

## REPORT

# **Environmental Management Programme for the Rehabilitation of a Culvert along Provincial Road P230 from km 37.0 to km 47.0 near Empangeni, KwaZulu-Natal**

## ENVIRONMENTAL MANAGEMENT PROGRAMME

Client: KwaZulu-Natal Department of Transport

Reference: MD1729\_R001\_D04\_P230 EMPr

Revision: 04/Draft

Date: 17 July 2017

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Classification

Project related



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## Acronyms

CA	Competent Authority
CBA	Critical Biodiversity Area
DoT	Department of Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EMPr	Environmental Management Programme
ERP	Emergency Response Plan
ESA	Ecological Support Area
GIS	Geographic Information Systems
GNR	Government Notice Regulation
IAP	Invasive Alien Plant
I&AP	Interested and Affected Party
IEM	Integrated Environmental Management
KZN	KwaZulu-Natal
MMP	Maintenance Management Plan
MSDS	Material Safety Data Sheet
NCR	Non-Conformance Report
NEM:AQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act (Act No. 36 of 1998) (as amended)
NEMA	National Environmental Management Act (Act No. 107 of 1998) (as amended)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
PM	Project Manager
RoW	Right of Way
SANBI	South African National Biodiversity Institute
SDC	Safe Disposal Certificate
SEF	Site Environmental File
SEMA	Suite of Environmental Management Acts
SHE	Safety, Health and Environmental
WUL(A)	Water Use Licence (Application)



## Glossary

<b>Accident</b>	A road vehicle accident.
<b>Alien Species</b>	(a) A species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention as set out in the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).
<b>Building and Demolition Waste</b>	Building and demolition waste means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition.
<b>Client</b>	The client is the individual responsible for the development in the form of ownership.
<b>Client's Project Manager</b>	The person appointed by the client who is responsible for the construction site as a whole.
<b>Contractor</b>	Companies appointed on behalf of the Developer to undertake activities, as well as their sub-contractors and suppliers.
<b>Construction Project Management Team</b>	The team consists of a Project Manager as well as a Safety, Health and Environmental (SHE) Officer.
<b>Culvert</b>	A pipe or box intended to convey water under a highway, railroad, canal, or similar facility.
<b>Degradation</b>	The lowering of the quality of the environment through human activities e.g. river degradation, soil degradation.
<b>Domestic Waste</b>	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.
<b>Emergency</b>	An undesired event that results in a significant environmental impact and requires the notification of the relevant statutory body such as a local or provincial authority.
<b>Environment</b>	In terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998)(as amended), "Environment" means the surroundings within which humans exist and that are made up of: <ul style="list-style-type: none"> <li>(i) the land, water and atmosphere of the earth;</li> <li>(ii) micro-organisms, plants and animal life;</li> <li>(iii) any part or combination of (i) of (ii) and the interrelationships among and between them; and</li> <li>(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.</li> </ul>
<b>Environmental Aspect</b>	An environmental aspect is any component of a Contractor's construction activity that is likely to interact with the environment.

<b>Environmental Control Officer</b>	An individual nominated through the Developer to be present on-site to act on behalf of the Developer in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
<b>Environmental Impact</b>	A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.
<b>Environmental Management Programme</b>	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts, and, limiting or preventing negative environmental impacts are implemented during the life-cycle of a project. It is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, long-term maintenance, and, decommissioning of a project are prevented and that positive benefits of the projects are enhanced.
<b>General Waste</b>	General waste means waste that does not pose an immediate hazard or threat to health or to the environment, and includes - <ul style="list-style-type: none"> <li>(i) domestic waste;</li> <li>(ii) building and demolition waste;</li> <li>(iii) business waste; and</li> <li>(iv) inert waste.</li> </ul>
<b>General Waste Landfill Site</b>	A waste disposal site that is designed, managed and permitted to allow for the disposal of general waste.
<b>Hazardous Waste Landfill Site</b>	A waste disposal site that is designed, managed and permitted to allow for the disposal of hazardous waste.
<b>Impact</b>	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.
<b>Maintenance Activities</b>	For the purpose of this document, maintenance refers to the relocation of the existing services, the provision of subsoil drainage, replacement of three culvert, the widening of the road to accommodate sidewalks in some areas, the provision of surface drainage facilities, and the rehabilitation of the upgraded road layer works and surfacing, including the associated ancillary works. There will also be an increase in the elevation of the existing road.
<b>Mitigation</b>	Measures designed to avoid, reduce or remedy adverse impacts.
<b>Principal Agent</b>	The principal agent is appointed by the Developer to oversee the overall project management and the management of the professional project team.
<b>Re-use</b>	To utilise articles from the waste stream again for a similar or a different purpose without changing the form of properties of the articles.
<b>Recycle</b>	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.
<b>Rehabilitation</b>	Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement re-vegetation of a disturbed area and the insurance of a stable land surface. Re-vegetation should aim to accelerate the natural succession

	<p>processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.</p>
<b>Road Reserve</b>	<p>A corridor of land, defined by co-ordinates and proclamation, within which the road, including access intersections or interchanges, is situated. A road reserve may, or may not, be bounded by a fence.</p>
<b>Road Width</b>	<p>For the purposes of this document, the road width is defined as the area within the road reserve i.e. fence line to fence line, but also includes all areas beyond the road reserve that are affected by the continuous presence of the road, e.g. a reach of a watercourse.</p>
<b>Safety, Health and Environmental (SHE) Officer</b>	<p>The SHE Officer is a Contractor representative, responsible for the safety, health and environmental aspects during maintenance. The SHE Officer will be responsible for the day-to-day monitoring of the EMPr and Health and Safety Plan.</p>
<b>Waste</b>	<p>Waste means any substance, whether or not that substance can be reduced, re-used, recycled and recovered -</p> <ul style="list-style-type: none"><li>(i) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;</li><li>(ii) which the generator has no further use of for the purposes of production;</li><li>(iii) that must be treated or disposed of; or</li><li>(iv) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—<ul style="list-style-type: none"><li>o a by-product is not considered waste; and</li><li>o any portion of waste, once re-used, recycled and recovered, ceases to be waste.</li></ul></li></ul>
<b>Waste Disposal Facility</b>	<p>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.</p>
<b>Workforce</b>	<p>The entire project team including people employed by 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.</p>

# 1 INTRODUCTION

This project forms part of the Empangeni Road Rehabilitation Programme and covers the rehabilitation of the provincial road P230 between km 37,0 and km 47,0 within the uMhlathuze Local Municipality which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal.

Provincial Road P230 from the intersection with P393 at km 37,0 to km 47,0 near Empangeni is defined as an undivided two lane road, and has been classified as a Class R1 Rural Arterial Road (in terms of the TRH26). The P230 forms part of the R34 long distance heavy haul freight route which connects the harbour of Richards Bay and the surrounding industrial and commercial areas, with inland provinces.

This route will be downgraded from a Class R1 to a Class R2 Rural Arterial Road when the planned Empangeni bypass is implemented. Therefore the design will be assessed for a Class R2 Rural Arterial Road.

The cumulative length of the project is approximately 10,0 km of single carriageway road having an existing surfaced width of approximately 9,0 m. The portion between km 37 to km 47,0 will be rehabilitated to a Class 2 single carriageway with a 10,0 m wide surfaced road including 1,5 m wide surfaced shoulders which will be trimmed on the road edges with gravel roundings which are 1,0 m and 0,5 m wide in fill and cut conditions respectively, including adequate stormwater drainage facilities.

The proposed rehabilitation comprises the relocation of services, the construction of bulk earthworks required for the horizontal and vertical alignment of the existing road formation and the construction of road layerworks and surfacing, including the associated ancillary works for the construction of the access roads off this main road to neighbouring communities as well as the replacement of one culvert at km 41,8 (Figure 1).



Figure 1: Locality map

## 1.1 Purpose of the Environmental Management Programme (EMPr)

In terms of The Constitution of the Republic of South Africa (1996), everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for benefit of present and future generations, through reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (Section 24). The needs of the environment as well as affected parties should thus be integrated into overall project management.

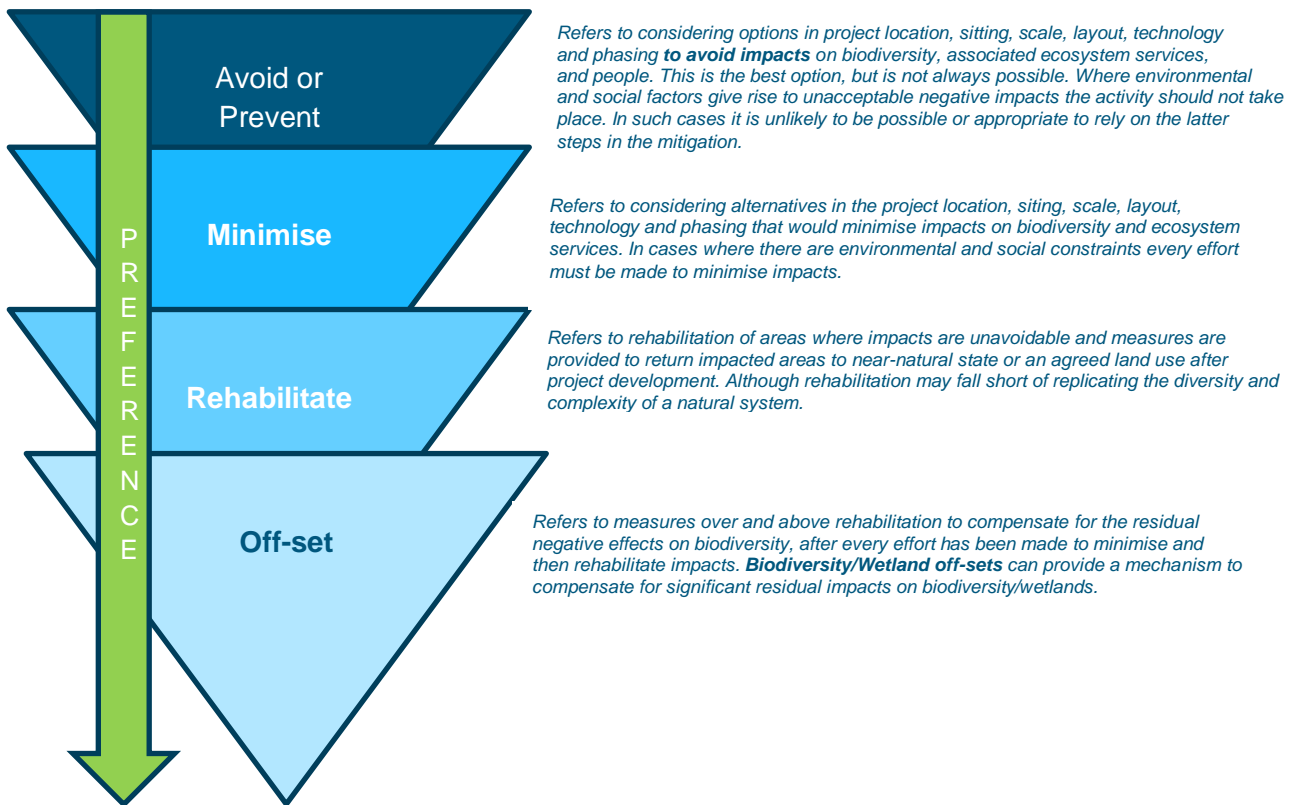
The Constitution is underpinned by the suite of Specific Environmental Management Acts (SEMAs) – including the National Environmental Management Act (Act No. 107 of 1998, NEMA), National Environmental Management Waste Act (Act No. 59 of 2008, NEM:WA), National Environmental Management Air Quality Act (Act No. 39 of 2004, NEM:AQA), National Environmental Management Biodiversity Act (Act No. 10 of 2004, NEM:BA), National Environmental Management Integrated Coastal Management Act (Act No. 24 of 2008, NEM:ICMA), National Environmental Management Protected Area Act (Act No. 57 of 2003, NEM:PAA), as well as the National Water Act (Act No. 36 of 1998, NWA) – which combined, serve to control all relevant facets of the environment so as to ensure that **section 24** of the Constitution is ensured.

The EMPr is developed in terms of the SEMAs and ensures that construction activities meet the requirements of existing environmental legislation and good environmental practice in terms of local and international standards and guidelines. This is achieved by identifying those construction activities for the proposed development that may have a negative impact on the environment; outlining the mitigation measures that will need to be taken and the steps necessary for their implementation and describing the reporting system to be undertaken during construction.

It is noted that protection of the environment is enshrined in the Duty of Care requirement of the NEMA (as amended), which thus means that it is the duty of all landowners and users to ensure that the activities they carry out on a site do not cause detriment to the environmental facets thereof. The EMPr thus functions as a programme which can be monitored and audited that will allow the Developer the ability to ensure that all that operate on the site do so in an environmentally safe manner. It is also structured in such a way that the conditions may be linked to a standard construction contract. It is essential that the EMPr requirements be carefully studied, understood, implemented, and adhered to at all time. Each action within the EMPr is supported by the priority of when the specific action will need to be implemented.

Core to the purpose of the EMPr is to implement the ‘mitigation hierarchy’ (DEA et al., 2013), which is illustrated in **Figure 2**.





**Figure 2: Mitigation Hierarchy**

## 1.2 Objectives of the EMPr

The EMPr has the following objectives:

- To ensure compliance with regulatory authority stipulations and guidelines; which may be local, provincial, national, and/or, international.
- To outline functions and responsibilities of responsible persons.
- To state standards and guidelines, which are required to be achieved / complied with in terms of environmental legislation.
- 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.
- To identify measures that could optimise beneficial impacts.
- To prevent long-term or permanent environmental degradation.
- To establish a method of monitoring and auditing environmental management practices during all phases of development.
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project.
- Ensure that the safety recommendations are complied with.
- Propose mechanisms for monitoring compliance with the EMPr and reporting thereon.
- Specify time periods within which the measures contemplated in the draft EMPr must be implemented, where appropriate.
- To provide an environmental awareness plan.
- Provide rational and practical environmental conditions / requirements to:

- Minimise disturbance of the natural environment;
- Ensure water resource protection;
- Prevent or minimise all forms of pollution;
- Protect indigenous flora and fauna;
- Prevent soil and sand erosion and facilitate the re-vegetation of affected areas;
- Maintenance of newly re-vegetated areas;
- Restrict noise disturbance;
- Ensure compliance with all applicable laws, regulations, standards and guidelines for the protection of the environment;
- Adopt the best practical means available to prevent or minimise adverse environmental impacts;
- Develop waste management practices based on prevention, minimisation, recycling, treatment or disposal of waste; and
- Train the Developer, their employees and contractors (including all sub-contractors) with regard to their environmental obligations.

The EMPr is essentially, a written programme of how the environment is to be managed in practical and achievable terms.

An independent Environmental Control Officer (ECO) must be appointed by the Developer (i.e. KZN DoT), to ensure compliance with the EMPr.

### 1.3 Scope of the EMPr

In accordance with the requirements of the NEMA, this EMPr is to be implemented by the Developer as well as any employee, contractor, agent, or sub-contractor appointed to act on behalf of the Developer in the execution of the project, in order to ensure environmental compliance on site.

The specifications outlined in this EMPr are thus applicable to all activities undertaken by the Developer as well as their appointed contractors and all persons involved in the execution of the works, including sub-contractors, the workforce, suppliers, and volunteers, for the duration of construction, operation and future maintenance.

Included within the EMPr is guidance for on-going training with respect to the implementation of the conditions included therein, including induction by all new people coming onto site to carry out work, and 'top-up' activities such as regular 'toolbox talks' on specific key issues.

An Environmental Code of Conduct has also been developed that provides a simplified set of rules that must be adhered to by all persons involved with the project at all times. This is to be displayed at strategic points to ensure constant environmental awareness.

The effectiveness of the EMPr is limited by the level of adherence to the conditions set forth in the EMPr by the Developer, the Contractor and Sub-contractors. It is further assumed that compliance with the EMPr will be monitored and audited as set out in this EMPr and contractual clauses.

### 1.4 Structure of the EMPr

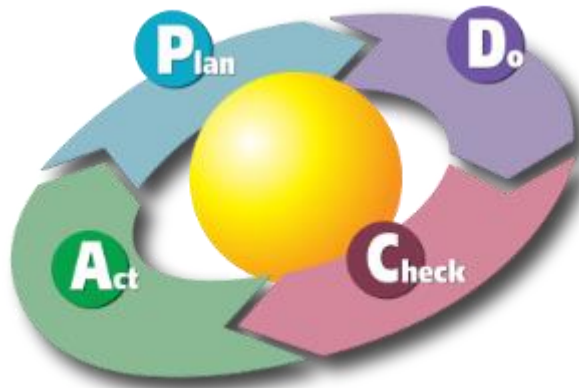
The EMPr provides proposed mitigation and management measures for the following phases of the project (**Table 1**).

*Table 1: Different Phases of the Project Construction*

PHASE	DESCRIPTION
<b>Pre-Construction (Planning &amp; Design)</b>	This section will provide guidelines on pre-construction activities including site establishment and clearance; environmental induction and training and awareness; site access and health and safety.
<b>Construction</b>	This section will provide guidelines on construction methods and considerations.
<b>Post-Construction</b>	This section of the EMPr provides management principles for the rehabilitation, maintenance and operational phases of the project. This will include best practice, procedures and responsibilities as required for various associated activities.

## 1.5 The EMPr as a “Live” Document

The approach adopted for this EMPr is derived from the Deming Cycle (**Figure 3**), a cycle of continuous improvement that entails the reiterative actions of plan, do, check, act, and critically to then return to the planning phase.



*Figure 3: Deming Cycle of Continuous Improvement*

### 1.5.1 Plan

Project-specific planning for the proposed project involves consideration of the legal triggers, the specifics of the proposed development, and the nature of the receiving environment. This provides a starting point for targeted environmental management objectives.

Environmental performance indicators are then determined with measurable targets prescribed to monitor the environmental performance of the project. Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.

### 1.5.2 Do

Throughout the development’s life-span, the Developer will be required to develop and maintain a Quality Management System (QMS) – designed to ensure that best management practices are implemented in day-to-day management.

Such a QMS must at least include the following information:

- Location and extent of associated infrastructure;
- Associated activities, such as the transportation of people and equipment;
- Resources and experience required (staffing);



- Materials and equipment to be used;
- Management actions;
- Human resources used;
- Construction-monitoring activities;
- Emergency / disaster incident and reaction procedures; and
- Rehabilitation procedures for the impacted environment.

These topics will be cross-linked into the contracts related to the development of the project.

### 1.5.3 Check

A system of assessing monitoring results has been developed to check the environmental management performance. Continuous assessment facilitates proactive management of the environmental issues. Mitigation measures can then be successfully implemented on an on-going basis to keep environmental indicators within their target thresholds. Moreover, the assessment system also enables the assessment of the efficacy of the EMPr. Regular auditing of environmental performance is prescribed to prove and preserve accountability.

### 1.5.4 Act

The assessments and monitoring of the results and findings of the regular audits must be documented within a reporting system. Precautionary mitigation measures and corrective actions will be prescribed and instructions will be given in order to implement these in the field. The findings of monitoring and auditing programmes can also be used to update the EMPr. Although the EMPr is a project-specific document, it is dynamic and must be updated regularly to address the changing circumstances of the scheme.

## 1.6 Project Team Details

### 1.6.1 Project Developer

The Developer is the KZN DoT and the details of the responsible person are listed in **Table 2**.

**Table 2: Details of the Developer**

Applicant	KwaZulu-Natal Department of Transport	
Representative	Ms Khumbu Sibiya	
Physical Address	172 Burger Street, Pietermaritzburg, 3200	
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### 1.6.2 Details of the Environmental Assessment Practitioner

The team responsible for the preparation of the EMPr is presented in **Table 3** below.

**Table 3: Details of the Environmental Team**

Environmental Assessment Practitioners			
Contact Persons	Humayrah Bassa (EAP)	Prashika Reddy	Clive Zwane (PPP Consultant)

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<b>Qualification</b>	MSc Environmental Science	BSc (Hons) Geography	BA (Hons) Geography and Environmental Management
<b>Expertise</b>	Humayrah Bassa is an Associate with 7 years' experience in various facets of environmental management. These include conducting environmental impact assessments and the public participation process (PPP); compiling environmental impact reports; developing environmental management programmes; compiling water use licence applications; conducting environmental control officer duties; and conducting legal compliance audits. She is a Professional Natural Scientist (400032/15) with the South African Council for Natural Scientific Professions.	Prashika Reddy is a Principal Associate (Pr Sci Nat 400133/10) with a BSc Honours in Geography and Botany. Ms Reddy has 15 years' experience in various environmental fields including: environmental impact assessments, environmental management plans/programmes, public participation and environmental monitoring and auditing. Ms Reddy has extensive experience in compiling environmental reports (Screening, Scoping, EIA and Status Quo Reports). Ms Reddy is/has been part of numerous multi-faceted large scale projects, including the establishment of linear developments (roads, and power lines); industrial plants; electricity generation plants and mining-related projects.	Clive is an Environmental Consultant at Royal HaskoningDHV with 4 years' experience as an ECO and Public Participation consultant.

CVs of the Environmental Team are provided in **Appendix A**.

## 2 SITE DESCRIPTION

### 2.1 Site Description and Ownership

The existing road cross-section is a single carriageway with 3,5 m wide lanes in each direction and 1,2 m wide shoulders on both sides. The existing road reserve is 30 m wide and all rehabilitation work will be undertaken within the road reserve. The road and associated reserve is wholly owned by the KZN DoT.

### 2.2 Co-ordinates

#### 2.2.1 Culvert

*Table 4: Co-ordinates of the Culvert to be Replaced*

Culvert Details	Watercourse(s) within 500m buffer	Culvert location
Culvert 1 at km 41,8	Channelled valley-bottom wetland	28°43'29.79"S 31°50'14.28"E

#### 2.2.2 Road Rehabilitation

*Table 5: Co-ordinates of the Road Rehabilitation Project (start, middle and end points)*

	Latitude	Longitude
Start	28°44'16.26"S	31°47'49.30"E
End	28°44'30.38"S	31°52'56.00"E

### 2.3 Description of the Sensitive Environments

#### 2.3.1 Watercourses

The proposed culvert upgrade associated with the rehabilitation of the P230 from km 37,0 to km 47,0, stands to measurably impact only one (1) channelled valley bottom wetland (W01) and a weakly seasonal river system (R01), triggering water use and the need for impact assessment (**Figure 4**).

Wetland Unit W02 (wetland seep) and Wetland Unit W03 (channelled valley-bottom wetland) are either located in adjacent micro-catchments or some distance upstream of the zone of impact. No impacts resulting from the construction and operation of the culvert are likely to be incurred by these watercourses.

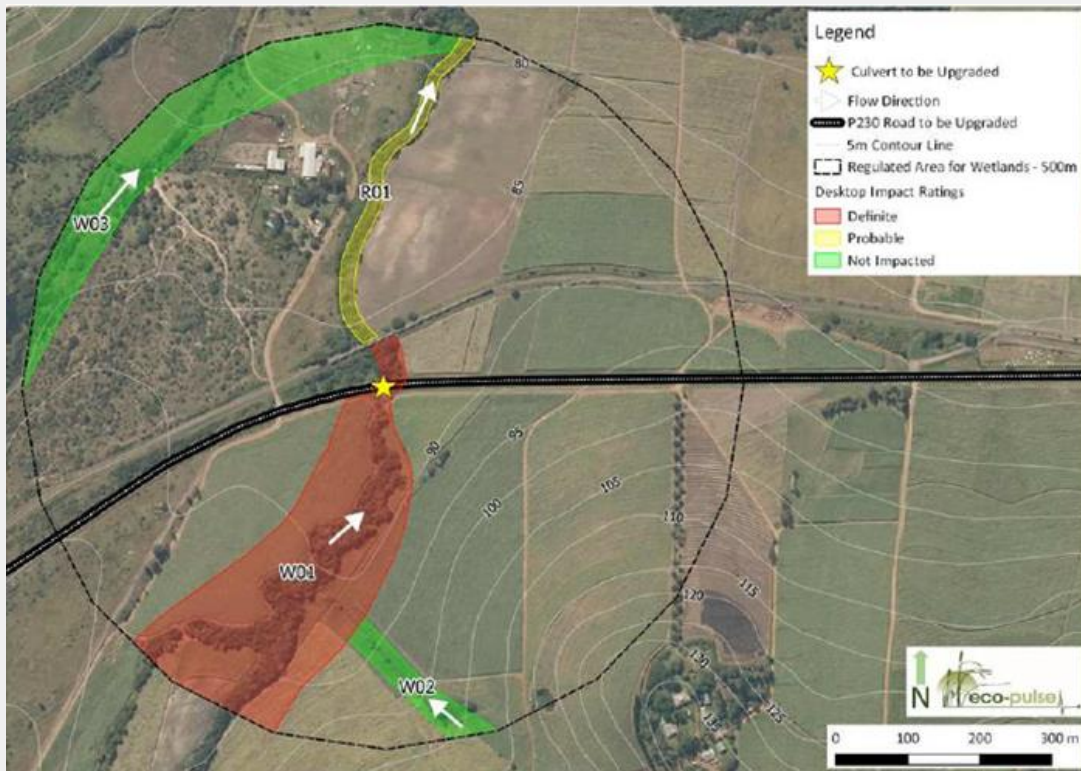


Figure 4: Map showing the impact screening and rating of desktop mapped watercourses within the 500m regulated area for wetlands in terms of section 21 c and/ or i water use (National Water Act)

### Biophysical Characteristics of Impacted Watercourses

Table 6: Summary of the Biophysical Description of River and Wetland Habitats Assessed

Unit	Classification	Description
W01	Valley-Bottom Wetland	<p><b>Hydrology:</b> Water inputs are mainly in the form of overland flow with some subsurface interflow from the upstream catchment supporting the wetland, and adjacent valley sides. Water generally moves through the wetland system as concentrated/channelled flow via a central channel.</p> <p><b>Vegetation/habitat:</b> The wetland comprises three different vegetation communities including (i) a secondary herbaceous marsh immediately upstream of the culvert, (ii) a wooded riparian community along the river channel and (iii) a cultivated sugarcane (<i>Saccharum officinarum</i>) plantation which covers a large portion of the wetland. The secondary herbaceous marsh comprises a mix of hygrophilous grasses, reeds, <i>Cyperus</i> species and a few ruderal forbs whilst the forested/wooded riparian community along the river channel comprises typical coastal indigenous trees such as <i>Syzygium cordatum</i>, <i>S. cumini</i>, <i>Phoenix reclinata</i>, <i>Rauvolfia caffra</i>, <i>Trema orientalis</i>, <i>Trichilia emetica</i> and <i>Bridelia micrantha</i>.</p> <p><b>Existing anthropogenic impacts:</b> included direct habitat loss associated with sugarcane cultivation within and adjacent to the wetland, sedimentation of the river channel due to blockage of a small culvert on an agricultural road, erosion of the river channel below the P230 culvert and some limited Invasive Alien</p>

Unit	Classification	Description
		Plant (IAP) infestation.
R01	Weakly Seasonal River	<p><b>Hydrology and channel morphology:</b> The river was characterised by near vertical banks and ephemeral to weakly seasonal flows driven principally by upstream water inputs.</p> <p><b>Vegetation/habitat:</b> The instream habitat comprised a few forbs mainly <i>Plectranthus</i> species established along the edges of the active channel. Channel banks were characterised by a wooded riparian community (lowland riverine forest) comprising the following indigenous trees: <i>Phoenix reclinata</i>, <i>Rauvolfia caffra</i>, <i>Trema orientalis</i>, <i>Trichilia emetica</i>, <i>Syzygium cordatum</i>, <i>S. cumini</i> and <i>Bridelia micrantha</i>.</p> <p><b>Existing anthropogenic impacts:</b> included channel incision (particularly channel widening and deepening) and limited encroachment by invasive alien trees such as <i>Melia azedarach</i> and <i>Eucalyptus</i> sp.</p>

### Provincially Protected Plants and Protected Trees

A single protected plant species (*Crinum* sp.) was identified within Wetland Unit W01 (GPS Coordinates 28° 43' 29.46" S, 31° 50' 14.89" E). In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974 an Ordinary Permit is required to handle the *Crinum* plant (i.e. to handle, remove, destroy, damage, and relocate the specimen). An ordinary permit can be obtained from eZemvelo KZN Wildlife (EKZNW) for this purpose.





Figure 5: Map indicating the location of the protected *Crinum sp.* Identified near the site of the culvert replacement that requires a permit to handle the plant species.

## 2.4 Sensitivity Map

The overall sensitivity map is included in Figure 6.



Figure 6: Sensitivity map

### 3 LEGAL FRAMEWORK

#### 3.1 Legal Framework

##### 3.1.1 EIA Regulations (2014 as amended in 2017)

The potential environmental impacts associated with this proposed project are required to be considered in compliance with (EIA) Regulations (2014 as amended in 2017) made under Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

The first facet of the advisory process as provided by Royal HaskoningDHV was to determine whether the activity under consideration triggered an environmental legislation specific permitting process. In this regard, an Environmental Screening exercise was undertaken to determine (a) whether the proposal requires an environmental assessment and authorisation by a Competent Authority; and (b) the level of the environmental assessment required.

The Competent Authority i.e. the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) confirmed that **Activity 19 of Listing Notice 1** is applicable:

**Activity 19** - The infilling or depositing of any material of more than 10 m<sup>3</sup> into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 m<sup>3</sup> from a watercourse.

EDTEA also confirmed that since the rehabilitation of the road (i.e. bulk earthworks, layerworks, surfacing and ancillary works) did not trigger any listed activities, these activities could proceed whilst the Basic Assessment (BA) study for the culvert replacement is being undertaken.

### 3.1.2 National Water Act (Act No. 36 of 1998)

As the proposed development impacts a channelled valley bottom wetland (W01) and a weakly seasonal river system (R01), a Water Use Authorisation is required in terms of Section 21 (c) and (i) of the National Water Act (Act No. 36 of 1998):

- **Section 21(c)** - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and
- **Section 21 (i)** - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).

### 3.1.3 Other Relevant Legislation / Policies / Guidelines

**Table 7: Legislative Requirements<sup>1</sup>**

Legislation	Sections	Relates to
The Constitution (No. 108 of 1996)	Chapter 2	Bill of Rights.
	Section 24	Environmental rights.
National Environmental Management Act (Act No. 107 of 1998 [as amended])	Section 2	Defines the strategic environmental management goals and objectives of the government. Applies through-out the Republic to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The Developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
EIA Regulations (2014 as amended in 2017)	GNR983	Activities requiring a Basic Assessment study to be undertaken.
	GNR984	Activities requiring a Scoping and Impact Assessment study to be undertaken.
	GNR985	Activities in special geographical areas requiring a Basic Assessment study to be undertaken.
National Forests Act (Act No. 84 of 1998) and Regulations	Section 7	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	Schedule 12	Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation.

<sup>1</sup> It is noted that the legal framework provided in this document relates to the most recent legislation at the time of compiling this document. It is noted that legislation changes continuously and it is the Developer's responsibility to ensure that they are compliant with the most relevant legislation at any given time.



Legislation	Sections	Relates to
		In KwaZulu-Natal the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from Ezemvelo KZN Wildlife to remove or destroy any plants listed in the Ordinance.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)		Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.
<ul style="list-style-type: none"> <li>Threatened or protected species (GN 388)</li> </ul>	Section 53	Protection of threatened or protected ecosystems.
	Section 65	Control of alien species.
<ul style="list-style-type: none"> <li>Lists of species that are threatened or protected (GN 389)</li> <li>Alien and invasive species regulations (GNR 506)</li> <li>Publication of exempted alien species (GNR 509)</li> <li>Publication of National list of invasive species (GNR 507)</li> <li>Publication of prohibited alien species (GNR 508)</li> </ul>	Section 71	Control of invasive species.
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 NEM:PAA, or customized regulations for individual protected areas.
National Waste Act (Act No. 59 of 2008) and List of Waste Activities (November 2013)		Provides for specific waste management measures and the remediation of contaminated land.
Norms and Standards for the Storage of Waste, 2013	GNR 926 – Sections 7 – 20	Provides specific guidelines for the operational procedures for a facility for the storage of waste.
National Heritage Resources Act (Act No. 25 of 1999) and regulations	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

Legislation	Sections	Relates to
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), not already covered under the environmental law. Where covered under such law the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The HIA is thus approved under the environmental authorisation, which must take into account the provincial heritage resources authorities' comments prior to making a decision on the HIA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Section 34	Control of noise.
	Section 35	Control of offensive odours.
National Dust Control Regulations (GNR 827 of November 2013)		Control of dust.
Occupational Health and Safety Act (Act No. 85 of 1993)	Section 8	General duties of employers to their employees.
	Section 9	General duties of employers and self-employed persons to persons other than their employees.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Section 22 / 27	Application for a mining right / permit.
	Section 39	Environmental management programme and environmental management plan.
Hazardous Substances Act (Act No. 15 of 1973) and regulations		Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.
National Road Traffic Act (Act No. 93 of 1996)		Road safety.
SANS 10103 (Noise Regulations)		The measurement and rating of environmental noise with respect to annoyance and to speech communication.

Legislation	Sections	Relates to
Relevant By-laws King Cetshwayo District Municipality IDP (2016 – 2017) uMhlathuze Local Municipality Final IDP review 2016/2017 uMhlathuze Local Municipality Spatial Development Framework (2016/2017)		

### 3.2 Applicable Documentation

The following environmental documentation is applicable for the project, and must be read in conjunction with this EMPr:

- Environmental Authorisation (EA) – *once issued*;
- Final Approved Consultation Basic Assessment Report for the project;
- Water Use Authorisation– *once issued*;
- *eZemvelo* KZN Wildlife Permits for the removal / relocation of indigenous plants – *once issued*;
- Stormwater Management Plan

Once the relevant authorisations and / or permissions have been obtained, these must be appended to this EMPr and kept on site.

## 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 ECO (as appointed) to ensure that each contractor, sub-contractor and workforce understand and adhere to the Code of Conduct.

### 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!**

#### Environmental Rules

- Do not waste electricity, water or consumables;
- Only use authorised accesses;
- Do not litter;
- Dispose 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 in the sand;
- 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 procedures.

## 5 MANAGEMENT AND MONITORING PROCEDURES

### 5.1 Organisational Structure and Responsibilities

KZN DoT is the Primary Developer for the Project. It is noted that KZN DoT and their respective professional project teams, are responsible for the rehabilitation works.

Each of the team roles are elaborated on in terms of their specific duties hereafter.

The following outlines the defined and specific roles and responsibilities of each team member:

**Table 8: Roles and Responsibilities**

ROLES AND RESPONSIBILITIES
<b>DEVELOPER</b>
<p>The Developer is ultimately responsible for ensuring compliance with the environmental specification and upholding KZN DoT's environmental commitment to 100% compliance with all National, Provincial and local legislation that relates to management of the environment.</p> <p>The Developer will:</p> <ul style="list-style-type: none"> <li>▪ Appoint a Project Manager (PM) to assume ultimate project responsibility;</li> <li>▪ Be familiar with the contents of the EMPr;</li> <li>▪ Ensure the EMPr is in the tender documentation issues to prospective Contractors;</li> <li>▪ Request for, review and approve the method statements prepared by the Contractor;</li> <li>▪ Review and comment on environmental assessments and / or reports produced by the Contractor and ECO;</li> <li>▪ Undertake regular site visits and ensure environmental specifications are implemented;</li> <li>▪ Discuss with the ECO the application of penalties for the infringement of the Environmental Specifications, another possible enforcement measures necessary;</li> <li>▪ Issue penalties as and when necessary;</li> <li>▪ Arrange information meetings for or consults with I&amp;APs about the impending construction activities;</li> <li>▪ May on the recommendation of the engineer and / or SHE 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;</li> <li>▪ Maintain a register of complaints and queries by members of the public at the site office; and</li> <li>▪ Ensure the EMPr is implemented as well as revised and updated as and when required.</li> </ul>
<b>ENGINEER</b>
<p>The Engineer will:</p> <ul style="list-style-type: none"> <li>▪ Enforce the environmental specification on site;</li> <li>▪ Be familiar with the contents of the EMPr;</li> <li>▪ Ensure the EMPr is in the tender documentation issued to prospective Contractors;</li> <li>▪ Request for, review and approve the method statements prepared by the Contractor;</li> <li>▪ Review and comment on environmental assessments and / or reports produced by the Contractor and ECO;</li> <li>▪ Undertake regular site visits and ensure environmental specifications are implemented;</li> <li>▪ Monitor compliance with the requirements of the specification;</li> <li>▪ Assess the Contractor's environmental performance in consultation with the SHE Officer from which a brief monthly statement of environmental performance is drawn up for record purposes and to be reported to project meetings; and</li> <li>▪ Ensure the documentation, in conjunction with the Contractor, the state of the site prior to construction activities commencing. This documentation will be in the form of photographs or video record.</li> </ul>

## ROLES AND RESPONSIBILITIES

### CONTRACTOR (INCLUDING SUB-CONTRACTORS)

The Contractor is required to:

- Be fully conversant with the EMPr;
- Implement, manage and maintain the EMPr for the duration of the contract;
- Appoint a suitably qualified SHE Officer whose responsibility includes on-going monitoring and control of all construction activities concerning minimisation of environmental impact and adherence to the EMPr for the duration of the project;
- Provide information on previous environmental management experience and company environmental policy 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 Developer, SHE Officer and / or engineer during the duration of the Contract.
- Comply with requirements of the EMPr and any subsequent revisions in terms of this specification and the project specification, as applicable, within the time period specified.
- 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 will be held responsible for non-compliance on their behalf;
- Provide appropriate resources - budgets, equipment, personnel and training - for the effective control and management of the environmental risks associated with the construction of the development;
- Bear the cost of any delays, with no extension of time granted, should he or his sub-contractors / suppliers contravene the said specifications such that the engineer orders a suspension of work. The suspension will be enforced until such time as the offending party(ies), procedure, or equipment is corrected;
- Bear the costs of any damages / compensation resulting from non-adherence to the said specifications or written site instructions;
- Review ECO reports and take cognisance of the information / recommendations contained therein;
- Comply with all applicable legislation;
- Ensure that he informs the Engineer timeously of any foreseeable activities which will require input from the SHE Officer;
- Notify the ECO and PM, verbally and in writing at least 10 working days in advance of any activity he has reason to believe may have significant adverse environmental impacts, so that mitigatory measures may be implemented timeously;
- Ensure environmental awareness among his employees, sub-contractors and workforce so that they are fully aware of, and understand the Environmental Specifications and the need for them;
- Maintain a register of environmental training for site staff and sub-contractor's staff for the duration of the contract; and
- Communicate and liaise frequently and promptly with the ECO and the PM to ensure effective, proactive environmental management with the overall objective of preventing or reducing negative environmental impacts while enhancing positive environmental impacts.
- The Contractor will conduct all activities in a manner that minimises disturbance to the natural environment as well as directly affected residents and the public in general.
- The primary Contractor assumes responsibility and accountability of all appointed sub-contractors and must ensure their compliance with this EMPr.

## ROLES AND RESPONSIBILITIES

### ENVIRONMENTAL CONTROL OFFICER

The ECO will:

- Be familiar with the recommendations and mitigation measures of the associated EMPr for the project;
- Monitor the implementation of the EMPr during the pre-construction, maintenance and rehabilitation phases;
- Ensure site protection measures are implemented on-site;
- Monitor that the Principal Contractor, sub-contractors, construction teams and the Developer are in compliance with the EMPr at all times during the pre-construction, maintenance 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 Developer / Contractor;
- Attend monthly site meetings;
- 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 prescriptions; and
- Conduct once-off training with the Contractor on the EMPr and general environmental awareness.

***It must be noted that the responsibility of the ECO is to monitor compliance and give advice on the implementation of the EMPr and not to enforce compliance. Ensuring compliance is the responsibility of the Developer, Contractor and the SHE Officer.***

### SAFETY, HEALTH AND ENVIRONMENTAL (SHE) OFFICER

The Safety, Health and Environmental Officer will:

- Be fully conversant with the EMPr;
- Be fully conversant with all relevant environmental legislation applicable to the project, and ensure compliance with them;
- Compilation of method statements together with the Principal 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;
- Undertake regular and comprehensive inspection of the site and surrounding areas in order to monitor compliance with the EMPr;
- Take appropriate action if the specifications contained in the EMPr are not followed;
- Monitor and verify that environmental impacts are kept to a minimum, as far as possible;
- Order the removal from the construction site of any person(s) and / or equipment in contravention of the specifications of the EMPr;
- Report any non-compliance or remedial measures that need to be applied to the appropriate environmental authorities, in line with the requirements of the EMPr;
- Submitting a report at each site meeting which will document all incidents that have occurred during the period before the site meeting;
- 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 incidents which occur on the site during construction.



## 5.2 Monitoring

A monitoring programme will be in place not only to ensure compliance with the EMPr through the contract / work instruction specifications, 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 will be implemented for the duration of the construction phase of the project. This programme will include:

- Monthly audits will be conducted by the ECO for the duration of the maintenance activities including rehabilitation – the ECO shall undertake this environmental monitoring with the audits considering compliance with the EMPr.
- On-going monitoring is to be undertaken by the Contractor's SHE Officer – this will include notification to the ECO should an incident take place.
- External auditing may take place at unspecified times by the authorities and / or other relevant authorities.
- The Contractor's SHE Officer must undertake regular site inspections (at least twice weekly) to ensure all legislative requirements are adhered to.

## 5.3 Reporting Procedures

### 5.3.1 Documentation

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

- An Environmental File which includes:
  - Copy of the EMPr;
  - Copy of relevant legislation;
  - Environmental Policy of the main Contractor;
  - Environmental method statements compiled by the Contractor;
  - Non-conformance Reports;
  - Environmental register, which shall 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; and
    - Incident book – including copies of notification of Emergencies and Incidents, this must be accompanied by a photographic record.
  - Waste Documentation such as, but not necessarily limited to: Waste Manifest Documents, Safe Disposal Certificates (SDCs) and Sewerage Disposal Receipts;
  - Material Safety Data Sheets (MSDSs) for all hazardous substances;
  - Dust suppression register;
  - Written Corrective Action Instructions; and
  - Notification of Emergencies and Incidents.

### 5.3.2 Environmental Register

The Developer will put in place an Environmental Register. The Contractor will ensure that the following information is recorded for all complaints / incidents:

- Nature of complaint / incident.
- Causes of complaint / incident.
- Party / parties responsible for causing complaint / incident.



- Immediate actions undertaken to stop / reduce / contain the causes of the complaint / incident.
- Additional corrective or remedial action taken and / or to be taken to address and to prevent reoccurrence of the complaint / incident.
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions.
- Procedures to be undertaken and / or penalties to be applied if corrective or remedial actions are not implemented.
- Copies of all correspondence received regarding complaints / incidents.

The above records will form an integral part of the Contractor's records. These records will be kept with the EMPr, and will be made available for scrutiny if so requested by the Developer.

### 5.3.3 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 issue. 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.

### 5.3.4 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 damage to existing utilities e.g. sewer and water pipelines;
- 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 shall 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) shall 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.

### **5.3.5 Public Communication and Liaison with I&APs**

The Developer must ensure that the adjacent landowners are informed and updated throughout the construction phases.

Sufficient 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.

## 6 ENVIRONMENTAL AWARENESS PLAN

The Developer is committed to promoting and implementing sustainability throughout their operations. As part of this commitment, the Developer recognises the importance of making all employees aware of the potential environmental impacts that could result from conducting their jobs and how this potential can be minimised through effective training. Environmental awareness to the employees of the project will be provided by implementing environmental awareness training in the following forums:

- Toolbox Talks (Weekly)
- Environmental Awareness Courses (*Ad hoc*)
- EMPr Awareness (as and when required)

The above mentioned awareness activities will be used to share information and to ensure that all personnel are aware of the environment in which they operate and what environmental aspects require attention during their daily operations / activities / tasks. Additionally, personnel awareness training will be undertaken if and when required to strengthen the personnel's understanding of environmental issues.

The method and medium of communication during the environmental meetings will be determined by the SHE Officer facilitating the meetings. The topics discussed in meetings will be recorded, with all employees present signing an attendance register. As potential environmental impacts differ in each department of the operation, the environmental topics selected for discussion can either be:

- General topics that are applicable to the entire activity;
- Area specific topics as identified in the impacts on the receiving environment;
- Topics that can be "taken home" and implemented off-site.

### 6.1 General Topics

There are a number of environmental impacts resulting from the proposed project. General topics include, but are not limited to, the following:

- Water consumption and conservation;
- Dust generation related impacts (including health-related) ;
- Noise generation and related impact (including health-related);
- Domestic waste minimisation and recycling;
- Practical training regarding the clean-up of major and minor hydrocarbon spills / use of spill management kit;
- Practical training on using a fire extinguisher;
- Social awareness and HIV/AIDS education;
- Alien vegetation identification and removal, and the importance of indigenous vegetation.

### 6.2 Activity Specific Topics

Some activities may have environmental impacts that are unique to each area. These must be addressed in the SHEQ meetings. Area specific topics include and some of these topics may be a repeat of those covered under general topics.

- Protection of water resources;
- Stormwater management;
- Potential for water pollution and the related impacts;
- Identification and management of erosion;
- Vehicle emissions and related impacts (including health related);
- Practical training regarding the clean-up of major and minor hydrocarbon spills;
- The importance of the waste management system and implementing good housekeeping;

- Dust generation and why and how to reduce dust; and
- Biodiversity interaction awareness.

### **6.3 Take-home Topics**

Environmental awareness should not stop at the work place. Many of the concepts learned at work can be applied to employees' life style at home. Topics that can be covered under "take home topics" include, but are not limited to:

- Water consumption and conservation, and;
- Domestic waste minimisation and recycling - "Reduce, Reuse and Recycle".

## 7 REHABILITATION ACTIVITIES DESCRIPTION & PROGRAMME

The construction programme is expected to be 18 months, commencing in November 2017 if all the necessary approvals are obtained on time.

Main Tasks	Key Activities	Construction Programme (Commencement and Duration)
Site establishment	<ul style="list-style-type: none"> <li>▪ Establishment of the Contractor's site camp, including the provision of office and laboratory facilities for the Engineer.</li> <li>▪ Provision of traffic accommodation facilities.</li> <li>▪ Clearing and grubbing works.</li> </ul>	Month 1
Layerworks rehabilitation	<ul style="list-style-type: none"> <li>▪ Drilling and blasting in the necessary cuttings using controlled blasting techniques.</li> <li>▪ Construction of new layerworks for the lower selected subgrade layer (where applicable), upper selected subgrade layer, subbase layer, stabilised base layer and shoulders for the 8,5 m wide surfaced road.</li> <li>▪ Excavation in soft and intermediate materials to provide G8 and G7 selected subgrade materials where such material classes are encountered.</li> <li>▪ Crushing of hard rock material to provide G8 and G7 selected subgrade materials.</li> <li>▪ Crushing and screening of hard rock material to provide G5 subbase and G5 base materials (both crushed to a G4 grading).</li> <li>▪ Provision of G5 crushed stone base material (crushed to a G4 grading) obtained from commercial sources should the quantity of G5 material produced by the on-site crushing operation prove insufficient.</li> <li>▪ The stabilised C3 (G5) base shall be primed then paved with a 40 mm asphalt surfacing.</li> <li>▪ The access points to the properties on either side of the road shall generally be formalised by means of concrete edge beams.</li> </ul>	Months 2 – 12
Drainage works	<ul style="list-style-type: none"> <li>▪ The extensive daylighting and removal of vegetation and silt to the</li> </ul>	Months 2 -12

Project related



Main Tasks	Key Activities	Construction Programme (Commencement and Duration)
	existing drainage system. <ul style="list-style-type: none"> <li>▪ The re-construction of drainage structures, headwalls and improvements to side-drains plus formation of new meadow drains</li> </ul>	
Rehabilitation of culvert	<ul style="list-style-type: none"> <li>▪ Construction of box culvert:</li> </ul>	Each culvert will require 1 month for the decommissioning of the existing structure and 3 months for the construction of the new structure.
Post roadwork and culvert construction rehabilitation	<ul style="list-style-type: none"> <li>▪ Grass sodding and hydroseeding (where applicable) to protect the cut and fill slopes where required, and to reinstate the vegetation at spoil, stockpile and borrow areas.</li> <li>▪ The application of road markings and road studs.</li> <li>▪ Finishing and cleaning up of the road and road reserve.</li> <li>▪ The erection of new road signs, guardrails and hazard plates at all the culvert crossings.</li> <li>▪ Removal of all site establishment facilities and constructional plant on completion of the works.</li> </ul>	Months 12 -14

## 8 IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

The EMPr specifies the minimum requirements to be implemented by the Developer as per the scope of works, in order to minimise and manage the potential environmental impacts and ensure sound environmental management practices. It also provides the framework for environmental monitoring throughout the maintenance activities including rehabilitation.

The provisions of this EMPr are binding on the Developer and their teams during the maintenance activities including rehabilitation. The EMPr must be binding to KZN DoT or any authority to which responsibility for the construction activities has been delegated to.

It is essential that the EMPr requirements be carefully studied, understood, implemented, and adhered to at all time.

To simplify the EMPr requirements, each aspect related to the EMPr has been addressed in the tables hereafter.

Each action within the EMPr is supported by the priority of when the specific action will need to be implemented. Each of these aspects is briefly described below (**Table 9**) for ease of reference.

**Table 9: Summary of Aspects included in the EMPr Tables**

### **ENVIRONMENTAL MEASURES, ACTIONS AND CONTROLS:**

This section indicates the actions required to either prevent and/or minimise the potential impacts on the environment that is associated with the project.

### **RESPONSIBILITY:**

This section indicates the party responsible for implementing the environmental measures and action plans laid out in the EMPr.

### **MONITORING FREQUENCY:**

This section indicates when the actions for that specific aspect must be implemented and/or monitored.

## 8.1 Pre-Construction (Planning & Design) Phase

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.1.1 Authorisations, Permits and Licences</b>		
All necessary authorisations, permits and licences must be obtained by the Developer prior to the commencement of construction (if required).	Developer	Once-off and On-going
All activities must comply with the EMPr.		
<b>8.1.2 Appointment of Contractor</b>		
The Developer must ensure that this EMPr forms part of any contractual agreements with a Contractor(s) and sub-contractors for the execution of the proposed project. The Contractor must make adequate financial provision in their budgets for the implementation of the EMPr.	Developer	Once-off
The principal Contractor (including sub-contractors and suppliers) must comply with the relevant provisions of the EMPr, applicable environmental legislation, by-laws and associated regulations promulgated in terms of these laws.		
Tender documents must include statements which include the use of local communities or local community organisation(s) in supplying services and labour for the construction activities. The Contractor must appoint a CLO (Community Liaison Officer).		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.1.3 Monitoring</b>		
<p>The monitoring by the ECO must be extensive and inclusive; this involves the monitoring of construction-related impacts as identified. Regular monitoring of the construction activities is critical to ensure that any problems with are picked up in a timeous manner. In this regard, the following potential concerns must be taken into consideration:</p> <ul style="list-style-type: none"> <li>▪ Destruction of habitat outside the construction area including 'No-go' areas (limited to 10 m on either side of development footprint);</li> <li>▪ Erosion of the bed and banks of water resources;</li> <li>▪ Signs of intense or excessive erosion (gullies, rills, scouring and headcuts) and / or sedimentation within, along the edge and/or immediately downstream of the construction zone;</li> <li>▪ Erosion of disturbed soils and soil stockpiles by surface wash processes;</li> <li>▪ Sedimentation of aquatic habitats downstream of work areas;</li> <li>▪ Altering the hydrology and through flows to downstream habitat during construction across rivers / streams / wetlands;</li> <li>▪ Pollution of water resources (with a particular focus on water turbidity and hazardous substances such as fuels, oils and cement products);</li> <li>▪ Poorly maintained and damaged erosion control measures e.g. sandbags, silt fences and silt curtains; and</li> <li>▪ Evidence of unsafe working conditions (e.g. evidence of flow overtopping the bund wall / running tracks).</li> </ul>		
<b>8.1.4 Public Communication</b>		
<p>The Developer must ensure that the adjacent landowners are informed and updated throughout the construction phases. Sufficient signage must be erected around the site (including at the entrance), informing the public of the construction activities taking place.</p> <p>The signboards must include the following information:</p> <ul style="list-style-type: none"> <li>▪ The name of the Contractor.</li> <li>▪ The name and contact details of the site representative to be contacted in the event of emergencies or complaint registration.</li> </ul>	Contractor / ECO	Once-off
<p>A formal communications protocol should be set up during this phase. The aim of the protocol is to ensure that effective communication on key issues that may arise during construction is maintained between key parties such as the ECO, SHE Officer and Contractor. The protocol should also ensure that concerns / issues raised by I&amp;APs are formally recorded and considered and where necessary acted upon. If necessary, a forum for communicating with key stakeholders on a regular basis may need to be set up. The</p>		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
communications protocol should be maintained throughout the construction phase.		
<b>8.1.5 Protected Plants</b>		
<ul style="list-style-type: none"> <li>▪ Before any work commences sediment control / silt capture measures ( e.g. bidim /silt curtains ) must be installed downstream of the working areas specifically above the pool habitats. A minimum of 3 rows of silt fences / curtains must be installed across the river / stream channel established at regular intervals.</li> <li>▪ Prior to the stripping, infilling, excavation and re-shaping of the aquatic habitat within the development footprint / corridor, a plant search and rescue must be undertaken prior to habitat destruction.</li> <li>▪ This must be followed by harvesting of all robust indigenous hygrophilous vegetation for later use during re-vegetation. In this regard, a wetland / aquatic ecologist must guide the contractor on the plants to rescue prior to clearing.</li> <li>▪ No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).</li> <li>▪ In accordance with the provisions of the Natal Nature Conservation Ordinance of 1974, an Ordinary Permit from EKZNW is required to handle the <i>Crinum</i> sp. plant identified within Wetland Unit W01 (GPS Coordinates 28° 43' 29.46" S, 31° 50' 14.89" E).</li> </ul>	Contractor, ECO, Ecologist,	Once-off
<b>8.1.6 Demarcation of the Construction Servitude</b>		
<ul style="list-style-type: none"> <li>▪ The construction servitude must be limited to the proposed development footprint and a 10 m working servitude either side thereof. This working servitude must accommodate all construction-related activities, including materials storage and access routes. 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.</li> <li>▪ Maintain site demarcations in position until the cessation of construction works.</li> <li>▪ The location of stockpile areas, site camps and equipment laydown areas must be agreed to and demarcated to the satisfaction of the ECO prior to the clearing. A recommended setback distance of at least 30 m from the active river channel edge is recommended.</li> <li>▪ All areas outside (including up-stream and downstream) of this demarcated construction servitude must be considered 'No-Go' areas. Any contractors found working inside the no-go areas should be fined as per fining schedule / system setup for the project.</li> <li>▪ The demarcation work must be signed off by the ECO before any work commences</li> </ul>	Engineering team ECO	Once-off

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul style="list-style-type: none"> <li>Do not paint or mark any natural feature. Marking for surveying and other purposes must be done using pegs, beacons or rope and droppers.</li> </ul>		

## 8.2 Construction Phase

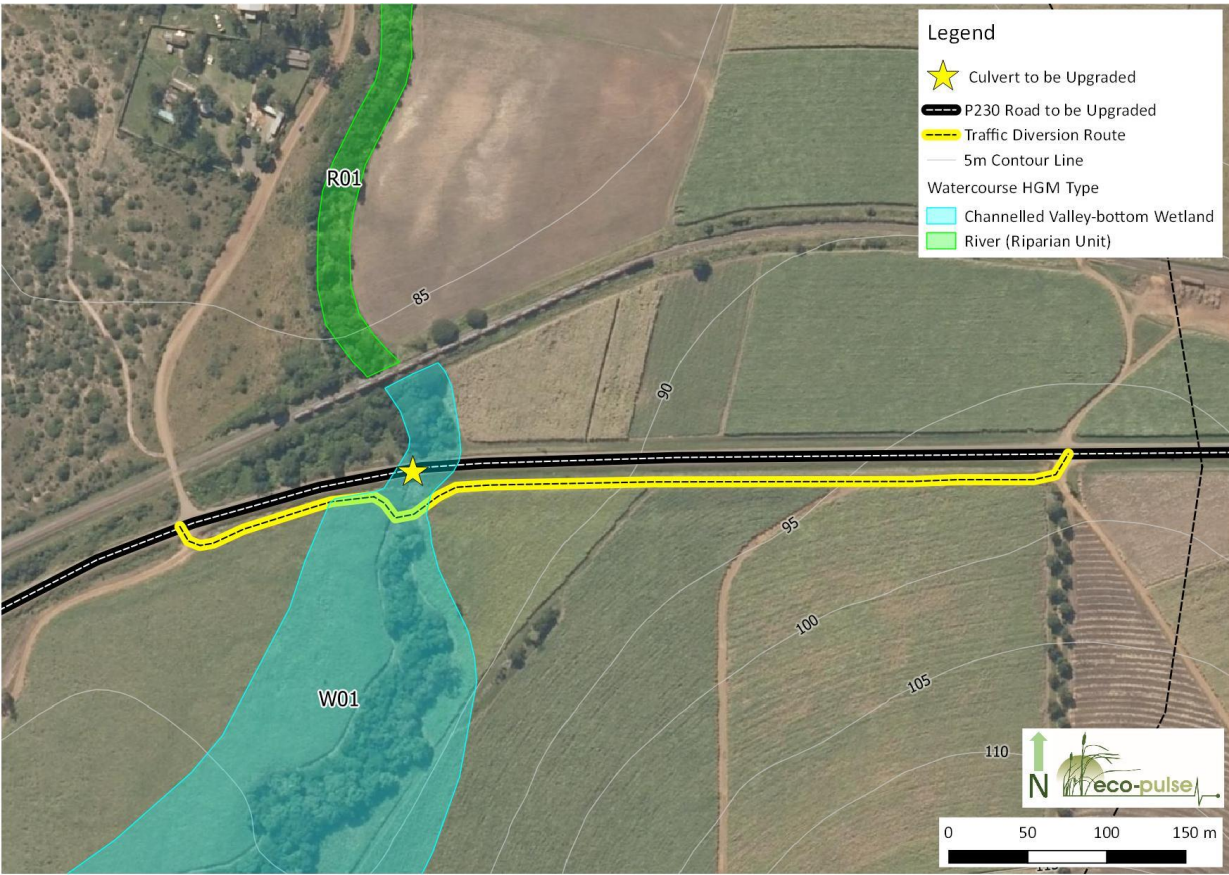
ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.2.1 Site Preparation &amp; Site Offices</b>		
<ul style="list-style-type: none"> <li>Vegetation removed for any additional construction camp establishment must be kept to a minimum. No trees are to be removed with the exception of alien weeds and invader plants identified and approved by the SHE Officer and ECO.</li> <li>The size of the construction camp must be minimised.</li> <li>Adequate yet not extensive parking must be provided for site staff and visitors at the construction camp with the intention to disturb as little grassland as possible.</li> </ul>	Contractor SHE Officer ECO	Once-off
<ul style="list-style-type: none"> <li>The construction areas must be kept in an orderly state at all times.</li> <li>Unauthorised entry, stockpiling, dumping or storage of equipment, material or waste must be strictly prohibited in identified No-go areas.</li> <li>The Contractor must ensure that drainage on-site is such to prevent standing water and/or sheet erosion from taking place or that it is not altered even temporarily which adversely impacts on drainage.</li> <li>Unauthorised access onto / into private properties is strictly prohibited.</li> </ul>	Contractor	Weekly
<b>8.2.2 Pollution Prevention Measures</b>		
<ul style="list-style-type: none"> <li>The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) must to be administered. Storage containers must be regularly inspected to prevent leaks and all hazardous storage must take place in a bunded area or within drip trays to prevent soil/water contamination.</li> <li>Material Safety Data Sheets (MSDSs) must be readily available on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes.</li> <li>Mixing and / or decanting of all chemicals and hazardous substances must take place on trays, shutter boards or on impermeable surfaces and must be protected from the ingress and egress of stormwater.</li> <li>Drip trays should be utilised at all dispensing areas.</li> </ul>	Contractor SHE Officer	Daily

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<ul style="list-style-type: none"> <li>▪ No refuelling, servicing or chemical storage should occur within 50 m of the delineated watercourse habitat or within the 100-year flood line, whichever is applicable.</li> <li>▪ No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site.</li> <li>▪ Vehicle maintenance must not take place on site unless a specific bunded area with an oil filter trap is constructed at the site camp for such a purpose.</li> <li>▪ Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations must be implemented in the event of an accidental spillage.</li> <li>▪ If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil / water contamination. The drip tray must be lined with absorbent pads and checked daily while in use.</li> <li>▪ All equipment to be used within the sensitive working areas (within the watercourses) must be checked daily for oil and diesel leaks before gaining access to these working areas.</li> <li>▪ Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor.</li> <li>▪ Workers need to be encouraged to use toilet facilities provided and not the natural environment.</li> <li>▪ Toilets must not be located within the 1:100 year flood line of a watercourse or closer than 50 m or from any natural water bodies including rivers, streams, riparian areas and wetlands.</li> <li>▪ Any spill incident, which may occur, must be investigated and immediate action must be taken. This must also be reported to the ECO and SHE Officer.</li> <li>▪ An emergency spill response procedure must be formulated and staff is to be trained in spill response.</li> <li>▪ In the case of a spill of hydrocarbons, chemicals or bituminous material in the construction camp or on the construction-site / bunding area, the spill must be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk and reduce bunding capacity.</li> <li>▪ Should a pollution incident occur on-site, the Contractor must:               <ul style="list-style-type: none"> <li>○ Implement reasonable measures immediately to contain and minimise the impacts of the incident;</li> <li>○ Contain the spill;</li> <li>○ Notify all persons whose health may be affected by the incident;</li> <li>○ Undertake clean up procedures immediately;</li> <li>○ Notify the Contractor of the incident immediately who will advise the employee as to the measures that must be implemented;</li> <li>○ Record the incident in the Environmental Incident Register; and</li> <li>○ Implement measures to prevent similar incidents from occurring in the future.</li> </ul> </li> </ul>		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.2.3 Worker Conduct on-site</b>		
<p>A general regard for the social and ecological wellbeing of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules:</p> <ul style="list-style-type: none"> <li>▪ No alcohol / drugs to be present on the site.</li> <li>▪ No firearms allowed on-site or in vehicles transporting staff to and from site, unless used by security personnel.</li> <li>▪ Prevent excessive noise.</li> <li>▪ Prevent unsocial behaviour.</li> <li>▪ Bringing pets onto the site is forbidden.</li> <li>▪ No harvesting of firewood from the site or from the areas adjacent to it.</li> <li>▪ Construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bush for toilet facilities).</li> <li>▪ Trespassing on private properties adjoining the site.</li> <li>▪ Driving under the influence of alcohol is prohibited.</li> </ul>	Contractor SHE Officer	Daily
<b>8.2.4 Clearing and Protection of Vegetation</b>		
No natural vegetation is to be collected for use as firewood.		
No animals are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason.		
Any wildlife that is injured or killed on the site by accidental means i.e. hit by a vehicle, are to be reported to the Developer, who must take appropriate action to facilitate the recovery of the animal where possible i.e. take the animal to the SPCA.		
<ul style="list-style-type: none"> <li>▪ Before any work commences, sediment control/silt capture measures (e.g. bidim / silt curtains) must be installed downstream of the working areas, specifically above the pool habitats. A minimum of 3 rows of silt fences / curtains must be installed across the river / stream channel established at regular intervals.</li> <li>▪ 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.</li> <li>▪ This must be followed by harvesting of all robust indigenous hygrophilous vegetation for later use during re-vegetation. In this regard, a wetland / aquatic ecologist must guide the contractor on the plants to rescue prior to clearing.</li> <li>▪ No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for fire wood or medicinal use).</li> </ul>	Contractor	Daily

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>All IAPs found, must be immediately removed and disposed of responsibly in accordance with the requirements of the ECO. No alien plants are permitted to be brought to site.</p> <p>Cleared areas must be planted with the present, indigenous grass sods as soon as is possible. All alien invasive vegetation that has colonised the construction-site must be removed, preferably by uprooting. The contractor must consult the ECO regarding the method of removal.</p> <p>All bare surfaces across the construction-site must be checked for IAPs every 2 weeks and alien plants removed by hand pulling / uprooting and adequately disposed.</p> <p>Herbicides must be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority to be used. The ECO must be consulted in this regard.</p> <p>Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas.</p> <p>Where IAPs have been introduced on to the site during clearing and infilling, they must be removed. The Contractor must develop an Action Plan for the removal of IAPs and submit it to the ECO for approval.</p> <p>Invader species and weeds must be removed and disposed of in accordance with existing legislation on a regular basis.</p> <p>The removal of indigenous / endemic shrubs and small trees must be kept to a minimum and only be removed if absolutely necessary and where authorisation has been received where applicable.</p>		
<b>8.2.5 Heritage</b>		
<p>If an artefact on-site is uncovered, work in the immediate vicinity must be stopped immediately.</p> <p>The Contractor must take reasonable precautions to prevent any person from removing or damaging any such article and must immediately, upon discovery thereof, inform the Construction Engineer of such discovery which in turn must contact a registered archaeologist and AMAFA.</p> <p>No structures older than sixty years or parts thereof are allowed to be demolished altered or extended without a permit from Amafa and no activities are allowed within 50 m of a site, which contains rock art.</p> <p>Work may only resume once clearance is given in writing by the archaeologist and/or AMAFA.</p>	Contractor	Daily
<b>8.2.6 Traffic and Safety</b>		
<p>Provision of traffic accommodation facilities including the use of half-width construction methods with STOP / GO traffic control. The traffic accommodation facilities must also include the use of traffic signals when the half-width of road under construction is to remain closed between sunset and sunrise. This applies to from the start of construction such time as the surfacing has been constructed above the base on that half-width work zone.</p> <p>Traffic must be diverted around the construction area (where necessary) using the proposed route highlighted</p>	Contractor	Daily



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>in the figure below. This should avoid unnecessary disturbance to more intact aquatic habitats in the area.</p>  <p><b>Figure 7: Map showing the proposed traffic diversion route</b></p> <p>Temporary loading and off-loading areas and holding of construction vehicles must be designed prior to construction activities to ensure that the most preferable access and haulage routes has been identified.</p> <p>Implement proper road signs to warn motorists of construction activities ahead.</p>		



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
Ensure that there are flag men and signs in place at access points to the construction-site.		
Road signs for all lane closures to be done in accordance to the South African Road Traffic Signs Manual (SARTSM, 1999).		
Construction routes must be clearly defined.		
Disruption to the peak traffic periods 06h00 – 9h00 and 15h00 – 18h00 to be minimised or if possible avoided.		
All contractors must ensure that their employees and in particular, construction vehicle drivers / operators comply with the safe access and egress plans that are to be put in place during the construction process. Appropriate warning and reduced speed signage must be erected where necessary.		
<b>8.2.7 Pedestrian Protection</b>		
Pedestrians to be protected from construction activities at all times.	Contractor	Daily
Pedestrian conflict with site access and construction vehicles to be managed by traffic officer.		
The construction camp must remain fenced for the entire construction period.		
<b>8.2.8 Construction Vehicles</b>		
Access of all construction and material delivery vehicles must be strictly controlled.	Contractor	Daily
Holding of all construction vehicles is to be controlled to ensure that through traffic is not unnecessarily impeded.		
Vehicles and equipment must be serviced regularly to avoid the contamination of the area from oil and hydraulic fluid leaks, etc.		
Servicing of vehicles must be done off-site.		
All speed limits must be adhered to.		
Machinery or equipment used on-site must not constitute a pollution hazard in respect of the above substances.		
The Contractor must order such equipment to be repaired or withdrawn from use if they consider the equipment or machinery to be polluting and irreparable.		
Suitably covered receptacles must be available at all times and conveniently placed for the disposal of waste. All used oils, grease or hydraulic fluids must be placed therein and these receptacles will be removed from the site on a regular basis for disposal at a registered or licenced disposal facility.		
<b>8.2.9 Road Maintenance</b>		
Contractors must ensure that the pedestrian walkway or holding areas are maintained in good condition by attending to any damages (e.g. road signs or stormwater damage, etc.) as soon as these develop.	Contractor	Daily

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
If necessary, staff must be employed to clean surfaced roads adjacent to construction-sites where materials have spilt.		
All temporary road signs to be removed and pavement reinstated at completion of works.		
All covered road signs to be reinstated.		
<b>8.2.10 Topsoil</b>		
The Contractor must strip and stockpile all topsoil within the work area for subsequent use at a later stage.		
The removal of any topsoil from site is prohibited and this must be stockpiled and used solely in the rehabilitation of the works area.		
Stockpiles must be located outside of the 32 m watercourse buffer.		
Stockpiles must be protected from wind and rain with the use of tarpaulins where necessary. The Contractor is to use his discretion as to the mechanism to be used to ensure this protection.		
Topsoil must be kept separate from overburden and must not be used for infilling.	Contractor	Daily
Noxious weeds must be eradicated from topsoil stockpiles.		
The Contractor must exercise suitable precautions with the storage, handling and transport of all materials that could adversely affect the environment.		
If pollution of any surface or groundwater occurs, it must immediately be reported to the DWS and appropriate mitigation measures must be employed.		
The topsoil and spoil material must be used to create stormwater attenuation berms and contour the topography accordingly, were required, rather than be spoiled.		
<b>8.2.11 Spoil</b>		
Litter and general waste is to be removed from the topsoil and spoil material before stockpiling.		
Spoil sites will be shaped to fit the natural topography.		
Erosion/sediment control measures such as silt fences, low soil berms or wooden shutter boards must be placed around the stockpiles to limit sediment run-off from stockpiles.		
Subsoil and topsoil is to be stockpiled separately. Stockpiled soil must be replaced in the reverse order as to which it was removed (subsoil first followed by topsoil).		
Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils.	Contractor	Daily
The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. The Contractor must, where possible, avoid stockpiling materials in vegetated areas that will not be cleared.		
Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled soil must be kept		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
moist using some form of spray irrigation on a regular basis as appropriate and according to weather conditions.		
The height of stockpiles must be limited to 2 m to avoid soil compaction and the destruction of micro-organisms		
Spoil sites must receive a minimum of 75 mm topsoil and be grassed with a recommended seed mixture by a qualified horticulturist.		
Slopes must not exceed a vertical: horizontal ratio of 1:3.		
The topsoil and spoil material must be used to create stormwater attenuation berms and contour the topography accordingly, were required, rather than be spoiled.		
<b>8.2.12 Soil Erosion and Sedimentation</b>		
Construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially on steep slopes.		
<ul style="list-style-type: none"> <li>▪ The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes.</li> <li>▪ All bare slopes and surfaces to be exposed to the elements of weather during clearing and earthworks must be protected against erosion using rows of silt fences and sandbags.</li> <li>▪ Sediment barriers such as berms, sandbags and / or silt fences must be monitored for the duration of the construction phase and repaired immediately when damaged.</li> <li>▪ Sediment barriers must only be removed once vegetation cover has successfully re-colonised the embankments.</li> <li>▪ After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately.</li> <li>▪ Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gully for additional protection until grass has re-colonised the rehabilitated area.</li> <li>▪ Where required sandbags must be used to retain banks vulnerable to collapse.</li> </ul>		
The natural flow of rivers or streams must not be permanently diverted or blocked.		
Maintain adequate through flows to downstream aquatic ecosystems to protect aquatic life, and prevent the interruption of existing downstream uses.		
Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities must be put on hold. In this regard, the contractor must be aware of weather forecasts.		
Subsoil and topsoil is to be stockpiled separately. Stockpiled soil must be replaced in the reverse order as to which it was removed (subsoil first followed by topsoil)		
The slope and height of stockpiles must be limited to 2 m to avoid collapse. If rehabilitation is undertaken		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>effectively and is signed off after successful indigenous vegetation re-establishment, the risks of these impacts must be minimised.</p> <p>Indigenous vegetation and topsoil cleared for the working area must be rescued and stored at the designated vegetation and soil stockpile area outside of the wetland/aquatic zone for use later in rehabilitation. In this regard, vegetation will need to be cleared in-situ (with sods/topsoil).</p> <p>The Contractor must, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. Stockpiled soils are to be kept free of weeds and are not to be compacted. The stockpiled soil must be kept moist using some form of spray irrigation on a regular basis as appropriate and according to weather conditions.</p> <p>Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils. The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area.</p>		
<p><b>8.2.13 Waste Management</b></p>		
<p>General Waste: General waste produced on-site is to be collected in skips for disposal at a registered landfill site. Hazardous waste in not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site.</p> <ul style="list-style-type: none"> <li>▪ Eating areas must not be located within 30 m of the watercourse habitats. Waste bins must be provided at the eating areas.</li> <li>▪ Under no circumstances is waste to be burnt or buried on-site. The excavation and use of rubbish pits on-site is forbidden.</li> <li>▪ Waste bins must be cleaned out on a regular basis to prevent any windblown waste and/or visual disturbance.</li> <li>▪ All general waste must be removed from the construction areas on a daily basis and disposed of in suitable waste receptacles. No general waste is to be disposed of on-site.</li> </ul> <p>Construction rubble:</p> <ul style="list-style-type: none"> <li>▪ Rubble generated from demolishing of existing infrastructure must be loaded onto a dump truck as soon as it is generated. A dump truck must be on standby while the culvert is being demolished.</li> <li>▪ No building material, soils or rubble is to be disposed of within any watercourse (wetland or river).</li> <li>▪ Once loaded onto a truck, the rubble must be taken to a landfill site and a waybill must be retained as proof of safe disposal.</li> <li>▪ Should rubble be required as a raw material for the construction, it must be taken to a designated stockpile area – which must be approved by the ECO.</li> </ul>	<p>Contractor SHE Officer</p>	<p>Daily</p>

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>Hazardous waste:</p> <ul style="list-style-type: none"> <li>▪ Hazardous waste produced on-site includes: Oil and other lubricants, diesel, paints, solvent; containers that contained chemicals, oils or greases; and equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen).</li> <li>▪ Hazardous waste is to be disposed of at a licenced hazardous waste landfill site.</li> <li>▪ No vehicles transporting asphalt, concrete or any other bituminous product may be washed on site.</li> <li>▪ Mixing and/or decanting of all chemicals and hazardous substances must take place on trays, shutter boards or on impermeable surfaces and must be protected from the ingress and egress of stormwater.</li> <li>▪ Drip trays should be utilised at all dispensing areas.</li> <li>▪ No refuelling, servicing or chemical storage should occur within 50 m of the delineated aquatic habitat or within the 100-year flood line, whichever is applicable.</li> <li>▪ Vehicle maintenance should not take place on site unless a specific bunded area with an oil filter trap is constructed at the site camp for such a purpose.</li> <li>▪ If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil/water contamination. The drip tray will need to be lined with absorbent pads and checked daily while in use.</li> <li>▪ All equipment to be used within the sensitive working areas (within the drainage channel) must be checked daily for oil and diesel leaks before gaining access to these working areas.</li> <li>▪ An emergency spill response procedure must be formulated and staff is to be trained in spill response. All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site.</li> <li>▪ The ECO must approve a licenced waste disposal site at the inception of the project.</li> <li>▪ Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid).</li> <li>▪ Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor.</li> <li>▪ SDCs must be obtained from the waste removal company as evidence of correct disposal and kept on-site within the Site Environmental File.</li> <li>▪ Transport of hazardous materials must be done in accordance with legislative control and Relevant SABS Codes of Practice must be adhered to.</li> </ul>		
<p><b>8.2.14 Wastewater</b></p>		
<ul style="list-style-type: none"> <li>▪ All wastewater generated at the proposed development must be disposed of in a suitable manner so as not to cause any surface or subsurface water pollution or health hazard.</li> <li>▪ Wastewater, including cement-contaminated water, must not enter any watercourse and must be</li> </ul>	<p>Contractor</p>	<p>Daily</p>

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>managed by the site manager to ensure that the existing water resources on and off site are not polluted by activities emanating from the above development.</p> <ul style="list-style-type: none"> <li>▪ Contaminated wastewater including cement-contaminated water must not enter any watercourse and must be managed by the Contractor to ensure that the existing water resources on- and off site are not polluted by activities emanating from the above development.</li> <li>▪ Used oil and wastewater must be disposed of at a registered facility. A SDC is to be obtained by the Contractor and kept on-site within the Site Environmental File.</li> <li>▪ Water containing waste must not under any condition be discharged into the natural environment. Measures to contain water containing waste and safe disposal of such must be implemented.</li> </ul>		
<p><b>8.2.15 Watercourse Management</b></p>		
<ul style="list-style-type: none"> <li>▪ Watercourses outside of the construction servitude that are disturbed during the construction phase must be rehabilitated immediately.</li> <li>▪ All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO as per the rehabilitation guidelines below.</li> <li>▪ Where stream channels have been disturbed, the channels must be re-graded (where necessary) and stabilised using geofabric and re-vegetated.</li> </ul>		
<p>No batching or chemical / fuel storage areas to be located within 50 m of watercourses.</p>		
<p>Water abstraction and use:</p> <ul style="list-style-type: none"> <li>▪ No water is to be abstracted from the river for use in construction activities without a Water Use Authorisation (WUA) in terms of <b>section 21 (a)</b> of the National Water Act</li> <li>▪ The Contractor shall only be allowed to draw water from the source/s indicated in the WUA.</li> <li>▪ Abstraction points should be carefully selected to minimize impacts to sensitive river biotopes.</li> <li>▪ Care is to be taken not to disturb the channel bed of watercourses during abstraction of water using suction pumps.</li> <li>▪ Locate the suction pump inlet at a sufficient height above the channel bed / floor where bed-load sediments accumulate.</li> <li>▪ Where necessary, install a suitable sediment filter / screen in front of the suction pump inlet to remove undesirable sediments, particles and debris from entering the pump.</li> <li>▪ Employees are not to make use of any natural water sources (e.g. rivers) for the purposes of swimming, bathing or washing of equipment, machinery or clothes.</li> <li>▪ Drinking water is to be provided to all employees and labourers must be discouraged from drinking directly from rivers on site.</li> </ul>		
<p>Adequate measures must be put in place to protect the water resources which flow in close proximity to the site. Visible markings showing the buffers demarcated must be provided during the construction phase.</p>		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>Protective measures such gabions and revetments should be used to protect the riverine habitats.</p> <p>It is recommended that construction take place in the winter / dry months to reduce erosion and sedimentation risks associated with high summer rainfall in this region. Stormwater and erosion control measures must be implemented during the construction phase to ensure that erosion and sedimentation impacts to the river including in-stream habitats are minimised and avoided. In this regard, the following measures must be implemented:</p> <ul style="list-style-type: none"> <li>▪ The natural flow of rivers or streams must not be permanently diverted or blocked.</li> <li>▪ Maintain adequate through flows to downstream aquatic ecosystems to protect aquatic life, and prevent the interruption of existing downstream uses.</li> <li>▪ Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities must be put on hold. In this regard, the contractor must be aware of weather forecasts.</li> <li>▪ Construction activities must be scheduled to minimise the duration of exposure to bare soils on-site, especially on steep slopes.</li> </ul> <p>A method statement for working in watercourses is provided in <b>section 9</b>.</p>		
<b>8.2.16 Noise</b>		
<p>Neighbouring landowners must be notified about construction activities.</p> <p>All construction vehicles and equipment are to be kept in good repair and must be fitted with standard silencers prior to construction.</p> <p>Where possible, stationary noisy equipment (for example compressors, generators etc. must be encapsulated in acoustic covers, screens or sheds. Portable acoustic shields must be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers).</p> <p>Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening.</p> <p>Machines in intermittent use must be shut down in the intervening periods between work or throttled down to a minimum.</p> <p>In general, operations must meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993).</p> <p>Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA must wear ear protection equipment.</p> <p>Noise levels must be kept within acceptable limits.</p> <p>All noise and sounds generated must adhere to SANS 10103 specifications for maximum allowable noise levels for central business districts.</p> <p>No pure tone sirens or hooters may be utilised except where required in terms of SANS standards or in</p>	Contractor	Daily



ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>emergencies.</p> <p>Noisy operations must be combined so that they occur where possible at the same time.</p> <p>Noise from labourers must be controlled.</p> <p>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 which are kept in good working order.</p> <p>Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.</p> <p>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> <p>Construction activities are to be contained to reasonable hours during normal working hours.</p> <p>Neighbours are to be given at least three (3) days warning prior to any blasting or other 'noisy' activities.</p>		
<b>8.2.17 Air Quality Pollution Management and Odour Control</b>		
<p>Any oil containing equipment or containers must be managed in a manner to avoid oil exposure to atmosphere to limit evaporation of volatiles to atmosphere.</p> <p>Portable toilets must be regularly emptied to avoid and minimise sanitary odour pollution.</p> <p>No fires are to be allowed on-site.</p> <p>Vehicles must be maintained to avoid excessive emissions and smoke. Similarly equipment must be serviced.</p>	Contractor	<p>Daily</p> <p>Weekly</p> <p>Daily</p>
<b>8.2.18 Dust Control</b>		
<p>Dust track-on from disturbed areas to gravel road surfaces must be avoided by making use of one of the following measures to:</p> <ul style="list-style-type: none"> <li>▪ Road sweeping.</li> <li>▪ Chemical dust suppression of disturbed areas to reduce the amount of dust which can be lifted by the wheels of trucks.</li> <li>▪ Wet suppression to the roads using a light spray.</li> <li>▪ The washing down of the wheels of trucks before they exit only paved road surfaces.</li> </ul> <p>If water is abstracted from a water resource for dust suppression, a WUA must be obtained from the DWS.</p> <p>Dust liberated to atmosphere must not reduce the visibility for private vehicles making use of the road passing by the site.</p> <p>Wet suppression and wind speed reduction are common methods used to control open dust sources at construction-sites.</p>	Contractor SHE Officer ECO	Daily

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>Re-vegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion.</p> <p>Plants used for re-vegetation must be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and must easily be propagated by seed or cuttings.</p> <p>All construction vehicles and equipment are to be kept in good repair.</p> <p>Speed limits of a maximum of 40 km/hr are to be implemented on-site and enforced by the Contractor.</p> <p>Dust liberated to atmosphere must not reduce the visibility for vehicles making use of the road passing by the site.</p> <p>Shade cloth fencing is to be used to reduce dust aggravation.</p> <p>Construction activities are to be contained to reasonable hours during the day avoiding periods of sunrise and sunset.</p> <p>In areas where there is a large potential for dust liberation (high wind days) wet suppression using a light spray must be applied to the areas in question.</p> <p>A dust suppression register as well as a complaints register needs to be kept.</p> <p>All complaints received need to be investigated with remedial action taken communicated to the affected party within 14 days.</p>		
<b>8.2.19 Stormwater Management</b>		
<p>The construction phase Stormwater Management Plan must be implemented to ensure proper management of stormwater on the site during construction to ensure that pollutants and sediment are not released into any water resources.</p> <p>Stormwater drainage must be <i>via</i> open drains / swales adjacent to the road with energy check structures rather than concrete drains. Under no circumstances must drop inlets and concrete pipes be utilised.</p> <p>Wherever possible, the temporary chutes / berms must not be aligned perpendicular to the slope.</p> <p>Outlet erosion protection structures must be designed to reduce outflows to energy levels that do not pose an erosion risk to downslope soils.</p> <p>Outlet erosion structures must be properly installed along the grade and elevation of the slope.</p> <p>Under no circumstances must the structures be placed higher than the ground surface thereby creating a drop off that may cause erosion.</p>	Contractor Engineer	Daily
<b>8.2.20 Fire Management</b>		
<ul style="list-style-type: none"> <li>▪ No open fires to be permitted on construction sites. Fires may only be made within the construction camp</li> </ul>		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>and only in areas and for purposes approved by the ECO.</p> <ul style="list-style-type: none"> <li>▪ Fire prevention facilities must be present at all hazardous storage facilities.</li> <li>▪ Ensure adequate fire-fighting equipment is available and train workers on how to use it.</li> <li>▪ Ensure that all workers on site know the proper procedure in case of a fire occurring on site.</li> <li>▪ Smoking must not be permitted in areas considered to be a fire hazard.</li> <li>▪ Ensure that no refuse wastes are burnt or buried on the construction site or on surrounding areas.</li> </ul>		
<p><b>8.2.21 Social Considerations</b></p>		
<p>Working hours are restricted to 07:00 – 18:00 during weekdays and 08:00 - 17:00 over weekends if necessary. Should work be required after these hours, the ECO must be notified and any person who resides in close proximity to the site and who may be impacted upon by the disturbance must also be notified.</p> <p>All neighbouring landowners and those that are disturbed due to construction activities are to be notified of construction activities and provided with regular feedback on the status of construction.</p> <p>The Contractor is to arrange for a suitable candidate to assist with the appointment of local labour and assist with labour disputes.</p> <p>Due to the concentration of a workforce in the area over the construction period, the Contractor must implement an HIV / AIDS Awareness Programme on-site. The Contractor must appoint an HIV / AIDS Awareness Officer for the duration of the construction period. Activities for HIV / AIDS awareness and prevention will be broad based, targeting both individuals and groups. They may consist of:</p> <ul style="list-style-type: none"> <li>▪ Information posters in public places both on and off site (eating places, bars, guest houses, etc.);</li> <li>▪ Peer educators (reference people) drawn from the local labour force and trained in HIV/AIDS issues for discussions with colleagues (estimate 1 per 30 employees);</li> <li>▪ Small focus group discussions and information covering key issues must be held;</li> <li>▪ Inclusion of HIV / AIDS activities at site meetings and other discussions; and</li> <li>▪ Voluntary Counselling and Testing.</li> </ul> <p>Education must cover:</p> <ul style="list-style-type: none"> <li>▪ Stigma and discrimination issues;</li> <li>▪ Preventative behaviours including partner reduction, condom use, and awareness and importance of treatment of STDs;</li> <li>▪ Skills including negotiating safer sex, correct condom use, purchase without embarrassment; and</li> <li>▪ Referral to local health centres and services available.</li> </ul>	<p>Contractor</p>	<p>Daily</p>

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.2.22 Reporting &amp; Record Keeping - Complaints Register</b>		
Complaints received must be registered and recorded by the contractor and also brought to the attention of the contractor. Both parties will respond accordingly. The following information must be recorded in the case of any complaint / incident: <ul style="list-style-type: none"> <li>Time, date and nature of complaint;</li> <li>Response and investigation undertaken; and</li> <li>Corrective and preventative actions taken and by whom.</li> </ul>	Contractor	Daily
All complaints received will be investigated and a response is to be given to the complainant within 7 days.		

### 8.3 Post Construction Phase

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<b>8.3.1 Construction areas</b>		
All structures comprising the construction affected areas are to be removed from the site and surrounding areas.	Contractor Developer	Post- Construction
The area that previously housed the construction materials is to be checked for spills of substances such as oil, paint, diesel, etc. and these must be cleaned up.		
All hardened surfaces within the construction affected area must be ripped, all imported materials removed, and the area must be top soiled and re-grassed accordingly with indigenous species.		
The Contractor must arrange the cancellation of any temporary services.		
<b>8.3.2 Vegetation</b>		
All areas that have been disturbed by construction activities (including the construction affected areas) must be cleared of alien vegetation.	Developer	Post- Construction
All vegetation that has been cleared during construction is to be removed from site or used as mulch, (except for vegetation which may result in inadvertently seeding alien vegetation).		
<b>8.3.3 Materials and Infrastructure</b>		
All residual stockpiles must be removed to spoil or spread on-site as directed by the Developer and/ or Engineer.	Developer Engineer Contractor	Post- Construction
All leftover building materials must be returned to the depot or removed from the site.		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
<p>The Contractor must repair any damage that the construction works has caused to neighbouring properties.</p> <p>Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Developer.</p>		
<p><b>8.3.4 Rehabilitation</b></p>		
<p>The Developer is responsible for compliance with the provisions for Duty of Care and Remediation of Damage in accordance with <b>section 28</b> of National Environmental Management Act (NEMA), Act No. 107 of 1998.</p>	<p>Contractor Engineer Developer ECO</p>	<p>Post- Construction</p>
<p>The 'precautionary principle' must apply and cost-effective measures must be implemented to pro-actively prevent degradation of the region's water resource and the social systems that depend on it. Ultimately, the risk of water resource degradation must drive sustainability in development design. The protection of water resources begins with the avoidance of adverse impacts and where such avoidance is not feasible; to apply appropriate mitigation in the form of reactive practical actions that minimises or reduces impacts. Examples of mitigation can include changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed development activities, as well as the restoration or rehabilitation of disturbed sites. Where environmental impacts can be severe, the guiding principle must be "anticipate and prevent" rather than "assess and repair."</p>		
<p>All remaining maintenance materials, building rubble and waste are to be removed from the site to an approved disposal site. Burying rubble on the site is prohibited.</p>		
<p>All disturbed surfaces compacted by maintenance activities including the ablutions and loading areas must be ripped to a minimum depth of 30 cm to allow organic contaminants to breakdown and promote vegetation establishment.</p>		
<p>The Contractor is required to rehabilitate all impacted areas according to the approved Method Statement for the Rehabilitation of Modified Environments.</p>		
<p>Final rehabilitation must be completed within a period specified by the Engineer.</p>		
<p>All internal access are existing gravel tracks. These existing accesses that will be closed will have drains and earthworks barriers. The accesses will then be rehabilitated.</p>		
<p>The site and surrounding areas is to be cleared of all litter.</p>		
<p>Surfaces are to be checked for waste products from activities such as concreting or asphaltting.</p>		
<p>All embankments are to be trimmed, shaped and replanted to the satisfaction of the ECO.</p>		
<p>Immediately after construction disturbed areas must be re-vegetated and supplemented with transplants from adjoining like habitats if required. Alternatively, reseeding via broadcasting using an indigenous seed mix reflecting the general species composition of the area must also be used where necessary. If such seed mixes are not available, seed will need to be harvested from the area and grown nearby for later re-</p>		

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
vegetation using plugs/sprigs.		
A biodegradable geo-fabric mat (or vegetation blanket) must be utilized to protect the topsoil on steep slopes from water and wind erosion during re-vegetation. Alternatively, the plants can be secured using a coarse mesh (steel wire or plastic). The mesh or mat is placed over the vegetation securing it until it can fully establish. The plants must be able to grow unhindered through the mesh or matting. Mats can be staked down.		
<p>Alien and weedy vegetation that colonise the disturbed areas must be removed and eradicated. 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 NEM:BA, the following applies to the control and eradication of invasive species:</p> <ul style="list-style-type: none"> <li>▪ 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;</li> <li>▪ 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</li> <li>▪ 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.</li> </ul> <p>Bi-annual alien plant clearing must be undertaken by the applicant for the first year post-rehabilitation. Thereafter, alien plant clearing must be undertaken annually until such a time that further risks of alien invasion resulting from disturbance factors are considered negligible.</p>		
The soils must be adequately prepared prior to planting by a contractor with experience in re-vegetation and under no circumstances must fertiliser be applied.		
Once the initial transplants / plugs are planted, the contractor must conduct weekly site visits to monitor re-establishment and remove alien plants (in accordance with the latest revised NEM:BA requirements) and address any re-vegetation concerns until re-vegetation is considered successful (i.e. >90% indigenous cover). Thereafter, the rehabilitation must be signed off by the ECO.		
All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO.		
Where drainage channels have been disturbed, the channels must be re-graded, stabilised using erosion control measures and re-vegetated as per the relevant re-vegetation/re-planting plan.		
The Contractor must check that all watercourses are free from building rubble, spoil materials and waste materials.		
<b>8.3.5 End of Contractor Services</b>		
A meeting is to be held on-site between the Developer and the ECO to approve all remediation activities and	ECO	Post-

ENVIRONMENTAL SPECIFICATION	RESPONSIBILITY	FREQUENCY
ensure that the site has been restored to a condition acceptable to the ECO and the Developer.	Developer	Construction
A site close-out audit is to be undertaken by the ECO prior to handover of the site by the Contractor.		
<b>8.3.6 Waste Management</b>		
The site must be kept void of litter.	Developer	On-going
Waste management at the site must subscribe to the principles of sustainable waste management. This includes: <ul style="list-style-type: none"> <li>▪ Waste prevention - the prevention and avoidance of the production of waste at source;</li> <li>▪ Waste reduction - the reduction of the volume or hazardous nature of the waste during production;</li> <li>▪ Resource recovery - recycling or re-use of the waste;</li> <li>▪ Waste treatment - the treatment of waste to reduce volume or risk to human and environmental safety and health to reduce the degree of hazard when waste is disposed of in a landfill or discharged into a water source; and</li> <li>▪ Waste disposal - the environmentally acceptable and safe disposal or discharge of waste, (e.g. encapsulation, incineration, landfill or discharge to a water source).</li> </ul> These principles must be practiced to the greatest extent possible.		
<b>8.3.7 Social Concerns</b>		
Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly inform the local community (on-site and at local community centres) of the progress and job / skills needs at the development sites.	Developer	Construction and operational phases – on-going



## 9 METHOD STATEMENT FOR WATERCOURSE CROSSINGS

The construction methodology adopted for the watercourse will be dependent on the season within which construction is undertaken.

General guidelines for construction of a culvert within a watercourse are provided below, following which the sequence to be followed by the Contractor is elaborated upon.

### 9.1 General Guidelines

Before the implementation of any of the proposed mitigation measures / rehabilitation activities, it is important to understand the following general site guidelines and restrictions:

- Indigenous vegetation may not be removed during rehabilitation unless this has been specifically specified for use in vegetation by means of transplanting.
- The use of chemicals / herbicides in alien plant control must be strictly restricted to a certified herbicide control applicator only. The application of herbicides will need to take into account the presence of aquatic systems (stream and riparian zone) on site.
- Where possible, water and herbicide solutions must be used instead of diesel and herbicide solutions. Water and herbicide solutions have lower pollution risks when compared to diesel and herbicide solutions.
- The education of field workers is very important as they will be primarily responsible for undertaking the rehabilitation work.
- Workers must be strictly monitored by a suitable trained site supervisor as they undertake rehabilitation.
- All vehicles used to access the site and transport equipment must be restricted to existing disturbed areas only and should not be permitted to move into undisturbed vegetation or habitat.
- Good timing and follow-ups are very important for a successful rehabilitation process which often generally capital expense in the long-term.
- Basic equipment requirements: alien plant control teams must wear the necessary personal protective clothing (PPE) and use appropriate equipment to do the work.

#### 9.1.1 Site Preparation Activities

The method adopted during the preparation activities, specifically the Construction Right of Way (ROW) phase of construction, will depend on the season in which construction activities are proposed. To reduce the need to divert water away from the construction working when crossing watercourses, all construction activities within the streams should ideally take place in the dry season / winter (May to September) where this is possible and depending on project timeframes.

Prior to any construction activity, the boundary of each wetland located adjacent to the P230 must be demarcated and a 32 m 'No-go' area must be maintained. The two remaining watercourses that will be impacted on due to the culvert replacements must be demarcated in the field. Rehabilitation activities within these watercourses are permitted, however, a 10 m construction servitude on either side of the road must be maintained for construction purposes. Working outside of the 10 m construction servitude is strictly prohibited.

Within this buffer zone a setback buffer area shall be preserved where vegetation and root systems will remain undisturbed. Topsoil will only be removed from any temporary accesses (where applicable) and on the construction footprint.

The footprint of the construction area as it traverses watercourses must be kept as narrow as possible. Demarcation of streams within the ROW will be undertaken by trained environmental personnel as per the approved EMPr. The ROW working width will be reduced where possible to minimise effects of the works on the streams which it passes through.

Where the stream is encountered in a wet state during the demarcation, topsoil stripping width will be minimised. The stripping operation will subsequently allow the installation of a temporary load spreading access, and allow construction operations to proceed with limited damage to the topsoil or underlying soils.

However, if in the opinion of the site supervisor responsible for ROW preparation, stripping the topsoil would be detrimental to the stream and hamper construction progress, the topsoil may remain in place. Only the ROW preparation crew would pass through the watercourse, until a temporary access can be laid.

Topsoil stripped from the ROW will be windrowed on the opposite side of the ROW to the storage of subsoil arising from stripping operations (if applicable), and suitably protected from washout and compaction through soil retention curtains and sandbags where necessary; to retain the functionality of the watercourses uppermost stratum.

Planning of crossings will incorporate the location of all environment and pollution prevention devices and equipment. This includes: location of parking and refuelling areas (if any), location of environment equipment storage where appropriate, of spill response equipment, silt control measures, etc.

### **9.1.2 Site Establishment**

This will include the establishment of the contractor's site camp, including offices, services, laboratory and amenities. The project team will ensure that work is competently supervised with respect to managing environmental impacts, as well as health, safety and quality aspects. A detailed environmental risk assessment must be produced and construction monitored accordingly.

The site camp must be securely fenced to prevent unauthorised access and will have:

- Approval from the ECO for the location and layout of the site camp;
- A designated, bunded plant refuelling area situated a minimum of 50 m away from any watercourse; and
- Emergency spill kits must be available and maintained at all times.

In addition to this all plant must be inspected on a daily basis for fluid leaks and must not be allowed to be used if a leak is identified until it is repaired.

All other requirements contained in this EMPr, and all other relevant permits and licences (where required), related to site establishment, shall be adhered to at all times for the duration of the project.

### 9.1.3 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.

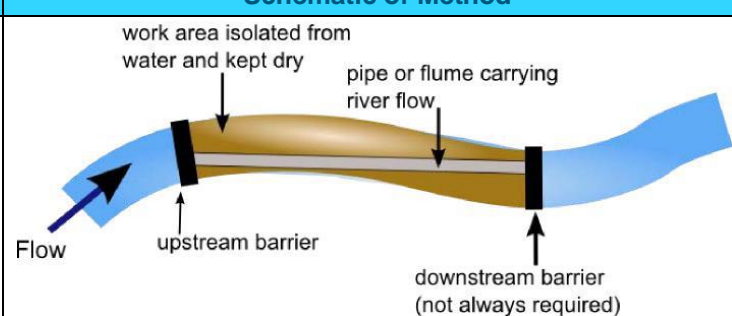
### 9.1.4 Temporary Flow Diversion

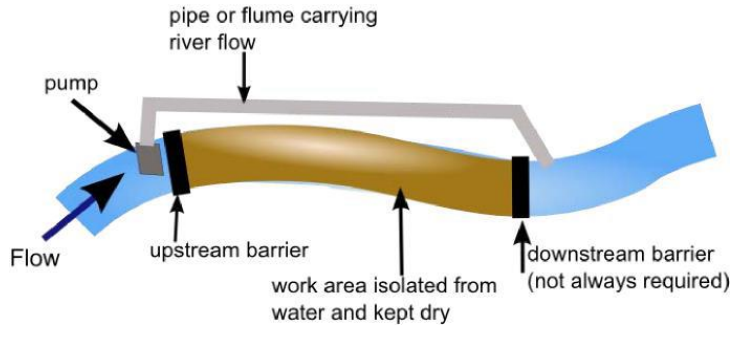
Diversions must be temporary in nature and no permanent walls, berms or dams may be installed within a watercourse. Not more than one diversion is to be undertaken within any given watercourse at any given time. Re-directed flow must be accompanied by erosion protection measures at the outlet point to 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 10).**
- **Method 2: Full isolation over pumping / siphon ((Table 10).**
- The temporary barrier must 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 work area
- Under no circumstance must a new channel or drainage canals be excavated to divert water away from construction activities.

**Table 10: Best practice methods for partial and full isolation (after SEPA, 2009)**

Description of Method	Schematic of Method
<p><b>1: Full isolation gravity/flume pipe</b></p> <p>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</p>	

Description of Method	Schematic of Method
downstream to prevent the water backing up into the work area.	
<p><b>2: Full isolation over pumping / siphon</b></p> <p>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>	

### 9.1.5 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.
- Trench for culvert through the existing road fill embankment to required depth.
- For culvert replacement: remove existing culvert.
- If it is required that the culvert invert be lowered further, carefully excavate by hand.
- Construct culvert bedding to correct fall and specification.
- Lay culvert to correct crossing angle and fall.
- 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.

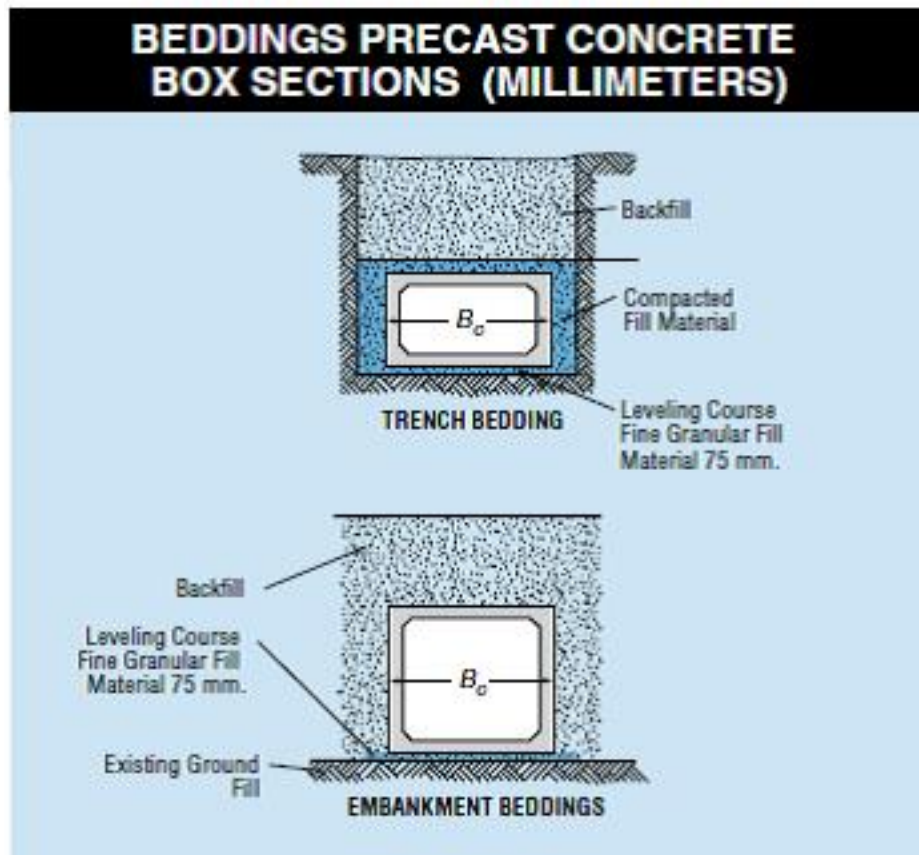


Figure 8: Generic foundations for a box culvert

## 9.2 Rehabilitation Activities

### 9.2.1 Site Preparation Prior to Re-vegetation

The following key rehabilitation objectives are proposed:

- To reshape, stabilise and re-vegetate (reinstate) wetland and riparian areas physically disturbed by construction activities, both planned and accidental. Rehabilitation must be pragmatic and focus on the stabilisation and re-vegetation of disturbed areas, with less focus on biodiversity aspects (i.e. reinstating reference species diversity).
- To remove all sediment and construction materials washed into wetlands / channels during construction and reshape and re-vegetate the affected surface (if applicable).
- To eradicate and control invasive alien plants and weeds that invade and colonise the watercourses post-disturbance; and
- To monitor the success of the rehabilitation actions and ensure that the above-listed objectives are achieved.

It must be emphasised however that these guidelines are not intended to be a detailed rehabilitation implementation plan for the site and detailed method statements, planting plans, bills of quantities and budget for rehabilitation will need to be developed based on these guidelines.

## 9.2.2 Conceptual Rehabilitation Strategy

Post-construction rehabilitation will aid the recovery of the disturbed ecosystems and is critical in preventing further impacts including those associated with IAP infestations, soil erosion and sedimentation, although it is important to note that the freshwater habitat within the construction servitude (road reserve) is already degraded and characterised by secondary vegetation. **Table 11** below provides guidance on the approach and basic methods for rehabilitating disturbed aquatic habitat during culvert replacement:

**Table 11: Post Construction Rehabilitation Guidelines for Disturbed River and Riparian Habitat**

Rehabilitation Step	Rehabilitation Guidelines and Specific Actions
<p><b>STEP 1:</b> Initial planning and strategy</p>	<ul style="list-style-type: none"> <li>• Upfront it is important to note that these guidelines do not constitute a detailed rehabilitation plan that includes detailed implementation measures and bills of quantities. As part of the approval of the final construction EMPr, a detailed plan should be compiled and appended to the EMPr.</li> <li>• A budget including costing of all re-vegetation activities and equipment costs, will need to be compiled prior to commencement of construction. A financial provision for all rehabilitation costs must be included in the contractual agreement for the project.</li> <li>• Rehabilitation must target all areas to be physically disturbed by activities, planned and unplanned. These areas must be identified prior to the implementation of the Plan.</li> <li>• It is important to keep in mind that quantities of required geofabric and plant material must be ordered at the right time to ensure that adequate quantities of the materials are available during implementation.</li> <li>• Rehabilitation of disturbed watercourses must ideally be initiated as soon as possible and occur as construction works progress.</li> <li>• 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 rehabilitation, managing a nursery for rescued plants, etc.</li> <li>• A suitably qualified aquatic / river ecologist with experience in rehabilitation may be required to provide practical input into the rehabilitation during implementation of the rehabilitation plan.</li> </ul>
<p><b>STEP 2:</b> Plant Rescue and Topsoil Management</p>	<ul style="list-style-type: none"> <li>• Where indigenous vegetation can be harvested and retained for use in re-vegetation, this must be done. Retained vegetation must be kept moist at all times until replanting can be achieved.</li> <li>• Where applicable topsoil stripped from the construction zones within the construction footprint must be conserved, stored and used in rehabilitation.</li> <li>• An effort must be made to ensure topsoils are not mixed with subsoils (to be kept separate).</li> <li>• Pre-emergent herbicide may be applied to stockpiled topsoil to rid it of IAPs.</li> </ul>
<p><b>STEP 3:</b> Remove any waste products</p>	<ul style="list-style-type: none"> <li>• All waste products (spoil, construction materials, hazardous substances and general litter) must be removed from the construction footprint and disposed of at an appropriate landfill site.</li> <li>• Minimise additional disturbance by limiting the use of heavy vehicles and personnel during</li> </ul>



	<p>clean-up operations.</p> <ul style="list-style-type: none"> <li>Any large plumes of sediment washed into river from upslope must be removed, taking care not to remove or disturb the natural soil profiles including instream and riparian habitats.</li> </ul>
<p><b>STEP 4:</b> Remove/control invasive alien plants</p>	<ul style="list-style-type: none"> <li>All exotic / alien plants and weeds must be removed and properly disposed of prior to the implementation of rehabilitation measures.</li> <li>Note that frequent <u>hand removal is the most preferred option</u> and only in the event that this is not a viable means of control, should chemical means be considered.</li> <li>Only herbicides which have been certified safe for use in aquatic environments by an independent testing authority may be considered. The ECO must be consulted in this regard.</li> </ul>
<p><b>STEP 5:</b> Formulation of Revegetation Strategy</p>	<p>A formal, detailed re-vegetation strategy will need to be formulated for the disturbed aquatic habitat, with some guidance on vegetation provided below:</p> <ul style="list-style-type: none"> <li>Based on the low diversity and existing disturbance at the site, we envisage a simple and functional re-vegetation strategy with the focus on achieving an adequate cover in the shortest time. A minimalistic approach to re-vegetation of the disturbed areas is thus 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.</li> <li>At this stage re-vegetation using a combination plugs of <i>Cynodon dactylon</i> and <i>Stenotaphrum secundatum</i>, with the hydroseeding of <i>Eragrostis tef</i> as a nursery cover, is proposed. Although it does not offer instant protection as with sodding, planting of plugs has a high success rate and provides protection within a few weeks, while being comparatively cheaper than sods.</li> <li>Plugs should ideally be planted at a high density of 16 plugs / m<sup>2</sup>. This will ensure that a cover of 80% is achieved within 4 – 6 weeks (<b>Granger, 2015</b>). The planting density can be altered as required.</li> <li>The plugs must be sourced from an appropriate nursery with capacity to produce the required quantities of plugs.</li> <li>The planting of plugs should ideally be undertaken early in summer. However, as it is recommended that construction occur in winter months to avoid peak flows and associated erosion issues, hydroscopic gel will be required for the plugs</li> <li>Geofabric will be generally be required for soil stabilisation on steep slopes.</li> <li>This strategy may be changed / revised following the finalisation of the detailed re-vegetation plan which will include the plating method, species and quantities / costs.</li> </ul>
<p><b>STEP 6:</b> Stabilise, reshape and prepare soil profiles</p>	<ul style="list-style-type: none"> <li>Any erosion features created by construction activities must be stabilised.</li> <li>Exposed banks and slopes must be stabilized and re-vegetated as soon as practically possible.</li> <li>Erosion control measures such as geofabric, eco-logs and biodegradable silt fences must generally be installed prior to re-vegetation.</li> <li>Channel banks must be shaped to a stable angle of repose to avoid slumping and prepared for re-vegetation immediately.</li> <li>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.</li> </ul>



	<ul style="list-style-type: none"> <li>• Stored topsoil must be re-spread across the reshaped surfaces prior to re-vegetation.</li> <li>• For the seeding of <i>E. tef</i>, the soil needs to be prepared to optimise germination. Such preparation is undertaken by hand hoeing. The soil in the seedbed should be loosened to facilitate good contact between the seeds and the soil.</li> <li>• Fertilizer / lime is not necessary nor is it permitted to be used for the re-vegetation of wetlands, rivers and riparian areas as this may promote increased weed growth and alter the soil structure.</li> <li>• A weed-free mulch is recommended to help retain moisture for germination on channel banks. It is very important that mulch not be derived from stands of IAPs or weeds.</li> </ul>
	<ul style="list-style-type: none"> <li>• Once construction is completed and alien vegetation and waste products have been removed and soils are prepared for planting, re-vegetation must commence as per the strategy in Step 5 above as soon as weather conditions allow for good plant growth.</li> <li>• Re-vegetation must focus primarily on bare exposed / unstable soils. Key focal areas include channel banks / margins of the active channel and riparian areas.</li> <li>• 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.</li> <li>• Do not use fertilizer or lime.</li> <li>• A trained re-vegetation / rehabilitation expert must be contracted to oversee the rehabilitation of areas.</li> </ul>
<p><b>STEP 8:</b> Monitor re-vegetation progress and administer alien plant control</p>	<ul style="list-style-type: none"> <li>• The first 6 weeks after re-vegetation are the most critical in terms of maintenance and monitoring and weekly audits by an ECO with the contractor must be undertaken to monitor re-vegetation success. Only once an adequate ground cover is established must the ECO sign-off on the completion re-vegetation. Targets for re-vegetation success include:             <ul style="list-style-type: none"> <li>○ Low levels of Invasive Alien Plants (&lt;10% IAP cover).</li> <li>○ &gt;90% indigenous vegetation cover.</li> </ul> </li> <li>• Thereafter, monitoring visits by the ECO and contractor must be undertaken every 3 months for the first 6 months (two monitoring visits) after the completion of construction. At such visits the need for further re-vegetation, IAP clearing and erosion control / damage repair must be addressed where necessary. Any areas that are not progressing satisfactorily must be identified and action must be taken to actively re-vegetate these areas. If natural recovery is progressing well, no further intervention may be required.</li> <li>• The ECO must assess the need / desirability for further monitoring and control after the first 6 months and include any recommendations for further action to the relevant environmental authority.</li> </ul>

### 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 will apply but where slopes are steep, soft intervention techniques will need to be employed to provide sufficient slope stabilisation.
- As a principle, soft interventions should 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 can be used across the entire slope to retain eroded sediment.
- Use sandbags or timber logs place at regular intervals along the contour of slopes to retain sediment and stabilize the soils.
- Temporary sediment barriers will need to 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 respectfully 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 shall be removed during this activity.
- Slope instability or where slumping / erosion of stream banks have occurred be identified and recorded during and immediately after the initial clearing. These areas will then need to 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 may 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.

### **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.

### **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 comprising indigenous species must be laid out on all road batters and secured in place using wooden 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.
- 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 to 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 shall 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 are to 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 site<sup>2</sup>. 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 level<sup>3</sup>. 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<sup>4</sup>.

<sup>2</sup> **Russell, W.B., 2009.** *WET-Rehab Methods: National guidelines and methods for wetland rehabilitation.* WRC Report No. TT 341/09. Water Research Commission, Pretoria.

<sup>3</sup> **Jacobson, R.L., 2006.** *Restoring & Managing Native Wetland & Upland Vegetation.* Minnesota Board of Soil & Water Resources Minnesota Department of Transportation. January 2006.

<sup>4</sup> **Clarkson, B. and Peters, M., 2012.** *Wetland Restoration: A handbook for New Zealand Freshwater Systems. Chapter 10: Revegetation.* NSW Murray Wetlands Working Group Inc., Albury NSW.

## 10 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 NEM:BA, 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 must be removed after tree felling. This is

also the case for trees that could cause the blockage of watercourses. Brushwood must 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 must be taken into consideration when selecting methods/herbicides, etc.

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/](http://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 must only 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 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 litres / 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 debarking 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 20-100cm 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 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 proper/registered receiving area such as a local registered land fill site.



## 11 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.

### 11.1 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 violation will be:

**Table 12: 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

OFFENCE	AMOUNT
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.

## 11.2 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 (EDTEA) (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 EDTEA 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.



With its headquarters in Amersfoort, The Netherlands, Royal HaskoningDHV is an independent, international project management, engineering and consultancy service provider. Ranking globally in the top 10 of independently owned, non-listed companies and top 40 overall, the Company's 6,500 staff provide services across the world from more than 100 offices in over 35 countries.

### **Our connections**

Innovation is a collaborative process, which is why Royal HaskoningDHV works in association with Developers, project partners, universities, government agencies, NGOs and many other organisations to develop and introduce new ways of living and working to enhance society together, now and in the future.

### **Memberships**

Royal HaskoningDHV is a member of the recognised engineering and environmental bodies in those countries where it has a permanent office base.

All Royal HaskoningDHV consultants, architects and engineers are members of their individual branch organisations in their various countries.