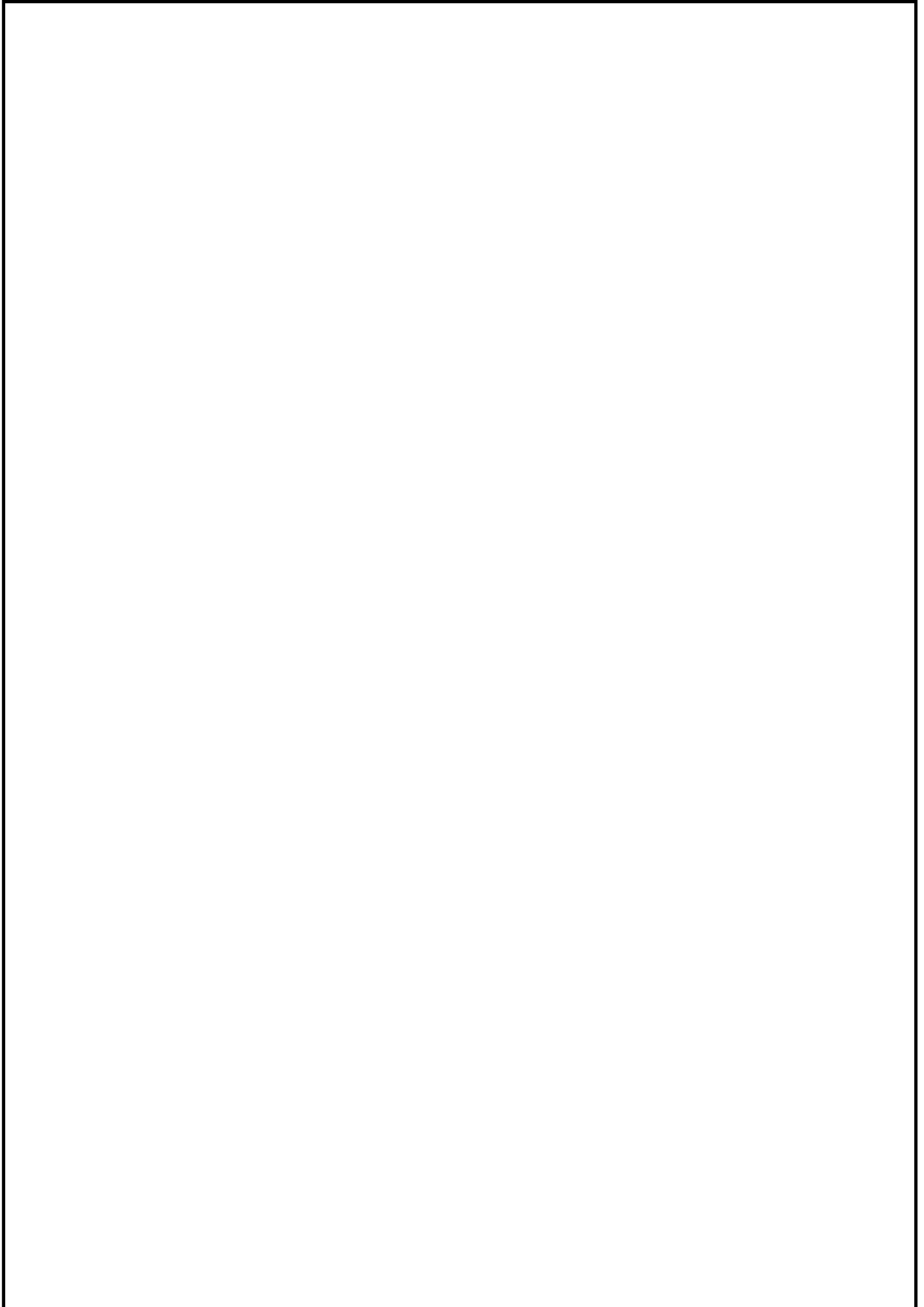


APPENDIX 10

ENVIROMENTAL MANAGEMENT PROGRAMME (EMPr)



**DRAFT ENVIRONMENTAL MANAGEMENT
PROGRAMME FOR THE PROPOSED PROVINCIAL
ROAD K77: ELIZABETH ROAD TO K154,
MIDVAAL LOCAL MUNICIPALITY,
GAUTENG**

GAUT: 002/14-15/0188

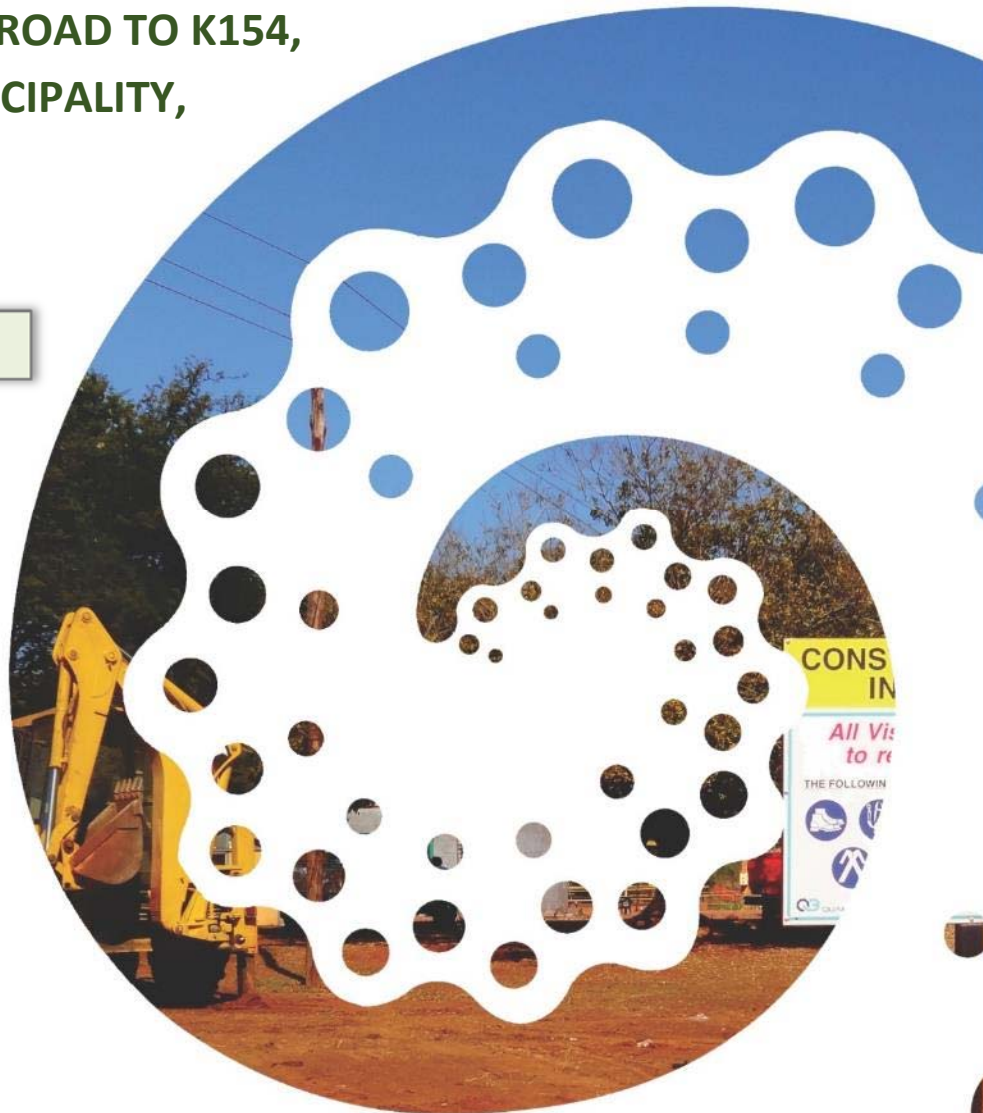
SUBMITTED TO:

Gauteng Department of
Agriculture and Rural
Development:
Sustainable Utilisation of
the Environment Branch
P.O. Box 8769
Johannesburg
2000

APPLICANT:



GAUTENG PROVINCE
ROADS AND TRANSPORT
REPUBLIC OF SOUTH AFRICA



spoor
environmental services

SPOOR Environmental Services (PTY) Ltd.

t: +27 (0)12 480 0612 f: +27 (0)86 763 5635 e: info@spooirenvironmental.co.za
p: Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040, Pretoria, South Africa
w: www.spooirenvironmental.co.za

June 2016

REPORT TITLE:	Draft Environmental Management Report for the Proposed Road K77: Elizabeth Road to the K154 Midvaal Local Municipality Gauteng Province
CLIENT:	Knight Piésold Consulting Engineers
SPOOR PROJECT REFERENCE:	8/20_k77
REPORT STATUS:	Draft
PLACE AND DATE:	Pretoria, June 2016

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Report	Date	Version	Status
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APPLICANT

APPLICANT:	Gauteng Province Department of Transport and Roads
CONTACT PERSON:	Mr. Kumen Govender
PHYSICAL ADDRESS:	41 Simmonds Street, Sage Life Building, Marshalltown, Johannesburg 2007
POSTAL ADDRESS:	Private Bag X83, Marshalltown, 2017
TELEPHONE:	011 355 7050
FAX:	011 355 7235
EMAIL:	kumen.govender@gauteng.gov.za

ENVIRONMENTAL ASSESSMENT PRACTITIONER

CONSULTANT:	SPOOR Environmental Services (Pty) Ltd
CONTACT PERSON:	Mr. JC van Rooyen
POSTAL ADDRESS:	Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040
TELEPHONE:	012 480 0612
FAX:	086 763 5635
EMAIL:	jcvr@spoorenvironmental.co.za

DECLARATION OF INDEPENDENCE

I, JC van Rooyen as authorised representative of SPOOR Environmental Services (Pty) Ltd, hereby confirm my independence as an Environmental Assessment Practitioner and declare that neither I nor SPOOR Environmental Services (Pty) Ltd have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which SPOOR Environmental Services (Pty) Ltd was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the proposed Detailed Design and Construction of Road K77: Elizabeth to the K154, Midvaal Local Municipality, Gauteng Province.

Signed: _____

Date: _____

DISTRIBUTION OF ENVIRONMENTAL MANAGEMENT PLAN

PUBLIC			
Area	Venue	Location	Contact Person
Drumblade, Midvaal Local Municipality	The Old "Touch of Green Nursery" 19 Elizabeth Road, Drumblade AH, Midvaal	19 Elizabeth Road, Cnr Elizabeth Road and Joan Avenue Drumblade AH, Midvaal	Mrs V Geffen 084 526 9195

INSTITUTIONS	
Name	Institution
Mrs. B. Belot Mrs. F. Mlambo	Gauteng Department of Agriculture and Rural Development: Sustainable Utilization of the Environment Branch
Mr. K. Govender	Gauteng Provincial Department of Roads and Transport
Mr. J. Viljoen	Knight Piésold Consulting
Mr. L. Mabona	Department of Water and Sanitation
Mr. S. Manele	Sedibeng District Municipality Transport Infrastructure and Environment (Executive Director)
Mr. H. Human	Midvaal Local Municipality Department Development and Planning (Executive Director) Division Environmental Management
Mr. S. Coetzee	Midvaal Local Municipality Department Engineering Services (Executive Director)
Mr. B. Welchman	Midvaal Local Municipality Department Engineering Services
Mr. N. Mashele	Midvaal Local Municipality Department Engineering Services Civil Engineering Services (Director)
Mr. R. Maswime	Midvaal Local Municipality Department Engineering Services Division Roads (Assistant Director)
Mr. A. Kilian	Gauteng Department of Roads and Transport

Mr. G. Botha	Provincial Heritage Resources Agency Gauteng (PHRAG)
Mr. A. Solomon	South African Heritage Resources Agency

EXECUTIVE SUMMARY

Introduction

SPOOR Environmental Services (PTY) Ltd. was appointed by Knight Piésold Consulting Engineers on behalf of the Gauteng Provincial Department of Roads and Transport as the Environmental Assessment Practitioner to manage the relevant environmental management processes related to the proposed road development.

Locality

The proposed road falls within the Sedibeng District Municipality which is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the Midvaal Local Municipality, between the areas of the Drumblade Agricultural Holdings and Eikenhof. The proposed road K77 alignment is planned to extend between Elizabeth Road and the R550 (Klipriver Road) or the K154.

Project Description

The proposed provincial Road K77 will extend over a distance of approximately 4.3 kilometres and stretch from Elizabeth Road (D2310) to the R550 (K154). The proposed road will be designed and constructed as a tar surfaced dual carriageway (three lanes in each direction) within a road reserve of 62 metres. The first phase of this proposed project will however only include a single carriage way of one lane (3.7m wide) in each direction. A typical section of the completed road will consist of a 3 metre shoulder, three lanes of 3,7 metre each, an eight metre middle median and three lanes in the opposite direction and the final shoulder.

On a local scale the proposed road K77 is included in the planning frameworks included in the Sedibeng Integrated Development Plan, the Midvaal Integrated Development Plan, the Midvaal Spatial Development Framework as well as the Midvaal Western Regional Spatial Development Framework. These planning frameworks allow for the development of the proposed road within the auspices of the local development guidelines. In terms of development in the area of the proposed road K77, the primary development driver comes in the form of the Highlands Mixed Use Development. This development consists of a host of smaller residential, commercial and industrial developments which spans an area of more than 3500ha and which is in various stages of application, authorization and implementation. The proposed road K77 is anticipated to add to the free flow of traffic when these developments are in their operational phases.

Environmental Impacts Identified

In terms of ecological sensitivity, the biodiversity Specialist found that the majority of the project footprint does not pose the risk of noteworthy environmental degradation purely as a result of the situation that the road will be developed in an area that was subjected to anthropogenic disturbances in the past. The development site for the proposed road will however enter into an area that has been devoid of any development for a long time. Local residents have reported to the incidence of sensitive species such as the Grass Owl (*Tyto capensis*), Melodious Lark (*Mirafra cheniana*) and the African Bull Frog. (*Pyxicephalus adspersus*) as well as other species such as the Black Backed Jackal and antelope. Additionally, the proposed alignment also traverses sensitive areas to the likes of a Valley Bottom Wetland and a water

course. The Specialist reported that the wetland feature, although transformed, perform an important function in terms of habitat provision for avifauna and other faunal species. Disturbances within this habitat unit must be avoided. However, if construction within the wetland areas is absolutely unavoidable, the duration and footprint of disturbance must be minimised and rehabilitated as soon as possible. Socio-economic impacts include local ease of access (positive), possible disruption in services, security and general hindrances.

It is believed that the identified impacts can be significantly minimised provided that the mitigation and rehabilitation measures included in section 9 of this EMPr are strictly adhered to. It is therefore very important that the relevant Managers (the Applicant, GDARD, the project Engineers and construction and operational phase Managers) of each development stage of this road take cognisance thereof and implement it accordingly.

Environmental Management Programme

The aim of this Environmental Management Programme Report is to ensure that the planning, assessment, construction and operational phases of the development comply with the relevant environmental legislation, regulations and guidelines. The Environmental Management Programme Report furthermore aims to organize and coordinate the proposed environmental management and mitigation measures and to describe these measures in order to prevent, reduce or otherwise manage the potential negative social and environmental impacts associated with the proposed development and to add to the favourable impacts of the project.

DETAILS AND EXPERTISE OF SPOOR ENVIRONMENTAL SERVICES

Name:	JC van Rooyen
Company:	SPOOR Environmental Services (Pty) Ltd
Qualifications:	Pr LA Techno B.L. M.Sc (Env Soc)
Professional Registration:	SACLAP

In accordance with Section 31 (2) (a) (ii) of Government Notice No. R. 543 of June 2010, this section provides an overview of SPOOR Environmental Service's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team. SPOOR Environmental Services (Pty) Ltd. has been in operation since 2011. The Director, Mr. JC van Rooyen, has been involved in an array of environmental consultation and planning projects in various spheres of the landscape design, development and environmental management disciplines over the past 15 years. SPOOR Environmental Service's approach towards projects is to strive for sustainable environments that not only reflect artistic and aesthetic quality but also hold diverse ecological and cultural value. The Company is capable of conducting environmental applications and landscape development planning and design for various projects including:

- Scoping & Environmental Impact Assessment Reports,
- Visual Impact Assessments,
- Environmental Management Systems/ Plans,
- Environmental Management Programmes (EMPr),
- Environmental Audits & Monitoring,
- Waste Management Licence Applications,
- Air Emission Licences (AEL's)
- Water Use Licence Applications (WULA)
- Integrated Environmental Management (IEM),
- Tree Removal Permits,
- Environmental Rehabilitation,
- Conservation Planning / Eco-tourism Developments,
- Landscape Design and Development,
- Landscape/ Environmental Project Management.

To date JC van Rooyen of SPOOR Environmental Services has been involved in similar projects which indicate that the EAP is capable to conduct the environmental assessment for the proposed project:

❖ **Route K72 including the new Pinehaven Interchange, Mogale City Gauteng**

Client:	Development and Engineering Consultants (Pty) Ltd.
Applicant:	Gauteng Provincial Department of Roads and Transport
Responsibility:	Scoping & EIA Application, Environmental Management Programme, Visual Impact Assessment and Water Use Licence Application.

❖ **Upgrade of Road K46 Phase II between the PWV5 and the N14 Intersection**

Client:	Knight Piésold Consulting Engineers (PTY) Ltd.
----------------	--

Applicant: Gauteng Provincial Department of Roads and Transport
Responsibility: BA Application, Environmental Management Programme, Storm Water Management Guidelines, Water Use Licence Application.

❖ **Serapeng Road Extensions, Mamelodi, Gauteng Province**

Client: Development & Engineering Consultants
Applicant: City of Tshwane Metro Municipality
Responsibility: BA Application, Environmental Management Programme.

❖ **Middelburg Eastern Bypass, Middelburg, Mpumalanga**

Client: Bapela Cave Klapwijk Land Planning & Design
Applicant: Steve Tshwete Local Municipality
Responsibility: Finalization of Scoping and EIA process, Environmental Management Programme.

❖ **Brooklyn Circle Upgrade, Pretoria**

Client: Bapela Cave Klapwijk Land Planning & Design
Applicant: City of Tshwane Dept. Roads and Stormwater
Responsibility: Finalization of BA Application & Environmental Management Programme.

PROJECT TEAM

The project team working on the proposed project consists of the following practitioners:

Mr. J.C. Van Rooyen (*BL., M.Sc (Env. Soc) (SACLAP) (Principle EAP)*)
Landscape Technologist and Environmental Assessment Practitioner

Mrs. A. Le Roux (*B.Sc L Arch, B.L Hons*)
Candidate Landscape Technologist and Junior Environmental Assessment Practitioner

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ABBREVIATIONS

AH	-	Agricultural Holding
BID	-	Background Information Document
CLO	-	Community Liaison Officer
COIDA	-	Compensation for Occupational Injuries and Diseases Act (No 130 of 1993)
CPF	-	Community Policing Forum
DWA	-	Department of Water Affairs
DWS	-	Department of Water and Sanitation
EAP	-	Environmental Assessment Practitioner
ECA	-	Environment Conservation Act
ECO	-	Environmental Control Officer
EIA	-	Environmental Impact Assessment
EIAR	-	Environmental Impact Assessment Report
EMPr	-	Environmental Management Programme
GDARD	-	Gauteng Department of Agriculture and Rural Development
GPDRt	-	Gauteng Provincial Department of Roads and Transport
IEM	-	Integrated Environmental Management
IDP	-	Integrated Development Plan
I&AP	-	Interested and Affected Parties
ISDF	-	Integrated Spatial Development Framework
MAMSL	-	Metres Above Mean Sea Level
MLM	-	Midvaal Local Municipality
NEMA	-	National Environmental Management Act
NEMBA	-	National Environmental Management Biodiversity Act
NEMWA	-	National Environmental Management Waste Act
NFEPA	-	National Freshwater Ecosystems Priority Areas
NHRA	-	National Heritage Resources Act
OHS	-	Occupational Health and Safety
PC	-	Principal Contractor
PHRAG	-	Provincial Heritage Resources Authority of Gauteng
PM	-	Project Management
PVW	-	Pretoria Vereeniging Witwatersrand
QDSG	-	Quarter Degree Square Grid
RE	-	Resident Engineer
SABS	-	South African Bureau of Standards
SAHRA	-	South African Heritage Resources Agency
SDM	-	Sedibeng District Municipality
SDF	-	Spatial Development Framework
S&EIR	-	Scoping and Environmental Impact Report
SHE	-	Safety, Health and Environment
SME	-	Small and Medium Enterprise
H&S Rep	-	Health and Safety Representative
PPE	-	Personal Protective Equipment

1. INTRODUCTION

SPOOR Environmental Services (PTY) Ltd. was appointed by Knight Piésold Consulting Engineers as the Environmental Assessment Practitioner to manage the relevant environmental management processes related to the proposed road K77 development. This Environmental Management Programme Report (EMPr) was developed in order to guide the relevant contractors and maintenance managers with regard to their responsibilities in terms of responsible environmental management during the construction phase of the proposed road K77 between Elizabeth Road and the R550 (K154). See Figure 1. Finally, the EMPr must assist the Applicant in the management of the anticipated impacts during the operational phase of the project.

2. AIM OF THE EMPr

The aim of the EMPr is to ensure that the planning, assessment, construction and operational phases of the development comply with the relevant environmental legislation, regulations and guidelines. The EMPr furthermore aims to organize and coordinate the proposed environmental management and mitigation measures and to describe these measures in order to prevent, reduce or otherwise manage the potential negative social and environmental impacts associated with the proposed development and to add to the favourable impacts of the project. In brief the EMPr therefore aims to ensure that;

- ❖ activities arising as a consequence of the design, construction and operational on the site of the development are managed in a way that reduces or avoids negative social and environmental impacts and to enhance its positive effects,
- ❖ impacted environments are restored according to the recommendations of the EMPr,
- ❖ efficient information sharing is maintained and a clear understanding exists of all the responsibilities of all the relevant stakeholders,
- ❖ the necessary precautions are taken against damages and claims that occur as a result of the implementation of the development in a timeous fashion,
- ❖ accurate records are kept of the progress of the development during its various stages as well as of the ongoing monitoring of all its associated social and environmental impacts
- ❖ timeous completion occurs of all the implementation activities on account of generally sound management.

3. EMPr CONTEXT

This EMPr fits into the overall planning, implementation and operation of the proposed road K77 development and should be implemented by the Applicant. A copy of the EMPr should always be available on site. All contractors and sub-contractors must be well-informed of the EMPr and its contents.

4. PROJECT DESCRIPTION

4.1 Project Overview

SPOOR Environmental Services (Pty) Ltd was appointed as the independent environmental assessment practitioner (EAP) to manage the Scoping and Environmental Impact Assessment application for the proposed detailed design and construction of a section of road K77. The section of road under this application stretches over a distance of roughly 4.3 kilometres and lies between Elizabeth road (D2310) and the K154 (R550) in the area of the Drumblade Agricultural Holdings and Eikenhof, Midvaal Local

Municipality (MLM), Gauteng. The proposed road development will ultimately connect this area of the MLM to northern and southern development nodes via a network of other planned and existing roads. The primary motivation for the development of the road stems from the need to create sufficient traffic infrastructure to provide in the local area's future development requirements.

4.2 Locality

On a regional scale the proposed road falls within the Sedibeng District Municipality which, is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the MLM, between the areas of the Drumblade AH and Eikenhof. A list of the coordinates of the proposed road alignment is included in Table 1 below. Also See Figure 1.

Table 1: Route Positioning

ROUTE POSITIONING INFORMATION	
Distance (Kilometre)	Decimal Coordinates
From Elizabeth Road	
0m (Start)	26.44234° S 28.02887° E
500m	26.43951° S 28.03276° E
1000m	26.43669° S 28.03682° E
1500m	26.43497° S 28.04141° E
2000m	26.43326° S 28.04601° E
2167m (Middle)	26.43244° S 28.04745° E
2500m	26.43057° S 28.05002° E
3000m	26.42709° S 28.05316° E
3500m	26.42302° S 28.05525° E
4000m	26.41862° S 28.05626° E
4335m (End)	26.41554° S 28.05676° E
To R550 Heidelberg Road (K154)	

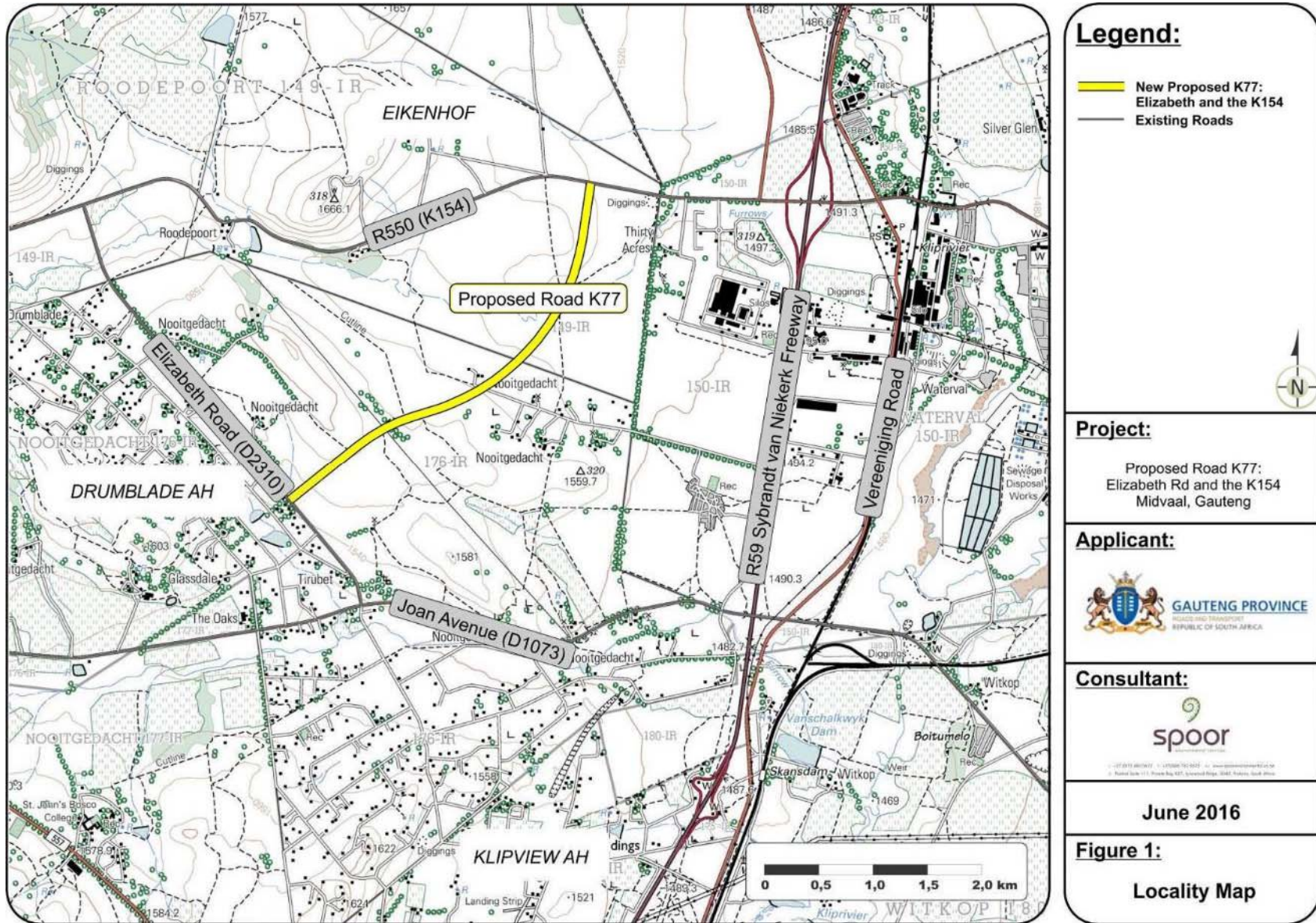


Figure 1: K77 Locality

Legend:

- New Proposed K77: Elizabeth and the K154
- Existing Roads

Project:

Proposed Road K77:
Elizabeth Rd and the K154
Midvaal, Gauteng

Applicant:



Consultant:



June 2016

Figure 1:

Locality Map

5. DESCRIPTION OF THE PROPOSED PROJECT

5.1 Road Design Considerations

SPOOR was informed by the GPDRT that the existing road K77 alignment detail was developed over the preceding two-year period. This alignment was based on the planning performed during the 1970's in addition to the more recent requirements of the overarching traffic planning strategies including the GPDRT Strategic Road Network Plan and the Sedibeng Integrated Transport Plan as well as the traffic infrastructure directives included in the Midvaal Local Municipality Integrated Development Plan (IDP) and Strategic Development Framework (SDF). Traffic Impact Assessments performed for adjacent developments were furthermore also taken into account during the design of this section of the proposed K77. The section of the proposed road K77 under this application constitutes the middle section of an alignment that will stretch further to the north and the south.

The average daily traffic on the road is estimated to be to 2938 vehicles. The estimated heavy vehicle traffic according to the SANRAL Traffic Count Information Yearbook of 2012 compiled by Mikros Traffic Monitoring, is approximately 70%. Thus, the estimated average daily truck traffic is estimated at 2,507 heavy vehicles per day for year 2019 for the section of the K77. The estimated traffic growth in the area is expected to be between 2% and 4% per annum. This is in line with the GDP growth in the country, as is expected to be the case. Predictions for future traffic loading are based on recommended values provided in Draft TRH 4 (1996), published by the Department of Transport for COLTO (Committee of Land and Transport Officials). Due to the medium level of service it is recommended that the road be designed as a Class C road. (Knight Piésold, 2016).

5.2 Road Design

5.2.1 Carriage Way

In terms of the proposed road development, the road will extend over a distance of approximately 4.3 kilometres and will stretch from Elizabeth Road (D2310) to the R550 (K154). The Design Engineer also reports that the proposed K77 will serve as an urban collector road providing North-South connections in the area between Elizabeth Road and the K154.

The proposed road will be designed and constructed as an asphalt surfaced (Pavement Class V) dual carriageway (three lanes in each direction) within a road reserve of 62 metres. (Knight Piésold, 2016). A Class V standard allows for an ES3-10 pavement class. (Knight Piésold, 2016). The first phase of this proposed project will however only include the construction of a single carriage way (eastern section) of one lane (3.7m wide) in each direction. Additional lanes will be constructed as required by the growth in the traffic load which the road need to carry. A typical section of road will consist of a 3 metre shoulder, three lanes of 3,7m each, an eight metre middle median, three lanes in the opposite direction and the final shoulder. Once completed the roadway will also have bus lanes along the middle of the carriageway. Storm water infrastructure will be added on the outer boundaries of the proposed road.

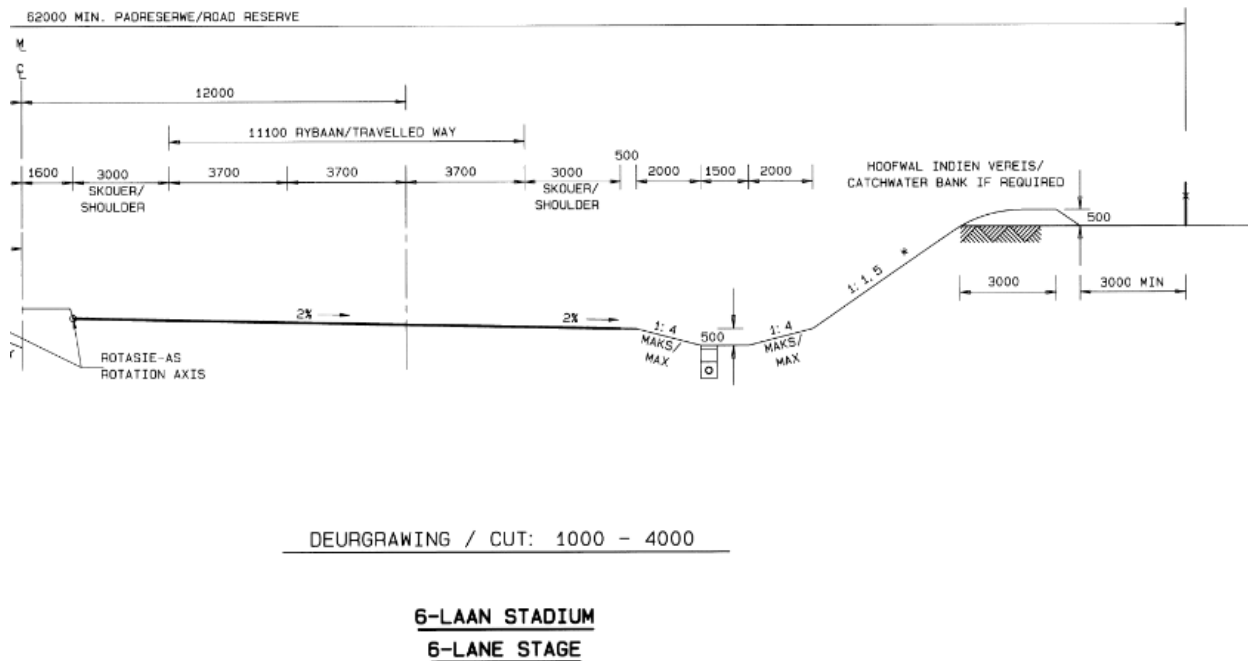


Figure 2: Typical Road Section (One Direction) (Knight Piésold, 2016)

Route K77 proposed between Elizabeth road and the K154 will start at Elizabeth Road at Km 0.00. Elizabeth Road is a single carriageway road with no median. The following accesses and intersections are located on the proposed route K77:

Km 0.600	30m access road at 90°
Km 1.254	40m access road at 90°
Km 1.987	40m access road at 90°
Km 3.108	30m access road at 90°

The end of route K77 intersects with route K154 at Km 4.343. Route K154 is a dual carriageway similar to Route K77. No other future accesses are planned for this section of route K77 and all accesses are spaced more than 600m apart. Bus and Taxi infrastructure will be accommodated at all the intersections.

Access to adjacent properties will happen via specific signalized intersections as described above. Mitigation measures will be included in the K77 specific Environmental Management Programme (EMPr) that will guide the applicant and associated contractors regarding access and fences during the construction and operational phases of the proposed development. (Knight Piésold, 2016).

5.2.2 Supporting Infrastructure

Additional road infrastructure will consist of;

1. the relevant street furniture e.g. street lighting, litter bins, traffic signage and safety barriers in the required areas;
2. bus and taxi pick-up areas in the designated areas with associated structures;
3. traffic signalling and related infrastructure;
4. storm water infrastructure including discharge structures;
5. a bridging structure to cross the non-perennial upper tributary of the Klip river.

5.2.3 Storm Water Management

A detailed storm water management plan was developed for the proposed road K77. The main purpose of the storm water management plan was to determine the flow of the storm water from the relevant catchments and to design storm water infrastructure to manage these flows efficiently. The master plan incorporates a minor drainage system for frequent storm events and a major drainage system for the less frequent storm events (CSIR, 2005). The major drainage system consists of the Klip River tributary and the minor drainage system consists of side drains, kerbs, discharge points, grid inlets and cross drains. (Knight Piésold, 2016).

5.2.4 Water Crossings

The proposed road K77 development intercepts two drainage features. One at the start of the proposed road (between chainage 0.000 and 0.100) and the other at a distance of 1 100m south of the K154 (between chainages 3 100 & 3 300). See Figure 3. The drainage feature at the intercept of the proposed K77 and Elizabeth road classifies as a minor drainage system of which the storm water drainage will be managed via a grassed trapezoidal channel and a pipe culvert cross drain. The crossing of the upper tributary of the Klipriver (between chainages 3 100 & 3 300) is however described as a major drainage system and would require a reinforced cellular concrete box culvert structure to transport storm water runoff along this natural channel underneath the alignment. A Water Use Licence Application will be submitted to the Department of Water Affairs in terms of Section 21(c) and (i) of the National Water Act, 1998, (Act 36 of 1998) for the crossing of the said drainage courses. See Figures 3 & 4.

5.3 Access Roads to Adjacent Properties

Traffic Impact Assessments provided to SPOOR motivates that the primary objective of the proposed K77 was to increase the regional traffic mobility in the area. In order to achieve this, the Traffic Impact Assessment determined the optimal required road design and infrastructure. The proposed design provides access to adjacent properties via specific signalized intersections provided along the required road safety and design standards. Access to adjacent properties will not be restricted in the case of the K77. Mitigation measures will however be included in the K77 specific Environmental Management Programme (EMPr) that will guide the applicant and associated contractors regarding access and fences during the construction and operational phases of the proposed development.



Figure 3: Drainage Features Along the K77 Route

5.4 Construction Phase

The construction activities associated with the proposed construction of the K77 will include the required construction camp including site offices and facilities, temporary sanitation facilities, construction vehicle parking, material holding and laydown areas, etc. Detailed mitigation specifications will be included in the K77 EMPr to guide the placing and management of this aspect of the proposed project.

5.5 Essential Services

All civil service related requirements for the proposed project are being managed by Knight Piésold Engineering Consultants (PTY) Ltd., who serves as the appointed Civil Engineering and Project Management Consultation firm on the Project. The Engineer has conducted in depth assessments of all the services that would be impacted on (Telkom, Eskom, Sasol, Rand Water) by the proposed alignment and reported that apart from a Rand Water Pipeline no services will be impacted. SPOOR contacted Rand Water as part of the standard public participation process and Rand Water confirmed that the road alignment will cross their B7 pipeline. They furthermore stated the recommended mitigation measures which is included in the project EMPr. Constant communication will be upheld by the Engineer and the various service providers throughout the pre-construction planning and construction phases.

The phasing of the construction will be discussed with all the service providers to ensure that services are moved well ahead of actual construction. This will be done in order to inform members of the local communities well before any disruptions in services will occur in order for them to prepare and also to

keep services disruptions minimal. In addition, these services will also be incorporated into the design and construction of the new road in a way that assures its effective functioning into the future.

Availability of infrastructural resources (e.g. water and electricity) will be negotiated with the relevant service provider (Eskom, Rand Water or the Midvaal Local Municipality - MLM) with specific reference to the construction and operational phases of the proposed road. In terms of water required for the construction phase the most probable scenario would be that the appointed construction contractor would link onto one of the nearest Rand Water or municipal water supply pipeline, which would be metered and the account paid. The electricity requirements of the development consist of the connection needed for the traffic signalling infrastructure, the lighting of the interchanges and lighting along a specified distance the K77 during the operational phase of this road. The appointed contractor will connect onto the existing Eskom or MLM electricity connection for this purpose.

6. RECEIVING ENVIRONMENT

The proposed K77 road development site is situated at an average altitude of 1 585m above mean sea level. The study area is located in the summer rainfall zone of the Republic of South Africa, with an expected mean annual precipitation (MAP) of approximately 670 mm. 1992 was the driest recorded year with a MAP of 399 mm. According to Mucina & Rutherford (2006) the study site falls predominantly in the Soweto Highveld Grassland vegetation unit with the smaller northern section falling in the Carletonville Dolomite Grassland unit. Although these veld types are described as endangered and vulnerable in terms of its conservation status, the proposed road development footprint does not traverse locally sensitive vegetation units. The proposed road development will however cross sections of sensitive zones associated with local wetland systems and an upper tributary of the Klip river. Although these watercourse systems were found to be in a state described as Category C (Moderately modified), by the Specialist, all riverine areas are to be treated as sensitive and must be treated in the manner described by the Specialist. See Figure 3 & 4.

In terms of the groundcover the ecological Specialist identified 3 principal habitat units. These consist of the Rocky Ridge Unit, the Transformed Unit and the Vegetation Wetland area. Transformation in the *rocky ridge habitat unit* has occurred, although it still provides habitat for possible floral species of Conservation Concern (SCC). The ecological functionality and habitat integrity of the *transformed habitat unit* is regarded as being low. The diversity of alien plant species and severe vegetation transformation result in this habitat unit having a low ecological sensitivity and little conservation value from a floral biodiversity perspective. Finally, the wetland has been significantly disturbed by historical earthworks and vegetation clearing. The wetlands are also significantly augmented by urban runoff. Its till performs important socio economic and ecological functions and is therefore deemed sensitive environment.

The Specialist reported that although no avifaunal SCC were directly observed on site, data provided by the South African Bird Atlas Project (SABAP) shows that *Tyto capensis* (Grass owl) and *Mirafra cheniana* (Melodious Lark) have been recorded in the area. Furthermore, there is also sufficient suitable habitat available for *Mirafra cheniana* (Melodious Lark) on the rocky ridge area. Therefore, due to the habitat suitability for these two SCC, it is recommended that the rocky ridge and wetland habitat units be excluded for development. (SAS, 2015).

In terms of the invertebrate assessment the Specialist identified no invertebrate SCC during the site assessment. The rocky ridge areas of the site are ideal habitat for *Chrysoritis aureus* (Heidelberg Copper butterfly) and *Lepidochrysops praeterita* (Highveld Blue Butterfly) however and they are also naturally found in the Suikerbosrand Nature Reserve. The road alignment was therefore optimised to avoid the area identified as sensitive to these species. This will reduce impacts to acceptable levels. Habitat for these species will be preserved and the proposed road development is unlikely to contribute to a loss of insecta diversity in the region. SAS, 2015. In terms of the occurrence of sensitive spider species the Specialist reported that these species are notoriously difficult to observe in the field due to their behavioural habits. Additionally, due to the size and nocturnal or crepuscular nature of many spider species it is not practical to identify all possibly occurring species during a limited field assessment. Therefore, an inference of possible species occurrences has to be made by evaluating habitat suitability, prey sources and the location of the K77 Route Alignment. SAS, 2015.

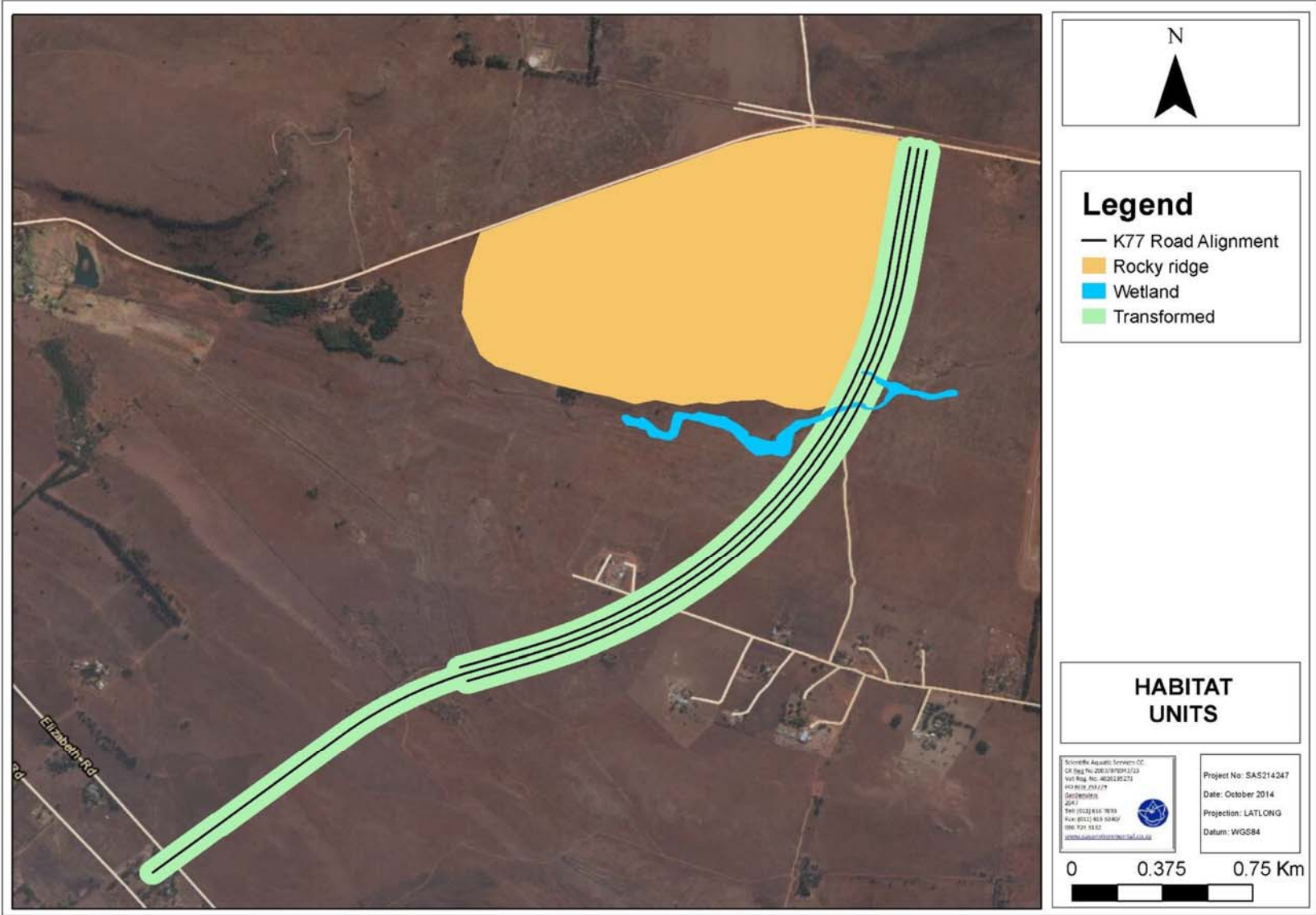


Figure 4: K77 Habitat Units (SAS, 2015)

Trapdoor and Baboon spiders are listed as threatened throughout South Africa (Dippenaar-Schoeman, 2002). All baboon spider species form the genus; *Ceratgyrus*, *Harpactira* and *Pterinochilus* are protected under the National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA). All scorpion species from the genus *Hadogenes*, *Opisthacanthus* and *Opisthophthalmus* are also protected under NEMBA for South Africa. Where necessary, permit applications should be obtained from the relevant authorities if species needs to be relocated. SAS, 2015.

Special emphasis was placed by the Specialist on locating any SCC Trapdoor spiders, but none was found. Furthermore, the rocky ridge section within the study area was extensively searched for any signs of scorpions and spiders, *Opisthophthalmus pugnax* (Burrowing scorpion) was found, and only signs of the *Theraphosidae* family (Baboon Spiders) were encountered. The likelihood of members of the Baboon Spider family utilising the area is high. Should the rocky ridge be excluded from the proposed development, habitat for these species will be conserved and is unlikely to contribute to a loss of arachnid diversity in the region. SAS, 2015. Special measures will however be included in the EMPr to be able construction workers and staff to identify these species and to handle any occurrences in terms of the Specialist's recommendations.

Adjacent land uses consist predominantly of agricultural holdings. The proposed new road infrastructure is situated between a number of proposed new residential nodes and access routes in vicinity and will eventually contribute positively to the road safety for the local community members that need to travel between these areas and the major transport routes on a daily basis. Currently the area still boasts a tranquil rural nature and it will be critically important for the construction and operational phase managers of the proposed road to follow the recommended mitigation and rehabilitation measures very closely in order to minimize the anticipated impacts.

7. LEGISLATIVE FRAMEWORK

The following section includes the primary list of legislation which is deemed relevant to the proposed development on all levels of government, including the constitutional, national, provincial and local level. Although the aim was to be as comprehensive as possible the list does not represent a complete legal review and the responsibility remains with the Applicant to ensure compliance with the required relevant legislation.

7.1 The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)

The Constitution of the Republic of South Africa is the principal legal source of the Republics' legislative framework, including its environmental law. The Bill of Rights is fundamental to the Constitution of South Africa and in, section 24 of the Act, it is stated that:

Everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Given that environmental management is founded partly on the principles of public participation, Section 195 of the Constitution is of primary relevance. This section states that:

(1) Public administration must be governed by the democratic values and principles enshrined in the constitution, including the following principles: (a) (b) (c) (d) (e) People's needs must be responded to, and the public must be encouraged to participate in policy making. (f) Public administration must be accountable. (g) Transparency must be fostered by providing the public with timely, accessible and accurate information (Government Gazette, 1996).

7.2 Environment Conservation Act, 1989 (ECA) (Act 73 of 1989)

The primary objective of the ECA is to provide for the effective protection and control of the environment. Subsequent to the promulgation of the Act in 1989, a number of key regulations governing EIA's and identified activities that may be detrimental to the environment have also been promulgated. Section 8 of the Regulations regarding activities identified under section 21(1) of the Environmental Conservation Act (73 of 1989) – General EIA Regulations states that:

After a plan of study for the environmental impact assessment has been accepted, the applicant must submit an environmental impact report to the relevant authority, which must contain; (a) A description of each alternative including particulars on (i) The extent and significance of each identified environmental impact; and (ii) The possibility for mitigation of each identified impact. (b) A comparative assessment of all the alternatives; and (c) Appendices containing descriptions of (i) The environment concerned; (ii) The activities to be undertaken; (iii) The public participation process followed, including a list of interested parties and their comments; (iv) Any media coverage given to the proposed activity; and (v) Any other information included in the accepted plan of study.

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

The purpose of the Environmental Impact Assessment Amendment Regulations of 2010 I is to:

“regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment, or where it cannot be avoided, ensure mitigation and management of impacts to acceptable levels, and to optimise positive environmental impacts, and for matters pertaining thereto.”

The Act provides for the right to an environment that is not harmful to the health and well-being of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks (Government Gazette, 1998). Section 30 (1, 3 and 4) of NEMA states that:

Additionally, in terms of the regulations for certain activities, as identified in terms of Section 24(2)(a) and (d) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), the applicant must follow the Environmental Impact Assessment Process (also known as the EIA process) as described in the National Environmental Management Act, 1998 (Act No. 107 1998). This process must be performed with the aid of the appointed independent Environmental Assessment Practitioner (EAP) which must perform the necessary assessments and then submit the results of these assessments in the form of a scoping report and an environmental impact assessment report thereafter. These reports will be submitted to the Gauteng Department for Agriculture and Rural Development (GDARD) for authorisation.

The proposed project is listed in terms of the listed activities under the NEMA (Act 107 of 1998), June 2010 regulations. This document constitutes the Scoping Report and was compiled as part of an application for environmental authorization in terms of section 24 of the NEMA and as contemplated in regulation 28(f) and 29 of the EIA Regulations.

7.3.1 Listed Activities Applicable to the Proposed Design and Construction of Road K77 between Elizabeth Road and R550 (K154).

The table below provides a summary of the listed activities specified in the EIA Regulations of June 2010 and which is applicable to the proposed development.

Table 2: Listed Activities in terms of the June 2010 NEMA Regulations

GNR and Activity No	Activity Description	Discussion
GNR.544 Activity 11	<i>The construction of: (i) canals (ii) channels (iii) bridges; (xi) infrastructure or structures covering 50m² or more where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from</i>	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of a bridging structure covering 50m ² or more within 32m of a watercourse.

GNR and Activity No	Activity Description	Discussion
	<i>the edge of a watercourse, excluding where such construction will occur behind the development setback line.</i>	
GNR 544 Activity 18	<i>The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from: (i) a watercourse.</i>	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of a bridging structure. More than 5 cubic metres of soil will be excavated/ moved with the construction of the bridge or culvert.
GNR 544 Activity 22	<i>The construction of a road, outside urban areas, (i) with a road reserve wider than 13,5 meters, or (ii) where no reserve exists where the road is wider than 8 meters,</i>	The new proposed road will be constructed outside of the urban edge with a road reserve of 62 meters.
GNR 545 Activity 18	<i>The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, where this road: (ii) is a road administered by a provincial authority; (iii) road reserve is wider than 30 metres; or (iv) will cater for more than one lane of traffic in both directions.</i>	The proposed K77 was presented to the public with the first publication of a network of transportation corridors in November, 1974. The constructed road will be administered by the Gauteng Province Department of Roads and Transport, will have a 62m road reserve and will cater for 3 lanes of traffic in both directions.
GNR 546 Activity 13	<i>The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, (d) In Gauteng; v Sites identified as irreplaceable or important in the Gauteng Conservation Plan.</i>	The site will require the clearance of approximately 24 ha of area identified as important by the Gauteng Conservation Plan.
GNR 546 Activity 16	<i>The construction of: (iv) infrastructure covering 10 square metres or more, where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. (b) In Gauteng; v Sites identified as irreplaceable or important in the Gauteng Conservation Plan.</i>	The proposed new road will cross a non-perennial upper tributary of the Klip River by means of bridging infrastructure covering more than 10 square metres. This construction will take place within 32m of the watercourse.

SPOOR Environmental Services Environmental Consultants has subsequently been appointed by the applicant, Gauteng Province Department of Roads and Transport (GDPRT), as the independent

Environmental Assessment Practitioners (EAPs) to undertake this Environmental Impact Assessment process and to ensure compliance with all the relevant Environmental Legislation, Regulations and Guidelines.

7.4 National Environmental Management: Biodiversity Act, 2004 (NEM:BA) (Act 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed. In terms of the Biodiversity Act, the developer has a responsibility for:

- ❖ The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations),
- ❖ Application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity,
- ❖ Limit further loss of biodiversity and conserve endangered ecosystems.

7.5 National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)

In regulating air quality in South Africa, The NEM:AQA was introduced to protect the environment by introducing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development whilst promoting justifiable economic and social development. In addition the act aims to provide national norms and standards for regulating air quality monitoring as well as air quality management and control. The list of activities included in General Notice 248 must be considered for any activities that produces emissions. The following passages of the act bare relevance;

Section 22: No person may without a provisional atmospheric emissions licence conduct an activity;

- (a) listed on the national list anywhere in the Republic; or
- (b) listed on the list applicable in a province anywhere in the province.

7.6 National Environmental Management: Waste Act, 2008 (Act 59 of 2008)

Act no 59 of 2008 provides for the control of waste management activities which have or is likely to have a detrimental effect on the environment. The act aims to;

- ❖ Reform the law regulating waste management in order to protect health and the environment by providing reasonable measures to prevent pollution and ecological degradation and for securing ecologically sustainable development,
- ❖ To provide for institutional arrangements and planning matters,

- ❖ To provide for national norms and standards for regulating the management of waste by all spheres of government,
- ❖ To provide for specific waste management measures,
- ❖ To provide for the licensing and control of waste management activities,
- ❖ To provide for the remediation of contaminated land,
- ❖ To provide for a national waste information system,
- ❖ To provide for compliance and enforcement, and
- ❖ To provide for all matters related to the above aspect.

Importantly the act furthermore includes requirements that stipulate that no person may commence, undertake or conduct a waste management activity listed in the act unless a licence is issued in respect of that activity.

7.7 National Water Act, 1998 (NWA) (Act 36 of 1998)

The National Water Act (NWA) identifies 11 consumptive and non-consumptive water uses in terms of section 21 of the act which must be authorized. The authorization system includes scheduled uses, general authorizations and licences. It allows for the reserve of the specific water resource to be determined and also includes a public involvement process in the establishment of strategies and decision-making and guarantees the right to appeal against such decisions. The reserve is defined by the quality and quantity of the water resource in order to meet basic human needs as well the ecological requirements.

Section 27 of the NWA specifies that the following factors regarding water use authorization be taken in consideration:

- ❖ The efficient and beneficial use of water in the public interest;
- ❖ the socio-economic impact of the decision on whether or not water use is authorized;
- ❖ alignment with the catchment management strategy;
- ❖ the impact of the water use and possible resource directed measures;
- ❖ investments made by the applicant in relation with the water resource in question.

The proposed development will require a Water Use Licence in terms of Section 21 (c & i) of the National Water Act (Act 36 of 1998).

7.8 National Heritage Resources Act, 1999 (NHRA) (Act 25 of 1999)

Section 38(1) of the South African Heritage Resources Act (25 of 1999) requires that a heritage study be undertaken for:

- (a) *construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;*
- (b) *construction of a bridge or similar structure exceeding 50 m in length; and*
- (c) *any development, or other activity which will change the character of an area of land, or water –*
 - (1) *exceeding 10 000 m² in extent;*
 - (2) *involving three or more existing erven or subdivisions thereof; or*

- (3) involving three or more erven, or subdivisions thereof, which have been consolidated within the past five years; or
- (d) the costs of which will exceed a sum set in terms of regulations; or
- (e) any other category of development provided for in regulations.

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

The main aim of this act is to provide a legal vehicle for the protection of productive agricultural resources. The act provide for the control and protection of wetlands, soil conservation matters, control and prevention of veld fires, control of weeds and invader plants, and the control of pollution via agricultural practices. The act therefore focusses on fighting of soil erosion, the protection of water resources, and combatting the degradation of indigenous vegetation conducive to agricultural practices through the control of invasive alien vegetation.

7.10 Municipal Systems Act, 2000 (Act 32 of 2000)

The Municipal Systems Act form part of a string of other legislation which aims at empowering local government to fulfil its constitutional obligations. As part of this objective the SA government published the Local Government White Paper in 1998, which outline the policy framework for local government structures. In addition, government furthermore published the Municipal Demarcation Act, 1998 (Act 27 of 1998) which allowed for the demarcation of new municipal boundaries, the Municipal Structures Act, 2000 (Act 33 of 2000) which outlines the required structures of a local authority and the Municipal Financial Management Act, 2003 (Act 56 of 2003) which must secure sound and sustainable management of the fiscal and financial affairs of municipalities and municipal entities by establishing norms and standards and other requirements for the lawful financial management of these entities.

The Municipal Systems Act work in unison with these sets of legislation by regulating key municipal organizational, planning, participatory and service delivery systems. In combination these sets of legislation provide a framework for the democratic, accountable and developmental local government system as envisaged by the Constitution.

7.11 Integrated Environmental Management

The term Integrated Environmental Management (IEM) has been used in South Africa since the 1980's. Documentation on how IEM would assist the EIA process was originally produced in 1992 by the then National Environmental Management Competent Authority. The need has since arisen for more comprehensive inputs in the EIA process and this paved the way for the development of the Integrated Environmental Management Series in 2002 which consisted of a set of booklets providing more detailed insights in the approach and methodologies associated with EIA. In brief the IEM seeks to achieve the following;

“Integration of environmental considerations across the full lifecycle of the activity: for example, for a project this implies consideration of environmental issues through pre-feasibility, feasibility, planning and design, construction, operation and decommissioning” (DEAT 2002).

7.12 National Land Transport Act, 2009 (Act 5 of 2009)

The National Land Transport Act (Act 5 of 2009) provides appropriate structuring of land transport planning on national and provincial level and should guide the local municipality's Integrated Transport Plans (ITPs).

7.13 Occupational Health and Safety Act, 1993 (Act 85 of 1993)

The Occupational Health and Safety Act, 1993 (Act 85 of 1993) provides for the health and safety of individuals in the workplace as well as for the health and safety of individuals working near or with of plant and machinery. The Act also protects people, other than persons at work, against hazards to health and safety due to the activities of people at work.

7.14 Gauteng Policies

7.14.1 Gauteng Infrastructure Act, 2001 (Act 8 of 2001)

The Gauteng Transport Infrastructure Act (Act 8 of 2001) relates to the laws relating to roads and other types of transport infrastructure in Gauteng and provides guidance to the planning, design, development, construction, financing, management, control, maintenance, protection and rehabilitation of such infrastructure.

7.14.2 Gauteng 25-Year Integrated Transport Master Plan (ITMP 25)

The Gauteng 25-Year Integration Transport Master Plan is a medium-term transport plan recommending eight significant transport interventions which will be implemented over the next 25 years from November 2013. The report takes into account the National Development Plan and the Strategic Investment Projects (SIPs), the Gauteng Vision 2055 and the various Integrated Transport Plans (ITPs) developed by local government. The report also describes the current reality of transport in Gauteng, the expected population and economy growth over the next 25 years, funding and expected outcomes of the implementation.

7.14.3 Gauteng 5-Year Implementation Transport Plan (GITP 5)

The aim of the 5-Year Gauteng Transport Implementation Plan is to "fast-track" the implementation of certain urgent initiatives and projects. that are already being implemented by the Gauteng Department of Roads and Transport (GDRT) for completion during the next five years. as a precursor to achieving the ITMP25 goals and objectives.

The K77 is one of the initiatives listed in the GDRT Current Priority Road List in the 5-Year Gauteng Transport Implementation Plan.

7.15 Regional Policies

The following Regional strategies were considered with the assembling of the Scoping and Environmental Impact Report:

- ❖ Sedibeng Spatial Development Framework;
- ❖ Midvaal Spatial Development Framework 2013 – 2014;
- ❖ Midvaal Western Region Spatial Development Framework;
- ❖ Sedibeng Integrated Development Plan;
- ❖ Midvaal Integrated Development Plan;
- ❖ Midvaal Strategic Environmental Management Plan (SEMP);
- ❖ Midvaal Density Policy.

8. MANAGEMENT STRUCTURE

In order to ensure that the prescribed mitigation, rehabilitation and monitoring measures are effectively and efficiently implemented in all the relevant stages of the development, it is important to assign certain responsibilities to the specific managers thereof. The success of the implementation of the aims of this EMPr will not only depend on whether appropriate mitigation and rehabilitation measures have been adequately identified, but also on the level of commitment of all the responsible individuals to implement the recommendations which are proposed in this document.

8.1 Applicant

The party or agent who is or represents the Applicant and who will be implementing the development as the contractual overseer is the Applicant or Implementing Agent. In the case of the K77 road development the Applicant is;

The Gauteng Department of Roads and Transport (GPDRT)

Mr K Govender
41 Simmonds Street
Sage Life Building
Marshalltown
Johannesburg
2007

Tel: (011) 355 7050
Fax: (011) 355 7235
E Mail: kumen.govender@gauteng.gov.za

8.2 The Implementing Agent

The Implementing Agent who will be implementing the proposed road development on behalf of the GPDRT is:

Knight Piésold Consulting Engineers

Mr. Jannie Viljoen
4 De la Rey Road
Johannesburg
Rivonia 2128

Tel: (011) 806 7111
Fax: (011) 806-7100
E Mail: jviljoen@knightpiesold.com

The Applicant/Implementing Agent is responsible for:

- ❖ the implementation of the EMPr (from the initiation of the project to the completion of construction) and all the prescribed rehabilitation,
- ❖ appointing a project manager (PM) that will represent the developer/implementing agent and who will liaise competently with all the Services, contractors, the local community and the other entities involved.

8.3 Environmental Assessment Practitioner (EAP)

The appointed Environmental Assessment Practitioner (EAP) is responsible for:

- ❖ ensuring that the EMPr for the proposed road development complies with the relevant environmental legislation and all the conditions of the GDARD,
- ❖ liaising with the developer/implementing agent at the onset of the construction phase and for ensuring that he/she is aware of the identified responsibilities and of the environmental issues of the development,
- ❖ informing the developer/implementing agent of the need of appointing an environmental control officer (ECO) (See 8.5) and providing advice on the actual appointment.

8.4 Resident Engineer (RE) or Project Manager (PM)

The Resident Engineer (RE) also known as the Project Manager (PM) in cases usually fulfils the role of the overall project management of the construction project on behalf of the Applicant/Implementing Agent. The PM can also be appointed directly by the Applicant/Implementing Agent and stand independent of the principal construction Contractor, in which case the principal construction Contractor will appoint his/her own PM. It is therefore the responsibility of the Applicant/Implementing Agent to define the specifics of the appointment of the PM/RE. The RE/PM in conjunction with the ECO (See 8.5) will be responsible for the implementation of the EMPr.

8.5 Principal Construction Contractor or Principal Contractor (PC)

In the event that the principal construction Contractor and the PM are represented by the same entity, the PM will be responsible for the appointment of sub-contractors and the implementation of this document. With relevance to the EMPr the PC and/or his/her PM are responsible for:

- ❖ appointing a construction foreman to act as representative for the PC and their staff,
- ❖ responding timeously to any complaints and commands issued by the ECO or Community Liaison Officer (CLO) (See 8.8),
- ❖ recording any paper trails from the developer/implementing agent, ECO, CLO and the PM,
- ❖ rehabilitating the site to conditions acceptable to the directives of the EMPr and the reasonable approval of the ECO,
- ❖ compliance to any applicable laws and acts specifically those relevant to the project
- ❖ conducting site inspections along with the ECO, (See 8.6)

8.6 Environmental Control Officer (ECO)

The Applicant/Implementing agent is responsible for employing an environmental control Officer (environmental advisor) or ECO at the start of the construction phase.

The ECO, on behalf of the implementing agent will be responsible for:

- ❖ compiling a monitoring and auditing plan to ensure that the environmental management procedures of the EMPr are implemented and are effective,
- ❖ ensuring that the Contractors/Sub-contractors and Employees are aware of their environmental impact. (This can be achieved through an environmental awareness-training program conducted at the onset of the construction phase),
- ❖ conducting and monitoring site activities, and ensuring that they have the minimal environmental impact,

- ❖ recording and issuing spot-fines for any non-compliance with the requirements of the EMPr,
- ❖ producing a photographic record of the site before, during and after construction,
- ❖ liaising between the developer/implementing agent and the PC (and the relevant appointed sub-contractors) and the local community (via the community liaison officer – see 8.8) with regard to all environmental concerns,
- ❖ the ECO in association with the relevant parties will also be responsible for assisting in the resolution of conflicts arising due to the road development.

8.7 Health and Safety Officer

According to the Occupational Health and Safety Act in terms of the Construction Regulations 85 of 1993 (OHS act), which came into effect on 18 July 2003, a Health and Safety Representative (SHE Rep) must be employed under the Compensation for Occupational Injuries and Diseases Act. (COIDA) (Act No 130 of 1993). The SHE Rep will be responsible for the following:

- ❖ Investigate potential hazards and dangerous occurrences and examine the causes of accidents.
- ❖ Conduct toolbox talks on a weekly basis to sensitise workers of potential hazards on the construction site.
- ❖ Attend monthly Health and Safety (H&S) meeting with management.
- ❖ Make sure that the workers adhere to the Health and Safety standards regarding Personal Protective Equipment (PPE) and weather related work conditions.
- ❖ Have a Safety file on site with the relevant certificates, minutes of H&S meetings and documentation regarding the toolbox talks according to the COIDA act.

8.8 The Community Liaison Officer (CLO)

The CLO must preferably consist of an individual representative of the neighbouring Communities and/or other local interest groups. The CLO is appointed by the PC or PM and is responsible for the communication between the neighbours and all the other representatives of the PC/PM management structure for the total duration of the construction phase of the development. The CLO can also function as the community representative during the Operational phase of the development. He/she will therefore be responsible for liaising between the development management, the surrounding landowners and other affected parties within the community as soon as details become available on how the project will affect them and how it might affect them in the foreseeable future.

8.9 The Local Community

It is important to involve the local communities where this is relevant in terms of impacts that the development may have on their activities or facilities. If possible a local community member or group should be identified to which pertinent information can be communicated. These parties will also have an open channel through the ECO to communicate any issues to the applicant.

8.10 In General

All of the abovementioned parties (8.1 – 8.9) are responsible for appointing representatives that are suitably qualified to perform the necessary tasks appointed to them. These representatives must also be able to interact within a professional team in order to facilitate all the relevant activities needed for the successful implementation of the EMPr and the completion of the proposed Road K77 development.

9. BIOPHYSICAL, SOCIO-ECONOMIC AND CULTURAL IMPACTS AND THE ASSOCIATED MITIGATION AND REHABILITATION MEASURES

BIOPHYSICAL ENVIRONMENT

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p>Aspect:</p> <p>Composition of Labour Force</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Employment of members of the Local Community. ❖ Appointment of Local SME's 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Construction and ❖ Operational. <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO.</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Employment opportunities, ❖ Skills development. 	<ul style="list-style-type: none"> ❖ Members of the local communities closest to the proposed road development must be employed during the construction and operational phases as far as possible, and the contingent of the local community employed must preferably be equally represented by male and female workers. ❖ The Relevant skills development workshops should be conducted at all the applicable levels of the local communities and for every possible activity wherever the construction phase of the development can allow for this. ❖ The proposed project must make use of the Maximum extent of local SME's as far as possible. A fixed percentage of work to be allocated to the local SME's must be agreed upon between the stakeholders before the start of the construction phase. The Applicant must create a labour desk and ensure information about the number and nature of jobs are advertised in the local communities. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p><u>Aspect:</u></p> <p>Environmental Awareness</p> <p><u>Impacts:</u></p> <ul style="list-style-type: none"> ❖ Fires. ❖ Sensitive habitat. ❖ Sensitive species. (See Vegetation and Animal Life) ❖ Proper personal conduct. ❖ Community safety. ❖ Spread of HIV Aids. ❖ Pollution. ❖ EMPr. 	<p><u>Project Phase:</u></p> <ul style="list-style-type: none"> ❖ Construction and ❖ Operational <p><u>Responsible Parties:</u></p> <p>PC, RE, PM, ECO & CLO</p> <p><u>Performance Indicators:</u></p> <ul style="list-style-type: none"> ❖ Environmentally sensitive and responsible conduct. ❖ Community safety. 	<ul style="list-style-type: none"> ❖ Cooking in the construction camps must be performed by electrical or gas stoves in well ventilated areas which are declared safe for this purpose. Designated fire places must be provided for, in the construction camps in safe areas away from flammable materials. No fires may be built outside these areas. ❖ Sufficient temporary ablution facilities (1 for every 15 people) in the form of chemical toilets must be provided for all workers during the pre-construction, construction and rehabilitation phases of the development. These ablution facilities must be serviced on a regular basis as per the contractor's schedule that provides them. ❖ Conduct Environmental Awareness Workshop(s) to sensitize any and all visitors and workers on the site to the relevant site specific sensitivities (significant habitats, such as the wetlands and the Klip river tributary) and on how these areas must be handled. ❖ The community and children must be educated about the dangers of storm water and living and playing in flood prone areas. The ward councillors and teachers in the community should be educated to act as peer educators. ❖ An AIDS awareness programme must be also form part of the Environmental Awareness Programme. ❖ This EMPr must be made available to all employees, construction workers, visitors and maintenance personnel on the site to ensure that they are informed of the appropriate environmentally responsible conduct. A copy must therefore be held at the site offices at all times. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ This EMPr is drafted in such a manner that this section can be reproduced (photo copied) and handed out to all of the managers and contractors who must use it as a monitoring tool whereby check-ups (weekly or monthly whatever is applicable) can be performed and be added to a final monthly report or project completion report to track the monitoring of the project effectively over the lifetime of the construction phase and the Operational phase of the development. ❖ All employees, construction workers, maintenance personnel and the RE or PM must furthermore be made aware of the location of the EMPr document (at the site office) and of their responsibility to adhere to the content thereof. This action can be performed at an Environmental Awareness Workshop at the first appropriate time when the bulk of the contractors and sub-contractors have been appointed. ❖ Activities such as littering, informal settlement, loud music and other ill-mannered behaviour will be regarded as unacceptable and it will be the responsibility of the various contractors and other employers to ensure that workers under their supervision conduct themselves appropriately. These actions must be reported to the ECO who will see to the issuing of the relevant fines. See Appendix 1. ❖ No damage and/or removal of indigenous plant or animal material for cooking or other purposes will be allowed. See Appendix 1. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p>Aspect:</p> <p>Start of Construction & Related Activities</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Site clearance for administration structures. ❖ Compaction of resident soils by construction vehicles. ❖ Possible contamination by fuels and other construction materials. ❖ Security. ❖ Traffic. ❖ Access. ❖ Informal traders. ❖ Occupational Health and Safety. <p><i>See Appendix 2_Typical Composition of Construction Camp</i></p>	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction & Operational <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Public awareness of start of construction on site. ❖ Safety around the construction site. ❖ Design and construction of the construction camps. ❖ Responsible environmental management in and around construction camps. ❖ Concurrent management of Occupational Health and Safety aspects. 	<ul style="list-style-type: none"> ❖ Local authorities (e.g. the Midvaal Local Municipality (MLM), SA Police Services (Kliprivier and De Deur Stations) MLM EMS, and Traffic department) as well as the surrounding land owners and the relevant ward councillors must be notified of the commencement of the construction activities at least 6 weeks before the actual start of the activities. ❖ The contractors must, at the relevant community liaison meeting communicate the dangers of the construction site and stress that the site is specifically out of bounds for small children. ❖ Special arrangements must be made for traffic management specifically during the construction phase and the Traffic Section of the MLM and the PC must ensure that the relevant warnings are communicated to the local community before the commencement of major construction. Pointsmen must be deployed at major intersections to assist in managing traffic flow during construction where necessary. ❖ A complaints register must be maintained on site. ❖ The whole of a construction site should preferably be fenced off during construction. The principal contractor must in addition provide suitably visible signage (visible for both motorists and pedestrians) along all of the major circulation routes and entrances around the site informing people that the site is under construction and private property and that no access is allowed for any unauthorised persons. No casual access may be allowed here. 		

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			YES	NO
		<ul style="list-style-type: none"> ❖ Full documentation (ID, contact details and of next of kin) of all construction personnel must be kept on file at the site office and no unauthorized persons may be allowed on site. ❖ The construction phase must be managed by strict management guidelines (EMPr as well as the internal guidelines of the individual contractors) and it will be the responsibility of the relevant contractors to ensure that they themselves and their workers conduct themselves according to the management guidelines laid down. ❖ The chosen site for construction camps must not be located closer than 100m horizontally from any drainage courses or within the 1:100 year floodline. ❖ Vegetation clearance for the erection of construction camps must be kept to an absolute minimum and must adhere to the footprint no larger than the camps themselves. (refer to Appendix 1) ❖ The main site office must be situated within one of these camps (PC or Civils) as well as storage areas for construction vehicles and other construction related equipment. Temporary water and fuel tanks must also be contained in the camp as well as a workshop area. ❖ Adequate water, sanitation and solid waste disposal services must be provided or arranged for prior to human habitation on the site. Solid waste should be sorted into categories and those not suited to be dumped in an appropriate waste skip at the temporary facility (E.g. cement and chemicals) must be dumped at a recognized waste disposal facility designed for this purpose. A suitable site must be selected for the waste skip site and this site should only contain materials that do not pose any risk in terms of surface or sub surface 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<p>environmental contamination (e.g. building rubble). This site must also be suitably rehabilitated after completion of the construction activities.</p> <ul style="list-style-type: none"> ❖ An earth berm or drainage ditch (450mmx450mm) must be constructed around construction camps to prevent runoff onto and from these camps. ❖ The batching plant must be positioned away from drainage lines, and measures to ensure that no polluted water enters a natural stream, i.e. more than 100m horizontally from any drainage feature and outside of the 1:100 year floodline. All runoff from batching areas must be strictly controlled. ❖ Cement contaminated water must be collected, stored and disposed of at a site approved by the RE. Appropriate measures for overflow from batching plant, e.g. during heavy rains, must be put in place. The batching plant shall be banded with earth berms, sandbags or straw bales to prevent runoff escaping from the site. ❖ Waste concrete and cement sludge must be scraped off the site of the batching plant daily and removed to an approved landfill site. (To prevent pollution during the rain). Concrete shall not be mixed directly on the ground. Plastic liners or mixing trays are to be used. ❖ Special attention must be given to any temporary fuel tank and its surrounding area. This area should be appropriately designed, in a watertight bunker which is able to hold 110% of the volume of the tank itself. The area should be monitored on a weekly basis to ensure that no fuel is leaking into the local soils. ❖ The drainage valve of the banded area may not be allowed to drain into the surrounding soils but must be pumped or emptied into containers to be removed by an Oil recycling company. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Should an accidental puncture of a fuel tank occur and the bunded area be breached, an appropriate specialist should be contacted immediately for clean-up operations. The top soils and sub soils of the site of the spillage must be completely removed and be disposed of at a fittingly licensed facility by the specialist. The excavation must be filled up to the top with healthy soils. This must be performed directly after a spillage and not only at the final rehabilitation of the construction camp to ensure no leaching of oils and fuels into the sub soils. See Appendix 3 for options. ❖ Containment bunkers must be kept empty at all times to be prepared for any emergency spills. ❖ All construction materials must be stored in designated areas that are suitable for the containment of that specific material. (Cement, paints, acidic cleaning agents and bitumen, must be stored in water tight containers within the construction camp). In the event of a spillage the appropriate environmental specialist must be contacted. The contaminated soil must be removed to a depth at which no sign of the contaminant is visible and replaced with healthy soils. See Appendix 3 for options. ❖ Construction vehicles and equipment must be checked and maintained on a regular basis (weekly) to ensure that no environmental contamination is brought about by oil, fuel or hydraulic fluid leakages. ❖ All fuel and lubricant oriented areas (for storage and waste) at the service site (e.g. diesel tanks, workshop shed, and compressor shed) must be constructed with impervious concrete floors and oil and fuel resistant walls, with watertight sumps at the end of the catchment drains of these areas. Sumps 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<p>must be pumped into suitable containers and removed by an appropriate specialist, to a suitably licensed waste disposal facility.</p> <ul style="list-style-type: none"> ❖ After construction is complete the construction camp must be dismantled and full rehabilitation of the site be done. ❖ Compacted soils must be loosened to a depth of 300mm and reseeded with seed of locally occurring indigenous ground covering species. This must occur in all the areas not to be taken up by building structures. All soils in areas contaminated with cement dust, small oil and fuel leakages and other contaminants must be removed to an appropriate depth as per the specific contaminant as prescribed by the ECO. These soils must be replaced with suitably healthy soils (able of harbouring plant and animal life) and be stabilized by contouring the soils according to the local site contours, reseeded or re planted with soil stabilising ground covering species indigenous to the local area. ❖ Where possible, access roads must be restricted to already degraded areas or make use of existing roads and paths. ❖ The orientation of these access roads (new roads) must be parallel to the contours to eliminate erosion as far as possible. ❖ Drivers of construction vehicles must be informed to make use of accepted access roads only and not enter into any sensitive areas. ❖ Site roads must also be reshaped according to the prevailing contours, scarified, fertilized and re-seeded and re-vegetated with indigenous grasses and vegetation characteristic of the local ecological veld types (where no future construction will occur). 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Plan for informal traders on the construction site to avoid potential problems on site. Signs prohibiting other hawkers from operating illegally on / adjacent to the site must be erected. ❖ Informal traders must be educated about the safety and legal aspects associated with trading next to the new road. ❖ A permanent and suitably qualified Occupational Health and Safety Officer must be appointed to manage the relevant health and safety aspects during the proposed road development. ❖ Construction workers and staff must be supplied with sufficient protective clothing and other gear (e.g. ear plugs) and must furthermore be trained how to use this gear properly by the Occupational Health and Safety Officer. ❖ Also see Recommendations under Geology and Soils. 		
<p>Aspect:</p> <p>Cutting and blasting</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Stability of specific cut and fill sites ❖ Public Safety ❖ Occupational Health and Safety ❖ Rubble removal 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction ❖ Construction <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Environmentally responsible conduct 	<ul style="list-style-type: none"> ❖ Specific sites where cut and fill activities is needed must be inspected by qualified engineers and signed off as stable and safe before construction activities can commence here. ❖ Topsoil (top 300mm layer minimum) must be removed, prior to any earthmoving activities and stockpiled separately from subsoil material. ❖ Where these procedures are used during the construction process, rubble associated with the cut operations (natural and not building rubble) must be used in the fill areas where no structural stability is needed. E.g. in front of the structures. Rubble may not be left anywhere on the construction site or be pushed down valleys or drainage ways. Materials and rubble left over must 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
❖ Waste Soils	<p>during cutting and/or blasting operations.</p> <ul style="list-style-type: none"> ❖ Occupational health and safety. 	<p>otherwise be reshaped and re-vegetated to resemble the surrounding landscape.</p> <ul style="list-style-type: none"> ❖ Material (only natural) from cutting should be used for the shaping of earth berms or for landscaping. ❖ Near vertical slopes (1:1 or 1:2) must be stabilized using hard structures following specifications, preferably with a natural look and facilities for plants to grow in. Areas with a 1:3 – 1:6 slopes must be logged or covered with a biodegradable membrane material (e.g. Kaytech Soil Saver). Secured logs must be placed in continuous lines following the contours and spaced appropriately depending on the steepness (aspect) of the slope. These slopes must be seeded with an indigenous grass mix to reduce soil erosion. A maintenance programme must be developed to ensure sufficient coverage of the grassed areas and to detect and rehabilitate eroded areas timeously. ❖ Where the excavation work involves the use of explosives, a method statement must be developed in accordance with the applicable explosives legislation; The Explosives Act 2003 (Act 15 of 2003) by an appointed person who is competent in the use of explosives for excavation work and the contractor shall ensure that the procedures therein are followed. ❖ Where there is a reasonable possibility of damage to power and telephone lines or any other property, the contractor shall suitably adapt his method of blasting and the size of charges and shall use adequate protective measures, such as cover blasting, to limit the risk of damage as far as possible. Specific requirements relating to certain services may be included in the Project Specifications. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Vibrations caused by blasting operations must be recorded by one or more blasting seismographs of a type as approved by the Engineer and in positions as described by the specialist blasting consultant. ❖ A photographic record (before and after) shall be kept by the blasting consultant of all properties that may be affected by the blasting operations. ❖ The Engineer shall be given 24 hours' notice by the Contractor before each blasting operation is carried out. 		
<p>Aspect:</p> <p>Climate</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ High rainfall in 24 hours could cause potential storm water related impacts e.g. scouring and erosion. ❖ Community safety. ❖ Potential water saturated soil conditions. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction and ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Storm water management. ❖ Community safety. ❖ Responsible personal conduct of construction staff. 	<ul style="list-style-type: none"> ❖ Implement a construction/management plan to specify the most appropriate time (preferably May – early September) for any construction activities to commence and to phase the construction phase so as to clear only those areas influenced by the next phase of construction. ❖ Special attention must be given to the overall storm water design so as to increase the volume of site-specific storm water absorption thereby decreasing the volumes and velocities of storm water at the discharge ends of the storm water system. ❖ Construction and occupational phase storm water management plans must ensure community safety. The management plan must ensure conditions of slow flow and no ponding. Concentrated discharge must be avoided as far as possible and discharged safely and the end of a local storm water channel. ❖ The local community and children must be educated about the dangers of storm water and living and playing in flood prone areas. The ward councillors and teachers in the community should be educated to act as peer educators. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<ul style="list-style-type: none"> ❖ The incidence of frost brought about by the proximity to a river system. ❖ Incidence of Fog. ❖ Electrical storms. ❖ Veld fires. ❖ Precautionary measures. 	<ul style="list-style-type: none"> ❖ Responsible environmental management practice. 	<ul style="list-style-type: none"> ❖ The occurrence of fog along the water course must be investigated and the relevant road signage be placed along this section of road to warn road users. ❖ Workers and staff must be educated on the incidence of lightning and how to work safely under these conditions. This aspect must furthermore be overseen by the site health and safety representative. ❖ Special attention must also be given to the design of the storm water structures at the discharge ends of the storm water system so as not to cause erosion damage here. See Appendix 4. ❖ Ensure that the founding structures of all the structures are constructed during a time of stable sub soil conditions and as per engineer's detail. ❖ Strict safety management rules must accompany the manifest of the road development in terms of fire safety. No fires may be allowed outside of designated fireplaces and braai areas. All activities and facilities which has fire related activities must be provided with the appropriate fire distinguishing equipment which must be monitored and serviced by a qualified service operator on a regular basis, according to NHBRC specification. 		
<p>Aspect:</p> <p>Geology and Soils</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Loss of topsoil – (essential 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction and ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p>	<ul style="list-style-type: none"> ❖ Topsoil (top 300mm layer minimum) must be removed prior to any earthmoving activities and stockpiled separately from subsoil material and only at the sites of the construction camps and the footprints of the specific structures to be built. The stockpiled topsoil mounds should not exceed 1,5m in height. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
vegetative substrate). ❖ Scouring and erosion ❖ Compressibility and collapse potential of transported and residual soils between founding depth and bedrock ❖ Site drainage – to reduce risk of subsurface material saturation and consequent differential movement ❖ Perched water conditions on shallow soils ❖ Contaminations	<u>Performance Indicators:</u> ❖ Topsoil conservation. ❖ Storm water management. ❖ Management of accidental contamination and spills. ❖ Responsible environmental management practice.	❖ Topsoil stripping should occur in a phased manner and only where construction will follow rapidly to avoid long periods of exposure and only during periods of low precipitation to avoid erosion and subsequent siltation of nearby water bodies. ❖ Areas where construction has to take place must be clearly demarcated to ensure that only these areas are stripped. ❖ Stockpiled topsoil must not be compacted by any vehicle and should be protected against erosion. (E.g. construct a bunded area of sand around the topsoil stockpiles to ensure the containment of the topsoil). ❖ Stockpiled topsoil must not be contaminated with oil, diesel, petrol, construction material or rubble or any other foreign matter, which may inhibit its potential to harbour faunal and floral communities after rehabilitation. ❖ Stockpiled topsoil must not be used as fill material and should be replaced wherever rehabilitation is needed, after construction. ❖ Compressibility and collapse potential of the soils and subsurface material of areas where the road infrastructure are to be constructed should be investigated by a qualified engineer and construction should then commence according to the specialist’s prescriptions. ❖ It is recommended that an engineering geologist or geotechnical engineer inspect all foundation trenches prior to construction in order to identify and evaluate any surface or subsurface geological characteristics in variance with that found during the original geotechnical investigations. Any trench or cutting must also be declared safe to work in by the relevant Engineer and OHS Officer.		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Special attention should be given to site drainage details. Qualified engineers should inspect paving sections and adequate drainage structures should be designed and constructed to avoid subsurface water saturation and possible structural failure. ❖ Erosion control measures should be implemented to prevent siltation and loss of existing and remaining topsoil on site. ❖ In the event of spills from vehicles, the area should be cleaned immediately using a bioremediation product, such as Petro-Clean TM or similar. The absorbent and soil must be placed in a bin and removed from the site by a certified company and disposed of as a hazardous waste at a licensed commercial facility. No Hydrocarbons may escape into the environment. A spill recovery kit must be on site, along with trained personnel. See Appendix 3. 		
<p>Aspect:</p> <p>Hydrology</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Unstable soil conditions as a result of water saturation. ❖ Site drainage ❖ Scouring and erosion 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction, ❖ Construction ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p> <p>Performance Indicators:</p>	<ul style="list-style-type: none"> ❖ No long term vegetation clearing of may occur. A construction management plan should be implemented to specify appropriate time for the bulk of the construction activities to commence (preferably May to early September). Site clearance may not in any area be done beyond 15m on both sides of the 62m road reserve. ❖ The whole of the construction site may also not be cleared of vegetation at once. Site clearance may only proceed for the next phase of construction as per the construction management plan. ❖ Construction work carried out in the drainage line must be performed strictly between the months of April to August as far as this is reasonably possible. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<ul style="list-style-type: none"> ❖ Siltation of downstream water bodies ❖ Surface water pollution as a result of spillages ❖ Possible groundwater pollution. ❖ Ponding 	<ul style="list-style-type: none"> ❖ Storm water management. ❖ Management of accidental contamination and spills. ❖ Responsible environmental management practice. 	<p>Where this is not possible the PC must prepare a report stating the reasons and additional measures that will be taken to curb storm water related impacts as well as the degradation of water quality.</p> <ul style="list-style-type: none"> ❖ Detailed method statements must be submitted to the ECO by the PC on the methodologies to be followed during construction in the water course. ❖ All such materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages. Sufficient bunding of fuel storage tanks and chemical storage areas must be provided. ❖ Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum. ❖ Spill trays must be provided if refuelling of construction vehicles are done on site. See Appendix 3. ❖ On site waste disposal and pit latrines must strictly be prohibited during the construction phase and disposal must be carried out with standard sealed chemical toilets and waste disposal containers. The Principle Contractor must make arrangements with the Midvaal Local Municipality's waste section for proper disposal at licenced waste disposal sites of all construction waste. ❖ No uncontrolled discharges may be permitted from the construction camp. ❖ All spillages from any potential contaminants such as lubricants and hydro-carbon based fuels must be safely and immediately removed and disposed of at an appropriate site. ❖ Surface water draining of contaminated areas containing oil and petrol should be channelled towards a sump which will separate these chemicals and oils. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Storm water shall not be allowed to flow through the batching area. Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the RE. ❖ Spoil sites may not be used for the disposal of hazardous or toxic waste. ❖ A long term maintenance plan must be developed by the GPDRT for routine maintenance of the road verges and other related road infrastructure to decrease the volume of road related waste spilling over into the surrounding environment. ❖ Special attention must be given to site drainage details and adequate drainage structures must be designed and constructed to avoid subsurface water saturation and possible structural failure of road infrastructure. ❖ The use of all materials, fuels and chemicals which could potentially leach into underground water must be controlled and managed according to the relevant legislation. ❖ A ground and surface water monitoring program must be designed and implemented in order to verify the impact on local resources. ❖ When excavations are being done, potential collapsible soil must be pointed out by the engineering and the necessary precautions taken. ❖ Storm water drainage structures must be designed by qualified engineers and in a way that disposes of the site storm water in a safe matter, which is not harmful to the surrounding environment in any way. ❖ Sufficient numbers of temporary chemical toilets (1 per 15 people) must be installed by the PC for the time of the construction activity and before the permanent sewer system is installed and in an approved working order. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Storm water runoff must be channelled from open areas with retention structures (Gabion and Reno Mattresses) to any outlets if applicable. This must be done without compromising the conditions of the sub soil stability. Storm water outlets discharging storm water into the surrounding areas must contain energy dissipating structures that will curb erosion at this outlet into the river effectively. ❖ Straw bales should be placed and adequately secured on all downhill locations where erosion may occur to prevent washouts and to retain siltation and topsoil from the site. A supply of straw bales must be kept on site for this purpose. ❖ Where ponding occurs these areas must be pumped out or drained to ensure that no ponding occurs that may cause dangerous Operational health and safety conditions especially to the local community's children. These conditions must also be communicated to the community via the CLO and it must be stressed that children especially must stay away from the construction site. See Appendix 4. 		
<p>Aspect:</p> <p>Vegetation and Animal Life</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Removal of vegetation and 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction ❖ construction ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p>	<ul style="list-style-type: none"> ❖ All of the significant indigenous trees and other indigenous vegetation which fall within the areas to be developed if any must be retained or transplanted under the supervision of a specialist. Special attention must be given to ensure that the vegetation in these areas are not disturbed for any purposes i.e. firewood. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p>animal habitat as a result of construction activity.</p> <ul style="list-style-type: none"> ❖ Red Data listed species. ❖ Upper tributary of the Klip river. ❖ Site specific management plans. ❖ Removal of Alien invasive plant species. 	<p>Performance Indicator:</p> <ul style="list-style-type: none"> ❖ Protection of indigenous vegetation. ❖ Relocation of sensitive species on site. ❖ Management of alien invasive species. ❖ Environmental Awareness Training. 	<ul style="list-style-type: none"> ❖ Any significant indigenous plant specimens (e.g. trees of 1,5m high with a trunk thicker than 150mm and vegetation clusters) that will come into harm's way must be transplanted, (if feasible from a transplantable point of view and to a similar suitable natural area of the site or in a temporary nursery (this can happen at a safe site near the construction camp) and be replanted in the natural areas of the site or be used in the rehabilitation or landscaping of the site during the post construction period. ❖ (<i>Hypoxis hemerocallidea</i>) Star Lily and Bushman Poison Bulb (<i>Boophane disticha</i>) are Red Data Listed (RDL) species identified by the biodiversity specialist to occur along the construction area. ❖ In terms of faunal species, the Specialist reported that habitat for the African Grass Owl (<i>Tyto capensis</i>) Melodious Lark (<i>Mirafra cheniana</i>) and Giant Bullfrog (<i>Pyxicephalus adspersus</i>), also exist on site. In addition, the site also harbours habitat for <i>Opisthophthalmus pugnax</i> (Burrowing scorpion) and <i>Theraphosidae</i> family (Baboon Spiders) as well as <i>Chrysoritis aureus</i> (Heidelberg Copper butterfly) and the <i>Lepidochrysops praeterita</i> (or Highveld Blue Butterfly). ❖ Prior to ground breaking a biodiversity Specialist must be appointed to perform a thorough walkthrough along the alignment and especially in the sensitive areas and identified habitat areas and clear the area of any sensitive faunal or floral species. Any species found must be relocated to suitable areas along a relocation plan. The Biodiversity Rescue and Relocation Unit of the GDARD must be contacted in this regard. ❖ Notice boards of the occurrence of owls and frogs must be erected along the route during the operational phase. The Biodiversity Specialist also 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<p>recommends a maximum travelling speed of 80km/h along this section of road. Additional mitigation measures to curb owl – vehicle conflicts would be the fitment of rumble strips on the tar road placed from 100m either side of the outer edge of the wetland boundary, placed approximately every 50 m throughout the impacted areas.</p> <ul style="list-style-type: none"> ❖ The presence of these species must be communicated during the environmental awareness training as well as the appropriate procedure to follow when these species are encountered by construction staff. Posters disclosing identifiable pictures of these species must be displayed at a suitable location at the construction camp during the construction period. ❖ Only indigenous vegetation must be planted during the operational phase to increase the biodiversity of the site and effort should be given to retain the natural character of the site as far as possible. ❖ Any small game or other bird, reptile or amphibian specie that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed in a suitable container. The relevant GDARD or closest SPCA must then be contacted to come and remove the animal. This Conservation Department or SPCA will then bear the responsibility to relocate the specie to a suitable habitat. ❖ Proliferation of alien and invasive species is expected within disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the proposed K77 route. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ Removal of the alien and weed species encountered along the alignment must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational and rehabilitation/ maintenance phases. ❖ Species specific and area specific eradication recommendations: <ol style="list-style-type: none"> 1. Special attention must be given to the spread and proliferation of especially <i>Campuloclinium macrocephalum</i> (Pompom weed). Posters can be put up in the same manner as above. The appropriate agency should implement an on-going monitoring and eradication program for all invasive and weedy plant species growing within the road servitudes. 2. Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used. 3. No vehicles should be allowed to drive through designated sensitive areas unnecessarily during the eradication of alien and weed species. 		
<p>Aspect:</p> <p>Sensitive Sites</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Construction in wetland areas. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction ❖ Construction ❖ Operational <p>Responsible Parties:</p>	<ul style="list-style-type: none"> ❖ Sensitive areas as indicated in the sensitivity map (Figure 3&4) must be set out on a plan which must be permanently displayed at the site offices of the operational phase site manager and the construction contractor's offices. ❖ A reasonable buffer (max 15m) should be created around this area and must be fenced off to ensure no access into these areas during construction and 		

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			YES	NO
<ul style="list-style-type: none"> ❖ Wetlands as depicted in Figures 3 & 4. ❖ The upper tributary of the Klip river. ❖ The rocky ridge area. ❖ Sensitive species 	<p>PC, RE, PM & ECO</p> <p><u>Performance Indicators:</u></p> <ul style="list-style-type: none"> ❖ Sensitive construction methodologies in wetland areas. ❖ Avoidance of identified sensitive areas on site. ❖ COLTO Standard Specifications for Road and Bridge Works. ❖ SANRAL Drainage Manual Specifications. ❖ Relocation of sensitive species on site. ❖ Responsible personal conduct by construction staff. ❖ Management of invasive alien vegetation. ❖ Storm water management. 	<p>routine operations apart from the road construction itself. These areas are to be regularly checked by the ECO.</p> <ul style="list-style-type: none"> ❖ The Wetland Specialist identified area where the road alignment will need to cross wetland areas. In terms of these crossings the Specialist made the following recommendations that would need to be followed: <ol style="list-style-type: none"> 1. The design of such culverts / bridges should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained. 2. The design of such culverts and/or bridges should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface; 3. The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 300mm of the soil surface at all times; 4. Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer season. ❖ In terms of the above it is further recommended that the relevant standard and specifications in terms of the COLTO Standard Specifications for Road and Bridge Works for State Authorities as well as the SANRAL Drainage Manual be implemented in the design of the road crossings in the wetland areas. ❖ In the event that any sensitive or red data species be encountered on site (see above section), the ECO must be contacted (during the construction phase) and relevant the GDARD official or closest SPCA must be notified. The ECO or GDARD or SPCA must then be contacted to remove and relocate the specie 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<p>found. The specie must be relocated by the specialist to where suitable habitat for the specie exists. The relevant fines must be incurred when these areas or mitigation measures are breached. See Appendix 1.</p> <ul style="list-style-type: none"> ❖ No trapping or other method of catching of any animal or bird species may be performed by any party on the construction or operations site or by any person during the operational phase of the development. If these species become trapped in the foundation trenches or other construction or operational related circumstance, it must be reported to the ECO or Operational Phase Site Manager who must in turn report it to the GDARD or closest SPCA. ❖ No dumping of any form is permitted in the drainage area or its surrounds, any non-compliance must be reported immediately. It is the responsibility of the relevant contractor or site manager to inform and supervise their employees. ❖ No damage and/ or removal/trapping/snaring of indigenous plant or animal material for cooking and other purposes will be allowed. (See Appendix 1) ❖ A property alien eradication and rehabilitation plan must be drafted with the aid of a specialist. ❖ Any storm water outlets discharging storm water into the drainage ways must contain energy dissipating structures that will curb erosion at this outlet effectively. ❖ The storm water outlet should be constructed according to an approved design for grass species can re-vegetate the proposed gabion blocks speedily. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p><u>Aspect</u></p> <p>Waste Management</p> <p><u>Impacts:</u></p> <ul style="list-style-type: none"> ❖ Waste Management Plan ❖ Recycling ❖ Storage ❖ Cleaning ❖ Disposal ❖ Waste Removal ❖ Record Keeping 	<p><u>Project Phase:</u></p> <ul style="list-style-type: none"> ❖ Construction ❖ Operational <p><u>Responsible Parties:</u></p> <p>PC, RE, PM, & ECO</p> <p><u>Performance Indicators:</u></p> <ul style="list-style-type: none"> ❖ Construction and Operational Waste Management Plan. ❖ Closure and Rehabilitation of construction site and construction site camps on completion of construction phase. ❖ Waste re-use, recycling and disposal record keeping. 	<ul style="list-style-type: none"> ❖ Prepare a Waste Management Plan for the construction site and offices during the construction phase and ensure the provision of dustbins at regular distances (as per MLM specification) along the routes during the operational phase of the alignment. ❖ All construction related areas and roads should be cleared of any construction waste and should be swept clean as to avoid the waste from entering the storm water systems. ❖ All solid waste must be removed and transported to an approved registered landfilled site on a weekly basis. ❖ On completion of works, the contractor shall clear away and remove from the site all construction paint, surplus material, foundations, plumbing and other fixtures of every kind. Areas thus cleared shall be graded and scarified to restore the ground as near as possible to its original profile. ❖ Keep monthly records of waste reuse, recycling and disposal for future reference. Provide information to ECO. ❖ Waste must be sorted into the various categories (glass, paper, metals and plastics) and the relevant local recycling contractors should be contacted to remove this waste on a weekly basis. ❖ The contractors must supply the principle construction Contractor with a monthly report indicating the types and volumes of waste removed from site. 		

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			YES	NO
<p>Aspect</p> <p>Fuel Management</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Storage ❖ Re-Fuelling ❖ Drip trays and Spill Kits ❖ Notification ❖ Rehabilitation 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Construction ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Management of fuel related areas. ❖ Spill management. 	<ul style="list-style-type: none"> ❖ Re-fuelling must take place in the designated area with sufficient surface sealing such as a concrete liner to prevent spillage and soil contamination. See Appendix 1. ❖ Drip trays (min 10cm deep) must be placed under all vehicles awaiting maintenance, suspected of having a mechanical problem that can lead to a significant leakage, that is decommissioned and awaiting removal or that will remain in the parking area for more than one week. ❖ Spill kits must be available in all vehicles that transport hydrocarbons for dispensing to other vehicles on the site. The dispensing devices (pump heads) must be compatible with the vehicles to which they are dispensing. In addition, the dispensing devices must be fitted with the necessary valves/ apparatus that will ensure that the nozzles do not drip fuel after pumping has stopped. See Appendix 3. ❖ The whole of the site where vehicles are operated must undergo routine weekly inspections for any spillages, and these areas must be rehabilitated accordingly. ❖ Applicable provincial and local government departments, local municipalities and adjacent landowners must be notified within 24 hours of a spillage or leak. ❖ In the event of spills from vehicles, the area should be cleaned immediately using a bioremediation product, such as Petro-Clean TM. The absorbent and soil must be placed in a bin and removed from the site by a certified company and disposed of as a hazardous waste at a licensed commercial facility. No 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		Hydrocarbons may escape into the environment. A spill recovery kit must be on site, along with trained personnel. See Appendix 3.		
<p>Aspect:</p> <p>Vehicle Maintenance</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Design ❖ Maintenance area ❖ Equipment ❖ Machinery 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Construction ❖ Operational <p>Responsible Parties: PC, RE, PM, & ECO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Sustainable vehicle management for optimal use. 	<ul style="list-style-type: none"> ❖ Vehicle maintenance may only be performed if in a sealed off area with an oil impenetrable floor. In the case that the PC cannot supply such a facility on site, all vehicles and machinery must be serviced and maintained off site. Vehicle maintenance yards and secured storage areas will be established as far as is practicable, further than 100m horizontally from and water course and outside the 1:100 year flood lines and buffer areas as determined by the storm water management plan. The maintenance yard should be indicated on the layout plan of the site. ❖ The maintenance of vehicles and equipment used for any purpose during any phase must take place only in the maintenance yard. ❖ Any breakdown other than that in the maintenance area of the site requires the presence of a spill treatment team and equipment. This team must prevent and mitigate any spills that occur in this situation. ❖ Equipment used in the construction and operational phases must be adequately maintained in order not to spill oil, diesel, fuel, or hydraulic fluid during operations. ❖ Machinery or equipment used on the site must not constitute a pollution hazard in respect of the above substances. The main contractor, site manager or ECO shall order such equipment to be repaired or withdrawn from use if he or she considers the equipment or machinery to be polluting and irreparable. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p>Aspect:</p> <p>General Rehabilitation Measures</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Relevant phases of the activity ❖ Contamination ❖ Rehabilitation measures 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Construction ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Removal and rehabilitation of construction camps. ❖ Rehabilitation of contaminated areas. ❖ Establishment of sufficient vegetation layer on all barren soil areas. 	<ul style="list-style-type: none"> ❖ Rehabilitation should be implemented immediately after construction activities and should aim to prevent erosion and aid the return of natural, endemic and indigenous vegetation cover. ❖ After any construction activities are complete, the services camp must be taken down and full rehabilitation of the temporary construction site be done. Compacted soils must be loosened to a depth of 300mm re-compacted lightly (via turf roller) and reseeded with seed of locally occurring indigenous ground covering species. ❖ All soils contaminated with cement dust, small oil and fuel leakages and other contaminants must be removed to an appropriate depth as per the specific contaminant and as prescribed by the ECO and be taken to an approved landfill site. These soils must be replaced with healthy soils (able of harbouring plant and animal life) and be stabilized by contouring the soils according to the local site landform. ❖ Site roads used during construction must also be reshaped according to the prevailing landform, scarified, fertilized and re-seeded and re-vegetated with indigenous grasses and vegetation characteristic of the local ecological veld types. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<ul style="list-style-type: none"> ❖ After construction, the PC/PM/operational phase Site Manager must ensure that the site is clean and void of any soils, construction rubble or any other construction related materials. ❖ All barren sections of the finished construction area around the development must be wetted and stabilized to form a good medium for planting. These areas must then be reseeded with indigenous species resembling the existing specie mix. The area must be reseeded at a rate of 5kg/ha with an indigenous seed mix appropriate for the local area. ❖ The whole of the construction area must be cleared of any loose laying mounds of soil or other construction materials and litter. The ECO and the PC/PM must organize a final site inspection to see if this measure is in place before the site is signed off as finished. ❖ Cognisance must be taken of all of the mitigation and rehabilitation measures in the site specific EMPr and must be read in conjunction with this rehabilitation plan. 		
<i>SOCIO-ECONOMIC ENVIRONMENT</i>				
<u>Aspect:</u> <u>Access:</u> <u>Impacts:</u>	<u>Project Phase:</u> <ul style="list-style-type: none"> ❖ Construction ❖ Operation <u>Responsible Parties:</u>	<ul style="list-style-type: none"> ❖ Surrounding landowners, commercial activities and other relevant stakeholders (Service providers) must be notified well in advance (6 weeks) in terms of any services interruptions which might affect them. 		

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			YES	NO
<ul style="list-style-type: none"> ❖ Temporary lack of access to residential properties. ❖ Temporary lack of access to commercial activities. 	<p>PC, RE, PM, ECO, & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Stakeholder communication. ❖ Sufficient access to residential property. ❖ Sufficient access to commercial activities. 	<ul style="list-style-type: none"> ❖ The relevant land owners and business owners along the K77 must retain legal access to their properties. Where new access needs to be provided for a landowner or business owner the Applicant must either compensate the landowner for this infrastructure, or appoint and pay the PC to perform the required construction on their behalf. ❖ Where new access needs to be provided, the Applicant must discuss the most feasible location of this access with the landowner in line with accepted traffic safety standards and the property specific access authorizations. ❖ New access roads to properties should be maintained by the relevant authority and should represent high quality gravel roads. 		
<p>Aspect:</p> <p>Disruption of Services:</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Temporary disruptions in services. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Construction <p>Responsible Parties:</p> <p>PC, RE, PM, ECO, & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Sufficient notifications to surrounding landowners and relevant stakeholders in terms of possible 	<ul style="list-style-type: none"> ❖ Surrounding landowners and other relevant stakeholders (Service providers) must be notified well in advance (6 weeks) in terms of any services interruptions which might affect them. ❖ Business ventures specifically and also alongside road K77 must likewise be notified well in advance of the estimated start of the construction activities. ❖ Services on properties must be relocated before construction commences and is finalized. The Applicant should compile an Asset and Infrastructure Baseline report (including photographic evidence) of all services and infrastructure in the servitude. This could be used in the negotiation process and by the valuers to determine the compensation amounts. ❖ A complaints register must be maintained on site. Complaints must be discussed at each of the construction Technical Meetings and specific responsibility must be assigned to manage each complained. The responsible parties must report back at the following Technical Meeting as to the progress 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
	<p>disruption of services.</p> <ul style="list-style-type: none"> ❖ Maintenance of Complaints Register. ❖ Wayleave authorizations. 	<p>in terms of the management of each compliant up until it is resolved. The relevant penalties must be levied in terms of non-compliance to this management measure.</p> <ul style="list-style-type: none"> ❖ Owners along the route must be provided with the contact detail of the relevant agent of the PC where access related issues can be reported and resolved speedily ❖ The PC and the PM must ensure that they are in contact with the relevant services providers where services will need to be moved and that the required wayleave authorizations are in place before the services are moved. 		
<p>Aspect:</p> <p>Visual Environment</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Construction related activities. ❖ Final visual outlook of the development. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction ❖ Construction ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Maintenance of construction camps and site during construction phase. ❖ Screening of negative visual aspects of the 	<ul style="list-style-type: none"> ❖ Negative impacts related to the construction phase of the development will only last for the duration of the construction phase of the development and will thus not be permanent. The PC and subcontractors must see to the overall tidiness of the construction area and that construction vehicles, materials and personnel stay within the construction camps after hours, over weekends and on public holidays. For the relevant proposed fines see Appendix 1. ❖ Indigenous vegetation must be used to screen negative visual aspects of structures. Screening must however not be obtrusive to the natural character of the site. ❖ Screening vegetation and landscaping must be planted to ensure that it is applied in a way that compliments the vegetation of the region. ❖ Existing vegetation should be retained as far as possible at the construction site and the temporary construction camp structures to act as visual screens/absorbers and dust collectors. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
	road construction with vegetation.	<ul style="list-style-type: none"> ❖ Construction camp to be positioned so as to reduce its visual intrusion. The construction camp and laydown areas must furthermore be screened with netting to reduce its visual impact during the construction phase ❖ No painting or marking of natural features shall be allowed. Marking for surveying and other purposes shall only be with pegs and beacons. ❖ Additional locally indigenous landscaping should also be implemented in key areas to screen negative visual aspects. ❖ Topographic shaping should be implemented - final profile of rehabilitated areas is formed to emulate natural contours of the area. Road cuttings and fill areas to be rehabilitated to emulate occurrence of natural rocky outcrops in the area both in color and shape. ❖ Rehabilitate/restore exposed areas as soon as possible after construction activities are complete. ❖ Dust suppression techniques should be in place at all times during the construction and operational phases. ❖ No construction rubble, construction material, refuse, litter or any other material not found naturally in the surroundings should be allowed at any time to be lying around on the construction site. ❖ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the road development. ❖ Routine maintenance should be part of the operational phase management plan of the proposed road in order for it to be kept neat and in good order. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<p>Aspect:</p> <p>Noise:</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Possible noise pollution occurring as a result of construction activities. ❖ Use of explosives ❖ Occupational Health and Safety 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction and ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Notification of surrounding landowners pre construction commencement. ❖ Maintenance of construction equipment. ❖ Proper personal conduct by all construction staff. ❖ Compliance with occupational health and safety regulations. 	<ul style="list-style-type: none"> ❖ The surrounding land owners and all of the registered I&AP's must be notified of the commencement of construction activities well in advance of the actual start of the activities (At least 6 weeks). ❖ Structures containing activities that may contribute to undesirable noise levels in the area must be placed and orientated to face away from areas sensitive to noise pollution as far as possible. ❖ Noisy activities related to the construction phase of the development (e.g. vehicles, compressors, workers) must be kept to the necessary minimum. Construction activities must also be restricted to between 08:00 in the mornings and 05:00 in the evening and not on any weekend or public holidays. This must be monitored by the ECO and fines must be levied for non-compliance. (See Appendix 1). ❖ Noise barriers such as solid walls near must be erected near sensitive receptors such as schools, hospitals, old age homes and residences. ❖ All employees, construction workers and maintenance personnel must be instructed to be sensitive towards the surrounding land owners. This action can be performed via an Environmental Awareness Workshop at the first appropriate time when the bulk of the contractors and sub-contractors have been appointed. (See Appendix 1) ❖ Activities such as loud music and other ill-mannered behaviour must not be allowed. This behaviour will be regarded as unacceptable and it will be the responsibility of the various contractors and other employers to ensure that workers under their supervision conduct themselves appropriately. These actions must be reported to the ECO who will see to the issuing of the relevant fines. (See Appendix 1). Further it is the responsibility of the Body 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
		<p>Corporate to implement and inform residents of the noise policy guidelines for the development.</p> <ul style="list-style-type: none"> ❖ Construction vehicles and equipment must be regularly serviced to avoid the noise that these machines may make if in disrepair. ❖ Construction workers and staff must be supplied with sufficient protective clothing and other gear (e.g. ear plugs) and must furthermore be trained how to use this gear properly by the Occupational Health and Safety Officer. ❖ The contractor shall give the Engineer 24 hours' notice before any blasting operation is carried out. ❖ The applicant via the contractor must inform surrounding landowners, the local community and any other registered I&AP at least 24 hours prior to blasting operations in order for them to make the necessary arrangement. 		
<p>Aspect:</p> <p>Air Quality:</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Increased dust pollution could occur during construction activities. ❖ Generation of dust on site dirt roads. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction and ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, ECO & CLO</p> <p>Performance Indicators:</p>	<ul style="list-style-type: none"> ❖ Dust suppression must be performed according to the seasonal changes and according to the prevailing site-specific circumstances via a dust suppression truck on the site roads, other construction areas and the parking areas. ❖ Vegetation along roads and landscaping of the larger development environment will help improve air quality over the long term and must therefore be planted wherever disturbed as far as possible. ❖ Site roads and parking areas must furthermore be maintained to remain in a good condition (e.g. roads must be kept from widening so as to keep the exposed area (area influenced by winds) as small as possible. 		

ASPECT & IMPACTS	PROJECT PHASE RESPONSIBLE PARTY PERFORMANCE INDICATOR	MITIGATION AND REHABILITATION MEASURES	COMPLIANT	
			YES	NO
<ul style="list-style-type: none"> ❖ Occupational Health and Safety 	<ul style="list-style-type: none"> ❖ Sufficient dust suppression regimes during construction and operation. ❖ Speed control on gravel roads during construction and operation. 	<ul style="list-style-type: none"> ❖ Construction vehicles must maintain low speeds on all site roads (10 – 30 km\h) to reduce dust dispersal during construction. ❖ The onsite health and safety manager must ensure that workers are supplied with the correct safety wear and equipment (e.g. dust masks) and that they are informed as to their appropriate use. 		
<p>Aspect:</p> <p>Archaeological Findings:</p> <p>Impacts:</p> <ul style="list-style-type: none"> ❖ Possible archaeological findings. 	<p>Project Phase:</p> <ul style="list-style-type: none"> ❖ Pre-construction; ❖ Construction and ❖ Operational <p>Responsible Parties:</p> <p>PC, RE, PM, & ECO</p> <p>Performance Indicators:</p> <ul style="list-style-type: none"> ❖ Environmental Awareness 	<ul style="list-style-type: none"> ❖ Employees, contractors and construction workers should be informed to report any unusual finds during the construction and operational phases, to the ECO in order to implement the correct procedures according to the South African Heritage Resources Act to conserve these finds appropriately. ❖ This impact must be brought forward during the environmental awareness workshops. 		

Note: The following sections of previously compiled documents and addendums must be reviewed in conjunction with this EMPr;

- ❖ All recommendations and mitigation measures discussed in the Draft EIA for the proposed detailed design and construction of Road K77 (SPOOR Environmental Services (PTY) Ltd. November 2014), Ref. GAUT: 002/14-15/0188,
- ❖ All recommendations and mitigation measures discussed in the Civil Engineering Detailed Design Report,
- ❖ All recommendations and mitigation measures discussed in the specialist Geo-Technical Investigations,
- ❖ All recommendations and mitigation measures discussed in the specialist Faunal, Floral and Wetland Delineation Assessment,
- ❖ All recommendations and mitigation measures discussed in the specialist Social Impact Assessment,
- ❖ All recommendations and mitigation measures discussed in the specialist Heritage Impact Assessment.

10. CONCLUSION

Impacts caused as a result of the construction and operational phases of the proposed road K77 development are in general not deemed to be significant. This statement is primarily made as a result of the existing anthropogenic impacts as well as the low levels of existing environmental sensitivity found during the Specialist Assessments. From a biodiversity perspective construction activity will enter sensitive wetland and riverine areas and will also negatively impact on the more general fauna (small antelope species, Jackal, Owls, etc.) of this rural setting. The road alignment has also been re-routed to exclude the rocky area to the direct west of the existing proposed route where this route connects to the R550 (K154) as a result of these sensitivities. This area boasts habitat which is still intact and harbours sensitive vegetation animal species and habitat for these species and is therefore sensitive and worthy of protection. Ridge areas are the lungs and biodiversity hot spots of urban areas and must be conserved at all cost.

The sections of wetland and watercourse and its verges are also sensitive as a result of the habitat these areas provide for sensitive species such as the Grass Owl and Giant Bull Frog but also because of the important services these ecological amenities provide to its local communities. Wetlands assist in storm water management and also contributes in improving water quality. Most importantly wetlands functions as natural water reservoirs which is a critical environmental service in South Africa today. Recommendations have therefore been developed by the biodiversity Specialist and the EAP on how anticipated impacts on these environmental aspects can be mitigated to reduce impacts to levels that will allow for the future existence of the wetland and watercourse areas to be able to provide these important ecological and social services.

Socio-economically the proposed construction of this section the K77 is not deemed to impose noteworthy impacts. Possible local ease of access (positive), disruption in services, security and general hindrances has been identified as some of these impacts. Current and future development in the area has made it necessary that the road be constructed though and it is believed that the construction of the road will enhance the socio-economy of the local area in the medium to longer term. The principle benefit of the proposed road and associated infrastructure would be to the local communities although it will also provide services and amenities to visitors travelling through the area. Although not on a grand scale, the proposed development will affect a range of new employment opportunities, which could provide noteworthy skills development opportunities in the short term, as well as sustained opportunities (maintenance) over the longer term.

It is believed that the identified impacts can be significantly minimised provided that the mitigation and rehabilitation measures included in section 9 of this EMPr are strictly adhered to. It is therefore very important that the relevant Managers (the Applicant, GDARD, the project Engineers and construction and operational phase Managers) of each development stage of this road take cognisance thereof and implement it accordingly.

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- ❖ NEMAI, 2014. Proposed K154 Road Development, Midvaal Municipality, Gauteng: Final EIA Report. Ferndale: NEMAI.
- ❖ Viljoen, J. & Smit, G., 2016. Draft Detailed Design Report: Upgrading Provincial Road K77: From Elizabeth Road to K154. Addendum A. Johannesburg: Knight Piésold Consulting Engineers (PTY) Ltd.

APPENDIX 1

**Proposed Penalties and Fines Associated with Various Acts of
Non-compliance and Miss-conduct**

PROPOSED PENALTIES AND FINES FOR NON-COMPLIANCE OR MISCONDUCT

This EMPr forms part of the contract agreement between the Client and the Principal contractor and the Site Manager. As such, non-compliance with conditions of the EMPr will amount to a breach of contract. Penalties will be issued directly to the PC/Site Manager by the ECO in the event of non-compliance to the EMPr specifications. The issuing of a penalty will be preceded by a verbal warning by the ECO, as well as strict instruction in at least one monthly ECO report to rectify the situation. The ECO and PC/Site Manager will communicate with regards to realistic time-frames for possible rectification of the contravention, and possible consequences of continued non-compliance to the EMPr.

Penalties incurred do not preclude prosecution under any other law. Cost of rehabilitation and/or repair of environmental resources that were harmed by the actions of the PC/Site Manager if such actions were in contravention of the specifications of the EMPr will be borne by the PC/Site Manager himself. Penalties may be issued over and above such costs. The repair or rehabilitation of any environmental damage caused by non-compliance with the EMPr cannot be claimed in the Contract Bill, nor can any extension of time be claimed for such works. Penalty amounts shall be deducted from Certificate payments made to the Contractor.

The following categories of non-compliance are an indication of the severity of the contravention, and the fine or penalty amounts listed in table 1 may be adjusted depending on the seriousness of the infringement.

Category One – Acts of non-compliance that are unsightly, a nuisance or disruptive to adjacent landowners, existing communities or persons passing through the area.

Category Two – Acts of non-compliance that cause minor environmental impact or localised disturbance.

Category Three – Acts of non-compliance that affect significant environmental impact extending beyond point source.

Category Four – Acts of non-compliance that result in major environmental impact affecting large areas, site character, protected species or conservation areas.

All of the contraventions mentioned in table 1 as well as any other contravention to the EMPr specifications should be measured in terms of one of these 4 categories of non-compliance and penalties or fines should be adjusted accordingly.

TABLE 1: List of Proposed Fines and Penalties as Applicable to Various Acts of Non-Compliance or Misconduct:

DESCRIPTION OF NON-COMPLIANCE TO EMPr SPECIFICATION	SPOT FINES AND PENALTIES THAT COULD BE INCURRED
Any person, vehicle, plant or other activity related to the contractor's operations that spill over into a "no-go" or sensitive area	R 4 000
Any vehicle driving in excess of specified speed limits	R 1 000
Vehicles being driven, plant or construction materials being stored outside of demarcated areas within the construction site. Unauthorised persons on site.	R 2 000
Persistent, un-repaired oil/fuel leaks from machinery/vehicles. Spillages of oil/fuel at the re-fuelling site. Spillage of hazardous (e.g. Cement, Asphalt, Chemicals) materials on site. Burying of soils containing these spillages.	R 5 000
Litter on site or dumping/ burying of rubble or waste outside designated location/s. Inadequate provision of waste disposal facilities on site	R 2 000
Illegal Fires on site	R 5 000
Eating / cooking food outside of designated areas. Inadequate site ablution facilities or failure to make use of the site ablution facilities.	R 1 000
Excessive noise and / or dust as a result of site activities	R 2 000
Contractor's operations causing a public nuisance as a result of contravention of EMPr specifications.	R 2 000
Activities in contravention of EMPr that cause water waste or pollution	R 5 000
Poaching/ setting of snares or traps.	R 5 000
Damage to cultural Sites	Up to R 100 000
Erosion as a result of non-compliance – penalty shall be equivalent to the cost of rehabilitation plus 20%	

Severe oil spills - penalty shall be equivalent to the cost of clean-up operations plus 20%	
Damage to indigenous vegetation or sensitive environments - penalty shall be equivalent to the cost of rehabilitation plus 20%	
Penalties for removing or damaging trees that are to be retained	
Girth of Trunk 1m above ground level	Replacement value per tree
0 – 15 mm	R 100
16 – 30 mm	R 200
31 – 50 mm	R 500
51 – 75 mm	R 1 000
76 – 100 mm	R 2 500
101 – 150 mm	R 5 000
151 – 300 mm	R 10 000
Larger than 300 mm	R 15 000 – R 100 000

FOR ANY REPEAT OFFENDERS THE FINE WILL BE DOUBLED AND A THIRD OFFENCE COULD RESULT IN PERMANENT SUSPENSION.

The following acts and legislation, amongst others, apply and will be enforced and monitored by the ECO;

- ❖ Environmental Conservation Act, (Act 73 of 1989)
- ❖ National Environmental Management Act, (Act 107 of 1998)
- ❖ National Environmental Management: Biodiversity Act, (Act 10 of 2004)
- ❖ Water Act, 1998, (Act 36 of 1998)
- ❖ National Parks Act, (Act 57 of 1976)
- ❖ Lake Areas Development Act, (Act 139 of 1975)
- ❖ Mountain Catchment Areas Act, (Act 63 of 1970)
- ❖ Forest Act, (Act 122 of 1984)
- ❖ Conservation of Agricultural Resources Act, (Act 43 of 1983)
- ❖ All Provincial ordinances and regulations as applicable

APPENDIX 2

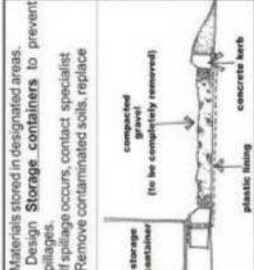
Typical Composition of a Construction Camp

Location of Site Camp

- Located practically and on already disturbed area.
- ECO should screen the site and approve.
- Camp minimum 100m horizontally from drainage courses.
- Camp must be rehabilitated after construction.
- Soils loosened, re-planted with appropriate vegetation.
- Remove contaminated soils. Contact specialist to replace with healthy soils and shape to resemble original land form.
- Final payments may be withheld until relevant mitigation and rehabilitation have been completed.
- Erosion may not occur in the construction camp.

Materials stored in designated areas:

- Design **Storage containers** to prevent spillages.
- If spillage occurs, contact specialist
- Remove contaminated soils, replace

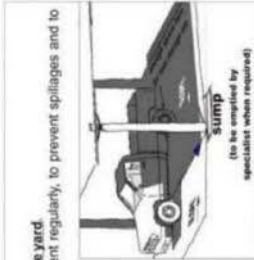


The Main Site Office must contain:


- The EMPr notices that all parties are to adhere to it.
- A space to conduct environmental awareness **workshops** and relay pertinent information.
- **Safety** information and emergency response plan.
- **Emergency Contact numbers**
- **Fire Extinguisher.**
- Site must be rehabilitated.
- Use Existing structures on site, build a simple structure or the office can be housed in a rented shed or container.

The camp must contain a service yard.

- Maintain vehicles and equipment regularly, to prevent spillages and to minimise noise levels. No oil, fuel hydraulic fluid etc may leak onto the soil. Service areas must have impervious concrete floors & oil and fuel resistant walls.
- Watertight sumps at the end of these catchment drains. Pump into containers: specialist to remove.
- Contractor to provide proof to the ECO.



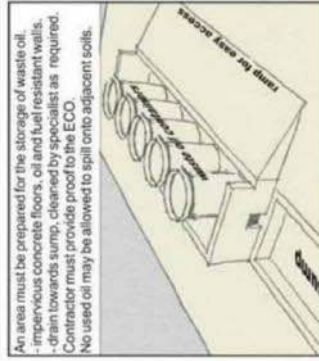
Parking areas: prevent spills or contain contaminants.

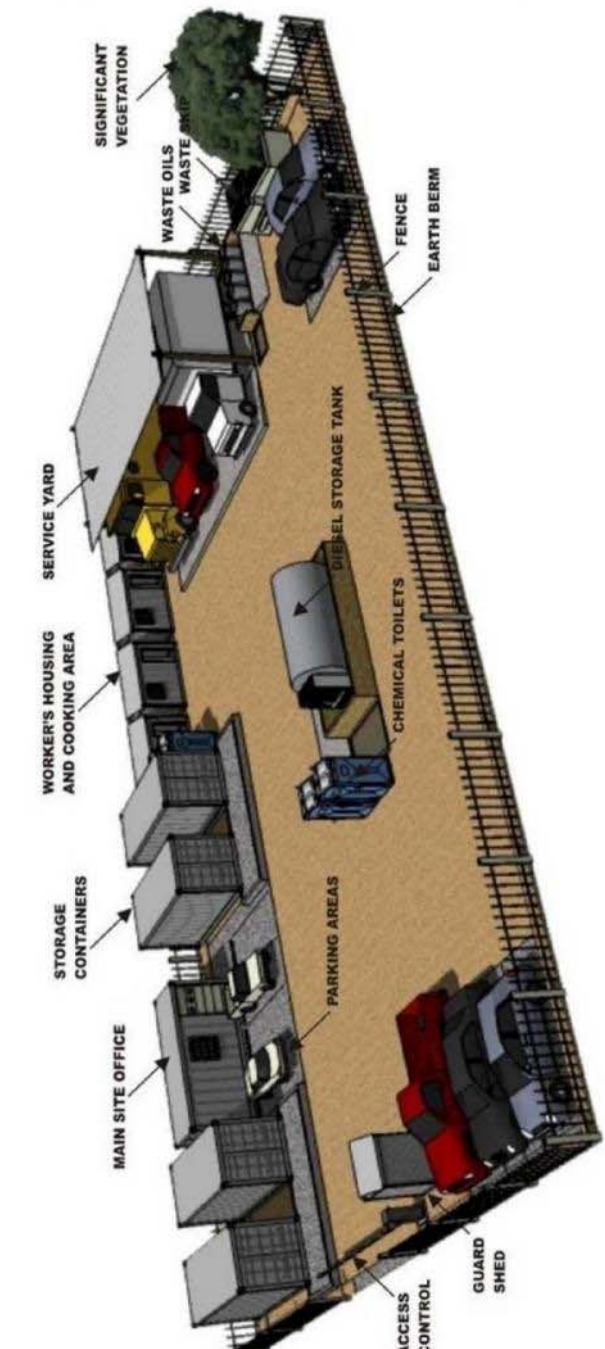


- Workers will not disturb local community.
- Workers will not litter, play loud music or build shacks.
- **On-site accommodations:** be neat, clean and safe.
- **Cooking only in designated cooking area(s).** Only with **Electrical or gas stoves.** Area must be ventilated and safe for cooking in. **No fires,** especially in winter.
- **Waste skip** at appropriate place. Sort solid waste into categories and send Hazardous waste to registered facility.
- **Minimum Vegetation clearance** - retain significant trees
- Footprint not be larger than the camps them selves.

An area must be prepared for the storage of waste oil.


- impervious concrete floors, oil and fuel resistant walls.
- drain towards sump, cleaned by specialist as required.
- Contractor must provide proof to the ECO.
- No used oil may be allowed to spill onto adjacent soils.





Prevent runoff entering or leaving camp. (Earth berm drainage ditch or sandbags @ 500mm high)


- 1 **chemical toilet** for every 15 people on the site
- Workers will use these toilets, not the site.
- Toilets will be clean and within walking distance from activities.



Temporary fuel tank and its surrounding area in a watertight bunker able to hold the volume of the tank.

- Monitor area weekly - no fuel onto surrounding soils.
- If puncture occurs, contact ECO and specialist. Remove contaminated soils completely. Dump at licensed facility. Fill excavation to top with healthy soils.
- Always keep containment bunkers empty.

Procon Environmental Technologies tel: (013) 697 4617/34



ENVIRONMENTAL MANAGEMENT PLAN

PROPOSED CONFIGURATION OF A TYPICAL CONSTRUCTION SITE CAMP AS PER ENVIRONMENTAL MANAGEMENT PLANS

SPOOR

APPENDIX 3

Spill Management Contractors List

SPILL AND POLLUTION RESPONSE COMPANIES						
Company	Product Description	Operating District	Website	Email address	Contact details	
Services Providers	24 Hour Spill Response Association	Oil and hazardous materials spills, Truck roll-overs/transfers, derailments, acid spills, biohazard containment and cleanup, ship leaks, fuel spills, industrial plant emergencies, air quality monitoring, clean up and remediation including facility and equipment decontamination, soil excavation and disposal, sludge processing, cleaning services, waste management ensuring safe disposal and safe disposal certificates, contingency planning, asbestos removal, offshore vessel services and support, pollution control, maintenance and service, consumable sales	National	www.24hourspillresponse.co.za www.facebook.com/pages/24-Hour-Spill-Response/203191236393968	info@24hourspillresponse.co.za	t: 0800 00 5817
	Oil Spill Control	Range of absorbent materials for oil and other hydrocarbon based products, chemicals and other liquids, spill kits, oily water separators, oil skimmers, pumps, oil containment booms, training service, spill response service, site inspection service, providing guidance on safety, environment and ISO regulations	Western Cape	http://oilspillcontrol.co.za/		t (sales): 021 531 5335 t: 082 774 8964 t: 082 455 7832
	Oil-Gone Agency cc Enretech	Bioremediation, spill clean-ups, spill kits, environmental remediation technology	Eastern Cape	http://www.oilgone.co.za/ http://www.enretech.co.za		t: 084 580 0327
	Procon Environmental Technologies	Environmental Products and Technologies, specializing in systems that minimize the impact of contamination on the environment and surrounding areas, prevention and treatment of oil pollution in soil and water	Centurion Witbank	http://www.pro-enviro.co.za/	procon@pro-enviro.co.za	t: 013 697 4617/4634 f: 013 697 4618 t: 012 667 5389 f: 012 667 5389
	ROSE Foundation (Recycling Oil Saves the Environment)	None-profit organisation - collect used oil	Burgersfort, Cape Town, Durban, Johannesburg, Middelburg, Nelspruit, Pietermaritzburg, Port Elizabeth, Pretoria, Richards Bay, Rustenberg, Weenen	http://www.rosefoundation.org.za/	usedoil@iafrica.com	t: 021 448 7492 c: 082 378 8556 f: 086 652 7384
	Spill Tech	Spill response 24/7, absorbent products, spill kits, asbestos disposal service, hazmat, high pressure cleaning, waste management, marine response, bioremediation, clean up after fires and floods.	National	http://www.spilltech.co.za/	info@spilltech.co.za	t: 0861 000 366
	HazClean	24h spillage response, spill kits, equipment, absorbent products	National	http://www.hazclean.co.za/	ian@hazclean.co.za	t: 0080 00 5817
	IFRT Spill Response	24h spillage response, industrial cleaning, spill kits, equipment, absorbent products, training	Vereeniging	http://www.ifrt.co.za/		t: 016 428 2207 t: 083 284 1879 t: 083 284 1880
Products	Absorbetech Environmental (former name SupaZorb Sales)	Absorbetech, a hydrocarbon absorbent, which is used to clean up spillages in factories, on water and capped or uncapped outdoor surfaces. The main benefit of using this product however, is the bio-remedial capacity it possesses. This means, the cleaning of such spillages utilizing a natural process through which a blend of bacteria and fungi break down, or degrade, a wide variety of hydrocarbons. In addition we offer a number of related products.	Durban Cape Town Johannesburg	http://absorbetech.yellowpages.co.za/	info@absorbetech.com	t: 031 914 3939 t: 031 700 8617 t: 021 531 9999 t: 011 708 1494
	Bio-systems SA	Products for the bioremediation of oil-contaminated soils, the bioaugmentation of urban, agricultural and rural effluent streams and the re-use of grey water.		www.biosystemssa.co.za	info@biosystemssa.co.za	t: 021 786 2972 f: 086 726 5445
	Earthwise Environmental SA (PTY) Ltd.	Oil and chemical absorbent products	National	http://www.spillsorb.co.za/	gus@enviroshore.co.za	t: 012 568 1043

APPENDIX 4

Storm Water Management Guidelines

**STORM WATER MANAGEMENT GUIDELINES
FOR THE PROPOSED PROVINCIAL ROAD K77:
ELIZABETH ROAD TO K154,
MIDVAAL LOCAL MUNICIPALITY,
GAUTENG**

GAUT: 002/14-15/0188

SUBMITTED TO:

**Gauteng Department of
Agriculture and Rural
Development:
Sustainable Utilisation of
the Environment Branch
P.O. Box 8769
Johannesburg
2000**

APPLICANT:



GAUTENG PROVINCE

ROADS AND TRANSPORT
REPUBLIC OF SOUTH AFRICA



spoor
environmental services

SPOOR Environmental Services (PTY) Ltd.

t: +27 (0)12 480 0612 f: +27 (0)86 763 5635 e: info@spoorenservices.co.za
p: Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040, Pretoria, South Africa
w: www.spoorenservices.co.za

June 2016



REPORT TITLE:	Storm Water Management Guidelines for the Proposed Road K77: Elizabeth Road to the K154 Midvaal Local Municipality Gauteng Province
CLIENT:	Knight Piésold Consulting Engineers
SPOOR PROJECT REFERENCE:	8/20_k77
REPORT STATUS:	Draft
PLACE AND DATE:	Pretoria, June 2016

DOCUMENT HISTORY

Report	Date	Version	Status
K77 Storm Water Management Guidelines	June 2016	1.0	Draft for public comment

APPLICANT

APPLICANT:	Gauteng Provincial Department of Roads and Transport (GPDRT)
CONTACT PERSON	Mr. K Govender
POSTAL ADDRESS:	Private Bag X83, Marshalltown 2107
TELEPHONE:	011 355 7050 011 355 7264
FAX:	011 355 7235
E MAIL:	kumen.govender@gauteng.gov.za

ENVIRONMENTAL ASSESSMENT PRACTITIONER

CONSULTANT:	SPOOR Environmental Services (PTY) Ltd.
CONTACT PERSON:	JC van Rooyen
POSTAL ADDRESS:	Postnet Suite 111, Private Bag X37, Lynnwood Ridge, 0040
TELEPHONE:	012 480 0612
FAX:	086 763 5635
E MAIL:	jcvr@spoorenvironmental.co.za

DECLARATION OF INDEPENDENCE

I, JC van Rooyen as authorised representative of SPOOR Environmental Services (Pty) Ltd, hereby confirm my independence as an Environmental Assessment Practitioner and declare that neither I nor SPOOR Environmental Services (Pty) Ltd have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which SPOOR Environmental Services (Pty) Ltd was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the proposed Detailed Design and Construction of Road K77: Elizabeth to the K154, Midvaal Local Municipality, Gauteng Province.

Signed.....

Date.....

REPORT DISTRIBUTION

PUBLIC			
Area	Venue	Location	Contact Person
Drumblade, Midvaal Local Municipality	The Old "Touch of Green Nursery" 19 Elizabeth Road, Drumblade AH, Midvaal	19 Elizabeth Road, Cnr Elizabeth Road and Joan Avenue Drumblade AH, Midvaal	Mrs V Geffen 084 526 9195

INSTITUTIONS	
Name	Institution
Mrs. B. Belot Mrs. F. Mlambo	Gauteng Department of Agriculture and Rural Development: Sustainable Utilization of the Environment Branch
Mr. K. Govender	Gauteng Provincial Department of Roads and Transport
Mr. J. Viljoen	Knight Piésold Consulting
Mr. L. Mabona	Department of Water and Sanitation
Mr. S. Manele	Sedibeng District Municipality Transport Infrastructure and Environment (Executive Director)
Mr. H. Human	Midvaal Local Municipality Department Development and Planning (Executive Director) Division Environmental Management
Mr. S. Coetzee	Midvaal Local Municipality Department Engineering Services (Executive Director)
Mr. B. Welchman	Midvaal Local Municipality

	Department Engineering Services
Mr. N. Mashele	Midvaal Local Municipality Department Engineering Services Civil Engineering Services (Director)
Mr. R. Maswime	Midvaal Local Municipality Department Engineering Services Division Roads (Assistant Director)
Mr. G. Botha	Provincial Heritage Resources Agency Gauteng (PHRAG)
Mr. A. Solomon	South African Heritage Resources Agency

EXECUTIVE SUMMARY

Introduction

SPOOR Environmental Services (PTY) Ltd. was appointed by Knight Piésold Consulting Engineers on behalf of the Gauteng Provincial Department of Roads and Transport as the Environmental Assessment Practitioner to manage the relevant environmental management processes related to the proposed road development.

Locality

The proposed Road 77 will extend from Elizabeth Road and the K154. The proposed road falls within the Sedibeng District Municipality which is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the Midvaal Local Municipality, between the areas of the Drumblade AH and Eikenhof.

Project Description

The proposed provincial Road K77 will extend over a distance of approximately 4.3 kilometres and stretch from Elizabeth Road (D2310) to the R550 (K154). The proposed road will be designed and constructed as a tar surfaced dual carriageway (three lanes in each direction) within a road reserve of 62 metres. The first phase of this proposed project will however only include a single carriage way of one lane (3.7m wide) in each direction. A typical section of the completed road will consist of a 3 metre shoulder, three lanes of 3,7 metre each, an eight metre middle median and three lanes in the opposite direction and the final shoulder.

On a local scale the proposed road K77 is included in the planning frameworks included in the Sedibeng Integrated Development Plan, the Midvaal Integrated Development Plan, the Midvaal Spatial Development Framework as well as the Midvaal Western Regional Spatial Development Framework. These planning frameworks allow for the development of the proposed road within the auspices of the local development guidelines. In terms of development in the area of the proposed road K77, the primary development driver comes in the form of the Highlands Mixed Use Development. This development consists of a host of smaller residential, commercial and industrial developments which spans an area of more than 3500ha and which is in various stages of application, authorization and implementation. The proposed road K77 is anticipated to add to the free flow of traffic when these developments are in their operational phases.

Environmental Impacts Identified

In terms of ecological sensitivity, the biodiversity Specialist found that the majority of the project footprint does not pose the risk of noteworthy environmental degradation purely as a result of the situation that the road will be developed in an area that was subjected to anthropogenic disturbances in the past. The development site for the proposed road will however enter into an area that has been devoid of any development for a long time. Local residents have reported to the incidence of sensitive species such as the Grass Owl (*Tyto capensis*), Melodious Lark (*Mirafra cheniana*) and the African Bull Frog. (*Pyxicephalus adspersus*) as well as other species such as the Black Backed Jackal and antelope. Additionally, the proposed alignment also traverses sensitive areas to the likes of a Valley Bottom Wetland and a water course. The Specialist reported that the wetland feature, although transformed,

perform an important function in terms of habitat provision for avifauna and other faunal species. Disturbances within this habitat unit must be avoided. However, if construction within the wetland areas is absolutely unavoidable, the duration and footprint of disturbance must be minimised and rehabilitated as soon as possible.

Socio-economic impacts include local ease of access, possible disruption in services, security and general hindrances. Specific impact mitigation measures were suggested for the management of these impacts and it is believed that the effects thereof can be significantly reduced if the measures are strictly adhered to.

The principal goal of this document is to provide a set of Storm Water Management Guidelines as preventative measures to avoid erosion and sediment flows caused as a result of storm water runoff during and after the proposed construction of road K77.

Management guidelines are discussed under the following themes:

- ❖ Erosion control on bare open soils, open cuttings and on slopes,
- ❖ General road surface run-off management,
- ❖ Culverts and bridges, and
- ❖ Construction through wetlands.

These guidelines serve as an addendum to the EMPr in terms of erosion control and storm water management and should be used in reference to the project specific bio-physical characteristics. It is the opinion of the EAP that the principles contained within this document must be scrutinized by the relevant Authority and project Managers and be implemented in order to mitigate the negative effects of storm water flows during periods of flooding and normal storm water runoff, both during and after the construction phase.

DETAILS AND EXPERTISE OF SPOOR ENVIRONMENTAL SERVICES

Name:	JC van Rooyen
Company:	SPOOR Environmental Services (Pty) Ltd
Qualifications:	Pr LA Techno B.L. M.Sc (Env Soc)
Professional Registration:	SACLAP

In accordance with Section 31 (2) (a) (ii) of Government Notice No. R. 543 of June 2010, this section provides an overview of SPOOR Environmental Service's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team. SPOOR Environmental Services (Pty) Ltd. has been in operation since 2011. The Director, Mr. JC van Rooyen, has been involved in an array of environmental consultation and planning projects in various spheres of the landscape design, development and environmental management disciplines over the past 15 years. SPOOR Environmental Service's approach towards projects is to strive for sustainable environments that not only reflect artistic and aesthetic quality but also hold diverse ecological and cultural value. The Company is capable of conducting environmental applications and landscape development planning and design for various projects including:

- ❖ Scoping & Environmental Impact Assessment Reports,
- ❖ Visual Impact Assessments,
- ❖ Environmental Management Systems/ Plans,
- ❖ Environmental Management Programmes (EMPr),
- ❖ Environmental Audits & Monitoring,
- ❖ Waste Management Licence Applications,
- ❖ Air Emission Licences (AEL's)
- ❖ Water Use Licence Applications (WULA)
- ❖ Integrated Environmental Management (IEM),
- ❖ Tree Removal Permits,
- ❖ Environmental Rehabilitation,
- ❖ Conservation Planning / Eco-tourism Developments,
- ❖ Landscape Design and Development,
- ❖ Landscape/ Environmental Project Management.

To date JC van Rooyen of SPOOR Environmental Services has been involved in similar projects which indicate that the EAP is capable to conduct the environmental assessment for the proposed project:

- ❖ **Route K72 including the new Pinehaven Interchange, Mogale City Gauteng**

Client:	Development and Engineering Consultants (Pty) Ltd.
Applicant:	Gauteng Provincial Department of Roads and Transport
Responsibility:	Scoping & EIA Application, Environmental Management Programme, Visual Impact Assessment and Water Use Licence Application.

- ❖ **Upgrade of Road K46 Phase II between the PWV5 and the N14 Intersection**

Client:	Knight Piésold Consulting Engineers (PTY) Ltd.
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Applicant: Gauteng Provincial Department of Roads and Transport
Responsibility: BA Application, Environmental Management Programme, Storm Water Management Guidelines, Water Use Licence Application.

❖ **Serapeng Road Extensions, Mamelodi, Gauteng Province**

Client: Development & Engineering Consultants
Applicant: City of Tshwane Metro Municipality
Responsibility: BA Application, Environmental Management Programme.

❖ **Middelburg Eastern Bypass, Middelburg, Mpumalanga**

Client: Bapela Cave Klapwijk Land Planning & Design
Applicant: Steve Tshwete Local Municipality
Responsibility: Finalization of Scoping and EIA process, Environmental Management Programme.

❖ **Brooklyn Circle Upgrade, Pretoria**

Client: Bapela Cave Klapwijk Land Planning & Design
Applicant: City of Tshwane Dept. Roads and Stormwater
Responsibility: Finalization of BA Application & Environmental Management Programme.

PROJECT TEAM

The project team working on the proposed project consists of the following practitioners:

Mr. J.C. Van Rooyen (*BL., M.Sc (Env. Soc) (SACLAP)*) (Principle EAP)
Landscape Technologist and Environmental Assessment Practitioner

Mrs. A. Le Roux (*B.Sc L Arch, B.L Hons*)
Candidate Landscape Technologist and Junior Environmental Assessment Practitioner

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ABBREVIATIONS

AH	-	Agricultural Holding
BID	-	Background Information Document
CLO	-	Community Liaison Officer
COIDA	-	Compensation for Occupational Injuries and Diseases Act (No 130 of 1993)
CPF	-	Community Policing Forum
DWA	-	Department of Water Affairs
DWS	-	Department of Water and Sanitation
EAP	-	Environmental Assessment Practitioner
ECA	-	Environment Conservation Act
ECO	-	Environmental Control Officer
EIA	-	Environmental Impact Assessment
EIAR	-	Environmental Impact Assessment Report
EMPr	-	Environmental Management Programme
GDARD	-	Gauteng Department of Agriculture and Rural Development
GPDRT	-	Gauteng Provincial Department of Roads and Transport
IEM	-	Integrated Environmental Management
IDP	-	Integrated Development Plan
I&AP	-	Interested and Affected Parties
ISDF	-	Integrated Spatial Development Framework
MAMSL	-	Metres Above Mean Sea Level
MLM	-	Midvaal Local Municipality
NEMA	-	National Environmental Management Act
NEMBA	-	National Environmental Management Biodiversity Act
NEMWA	-	National Environmental Management Waste Act
NFEPA	-	National Freshwater Ecosystems Priority Areas
NHRA	-	National Heritage Resources Act
OHS	-	Occupational Health and Safety
PC	-	Principal Contractor
PHRAG	-	Provincial Heritage Resources Authority of Gauteng
PM	-	Project Management
PVW	-	Pretoria Vereeniging Witwatersrand
QDSG	-	Quarter Degree Square Grid
RE	-	Resident Engineer
SABS	-	South African Bureau of Standards
SAHRA	-	South African Heritage Resources Agency
SDM	-	Sedibeng District Municipality
SDF	-	Spatial Development Framework
S&EIR	-	Scoping and Environmental Impact Report
SHE	-	Safety, Health and Environment
SME	-	Small and Medium Enterprise
H&S Rep	-	Health and Safety Representative
PPE	-	Personal Protective Equipment

1. INTRODUCTION

SPOOR Environmental Services (PTY) Ltd. was appointed by Knight Piésold Consulting Engineers as the Environmental Assessment Practitioner to manage the relevant environmental management processes related to the proposed road K77 development. The principal goal of this document is to provide a set of Storm Water Management Guidelines as preventative measures to avoid erosion and sediment flows caused as a result of storm water runoff during and after the construction of the road K77.

Management guidelines are discussed under the following themes:

- ❖ Erosion control on bare open soils, open cuttings and on slopes,
- ❖ General road surface run-off management,
- ❖ Culverts and bridges, and
- ❖ Construction through wetlands.

These guidelines serve as an addendum to the EMPr in terms of erosion control and storm water management and should be used in reference to the project specific bio-physical characteristics. It is the opinion of the EAP that the principles contained within this document should be adopted by the Design Engineer in order to mitigate the effects erosion during periods of flooding and normal storm water runoff during and after construction.

2. LOCATION

The proposed road falls within the Sedibeng District Municipality which is the southernmost district municipality in the Gauteng Province. Locally, the proposed alignment is situated in the northern regions of the Midvaal Local Municipality, between the areas of the Drumblade Agricultural Holdings and Eikenhof. The proposed road K77 alignment is planned to extend between Elizabeth Road and the R550 (Klipriver Road) or the K154. See Figure 1.

2.1. Stream Crossings, Wetlands and Road Surface Drainage Systems

The proposed road K77 development intercepts two drainage features. One at the start of the proposed road (between chainage 0.000 and 0.100) and the other at a distance of 100m south of the K154 (between chainages 3 100 & 3 300). See Figure 3. The drainage feature at the intercept of the proposed K77 and Elizabeth road classifies as a minor drainage system of which the storm water drainage will be managed via a grassed trapezoidal channel and a pipe culvert cross drain. The crossing of the upper tributary of the Klipriver (between chainages 3 100 & 3 300) is however described as a major drainage system and would require a reinforced cellular concrete box culvert structure to transport storm water runoff along this natural channel underneath the alignment. A Water Use Licence Application will be submitted to the Department of Water Affairs in terms of Section 21(c) and (i) of the National Water Act, 1998, (Act 36 of 1998) for the crossing of the said drainage courses. See Figure 2.

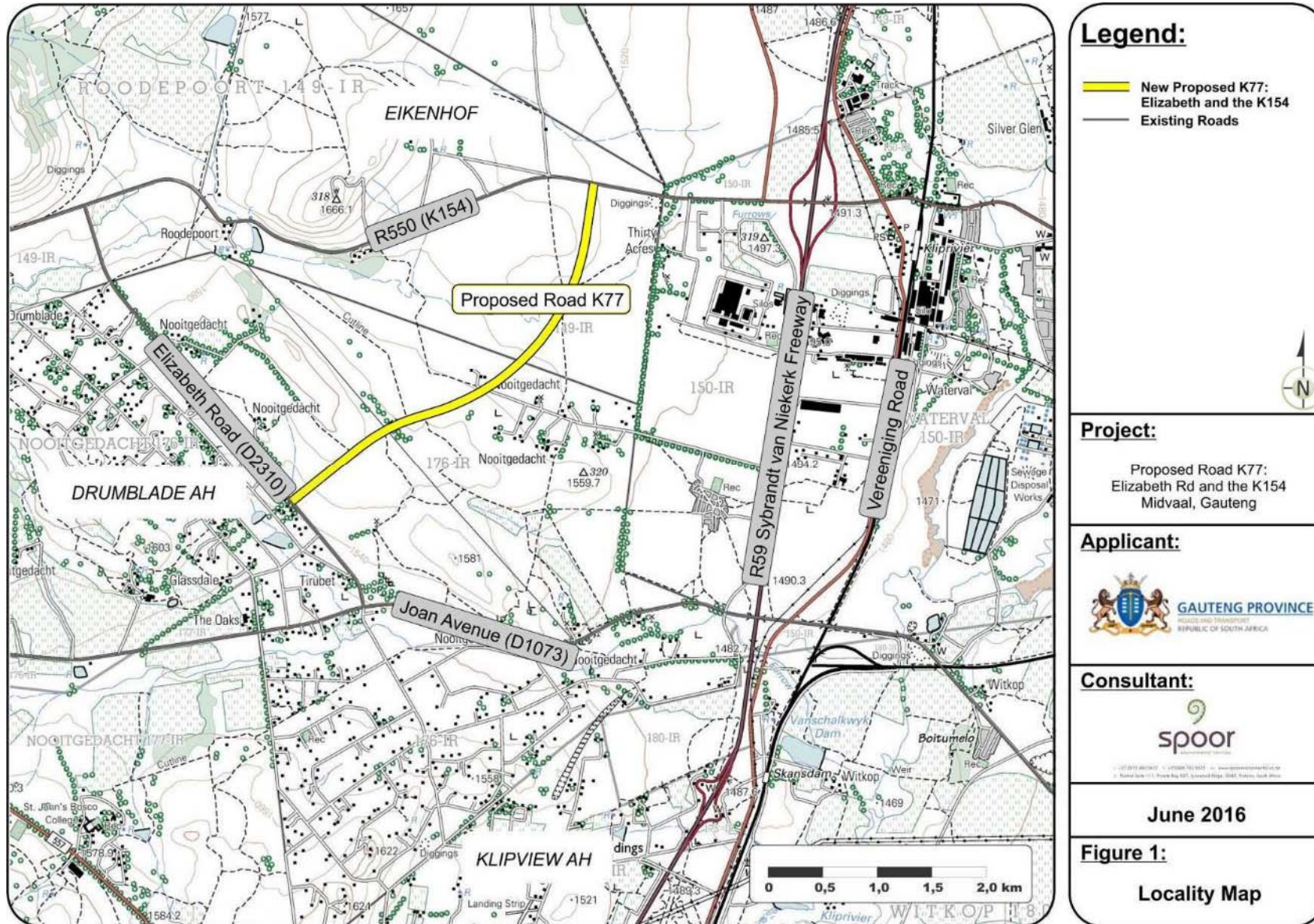


Figure 1: Locality

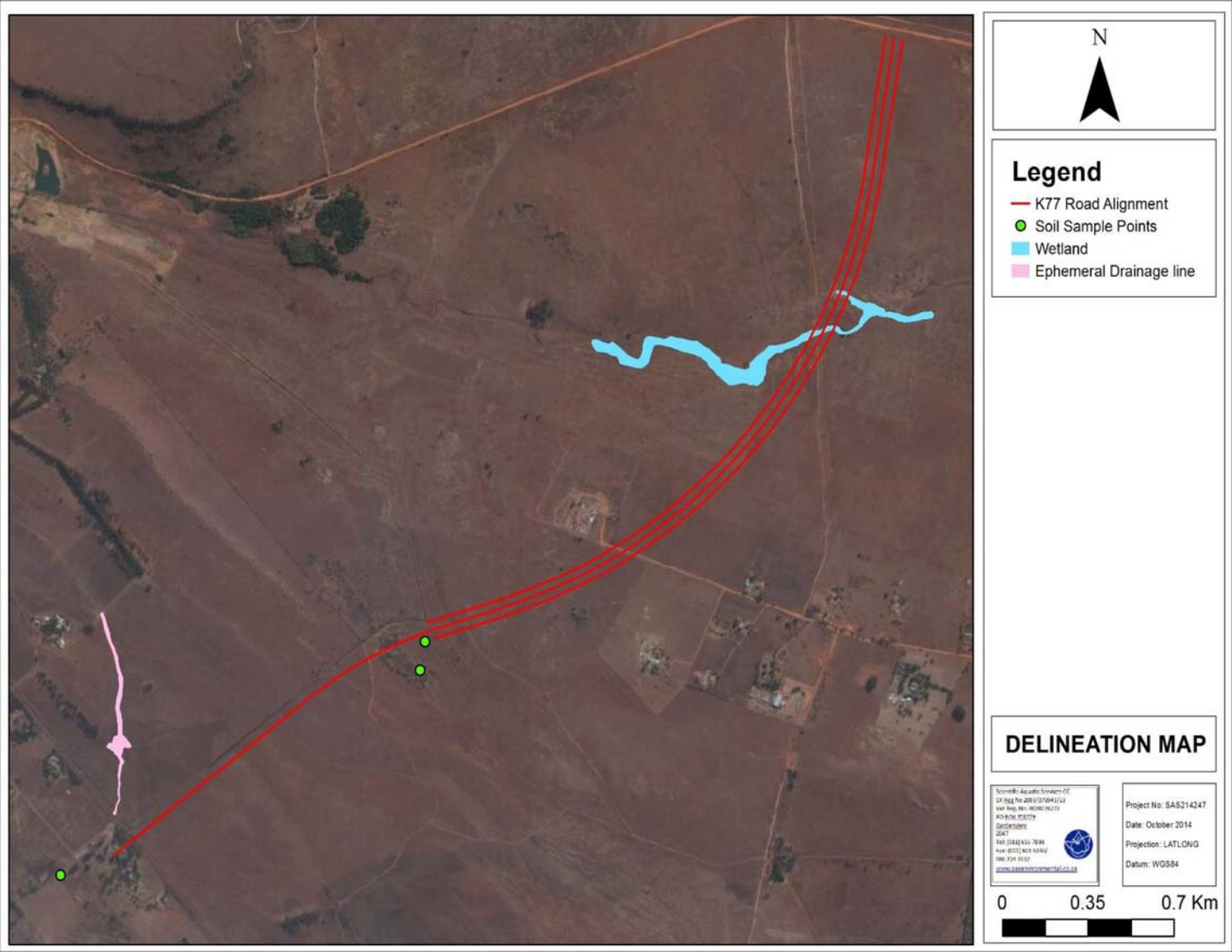


Figure 2: Road K77 Water Course Crossings

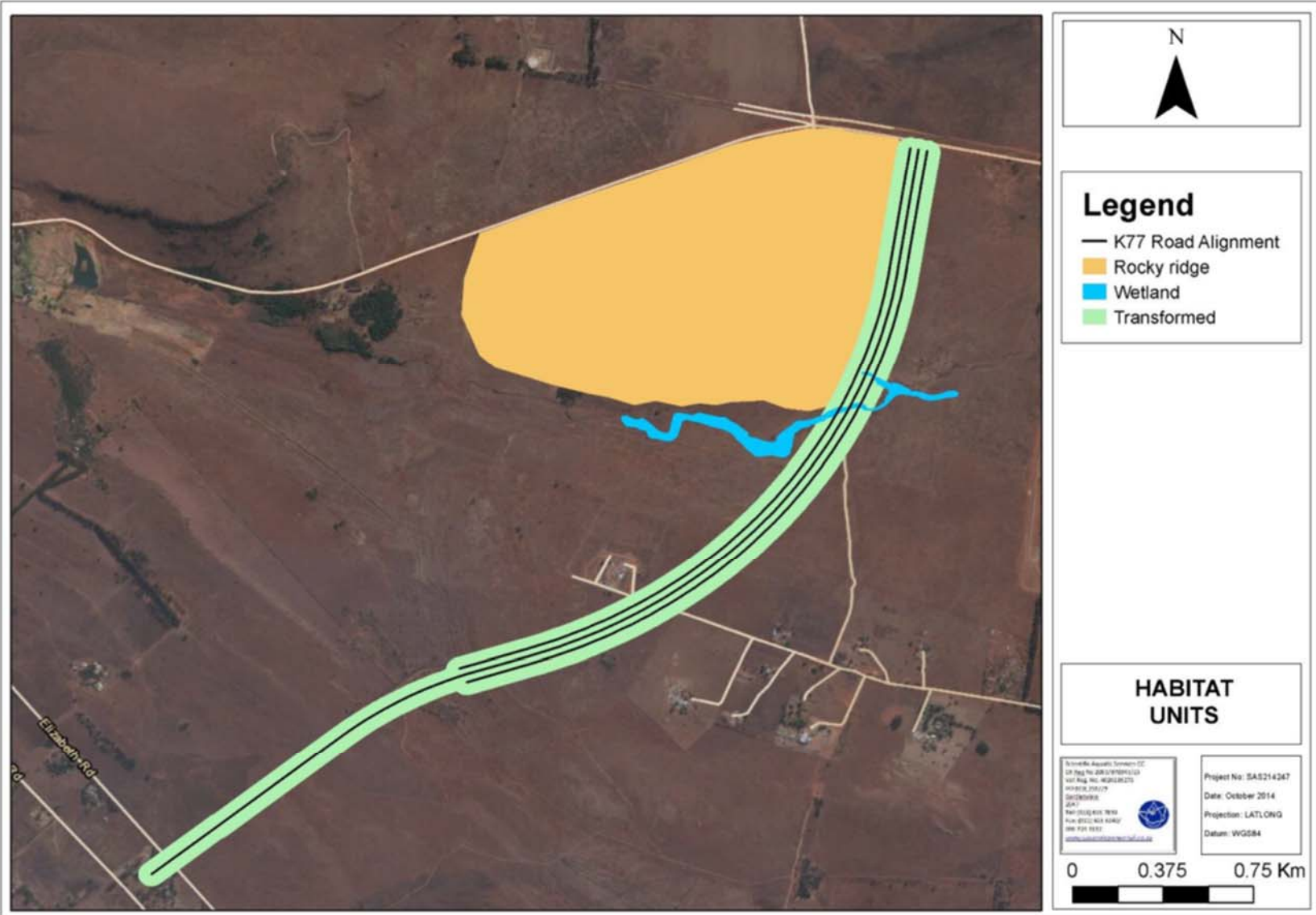


Figure 3: Primary Water Crossing

3. CULVERTS AND BRIDGES

3.1. Introduction

As aforementioned it is unavoidable that the receiving environments of the wetland crossing and the upper tributary of the Klip river with the associated wetland here will be affected. Impacts will occur both during the construction and the operation phases of the proposed road construction development. The challenge lies in obtaining a crossing solution over the said drainage features which is economical in terms of construction and long term maintenance cost but which will enable sustained and productive ecological functioning at the associated wetland and river systems.

3.2. Proposed Drainage Course Crossing Structures and Associated Impacts

The crossings of the proposed road over the water course will consist of a reinforced concrete box culvert structure. Future residential development with the associated infrastructure causes a subsequent loss of storm water infiltration as a result of the increase of impenetrable paved areas. This in turn causes the volumes and velocity of storm water to increase dramatically. Storm water is channelled and discharged in the natural drainage ways where it places the structures crossing drainage ways and the drainage ways itself under severe pressure. The primary anticipated impacts related to the proposed crossing structures include;

- ❖ Severance of the sub-surface water base flow between the sections of wetland above and below stream the wetland crossing;
- ❖ Erosion commencing at the toe of the outlet as a result of the failure of storm water management measures at the interface of the toe of the outlet structure and the natural drainage channel or wetland;
- ❖ Erosion channels forming from the toe of the outlet and growing downstream in the drainage way. Erosion channels deepens and widens over time and progressively drains the wetlands associated with the systems to cause wetland failure in terms of habitat and function over the long term;
- ❖ If left unattended failure of the culvert structure itself from position of the outlet and working its way back upstream. In extreme examples this may lead to the failure of the crossing structure itself over the drainage system.

Measures should therefore be implemented to ensure the sustained ecological functioning of the wetland as well as the conservation of the structural integrity of the proposed crossing structures. These measures will be discussed in the following sections.

3.3. Minor Culverts

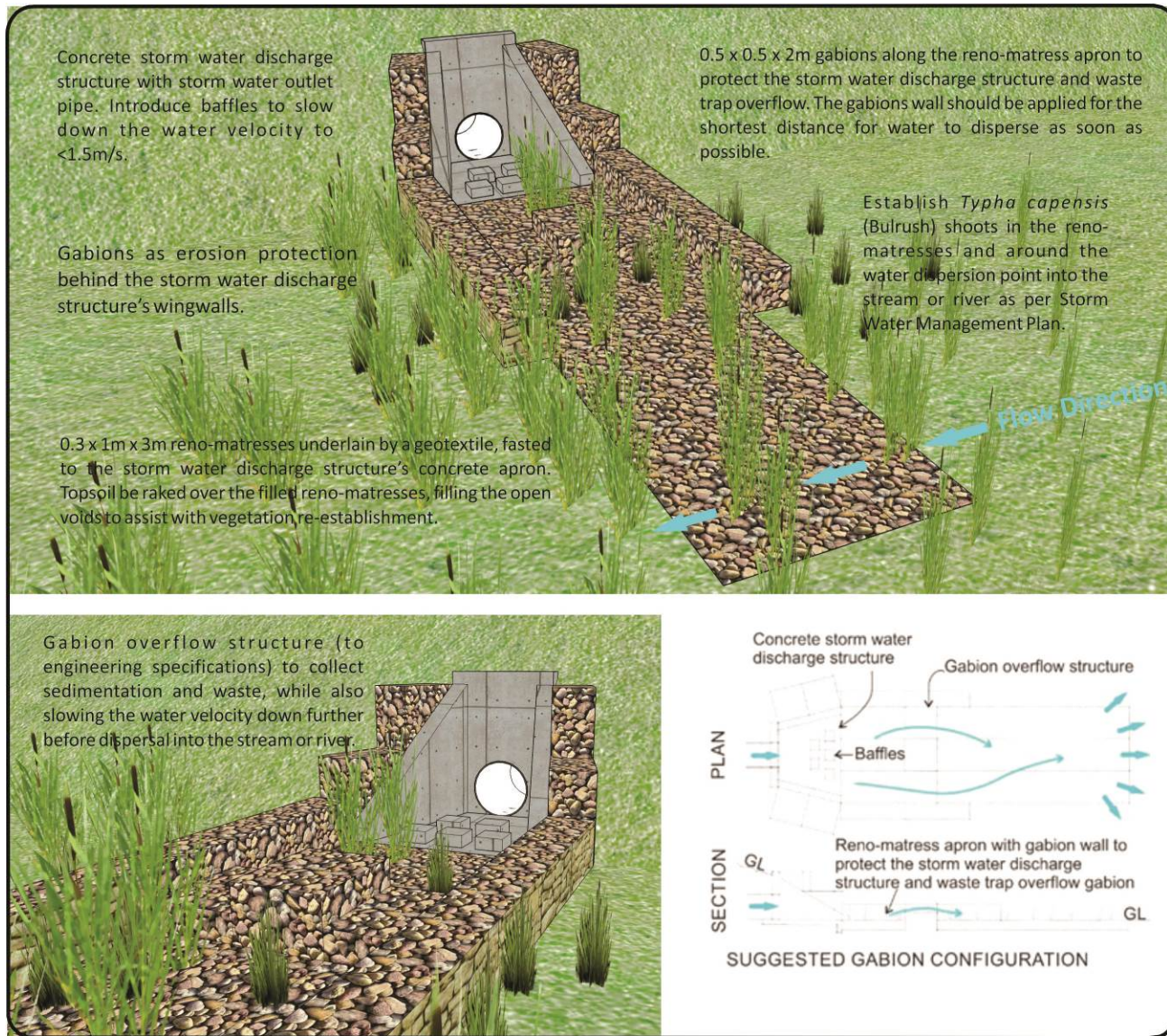
A minor culvert can be defined as an outlet into a natural stream of channel or as a storm water discharge structure of a relatively small catchment area. The culvert can also be in the form of a pipe. Recommendations regarding discharge structures containing minor culverts include;

- ❖ All minor culverts discharging storm water into a natural drainage way must be constructed as part of a storm water discharge structure;
- ❖ Storm water discharge structures must include the headwall, wing wall and floor section and must be designed by the engineer to be able to safely discharge the storm water runoff;
- ❖ As far as possible, discharge structures shall not be positioned on a slope;
- ❖ If on a slope, the gradient where the discharge structure is constructed should be consistent throughout this section of the embankment to reduce the risk of erosion;
- ❖ The top and side slopes of the discharge structure must be protected against erosion. This can be accomplished with stacked gabion construction;
- ❖ The storm water discharge structures must be constructed to include energy dissipaters to reduce the velocity at which storm water drains into the natural drainage ways;
- ❖ Storm water shall be released to spread out at the outlet ensuring subcritical flow velocities, not exceeding 1.5m/s. This can be accomplished by implementing reno mattresses with gabion side protection, or similar a solution;
- ❖ If on a slope the reno mattress discharge structure must be constructed downwards along the slope onto the wetland or river channel floor for a distance of at least three metres where the channel permits. The reno mattresses must be flanked by gabions and where the reno mattresses intersects the wetland or river channel floor, the reno mattresses and gabions must be angled in a downstream position;
- ❖ The storm water outlet structures should include waste traps and sediment traps to reduce the volume of waste and sediment flowing into the water courses and to create easily accessible cleaning mechanisms;
- ❖ Where the discharge structure abuts on the wetland or river channel floor itself reno mattresses must be employed to protect the gabions on the overflow side of the discharge structure;
- ❖ To allow for cleaning, pipe culverts should not be smaller than 750 mm diameter and box culverts not lower than 600 mm.
- ❖ See Figure 4 for a diagrammatic representation of a proposed outlet structure.

3.4. Major Culverts and Bridges

In the case of the proposed Road K77 project a major culvert can be defined as a structure used to cross a section of wetland or small water course associated with a small to medium sized catchment area. Recommendations regarding discharge structures containing major culverts include;

- ❖ The culverts and/or bridges to be constructed over the wetland area and the upper tributary of the Klip river are to be designed by a professional engineer to ensure that the subsurface flow of water in the wetland areas is not severed between the upstream and downstream positions of these structures.
- ❖ The design of such culverts and/or bridges should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained;
- ❖ The COLTO Standard Specifications for Road and Bridge Works for State Authorities 1998 (Green Book) as well as the standards and specifications of the South African Roads Agency (SANRAL) Limited: Drainage Manual must be implemented here.



Legend:

Note: This is a diagrammatic representation of a storm water discharge structure and should be adjusted by the Engineer according to the storm water volume and velocity.

Project:

Proposed Construction of Road K77 Midvaal Gauteng

Applicant:



Consultant:



June 2016

Diagrammatic Representation of a Proposed Outlet Structure

Figure 4: Proposed Storm Water Discharge and Major Culvert Rehabilitation

In addition;

- i. *The design of such culverts and/or bridges should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface;*
 - ii. *The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 300mm of the soil surface at all times;*
 - iii. *Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during the summer season. (SAS, 2015)*
- ❖ The channel of the culvert or bridge structure must be angled to be parallel with the natural stream flow direction to decrease erosion of the wetland and river embankments downstream of these structures;
 - ❖ The culverts and bridges are to be designed by a professional engineer to ensure that the structures do not cause erosion of the wetland or the river channel floor downstream of these structures;
 - ❖ Reno mattresses must be laid in the downstream wetland and river channel floor positions of the wetland and River system for a minimum of 10 meters;
 - ❖ The Reno mattresses must be laid to ensure a long term suitable connection with the downstream toe end of the reinforced concrete box culvert crossing structures;
 - ❖ The embankments on the up-and downstream positions of the culverts and/or bridges must be protected via stacked gabion structures or similar anti erosion measure for a suitable distance to ensure long term stabilization of the areas around the culvert and/or bridge structures and to curb erosion in these positions.

4. CONSTRUCTION THROUGH WETLANDS

Additional mitigation and rehabilitation measures recommended by the wetland Specialist to be considered during bridge or culvert construction are as follows;

- ❖ Disturbance to any wetland crossings must be minimised;
- ❖ Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the culverts;
- ❖ It must be ensured that flow connectivity along the wetland features is maintained;
- ❖ Re-profiling must be performed at the banks of disturbed wetland areas post construction to return the embankments to a functional state for the long term sustained existence of the wetland;
- ❖ Edge effects of activities including erosion control need to be strictly managed in the wetland areas;
- ❖ Implement an alien vegetation control program within wetland areas associated with the proposed road development.

5. EROSION CONTROL ON BARE SOILS, OPEN CUTTINGS AND EMBANKMENTS

To avoid erosion of exposed soils left bare after construction as well as the channel and embankment areas of the drainage features mitigation measures should be considered in terms of the:

- ❖ Embankment and road verge rehabilitation;
- ❖ Soil preparation for embankments, the road reserves and other bare areas;
- ❖ Establishment of vegetation cover;
- ❖ Watering programme, and
- ❖ Monitoring and maintenance.

5.1. Embankment Rehabilitation

- ❖ All cuttings not situated in solid material (i.e. in rock material) and which include disturbed erodible material, should be re-shaped to a stable natural uniform landform along the entire length of the disturbed area;
- ❖ Clear all construction spoil material and debris so that the toe end of the embankment terminates at its original position;
- ❖ Grade both the crest and the toe areas of the embankment to form a more natural flowing land form;
- ❖ Fill all depressions and uneven areas to form an even land form over the entire embankment area;
- ❖ Before any topsoil is placed on slopes with a gradient of 1:2, the subsoil should be ripped or scarified by hand or mechanically along the contours to form a proper bond between subsoil and topsoil;
- ❖ Concentrated surface run-off on a long slope should be released in a controlled manner as discussed in Section 4;
- ❖ All bare soil areas must be vegetated as discussed in the sections below.

5.2. Soil Preparation

Soil Preparation for Embankments

- ❖ Topsoil to a minimum of 150 mm (preferably 300 mm) must be spread evenly over the entire embankment area;
- ❖ Topsoil shall be free of detrimental salts and other impurities harmful to plant growth, weeds, stones or similar objects no larger than 25 mm in any dimensions, also brush, roots and other objectionable vegetal matter, litter or any other foreign material unsuitable or harmful to plant growth;
- ❖ Topsoil shall not be stripped, collected or deposited while wet;
- ❖ Apply 4:3:4 (36) or 2:3:2 (22) at a rate of 60-100gms/m² over the whole area to be established and rake into the topsoil;
- ❖ Topsoil shall not be extremely acid or alkaline. The pH shall be in the range of 6-7;
- ❖ For slopes steeper than a gradient of 1:3, additional biodegradable erosion containment in the form of biomats (BioJute®, Bio Mac®, etc.) should to be installed to assist in re-vegetation of the slope;
- ❖ For slopes steeper than a gradient of 1:1, engineered erosion protection such as Gabions,

Armorflex® or segmented paving should be installed.

Soil Preparation for Bare Areas

- ❖ Compacted areas must be ripped in two directions and at 90°, to a minimum depth of 150 mm and with the final direction of ripping to be along the contour;
- ❖ Apply 4:3:4 (36) or 2:3:2 (22) at a rate of 60 – 100gms/m² over the whole area before the ripping and scarifying is performed;
- ❖ The area must furthermore be covered by a topsoil layer of no less than 300mm;
- ❖ Topsoil shall not be extremely acid or alkaline. The pH shall be in the range of 6-7;
- ❖ Topsoil shall be free of detrimental salts and other impurities harmful to plant growth, weeds, stones or similar objects no larger than 25 mm in any dimensions, also brush, roots and other objectionable vegetal matter, litter or any other foreign material unsuitable or harmful to plant growth,
- ❖ Topsoil shall not be striped, collected or deposited while wet;
- ❖ Scarify all remaining bare soil areas to a minimum depth of 150mm and with the final direction of ripping to be along the contour;
- ❖ All loose stones larger than 50 mm must be removed from the planting area;
- ❖ Fill all depressions and even out all uneven areas to form an even land form.

5.3. Re-vegetation

Establishment of the Grass Cover

- ❖ The entire area must be hand seeded with a seed mix and rate per hectare as provided below;
- ❖ The areas to be seeded shall unless wet be thoroughly watered before seeding to ensure that soil will be uniformly wet over a depth of at least 150 mm when seeding takes place;
- ❖ For slopes steeper than a gradient of 1:3, additional biodegradable erosion containment in the form of biomats (BioJute®, Bio Mac®, etc.) should to be installed to assist in re-vegetation of the slope;
- ❖ The grass seed mix (re-vegetation mix) used must be representative of the project area's vegetation and must be a combination of pioneer, sub-climax and climax grasses;
- ❖ The proposed seed mix are as follows:

○ <i>Cynodon dactylon</i>	3,5kg/ha
○ <i>Eragrostis plana</i>	2.0kg/ha
○ <i>Setaria sphacelata var sphacelata</i>	2.0kg/ha
- ❖ If not available the *Eragrostis curvula*, *Eragrostis tef*, *Cynodon dactylon* and *Digitaria eriantha*. *Panicum maximum*, *Cenchrus ciliaris* and *Chloris gayana* as provided in the Mayford Veld mix can also be used. (<http://www.sakata.co.za/VELDMIX.php>);
- ❖ Only good quality fresh seed shall be used. Agricol (012) 813 8079 is a specialist grass seed provider can be contacted for advise in this regard;
- ❖ The seeding, must be done with the seed mixed with an equal quantity of river sand;
- ❖ To ensure even distribution sowing must be done in two passes over the area and at 90°;
- ❖ The seed application must be done directly onto the rough un-raked ripped surface;
- ❖ The entire seeded area must be thoroughly wetted down after seeding to fix the seed to the soil surface ad to prevent undue drying out;
- ❖ Ensure that the area is not traversed by any vehicle or unnecessarily by foot for a period of at

least two months after the re-vegetation has been done.

Planting of Typha capensis (Bulrush) on the banks of waterways

Typha capensis or Bulrush is an indigenous fast growing aquatic species with a distribution range throughout South Africa. It occurs commonly along rivers, wetlands, dams and marshes and has a variety of uses in the medicinal, economic and agricultural fields. In terms of its ecological role in watercourses it serves as a source of food and habitat for faunal species and also protects the edges of water courses. It is recommended that sections of the waterways' banks be planted with Bulrush to protect the banks against erosion and to enhance the local micro environment. Bulrush can be established as follows;

- ❖ Collect Bulrush cuttings from surrounding water courses where well established populations exist;
- ❖ Bulrush cuttings may not be collected from a single area and depleted here but should be collected randomly over a larger area;
- ❖ Cuttings must be collected between the months of November and February;
- ❖ Cuttings must consist of a section of at least 200 mm of the Bulrush rhizome with sufficient roots attached;
- ❖ The cutting's foliage can be removed at 400 mm above the rhizome;
- ❖ Plant the bulrush cuttings at 3 cuttings / m² in the wetland channel and the river channel floor along all of the areas disturbed during the construction process;
- ❖ Bulrush cuttings must be planted on the edge of the waterline in water-logged soils,
- ❖ Bulrush cuttings must be planted at a minimum depth of 200 mm.

As much vegetation growth as possible should be promoted within the disturbed sections of the wetland areas and the upper tributary of the Klip river channel in order to protect soils. In this regard, special mention is made of the need to use indigenous vegetation species only.

Tree Planting

If trees are to be planted as part of the re-vegetation of the disturbed areas along the road alignment and along the Wetland and upper tributary of the Klip river, four Highveld species, fond of growing along streams and riverbanks, are recommended:

- ❖ *Salix mucronata* (Cape Willow/ Kaapse Wilger)
- ❖ *Celtis africana* (Witstinkhout/ White Stinkwood)
- ❖ *Rhus lancea* (Karee)
- ❖ *Combretum erythrophyllum* (Vaderlandswilg/ River Bushwillow)

Trees should be planted in the following manner:

- ❖ Prepare a 1 m x 1 m x 1 m hole for each tree to be planted;
- ❖ Prepare a soil mixture of 250 gms 2:3:2 (22) fertilizer, 500 gms Superphosphate, 2 parts per volume well decomposed compost and 8 parts per volume of the soil removed from each tree hole;
- ❖ Backfill each tree hole with the soil mixture to the level that the whole of the tree's root ball will be covered when placed in the whole;
- ❖ Compact the backfilled soil lightly before placing the tree in the whole;
- ❖ Place each tree in the whole and replace the remainder of the soil mixture around the root ball;

- ❖ Compact the backfilled soil slightly around the trees to ensure that they stand firmly in position;
- ❖ Fix each tree to a suitable timber stake to stabilize it after planting,
- ❖ Create a soil berm 20 mm high and 1 m diameter around each tree for watering purposes;
- ❖ Water each tree thoroughly after planting.

5.4. Watering Programme

- ❖ The total re-vegetated area must be watered on a bi-weekly basis for the first three months after the Storm Water Management Plan has been implemented, after which watering can be reduced to one a month during the first year. Watering can then be terminated;
- ❖ All trees must be watered on a weekly basis for the first three months upon which watering can be reduced to once a month during the first year after being planted. Watering can then be terminated;
- ❖ The re-vegetated areas must be thoroughly watered but watering must be adapted in terms of the rainfall pattern;
- ❖ Do not over water the re-vegetated areas as the exposed surface may erode due to early exposure to surface drainage and flooding.

5.5. Site Monitoring and Maintenance

- ❖ Site monitoring must be done by the Contractor on a monthly basis and for a period of one year after the rehabilitation has been completed;
- ❖ The Contractor shall be solely responsible for establishing an acceptable vegetation cover and for the cost of replanting where acceptable cover is not obtained;
- ❖ Any signs of erosion or failing of the embankment or the surrounding rehabilitated areas must be reported to the Contractor and must be repaired straightaway;
- ❖ Maintenance of the vegetation cover will include reseeding of grass on embankments and other bare areas to ensure a 100% coverage;
- ❖ There shall be no bare patches of more than 500 mm maximum dimension;
- ❖ Weeds and other alien vegetation must be removed as part of the monthly monitoring of the rehabilitated area for at least one year after completion of the rehabilitation activities and on an on-going basis as part of responsible environmental management by the GPDRT.
- ❖ Alien / weed control need to be strictly managed in the wetland and river areas, and an alien vegetation control program needs to be implemented in accordance with the recommendations of the EMPr.

6. GENERAL ROAD SURFACE RUN-OFF MANAGEMENT

- ❖ Storm water drainage inlets along the proposed road should be determined by the design engineer at regular intervals along the route;
- ❖ For road sections on fill, the run-off should be contained on the road surface and released into down shoots or storm water side curb inlets at regular intervals, in order to curb sheet run-off onto fill slopes as an erosion control measure;
- ❖ The road median should be shaped to concentrate run-off to the storm water drop inlets;
- ❖ The road median should not be paved and must be vegetated with a 100% grass cover to decrease sediment and debris flow into the drop inlets;

- ❖ Appropriate erosion control as indicated in section 3 should be implemented at all storm water discharge ends;
- ❖ The storm water systems need to be cleared of urban waste that ultimately ends up in the urban water courses.

7. CONCLUSION

The storm water management guidelines and rehabilitation measures developed for the proposed Road K77 construction sets out to identify possible areas where erosion can occur during and after the construction phase. The guidelines provided in this document must be taken into account by the design engineer and the principal contractor during the pre-construction planning and design phases as well as in the construction phase itself. It is believed that the erosion control measures presented will provide suitable solutions to prevent possible erosion related impacts on the receiving environment.

Finally, it is critically important that the relevant monitoring and maintenance be performed on a concurrent basis in order to ensure the long term integrity of the new infrastructure as well as the sustained productive functioning of the local wetlands and the Diepsloot River.

PLEASE NOTE:

- ❖ The recommendations made in this report are made in the light of achieving a state of sustained ecological functioning of the general site environment after construction and during the operational phase of the proposed Road K77. Recommendations made in terms of any civil infrastructural component of the proposed roads and associated infrastructure must first be studied by the design Engineer and certified before implementation.
- ❖ The most preferable design solutions for the crossing of the wetlands and the watercourse would include structures spanning these natural features with supporting beams and pillars which is situated outside of the main wetland area and stream channel. It is understood that these kinds of spanning structures are expensive and uneconomical in relation to the proposed construction of road K77. The recommended mitigation measures are those that are deemed appropriate in relation to the reinforced concrete box culvert infrastructure designed for the purposes of crossing the wetland and the watercourse. ***Concurrent maintenance of the recommended rehabilitation infrastructure will be imperative in order to achieve the sustained ecological functioning of the receiving environment and the structural integrity of the proposed new road infrastructure.***

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