6 Construction Camp

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Impacts relating to the construction camp	<p>Site of Construction Camp</p> <ol style="list-style-type: none"> 1. Choice of site for the Contractor's camp requires the ECO's permission and must take into account location of local residents and / or ecologically sensitive areas, including flood zones and slip / unstable zones. A site plan must be submitted to the ECO and project manager for approval. 2. The construction camp may not be situated within the 1:100 year flood line or on slopes greater than 1:3. 3. If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the project manager and the landowner. 4. The size of the construction camp must be minimized (particularly where natural vegetation or grassland has had to be cleared for its construction). Care must be taken that the EIA Regulation listed activities are not triggered. <p>Site of Construction Camp</p> <ol style="list-style-type: none"> 5. The Contractor must attend to drainage of the camp site to avoid standing water and / or sheet erosion. 6. Suitable control measures over the Contractor's yard, plant and material storage to mitigate any visual impact of the construction activity must be implemented. 7. No development, or activity of any sort associated with camp, is allowed below the 1:100 year flood line of any water system. <p>Storage of Materials (including hazardous materials)</p> <ol style="list-style-type: none"> 1. Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general on site topography and water erosion potential of the soil. 2. Storage areas must be designated, demarcated and fenced. 3. Storage areas must be secure so as to minimize the risk of crime. They must also be safe from access by unauthorised persons. 4. Fire prevention facilities must be present at all storage facilities. 5. Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). 	Contractor, ESO	Daily

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>6. The areas for the storage of hazardous goods, must be locked and a single individual appointed as responsible, and a list of goods and their usage must be created to ensure that the hazardous goods are correctly utilised.</p> <p>7. These pollution prevention measures for storage must include a bund wall high enough to contain at least 110% of any stored volume, and this must be sited away from drainage lines, the ECO must comment on the position selected and the Engineer must approve the position.</p> <p>8. These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.</p> <p>9. Clear signage must be placed at all storage areas containing hazardous substances / materials.</p> <p>10. Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.</p> <p>11. The Contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing / equipment in case of spillages or accidents and have received the necessary training.</p> <p>12. All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site.</p> <p>13. Any spillage, which may occur, must be investigated and immediate action must be taken. This must also be reported to the ECO and KZN DDEDTEA, as well as local authorities if so required.</p> <p>Drainage of Construction Camp</p> <p>1. Run-off from the camp site must not discharge into neighbours' properties or into adjacent watercourses.</p> <p>End of Construction</p> <p>1. Once construction has been completed on site and all excess material has been removed, the storage area must be rehabilitated. If the area was badly damaged, re-seeding must be done.</p> <p>2. Such areas must be rehabilitated to their natural state. Any spilled concrete must be</p>		

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>removed and soil compacted during construction must be ripped, levelled and re-vegetated.</p> <p>3. Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment.</p> <p>4. Specific areas must be designated for cement batching plants. Sufficient drainage for this type of plant must be in place to ensure that soils do not become contaminated.</p> <p>5. The construction camp must be kept clear of litter at all times.</p> <p>6. Spillages within the construction camp must be cleaned up immediately and disposed of in the hazardous skip bin for correct disposal.</p> <p>7. No open fires are permitted within the construction camp and no wood from surrounding vegetation is permitted to be used to create a fire.</p>		

7.7 Soil Management

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Impact that construction activities will have on soil</p>	<p>Topsoil</p> <ol style="list-style-type: none"> 1. The Contractor must, prior to the commencement of earthworks determine the average depth of topsoil, and agree on this with the ECO. The full depth of topsoil must be stripped from areas affected by construction and related activities prior to the commencement of major earthworks. This must include the building footprints, working areas and storage areas. Topsoil must be reused where possible to rehabilitate disturbed areas. 2. Care must be taken not to mix topsoil and subsoil during stripping. 3. Removed polluted topsoil must be transported to a licensed landfill site. 4. Remove and store topsoil separately in areas where excavation/degradation takes place. Topsoil must be used for rehabilitation purposes in order to facilitate re-growth of species that occur naturally in the area. <p>Soil Stripping</p> <ol style="list-style-type: none"> 1. No soil stripping must take place on areas within the site that the Contractor does not require for construction works or areas of retained vegetation. 2. Subsoil and overburden must, in all construction and lay down areas, be stockpiled separately to be returned for backfilling in the correct soil horizon order. 3. Construction vehicles must only be allowed to utilise existing tracks or pre-planned access routes. <p>Erosion:</p> <ol style="list-style-type: none"> 1. No vehicles are permitted to cross rivers or streams in any area other than an approved crossing, designated to prevent any impact (particularly erosion) in a surrounding habitat. <p>Stockpiles</p> <ol style="list-style-type: none"> 1. Stockpiles must not be situated such that they obstruct natural water pathways and drainage channels. 2. Stockpiles must not exceed 2 m in height. 3. If stockpiles are exposed to windy conditions or heavy rain, they must be covered either by vegetation or cloth. Stockpiles must further be protected by the construction of berms or low brick walls around their bases. 4. Stockpiles must be kept clear of weeds and alien vegetation growth by regular weeding. 5. Where contamination of soil is expected, analysis must be done prior to disposal of excess soil to determine the appropriate disposal route. 	<p>Contractor, ESO</p>	<p>Daily</p>

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>Fuel Storage</p> <ol style="list-style-type: none"> 1. Topsoil and subsoil must be protected from contamination. 2. Fuel and material storage must be away from stockpiles. 3. Cement, concrete and chemicals must be mixed on an impermeable surface and provisions must be made to contain spillages or overflows into the soil. 4. Any storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material. 5. Contaminated soil must be contained and disposed of site at an approved landfill site. <p>Concrete Mixing (if required)</p> <ol style="list-style-type: none"> 1. Concrete mixing must only take place within designated areas. 2. Ready mixed concrete must be utilised where possible. 3. No vehicles transporting concrete to the site may be washed on site. 4. If a batching plant is necessary, run-off must be managed effectively to avoid contamination of other areas of the site. Untreated run-off from the batch plant must not be allowed to get into the stormwater system or any other watercourses. <p>Earthworks</p> <ol style="list-style-type: none"> 1. Soils compacted during the construction phase must be deeply ripped to loosen compacted layers and re-graded to even running levels. Topsoil must be re-spread over landscaped areas. 		

7.8 Groundwater and Surface Water Pollution

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Impact that construction activities could have on groundwater and surface water.</p>	<p>Sanitation</p> <ol style="list-style-type: none"> 1. Adequate sanitary facilities and ablutions must be provided for construction workers. 2. The facilities must be regularly serviced and emptied to reduce the risk of surface or groundwater pollution. <p>Hazardous Materials</p> <ol style="list-style-type: none"> 3. Use and / or storage of materials, fuels and chemicals which could potentially leak into the groundwater and surface water must be controlled. 4. All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund wall must be high enough to contain 110% of the total volume of the stored hazardous material with an additional allocation for potential stormwater events. 5. Any hazardous substances must be stored at least 50 m from any of the water bodies on site. 6. The ESO must be responsible for ensuring that potentially harmful materials are properly stored in a dry, secure, ventilated environment, with concrete or sealed flooring and by means of preventing unauthorised entry. 7. Contaminated wastewater must be managed by the Contractor to ensure existing water resources on the site are not contaminated. All wastewater from general activities in the camp must be collected and removed from the site for appropriate disposal at a licensed commercial facility. <p>Cement Mixing</p> <ol style="list-style-type: none"> 8. Cement contaminated water must not enter the water system as this disturbs the natural acidity of the soil and affects plant growth. <p>Public Areas</p> <ol style="list-style-type: none"> 9. Food preparation/consumption areas must be provided at the construction camp with adequate washing facilities and food refuse must be stored in sealed refuse bins which must be removed from site on a regular basis. 10. The Contractor must take steps to ensure that littering by construction workers does not occur and persons must be employed on site to collect litter from the site and immediate surroundings, including litter accumulating at fence lines. 	<p>Contractor, ESO</p>	<p>Daily</p>

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>11. No washing or servicing of vehicles on site.</p> <p>Water Resources</p> <p>12. Site staff must not be permitted to use any other open water body or natural water source adjacent to or within the designated site for the purposes of washing of construction tools or for any construction or related activities.</p> <p>13. Municipal water (or another source approved by the ECO) must be used for all activities related to construction such as washing of equipment or, dust suppression, concrete mixing, compacting, etc.</p> <p>14. It is strongly recommended that works take place in winter (the dry season) when flow velocities will be at their lowest, and thus more easily manageable.</p> <p>15. Spill prevention measures must be put in place prior to any activities taking place. Other spill response equipment must also be on-site during construction activities.</p> <p>16. It is recommended that river flow be allowed to bypass the works on one side of the watercourse with temporary structures placed (e.g. sand bags etc.) to keep the works dry. Once work is completed, the watercourse flow must be allowed to return to its normal state.</p> <p>17. Access control must be in place on site.</p> <p>18. Onsite best management practices must be implemented for sediment and pollution controls.</p> <p>19. Post-construction rehabilitation must be implemented.</p> <p>20. Ultimately, the risk of water resource degradation and biodiversity reduction/loss must drive sustainability in development design and operation.</p> <p>Working Servitude Clearing</p> <p>21. No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).</p> <p>22. Before any work commences, a series of sediment control/silt capture measures (e.g. bidim / silt curtains) must be installed in the downstream reaches of the wetland or river at regular intervals. Quantities of silt fences/curtains must be decided on site with the engineer, contractor and ECO. The ECO must be present during the location and installation of the silt curtains.</p> <p>23. Silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary.</p> <p>24. Movement of construction vehicles across watercourses (wetlands / river channels) must be minimised as much as possible.</p> <p>25. Excavated rock and sediments from the construction zone, and including any foreign</p>		

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>materials, may not be placed within the delineated wetlands, rivers and riparian areas in order to reduce the possibility of material being washed downstream.</p> <p>26. No physical damage must be done to any aspects of the channel and banks of watercourses other than those necessary to complete the works as specified. Channel bed and bank materials are not to be removed from the watercourse or used for construction purposes. Bed material disturbed during construction must be stockpiled for use in rehabilitation.</p> <p>27. Prior to the stripping, infilling, excavation and re-shaping of the aquatic habitat within the development footprint/corridor, a search and rescue of indigenous flora and fauna must be undertaken prior to habitat destruction (if present). Based on the sparse nature of vegetation and the dominance by alien species this requirement may be limited.</p> <p>28. Any topsoil and vegetation from areas to be excavated will need to be stripped and stored at the designated soil stockpile area outside of the aquatic zone for use later in post-construction wetland/river rehabilitation.</p> <p>Temporary River / Flow Diversions:</p> <p>29. Temporary diversions will need to be put in place to temporarily divert water away from activities and ensure a dry work area.</p> <p>30. To reduce the requirements to divert water from the construction working area within or adjacent to a watercourse, all construction activities within wet areas must ideally take place in the dry season / winter (May to September) where this is possible and depending on project timeframes.</p> <p>31. Construction within the channel must progress as quickly as practical to reduce the risk of exceeding the temporary diversion capacity.</p> <p>32. Diversions will need to be temporary in nature and no permanent walls; berms or dams may be installed.</p> <p>33. Only one diversion is to be made at a time.</p> <p>34. Under no circumstance must a new channel or drainage canals be excavated to divert water away from construction activities.</p> <p>35. Re-directed flow must not be channelled towards stream / river banks which could cause bank erosion.</p> <p>36. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse.</p> <p>37. Erosion protection measures such as sandbags must be placed at the downstream diversion outlet in order to reduce outlet flow velocities and erosion potential.</p> <p>38. Upon completion of the construction at the site, the diversions need to be removed to restore natural flow patterns, and the channel and riparian zone rehabilitated / restored to</p>		

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>their original condition (reference state) as soon as practically possible.</p> <p>39. Options for temporary flow diversion when working within channels may include:</p> <ul style="list-style-type: none"> • diversion of the entire watercourse through use of a bypass large diameter pipe; • the installation of removable coffer dams; and • use of removable sandbags. <p>40. It is recommended that either diversion via a bypass pipe / flume or isolation of the working area using a coffer dam be considered (refer to Appendix B) for coffer dam implementation and removal).</p>		

7.9 Stormwater

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Impact that construction activities could have on hydrology	<ol style="list-style-type: none"> 1. Measures must be taken to ensure that stormwater is controlled as far as possible and that all silt and other foreign materials are prevented from entering any surface water feature located adjacent to the construction area during the construction phase. 2. The site must be managed in order to prevent pollution of drains, downstream watercourses or groundwater, due to suspended solids, silt or chemical pollutants. 3. Silt fences must be used to prevent any soil entering the stormwater drains. 4. Temporary cut of drains and berms may be required to capture stormwater and promote infiltration. 5. Promote water saving mind set with construction workers in order to ensure less water wastage. 6. New stormwater infrastructure construction must be developed strictly according to specifications from ESO and ECO in order to ensure efficiency. 7. Hazardous substances must be stored at least 20 m away from the buffer area surrounding any water bodies on site to avoid pollution. 8. The installation of the stormwater system must take place as soon as possible after commencement of the construction activities, to attenuate stormwater from the construction as well as the operational phase. 9. Earth, stone and rubble is to be properly disposed of so as not to obstruct natural water path ways over the site (I.e. these materials must not be placed in stormwater channels, drainage lines or rivers). 10. There must be a periodic checking of the site's drainage system to ensure that the water flow is unobstructed. 	Contractor, ESO	Daily

7.10 Air Quality Management

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Vehicle activities associated with the transport of equipment to the site; preparation of the surface areas which may be required prior to the set up of new infrastructure; and the removal of construction equipment from site after the set-up of new equipment will result in air pollution</p>	<p>Dust Control</p> <ol style="list-style-type: none"> 1. Frequent and effective dust-suppression must be undertaken, particularly along dirt roads. Dust must be suppressed on the construction site during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off. 2. Retention of vegetation where possible will reduce dust travel. 3. Excavations and other clearing activities must only be done during agreed working times and permitting weather conditions to avoid drifting of sand and dust into neighbouring areas. 4. The Contractor must be responsible for dust control on site to ensure no nuisance is caused to the landowner or neighbouring communities. 5. A speed limit of 40 km/h must not be exceeded on dirty roads (if any). 6. Any complaints or claims emanating from the lack of dust control must be attended to immediately by the Contractor. <p>Odour Control</p> <ol style="list-style-type: none"> 7. Regular servicing of vehicles must be done in order to limit gaseous emissions (to be done off-site). 8. Regular servicing of on-site toilets must be done to avoid potential odours. 9. Where possible construction workers must bring their own lunch boxes to avoid cooking on site. <p>Rehabilitation</p> <ol style="list-style-type: none"> 10. The Contractor must commence rehabilitation of exposed soil surfaces as soon as practical, after completion of earthworks. <p>Fire Prevention</p> <ol style="list-style-type: none"> 11. The Contractor must ensure that any grass left in a natural state during construction must be cut in order to prevent veld fires, especially during the dry months. 12. No open fires must be allowed on site under any circumstance. 13. The Contractor must have operational fire-fighting equipment available on site at all times. The level of firefighting equipment must be assessed and evaluated through a typical risk assessment process. It may be required to increase the level of protection, especially during the winter months. 	<p>Contractor, ESO</p>	<p>Daily</p>

7.11 Fauna and Flora

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Impacts on flora relating to the destruction of threatened and protected flora species and destruction of sensitive pristine habitat types</p>	<p>Flora</p> <ol style="list-style-type: none"> 1. Removal of vegetation / plants that are not interfering with the construction activities is prohibited and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible. 2. Disturbance of vegetation must be limited to areas of construction. 3. The removal or picking of any protected or unprotected plants must not be permitted and no horticultural specimens (even within the demarcated working area) must be removed, damaged or tampered with unless agreed to by the ESO and ECO. 4. Use of branches of trees and shrubs for fire making purposes is strictly prohibited. 5. The establishment and re-growth of alien vegetation must be controlled after the removal of grass. 6. Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. 7. Re-seeding must be done on disturbed areas as directed by the ESO and ECO. 8. All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting. 9. Environmental friendly and safe Herbicides must be utilised where hand pulling / uprooting is not possible. <p>Fire Management</p> <ol style="list-style-type: none"> 10. No open fires are to be permitted. Fires may only be made within the designated areas at construction camps for purposes approved by the ECO. 11. Fire prevention facilities must be present at all hazardous storage facilities. 12. Ensure adequate fire-fighting equipment is available and train workers on how to use it. 13. Ensure that all workers on site know the proper procedure in case of a fire occurring on site. 14. Smoking must not be permitted in areas considered to be a fire hazard. <p>Fauna</p> <ol style="list-style-type: none"> 15. The opening up of existing vegetated areas, thereby creating corridors along which animals can move, may result in increased predation levels of small mammals, reptiles, amphibians, arachnids and scorpions. The limitation of disturbance of vegetation cover as well as rocky outcrop, logs, stumps, termite mounds within sensitive areas will ameliorate these impacts. 16. The Contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase. 17. All necessary mitigation measures must be implemented to minimise impacts on the 	<p>Contractor, ES Officer</p>	<p>Daily</p>

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	environment.		

7.12 Noise

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Construction activities (excavating and site clearing); construction vehicles; and construction staff resulting in noise pollution	<ol style="list-style-type: none"> 1. The construction phase must aim to adhere to the relevant noise regulations and limit noise to within standard working hours in order to reduce disturbance of residential areas in close proximity to the development. SANS 10103 is the guiding standard in this regard. 2. Construction site yards, workshops, and other noisy fixed facilities must be located well away from noise sensitive areas. Once the proposed final layouts are made available by the Contractor(s), the sites must be evaluated in detail and specific measures designed into the system. 3. Truck traffic must be routed away from noise sensitive areas, where possible. 4. Construction noise levels must be kept within acceptable limits. 5. Noisy operations must be combined so that they occur where possible at the same time. 6. Blasting operations (if required) are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day must be limited, blasting must be undertaken at the same time each day and no blasting must be allowed at night. 7. Construction activities are to be contained to reasonable hours during the day and early evening (07H00-17H00). 8. With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the Contractor and ESO must liaise with local residents on how best to minimise impact, and the local communities must be kept informed of the nature and duration of intended activities. 9. As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). 10. Noisy activities to take place during allocated construction hours only as per the Noise Control Regulations published under the Environment Conservation Act, 1989 (Act No. 73 of 1989). 11. Noise from labourers must be controlled. 12. Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers 	Contractor, ES Officer	Daily

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>which are kept in good working order. Vehicles or equipment that are not in good working order, must be removed from site.</p> <p>13. The Contractor must take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour must be transported to and from the site by the Contractor or his Sub-Contractors by the Contractors own transport.</p>		

7.13 Waste Management

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Waste produced during construction includes: general construction rubble, hazardous waste (used oil, cement and concrete etc.)</p>	<p>Construction Rubble</p> <p>1. Construction rubble must be disposed of in pre-agreed, demarcated spoil dumps that have been approved by uMhlathuze Local municipality.</p> <p>Litter management</p> <p>2. Refuse bins must be placed at strategic positions to ensure that litter does not accumulate within the construction site.</p> <p>3. If possible and feasible, all waste generated on site must be separated into glass, plastic, paper, metal and wood and recycled. An independent Contractor can be appointed to conduct this recycling.</p> <p>4. Littering by the employees of the Contractor must not be allowed under any circumstances. The ESO must monitor the neatness of the work sites as well as the Contractor campsite.</p> <p>5. Skip waste containers must be maintained on site. These must be kept covered and arrangements made for them to be collected regularly from the site by the local municipality.</p> <p>6. All waste must be removed from the site and transported to a landfill site as approved by the uMhlathuze Local Municipality.</p> <p>7. Waybills providing disposal must be provided to the ESO and ECO's inspection.</p> <p>Hazardous Waste</p> <p>8. All waste hazardous materials must either be stored in a bunded or lined area or as otherwise advised by the ESO and ECO, and then disposed of at a licensed landfill site. Hazardous waste must not be stored on site in excess of a 90 calendar day period.</p> <p>9. Contaminants to be stored safely to avoid spillage.</p>	Contractor, ES Officer	Daily

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>10. Machinery must be properly maintained to keep oil leaks in check.</p> <p>11. Labelled containers must be provided to store used oils, as well as hazardous waste containers for oily rags, oil filters etc. These types of waste must be disposed of at a suitable approved register dumpsite.</p> <p>Sanitation</p> <p>12. The Contractor must install mobile chemical toilets on the site.</p> <p>13. No indiscriminate sanitary activities on site must be allowed.</p> <p>14. Ablution facilities must be within 100 m from workplaces but not closer than 50 m from any boreholes. There must be enough toilets available to accommodate the workforce. Male and females must be accommodated separately where possible.</p> <p>15. Toilets must be no closer than 100 m or above the 1:100 year flood line from any natural or manmade water bodies or drainage lines or alternatively located in a place approved of by the ESO and ECO.</p> <p>16. Potable water must be provided for all construction staff.</p> <p>Remedial Actions</p> <p>17. Depending on the nature and extent of the spill, contaminated soil must be either excavated or treated on-site using oil absorbents.</p> <p>18. Excavation of contaminated soil must involve careful removal of soil using appropriate tools / machinery to storage containers until treated or disposed of at a licensed hazardous landfill site.</p> <p>19. The ESO and ECO must determine the precise method of treatment of polluted soil. This could involve the application of soil absorbent materials as well as oil-digestive powders to the contaminated soil. In addition, another method of removal is to remove all contaminated soils and dispose of these at a registered landfill site.</p> <p>20. If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent materials.</p> <p>21. If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure.</p> <p>22. Materials used for the remediation of petrochemical spills must be used according to product specifications and guidance for use.</p> <p>23. Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of petrochemicals to the environment, and stored in adequate containers until appropriate disposal at a registered landfill site.</p>		

7.14 Health and Safety

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
<p>Safety of workers and the public exposed to construction activity hazards</p>	<p>Worker Safety</p> <ol style="list-style-type: none"> 1. Implementation of safety measures, work procedures and first aid must be implemented on site in accordance with the Construction Regulations. 2. A health and safety plan in terms of the Occupational Health and Safety Act (Act No. 85 of 1993) must be drawn up to ensure worker safety. 3. Workers must be thoroughly trained in using potentially dangerous equipment. 4. Contractors must ensure that all equipment is maintained in a safe operating condition. 5. A record of health and safety incidents must be kept on site. 6. Any health and safety incidents must be reported to the project manager immediately. 7. First aid facilities must be available on site at all times. 8. Workers have the right to refuse work in unsafe conditions. 9. A record must be kept of drugs administered or precautions taken and the time and dates when this was done. 10. Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers. <p>Worker Facilities</p> <ol style="list-style-type: none"> 11. Eating areas must be regularly cleaned to ensure the highest possible standards of hygiene and cleanliness. 12. Fires are not permitted on site. <p>Protective Gear</p> <ol style="list-style-type: none"> 13. Personal Protective Equipment (PPE) and clothing must be made available to all construction staff and must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn where necessary i.e. dust masks, ear plugs etc. 14. No person is permitted to enter the site without the necessary PPE. <p>Site Safety</p> <ol style="list-style-type: none"> 15. The construction camp must remain fenced for the entire construction period. 16. Potentially hazardous areas such as trenches must be demarcated and clearly defined. 17. Adequate warning signs of hazardous working areas must be erected. 18. Uncovered manholes and excavations must be clearly demarcated. 19. Emergency numbers for local police and fire department etc. must be placed in a prominent 	<p>Contractor, ESO , KZN DoT</p>	<p>Daily</p>

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>area.</p> <p>20. Firefighting equipment must be placed in prominent positions across the site where it is easily accessible. This includes fire extinguishers, a fire blanket as well as a water tank.</p> <p>21. Suitable visible warning signs must be placed at all entrances to the site.</p> <p>22. All speed limits must be adhered to (40 km/h).</p> <p>Hazardous Material Storage</p> <p>23. Staff that will be handling hazardous materials must be trained to do so.</p> <p>24. Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor.</p> <p>25. Storage areas containing hazardous substances / materials must be clearly sign-posted.</p> <p>26. All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material.</p> <p>27. Oil Spill Clean-up and Rehabilitation Standards prescribed by statutory requirements must be maintained and adhered to at all time.</p> <p>28. The provisions of the Hazardous Chemical Substances Regulations promulgated in terms of the Occupational Health and Safety Act 85 of 1993 and the SABS Code of Practise must be adhered to. This must apply to solvents and other chemicals possibly used in the construction time.</p> <p>Procedure in the Event of a Petrochemical Spill</p> <p>29. The individual responsible for or who discovers the petrochemical spill must report the incident to the Project Manager, ESO or Contractor, immediately.</p> <p>30. The spill must be assessed and the necessary actions required undertaken.</p> <p>31. An immediate response must be to contain the spill.</p> <p>32. The source of the spill must be identified, controlled, treated or removed.</p> <p>Fire Management</p> <p>33. Firefighting equipment must be present on site at all times as per Occupational Health and Safety Act 85 of 1993.</p> <p>34. All construction staff must be trained in fire hazard control and firefighting techniques.</p> <p>35. All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances.</p> <p>36. Open fires are prohibited on site.</p>		

7.15 Social Environment

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Social impacts of construction activities will have on the site and surrounds)	<ol style="list-style-type: none"> 1. All contact with the affected parties by the project team must be courteous at all times. The rights of the affected parties must be respected at all times. 2. A complaints register must be kept on site. Details of complaints must be incorporated into the audits as part of the monitoring process. This register is to be tabled during monthly site meetings. 3. All complaints must be addressed within seven (7) working days. 4. No interruptions other than those negotiated must be allowed to any essential services. Damage to infrastructure must not be tolerated and any damage must be rectified immediately by the Contractor. A record of all damage and remedial actions must be kept on site. <p><i>Employment Opportunities</i></p> <ol style="list-style-type: none"> 5. Employment opportunities must be afforded to the local community to transfer the skills by the appointed Contractor. 6. A Community Liaison Officer (CLO) must be appointed to act as an intermediary between the Contractor and the Local Community. 	Contractor, ESO ,	Daily

7.16 Cultural and Heritage Artefacts

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
Impact that the construction has on potential heritage and archaeological artefacts that could be found in the study area.	<ol style="list-style-type: none"> 1. Any artefact finds must be reported to the nearest National Monuments office to comply with the National Heritage Resources Act (Act No 25 of 1999) and a heritage specialist must be notified to conduct investigations. 2. Local museums as well as the South African Heritage Resource Agency (SAHRA) and AMAFA must be informed if any artefacts are uncovered in the affected area. 3. The Contractor must ensure that his workforce is aware of the necessity of reporting any possible historical or archaeological finds to the ESO and ECO so that appropriate action can be taken. 4. Any discovered artefacts must not be removed under any circumstances. Any destruction of a site can only be allowed once a permit is obtained and the site has been mapped and noted. Permits must be obtained from the South African Heritage Resources. 5. If anything is noticed, work in that area must be stopped and the findings be reported to a museum, preferably one at which an archaeologist is available. The archaeologist must then investigate and evaluate the find. 	Contractor, ESO ,	Daily

8 DECOMMISSIONING PHASE OF CONSTRUCTION ACTIVITIES

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
DECOMMISSIONING	<p>Removal of Equipment</p> <ol style="list-style-type: none"> 1. All structures comprising the construction camp must be removed from site. 2. The area that previously housed the construction camp must be checked for spills of substances such as oil, paint, etc., and these must be cleaned up. 3. All hardened surfaces within the construction camp area must be ripped, all imported materials removed, and the area must be top soiled and regressed. <p>Temporary Services</p> <ol style="list-style-type: none"> 4. The Contractor must arrange the cancellation of all temporary services. 5. A copy of all waste disposal certificates from waste disposal service providers must be presented to the Project Manager. 6. Temporary roads must be closed and access across these, blocked. 7. All areas where temporary services were installed must be rehabilitated to the satisfaction of the Project Manager. <p>Associated Infrastructure</p> <ol style="list-style-type: none"> 8. Surfaces must be checked for waste products from activities such as concreting and cleared in a manner approved by the ESO and ECO. 9. All surfaces hardened due to construction activities must be ripped and imported material thereon removed. 10. All rubble must be removed from the site to an approved disposal site as approved by the ESO and ECO. Burying of rubble on site is prohibited. 11. The site must be cleared of all litter. 12. The Contractor must check that all watercourses are free from building rubble, spoil materials and waste materials, and photographic evidence provided. 13. Fences, barriers and demarcations associated with the construction phase must be removed from the site. 14. All residual stockpiles must be removed to spoil or spread on site as directed by the ESO and ECO. 15. All leftover building materials must be returned to the depot or removed from the site. 16. The Contractor must repair any damage that the construction works has caused to neighbouring properties, specifically, but not limited to, damage caused by poor storm water management. 	Contractor, Project Manager, ESO	Daily

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
	<p>Waste Disposal</p> <p>17. Disposal of waste must be in accordance with relevant legislative requirements.</p> <p>18. Waste must be disposed of in the appropriate manner at a licensed disposal site.</p> <p>Erosion</p> <p>19. Rehabilitation of areas affected by construction activities must ideally commence at the start of the raining season (September–October).</p> <p>20. All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting.</p> <p>21. Environmental friendly and safe Herbicides must be utilised where hand pulling / uprooting is not possible.</p> <p>22. Recommended rehabilitation is in the form of active re-vegetation of affected areas, including areas where surface disturbances resulted from construction.</p> <p>23. All areas of incomplete construction must be completed and prepared for final rehabilitation and re-vegetation;</p> <p>24. All areas where topsoil was removed must be landscaped in order to reflect surrounding conditions.</p> <p>25. Erosion monitoring and control must be conducted. This must be in the form of inspections subsequent to rains. Topsoil must be replaced in all areas that were eroded. It is critical that adequate topsoil remains in construction areas, implying that topsoil might need to be supplemented in some areas until such time that a layer of vegetation has stabilised the soil.</p> <p>Rehabilitation Plan of Aquatic Species</p> <p>26. To reshape, stabilise and re-vegetate (reinstate) wetland, river bed & banks and riparian areas physically disturbed by construction activities, both planned and accidental. Rehabilitation must be pragmatic and focus on the stabilisation and revegetation of disturbed areas, with less focus on biodiversity aspects (i.e. reinstating reference species diversity).</p> <p>27. To eradicate and control invasive alien plants and weeds that invade and colonise the watercourses post-disturbance; and</p> <p>28. To monitor the success of the rehabilitation actions.</p> <p>29. Other rehabilitation guidelines are contained in Appendix A.</p>		

9 EMPR: OPERATIONAL PHASE

ASPECT/IMPACT	MITIGATION	RESPONSIBILITY	FREQUENCY OF MONITORING REQUIREMENT
MAINTENANCE OF THE ROAD AND BRIDGES	<ol style="list-style-type: none"> All applicable standards, legislation, policies and procedures must be adhered to during operation. Emergency numbers must be visibly displayed at the near the road and bridges in case of an emergency and the community need to be encouraged to use the emergency numbers to minimise the extent of the incidence. Any oil spillages that might occur must be removed as soon as possible and disposed at the appropriate hazardous landfill site. Regular inspection of the road and bridges must take place to monitor the operation status. 	Project Manager	Annually
FAUNA AND FLORA Disturbance of vegetation and animals.	<ol style="list-style-type: none"> Indigenous vegetation must be maintained on site on an annual basis and all exotics removed as they appear and disposed of appropriately. No faunal species must be harmed by maintenance staff during any routine maintenance. 	Project Manager	Annually
WASTE Waste generation will have a negative impact on the environment, if not controlled adequately.	<ol style="list-style-type: none"> Disposal of waste must be in accordance with relevant legislative requirements. Burning of waste material will not be permitted. 	Project Manager	Annually

10 REHABILITATION GUIDELINES

Table 3: Rehabilitation Guidelines

REHABILITATION STEP	REHABILITATION GUIDELINES AND SPECIFIC ACTIONS
<p>STEP 1: Initial planning</p>	<ul style="list-style-type: none"> ▪ A budget including costing of all rehabilitation and revegetation activities detailed in this plan and equipment costs will need to be compiled prior to commencement of construction. The cost must be included in the contractual agreement for the project. ▪ Rehabilitation and management target areas must be identified prior to the implementation of the Plan. These include areas affected by erosion, IAPs and pollution for example. ▪ Whilst appointment of external landscapers is a feasible and acceptable option, a lot of preparation will need to be undertaken exclusively by the main contractor at the inception of the project. Preparation activities include correct stockpiling of topsoil needed for rehabilitation, harvesting of indigenous plants for use later on in rehab, managing a nursery for rescued plants, etc. ▪ A suitably qualified aquatic / river ecologist with experience in rehabilitation must be appointed to provide practical input into the rehabilitation during implementation of the rehabilitation plan. ▪ Identify key areas requiring rehabilitation. In this case river bed and banks must be the focus for rehabilitation efforts. ▪ Rehabilitation of disturbed watercourses must ideally be initiated as soon as possible and occur concurrently as construction works progress. ▪ If plant plugs are to be used to transplant whole plants or seed must be sourced from a donor site, a permit for sourcing such plants will need to be applied for prior to plant harvesting.
<p>STEP 2: Remove any waste products</p>	<ul style="list-style-type: none"> ▪ All waste products (spoil, construction materials, hazardous substances and general litter) must be removed from wetland / riparian areas and disposed of in proper local waste facilities. ▪ Minimise additional disturbance by limiting the use of heavy vehicles and personnel during clean-up operations. ▪ Any large plumes of sediment washed into river or riparian habitat from upslope must be removed, taking care not to remove or disturb the natural soil profiles including in-stream and riparian habitats.
<p>STEP 3: Remove/control invasive alien plants</p>	<ul style="list-style-type: none"> ▪ All exotic / alien plants and weeds to be removed and properly disposed of prior to the implementation of rehabilitation measures. ▪ Note that frequent <u>mechanical removal is the most preferred option</u> and only in the event that this is not a viable means of control and eradication, must additional means be considered. ▪ ONLY herbicides which have been certified safe for use in aquatic environments by an independent testing authority must be used. The ECO must be consulted in this regard, prior to use and / or application.
<p>STEP 4: Stabilise, reshape and</p>	<ul style="list-style-type: none"> ▪ Any erosion features created by construction must be stabilised. ▪ Exposed embankments must be stabilized and vegetated as soon as practically possible.

REHABILITATION STEP	REHABILITATION GUIDELINES AND SPECIFIC ACTIONS
prepare soil profiles	<ul style="list-style-type: none"> ▪ Erosion control measures such as soil savers, eco-logs, sand bags and biodegradable silt fences must generally be installed prior to revegetation. ▪ Re-establishment of the natural water flow patterns must be undertaken within the channel through re-shaping of disturbed areas. ▪ Channel banks on the approach to the bridge must be shaped to a stable angle of repose to avoid slumping and prepared for revegetation immediately. ▪ Any sediment washed into wetlands and channels must be removed by hand (no heavy machinery in these sensitive areas). ▪ Prior to commencing with any revegetation activity (e.g. planting/seeding), it is important that disturbed areas are adequately prepared in advance. ▪ Where significant soil compaction has occurred, the soil must be ripped in order to reduce the bulk density of the soil such that vegetation can become established at the site. Rip and / or scarify all disturbed and compacted areas of the construction site. The ECO with the assistance of the engineer must specify whether ripping and / or scarifying is necessary, based on the site conditions. Do not rip and / or scarify areas that are saturated with water, as the soil will not break up. ▪ Where good topsoil exists, no specific preparation is required. ▪ Where topsoil is lacking, about 300 mm of topsoil must be applied on top. The thickness of the topsoil maybe reduced at the instruction of the engineer only if 300 mm of topsoil compromises the integrity of the works. ▪ For seeding the soil must be prepared to optimise germination. Such preparation is undertaken by hand hoeing. The soil in the seedbed must be loosened but firmed to facilitate good contact between the seeds and the soil. ▪ In general, fertilizer / lime must nt be used for re-vegetation in rivers and riparian areas as this may promote increased weed growth. ▪ A weed-free mulch must be utilised to help retain moisture for germination on channel banks and road embankments. Mulch must be crimped in if possible to limit floatation if flooding is likely to occur. It is very important that mulch not be derived from stands of invasive exotic species or weeds.
	<ul style="list-style-type: none"> ▪ Once construction is completed and alien vegetation and waste products have been removed and soils are prepared for planting, vegetation must be reinstated as soon as weather conditions allow for good plant growth. ▪ Revegetation must focus primarily on bare/exposed and unstable soils. Key focal areas include channel banks / margins of the active channel and riparian areas on the approach to the bridge but also include road embankments on the approach to the bridge. ▪ A trained revegetation / rehabilitation expert must be contracted to oversee the rehabilitation of areas. ▪ A minimalistic approach to re-vegetation of the disturbed areas is proposed for this site that will involve the rapid re-establishment of an indigenous pioneer plant dominated vegetation cover via a combination of cost-effective planting methods. ▪ This must comprise a mix of rapidly germinating locally common indigenous grass species (e.g. <i>Cynodon dactylon</i>) as the basis where necessary. Based on the disturbed nature of the construction zone, which is currently very sparsely vegetated, establishing grass cover with stabilisation as the key objective is the primary goal and not restoring biodiversity aspects. ▪ Damaging / destroying indigenous trees must be avoided unless absolutely necessary for construction works. Trees that are removed must either be

REHABILITATION STEP	REHABILITATION GUIDELINES AND SPECIFIC ACTIONS
<p>STEP 5: Re-vegetation of disturbed areas</p>	<p>relocated if possible or replaced through planting new trees of the same species.</p> <ul style="list-style-type: none"> ▪ Alien plant species must not be used for re-vegetation, particularly those with invasive potential (Category 3 and above – National Environmental Management: Biodiversity Act or NEMBA). ▪ It would be advisable to plant at the onset of the wet season (early spring – August to October) so that watering requirements are minimal. This may however not coincide with the construction period and needs to be carefully planned. ▪ Do not use fertilizer, lime, or mulch unless required. ▪ The recommended methods for consideration when re-vegetating areas include: sodding, hydro-seeding, broadcasting and transplanting of live plants or plugs. These methods are discussed below in more detail. <p>5-1 Sodding:</p> <ul style="list-style-type: none"> ▪ Runner grass sods composed of indigenous species must be laid out on disturbed river road embankments and channel banks and secured in place using wooded pegs. Use of grass sods is the most preferred re-vegetation method because it offers instant protection of vulnerable areas. It is best to install the sod as soon as it is delivered. ▪ Lay the grass sods then peg each on to the ground using wooden pegs/stakes. ▪ When sodding is carried out in alternating strips, or other patterns the areas between the sods must be seeded immediately after the sodding. ▪ Immediately after re-vegetation, the grass sods must be watered thoroughly. <p>5-2 Hydroseeding:</p> <ul style="list-style-type: none"> ▪ Hydroseeding is the second preferred option to re-vegetating slopes. The advantages of hydro seeding include faster germination, increased plant survival, and the ability to cover large, often inaccessible areas rapidly. ▪ Prior to hydro seeding water must be sprayed over target area to provide added moisture. ▪ The target groundcover of re-vegetated areas must be no less than 80% of specified vegetation and there must be no bare patches of more than 500 x 500 mm in maximum dimension. ▪ Ideal species for hydro seeding include runner and short tufted species, such as <i>Stenotaphrum secundatum</i> and <i>Cynodon dactylon</i> or suitable alternative indigenous grasses species. <p>5-3 Broadcasting of Seed:</p> <ul style="list-style-type: none"> ▪ On application, seeds must be either manually/hand broadcasted or can be planted in rows her by hand and then raked in the soil then watered immediately after. ▪ The seeding rate (seed used in kg/ha) varies according to the method and the type of seed being used. A good rule of thumb is to use twice the amount of seed used for row planting when broadcasting. ▪ The seed must be planted no deeper than 2.5 times the width of the seed but never left lying on the surface of the soil. The more sandy a soil, the deeper the seed must be planted and the more rich in clay a soil is, the shallower the seed must be sown (within the above limits).

REHABILITATION STEP	REHABILITATION GUIDELINES AND SPECIFIC ACTIONS
	<ul style="list-style-type: none"> ▪ When broadcasting seed it is necessary to lightly cover the seed with soil by hand raking the seed into the soil to ensure the seed has good contact with the soil. ▪ Avoid sowing or thatching in areas where runoff concentrates (i.e. naturally channelled flow, drains, etc.). ▪ All planted areas must be mulched preferably immediately following planting, but in no later than 14 days from planting. Mulch conserves water and reduces erosion. The most common type of mulch used is hay or grass that is crimped into the soil to hold it. ▪ Thorough weed control is essential for the seeding method to be successful, as germinating native seedlings tend to be out-competed by faster growing introduced species. ▪ Temporary erosion protection measures must only be removed once good vegetation cover has established. <p>5-4 Planting of live plugs:</p> <ul style="list-style-type: none"> ▪ Planting of live plugs may only be applicable to instream/wetland habitat, channel margins or riparian areas outside the construction zone that has been accidentally disturbed. Given the very narrow construction zone, transplanting may not be required but will need to be assessed at a site level by those undertaking the rehabilitation and depending on impacts incurred during construction. ▪ When using vegetation plugs, the spacing of plugs must not be too wide and planting must be done in patches rather than wider spacing ▪ A recommended approximate planting density of 1–3 plants per m² generally applies to wetlands ▪ The plants must be planted with their roots in as much of the original soil medium as possible from which they were removed and in a water depth similar to that where they were collected. ▪ Plants in general must be planted with their tops out of the water or they will die. ▪ When planting the material, dig a hole deep enough to ensure that the roots do not bend upwards. ▪ The bottom of the root ball must be in contact with the saturation zone. ▪ The soil around the plant must be firmly compacted. ▪ Leaves of large plants must be trimmed back to about 10 to 15 cm in length so as to reduce water losses through transpiration. ▪ Vegetation that has very recently been planted is generally susceptible to being washed away until it has become well established, particularly in areas of permanent water flow or high-energy environments. The plants may need to be secured using a coarse mesh (steel wire or plastic) and/or a fine biodegradable mat placed over the vegetation to secure the plants while they become established. ▪ Temporary erosion protection measures must only be removed once good vegetation cover has established. ▪ When sourcing plants from nurseries, it is important to consider the genetic origin of the plants. It is considered best to use small regional nurseries that breed plants from the region, instead of large commercial nurseries that are likely to obtain stock from large regional suppliers. ▪ It is important that the seed utilized is of adequate quality and certified, as well as tested for germinability prior to reseeding. ▪ Plugs will need to be sourced from the nearest nursery or harvested locally and/or grown by a nursery for the purposes of this project. The latter

REHABILITATION STEP	REHABILITATION GUIDELINES AND SPECIFIC ACTIONS
	option is preferred. Such a nursery must have the required infrastructure and experience to harvest and propagate the required amount of plant material.
<p>STEP 6: Monitor re-vegetation progress and administer alien plant control</p>	<ul style="list-style-type: none"> ▪ Recovery of disturbed wetland / riparian areas must be assessed for the first six (6) months to assess the success of rehabilitation actions. Any areas that are not progressing satisfactorily must be identified (e.g. on a map) and action must be taken to actively re-vegetate these areas. If natural recovery is progressing well, no further intervention may be required. ▪ Implement IAP control for the first 12 months post-construction to ensure that alien plants are actively managed and eradicated from the site, with adequate monitoring and follow-up measures. This will need to include any disturbed areas created during construction. ▪ The ECO must assess the need / desirability for further monitoring and control after the first 12 months and include any recommendations for further action to the relevant environmental authority (DEDTEA). ▪ The use of herbicides in IAP control must first be investigated into the necessity, type to be used, effectiveness and impacts of the agent on aquatic biota. ▪ Any soil erosion in rehabilitated areas must also be addressed through appropriate actions. ▪ There must be low levels of Invasive Alien Plants (<10% IAP cover) ▪ Vegetation cover must be re-instated to >90% cover

11 METHOD STATEMENT FOR WATERCOURSE CROSSING

Two watercourses will be affected by the proposed development. The construction methodology adopted for the watercourse will be dependent on the season within which construction is undertaken.

11.1 Access

Where machinery is to be used, the necessary precautionary mitigation measures must be implemented to minimise their environmental impact, especially when this involves entering a watercourse. Vehicles with tracks (as opposed to tyres) are preferable – the wider the track the more load spreading and therefore less compaction there is.

Clearing and grubbing works must be undertaken over the full extent of the works area, including access roads. This will require the removal of vegetation, topsoil and sods, all of which must be used for the sole purpose of rehabilitation.

The method adopted during this phase of construction will depend on the season of construction.

11.2 Temporary Flow Diversion

Diversions must be temporary in nature and no permanent walls, berms or dams must be installed within a watercourse. Not more than one diversion must be undertaken within any given watercourse at any given time. Re-directed flow must be accompanied by erosion protection measures at the outlet point to avoid scouring, gully erosion and sedimentation of downstream habitat. Sandbags used in any diversion or for any other activity within a watercourse must be in a good condition, so that they do not burst and empty sediment into the watercourse. Upon completion of the construction at the site, the diversions must be removed to restore natural flow patterns. Options for temporary flow diversion when working within watercourses may include:

- **Method 1: Full isolation gravity / flume pipe** (Table 4)
- **Method 2: Full isolation over pumping / siphon** (Table 4)
- The dam wall should be constructed using sandbags.
- A method statement must be compiled by an aquatic specialist in conjunction with the appointed contractor to guide the flow diversion process from start to finish.
- Temporary diversions must be put in place to temporarily divert water away from activities and ensure a dry works area
- Diversions must be temporary in nature and no permanent walls, berms or dams must be installed.
- Under no circumstance must a new channel or drainage canals be excavated to divert water away from construction activities.

- Upon completion of the construction at the site, the diversions must be removed to restore natural flow patterns, and the channel and riparian zone must be rehabilitated / restored to their original configurations as soon as practically possible.

Table 4: Best Practise Methods for Partial and Full Isolation (after SEPA, 2009)

Description of Method	Schematic of Method
<p>1: Full isolation gravity/flume pipe A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area through gravity fed flumes/pipes. The flume(s) is normally placed on the bed of the watercourse through the works area and outfalls at the downstream barrier, if present, or far enough downstream to prevent the water backing up into the work area.</p>	
<p>2: Full isolation over pumping / siphon A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area by mechanical assistance (pumping or siphon). The pump and associated pipe work need not be located in the isolated area.</p>	

Where a dry stream is encountered, topsoil stripping must also be minimised and stored in a similar manner to protect it from vehicular compaction and washout. In this situation, no locally sourced stone-material must be laid to complement the temporary access, as a safe working platform can be provided on the dry stable underlying strata.

If precipitation occurs, access through such areas must be restricted, to prevent compaction of soils. Access must be restored once the soil conditions permit. Furthermore, if access is urgently required, or rainfall occurs during a vital phase of construction, the method employed for a wet stream must be implemented to protect the underlying geology and permit construction to proceed in a safe manner.

11.3 Watercourse Crossing

The following construction method guidelines are required:

- Ensure that site workers are well versed in the method statement and any other mitigation and management guidelines.
- Ensure that appropriate mitigation measures for site establishment are implemented.
- Ensure that mitigation measures for access control are implemented.
- Ensure that appropriate mitigation measures for site clearing and vegetation stripping are implemented.
- Ensure that appropriate stormwater management and erosion control measures are implemented.
- Backfill according to the specifications indicated on the construction drawings with material approved by the engineer to the height of the fill.
- Perform required compaction tests on all backfill material.

11.4 Rehabilitation Activities

11.4.1 Site Preparation Prior to Re-vegetation

The following are general land preparation requirements for all riparian areas requiring rehabilitation / re-vegetation:

- All rubble, litter, foreign materials and waste products must be removed from the watercourses and riparian areas and disposed of at proper local waste disposal / landfill facilities. Minimise additional disturbance by limiting the use of heavy vehicles and personnel during clean-up operations.
- Any large plumes of sediment washed into the watercourses from upslope must be removed, taking care not to remove or disturb the natural soil profile.
- All Invasive Alien Plants (IAPs) and weeds must be removed from target sites, preferably by uprooting. The Contractor should consult the ECO regarding the method of removal. Herbicides should be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands / aquatic environments by an independent testing authority may be considered. The ECO must be consulted in this regard.
- All embankments must be shaped to the specification of the project or recommendations of the Engineer / ECO. Prior to commencing with any re-vegetation activity (e.g. planting / seeding), it is important that disturbed riparian areas are adequately prepared in advance.
- Where significant soil compaction has occurred, the soil must be ripped in order to reduce the bulk density of the soil to facilitate vegetation establishment at the site. Rip and / or scarify all disturbed and compacted areas of the construction site. The ECO with the assistance of the Engineer must specify whether ripping and / or scarifying is necessary, based on the site conditions. Do not rip and / or scarify areas that are saturated with water, as the soil will not break up.

- In addition, any erosion features immediately upslope and / or within the streams that have been created during the road construction must be stabilised. This must include the need to deactivate any erosion headcuts / rills / gullies that have developed. Compacted soil infill, rock plugs, gabions or any other suitable measures can be used for this purpose.
- Immediately after ripping and scarifying disturbed areas, about 300 mm of topsoil must be applied over the top of the disturbed areas. The thickness of the topsoil maybe reduced at the instruction of the engineer only if 300 mm of topsoil compromises the integrity of the works.
- Topsoil must be placed in the same area from where it was originally stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality must be brought from other areas. Where topsoil is lost during construction as a result of erosion, topsoil must be imported to the site and re-established. Such topsoil must be sourced responsibly and legally.
- The topsoil must be compacted to similar compaction levels as natural soils in the area. The Engineer will provide detailed advice on this.
- For seeding, the soil needs to be prepared to optimise germination. This is typically undertaken by hand hoeing to loosen the soil in the seedbed but must be firm enough to facilitate good contact between the seeds and the soil.

11.4.2 Crossings, Road Batters and Roadside Drains

The following are land preparation requirements for watercourse crossings, road batters and side drains that need to be taken into account:

- Road batters range from gentle to steep slopes on which vegetation must be established. Where slopes are gentle, general land preparation requirements must apply but where slopes are steep, soft intervention techniques must need to be employed to provide sufficient slope stabilisation.
- As a principle, soft interventions must be favoured over hard interventions wherever possible to ensure that the watercourse crossings retain their natural flow regimes and habitat.
- The following soft interventions are recommended for steep slopes:
 - Soil savers;
 - Vegetation blankets or mats;
 - Geo-cells; and
 - Fibre rolls or bags.
- It is important to note that bioengineering interventions are vulnerable to failure if not adequately implemented or poorly maintained.
- Retaining structures such as silt fences, sandbags, hay bales, brush packs, timber logs placed in continuous lines following the slope contours or cut-off trenches must be used across the entire slope to retain eroded sediment.
- Use sandbags or timber logs placed at regular intervals along the contour of slopes to retain sediment and stabilize the soils.
- Temporary sediment barriers must remain in place until such time as re-vegetation and stabilization of disturbed areas is judged to be a success and the risk of erosion / sedimentation has been reduced to a low level.

- Note that care must be taken not to disturb the vegetation, river banks, soils or in-stream areas during site clean-up. No natural material (e.g. sediment, rocks, and stones) from the stream channel or river banks must be removed during this activity.
- Slope instability or where slumping / erosion of stream banks has occurred, these areas must be identified and recorded during and immediately after the initial clearing. These areas must then be stabilised / repaired using suitable interventions depending on the extent / intensity of erosion / destabilisation and risk of further bank instability. Potential measures suitable for bank stabilisation must include:
 - Compaction of soils on stream banks by hand (no machinery to be used within sensitive riparian areas);
 - Planting of suitable indigenous ground-cover to stabilise soils on stream banks;
 - Use of rock pack for eroded banks; and
 - Use of gabion baskets for eroded banks.

11.4.3 Re-vegetation of Disturbed Areas

Once construction is completed and alien vegetation and waste products have been removed and soils are prepared for planting, vegetation is to be reinstated as soon as weather conditions allow for good plant growth.

11.4.4 Road Batters, Road Reserve and Roadside Drains

Immediately after preparing the soil, re-vegetation must commence in order to help bind the soil and prevent soil erosion and to inhibit IAP / weed establishment which will compete with the natural vegetation for space, light, nutrients and water. In this regard, the following mitigation measures must be implemented for road batters, roadside drains and general road reserves disturbed during construction:

Method 1: Sodding

- Runner grass sods composed of indigenous species must be laid out on all road batters and secured in place using wooded pegs. Use of grass sods is the most preferred re-vegetation method because it offers instant protection of vulnerable areas. It is best to install the sod as soon as it is delivered.
- No exotic / alien plants are to be used in sodding (i.e. no Kikuyu Pennisetum clandestinum).
- Prior to installing sods, rake or harrow to achieve a smooth, final grade.
- When sodding is carried out in alternating strips, or other patterns the areas between the sods should be seeded immediately after the sodding.
- Immediately after re-vegetation, the grass sods must be watered thoroughly. Watering must be undertaken on a daily basis until such time as the sod becomes well rooted within the soil.
- Thereafter, less frequent watering should be sufficient until such time as the vegetation is established to the satisfaction of the rehabilitation implementer and ECO / resident engineer.

Method 2: Hydroseeding

- Hydroseeding is the second preferred option for re-vegetating slopes. The advantages of hydroseeding include faster germination, increased plant survival, and the ability to cover large, often inaccessible areas rapidly.
- The slurry (basic materials) for hydroseeding must consist of water, seed, fertiliser, anti-erosion compounds (soil binders) and organic supplements to enhance grass growth.
- Prior to hydroseeding water must be sprayed over target area to provide added moisture.
- The target groundcover of re-vegetated areas must be no less than 80% of specified vegetation and there must be no bare patches of more than 500 x 500 mm in maximum dimension.
- Ideal species for hydroseeding include runner and short tufted species, such as *Cynodon dactylon* or suitable alternative indigenous grasses species.
- No exotic / alien plants must be used in hydroseeding.

Active re-vegetation refers to the manual planting / seeding of vegetation within a riparian area and is considered important if there are risks involved in waiting for natural recruitment to occur or in situations where re-vegetation may be useful or even necessary, depending upon the objectives of rehabilitation or the particular conditions at a site¹. Re-vegetation of different riparian areas is likely to require planting mixes and planting strategies specific to a particular bioregion, or even at a local site level². Planting the “wet zone” can be a complicated task that requires consideration of water management levels, restrictions on use of herbicides, equipment limitations, site preparation and a good understanding of the “wetness requirements” for various wetland plants.

Table 5: Method Statement for the Implementation and Removal of Cofferdams/Diversions

METHOD STATEMENT FOR THE IMPLEMENTATION AND REMOVAL OF COFFER DAMS/DIVERSIONS	
PROJECT STAGES	DESCRIPTION
<p>STAGE 1 Pre-construction</p>	<ul style="list-style-type: none"> ▪ Refer to approved plans for construction. ▪ Train staff in cofferdam construction. ▪ Identify, demarcate and protect any affected water resources or sensitive habitat likely to be affected by the construction.

¹ Russell, W.B., 2009. *WET-Rehab Methods: National guidelines and methods for wetland rehabilitation*. WRC Report No. TT 341/09. Water Research Commission, Pretoria.

² Jacobson, R.L., 2006. *Restoring & Managing Native Wetland & Upland Vegetation*. Minnesota Board of Soil & Water Resources Minnesota Department of Transportation. January 2006.

METHOD STATEMENT FOR THE IMPLEMENTATION AND REMOVAL OF COFFER DAMS/DIVERSIONS

PROJECT STAGES	DESCRIPTION
<p>STAGE 2 Installation</p>	<ul style="list-style-type: none"> ▪ Site clearing. ▪ Pre-dredge to remove soil or soft sediments and level the area of the cofferdam. ▪ Drive temporary support piles. ▪ Temporarily erect bracing frame on the support piles. ▪ Set steel sheet piles, starting at all four corners and meeting at the centre of each side. ▪ Drive sheet piles to grade. ▪ Block between bracing frame and sheets, and provide ties for sheet piles at the top as necessary. ▪ Excavate inside the grade or slightly below grade, while leaving the cofferdam full of water. ▪ Drive or otherwise construct bearing piles. ▪ Place rock-fill as a levelling and support course. ▪ Place underwater tremie concrete seal. ▪ Check blocking between bracing and sheet piles. ▪ Remove water. ▪ Construct new permanent foundation and substructure of the bridge.
<p>STAGE 3 Removal</p>	<ul style="list-style-type: none"> ▪ Flood cofferdam. ▪ Remove sheet piles. ▪ Remove bracing. ▪ Backfill as required. ▪ End of cofferdam removal. ▪ Rehabilitate disturbed areas

12 METHOD STATEMENT FOR INVASIVE ALIEN PLANT ERADICATION

It is the responsibility of the Developer to eradicate and control alien invasive plants that invade all areas disturbed by the construction and operation of the proposed development. In terms of section 75 of NEMBA, the following applies to the control and eradication of invasive species:

- The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs (see Box 1 below for guidance on alien plant control methods);
- Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment; and
- The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

It is recommended that bi-annual annual alien plant clearing be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing should be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.

BOX 1. GUIDANCE ON INVASIVE ALIEN PLANT CONTROL

There are various means of controlling invasive alien plants in South Africa. The primary methods are discussed below. The suitability of control methods depends on a number of factors, including practical constraints, economic constraints and applicability of methods for particular species of alien plants. It is generally advised that a form of integrated control be implemented; however the final selection of the appropriate methods of control should be based on the following criteria:

- **Species to be controlled:** herbicides are registered for specific species. Selection should be based on “*A Guide to the use of Herbicides*” issued by the Directorate: Agricultural Production Inputs and labels and information brochures provides by herbicide suppliers.
- **Size/age of target plants:**
 - For seedlings: hand-pulling or hoeing and foliar applications of herbicides for dense stands.
 - For saplings: hand-pulling or hoeing, foliar applications of herbicides for dense stands, basal stem treatments and cut stump treatments recommended.
 - For mature trees: ring barking, frilling, basal stem treatments and cut stump treatments recommended.
- **Density of stands:** Overall applications of herbicide can be made to dense stands of seedlings or saplings. Where dense stands of large trees are present, treatment of standing trees may be appropriate to obviate the problem of disposing felled trees.
- **Accessibility of terrain:** In inaccessible areas, methods that rely on the minimum amount of transportation of equipment and chemicals should be given preference.
- **Environmental considerations:** Riparian/wetland areas require a careful approach to treatment/control. Only herbicides approved for use in wetland/riparian areas are to be considered. Washing of equipment or disposal of any chemical substances is prohibited in or near areas where there is a potential risk of contamination of wetlands/riparian areas.

- **Desirable vegetation:** Control methods that will cause the least damage to desirable vegetation must be considered. Selective herbicides or mixes that will not damage other desirable vegetation should be applied where relevant.
- **Disposal of dead vegetation:** Where possible, utilizable wood should be removed after tree felling. This is also the case for trees that could cause blockages of watercourses. Brushwood should be spread rather than stacked to limit soil damage in instances where burning is planned.
- **Cost of application:** the cost of application and re-treatment should be taken into consideration when selecting methods / herbicides, etc. for control.

The control methods detailed below have been adapted from the ARC-PPRI (Agricultural Research Commission: Plant Protection Research Institute) Weed Research Programme (online at www.arc.agric.za/arc-ppri/), the DWA Working for Water Programme (<http://www.dwaf.gov.za/wfw/Control/>) and eThekweni Municipality's *Practical tips on the management and eradication of invasive alien plants* (EcoFiles Sheet 4. Local Action for Biodiversity).

1. Mechanical control

Mechanical control entails physically damaging or removing the target alien plant. Mechanical control is generally labour intensive and therefore expensive, and can also result in severe soil disturbance and erosion. Different techniques can be applied and include uprooting/hand-pulling, felling, slashing, mowing, ring-barking or bark stripping. This control option is only really feasible in sparse infestations or on a small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice (e.g. *Eucalyptus* spp., *Melia azedarach*) need to have the cut stumps or coppice growth treated with herbicides following mechanical treatment.

Examples of mechanical controls include:

- **Hand pulling / uprooting:** should be reserved for small plants and shrubs with shallow root systems (not recommended for trees with a stem diameter of more than 10 cm). Grip the young plant low down and pull out by hand (using gloves). Uprooting is similar but is undertaken on slightly older individuals
- **Chopping / cutting / slashing:** This method is most effective for plants in the immature stage, or for plants that have relatively woody stems/trunks. An effective method for non re-sprouters or in the case of re-sprouts (coppicing). It must be done in conjunction with chemical treatment of the cut stumps. Cut/slash the stem of the plant as near as possible to ground level. Paint re-sprouting plants with an appropriate herbicide immediately after they have been cut.
- **Strip bark:** Using a bush knife, strip bark away from tree from waist height down to soil. Cambium is stripped with the bark. No herbicide used.
- **Felling:** Large trees can be cut-down in their entirety, however, this is often not recommended unless absolutely necessary as large trees can play a pivot role in soil protection and biodiversity maintenance.
- **Girdling:** Girdling involves cutting a groove or notch into the trunk of a tree to interrupt the flow of sap between the roots and crown of the tree. The groove must completely encircle the trunk and should penetrate into the wood to a depth of at least 1.5 centimetres on small trees, and 2.5 to 4 centimetres on larger trees. .

2. Chemical control

Chemical control involves the use of registered herbicides to kill the target weed. The use of herbicide is often essential to the success of an eradication/control programme as it greatly reduces the re-growth potential of alien plants. Unfortunately, if the wrong herbicide is chosen, one can potentially cause more harm than good to the environment. Some additional recommendations regarding herbicide use include:

- Herbicides should be applied during the active growing season.

- Always observe all safety precautions printed on the labels and manufacturer's instructions when mixing and applying herbicide.
- Herbicides can be applied in various ways. They can be sprayed onto dense infestations or painted onto the main stem of the plant or cut stump.
- Spraying herbicide on small infestations is not recommended, rather cut and apply herbicide to the stumps either with a brush.
- Spraying should be restricted to windless days when there is less risk of droplets drifting onto non-target species.
- Pressure or flow regulators should be fitted to sprayers for overall application. Spraying should be restricted to plants waist height or lower, but also ensuring there is sufficient foliage to carry the applied herbicide to the root system of the target plant.
- For water-based applications, Actipron Super Wetter should be added where recommended on the herbicide label, at a rate of 1.75 / ha for dense-closed stands of alien vegetation.
- For all water-based treatments, a suitable brightly coloured dye should be added to the mix to ensure that all target plants are treated. For diesel-based applications, Sudan Red Dye should be added.
- Chemical control of IAPs is not recommended in aquatic systems due to the risk of water pollution, but may be used in conjunction with cutting or slashing of plants.
- Chemicals should only be applied by qualified personnel.
- Only herbicide registered for use on target species may be used.
- Follow the manufacturer's instructions carefully.
- Appropriate protective clothing must be worn.
- Only designated spray bottles to be used for applying chemicals.
- The number of herbicides for safe use under wet conditions is very limited.

3. Biological control

Biological weed control involves the releasing of natural biological enemies to reduce the vigor or reproductive potential of an invasive alien plant. Research into the biological control of invasive alien plants is the main activity of the Weeds Research Programme of ARC-PPRI and a list of biocontrol agents released against invasive alien plants in South Africa can be downloaded from their website. To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF).

4. Mycoherbicides

A mycoherbicide is a formulation of fungal spores in a carrier, which can be applied to weeds in a similar way as a conventional chemical herbicide (using herbicide application equipment). The spores germinate on the plant, penetrating plant tissues and causing a disease which can eventually kill the plant. Mycoherbicides are indigenous to the country of use and therefore are already naturally present in the environment and do not pose a risk to non-target plants. Under natural conditions they do not cause enough damage to the weed to have a damaging impact and are therefore mass produced and applied in an inundative inoculation, which leads to an epidemic of the disease knocking the weed population down. Mycoherbicides need to be re-applied at regular intervals.

5. Integrated control

It is frequently advisable to use a combination of two or more of the control method mentioned above, which is referred to as integrated control. Killing plants without cutting down causes the

least disturbance to the soil and is the ideal.

The following integrated control options are available:

- **Basal bark and stem application:** apply recommended herbicide mixed in diesel carrier to the base of the stem of trees (<25 cm stem height) and saplings. This method is appropriate for plants with thin bark or stems up to 25 cm in diameter. Do not cut the bark. Apply herbicide mix with paintbrushes or using a coarse droplet spray from a narrow angle solid cone nozzle at low pressure. For multi-stemmed plants, each stem must be treated separately.
- **Ring barking:** Invasive trees growing away from any structures or roads can be ring-barked, poisoned and left standing rather than felled. They will slowly collapse over time and can establish habitat for birds, etc. Strip all bark and cambium from a height of 75 cm to 100 cm down to just below soil level. Cut a ring at the top and pull strips. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Bush knives or hatchets should be used for debarking.
- **Frilling:** Using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to effect the cuts around the entire stem and apply herbicide into the cuts.
- **Cut stump treatment:** This is a highly effective and appropriate control method for larger woody vegetation that has already been cut off close to the ground. The appropriate herbicide should be applied to the stump using a paintbrush within 30 min of being cut. Apply recommended herbicide mixture to the cut surface with hand sprayers, a paintbrush or knapsack sprayer at low pressure. Apply only to the cambium or outer layer of large stumps and the entire cut surface of small stumps. Ensure the stumps are cut as low to the ground as practically possible (about 10 – 15 cm or as stipulated on specific herbicide label). Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.
- **Scrape and paint:** This method is suitable for large vines and scrambling plants i.e. creepers. Starting from the base of the stem, scrape 20-100 cm of the stem to expose the sapwood just below the bark. Within 20 seconds apply the herbicide to the scraped section. Do not scrape around the stem. Stems over 1cm in diameter can be scraped in 2 sides. Leave the vines to die in place to prevent damaging any indigenous plants they may be growing over.
- **Foliar spray:** This is not an advocated method of application by unqualified applicators due to the danger of spraying indigenous species. Should be restricted to droplet application made directly on the leaves on plants that are no higher than knee height. Use a solid cone nozzle that ensures an even coverage on all leaves and stems to the point of runoff. Do not spray just before rain (a rainfall-free period of 6 hours is recommended) or before dew falls. Avoid spraying in windy weather as the spray may come into contact with non-target plants. Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.
- **Burning:** Spindly invasive alien plant species, such as Fame Weed and/or Triffid Weed (*Chromolaena odorata*), growing on sandy soils, where there is between 30-40% grass still present, can be eradicated using annual controlled burns. Moderate to low infestations in wetland areas can be treated by controlled burning at the beginning of autumn, followed by mechanical removal or herbicide application in mid spring. *Note that burning would generally not be acceptable in an urban area due to fire hazard / risk and nuisance.*

Note that no heavy machinery should be used to remove invasive alien plants, no matter how high the infestation, without prior authorization from relevant government departments when operating in wetlands and riverine areas.

6. Disposal of alien plant material

Treated / removed alien plant material will need to be removed from the site and disposed of at a registered receiving area such as a local registered land fill site.

13 COMPLIANCE WITH THE ENVIRONMENTAL SPECIFICATION

The EMPr forms part of the Contract Documentation and is thus a legally binding document. It is also necessary for the contractor to make provisions as part of their budgets for the implementation of the EMPr. In terms of *Polluter Pays Principle*. Section 28 of the NEMA, an individual responsible for environmental damage must pay the costs for both environmental and human health damage. As far as possible preventative measures must be in place to reduce or prevent additional pollution and/or environmental damage from occurring.

The Contractor is deemed not to have complied with the Environmental Specification / EMPr if:

- There is evidence of contravention of clauses within the boundaries of the site, site extensions and haul / access roads;
- Environmental damage ensues due to negligence;
- The contractor ignores or fails to comply with corrective or other instructions issued by the Developer, ECO or Engineer within a specified time; or
- The contractor fails to respond adequately to complaints from the public.

13.1 Penalties

Application of a penalty clause will apply for incidents of non-compliance. The contractor will be allowed one offence and a written warning will be issued to the Contractor's SHE Officer. Failure to rectify the offence within one (1) working week of the issue of the warning or a repeat offence will result in a penalty.

The penalty will be issued by a representative of the Developer. The penalty imposed will be per incident at the discretion of the Developer's SHEQ Manager or any other duly authorised representative. The value of the penalty imposed shall be as defined in the contract and enforcement shall be at the discretion of the Developer. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the EMPr. The Developer will inform the contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract.

The penalty monies will become the property of the Developer to be used for rehabilitation and maintenance of the site. Unless stated otherwise in the project specification, the penalties imposed per incident or violations are outlined below in Table 6.

Table 6: Penalties Applicable

OFFENCE	AMOUNT
Failure to demarcate working areas	R10,000
Working outside of demarcated areas	R30,000
Failure to strip topsoil with intact vegetation	R50,000
Failure to stockpile topsoil correctly	R30,000
Failure to stockpile materials in designated areas	R10,000
Failure to take measures to prevent soil contamination	R10,000
Failure to take measures to control dust dispersion on-site	R10,000
Washing of vehicles on-site	R10,000
Pollution of water bodies and/or groundwater	R20,000
Failure to implement stormwater management provisions during construction	R20,000
Failure to control stormwater run-off	R30,000
Downstream erosion	R30,000
Failure to provide adequate sanitation	R10,000
Failure to erect temporary fences around trenches	R10,000
Failure to provide adequate waste disposal facilities and services	R50,000
Failure to reinstate disturbed areas within the specified time-frame	R30,000
Any other contravention of the project specific specification	R10,000

The Developer is responsible for the implementation of the EMPr and for compliance monitoring of the EMPr.

The EMPr will be made binding on all contractors (including sub-contractors) operating on the site and will be included with the Contract.

Non-Compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. Non-compliance with the conditions of the EMPr constitutes a breach of Contract.

13.2 Removal from Site and Suspension of Works

Failure to remediate after the issue of a financial penalty, depending on the severity and significance of the impact related to non-compliance, the ECO may undertake to report directly to KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) (Compliance) recommending that for:

- High impact: to issue a notice to cease construction;
- Medium impact: to issue a notice instructing the Developer to implement recommended remedial action; or
- Low impact: ECO to notify, but up to discretion of DEDTEA to apply sanction.

The Developer, at the direction of the ECO, or of his own conviction, has the power to remove from site any person who is in contravention of the EMPr, and if necessary, the Developer can suspend part or the whole of the works, as required.