

## REPORT

# **Consultation Basic Assessment Report for the Proposed Rehabilitation of Provincial Road P50-1 from km 17,34 to km 26,00, within the uMlalazi Local Municipality, KwaZulu-Natal**

Client: KwaZulu-Natal Department of Transport

Reference: MD1730\_R01\_D01\_P50-1 Rehab

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ROYAL HASKONINGDHV (PTY) LTD

19 Park Lane  
Floor 3 The Boulevard Umhlanga  
Umhlanga  
Umhlanga Rocks  
4319  
Transport & Planning  
Reg No. 1966/001916/07

+27 (0)873506660 **T**  
durban@rhdhv.com **E**  
royalhaskoningdhv.com **W**

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Author(s): Prashika Reddy

Drafted by: Prashika Reddy *Pr.Sci.Nat.*

Checked by: Humayrah Bassa *Pr.Sci.Nat.*

Date / initials: 10.08.2017 H.B.

Approved by: Humayrah Bassa *Pr.Sci.Nat.*

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## Executive Summary

### **Background**

This project forms part of the Empangeni Road Rehabilitation and covers the rehabilitation of P50-1 from km 17,34 to km 26,00 (Eshowe) within the uMlalazi Local Municipality which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal.

Main Road P50-1 is located northwest of Eshowe in the Empangeni Region, KwaZulu-Natal. The road is 26 km long and starts at km 0,00 at the intersection with the P47-5 (R66) and proceeds in a northwest direction towards Nkandla and ends at km 26,00. The section that forms the focus of this assessment starts at km 17,34 and ends at km 26,00 towards Nkandla. The road forms the main link between Eshowe and Nkandla. Many heavy vehicles make use of this road to transfer goods from Eshowe to Nkandla and Kranskop. P50-1 can be classified as a Category B major rural road according to **TRH4: (1996)**.

The proposed rehabilitation comprises the bulk earthworks, layerworks, surfacing, drainage, ancillary works and potential replacement and / or upgrade of four (4) culverts requiring rehabilitation.

***It is important to note that the present culverts are covered with marshy wetland vegetation which require Environmental Authorisation (EA) to approve. Therefore, the engineering team are uncertain as to the status of these wetlands and will only be in a position to assess the structural integrity of these structures once a Contractor is on site to clear the vegetation. Therefore, the maximum impacts on wetlands to clear the entire extent of the roadworks has been provided for, assuming the culverts may need to be rehabilitated, upgraded and/or replaced.***

Royal HaskoningDHV has been appointed by the KwaZulu-Natal Department of Transport to provide independent Environmental Consulting Services for the proposed project by conducting a Basic Assessment (BA) Study in terms of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended in 2017), as promulgated under the National Environmental Management Act (NEMA) (Act No. 107 of 1998) as amended.

### **Process**

This Basic Assessment (BA) follows the legislative process prescribed in the Environmental Impact Assessment (EIA) Regulations (2014)(as amended in 2017). This report constitutes the draft Consultation Basic Assessment Report (cBAR) which details the environmental outcomes, impacts and residual risks of the proposed activity. The report aims to assess the key environmental issues and impacts associated with the development, and to document Interested and Affected Parties' (I&APs) issues and concerns. Furthermore, it provides background information of the proposed project, a motivation and details of the proposed project, and describes the public participation undertaken to date.

The objective of this report is to provide the project's I&APs, stakeholders, commenting authorities, and the competent authority (CA), with a thorough project description and BA process description. The outcome being to engender productive comment / input, based on all information generated to date and presented herein.

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant portions of environmental legislation that were taken into consideration during this study and are elaborated on in this report.



The KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) is the lead / competent authority for this BA process and the development needs to be authorised by this Department.

This draft cBAR provides an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. Having duly considered the project, in the Environmental Assessment Practitioner's (EAP's) opinion, the project does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

The impacts identified and assessed by way of risk ratings, have been extensively reported herein. The report at hand (i.e. draft cBAR) will now be made available for comment and amended post comment period to form the final Consultation BAR (i.e. final cBAR). The final cBAR report will, together with a comprehensive issues trail, the final draft of the EMP, and all addenda as referred to, will be submitted to the KZN EDTEA, for decision making. The final cBAR report will thus be a culmination of scientific specialist studies' findings, public contribution via formal comment, and the drawing of conclusions by the EAP as the environmental specialist.

### **Key Findings**

Although the wetlands to be impacted are considered important and sensitive systems, the impact assessment revealed that potential impacts are not that significant. This is largely due to the road already being present and the proposed upgrade being minor in extent and involving low levels of encroachments into the wetland and stream habitats. The impact assessment also revealed that the construction impacts are the most significant impacts, particularly the impacts of freshwater habitat infilling, clearing and disturbance and the associated indirect impacts of working within the watercourses and altering flow patterns.

Most aquatic ecological impacts can probably be quite effectively mitigated through appropriate culvert design recommendations and supplemented by the application of on-site practical mitigation measures and management principles to control direct wetland / riverine habitat destruction, soil erosion and sedimentation, flow modification and pollution impacts and risks in conjunction with post-construction rehabilitation and ecological monitoring recommendations. Should the recommended mitigation and management guidelines be implemented timeously and to specification, impacts can be potentially reduced to acceptably Low significance levels.

A number of provincially protected plants species (under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974) were identified onsite, namely *Aloe cooperi*, *Aloe marlothii*, *Aloe* sp. (unidentified due to lack of flowering material), *Crocasmia aurea*, *Gladiolus ecklonii*, *Kniphofia* sp. (probably *K. tysonii* subsp. *tysonii*) and *Zantedeschia aethiopica*, which are listed as being Least Concern. An Ordinary Permit is required from *Ezemvelo* KZN Wildlife (EKZNW) to handle these plants.

Some species of conservation concern were also flagged to be possibly present as part of the Potential Occurrence Assessment, namely *Clivia gardenii* (Vulnerable), Natal Black Millipede (Vulnerable), Bifid Red Millipede (endemic) and Wandering Black Millipede (endemic). However, although possibly present due to a lack of confidence in confirmation (based crudely on range / distribution), the degraded nature of the habitats assessed, probably makes their presence unlikely.

## Acronyms

AMSL	Above Mean Sea Level
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBAR	Consultation Basic Assessment Report
CV	Curriculum Vitae
DAFF	Department of Agriculture, Fisheries and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
GA	General Authorisation
GIS	Geographic Information System
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
KZN	KwaZulu-Natal
NEMA	National Environmental Management Act (Act No. 107 of 1998)
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. 59 of 2008)
NFA	National Forests Act (Act No. 84 of 1998)
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act (Act No 85 of 1993)
PES	Present Ecological State
PPE	Personnel Protective Equipment
PPP	Public Participation Process
REC	Recommended Ecological Category
RMO	Resource Management Objective
SACNASP	South African Council of Natural Science Professionals
SAHRA	South African Heritage Resource Agency
SWMP	Stormwater Management Plan
WUL	Water Use Licence

## Glossary

<b>Activity (Development)</b>	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms ‘activity’ and ‘development’ are freely interchanged.
<b>Alternatives</b>	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
<b>Applicant</b>	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
<b>Biodiversity</b>	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
<b>Buffer</b>	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer is usually an artificially imposed zone included in a management plan.
<b>Construction</b>	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
<b>Cumulative Impact</b>	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
<b>Decommissioning</b>	The demolition of a building, facility, structure or infrastructure.
<b>Direct Impact</b>	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
<b>Ecological Reserve</b>	The water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.
<b>Ecosystem</b>	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
<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) and (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 Assessment</b>	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
<b>Environmental</b>	An authorisation issued by the competent authority in respect of a listed activity,

<b>Authorisation Environmental Assessment Practitioner (EAP)</b>	or an activity which takes place within a sensitive environment. The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
<b>Environmental Control Officer (ECO)</b>	An individual nominated through the Client to be present on site to act on behalf of the Client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
<b>Environmental Impact</b>	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
<b>Environmental Impact Assessment (EIA)</b>	In relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in NEMA.
<b>Environmental Issue</b>	A concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.
<b>Environmental Management</b>	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
<b>Environmental Management Programme (EMPr)</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. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
<b>Fatal Flaw</b>	An event or condition that could cause an unanticipated problem and / or conflict which will could result in a development being rejected or stopped.
<b>Groundwater</b>	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater runoff are supplied.
<b>Hazardous Waste</b>	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A – Hazardous Waste.
<b>Hydrology</b>	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.
<b>Indirect Impacts</b>	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity
<b>Integrated Environmental Management</b>	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level – that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
<b>Interested and Affected Party (I&amp;AP)</b>	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
<b>Method Statement</b>	A method statement is a written submission by the Contractor to the Engineer in

	<p>response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and / or will produce results in accordance with the Specifications.</p>
<b>Mitigate</b>	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
<b>NO-GO Option</b>	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
<b>Pollution</b>	The National Environmental Management Act, No. 107 of 1998 defines pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
<b>Public Participation Process</b>	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
<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>Rehabilitation</b>	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
<b>Sensitive Environments</b>	Any environment identified as being sensitive to the impacts of the development.
<b>Significance</b>	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
<b>Stakeholder Engagement</b>	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and / or management of proposals or activities.
<b>Sustainable Development</b>	Development which meets the needs of current generations without hindering future generations from meeting their own needs.
<b>Visual Contrast</b>	The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.
<b>Watercourse</b>	<p>Defined as:</p> <ol style="list-style-type: none"> <li>i. a river or spring;</li> <li>ii. a natural channel or depression in which water flows regularly or intermittently;</li> <li>iii. a wetland, lake or dam into which, or from which, water flows; and</li> <li>iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.</li> </ol>
<b>Water Pollution</b>	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the

**Wetland**

welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property”.

Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

## 1 INTRODUCTION

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This project forms part of the Empangeni Road Rehabilitation and covers the rehabilitation of P50-1 from km 17,34 to km 26,00 (Eshowe) within the uMlalazi Local Municipality which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal.

Main Road P50-1 is located northwest of Eshowe in the Empangeni Region, KwaZulu-Natal. The road is 26km long and starts at km0,00 at the intersection with the P47-5 (R66) and proceeds in a northwest direction towards Nkandla and ends at km26,00. The focus of this assessment is the road that starts at km 17,34 and ends at km 26,00 towards Nkandla (**Figure 1-1**). The road forms the main link between Eshowe and Nkandla, with many heavy vehicles making use of this road to transfer goods from Eshowe to Nkandla and Kranskop. P50-1 can be classified as a Category B major rural road according to TRH4: (1996).

The P50-1 links the communities of Entumeni Mission and Eshowe up to the intersection of the P47-5 and in to the P47-6 which connects to the National Route 2 (N2). The road also serves communities and social facilities (i.e. schools and clinics).

The route varies in surface width from 10 m wide (km 17,34 to km 22,00) to 8.5 m wide (km 22,00 to km 26,00). Rehabilitation therefore entails the widening of road surface on both sides from 8.5m to 10m in accordance with the Departmental "Type 2C" standard. The single carriageway 10 m wide surfaced road with surfaced shoulders will be trimmed on the surfaced road edges with gravel rounding's which are 1,0 m and 0,5 m wide in fill and cut conditions, respectively and will include adequate stormwater drainage facilities.

Improvement to the horizontal alignment on the left hand side varies between 10 m – 20 m to remove a blindspot between km 23,00 – km 23,25, increasing the change direction from Eshowe to Nkandla. This portion (km 17,340 to km 26,100) of road will be rehabilitated and widened.

The rehabilitation entails the widening of the road to make provision for the increased roadway width, together with the strengthening of the upper 200mm of the existing pavement by importing an additional 100mm of new material from a commercial source to create a C3 layer. The base shall be a paved 80mm Bituminous Treated Base for a new base layer and a new 40mm continuous graded medium-grade wearing course as surfacing. The existing finish road level will then be raised by 150mm by constructing new overlying base pavement layers and surface wearing course over the entire length of the works.

In addition, the proposed rehabilitation comprises the following associated ancillary works:

- Extension of the prefabricated pipe culvert cross-drainage together with the reconstruction of the affected inlet and outlet structures;
- Widening of the existing fills to accommodate the new roadway formation width, using gravel material imported;
- Construction of road prism drainage, including open concrete lined drains where necessary;
- Improvements to existing minor access points;
- Road marking and signs; and
- Erection of guardrails and fencing.

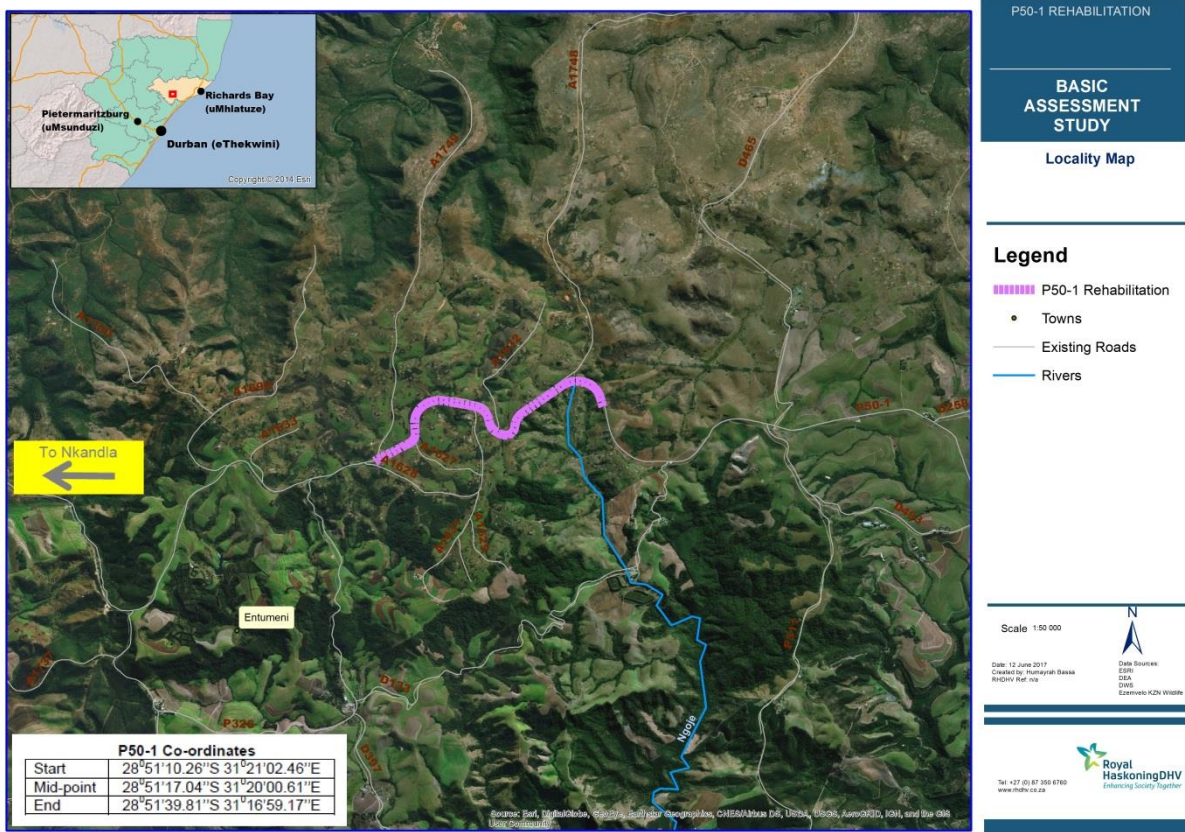


Figure 1-1: Locality map

## 1.1 Approach to the Study

### 1.1.1 Pre-application Consultation

A pre-application meeting and site visit was undertaken on 27<sup>th</sup> June 2017 with the Competent Authority, the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA), King Cetshwayo District.

### 1.1.2 Basic Assessment Study

A BA is the level of environmental assessment applied to activities listed in Listing Notices 1 and 3. A BA is applied to activities that are considered less likely to have significant environmental impacts and, therefore, unlikely to require a detailed EIA. In addition, the potential impacts are usually known and understood and the mitigation measures are relatively easy to implement. The BA Report (BAR) is a more concise analysis of the environmental impacts of the proposed activity / development than a Scoping and EIA Report.

The BA aims to achieve the following:

- Determine the policy and legislative context within which the proposed activity is undertaken and how the activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed project;
- Identify the alternatives considered, including the activity, location, and technology alternatives;



- Undertake an impact and risk assessment process inclusive of cumulative impacts (where applicable). The focus being; determining the geographical, physical, biological, social, economic, heritage and cultural sensitivity of the project and the risk of impact of the proposed activity on the these aspects to determine the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and the degree to which these impacts:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

This BAR has been compiled in accordance with the provisions of the EIA Regulations 2014 (as amended by **GNR 326** of 2017), and specifically the requirements as set out in **Appendix 1** of the aforesaid Regulations, which outlines the legislative BA process and requirements for the assessment of outcomes, impacts and residual risks of the proposed development. The BAR further incorporates the findings and recommendations of the specialist studies conducted for the project.

An EMPr (**Appendix B**) has been compiled according to **Appendix 4** of **GNR 386** of the EIA Regulations (2014) as amended for the construction and rehabilitation phases of the project. The EMPr has been compiled as a stand-alone document from the BAR and will be submitted to the EDTEA along with the BAR. The EMPr provides the actions for the management of identified environmental impacts emanating from the project and a detailed outline of the implementation programme to minimise and / or eliminate any anticipated negative environmental impacts and to enhance positive impacts. The EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

## 1.2 Structure of the Basic Assessment Report (BAR)

The BAR is structured as follows:

*Table 1-1: Structure of the report*

Chapter	Description
1	<b>Introduction</b> – Provides the background to the project as well as details of the specialist studies conducted and contact details for the project proponent and EAP
2	<b>Environmental Legislative Context</b> – Details the pertinent environmental legislation and the applicability to the project
3	<b>Project Context &amp; Motivation</b> – Provides the site locality, project description and need and desirability of the project
4	<b>Project Alternatives</b> – Describes the alternatives considered, including the ‘NO-GO’ option
5	<b>Description of the Baseline Environment</b> – Describes the pre-development context of the site
6	<b>Public Participation Process</b> – Explains the public consultation undertaken
7	<b>Specialist Assessments</b> – Describes the impact assessment and findings of the specialist studies
8	<b>Impact Assessment</b> – Details the impact assessment methodology and quantifies the impacts anticipated

Chapter	Description
9	<b>Environmental Impact Statement</b> – Provides the EAP opinion and summarises the impact assessment including Conclusion and Recommendations

### 1.3 Specialist Assessment

To ensure the scientific rigour of the BA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned specialist studies in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical), associated with the project, and where possible to provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts.

Specialist Study	Organisation
Freshwater Habitat Impact Assessment	Eco-Pulse Environmental Consulting Services
Terrestrial Habitat Impact Assessment	Eco-Pulse Environmental Consulting Services
Heritage Impact Assessment	Active Heritage cc

#### 1.3.1 Peer Review

In addition to the above, the EIA Regulations (2014) as amended requires the Environmental Assessment Practitioner (EAP) to be independent, objective and have expertise in conducting EIAs. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity. To ensure that there is no bias and that the process has been transparent, an external technical peer review will be undertaken prior to the public review during the formal BA process. This peer review has been conducted by Kinvig & Associates Environmental Consultants (Pty) Ltd.

### 1.4 Details of the Project Developer

The Developer is the KZN DoT and the details of the responsible person are listed in **Table 1-2** below.

*Table 1-2: Applicant details*

Applicant	KwaZulu-Natal Department of Transport	
Representative	Ms Khumbu Sibiya	
Physical Address	172 Burger Street, Pietermaritzburg, 3200	
Postal Address	Private Bag X9043, Pietermaritzburg, 3200	
Telephone	033 355 0594	
Facsimile	033 345 7537	
E-mail	<a href="mailto:Khumbu.Sibiya@kzntransport.gov.za">Khumbu.Sibiya@kzntransport.gov.za</a>	

### 1.5 Details of the Environmental Assessment Practitioner

The environmental team of Royal HaskoningDHV have been appointed as an independent Environmental Assessment Practitioner (EAP) by the KZN DoT to undertake the appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV has considerable experience in the environmental management field. Royal HaskoningDHV have been involved in and / or managed several of the largest EIAs undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), mixed-use developments, bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, urban, rural and township developments, environmental aspects of Local Integrated Development Plans, as well as general environmental planning, development and management.

*Table 1-3: EAP details*

Consultant	Royal HaskoningDHV	Royal HaskoningDHV
<b>Contact Persons</b>	Humayrah Bassa (EAP)	Prashika Reddy
<b>Postal Address</b>	PO Box 1243 Umhlanga Rocks 4320	PO Box 25302 Monument Park 0105
<b>Telephone</b>	087 350 6760	012 367 5973
<b>E-mail</b>	humayrah.bassa@rhdhv.com	prashika.reddy@rhdhv.com
<b>Qualification</b>	MSc Environmental Science	BSc (Hons) Geography
<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 with 16 years' work related experience in various environmental fields. She 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, mixed-use developments and mining projects. She is a Professional Natural Scientist (400133/10) with the South African Council for Natural Scientific Professions.

The Environmental Management and Planning Knowledge Group Profile for Royal HaskoningDHV and the Curriculum Vitae (CV) of the respective Consultants can be found in **Appendix D**.

## 2 ENVIRONMENTAL LEGISLATIVE CONTEXT

In order to protect the environment and ensure that the development is undertaken in an environmentally responsible manner, there are a number of significant sections of environmental legislation that need to be considered during this study.

This section outlines the legislation that is applicable to the proposed project and has been considered in the preparation of this report.

*Table 2-1: Key legislation considered*

Acts	Objectives, important aspects, associated notices and regulations
<p><b>National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended</b></p>	<p><b>Objectives:</b> To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state.</p> <p><b>Relevant Notices and Regulations:</b></p> <ul style="list-style-type: none"> <li>• EIA Regulations 2014 (as amended by GNR 326 of April 2017)</li> <li>• Listing Notice 1</li> <li>• Listing Notice 2</li> <li>• Listing Notice 3</li> </ul> <p><b>Relevance to the proposed project:</b></p> <ul style="list-style-type: none"> <li>• Development must be socially, environmentally and economically sustainable.</li> <li>• Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated; the social, economic and environmental impacts of activities including disadvantages and benefits, must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration.</li> <li>• 'Polluter Pays' principle.</li> <li>• Any activity that is proposed and which is listed in the NEMA EIA Regulations, requires environmental authorisation.</li> </ul> <p><b>Listed Activity / ies &amp; Applicability:</b>  <b>Listing Notice 1, Activity 19:</b> The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from (i) a watercourse.  <i>The proposed infrastructure (culverts) will be constructed within the watercourse and will thus require infilling or depositing of material meeting the threshold of this activity. The road will potentially be widened within wetlands at the culvert crossings.</i></p> <p><b>Listing Notice 3, Activity 14:</b> The development of infrastructure or structures with a physical footprint of 10 m<sup>2</sup> or more where such development occurs within a watercourse. In KwaZulu-Natal, outside urban</p>

Acts	Objectives, important aspects, associated notices and regulations
	<p>areas: (aa) within 5 km from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.</p> <p><i>The development of the culverts will exceed the physical footprint threshold and is within 5 km of the Entumeni Nature Reserve.</i></p>
<p><b>National Water Act (Act No. 36 of 1998) (as amended)</b></p>	<p><b>Objectives:</b></p> <p>The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations.</p> <p><b>Relevance to the proposed project:</b></p> <ul style="list-style-type: none"> <li>• Sustainable protection, use, development and conservation of water resources – including aquatic ecosystems.</li> <li>• Defines 11 water uses and provides licencing procedures.</li> </ul> <p><b>Notices and Regulations:</b></p> <ul style="list-style-type: none"> <li>• General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (a) and (b) (GN in GG 40243 of 02 September 2016).</li> <li>• General Authorisation in terms of Section 39 of the National Water Act (Act No. 36 of 1998, Water Uses Section 21 (c) and (i) (GN in GG 40229 of 26 August 2016).</li> </ul> <p><b>Water uses triggered:</b></p> <p>As the proposed development involves the direct crossing of watercourses, a Water Use Authorisation is required in terms of Section 21 (a), (c) and (i) of the NWA:</p> <ul style="list-style-type: none"> <li>• <i>Section 21(a) – taking water from a water resource.</i></li> <li>• <i>Section 21(c) - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses); and</i></li> <li>• <i>Section 21 (i) - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses).</i></li> </ul>

## 2.1 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
The Constitution (No. 108 of 1996)	Chapter 2 – Bill of Right Section 24 – Environmental Rights

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
KZN Nature Conservation Ordinance (Ordinance No. 15 of 1974)	<p>Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation.</p> <p>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.</p> <p><b><i>Seven plants species protected under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area. These include Aloe cooperi, Aloe marlothii, Aloe sp. (unidentified due to lack of flowering material), Crocosmia aurea, Gladiolus ecklonii, Kniphofia sp. (probably K. tysonii subsp. tysonii) and Zantedeschia aethiopica. An Ordinary Permit is required from Ezemvelo KZN Wildlife if provincially protected species listed are to be handled in any manner during implementation of the proposed road upgrade project.</i></b></p>
<p>National Environmental Management Biodiversity Act (Act No. 10 of 2004) and Regulations:</p> <ul style="list-style-type: none"> <li>• Threatened or protected species (GN 388)</li> <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>	<p>Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.</p>
National Environmental Management: Protected Areas Act (Act No. 57 of 2003) - NEMPAA	<p>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.</p> <p><b><i>The Entumeni Nature Reserve is located within 5 km of the road rehabilitation project.</i></b></p>
National Environmental Management:	Section 17 - Every attempt must be made to reduce,

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
Waste Act (Act No. 59 of 2008)	<p>recycle or re-use all waste before it is disposed.</p> <p>Section 25 - All waste (general and hazardous) generated during construction may only be disposed of at appropriately licenced waste disposal sites.</p>
National Environmental Management: Air Quality Act (Act No 39 of 2004)	<p>Section 32 - Control of dust.</p> <p>Section 34 - Control of noise.</p> <p>Section 35 - Control of offensive odours.</p>
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	<p>Section 22 - Application for a mining permit / right.</p> <p>Section 39 - Environmental management programme and environmental management plan.</p> <p><b><i>Material for construction shall be sourced from commercial sources.</i></b></p>
National Heritage Resources Act (Act No. 25 of 1999)	<p>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.</p> <p>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 palaeontological site.</p> <p>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.</p> <p><b><i>The site of the former Fort Chater is situated approximately 135 m to the immediate north of the footprint. A buffer zone of 30 m is proposed around the site.</i></b></p>
Occupational Health and Safety Act (Act No. 85 of 1993)	<p>Section 8 - General duties of employers to their employees.</p> <p>Section 9 - General duties of employers and self-employed persons to persons other than their employees.</p>
Construction Regulations (2014)	<p>Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.</p>

Acts/Guideline/Policies/Environmental Management Instruments	Considerations
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)	

## 2.2 Sustainable Development

The principle of Sustainable Development has been established in the Constitution of the Republic of South Africa (Act No. 108 of 1996) and given effect by NEMA. Section 1(29) of NEMA states that sustainable development means the integration of social, economic and environmental factors into the planning, implementation and decision-making process so as to ensure that development serves present and future generations.

Therefore, Sustainable Development requires that:

- The disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- The disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;
- Waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.

## 2.3 Climate Change Consideration

The proposed project will take into account energy efficient technologies and consider international best practice in terms of the construction methodologies and management of finite resources.

Since climate change concerns include unpredictability and severity in weather patterns, the provision of basic human needs, such as fresh water supply, is considered critical.



### 3 PROJECT CONTEXT & MOTIVATION

#### 3.1 Status Quo

Km 17,34 to km 26,00 is in an extremely poor condition, structural failure is evident with large extensive potholes throughout the section. Block cracks are extensive with the pumping fines are also evident throughout the section. The failures occur along the entire length (km 17,34 – km 26,00) of road due to moisture ingress and poor maintenance relative to the high traffic loading. The pavement is in a severe condition and is unsuitable for the future design traffic and requires strengthening.

Maintenance in the form of patches has been ongoing but it was noted that the patches on this section are not performing well and the road has reached the end of its design life.

#### 3.2 Road Reserve

The existing road reserve is 30m wide and all rehabilitation work will be undertaken within the road reserve. No temporary bypasses are required during the construction phase.

#### 3.3 Co-ordinates

*Table 3-1: Co-ordinates of the road rehabilitation project*

	Latitude	Longitude
Start	28° 51' 10.26" S	31° 21' 02.46"E
Point 1	28° 51' 02.91" S	31° 20' 59.83"E
Point 2	28° 50' 56.97" S	31° 20' 51.47"E
Point 3	28° 50' 57.97" S	31° 20' 42.52"E
Point 4	28° 51' 12.41" S	31° 20' 35.90"E
Point 5	28° 51' 17.16" S	31° 20' 29.04"E
Point 6	28° 51' 12.42" S	31° 20' 21.22"E
Point 7	28° 51' 17.05" S	31° 20' 16.11"E
Point 8	28° 51' 24.21" S	31° 20' 13.56"E
Point 9	28° 51' 23.69" S	31° 20' 04.36"E
Point 10	28° 51' 15.69" S	31° 20' 00.20"E
Point 11	28° 51' 11.28" S	31° 19' 55.90"E
Point 12	28° 51' 08.77" S	31° 19' 44.23"E
Point 13	28° 51' 07.06" S	31° 19' 34.35"E
Point 14	28° 51' 09.75" S	31° 19' 25.67"E
Point 15	28° 51' 17.71" S	31° 19' 20.60"E
Point 16	28° 51' 27.56" S	31° 19' 20.47"E
Point 17	28° 51' 33.47" S	31° 19' 11.47"E

	Latitude	Longitude
End	28° 51' 39.81" S	31° 16' 59.71"E

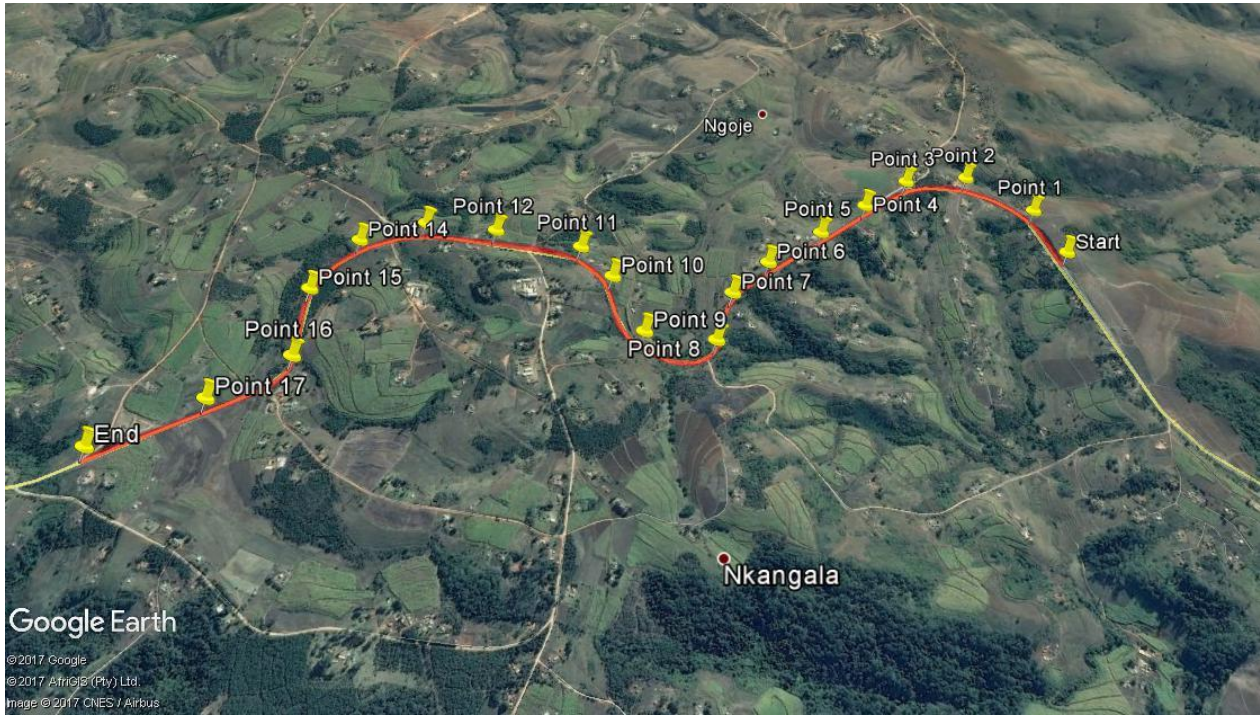


Figure 3-1: Route Alignment Co-ordinate Points

### 3.3.1 Surrounding Land Uses

Table 3-2: Surrounding land uses

Description	Y/N	Description	Y/N
Natural area	Y	Light industrial	N
Low density residential	N	Medium industrial	N
Medium density residential	N	Heavy industrial	N
High density residential	N	Power station	N
Informal residential	Y	Military or police base/station/compound	N
Retail commercial & warehousing	N	Spoil heap or slimes dam	N
Office/consulting room	N	Dam or reservoir	N
Quarry, sand or borrow pit	N	Hospital/medical centre	N
School	N	Tertiary education facility	N
Church	N	Old age home	N
Sewage treatment plant	N	Train station or shunting yard	N
Railway line	N	Major road (4 lanes or more)	N
Harbour	N	Plantation	Y

Description	Y/N	Description	Y/N
Sport facilities	N	Agriculture	N
Golf course	N	River, stream or wetland	Y
Polo fields	N	Nature conservation area	N
Filling station	N	Mountain, koppie or ridge	N
Landfill or waste treatment site	N	Museum	N
Historical building	N	Protected Area	Y
Graveyard	N	Archaeological site	N
Airport	N	Other:	N

Key: Y = Yes P = Possibly N = N

### 3.3.2 *Material for Construction*

All fill material shall be sourced from the existing borrow pit situated at km 0,02 just after the intersection P50-2 with P326 (28°53'1.56" S; 31°16'34.16" E). The gravel sub base, base layer material shall be obtained from commercial sources.

## 3.4 . Project Description

### 3.4.1 *Culvert Replacement and/or Upgrades*

The design methodology used for the culverts is in accordance with The South African National Roads Agency SOC Limited (SANRAL) Drainage Manual 6th Edition. The stormwater design also complies with the KZN: DOT Standard Specifications, KZN: DOT Drainage Manual and KZN: DOT Standard Drawings. The Rational Method Alternative 3 (SANRAL Drainage Manual 6th Edition) were used to calculate the flood peaks for the stormwater design. The individual catchment areas for the roads and minor culvert structures are less than 15km<sup>2</sup>.

The design philosophy is to allow the stormwater to flow through the culverts, which will be aligned along the natural watercourse. New 600 mm or larger pipe culverts will be installed at intervals where required to disperse overland and road surface runoff collected in the side drains. Outlet structures at a culvert or a natural watercourse are designed and equipped with energy dissipaters to reduce velocities to levels which mirror natural flow, in order to mitigate the impacts of erosion on the unlined downstream.

As a result of the requirement to replace the culverts a number of activities and legislated requirements will be triggered and they are summarised in the Text Box below.

***EIA Regulations (2014 as amended in 2017): Listing Notice 1 and 4 triggers due to the culvert replacement***

**Activity 19 (L.N.1)**- The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse

**Activity 14 (LN3)**: The development of infrastructure or structures with a physical footprint of 10m<sup>2</sup> or more where such development occurs within a watercourse. In KwaZulu-Natal, outside urban areas:

(aa) within 5 km from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.

***Section 21 water use triggers***

**Section 21(c)** - impeding or diverting the flow of water in a watercourse (applicable for the construction within watercourses)

**Section 21 (i)** - altering the bed, banks, course or characteristics of a watercourse (applicable for the construction within watercourses)

***Other potential permits & licences***

**Ezemvelo KZN Wildlife permit** for the handling, removal, destroying, damaging, and relocation of species listed in Schedule 12 of the Natal Nature Conservation Ordinance – not expected to be required.

### **3.4.2 Road Rehabilitation**

The Works to be carried out include the following main activities:

- The Contractor's establishment on site and the provision of facilities for the Engineer, including a materials testing laboratory facility.
- Provision of traffic accommodation facilities;
- Clearing and grubbing;
- Provision of survey control, and setting out of Works;
- Continuous maintenance of the existing road during the construction period, including patching and edge break repairs;
- Construction of subsoil drainage;
- Extension of the prefabricated pipe culvert(s) cross-drainage together with the reconstruction of the affected inlet and outlet structures;
- The existing drainage structures will require lengthening, cleaning (flushing), headwalls and gabion mattresses. Clearing of vegetation and excavating of earth side drains will be required.
- Widening of the existing fills to accommodate the new roadway formation width, using gravel material imported from the existing borrow pit;
- Construction of a 300 mm thick selected subgrade layer (G7) to the top of the fill widening using gravel material imported from the existing borrow pit;
- Import 100 mm G4 gravel material on top of the exiting bituminous surface;
- In situ cement stabilised the existing base together with the 100 mm imported G4 gravel material;
- Construction of a new 80 mm bituminous base layer;
- Construction of shoulder fill (G7) using gravel material imported from the existing borrow pit and from commercial source to achieve a 10 m wide surfaced road;
- Priming to protect the base layer;
- Construction of 40 mm continuously graded medium-grade wearing course;

- Construction of road prism drainage, including open concrete lined drains where necessary;
- Application of road markings and installation of roadstuds;
- Grass sodding and hydro-seeding to protect the cut and fill slopes where required, and to reinstate the vegetation at spoil, stockpile and borrow areas;
- Improvements to existing minor access points;
- Erection of new guardrails and fencing;
- Installation of road signs and road marking;
- Finishing and cleaning up of the road and road reserve; and
- Removal of all site establishment facilities and constructional plant on completion of the Works.

All of the above mentioned activities are viewed as maintenance and rehabilitation works and will be undertaken within the existing road reserve and sphere of influence and therefore they will not trigger any listed activities as summarised in the Text Box below.

### 3.5 Traffic Accommodation

It is proposed that all works on Road P50-1 (km 17,34 to km 26,00) will be undertaken using the half-width construction method (one lane will be worked upon at a time) under stop / go traffic accommodation. Two closures with a maximum closure distance of 2.0 km (0.25 km taper either side) are proposed. The minimum distance of 2 km between two closures shall be maintained at all times to allow for overtaking, no temporary bypasses will be constructed.

Allowance must be made for night closures. It is proposed that night closures be managed utilising traffic signals.

### 3.6 Project Motivation

#### 3.6.1 Need & Desirability

Table 3-3: Project need, desirability and benefits

Project Need			
1.	Was the relevant provincial planning department involved in the application?	YES	
2.	Does the proposed land use fall within the relevant provincial planning framework? As the project is a rehabilitation of the existing P50-1, it does not constitute a new land use and is therefore considered to be in line with the provincial framework.	YES	
3.	If the answer to questions 1 and / or 2 was NO, please provide further motivation / Explanation – N/A.		
Desirability			
1.	Does the proposed land use / development fit the surrounding area?	YES	
2.	Does the proposed land use / development conform to the relevant structure plans, SDF and planning visions for the area?	YES	

3.	<p><b>Will the benefits of the proposed land use / development outweigh the negative impacts of it?</b></p> <p>The current road and culverts in need of repair and rehabilitation, and therefore the benefits of rehabilitating this road to ensure it will continue to be safe to its users outweighs any impacts which are expected to be most prevalent during the temporary construction phase.</p>	YES	
4.	<b>If the answer to any of the questions 1-3 was NO, please provide further motivation / Explanation – N/A.</b>		
5.	<p><b>Will the proposed land use / development impact on the sense of place?</b></p> <p>The P50-1 is an existing road.</p>		NO
6.	<p><b>Will the proposed land use / development set a precedent?</b></p> <p>The project is limited to the rehabilitation of an existing road.</p>		NO
7.	<p><b>Will any person's rights be affected by the proposed land use / development?</b></p>		NO
8.	<p><b>Will the proposed land use / development compromise the "urban edge"?</b></p> <p>The area is completely rural in nature and will have no effect on the urban edge.</p>		NO
9.	<b>If the answer to any of the question 5-8 was YES, please provide further motivation / explanation – N/A.</b>		
<b>Benefits</b>			
1.	<p><b>Will the land use / development have any benefits for society in general?</b></p>	YES	
2.	<p><b>Explain:</b> The proposed rehabilitation design is based on the future design traffic and material testing. The rehabilitation proposal considers the widening of the surface width to 10m, the strengthening of the pavement and the construction of ancillary road works like concrete drains for drainage, guardrails and gabions to improve the safety of the road for the road user.</p>		
3.	<p><b>Will the land use / development have any benefits for the local communities where it will be located?</b></p>	YES	
4.	<p><b>Explain:</b> The existing road (km 17,34 – km 26,00) is in need of rehabilitation as it is in an extremely poor condition, structural failure is evident with large and extensive potholes throughout the section. Block cracks are extensive with the pumping fines also evident throughout the section. The pavement is in a severely degraded condition and is unsuitable for the future design traffic and requires strengthening.</p> <p>Furthermore the existing surfaced area varies around a width of 8,5 m and does not conform to a Class 2 cross section standard.</p> <p>The rehabilitation of this road will ensure that the road is safe for users.</p>		

### 3.6.2 Socio-economic Value

What is the expected capital value of the activity on completion?	R 30 million
What is the expected yearly income that will be generated by or as a result of the activity?	N/A
Will the activity contribute to service infrastructure?	Yes
Is the activity a public amenity?	Yes
How many new employment opportunities will be created in the development phase of the activity?	60
What is the expected value of the employment opportunities during the development phase?	R 0.9 million
What percentage of this will accrue to previously disadvantaged individuals?	100%
How many permanent new employment opportunities will be created during the operational phase of the activity?	N/A
What is the expected current value of the employment opportunities during the first 10 years?	N/A
What percentage of this will accrue to previously disadvantaged individuals?	N/A

## 4 PROJECT ALTERNATIVES

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In terms of the EIA Regulations (2014) (as amended in 2017) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the NEMA (Act No. 107 of 1998) (as amended).

An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity which may include alternatives to:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

### 4.1 Site Alternatives

The project involves the rehabilitation to a portion of the existing P50-1, therefore no off-site or other site-specific alternatives have been investigated.

### 4.2 Layout / Route Alignment Alternatives

As the project proposes to rehabilitate the existing P50-1 from km 17,34 to km 26,00, the existing layout or alignment will be followed and work will be undertaken within the 30 m road reserve.

### 4.3 Design Alternatives

New 600 mm or larger pipe culverts will be installed at intervals where required to disperse overland and road surface runoff collected in side drains.

The following best-practice environmental design considerations will need to be considered in culvert design and construction:

- Selection of culvert shape should be based on water depth, roadway embankment height, hydraulic performance, and allowing for species movement.
- Culverts should ideally be sized to transport not only water, but the other materials that might be mobilized during storm events, as well as provide passage of aquatic species such as fish.
- Best management practices for road engineering include designing stream crossing culverts to convey a minimum discharge equal to the 100-year flow.
- The culvert outlet apron must be established at the same level as the river bed.
- Contrary to the principle for piers of 'fewer and smaller is better', many large culverts are preferred over fewer small culverts. This ensures that these structures cater for the maximum flow volumes experienced by the river. To prevent culvert plugging, one large culvert is typically more effective than several smaller ones<sup>1</sup>.
- Appropriate measures to dissipate flow velocity below the culvert structure must be considered and designed for pre-construction.
- Erosion protection measures (e.g. Reno-mattresses) or energy dissipaters must be established below all culvert outlets.

<sup>1</sup> Furniss, MJ., Ledwith TS., Love MA., McFadin BC. And Flanagan SA. 1998. Responses of Road-Stream Crossings to Large Flood Events in Washington, Oregon, and Northern California. San Dimas Technology and Development Centre, San Dimas, California.



- The base (invert) of the new culvert must be at the exact same elevation as the existing one so that there are no significant upstream and downstream adjustments in channel form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be onsite to guide the settling of the foundation.
- The inlet of the culvert base must match the elevation of the river bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than river bed).
- The culvert must be designed to adequately allow for the natural through flows without impeding and focusing flows. Road-stream crossings with undersized culverts can cause large inputs of sediment to streams if the culvert inlet is plugged and stream-flow overtops the road fill<sup>2</sup>.
- Coarse stone material should be incorporated into culverts to mimic natural riffle/ run river biotopes. Furthermore, coarse culvert beds will reduce scouring downstream by reducing flow velocities through increased surface roughness.
- A headwall should be installed at the inlet of the culvert to protect crossing fill from saturation and scour and direct flow into the culvert. The stream should flow straight into the culvert inlet at all stream discharges without any ponding, eddying or abrupt changes in flow path which could result in increased potential for culvert blockage by woody material<sup>3</sup>.
- In situations where the base of the culvert is below natural ground level, a concrete drop inlet structure or chute must be constructed at the inlet of the culvert to drop the water level without cause headcut erosion of the wetland upstream.

#### 4.4 NO-GO Alternative

The NO-GO alternative will see the *status quo* of the P50-1 remain. Should the *status quo* remain, the culverts will not be replaced and will continue to experience hydraulic capacity challenges. Furthermore, the road will not conform to a Class 2 cross-section standard and there will be ongoing safety concerns for road users. The pavement which is already severely degraded will continue to pose a threat to users.

<sup>2</sup> Furniss, M.J., Ledwith TS., Love MA., McFadin BC. And Flanagan SA. 1998. Responses of Road-Stream Crossings to Large Flood Events in Washington, Oregon, and Northern California. San Dimas Technology and Development Centre, San Dimas, California.

<sup>3</sup> Cafferata, P., Spittler, T., Wopat, M., Bundros, G., and Flanagan, S., 2004, Designing watercourse crossings for passage of 100 year flood flows, wood, and sediment, California Department of Forestry and Fire Protection, Sacramento, CA. Available at: <http://www.fire.ca.gov/ResourceManagement/PDF/100yr32links.pdf>.

## 5 DESCRIPTION OF THE BASELINE ENVIRONMENT

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### 5.1 Geology and Soils

The site is primarily underlain by Natal Group Sandstone described as generally reddish, feldspathic and micaceous sandstone with subordinate quartz arenite, mudrock, granulestone and conglomerate. The central areas of the site are underlain to a lesser extent with Karoo dolerite which comprises a network of dolerite sills, sheets and dykes, mainly intrusive into the Karoo Supergroup (Department of Agriculture Land Cover Database).

Soils on site comprise primarily freely drained, red and yellow apedal soils with humic topsoils making up more than 40% of the land type with lesser extents of predominantly shallow soils (Mispah and Glenrosa forms) with little or no lime in the landscape (Department of Agriculture Land Cover Database).

### 5.2 Climate

The town of Eshowe usually receives approximately 933 mm of rain per year which falls primarily during mid-summer. The area receives the lowest rainfall in July (16 mm) and the highest in January (137 mm). The average midday temperatures range from about 21.8 °C in July to 27.5 °C in February. The coldest temperatures in the Eshowe area are observed in July where night temperatures are, on average, 9.3 °C.

### 5.3 Ecology

#### 5.3.1 Regional & Local Biophysical Setting

At a bioregional scale, the study area falls within the Savanna Biome and Sub-Escarpment Savanna Bioregion. At the regional and local vegetation type scale, the site falls within the Moist Coast Hinterland Grassland (Gs 20) (**Scott-Shaw and Escott, 2011**) also known as Ngongoni Veld (SVs 4) (**Mucina and Rutherford, 2006**) (**Figure 5-1**). This grassland type occurs on rolling and hilly landscapes and is characterised by dense tall sour grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*) with this mono-dominance associated with low species diversity (**Mucina & Rutherford, 2006**). However, when in good condition it is dominated by *Themeda triandra* and *Tristachya leucothrix* diversity (**Mucina & Rutherford, 2006**). The KZN Vegetation map also indicates the presence of an azonal vegetation type, Alluvial Wetlands: Temperate Alluvial Vegetation (**Rivers-Moore & Goodman, 2010**). This is a vegetation type that develops on seasonally or permanently saturated alluvial soils associated with rivers.

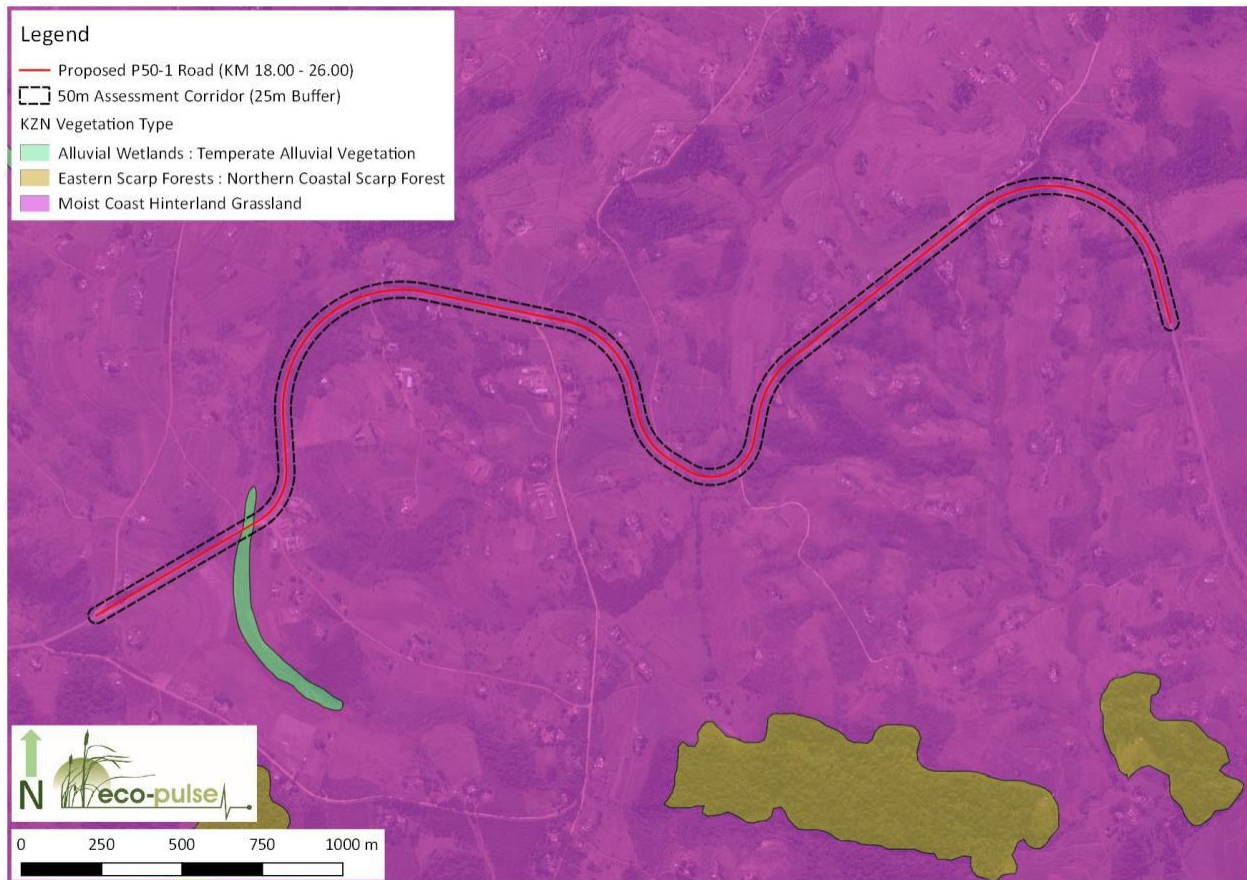


Figure 5-1: Map showing the distribution of Provincial vegetation types within and around the study area

### 5.3.2 Conservation Context

Understanding the conservation context and importance of the study area and surrounds is important to inform decision making regarding the management of the resources in the area. In this regard, national, provincial and regional conservation planning information available was interrogated to obtain an overview of the study site in terms of conservation. Key findings that have a bearing on the proposed development include the following:

#### 5.3.3 National and Provincial Vegetation Type (Mucina & Rutherford, 2006)

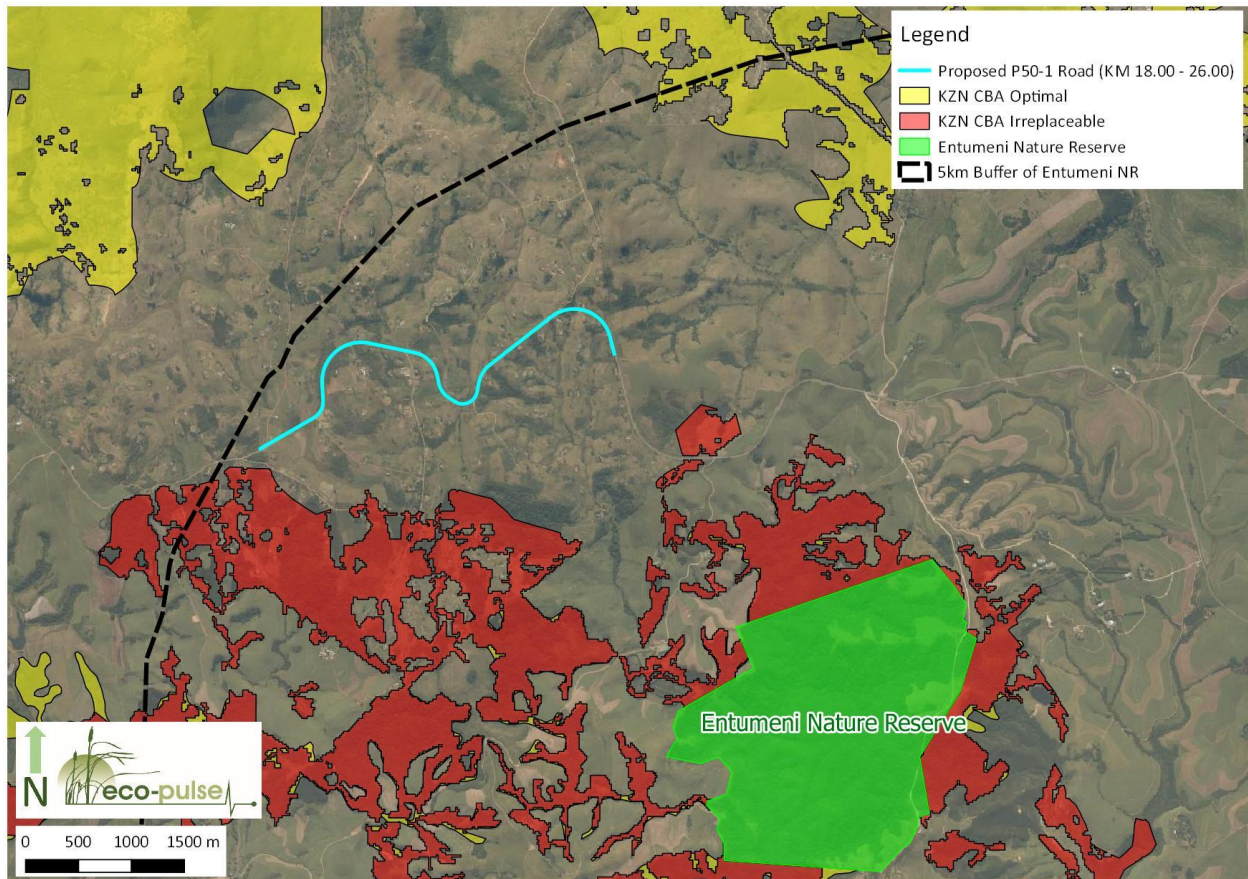
The Moist Coast Hinterland Grassland has a national threat status of **Vulnerable (NBA, 2011)** and provincial threat status of **Endangered (Jewitt, 2014)**. Less than 1% of the unit is statutorily conserved in the Ophathe and Vernon Crookes Nature Reserves hence it is considered poorly protected.

#### 5.3.4 KZN Systematic Conservation Assessment (SCA)

The Systematic Conservation Assessment (SCA) is a strategic conservation plan developed in 2016 by the Provincial Conservation Authority, *Ezemvelo KZN Wildlife (EKZNW)*, to ensure that representative samples of biodiversity are conserved. In terms of SCA, three categories were developed including;

- (i) Critical Biodiversity Area (CBA): Irreplaceable,
- (ii) (ii) CBA: Optimal and
- (iii) (iii) Ecological Support Area(s).

Interrogation of the SCA plan revealed that the study area is not a CBA or ESA (**Figure 5-2**). This means that the study area is a low priority area for the conservation of terrestrial biodiversity features.



*Figure 5-2: Map showing outputs of the Terrestrial SCA*

## 5.4 Freshwater Resources

The study area occurs within two DWA quaternary catchments; W11A (east) and W12B (west). The majority of the road upgrade will occur within the quaternary catchment W12B. Quaternary catchments W11A and W12B both form part of the Usutu to Mhlatuze Water Management Area (WMA).

Watercourses within the study area occurring within W12B are within the uMhlatuze River catchment. The uMhlatuze River is the main collecting river of the catchment and is located approximately 8 km downstream. More locally, the 1: 50000 2831CD topo-cadastral map indicates that the road under investigation currently crosses two tributaries of the Bomvana River. The Bomvana River is a right-bank tributary of the uMvazane River that is a right-bank tributary of the uMhlatuze River. The western tributary is called the Kwanonkolombelana Stream and the eastern tributary is unnamed.

Watercourses within the study area occurring within W11A are within the Matigulu River catchment. The Matigulu River is the main collecting river of the catchment and is located approximately 11.5 km south of the study area. According to the 1999, desktop PES assessment, the Mhlatuze River is in a 'Largely Natural' condition (**Class B**), whilst the Matigulu River is in an 'unmodified, natural' condition (**Class A**), potentially highlighting their ecological sensitivity.

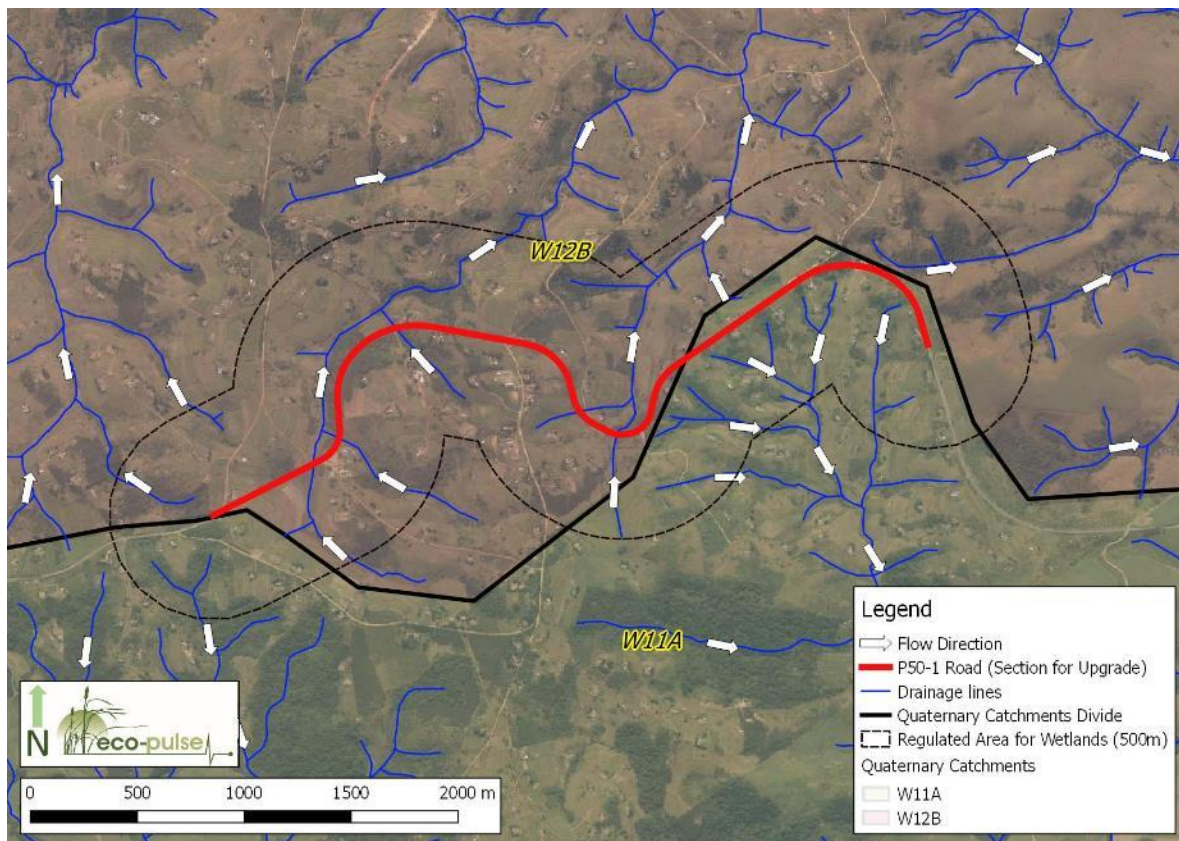


Figure 5-3: Local drainage setting within and downstream of the road upgrade site

#### 5.4.1 National Conservation Planning

In terms of the NFEPA project, the study area occurs within two sub-quaternary catchments. The northern sub-quaternary catchment is not classified as a River FEPA, however, the southern sub-quaternary catchment is classified as an Up-stream Management Area. Up-stream Management Areas are sub-quaternary catchments which have been identified as part of the NFEPA project where human activities need to be managed in order to prevent degradation of key downstream river FEPAs and Fish Support Areas (Driver et al0, 2011). No wetland FEPAs are present in close proximity to the study area.

In terms of the freshwater component (NFEPA), the sub-escarpment savannah wetland vegetation group is listed as **Endangered**.

#### 5.4.2 Provincial Conservation Planning

In terms of the provincial vegetation threat status assessment, the Moist Coast Hinterland Grassland Vegetation Type is listed as **Endangered** whilst the local wetland type, which occurs within the study area, Alluvial Wetlands: Temperate Alluvial Vegetation, is listed as **Vulnerable**.

In terms of the KZN Freshwater Systematic Conservation Plan (SCP), the planning units No. 2080, 2175 and 2179 which accounts for the majority of the area within the study site is classified as 'Available'. This means the catchment has been identified as being available for conservation purposes. Areas on the extreme western and eastern extents of the study site, namely: planning units No. 2074 and 2086, have been 'Earmarked' for conservation. This means the catchment has been identified as having a potential to conserve aquatic biodiversity.

In terms of the 2016 KZN SCA, terrestrial and freshwater ecosystems within the study area are not classified as either CBAs or ESAs. The study area is classified as a Biodiversity Area and none of the sites have been classified as a Critical Biodiversity Area (CBA). Biodiversity areas are not flagged as biodiversity priorities but do still potentially host important species and thus are not open to wholesale development (EKZNW, 2011).

## 5.5 Desktop Watercourse Delineation

The watercourse units occurring within a 500 m radius of the proposed project were mapped at a desktop level and classified in terms of their broad HGM type (**Figure 5-4**). The upper reaches of the quaternary catchment W11A, on the south eastern extent of the site, are synonymous with very steep slopes which do not favour wetland formation, however, some localised wetland units were evident some distance downstream (**Figure 5-4**). The western extent of the study site, located within the upper reaches of quaternary catchment W12B, had a much gentler gradient which seemed to favour wetland formation; this was confirmed during the site visit (**Figure 5-4**).

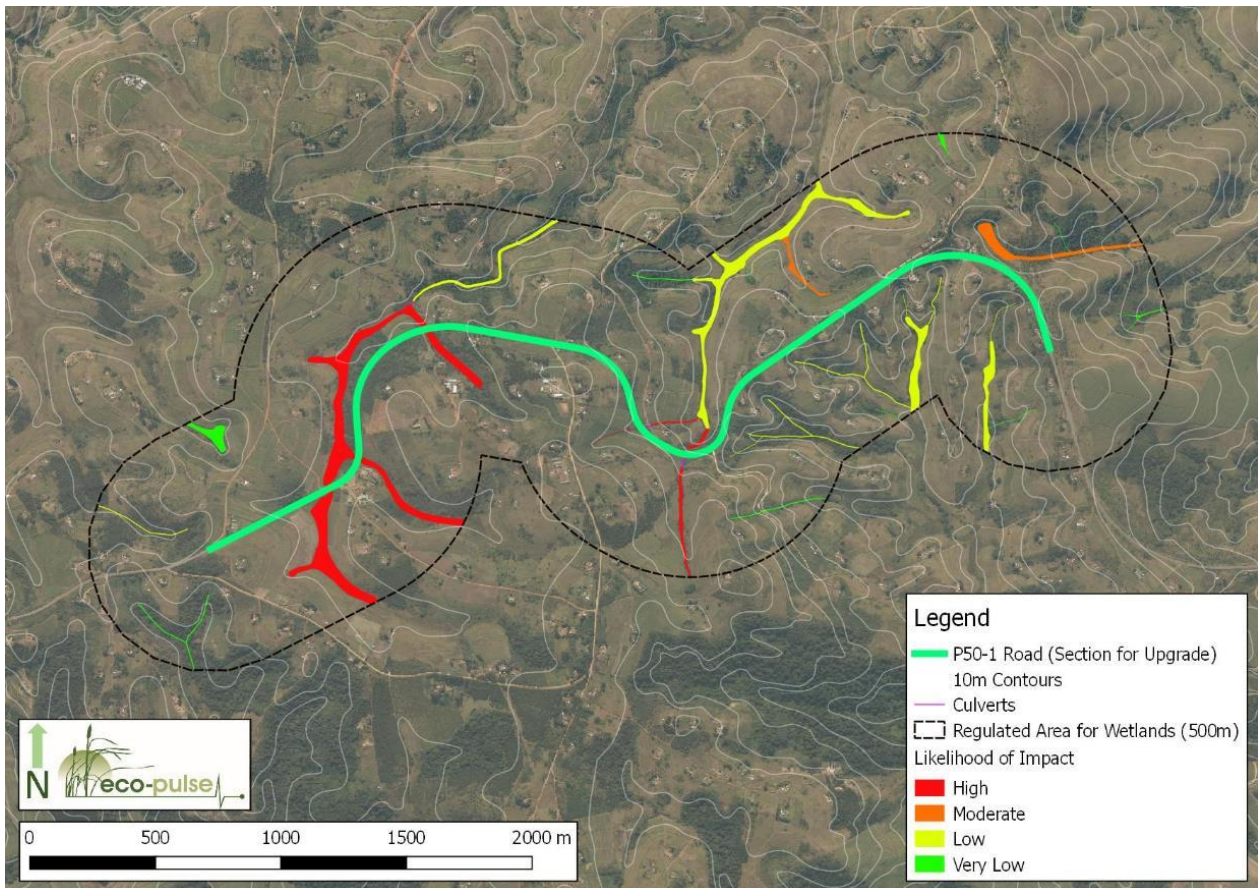


Figure 5-4: Likelihood of impact rating for the desktop mapped watercourses

## 5.6 Land Use

The road passes through an area that is surrounded by sugarcane and timber plantations with some farm accesses.

## 5.7 Heritage and Archaeological Resources

The middle reaches of the Thukela River Valley to the immediate south west of the project area has been thoroughly surveyed by archaeologists during the last 30 years or so. This area was the focus of various research projects by archaeologists associated with the then Natal and Ondini Museums respectively (**Huffman, 2007**). Three Early Iron Age sites have also been excavated in the recent past notably by archaeologist Len van Schalkwyk who has been working in this area for many years (*ibid*). The records of the KwaZulu-Natal Museum indicate the presence of 2 Early Stone Age sites, 3 Middle Stone Age sites, 6 Intermediate Stone Age sites, 8 Early Iron Age sites, 3 Later Iron Age sites, and 2 Historical sites in this area. However, none of these occur on the actual footprint.

The greater Eshowe area was pivotal in the rise and development of the Zulu kingdom in the 1820's, the Anglo Zulu-War of 1879, and the Bambatha Rebellion of 1910 (Derwent 2006). Various historical period sites occur in or adjacent to Eshowe. These include Queen Nandi's grave, the Manadawe Cross, Norwegian Soldiers Grave, Fort Kwa Mondli, King Cethswayo's Grave, The Eshowe Jail, the Old Residency, Fort Nongqayi, and the military Ikhanda of King Shaka – KwaBuluwayo. None of these sites are located closer than 1 km to the proposed development.

### 5.7.1 Fort Chater

According to the SAHRA national data base Fort Chater, a structure constructed in 1883, is situated approximately 135 m to the immediate north of the footprint at 28°51'15.72" S; 31°20'05.06" E. No physical remains of this former fort is visible on the surface. The reason is that the fort was a hastily constructed temporary feature. Today the area is covered by cultivated lands and woodlots and individual homesteads (**Figure 5-5**).



**Figure 5-5: Old exotic trees adjacent to an existing homestead may relate to the former Fort Chater, however, there are no archaeological remains or features on this site (A). Cane field plantations situated on the site of the former Fort Chater (B)**

#### **Historical context**

In May 1883 during the 3<sup>rd</sup> Zulu Civil War, the uSuthu repulsed the local forces raised by Melmoth Osborn, the then resident commissioner of the Reserve Territory, in the battle of Nkandla Forest. Osborn's men fell back on Fort Chater, an earthwork hastily thrown up by British troops of the Natal garrison stationed at Fort Curtis. Fort Chater was close to Entumeni, a Norwegian mission station, and barred the way to Eshowe, the seat of Osborn's administration, against the uSuthu in Nkandla. During mid-1884, British troops reinforced the African levies holding this strategic post. The uSuthu in Nkandla submitted in early September 1884, and the British garrison of Fort Chater was reduced. The fort was abandoned in May 1887 when the Reserve Territory became part of the colony of Zululand (**Laband, 2009**).

## 6 PUBLIC PARTICIPATION PROCESS

Public participation is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and / or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

I&APs include all interested stakeholders, technical specialists, and the various relevant organs of state who work together to produce better decisions.

The primary aims of the public participation process are:

- to inform I&APs and key stakeholders of the proposed application and environmental studies;
- to initiate meaningful and timeous participation of I&APs;
- to identify issues and concerns of key stakeholders and I&APs with regards to the application for the development (i.e. focus on important issues);
- to promote transparency and an understanding of the project and its potential environmental (social and biophysical) impacts (both positive and negative);
- to provide information used for decision-making;
- to provide a structure for liaison and communication with I&APs and key stakeholders;
- to ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process);
- to focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders; and
- to provide responses to I&AP queries.

The public participation process must adhere to the requirements of Regulations 41 and 42 (GNR 982 as amended by GNR 326 in 2017) under the NEMA (as amended).

The public participation process for proposed P50-1 rehabilitation project will be undertaken according to the stages outlined below.



**Figure 6-1: Responsibilities of I&APs**

In order to achieve a higher level of engagement, a number of key activities have taken place and will continue to take place. These included the following:



- The identification of stakeholders is a key deliverable at the outset, and it is noted that there are different categories of stakeholders that must be engaged, from the different levels and categories of government, to relevant structures in the non-governmental organisation (NGO) sector, to the communities of wards of residential dwellings which surround the works;
- The development of a living and dynamic database that captures details of stakeholders from all sectors;
- The fielding of queries from I&APs and others, and providing appropriate information;
- The convening of specific stakeholder groupings / forums as the need arises;
- The preparation of reports based on information gathered throughout the BA via the PPP and feeding that into the relevant decision-makers;
- The PPP includes distribution of pamphlets or Background Information Documents (BIDs) and other information packs; and
- Where appropriate site visits may be organised, as well as targeted coverage by the media.

The proposed P50-1 PPP has entailed the following activities.

## 6.1 Authority Consultation

The competent authority, the KZN EDTEA, is required to provide an EA (whether positive or negative) for the project. The KZN EDTEA was consulted from the outset of this study, and has been engaged throughout the project process.

Authority consultation included the following activities:

- Pre-application consultation and site visit with Mr M Mdamba KZN EDTEA on 27<sup>th</sup> June 2017.
- Submission of an application for environmental authorisation in terms of Section 26 of the EIA Regulations (2014) (as amended in 2017) on 28<sup>th</sup> August 2017.

## 6.2 Consultation with Other Relevant Stakeholders

Consultation with other relevant key stakeholders were, and will continue, to be undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project during the BA process.

Relevant key stakeholders were consulted and sent pamphlets or BIDs and other information packs (where requested).

All relevant stakeholders will be allowed an opportunity to comment on the draft Consultation BAR.

The identified stakeholders of this project are provided in **Table 6-1**.

*Table 6-1: Key stakeholders*

OWNERS AND OCCUPIERS OF LAND ADJACENT TO THE SITE	
Ingonyama Trust Board	
LOCAL AUTHORITY	
Mr. Mpanza	King Cetshwayo District Municipality
Mr. K.C. Zulu	uMlalazi Local Municipality
Mr Mzimela	Councillor
STATE DEPARTMENTS	

Ms. Weziwe Tshabalala	AMAFA KwaZulu-Natal
Ms. Modise	KwaZulu-Natal Department of Agriculture, Forestry and Fisheries
Mr. Andy Blackmore	Ezemvelo KZN Wildlife
Ms. Shameela Ramburan	National Department of Water and Sanitation

### 6.3 Site Notification

The EIA Regulations (2014)(as amended in 2017) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates and at points of access or high through traffic.

I&APs were identified primarily from responses received from the notices notify the public of the project and to invite the public to register as stakeholders and inform them of the PP Process.

Royal HaskoningDHV erected a number of notices at various noticeable locations along the rehabilitation route alignment (refer to **Appendix E**).

### 6.4 Identification of Interested and Affected Parties

E-mails were sent to key stakeholders and other known I&APs, informing them of the application for the project, the availability of the draft Consultation BAR for review and indicating how they could become involved in the project.

The contact details of all identified I&APs are updated on the project database, which is included in **Appendix E**.

This database will be updated on an on-going basis throughout the BA process.

### 6.5 Briefing Paper

A Background Information Document (BID) BID for the proposed project was compiled in English and isiZulu (refer to **Appendix E**) and distributed to key stakeholders.

The aim of this document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the BA process, and explains how I&APs could become involved in the project.

The briefing paper was distributed to all identified I&APs and stakeholders, together with a registration / comment sheet inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

### 6.6 Focus Group Meeting

A public meeting was not held for the project as the impacts regarding the project are predictable and can be mitigated effectively through the implementation of an EMPr. A Focus Group Meeting will be held should significant interest / issues arise during the project.

## 6.7 Advertising

In compliance with the EIA Regulations (2014)(as amended in 2017), notification of the commencement of the BA process for the project was advertised in a local newspaper as follows:

- The Isolezwe on 24<sup>th</sup> August 2017 (refer to **Appendix E**).

I&APs were requested to register their interest in the project and become involved in the BA process. The primary aim of these advertisements was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project.

## 6.8 Issues Trail

Issues and concerns raised in the public participation process during the BA process have been and will continue to be compiled into an Issues Trail.

The Issues Trail is attached as **Appendix E**, in which all comments received and responses provided have been captured.

### 6.8.1 Key Issues Raised by the Public

Thus far no comments have been received.

## 6.9 Public Review of the draft Consultation BAR

The draft Consultation BAR (cBAR) will be made available for authority and public review for a total of 30 days from 28<sup>th</sup> August 2017 to 27<sup>th</sup> September 2017.

The report will be made available at the following public locations within the study area, which are all readily accessible to I&APs:

- At a local library.
- Electronically on the Royal HaskoningDHV Website: [www.rhdhv.co.za](http://www.rhdhv.co.za).

## 6.10 Final Consultation BAR

The final stage in the BA process entails the capturing of responses and comments from I&APs on the cBAR in order to refine the BAR, and ensure that all issues of significance are addressed.

The final BAR (i.e. fBAR) will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

## 6.11 PPP Summary

A summary of the PPP is provided in **Table 6-2** below, with the documents provided in **Appendix E**.

**Table 6-2: Summary of Public participation process**

Activity	Description
Identifying stakeholders	Stakeholders were identified and a database of all I&APs were compiled.
Publishing newspaper adverts	The Isolezwe on 24 <sup>th</sup> August 2017.
Distribution of a BID	BIDs were distributed electronically and by hand to I&APs.

Activity	Description
<b>Erection of site notices</b>	A number of A2 site notices were erected on the perimeter of the site.
<b>Preparation of an on-going Issues Trail</b>	Comments, issues of concern and suggestions received from stakeholders thus far have been captured in an Issues Trail.
<b>Release of Draft Report</b>	The draft Consultation Basic Assessment Report (cBAR) has been advertised and made available for a period of 30 days for public review and comment. This cBAR is now available for review until 27 <sup>th</sup> September 2017.
<b>Focus Group Meeting</b>	Not expected.
<b>Release of final Report</b>	The fBAR will be the product of all comments and studies, before being submitted to KZN EDTEA for review and decision-making.

## 7 SPECIALIST ASSESSMENT

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### 7.1 Ecology

This study was undertaken by an independent specialist: Eco-Pulse Environmental Consulting Services.

The study area comprises two distinct terrestrial vegetation communities, namely Secondary Grassland<sup>4</sup> and Secondary Thicket<sup>5</sup> (**Figure 7-1** and **Figure 7-2**). Transformed areas are also present which have been divided to two land use types, namely Sugarcane Cultivation and Croplands (**Figure 7-1** and **Figure 7-2**).

#### 7.1.1 Secondary Grassland

The secondary grassland community is the most common vegetation community and is estimated to cover the largest area of the study area. This community covers the open stormwater drainage swales and previously cultivated lands. Historic cultivation was confirmed by either the presence of sugarcane plants and sugarcane farm roads along contours or through review of the 2006 aerial imagery on Google Earth.

The community is characterised by a high abundance of tall tufted grasses typically found in disturbed areas and road verges, and limited forb diversity. The following grasses are dominant in small patches *Digitaria eriantha*, *Paspalum urvillei*, *Panicum maximum*, *Eragrostis plana* and *Sporobolus africanus*. These grasses occur in different combinations giving rise to different sub-communities within different disturbance units. The dominance of these grasses is likely attributed to high nutrient levels within previously cultivated and fertilised land and the vigorous growth of these weedy grass species under elevated soil nutrient conditions, as well as the abundance of propagules / seed sources of such species in the surrounding agricultural lands.

Invasive alien plants (IAPs) are generally in low abundance. Although present throughout the secondary grassland community, IAPS are often in small stands. Common IAPs include *Lantana camara*, *Rubus cuneifolius*, *Ricinus communis*, *Psidium guajava* and *Sesbania* sp.



**Photograph 7-1: *Digitaria eriantha* and *Eragrostis plana* grassland with a mix of various forbs and alien shrub species**

<sup>4</sup> A secondary vegetation community is a community that re-establishes through natural processes after a significant removal or disturbance of the original vegetation community by humans or natural causes.

<sup>5</sup> A thicket is a dense stand of trees or tall shrub often with no well-developed herbaceous community covering the ground.

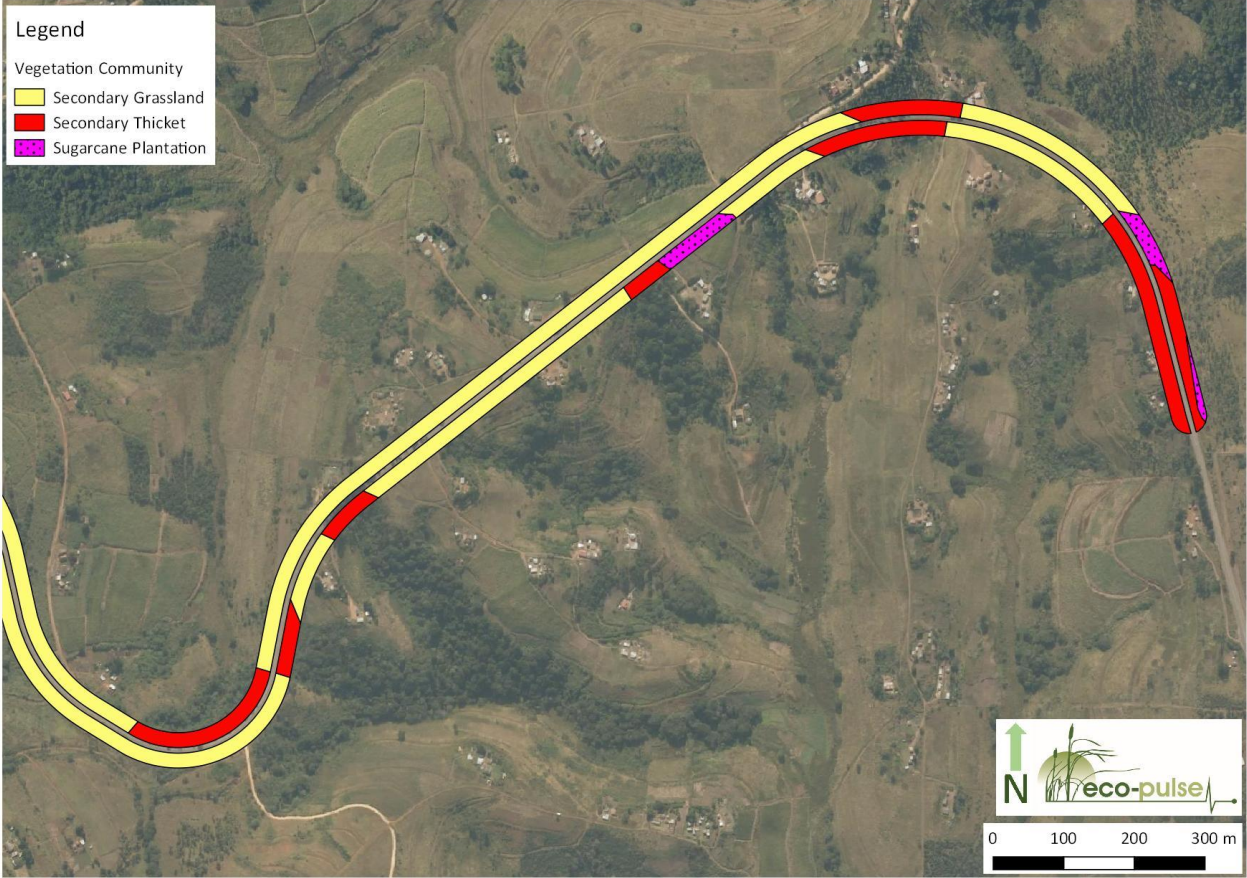


Figure 7-1: Spatial distribution of identified vegetation communities within the eastern half of the study area

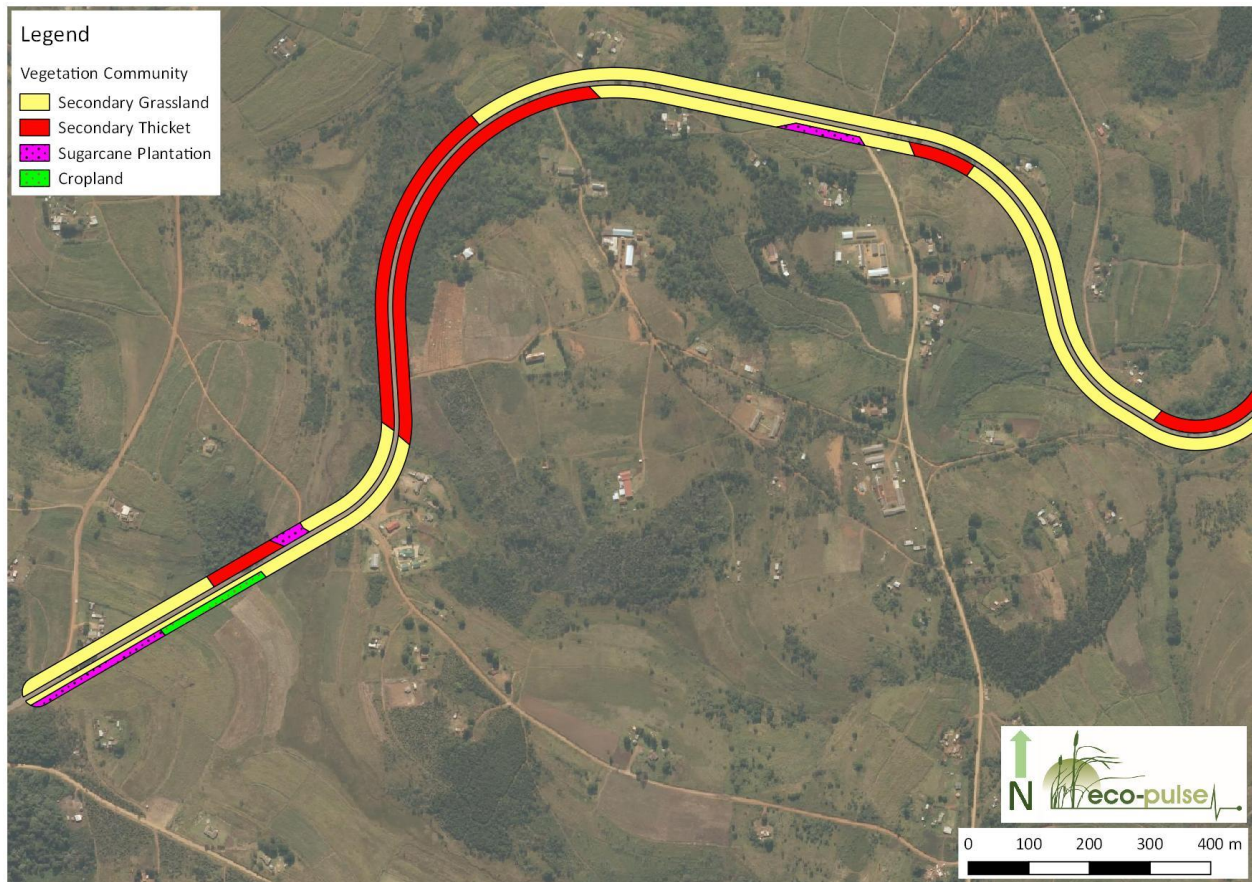


Figure 7-2: Spatial distribution of identified vegetation communities within the western half of the study area

### 7.1.2 Secondary Thicket

The Secondary Grassland community within the study corridor is interrupted by stands of woody species dominated by alien trees which form a Secondary Thicket community. This vegetation community is largely secondary because of past clearing and now it is largely dominated by pioneer / ruderal species and alien invasive species. The Secondary Thicket occurs primarily in valley head settings which are least desirable for sugarcane cultivation but ideal for plantation establishment.

The Secondary Thicket is characterised by a mix of short to medium tall trees interspersed with low shrubs and open and shaded herbaceous layers. Woody species are dominated by aliens, whilst the forbaceous layer is dominated by weeds and ruderal species. The characteristic tree species include alien species namely *Acacia longifolia*, *A mearnsii*, *Eucalyptus* sp., *Populus x canescens* and *Pinus* sp. All species with the exception of *P. x canescens* occur in small stands which suggest they have been planted for silviculture<sup>6</sup>.

<sup>6</sup> Silviculture refers to the growing and cultivation of trees often for commercial purposes.



**Photograph 7-2:** View of road to be upgraded looking southwest with Secondary Thicket characterised by tall trees and shrubs in the background

### **7.1.3 Sugarcane Cultivation**

Several small portions of land within the study corridor are under sugarcane cultivation. Due to transformation, indigenous vegetation is limited to a narrow 1 – 3 m secondary grassland strip along the edge of the P50-1 Road. This community is characterised by a mix of weedy grasses and forbs commonly found in highly disturbed areas. Grasses included *Cynodon dactylon*, *C. nlemfuensis*, *Eleusine coracana*, *Sporobolus pyramidalis* and *Paspalum notatum*.

### **7.1.4 Croplands**

The cropland is another transformed area currently used for cultivating vegetables and crops. This property is fenced off and falls within the study corridor.

### **7.1.5 Protected Flora and Plant Permit Requirements**

Seven plants species protected under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area. These include *Aloe cooperi*, *Aloe marlothii*, *Aloe* sp. (unidentified due to lack of flowering material), *Crocasmia aurea*, *Gladiolus ecklonii*, *Kniphofia* sp. (probably *K. tysonii* subsp. *tysonii*) and *Zantedeschia aethiopica* (**Figure 7-3**). In accordance with Section 200, sub-section 5(1) of the Natal Nature Conservation Ordinance, No. 15 of 1974, an Ordinary Permit is required from Ezemvelo KZN Wildlife if provincially protected species listed are to be handled in any manner during implementation of the proposed road upgrade project.



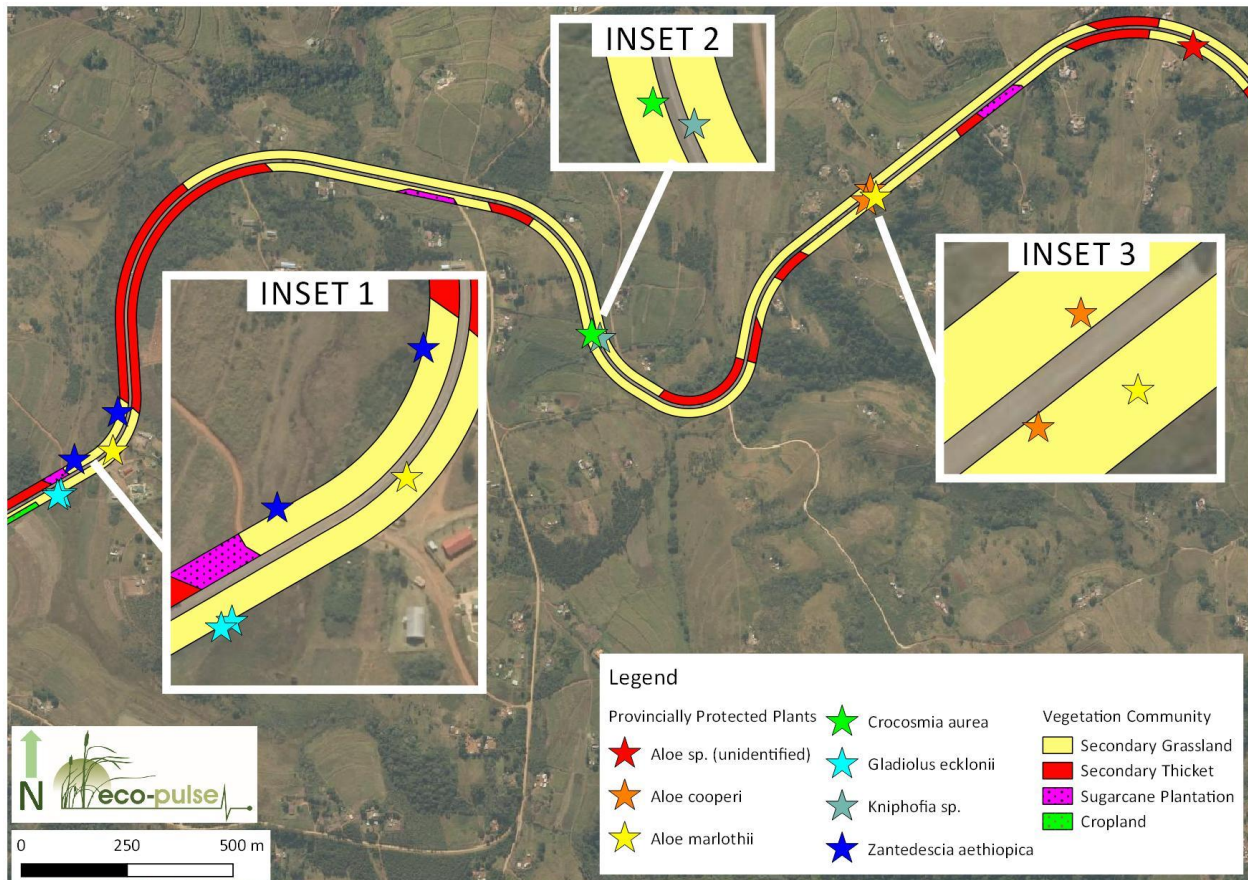


Figure 7-3: Spatial distribution of protected and conservation-important plants in the study area

### 7.1.6 Ecological Importance and Sensitivity of Vegetation Communities

Both vegetation communities were found to be secondary and degraded due to past and present direct and indirect anthropogenic disturbances. This is reflected in a significant change in species composition and reduction in species diversity, and most species of conservation importance that would have been locally common, are absent. What remains, are a few populations of provincially protected plants species that are of **Least Concern** in terms of the SANBI Red List for plants and that are not presently important for biodiversity conservation.

The desktop assessment did however highlight the potential presence of two species of conservation concern namely *Clivia gardenii* (plant) and the *Doratogonus natalensis* (Natal Black Millipede), both considered **Vulnerable** in terms of threat status. However, although possibly present due to a lack of confidence in confirmation, the degraded nature of the habitats assessed probably makes their presence unlikely or insignificant. Overall, both vegetation communities have been assigned a low importance rating based their poor condition and lack of confirmed species of moderate to high conservation importance (Figure 7-4).

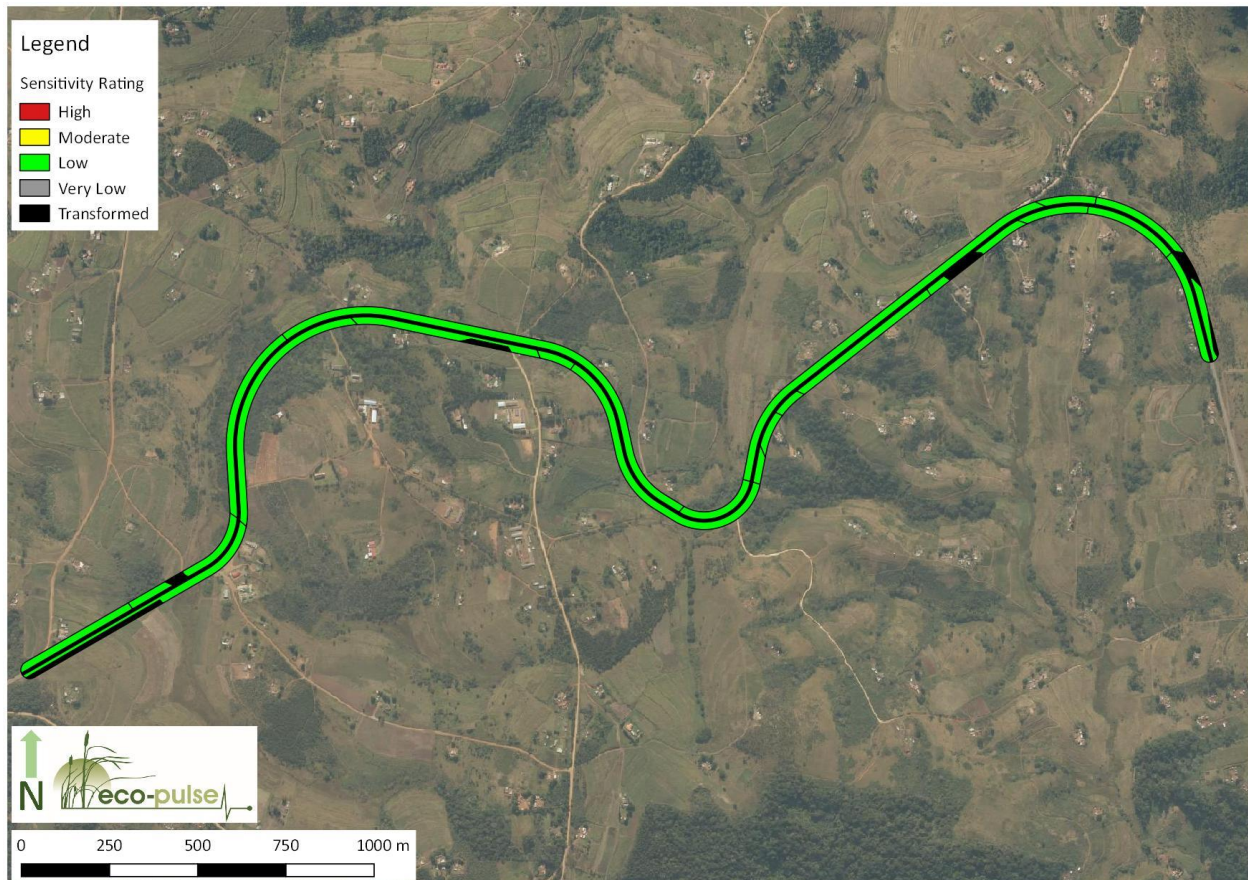


Figure 7-4: Map showing ecological sensitivity for terrestrial vegetation communities

### 7.1.7 Potential Impacts

- **Direct physical habitat destruction and modification**

This refers to the direct physical destruction and/or modification of terrestrial habitat during the construction and operational phases of the project and includes habitat degradation impacts (e.g. invasive alien plant invasion), habitat fragmentation impacts and losses in ecosystem services.

The rehabilitation of P50-1 Road particularly the widening of the road section from 8.5 m to 10 m wide between km 22,00 to km 26,00 will result in the destruction of an estimated 1.2 ha (worst case 4 km long x 3 m wide) of secondary vegetation. The 1.2 ha area comprises approximately less than 1 ha of non-cultivated or transformed areas. Widening of the road will require either lateral expansion of the existing fill or cutting of embankments resulting in the permanent loss of secondary habitat. The majority of the vegetation to be affected will be the Secondary Grassland community within the roadside drainage setting.

- **Indirect soil moisture, erosion and sedimentation impacts**

This impact refers to the indirect impacts of adjacent land cover modification and transformation on surface runoff and soil processes and associated ecological impacts like invasion by invasive alien plant species.

The construction activities will involve the clearing of vegetation, the disturbance of soil and the exposure of bare areas and soil stockpiles to the elements (rain and wind). Furthermore, construction could partially alter surface runoff patterns and soil moisture characteristics, particularly at stormwater

diversion / concentration and discharge points. Such land cover and runoff pattern changes will likely result in soil erosion within the construction footprint and possibly sedimentation and erosion downslope / adjacent to the construction corridors if erosion and sediment control is poor.

During the operational phase of the project, stormwater generated by the hardened surface will be conveyed by new stormwater infrastructure and discharged into adjoining terrestrial habitats. Of concern is how water is discharged into the environment. Use of piped infrastructure and a lack of, or poorly designed, energy dissipaters will increase the velocity / energy of water exiting the stormwater infrastructure and thus cause erosion. Erosion of the terrestrial habitat will result in the loss of vegetation and degradation of habitat. Low-lying terrestrial areas are likely to experience sedimentation which may bury small flora. Areas under sedimentation are prone to alien plant infestation which alter the species composition of the vegetation community and thus alter the quality of the habitat. This is often driven by the high seedbank in the soil.

- ***Soil and water pollution impacts***

This impact refers to the alteration or deterioration in the chemical and biological characteristics of soil and water, which inevitably impacts negatively on flora and fauna.

Potential contaminants and their relevant sources are listed below include:

- Hydrocarbons – leakages from petrol / diesel stores and machinery / vehicles, spillages from poor dispensing practices;
- Oils and grease - leakages from oil / grease stores and machinery / vehicles, spillages from poor handling and disposal practices;
- Cement - spillages from poor mixing and disposal practices;
- Bitumen - spillages from poor application, handling and disposal practices; and
- Sewage – leakages from and / or poor servicing of chemical toilets and/or informal use of surrounding bush by workers.

In terms of impacts to the terrestrial vegetation communities, significant pollutant spills and leaks or frequent small leaks / spillages that amount to significant toxic concentrations that come into contact with the mapped terrestrial habitats could cause local plant stress and / or die-offs, which could decrease the competitive ability of the affected plants and result in ruderal, weedy and / or invasive alien plant species invasion.

Well used roads are known to generate numerous pollutants, namely: nutrients, heavy metals, polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) such as benzene, toluene, ethylbenzene, xylene, and methyl tert-butyl ether (MTBE). Such pollutants generally enter the environment via surface runoff, particularly during a first flush of rain. In this case, it is expected that pollutants from the road surface will constantly be washed into adjoining habitats. The concentration of pollutants is likely to be low and therefore unlikely to have a noticeable influence on species composition within affected vegetation communities.

- ***Ecological disturbance and nuisance impacts***

This refers to the alteration of the ambient environment by nuisance factors such as noise, vibrations, light pollution, etc. produced by machinery, vehicles and labourers during the construction and operational phases of the project.

Road construction activities are known to generate dust from earthworks, and noise and vibrations due to the use of heavy vehicles and equipment. These impacts are generally short lived and limited

to the construction period. Local wildlife (fauna) generally respond to disturbances caused by human activities according to the magnitude, timing, and duration of the particular disturbance.

Anthropogenic activities occurring within a close proximity to natural habitats containing fauna (wildlife) can lead to both the physical disturbance of habitats supporting animal life by construction machinery/labourers as well as the disturbance of fauna due to noise and vibrations at the site during construction.

## 7.2 Freshwater Habitat Assessment

This study was undertaken by an independent specialist: Eco-Pulse Environmental Consulting Services.

### 7.2.1 Delineation, Classification and Habitat Characteristics

The infield sampling of soil and vegetation in conjunction with the recording of diagnostic topographical / terrain indicators and features, enabled the delineation of seven (7) watercourse units which could possibly be negatively affected by the road upgrade. The 7 units comprise five (5) wetland units and 2 (two) stream units (**Figure 7-5**).

The wetlands identified within the project area were primarily valley bottom wetlands, namely three (3) Un-channelled Valley Bottom (UCVB) units (W03, W04 and W05) and two (2) Channelled Valley Bottom (CVB) units (W01 and W02). The wetlands occurred within valley floor settings and were associated with gently sloping catchments whilst the two assessed stream units (S01 and S02) were found at the heads of valleys flanked by significantly steeper topography.

A summary of the key biophysical characteristics of each delineated watercourses unit is provided in **Table 7-1** below.

- **Vegetation Characteristics**

Due to many of the wetlands largely being intact and dominated by permanently and seasonally saturated soils, vegetation was a strong indicator of the presence and extent of wetland habitat within the study area. Intact wetland vegetation communities observed comprised *Cyperus latifolius* sedgeland (W01), *Juncus lomatophyllus* rushland (W01), *Cyperus latifolius* - *Juncus lomatophyllus* marshland (W02), *Paspalum urvillei* – *Leersia hexandra* hygrophilous grassland (W02), *Dissotis canescens* hygrophilous grassland (W03), *Ischaemum fasciculatum* - *Andropogon eucomus* hygrophilous grassland.

In the more disturbed and secondary vegetation communities dominated by opportunistic, weedy alien invasive species, the presence of obligate wetland plants was still notable.

The riparian vegetation varied from woody alien thickets dominated by *S. anceps* and *L. camara* to mixed forb and grassland communities with high abundances of *Sporobolus africanus* and *Panicum maximum* with co-dominant forbs including *Ranunculus meyeri*, *Commelina erecta* and *Desmodium incanum*. Instream vegetation was limited to *Fimbristylis complanata* subsp. *complanata* in Unit S02 whilst the active channel in Unit S01 was devoid of vegetation.

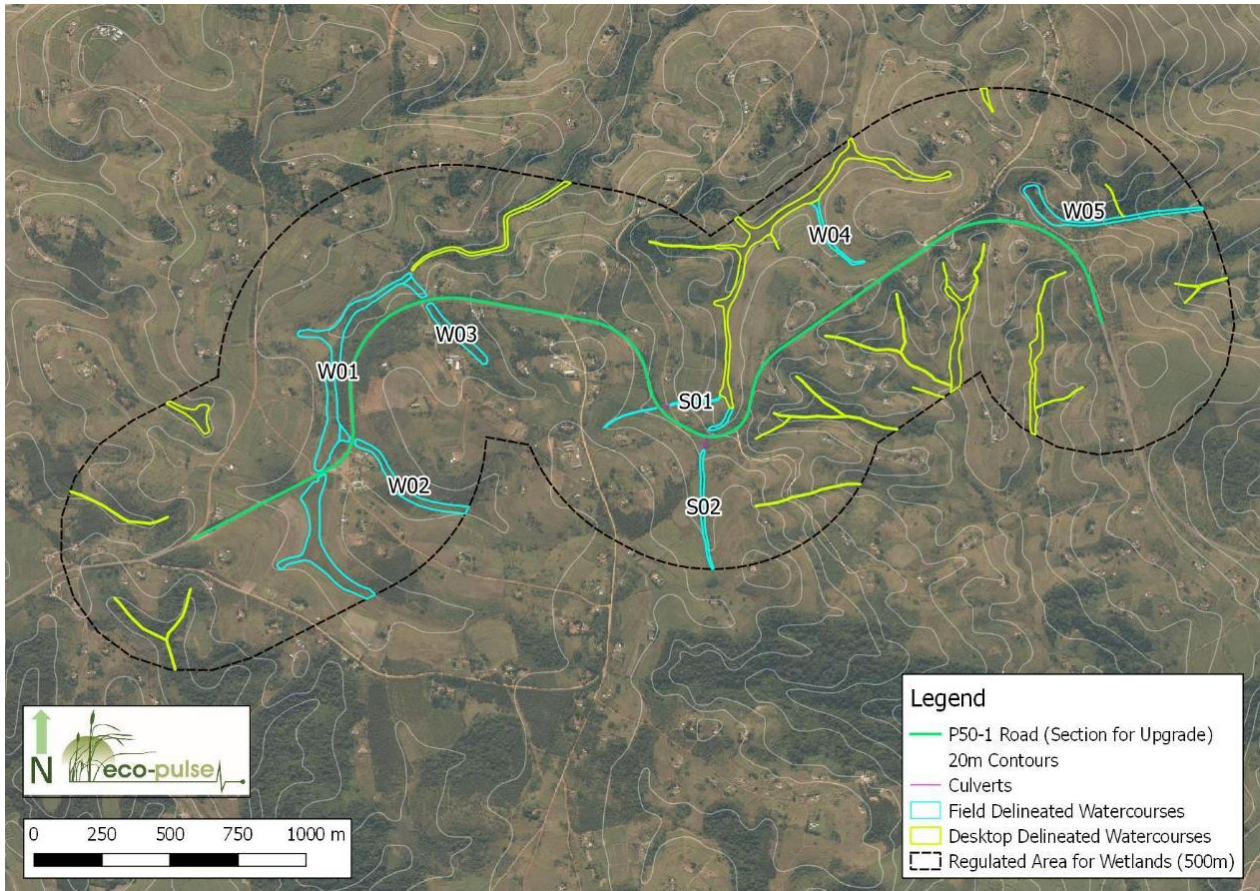


Figure 7-5: Field delineated watercourses and desktop delineated watercourses occurring within the regulated area for wetlands (500m buffer of P50-1 Road)

Table 7-1: Summary of the key hydro-geomorphic and biophysical characteristics of the delineated watercourses

Watercourse Units	Classification	Channel & Flow Characteristics	Dominant Wetness / Flow Regime & Soil Characteristics
W01	Channelled valley bottom wetland	Active channel: 0,5 m deep x 1 m wide; flows approximately 30 cm deep, very slow flowing	<p>Permanent saturation.</p> <p>The permanent hydric soils sampled typically comprised dark grey gleyed soils characterised by low matrix chroma (1) and faint orange mottling at a depth of 50 cm.</p> <p>The seasonal hydric soils comprised dark grey clay loam characterised by low matrix chroma (1-2) and a high abundance of orange mottles, particularly within the rhizospheres.</p>
W02	Channelled valley bottom wetland	Active channel: 0,5 m deep x 2 m wide; flows approximately 5 cm deep	<p>Permanent and seasonal saturation.</p> <p>The soils within this unit, above the road, comprise saturated dark grey clay loam with low matrix chroma (1-2) and no mottling. The saturation regime appears to have been elevated from seasonal to permanent due to the impounding of flows above the road crossing.</p> <p>Seasonal soils below the road comprise a dark grey clay loam with a low abundance of orange mottles,</p>

<b>Watercourse Units</b>	<b>Classification</b>	<b>Channel &amp; Flow Characteristics</b>	<b>Dominant Wetness / Flow Regime &amp; Soil Characteristics</b>
			<i>has a noticeably light in colour bulk density and contains high levels of organic matter.</i>
W03	<i>Un-channelled valley bottom wetland</i>	<i>n/a</i>	<i>Seasonal saturation.</i>  <i>Seasonally wet soils below the road were a mix of light and dark grey sandy loam soils characterised by low matrix chroma (1-2) and high abundance of orange mottles.</i>  <i>Soils above the road were marginally seasonal in nature and were characterised by grey sandy clay-loam with a low abundance of faint orange mottles.</i>
W04	<i>Un-channelled valley bottom wetland</i>	<i>n/a</i>	<i>Temporary saturation.</i>  <i>Temporary wetland soils comprise a dark brown-grey sandy loam to grey clayey loam matrix with a moderately low matrix chroma (2-3) and a low abundance of faint orange mottles present.</i>
W05	<i>Un-channelled valley bottom wetland</i>	<i>n/a</i>	<i>Seasonal saturation.</i>  <i>Seasonal soils comprise a grey sandy loam with a moderately low matrix chroma (2-3) and a low to moderate abundance of orange mottles.</i>
S01	<i>Mountain headwater ephemeral stream channel (mountain stream)</i>	<i>Ephemeral stream; Active channel: 0,5m deep x 2m wide; no flow at time of assessment.</i>	<i>Flows through the channel are likely ephemeral and limited to high rainfall events. This is evidenced by the lack of flow during sampling (which was completed during a season of high rainfall) and the small upstream catchment.</i>
S02	<i>Mixed bedrock-alluvial stream channel (mountain stream)</i>	<i>Seasonal stream; Active channel: 1m deep x 2m wide; flow approximately 20cm deep.</i>	<i>Flows were present during the time of sampling however based on the size of the upstream catchment it is likely that these flows are not perennial but more seasonal in nature.</i>

## 7.2.2 Baseline Ecological Assessment of Wetlands

- **Present Ecological State (PES)**

Three of the wetlands (W01, W04 and W05) were assessed as being in a good condition and Largely Natural ("B" PES Category) which indicates 'a slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place'. Wetland Units W02 and W03 have experienced higher levels of disturbance and modification and were assessed as being Moderately Modified ("C" PES Category) which indicates that 'a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact'.

- **Wetland Functionality (Ecosystem Services)**

- Units W01 and W03 were assessed as providing moderately important water quality enhancement services.
- Unit W01 was assessed as providing moderately important sediment trapping services.
- Units W01 and W04 were assessed as providing moderately important streamflow regulation services.
- Units W01, W02 and W05 were assessed as providing moderately important carbon storage services due to their seasonal to permanent saturation condition and dense vegetation. It is important to note the Unit W01 has organic rich sediments.

- e. In terms of biodiversity maintenance, Unit W01 was assessed as being of moderately-high importance due to the wetland being a large and significant system in the region and being relatively intact with low to moderate driver and habitats modification, and thus being representative of the endangered Sub-escarpment Savanna wetland vegetation group. Units W04 and W05 were assessed as being of moderate importance in terms of biodiversity maintenance due to having some representative herbaceous habitat the endangered Sub-escarpment Savanna wetland vegetation group but having higher levels of habitat fragmentation and smaller patch sizes. The rest of the units were assessed as being of low to moderately-low importance in terms of providing such services.
  - f. In terms of provisioning and cultural services, only Units W01, W03 and W05 were assessed as providing moderately important harvestable resources for the local communities.
- ***Ecological Importance and Sensitivity (EIS)***  
Unit W01 was assessed as being of moderately-high EIS due to the moderately-high importance of the biodiversity maintenance services provided. The rest of the units were assessed as being of moderate EIS due to the provision of one or more moderately important regulating and supporting services as well as providing moderately important biodiversity maintenance services in the case of Units W04 and W05. Units W01, W03 and W05 were assessed as being of moderate socio-cultural importance due to providing moderately important provisioning services, particularly harvestable resources.

### **7.2.3 Baseline Ecological Assessment of Streams**

- ***Present Ecological State (PES)***  
The ephemeral stream channel S01 was assessed as being in a Moderately Modified condition (reflected by a “C” PES Category). The moderate level of modification is primarily attributed to the modification of the channel immediately above and below the existing road crossing, the infilling of a section of channel for the establishment of the road, and the modification of the riparian vegetation manifested in the high levels of localised alien plant invasion, particularly immediately above and below the culvert.  
  
The seasonal stream channel S02 was assessed as being in a Moderately Modified condition (reflected by a “C” PES Category). This unit had a range of similar disturbances to unit S01, however, this unit was much larger and, as a result, the magnitude of the impacts affected a much smaller extent of the unit even though, in some cases (particularly flow modification), the intensity of the disturbances were slightly higher.
- ***Ecological Importance and Sensitivity (EIS)***  
Units S01 was assessed as being of very low EIS and Unit S02 of moderately-low EIS. The slightly higher EIS rating for Unit S02 is driven by a higher (moderate) sensitivity to change compared to Unit S01.

### **7.2.4 Recommended Ecological Category (REC) and Maintenance Objectives for Watercourses (RMOs)**

The recommended ecological category (REC) is the target or desired state of resource units required to meet water resource management objectives and quality targets. It is determined through the consideration of the PES, EIS and realistic opportunities to improve the PES that is driven by the context / setting.

The RMO for all of the watercourse units should be at a minimum to 'maintain the current status quo of aquatic ecosystems without any further loss of integrity/condition or functioning' (Table 7-2).

**Table 7-2: REC and RMO for the delineated watercourse unit based on its PES and EIS ratings**

Watercourse Units	PES Class	EIS Rating	REC	RMO
W01	B	Moderately-High	B	Maintain
W02	C	Moderate	C	Maintain
W03	C	Moderate	C	Maintain
W04	B	Moderate	B	Maintain
W05	C	Moderate	C	Maintain
S01	C	Low	C	Maintain
S02	C	Moderately Low	B	Maintain

## 7.3 Potential Impacts

### 7.3.1 Construction Phase

- **Direct Freshwater Habitat Modification and Destruction Impacts**

This impact type refers to the direct physical destruction or disturbance of freshwater habitat caused by vegetation clearing, excavation and/or infilling and alteration of soil and river bank / bed profiles), and associated impacts to ecosystem condition and ecosystem services.

The proposed widening of the road by 2 m at the crossings of Units W01, W02, W03 and S01 will involve some habitat infilling. Furthermore, an additional 2-3 m of habitat will be disturbed at these crossings points, during the construction phase. The exact area of wetland to be permanently infilled and temporarily cleared is unknown at this stage. This can only be calculated once the detailed upgrade layout including embankments is available. Nevertheless, a relatively small area of wetland and stream habitat is predicted to be lost. Assuming that wetland and stream habitat within 10 m of the existing road surface (factoring 5 m for embankment and 5 m for expansion) is either infilled and / or cleared, a total loss of 711.28 m<sup>2</sup> (0.071 ha) is predicted.

It is also important to note that if post-construction rehabilitation is poorly implemented, there is a possibility that the disturbed areas will be colonised by opportunistic and disturbance-tolerant species, including Invasive Alien Plants (IAPs) and local weeds. This could also contribute to decreased habitat quality over time.

- **Flow, Erosion and Sedimentation Impacts**

The key construction phase flow modification activities are:

- Flow diversion around working areas within the watercourses and/or dewatering of working areas.
- Physical disturbances of watercourses both planned and accidental e.g. soil stripping / grubbing, vegetation clearing.
- Physical disturbances of catchment slopes in close proximity to the watercourses.

Firstly, it is assumed that the upgrading of the road culverts will require that flow be temporarily impounded and / or diverted away from the working areas. The use of the coffer dam or flume pipe techniques is typical in such circumstances. Cofferdams can result in habitat back-flooding, flow reductions downstream of the impounded area, and increased rates of sedimentation and plant stress (in the case of wetlands) as well as flow concentration with the narrowing of the width of flow. Flume



pipes with associated berms / dams can also cause habitat back-flooding upstream, flow reductions downstream. The discharge of concentrated water from the working area and dewatering also poses an erosion risk to wetlands and river beds and banks, especially if positioned poorly in sensitive areas or inadequate energy dissipation and erosion protection measures are implemented at the discharge point.

Secondly, disturbance of vegetation and soils and the exposure of soils to the elements within and in close proximity to the watercourses will likely increase the rates of erosion and sedimentation within and in close proximity to the construction area, and downstream.

- **Water Quality Impacts**

Potential construction phase contaminants and their relevant sources may include:

- Hydrocarbons – leakages from petrol / diesel stores and machinery / vehicles, spillages from poor dispensing practices.
- Oils and grease - leakages from oil / grease stores and machinery/vehicles, spillages from poor handling and disposal practices.
- Cement - spillages from poor mixing and disposal practices.
- Bitumen - spillages from poor application, handling and disposal practices.
- Sewage – leakages from chemical toilets and/or informal use of surrounding areas by workers.
- Suspended solids – suspension of fine soil particles as a result of soil disturbance and altered flow patterns.
- Soil waste – Workers are likely to generate solid waste during construction which if not properly managed and monitored may lead to increased litter entering the watercourse.

During the construction phase, leakages, mishandling or poor disposal of the above-listed hazardous substances pose an immediate soil and runoff contamination threat and ultimately pose a threat to the onsite and downstream watercourses.

### 7.3.2 Operations

- **Direct Freshwater Habitat Modification and Destruction Impacts**

Once the road upgrades are completed and the freshwater habitats have been rehabilitated, no ongoing physical disturbance is planned. However, with road crossings, there is always the chance that infrastructure will need to be maintained or repaired which may necessitate some habitat disturbance.

- **Flow, Erosion and Sedimentation Impacts**

The two key flow modification impacts are:

- Increased concentration of flow within culverts, although this impact is already present.
- Increased volume of stormwater runoff discharge and increased velocities at outlets although this impact is already present.

Presently, the existing culverts are having a measurable impact on wetland flow through, with flow impoundment up-stream resulting in a 'bottle-neck' effect and the concentration of flow within single culverts with increased flow velocities at the outlet as well as the degradation of certain wetland areas immediately below the road crossing embankments.

The lengthening of the culverts will likely not increase the severity of the impact. However, the proposed development presents an opportunity to improve the hydrological functioning of the affected wetlands through installing more culverts and spreading outflow.

With regards to road stormwater management, stormwater generated by the road upgrade will be diverted off the road into concrete lined drains along the extent where the road is to be widened. The proposed upgrade will result in a relatively small increase in catchment surface hardening that will result in an increase surface runoff volumes, a reduction in soil infiltration and the diversion and point-source discharge of surface water.

Such a change in catchment hydrology will increase the volume and velocity / rate of surface water reaching the closest watercourse, as well as increase the time water takes to reach the closest watercourses (time of concentration), which will likely result in a small increase the floodpeaks through the wetland systems downstream of the outlets. Furthermore, the velocity of flow discharged at outlets will be slightly higher and, as a result, an increase in erosion and sedimentation may occur below the outlets. If gully erosion occurs within the buffer zones, sediment plumes are likely to be deposited within the wetlands which will smother and bury wetland vegetation and encourage further disturbance and invasion by weedy and invasive plant species.

## 7.4 Heritage and Archaeology

The proposed P50-1 project may proceed from a heritage perspective as there are no identified sites on the footprint. The site of the former Fort Chater is situated approximately 135 m to the immediate north of the footprint. A buffer zone of 30 m around the site should be observed and no development or alteration of the area is allowed.

It is also important to note that the greater Eshowe area is very rich from a heritage perspective and there is a slight possibility that excavations and / or ground works may yield “hidden” heritage sites or artefacts. It is therefore important to notice that the KwaZulu-Natal Heritage Act requires that operations exposing archaeological and historical residues, including modern graves, should cease immediately pending an evaluation by the heritage authorities.

## 8 IMPACT ASSESSMENT

### 8.1 Introduction

Impact assessment must take account of the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A brief discussion of the impact and the rationale behind the assessment of its significance is provided in this Section.

The EIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment is focussed on the following phases of the project namely:

- Planning Phase;
- Construction Phase; and
- Operational Phase.

As the project entails replacement of infrastructure which will be permanent, decommissioning is not applicable to this project, however, impacts associated with post construction clean-up are considered.

### 8.2 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature:** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- **Extent:** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration:** Indicates what the lifetime of the impact will be;
- **Intensity:** Describes whether an impact is destructive or benign;
- **Probability:** Describes the likelihood of an impact actually occurring; and
- **Cumulative:** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The criteria to be used for the rating of impacts are provided in **Table 8-1**.

*Table 8-1: Criteria to be used for the rating of impacts*

Criteria	Description			
<b>EXTENT</b>	<b>National (4)</b> The whole of South Africa	<b>Regional (3)</b> Provincial and parts of neighbouring provinces	<b>Local (2)</b> Within a radius of 2 km of the construction site	<b>Site (1)</b> Within the construction site
<b>DURATION</b>	<b>Permanent (4)</b>	<b>Long-term (3)</b>	<b>Medium-term (2)</b>	<b>Short-term (1)</b>

Criteria	Description			
	Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	The impact will last for the period of the construction phase, where after it will be entirely negated	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
<b>INTENSITY</b>	<b>Very High (4)</b> Natural, cultural and social functions and processes are altered to extent that they permanently cease	<b>High (3)</b> Natural, cultural and social functions and processes are altered to extent that they temporarily cease	<b>Moderate (2)</b> Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	<b>Low (1)</b> Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
<b>PROBABILITY OF OCCURRENCE</b>	<b>Definite (4)</b> Impact will certainly occur	<b>Highly Probable (3)</b> Most likely that the impact will occur	<b>Possible (2)</b> The impact may occur	<b>Improbable (1)</b> Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

**Table 8-2: Criteria for the rating of classified impacts**

	Class	Description
+	<b>Any value</b>	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.
-	<b>Low impact (4 -6 points)</b>	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	<b>Medium impact (7 -9 points)</b>	Mitigation is possible with additional design and construction inputs.
	<b>High impact (10 -12 points)</b>	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
	<b>Very high impact</b>	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases.

Class	Description
(12 - 14 points)	Any activity which results in a “very high impact” is likely to be a fatal flaw.
<b>Status</b>	Denotes the perceived effect of the impact on the affected area.
<b>Positive (+)</b>	Beneficial impact.
<b>Negative (-)</b>	Deleterious or adverse impact.
<b>Neutral (/)</b>	Impact is neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMP.

### 8.3 Potential Impacts and Significance

The following sections will provide a description of the potential impacts as identified by the specialist assessments, EAP and through the PPP as well as the assessment according to the criteria described in **Table 8-1** and **Table 8-2**.

All potential impacts associated by the proposed development through the construction and operation of the development life-cycle have been considered and assessed in the following sections. As the infrastructure is expected to be permanent, the decommissioning phase impacts have not been considered.

### 8.3.1 Planning Phase Impacts

Table 8-3: Planning phase impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Planning & Design	<b>Aspect:</b> Culvert construction and road widening.  <b>Impact:</b> Impact on provincially protected plants.	Without	1	4	2	4	-11	High
		With	1	1	1	1	-4	Low
	<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>Prior to commencement of construction, a qualified ecologist must be appointed to survey the construction footprint and working servitude, identify all conservation importance species and apply for necessary permits and licences to relocate them. The following provincially protected plants could be impacted on: <i>Aloe cooperi</i>, <i>Aloe marlothii</i>, <i>Aloe</i> sp. (unidentified due to lack of flowering material), <i>Crocasmia aurea</i>, <i>Gladiolus ecklonii</i>, <i>Kniphofia</i> sp. (probably <i>K. tysonii</i> subsp. <i>tysonii</i>) and <i>Zantedeschia aethiopica</i>.</li> <li>The commencement of construction must be preceded by a plant rescue programme which must be conducted only when plant permits have been issued by <i>Ezemvelo</i> KZN.</li> <li>Conservation-important plants falling just outside the construction footprint must be fenced off / demarcated to minimise any accidental impacts such as destruction. The following techniques can be used to demarcate protected plants: fencing off or using perimeter stakes and high visibility netting / barrier tape.</li> </ul>							
	<b>Aspect:</b> Design of culverts.  <b>Impact:</b> Impact on watercourses.	Without	2	2	3	3	-10	High
		With	1	1	1	1	-4	Low
	<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>Selection of culvert shape should be based on water depth, roadway embankment height, hydraulic performance, and allowing for species movement.</li> <li>Culverts must ideally be sized to transport not only water, but the other materials that might be mobilized, as well as provide passage of aquatic species such as fish.</li> <li>Best management practices for road engineering includes designing stream crossing culverts</li> </ul>							

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<p>to convey a minimum discharge equal to the 100-year flow.</p> <ul style="list-style-type: none"> <li>The culvert outlet apron must be established at the same level as the river bed.</li> <li>Culverts should be installed during the dry season to reduce the risk of erosion and sedimentation during construction.</li> <li>Appropriate measures to dissipate flow velocity below structures must be considered and designed for pre-construction.</li> <li>Erosion protection measures (e.g. Reno-mattresses) or energy dissipaters must be established below all culvert outlets.</li> <li>The base (invert) of the new culvert must be at the exact same elevation as the existing one so that there are no significant upstream and downstream adjustments in channel form. In this regard, the levels must be accurately pegged out by an engineer and the engineer must be onsite to guide the settling of the foundation.</li> <li>The inlet of the culvert base must match the elevation of the river bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than river bed).</li> </ul>					

### 8.3.2 Soils

Table 8-4: Impact on soils

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<p><b>Aspect:</b> Construction activities (site clearing).</p> <p><b>Impact:</b> Physical degradation due to the removal and compaction of soil</p>	Without	1	2	2	2	-7	Medium
		With	1	1	1	1	-4	Low
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Topsoil is to be handled twice only – once to strip and stockpile, and once to replace and level.</li> <li>In the absence of a recognizable topsoil layer, strip the upper most 300 mm of soil.</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	during construction activities.	<ul style="list-style-type: none"> <li>All stockpile areas must ideally be established on disturbed flat ground.</li> <li>Stockpile topsoil stripped from different sites separately, as reapplication during rehabilitation must preferably be site specific. A stockpile register may help in this regard.</li> <li>Erosion/sediment control measures such as silt fences, concrete blocks and/or sand bags must be placed around soil/material stockpiles to limit sediment runoff from stockpiles.</li> <li>Stockpiled soils are to be kept free of weeds and are not to be compacted.</li> <li>The slope and height of stockpiles must be limited to 2 m to avoid soil compaction and destruction of soil microbes.</li> <li>Spoil material must be hauled to a designated spoil site. No spoil material must be pushed down slope or discarded on site.</li> </ul>						
	<p><b>Aspect:</b> Construction activities (site clearing).</p> <p><b>Impact:</b> Physical degradation due to soil: erosion as a result of exposed soil and topsoil.</p>	<b>Without</b>	1	2	3	3	-9	Medium
		<b>With</b>	1	1	1	2	-5	Low
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Wherever possible, existing vegetation cover must be maintained during the construction phase. The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes.</li> <li>Clearing activities must only be undertaken during agreed working times and permitted weather conditions.</li> <li>Temporary downslope erosion and sediment protection must be established in the form of silt fences, hay-bales, sandbags and / or earthen berms aligned along the buffer zones or areas upslope not affected by construction activities.</li> <li>Steep slopes at risk of erosion and / or slumping must either be temporarily re-graded or temporarily stabilised using sandbags or other available material like dump rock.</li> <li>All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of hay-bales, sandbags and/or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2m) to break the energy of surface flows.</li> <li>Once shaped, all exposed / bare surfaces and embankments must be re-vegetated</li> </ul>						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p><b>Aspect:</b> Establishment of contractor laydown area (camp).</p> <p><b>Impact:</b> Impact on land use and land capability – disturbance of soils to the location of the construction camp and associated infrastructure.</p>	<p>immediately.</p> <ul style="list-style-type: none"> <li>If vegetation on exposed surfaces cannot be established immediately due to phasing issues, temporary erosion and sediment control measures must be maintained until such a time that re-vegetation can commence.</li> <li>All temporary erosion and sediment control measures must be monitored for the duration of the construction phase and repaired immediately when damaged. All temporary erosion and sediment control structures must only be removed once vegetation cover has successfully re-colonised the affected areas.</li> <li>After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. 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 vegetation has re-colonised the rehabilitated area.</li> </ul>						
		<b>Without</b>	1	2	2	2	-7	Medium
		<b>With</b>	1	1	1	1	1	-4
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>When locating the construction camp and equipment yard, watercourses and areas susceptible to soil erosion and / or water contamination must be avoided. The camp must be situated at least 100 m away from the edge of the nearest watercourse.</li> <li>The camp must be established on level ground.</li> <li>The location of the camp site should be approved by the appointed Environmental Control Officer (ECO).</li> <li>No material may be stored or equipment repaired beyond the boundaries of the contractor laydown area.</li> </ul>						

### 8.3.3 Geohydrology

Table 8-5: Geohydrology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		Without	2	2	3	2	-9	Medium
		With	1	1	1	2	-5	Low
Construction	<p><b>Aspect:</b></p> <ul style="list-style-type: none"> <li>Improper storage of fuels, chemical etc.</li> <li>Construction equipment, vehicles, workshop and wash bay areas.</li> <li>Inadequate ablutions.</li> </ul> <p><b>Impact:</b> Groundwater contamination as a result of:</p> <ul style="list-style-type: none"> <li>Spillage of fuels, lubricants and other chemicals.</li> <li>Construction equipment, vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source.</li> <li>Lack of provision of ablutions that may lead to the creation of informal ablutions.</li> </ul>	<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Potentially hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time.</li> <li>Material safety data sheets (MSDSs) are to be clearly displayed for all hazardous materials.</li> <li>The integrity of the impervious surface and bunded area must be inspected regularly and any maintenance work conducted must be recorded in a maintenance report.</li> <li>Employees should be provided with absorbent spill kits and disposal containers to handle spillages.</li> <li>Train employees and contractors on the correct handling of spillages and precautionary measures that need to be implemented to minimise potential spillages.</li> <li>All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability. No repairs may be undertaken beyond the contractor laydown area.</li> <li>Immediate reporting and rectification of any incident that might lead to pollution. Implementation of best practice methods to prevent potential incidents from occurring e.g. an Environmental Management System (EMS) reporting and monitoring system.</li> <li>An Emergency Preparedness and Response Plan will be developed and implemented should an incident occur.</li> <li>Access to storage areas on-site must be restricted to authorised employees only.</li> <li>Contractors will be held liable for any environmental damages caused by spillages.</li> <li>The construction workforce must have adequate sanitation facilities.</li> <li>The sanitation facilities should be on-site before the extended workforce is employed to ensure that no unauthorised sanitation practices are implemented on-site.</li> <li>Potential construction practices that might lead to groundwater contamination should be conducted on areas with impervious surfaces to avoid infiltration of contaminated</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		substances into the groundwater aquifer. <ul style="list-style-type: none"> <li>All contaminated stormwater should be treated before being discharged into the surrounding natural environment.</li> </ul>					

### 8.3.4 Vegetation

Table 8-6: Vegetation impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Clearing of vegetation for the construction of the culverts. <b>Impact:</b> Loss / degradation of wetland habitat.	Without	1	4	3	4	-12	High
		With	1	4	1	4	-10	High
		<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>The construction servitude should be limited to the proposed development footprint and a 5 m working servitude either side thereof. This working servitude must accommodate all construction related activities, including materials storage, access routes, etc.</li> <li>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. All areas outside (including upstream and downstream) of this demarcated construction servitude must be considered 'NO-GO' areas.</li> <li>Before any work commences, sediment control / silt capture measures (e.g. bidim / silt curtains) must be installed downstream of the working areas. A minimum of 3 rows of silt fences / curtains shall be installed across the watercourse(s).</li> <li>All freshwater habitats outside of the demarcated areas must be considered NO-GO areas for the duration of the construction phase. Any contractors found working inside the NO-GO areas should be fined as per fining schedule / system setup for the project.</li> </ul>						
Operations	<b>Impact:</b> Alien invasive plant (IAP)	Without	1	3	2	3	-9	Medium
		With	1	1	1	1	-4	Low



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	encroachment.	<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting.</li> <li>All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling / uprooting and adequately disposed.</li> <li>Herbicides should be utilised where hand pulling/uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority are to be used.</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.</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> <li>It is recommended that bi-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.</li> </ul>					

### 8.3.5 Watercourses

Table 8-7: Watercourse impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	Aspect: Construction activities within watercourses.	Without	1	2	3	4	-10 <b>High</b>
		With	1	1	1	4	-7 <b>Medium</b>
	Impact: Physical destruction and / or	<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>It is recommended that construction within the river take place in the winter / dry months</li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	disturbance of freshwater habitat caused by vegetation clearing, excavation and/or infilling and alteration of soil and river bank / (bed profiles), and associated impacts to ecosystem condition and ecosystem services.	(June-September) to reduce erosion and sedimentation risks during the construction phase. If construction is timed correctly the risk and intensity of temporary flow diversion and sedimentation impacts to downstream river reaches will be greatly reduced. <ul style="list-style-type: none"> <li>The construction servitude should be limited to the proposed development footprint and a 5 m working servitude either side thereof. This working servitude must accommodate all construction-related activities, including materials storage, access routes, etc.</li> <li>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>All areas outside (including upstream and downstream) of the demarcated construction servitude must be considered 'NO-GO' areas.</li> <li>Watercourses outside of the construction servitude that are disturbed during the construction phase must be rehabilitated immediately.</li> <li>All intact wetland and riparian vegetation to be infilled or cleared should be rescued and temporarily stored onsite for later rehabilitation.</li> <li>All disturbed areas must be prepared and then re-vegetated to the satisfaction of the ECO as per the rehabilitation strategy included in the EMPr (<b>Appendix B</b>).</li> <li>Where stream channels have been disturbed, the channels should be re-graded (where necessary) and stabilised using geofabric and re-vegetated as per the relevant re-vegetation/re-planting plan.</li> </ul>						
	<b>Aspect:</b> Construction activities within watercourses.	<b>Without</b>	2	2	2	4	-10	<b>High</b>
	<b>Impact:</b> Flow modification and erosion/sedimentation impacts: <ul style="list-style-type: none"> <li>Coffer dams and / or temporary diversions can</li> </ul>	<b>With</b>	1	1	1	2	-5	<b>Low</b>
		<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>One of two flow diversion methods is recommended for implementation during the construction phase:                             <ul style="list-style-type: none"> <li>Method 1: Full isolation gravity / flume pipe:                                     <ul style="list-style-type: none"> <li>A whole section of the channel is isolated using barriers that span the full width of</li> </ul> </li> </ul> </li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	<p>result in habitat backflooding, flow reductions downstream of the impounded area, and increased rates of sedimentation and plant stress (in the case of wetlands) as well as flow concentration with the narrowing of the width of flow.</p> <ul style="list-style-type: none"> <li>▪ Erosion risk to wetlands and river beds and banks.</li> </ul>	<p>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) are normally placed on the bed of the watercourse through the works area and outfalls at the downstream barrier, if present, or far enough downstream to prevent the water backing up into the work area.</p> <ul style="list-style-type: none"> <li>○ Method 2: Full isolation over pumping / siphon: A whole section of the channel is isolated using barriers that span the full width of the river. This keeps a stretch of the river dry and the water is transferred downstream of the works area by mechanical assistance (pumping or siphon). The pump and associated pipe work need not be located in the isolated area.</li> </ul> <ul style="list-style-type: none"> <li>▪ A method statement must be compiled by the Contractor for approval by the ECO to guide the flow diversion process from start to finish.</li> <li>▪ Erosion and sediment control measures (e.g. silt fences / curtains, sandbags etc.) must be implemented prior to any works within the watercourses. These structures will need to be maintained for the entire duration of the activity and monitored on a weekly basis. The location of these structures must be determined in conjunction with the project ECO. Such measures should be located downstream of the working area as well as along the edges of the construction servitude to protect freshwater habitat.</li> <li>▪ No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason.</li> <li>▪ For all works within the watercourses, the use of heavy machinery should be minimized as far as practically possible. If heavy machinery is required to access freshwater habitat, a running track to the working areas will need to be created that are suitable to the prevailing soil wetness conditions. For wetter areas, bog mats will likely be required to be laid down. For drier areas the use of crusher rock underlain by a geofabric will be sufficient. This is to avoid mixing of foreign material with the wetland soils.</li> <li>▪ The duration of temporary flow impoundment and diversion must be minimised as far as practically possible.</li> <li>▪ Diversions shall be temporary in nature and no permanent walls, berms or dams may be installed.</li> <li>▪ Under no circumstance shall a new channel or drainage canals be excavated to divert water away from construction activities.</li> <li>▪ Upon completion of the construction activities within the watercourse, all temporary</li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<p>structures must be removed immediately and the disturbed soils, beds, banks and vegetation rehabilitated in line with a detailed rehabilitation plan. Under no circumstances must temporary structures be left <i>in situ</i> for more than a day after completion and rehabilitation must commence within a day of completion. Financial penalties should be instituted if this is not adhered to.</p> <ul style="list-style-type: none"> <li>the following measures must be implemented:</li> <li>Wherever possible, existing vegetation cover should be maintained during the construction phase. The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes.</li> <li>Temporary downslope erosion and sediment protection must be established in the form of silt fences, hay-bales, sandbags and/or earthen berms aligned along the buffer zones or areas upslope not affected by construction activities.</li> <li>Steep slopes at risk of erosion and/or slumping must either be temporarily re-graded or temporarily stabilised using sandbags or other available material like dump rock.</li> <li>All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of hay-bales, sandbags and / or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2 m) to break the energy of surface flows.</li> <li>Once shaped, all exposed/bare surfaces and embankments must be re-vegetated immediately as per the detailed construction phase rehabilitation plan.</li> <li>If re-vegetation of exposed surfaces cannot be established immediately due to phasing issues, temporary erosion and sediment control measures must be maintained until such a time that re-vegetation can commence.</li> </ul>						
	<p><b>Aspect:</b> Construction activities within watercourses.</p> <p><b>Impact:</b> Impacts on water quality due to potential contaminants (hydrocarbons; oils and grease; cement; bitumen; sewage;</p>	<b>Without</b>	1	1	1	2	-5	Low
		<b>With</b>	1	1	1	1	-4	Low
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, bitumen, paint, etc.) needs 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>Mixing and / or decanting of all chemicals and hazardous substances must take place on</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	suspended solids and solid waste) released into watercourses.	trays, shutter boards or on impermeable surfaces and must be protected from the ingress and egress of stormwater. <ul style="list-style-type: none"> <li>▪ Drip trays should be utilised at all dispensing areas.</li> <li>▪ No refuelling, servicing or chemical storage should occur within 100 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 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>▪ Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. Correct emergency procedures and cleaning up operations should be implemented in the event of 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 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 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>▪ 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 100 m or from any natural water bodies including rivers, streams, riparian areas and wetlands.</li> </ul>						
Operations	Impact: Alien invasive plant (IAP) encroachment.	<b>Without</b>	1	3	2	3	-9	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<b>Key mitigation measures:</b>						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<ul style="list-style-type: none"> <li>All invasive alien plants that have colonised the construction site must be removed, preferably by uprooting.</li> <li>All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling / uprooting and adequately disposed.</li> <li>Herbicides should be utilised where hand pulling / uprooting is not possible. Only herbicides which have been certified safe for use in wetlands by independent testing authority are to be used.</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.</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> <li>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.</li> </ul>						
	<b>Impact:</b> Direct freshwater habitat modification and destruction impacts.	<b>Without</b>	1	3	3	2	-9	Medium
		<b>With</b>	1	3	1	1	-6	Low
		<b>Key mitigation measures:</b>						
		<ul style="list-style-type: none"> <li>Refer to the key mitigation measures presented in the Construction Section for this impact.</li> </ul>						
	<b>Impact:</b> Flow, erosion and sedimentation impact.	<b>Without</b>	1	3	2	4	-10	High
		<b>With</b>	1	3	1	1	-6	Low
		<b>Key mitigation measures:</b>						
		<ul style="list-style-type: none"> <li>Proper culvert design to prevent scouring and channel erosion leading to sedimentation and increased water turbidity downstream.</li> </ul>						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> <li>Adhere to the culvert design measures provided in the Planning Section earlier.</li> <li>The applicant is responsible for ensuring that road embankments and servitudes adjacent to wetlands are maintained in perpetuity so that long-term erosion and sedimentation risks are reduced.</li> <li>The applicant is responsible for the periodic monitoring of the road embankment and servitude vegetation cover and taking corrective action where necessary.</li> </ul>					

### 8.3.6 Waste

Table 8-8: Waste impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	<p><b>Aspect:</b> Construction activities including the removal of the existing culverts.</p> <p><b>Impact:</b> Waste generation during the construction phase will have a negative impact on the environment, if not controlled adequately. Waste includes demolished culverts, general construction rubble and hazardous waste (used oil, cement and concrete etc.).</p>	Without	1	2	2	3	-8 Medium
		With	1	1	1	1	-4 Low
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Eating areas must not be located within 30 m of the watercourse habitats.</li> <li>Waste bins must be provided at the eating areas.</li> <li>Bins and / or skips need to be supplied at convenient intervals on site for disposal of waste within the construction camp. The bins should have liner bags for easy control and safe disposal of waste.</li> <li>Bins must be provided to all areas that generate waste e.g. worker eating and resting areas and the camp site. General refuse and construction material refuse should not be mixed.</li> <li>Regular clearing of bins is required.</li> <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 culverts are being demolished.</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> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> <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>					

### 8.3.7 Air Quality

Figure 8-1: Air quality impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	<p><b>Aspect:</b> Construction activities (site clearing; operation of vehicles, equipment etc.).</p> <p><b>Impact:</b> Fugitive dust emissions from debris handling and debris piles; mobile plant/machinery and general construction activities.</p>	Without	1	2	1	2	-6
		With	1	1	1	2	-5
		<p><b>Key mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Dust must be suppressed on the construction site during dry periods by the regular application of water.</li> <li>Water used for this purpose must be used in quantities that will not result in the generation of runoff.</li> <li>Dust dispersion from construction activities, roads, soil stockpiles and other construction locations will be limited and suppressed to the maximum extent practical.</li> <li>Surplus fill material sites and stockpiles must be positioned such that they are not vulnerable to wind erosion.</li> <li>Cover skips and trucks which are loaded with construction materials.</li> <li>All piles must be maintained for as short a time as possible and should be enclosed by wind-breaking enclosures of similar height to the pile.</li> <li>Stockpiles must be situated away from the site boundary, watercourses and nearby receptors and should take into account the predominant wind direction.</li> <li>A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas or near stockpiles.</li> <li>Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion</li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		of dust and mud beyond the site boundary.						
	<b>Aspect:</b> Construction activities (site clearing; operation of vehicles, equipment etc.).	<b>Without</b>	1	1	2	2	-6	Low
		<b>With</b>	1	1	1	2	-5	Low
	<b>Impact:</b> Generation of fumes from vehicle emissions may pollute the air.	<b>Key mitigation measures:</b>						
		<ul style="list-style-type: none"> <li>All mobile plant and equipment must be in good working order.</li> <li>A register must be maintained for vehicle maintenance.</li> <li>All mobile plants that are unable to be repaired immediately must be removed from service until such time as they are in good working condition.</li> </ul>						
	<b>Aspect:</b> Chemical toilets.	<b>Without</b>	1	2	3	2	-8	Medium
		<b>With</b>	1	1	1	2	-5	Low
	<b>Impact:</b> Release of odours as a result of the chemical toilets on-site.	<b>Key mitigation measures:</b>						
<ul style="list-style-type: none"> <li>Chemical toilets must be provided and cleaned on a regular (weekly) basis.</li> <li>Servicing receipts and disposal sheets must be maintained and kept on site within the site environmental file.</li> </ul>								

### 8.3.8 Noise

Table 8-9: Noise impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction staff, vehicles and equipment.	<b>Without</b>	1	1	3	3	-8	Medium
		<b>With</b>	1	1	1	2	-5	Low
	<b>Impact:</b>	<ul style="list-style-type: none"> <li>All construction activities must be undertaken according to daylight working hours.</li> </ul>						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	Increase in noise pollution from construction vehicles and construction staff.	<ul style="list-style-type: none"> <li>The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order.</li> <li>All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability.</li> <li>Construction staff working in an area where the 8-hour ambient noise levels exceed 75 dBA must have the appropriate Personal Protective Equipment (PPE).</li> <li>All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993).</li> <li>Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities (blasting and excavations).</li> <li>A Complaints Register is to be kept at the Site Office at all times.</li> </ul>					

### 8.3.9 Heritage and Archaeology

Table 8-10: Heritage and Archaeology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	<b>Aspect:</b> Construction activities.  <b>Impact:</b> Unearthing of underground heritage and archaeological artefacts.	<b>Without</b>	1	4	1	1	-7 Medium
		<b>With</b>	1	4	1	1	-7 Medium
		<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>The site of the former Fort Chater is situated approximately 135 m to the immediate north of the footprint. A buffer zone of 30 m around the site should be observed and no development or alteration of the area is allowed.</li> <li>If an artefact on-site is uncovered, work in the immediate vicinity must be stopped immediately.</li> <li>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</li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		Construction Engineer of such discovery which in turn must contact a registered archaeologist and AMAFA. <ul style="list-style-type: none"> <li>Work may only resume once clearance is given in writing by the archaeologist and/or AMAFA.</li> </ul>					

### 8.3.10 Socio-economic & Health

Table 8-11: Socio-economic impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
Construction	<b>Aspect:</b> Construction activities.  <b>Impact:</b> Expected to provide in excess of 60 jobs during the construction phase.	Without	2	2	2	2	+8 Medium
		With	2	2	2	2	+8 Medium
	<b>Aspect:</b> Construction activities.  <b>Impact:</b> Contractors, the influx of people and potential job creation will result in the proliferation of social ills and	Without	2	2	3	2	-9 Medium
		With	2	2	1	1	-6 Low
		<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>All labour (skilled and unskilled) and Contractors should be sourced locally where possible.</li> <li>A labour and recruitment policy must be developed, displayed and implemented by the contractor.</li> <li>Recruitment at the construction site will not be allowed.</li> <li>A CLO must be appointed to deal with the employment of local labour and to interface between the contractor and the local community.</li> </ul>					
		<b>Key mitigation measures:</b> <ul style="list-style-type: none"> <li>The developer needs to be actively involved in the prevention of social ills associated with contractors.</li> <li>If possible all labour should be sourced locally.</li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>issues such as crime, prostitution, the spread of HIV / AIDS, informal settlements etc. Lack of provision of ablutions that may lead to the creation of 'informal ablutions' within or close to a surface water resource.</p> <p><b>Aspect:</b> Construction activities.</p> <p><b>Impact:</b> Public and construction staff safety during construction.</p>	<ul style="list-style-type: none"> <li>Contractors and their families may not stay on-site.</li> <li>No informal settlements will be allowed.</li> <li>Contractors must be educated about the risk of prostitution and spread of HIV and AIDS.</li> <li>Strict penalties will be built into tenders to deal with issues such as petty crime, stock theft, fence cutting, trespassing etc.</li> <li>No poaching of wildlife or selling of firewood will be allowed.</li> </ul>						
		<b>Without</b>	2	2	2	2	-8	Medium
		<b>With</b>	1	2	1	2	-6	Low
		<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Members of the public adjacent to the construction site must be notified of construction activities in order to limit unnecessary disturbance or interference.</li> <li>Construction activities will be undertaken during daylight hours.</li> <li>Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction.</li> <li>All construction staff must have the appropriate PPE.</li> <li>The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents.</li> <li>Report and record any environmental, health and safety incidents to the responsible person</li> <li>Implement traffic accommodation measures during construction of the culverts. All works on Road P50-1 (km 17,34 to km 26,00) must be undertaken in half-width methods (one lane will be worked upon at a time) under stop / go traffic accommodation. Two closures with a maximum closure distance of 2.0 km (0.25 km taper either side) are proposed. The minimum distance of 2 km between two closures must be maintained at all time to allow for overtaking, no temporary bypasses must be constructed.</li> </ul>						

## 9 ENVIRONMENTAL IMPACT STATEMENT

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### 9.1 Key Findings

The watercourses on site ranged from Largely Natural (“B”) to Moderately Modified (“C”) present ecological states. The wetlands were generally in a better condition than the streams encountered. With the exception of Unit W01, the wetlands were assessed as being of moderate ecological importance and sensitivity (EIS). Unit W01 was assessed as being of moderately-high EIS because it represents an intact permanent wetland vegetation / habitat that is representative of the endangered Sub-escarpment Savanna wetland vegetation.

Although the wetlands to be impacted are considered important and sensitive systems, the impact assessment revealed that potential impacts are not that significant. This is largely due to the road already being present and the proposed upgrade being small in extent and involving low levels of encroachments into the wetland and stream habitats. The impact assessment also revealed that the construction impacts are the most significant impacts, particularly the impacts of freshwater habitat infilling, clearing and disturbance and the associated indirect impacts of working within the watercourses and altering flow patterns.

Most aquatic ecological impacts can probably be quite effectively mitigated through appropriate culvert design recommendations and supplemented by the application of on-site practical mitigation measures and management principles to control direct wetland / riverine habitat destruction, soil erosion and sedimentation, flow modification and pollution impacts and risks in conjunction with post-construction rehabilitation and ecological monitoring recommendations. Should the recommended mitigation and management guidelines be implemented timeously and to specification, impacts can be potentially reduced to acceptably Low significance levels.

A few provincially protected plants species (under Schedule 12 of the Natal Nature Conservation Ordinance, No. 15 of 1974) were identified onsite, namely *Aloe cooperi*, *Aloe marlothii*, *Aloe* sp. (unidentified due to lack of flowering material), *Crocasmia aurea*, *Gladiolus ecklonii*, *Kniphofia* sp. (probably *K. tysonii* subsp. *tysonii*) and *Zantedeschia aethiopica*, which are listed as being Least Concern. An Ordinary Permit is required from the *Ezemvelo* KZN Wildlife (EKZNW) to handle these plants.

Some species of conservation concern were also flagged to be possibly present as part of the Potential Occurrence Assessment, namely *Clivia gardenii* (Vulnerable), Natal Black Millipede (Vulnerable), Bifid Red Millipede (endemic) and Wandering Black Millipede (endemic). However, although possibly present due to a lack of confidence in confirmation (based crudely on range / distribution), the degraded nature of the habitats assessed probably makes their presence unlikely or insignificant.

The sensitivity map presented in **Figure 9-1** must be considered when determining if the proposed project should be authorised.



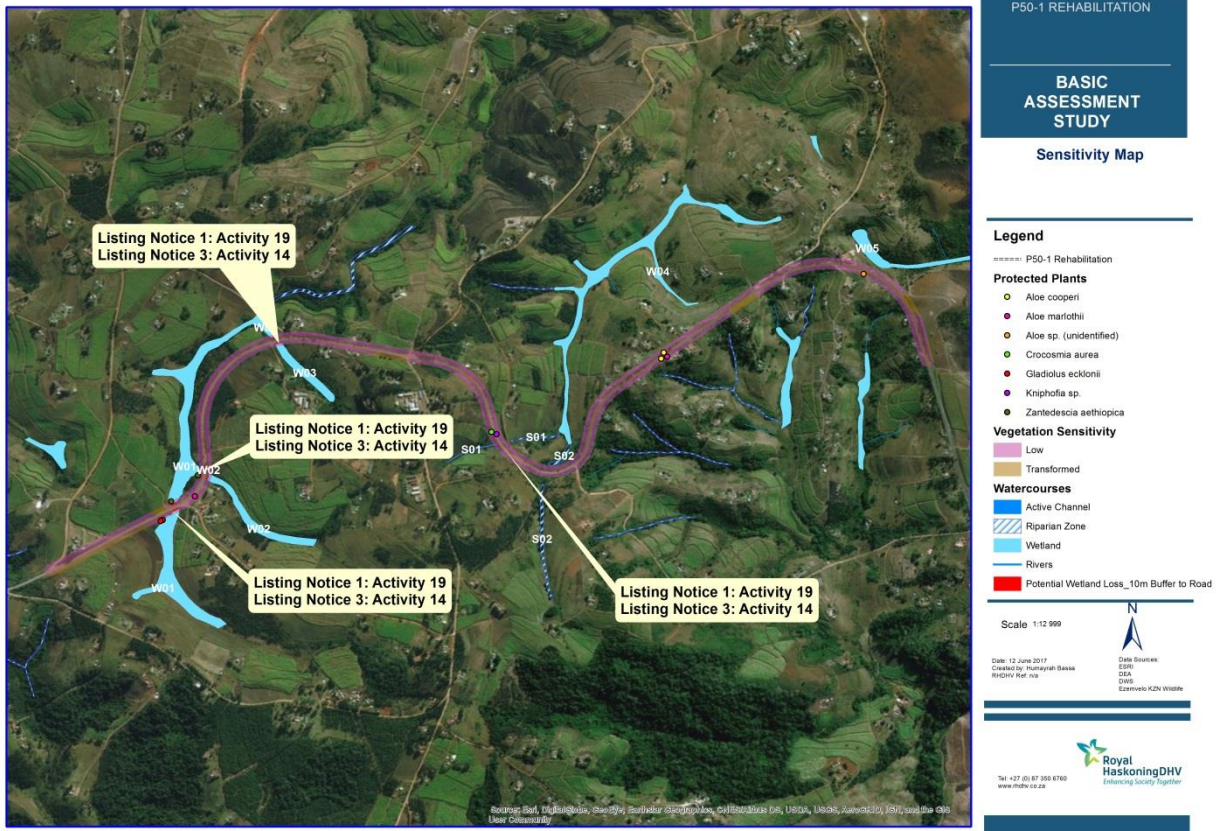


Figure 9-1: Sensitivity map<sup>7</sup>

A summary of the impacts is provided in Table 9-1.

Table 9-1: Summary of negative and positive impacts

Impacts	Without Mitigation	With Mitigation
<b>Planning Phase</b>		
Impact on seven provincially protected plants	High (-11)	Low (-4)
Inadequate culvert design and construction	High (-10)	Low (-4)
<b>Construction Phase</b>		
Physical degradation of soils due to removal and compaction	Medium (-7)	Low (-4)
Erosion as a result of exposed soil and topsoil	Medium (-9)	Low (-5)
Establishment of camp infrastructure and impact on soils	Medium (-7)	Low (-4)
Groundwater contamination (spillage of fuels, chemicals and lubricants; lack of ablution facilities; wash bay areas)	Medium (-9)	Low (-5)
Clearance of vegetation for the construction of culverts	High (-12)	High (-10)

<sup>7</sup> An enlarged map is included in Appendix F.

Impacts	Without Mitigation	With Mitigation
Physical destruction and / or disturbance of freshwater habitat caused by vegetation clearing, excavation and/or infilling and alteration of soil and river bank / bed profiles), and associated impacts to ecosystem condition and ecosystem services	High (-10)	Medium (-7)
Flow modification and erosion/sedimentation impacts (Coffer dams and / or temporary diversions can result in habitat back flooding, flow reductions downstream of the impounded area, and increased rates of sedimentation and plant stress (in the case of wetlands) as well as flow concentration with the narrowing of the width of flow and erosion risk to wetlands and river beds and banks)	High (-10)	Low (-5)
Impact on water quality (potential contaminants i.e. hydrocarbons; oils and grease; cement; bitumen; sewage; suspended solids and solid waste released into watercourses)	Low (-5)	Low (-4)
Waste generation (demolished culverts, general construction rubble and hazardous waste (used oil, cement and concrete etc.).	Medium (-8)	Low (-4)
Fugitive dust emissions from debris handling and debris piles; mobile plant / machinery and general construction activities	Low (-6)	Low (-5)
Generation of fumes from vehicle emissions may pollute the air	Low (-6)	Low (-5)
Release of odours as a result of the chemical toilets on-site	Medium (-8)	Low (-5)
Noise pollution from construction vehicles and construction staff	Medium (-7)	Low (-5)
Unearthing of underground heritage and archaeological artefacts	Medium (-7)	Medium (-7)
Job creation	Medium (+8)	Medium (+8)
Proliferation of social ills and issues such as crime, prostitution, the spread of HIV / AIDS, informal settlements	Medium (-9)	Low (-6)
Public and construction staff safety during construction	Medium (-8)	Low (-6)
<b>Operational Phase Impacts</b>		
Alien invasive plant encroachment	Medium (-9)	Low (-4)
Direct freshwater habitat modification and destruction	Medium (-9)	Low (-6)
Flow, erosion and sedimentation	Medium (-9)	Low (-6)

## 9.2 Conclusion and Recommendations

The BA Study has been undertaken in accordance with the EIA Regulations (2014) as amended in terms of Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

In order to protect the environment and ensure that the culverts are constructed and operated in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that have been taken into account during this study. These include:

LEGISLATION
The Constitution of South Africa (No. 108 of 1996)
National Environmental Management Act (Act No. 107 of 1998) (as amended) and EIA Regulations (2014)
National Environmental Management: Waste Act (Act No. 59 of 2008) (as amended)
National Environmental Management Biodiversity Act (Act No. 10 of 2004)
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
National Environmental Management: Air Quality Act (Act No. 39 of 2004)
National Water Act (Act No. 36 of 1998) (as amended)
National Forests Act (Act No. 84 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
KZN Nature Conservation Ordinance (Ordinance No.15 of 1974)
Hazardous Substance Act (Act No. 15 of 1973) and Regulations
Occupational Health and Safety Act (Act No. 85 of 1993)

This relevant legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.

The conclusions of this BAR including comments and concerns from I&APs are as a result of a comprehensive BA study. The public consultation process has been inclusive, and every effort has been made to include representatives of all stakeholders within the process.

The project is envisaged to have a **“Negative Low”** significance rating post application of mitigation measures proposed.

### 9.3 Assumptions, Uncertainties or Gaps in Knowledge

The BA process followed the legislated process required and as governed and specified by the EIA Regulations (2014) as amended. Inevitably, when undertaking scientific studies, challenges and limitations are encountered. For this specific BA, the following challenge was encountered:

- All information provided by the Engineering team to the EAP was correct and valid at the time it was provided.
- The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process.
- All data from unpublished research is valid and accurate.
- The scope of this investigation is limited to assessing the potential environmental impacts associated with the culvert replacements associated with the P50-1 rehabilitation.

In addition to the assumptions above, the following assumptions and limitations were noted by the specialist team:

### 9.3.1 *Freshwater Habitat Assessment*

- Formal sampling and assessment focussed on those watercourses currently crossed and/or in close proximity (within 15 m upslope and 32 m downslope) of the existing road.
- Access to some of the streams south of the road was not possible due to the dense and impenetrable alien vegetation present. Many of these streams were assumed to be located in excess of 32 m downslope and thus were not considered critical to the assessment in light of the localised impacts.
- The following delineation limitations must be noted:
  - The boundary between the lower fill embankment and Unit S02 was not sampled due to access being restricted by dense, impenetrable vegetation.
  - The right hand boundary of Unit W03 upstream of the road was not sampled due to access being restricted by dense, impenetrable vegetation.
- The accuracy of the delineations is based solely on the recording of the onsite wetland indicators using a GPS. GPS accuracy will therefore influence the accuracy of the mapped sampling points and therefore water resource boundaries, and an error of 1-5 m can be expected. All soil / vegetation / terrain sampling points were recorded using a Garmin Montana™ Global Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing.
- All vegetation information recorded was based on the onsite observations of the author and no formal vegetation sampling was undertaken. Furthermore, the vegetation information provided only gives an indication of the dominant and / or indicator wetland and riparian species and only provides a general indication of the composition of the vegetation communities. Thus, the vegetation information provided has limitations for true botanical applications.
- Although every effort was made to correctly identify the plant species encountered onsite, wetland plants, particularly the Cyperaceae (sedge) family, are difficult to identify to species level. Every effort has been made to accurately identify plants species but where identification to species level could not be determined, such species were only identified to genus level.
- With ecology being dynamic and complex, there is the likelihood that some aspects (some of which may be important) may have been overlooked. Similarly, sampling by its nature, means that generally not all aspects of ecosystems can be assessed and identified.
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. We have made an effort to substantiate all claims where applicable and necessary.
- PES and EIS assessments were applied at a unit scale, meaning the entire unit was assessed and not only the area sampled. However, what was observed at the sample site represented the entire unit unless aerial photography showed clear and distinct differences.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the field survey and based on the assessor's working knowledge and experience with similar development projects.

### 9.3.2 *Ecology*

- The study area for this report comprises exclusively of a 30 m corridor of the P50-1 Road (between km 17,34 and km 26.00) and the extent and nature of the vegetation and habitat / ecosystems in that area.
- The study focused on 'terrestrial' or dryland vegetation occurring within the study area. Wetland / aquatic vegetation and habitats were not included as these were dealt with separately in the Specialist Freshwater Impact Assessment Report dated May 2017 compiled by Eco-Pulse (Report No. EP280-01).

- The location of species of conservation concern was recorded using a Garmin Montana™ Global Positioning System (GPS). GPS accuracy was limited to 3 – 5 m and recording points beneath tree cover is likely to have further reduced GPS accuracy in heavily vegetated areas.
- The field assessment was undertaken in summer (early February 2017). The assessment therefore may have missed winter flowering cryptic forbs.
- With ecology being dynamic and complex, there is a possibility that some aspects may have been overlooked.
- Sampling by its nature means that generally not all aspects of ecosystems can be assessed and identified.
- Information on the threat status of plants species was informed largely by the SANBI Threatened Species Online database, which was assumed to be up to date and accurate at the time of compiling this report. Any changes made after the compilation of the report are therefore not covered.
- The assessment of the potential occurrence of fauna was informed by the presence and condition of ideal habitat for each faunal species. The habitat condition / integrity was used as a surrogate indicator of the likelihood of a particular species being present.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the vegetation field surveys and based on the assessor's working knowledge and experience with similar development projects.
- Additional information used to inform the assessment was limited to data and GIS coverage's available for the province and district municipality at the time of the assessment.

## 9.4 Recommendations

### 9.4.1 Recommendations to the CA

The project, in the EAP's opinion, does not pose a detrimental impact on the receiving environment and its inhabitants and can be mitigated significantly. Therefore, the EAP recommends the rehabilitation and widening of the P50-1 as proposed.

Construction is expected to commence in March 2018 and last 24 months. An EA with a validity of 5 years is recommended.

The Applicant should be bound to stringent conditions to maintain compliance and a responsible execution of the project.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this BA study are included within an EMPr (refer to **Appendix B**).

The EMPr must be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the construction phase of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, the following key conditions should be included as part of the authorisation:

- a) The Developer is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes *inter alia*:
  - i. Provisions of the National Environmental Management Waste Act (Act No. 59 of 2008) (as amended);
  - ii. Provisions of the National Water Act, 1998 (Act No. 36 of 1998) (as amended);
  - iii. Provisions of the National Forests Act (Act No. 84 of 1998); and
  - iv. Provisions KwaZulu-Natal Nature Conservation Ordinance (Ordinance No. 15 of 1974).
- b) The Developer must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.
- c) The Stormwater Management Plan must be complied with.
- d) An Ordinary Permit from the *Ezemvelo* KZN Wildlife (EKZNW) is required to handle the seven provincially protected plants encountered in the study area.
- e) All necessary permits, licences and approvals must be obtained prior to the commencement of construction.

#### **9.4.2 Recommendations to the Applicant**

The Applicant must adhere to the recommendations provided by the specialist and the EAP. The EMPr summarises these recommendations. The Applicant must take full responsibility for the execution of the project in a manner which does not negatively impact on the environment by ensuring that responsible decisions are made.

#### **9.5 Declaration by the EAP**

The following is hereby affirmed by the EAP to be included in this report:

- the correctness of the information provided in the reports;
- the inclusion of all comments and inputs from stakeholders and I&APs;
- the inclusion of all inputs and recommendations from the specialist reports where relevant; and
- any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by interested and affected parties.




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Signed: Humayrah Bassa *Pr.Sci.Nat.*



## **Appendix A**

### **Minutes of the EDTEA Pre-application Meeting**



## **Appendix B**

# **Environmental Management Programme**





**Appendix C**

**Specialist Studies**



## **Appendix D**

### **EAP CV and Knowledge Group Profile**



## **Appendix E**

### **Public Participation Summary**



## **Appendix F**

### **Maps & Facility Illustrations**

**Appendix G**

**Photographs**



**Appendix H**

**Other Items**



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, nonlisted 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.

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### **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.