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DEPARTMENT OF PUBLIC WORKS

LESOTHO BORDER ROAD SCOPING REPORT

DRAFT REPORT

REVISION 00

NOVEMBER 2016

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RECORD OF REVISIONS

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00	Draft	Issued for Public Commenting	14/10/2015
00	Draft	Issued together with the Application for Environmental Authorisation to DEA	25/11/2016

EXECUTIVE SUMMARY

The Department of Public Works (DPW) appointed Delta Built Environment Consultants (Delta BEC) to undertake the Environmental Impact Assessment (EIA) process as well as town planning and related work, for the clearance of a site for road development purposes between the Lesotho and Free State border. The study covers a distance of approximately 520 km, stretching from Clarens in the northern part of the Free State Province to Zastron in the southern part of the Free State Province.

The border between Lesotho and the Free State Province of South Africa is the international border for which both countries are responsible. The South African National Defence Force (SANDF) and Department of Agriculture, Forestry and Fisheries (DAFF) respectively, have been entrusted with the guarding and protection of the South African border to ensure that diseases such as foot and mouth disease do not spread to South Africa.

According to a settlement agreement between National Departments, Free State Provincial Departments and Free State Agriculture, the National Department of Public Works (DPW) is responsible for the development and maintenance of the border fences and the border patrol road between South Africa and Lesotho. The patrol road has fallen into disrepair and cannot be effectively used for its intended purpose. Although the road has been in existence and used for several decades, the state has not secured rights to the land or the use thereof for the intended purpose. The proposed road comprises a length of 520 km, traversing approximately 262 properties and a width of 4 m to ensure sufficient passing space for vehicles travelling in opposite directions at regular intervals. The road reserve with a width of 33 m will also be registered for the road.

Environmental authorisation is required for the infrastructure components of the project. The purpose of the EIA is to assess the components of the project that are listed as controlled activities by the National Environmental Management Act (NEMA) and associated regulations, the National Water Act (NWA) and the National Mineral and Petroleum Resources Development Act (MPRDA). The EIA process will provide the information that the environmental authorities require to decide whether the project should be authorised or not, and if so then under what conditions.

As part of this environmental assessment and authorisation process the proposed development would entail:

- Realignment, Design and Construction of the Free State/Lesotho Border Road.
- Repair and construction of the Border Fence.
- Use of construction material sourced from existing licenced borrow pits or as last resort from new borrow pits.
- Construction Camps.
- Repair and reconstruction or construction of bridges and small water crossings.
- Alignment, repair and or construction of access roads and fences.
- Maintenance of the Border Road and its access roads.
- Use of water during the road repair and construction phase.

This Scoping Report is undertaken in compliance with Regulation 21 of GN 982. Table 2-2 indicates how the requirements of Regulation 23(5) of GN 982 (Appendix 2) have been fulfilled in this report.

Table 1-1: Report content requirements in terms of Regulation 21 of GN 982 (Appendix 2)

Regulatory Requirements in terms of Regulation 21 of GN 982	Section of Report
(a) Details of:	**Chapter 2** Page 6-7
(i) The EAP who prepared the report	
(ii) The expertise of the EAP, including a curriculum vitae	
(b) The location of the activity, including –	**Chapter 3** Appendix B:
(i) The 21 digit Surveyor General code of each cadastral land parcel	
(ii) Where available, the physical address and farm name	
(iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties	
(c) A plan which located the proposed activity or activities applied for at an appropriate scale, or, if it is –	**Chapter 3** Page 8-9 **Appendix E:** Proposed Road and Fence Reserve Drawings
(i) A linear development, a description and coordinated of the corridor in which the proposed activity or activities is to be undertaken	
(ii) On land where the property has been defined, the coordinates within which the activity is to be undertaken	
(d) A description of the scope of the proposed activity, including –	**Chapter 4 & 5** Page 10-18 Page 20-43
(i) All listed and specified activities triggered	
(ii) A description of the activities to be undertaken, including associated structures and infrastructure.	
(e) A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process	**Chapter 6** Page 45-52
(f) A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location	**Chapter 7** Page 54-54
(h) full description of the process followed to reach the proposed preferred activity, site and location within the site, including –	**Chapter 8 & 9** Page 56-66 Page 69-73 **Appendix D5** **Chapter 10-20** Page 77-177
(i) details of all the alternatives considered:	
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs	
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them	
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	

Regulatory Requirements in terms of Regulation 21 of GN 982	Section of Report
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reserved (bb) may cause irreplaceable loss of resources (cc) can be avoided, managed or mitigated	**Chapter 21** Page 186-187
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives	**Chapter 21** Page 187-190
(vii) the possible mitigation measures that could be applied and level of residual risk	**Chapter 21** Page 175-183
(viii) the outcome of the site selection matrix	**Chapter 21** Page 187-191
(ix) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such	N/A
(x) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	**Chapter 22** Page 193
(i) a plan of study for undertaking the environmental impact assessment process to be undertaken, including	**Chapter 22** Page 184-192
(i) a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity	
(ii) a description of the aspects to be assessed as part of the environmental impact assessment process	
(iii) aspects to be assessed by specialists	
(iv) a description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists	
(v) a description of the proposed method of assessing duration and significance	
(vi) an indication of the stages at which the competent authority will be consulted	
(vii) particulars of the public participation process that will be conducted during the environmental impact assessment process	
(viii) a description of the tasks that will be undertaken as part of the environmental impact assessment process	
(ix) identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored	
(j) an undertaking under oath or affirmation by the EAP in relation –	**Chapter 23** Page 194-195
(i) the correctness of the information provided in the report	
(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties	
(iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	

Regulatory Requirements in terms of Regulation 21 of GN 982	Section of Report
(k) an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment	
(l) where applicable, any specific information required by the competent authority	-
(m) any other matter required in terms of section 24(4) (a) and (b) of the Act	-

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LIST OF ABBREVIATIONS & ACRONYMS

DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Agriculture and Environmental Affairs
DETEA	Department of Economic Development, Tourism and Environmental Affairs
DM	District Municipality
DEMC	Desired Ecological Management Class
DPW	Department of Public Works
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EC	Ecological Category
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
ESR	Environmental Scoping Report
FEPA	Freshwater Ecosystem Priorities
FRAI	Fish Response Assessment Index
I&AP	Interested and Affected Party
IHI	Index of Habitat Integrity
IHIA	Intermediate Habitat Integrity Assessment
IHAS	Invertebrate Habitat Assessment System
MAR	Mean Annual Precipitation
MIRAI	Macro-invertebrate Response Assessment Index
MPRDA	National Mineral and Petroleum Resources Development Act
NDF	National Defence Force
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priorities
NGO's	Non-Governmental Organisations
NWA	National Water Act
PEMC	Present Ecological Management Class
PEP	Project Execution Plan

PES	Present Ecological State
PPP	Public Participation Process
REC	Recommended Ecological Category
RQS	Resource Quality Services
SASS5	South African Scoring System 5
SANDF	South African National Defence Force
Scoping & EIR	Scoping and Environmental Impact Assessment Process
subWMA	Sub-Water Management Area
WMA	Water Management Area
WULA	Water Use License Application

1 INTRODUCTION

An agreement was signed between certain National Departments, Provincial Departments and Free State Agriculture which expressly conveys the responsibility of maintaining South Africa's border roads to the National Department of Public Works. The above agreement, which informs and underpins this project, specifically relates to the border road between the Free State Province and the country of Lesotho.

In order to develop a comprehension of the overall context of this project it is important to take cognisance of the fact that the agreement referred to in the paragraph above essentially emanated as a result of one primary consideration or problem being experienced. This problem can be summarised as the fact that the existing border road between the Free State Province and the country of Lesotho has fallen into disrepair and can therefore not be utilised for its intended purpose, namely the patrolling of the South African border.

The resultant implication of the border road falling into disrepair, namely the inability to patrol the border, presents significant and fundamental risks to the safety and security of the country and the directive was therefore passed to reinstate the usability of the road (and related infrastructure) as a matter of urgency.

In order to efficiently give effect to its mandate the National Department of Public Works will have to commission and implement a sequential process incorporating all required processes, actions and activities to allow for the actual completion of the construction and rebuilding of the border road.

To address the above need, the National Defence Force as the client of the National Department of Public Works, initiated a project that entails the preparation of a comprehensive site audit. In that way obtaining environmental authorisation for the proposed construction of the Lesotho Border road, which will then form the basis for defining the fence and road reserve and establishing the site for 'site clearance'.

To achieve the above mentioned it requires the execution of basic road planning activities through:

- Conducting of a detailed technical – engineering and geotechnical –environmental, planning and land use, cadastral and land tenure assessment of the existing road and its access roads
- Determining the class of road required. The road must be a usable road of a durable and permanent nature that enables the effective patrolling of the border, whilst minimising future maintenance requirements. The road needs to comply with minimum Departmental specifications
- Execution of road planning and design work, to determine possible route and road alternatives (three alternatives) for the road route/alignment and selection, to the level required to secure environmental authorisation
- Determining the need for the repair and reconstruction of the service road and its access roads
- Selecting the most optimal route in terms of integrated environmental management and planning

- Obtaining environmental authorisation for the preferred road route
- Acquiring of the land.

The above work will form the basis for informing the subsequent project phases of detailed road design and construction of the road.

The expected final deliverable for this project is an approved road route, including environmental authorisation, secured reserve/ servitudes, Project Execution Plan (PEP) and a cost report.

The environmental studies to be undertaken for the project will be divided into two phases namely:

- **Scoping Report** which is presented in this report
- **Environmental Impact Assessment (EIA)** which will include and Environmental Impact Assessment Report (EIAR) as well as an Environmental Management Programme (EMPr). The EMPr will be compiled based on the findings of the EIAR, providing mitigation measures and management actions for possible impacts identified, followed by the planning phase of the proposed linear development.

As part of the EIA process, other legislation and regulating authorities also need to be consulted. The following processes will also be included as part of the EIA authorisation as appropriate:

- Mining permits for any new borrow pits under the Mineral and Petroleum Resources Development Act, 2002
- Protection of graves and burial grounds and the demolition or alteration of a structure older than sixty years and palaeontological resources, under the National Heritage Resources Act, 1999
- Water use licensing/authorisation under the National Water Act, 1998 for all wetland and riparian zones, working within the flood line areas and the use of water for construction purposes.

1.1 METHODOLOGY

The Scoping Report provides the necessary project description and information required by the National Department of Environmental Affairs (DEA) to establish if all project activities, environmental criteria and legal obligations have been considered in order for the proposed development to comply with the requirements in terms of NEMA, the EIA Regulations, 2014 (GNR. 982, 983, 984 and 985) and the relevant specific legislation as it pertains to environmental protection.

This report has been prepared with regard to the following documents:

- Delta Built Environment Consultants, Lesotho Border Road – Basic Planning and Route Determination Report (Revision 00, July 2015 as amended).
- Delta Built Environment Consultants, Lesotho Border Road – Road Geometry and Pavement Design Report (Revision 00, July 2015 as amended).

- Delta Built Environment Consultants, Lesotho Border Road – Stormwater and Flood line Assessment Report, Reference No. 17/1/4/1/6732/3 (Revision 00, July 2015 as amended).
- Delta Built Environment Consultants, Lesotho Border Road – Road and Infrastructure Site Audit Report, Reference No. 17/1/4/1/6732/3 (Revision 00, July 2015).
- Delta Built Environment Consultants, Lesotho Border Road – Preliminary Geotechnical Report, Reference No. 17/1/4/1/6732/3 (Revision 00, July 2015, subject to the final investigation report).
- Delta Built Environment Consultants, Phase 1: Lesotho / Free State Border: Traffic Impact Assessment, Reference No. 17/1/4/1/6732/3 (Revision 00, July 2016)
- Delta Built Environment Consultants, Lesotho Border Road – Land Use Report, Reference No. 17/1/4/1/6732/3 (Revision 00, July 2015, as amended).
- Scientific Aquatic Services, Wetland, Aquatic, Floral and Faunal Scoping Report for the Proposed Lesotho Border Road and Fence within the Free State Province (Revision 00, SAS 214261 September 2015).
- Scientific Aquatics Services, Soil and Land Capability Scoping Report for the Proposed Lesotho Border Road and Fence within the Free State Province (Revision 00, SAS 2015206 September 2015).
- J van Schalkwyk (D Litt et Phil), Heritage Consultant, Cultural Heritage Impact Assessment for the Proposed Eastern Free State Province (2015/JvS/003 January 2015).
- Dr H Fourie, Palaeontological Consultant, Palaeontological Impact Assessment: Phase 1 for the Proposed Eastern Free State Province (Revision 00, SAS 215207, September 2015).
- Willem du Preez, The Geotechnical Hub, Evaluation of potential borrow Pit (March 2016)
- Jonny Steinberg, Institute for Security Studies (ISS): The Lesotho/Free State Border. (ISS Paper 113, October 2005).

A methodology was developed to formally screen the proposed road development, based on the requirements of NEMA and associated EIA Regulations (2014) and therefor examines the development activity and the related legal obligations (i.e. permits/licenses and/or approvals required).

1.2 OBJECTIVE OF THE SCOPING PHASE

In terms of Government Notice R982 of 4 December 2014 (Appendix 2, Section 1), the scoping process is to, through a consultative process:

a) identify the relevant policies and legislation relevant to the activity

b) motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location

c) identify and confirm the preferred activity and technology alternatives through an impact and risk assessment and ranking process

d) identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment

e) identify the key issues to be addressed in the assessment phase

f) agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site

g) identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

1.3 STRUCTURE OF THIS REPORT

The report structure is summarised in the table below.

Table 1-1: Report Structure

CHAPTER	CONTENT
Chapter 2	Details of the EAP
Chapter 3	Location of the activity
Chapter 4	Plan depicting the proposed activities applied for
Chapter 5	Description of the scope of the proposed activity,
Chapter 6	Policy and legislative context
Chapter 7	Motivation for the need and desirability for the proposed ACTIVITY
Chapter 8	Alternatives considered
Chapter 9	Details of the public participation process undertaken
Chapter 10	Declaration of the EAP
Chapter 11	Ecological baseline assessment
Chapter 12	Floral baseline assessment
Chapter 13	Faunal baseline assessment
Chapter 14	Water catchment areas baseline assessment
Chapter 15	Flood lines and hydrology
Chapter 16	Wetland and aquatic baseline assessment
Chapter 17	Heritage resources
Chapter 18	Paleontological resources
Chapter 19	Socio-economic baseline

CHAPTER	CONTENT
Chapter 20	Socio-cultural baseline
Chapter 21	Impacts and risks identified
Chapter 22	Plan of study for the Environmental Impact Assessment (EIA) Report
Chapter 23	Project conclusion and way forward
Chapter 24	References
Chapter 25	Glossary of terms
Chapter 26	Appendixes

2 DETAILS OF THE EAP

2.1 ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Roelien du Plessis (External Environmental Assessment Practitioner – Life4All Environmental Consultancy)

Roelien du Plessis completed her MA in Environmental Management in 2011 and is a lecturer at Unisa in Environmental Management and present honours level modules in Integrated Environmental Management, Environmental Management Systems and Auditing, and Environmental Management for Civil and Chemical Engineers on BTech level. She has 14 years of experience in environmental management.

She is a member of several professional institutions and associations such as (Integrated Waste Management South Africa (IWMSA), Water Institute of South Africa (WISA), the Geographical Society of South Africa (GSSA) and International Association for Impact Assessment South Africa (AIAsa).

The expertise of the EAP, including her curriculum vitae is attached in **Appendix A.**

Gerhard Schoeman (Environmental Assessment Practitioner – Delta Built Environment Consultants)

Gerhard Schoeman graduated in 2009 with a B.Sc. in Tourism and completed his BSc Honours in Environmental Sciences [Geography and Environmental Management] in 2011. He also completed a training course in Environmental Law in 2016 (Accreditation No: SAAMA01141).

Gerhard is the environmental unit manager and senior environmental analyst at Delta BEC with five (5) years of experience in environmental management. His responsibilities include formulating direct environmental policies and procedures to enforce compliance with all environmental legislation and regulations as applicable.

The work entails providing environmental consultation and advice to clients, which encompasses various environmental services ranging from environmental site analyses and mapping using his GIS capabilities, managing specialist studies, facilitating public participation, compiling environmental impact assessments reports, water use license applications, compliance monitoring and auditing, and providing strategic environmental planning advice for engineering-based projects.

He is also an avid member of the Land Rehabilitation Society of South Africa (LaRSSA) and is a South African affiliate of the International Association for Impact Assessment (IAIA).

2.2 PROJECT TEAM

Stephen van Staden (Environmental Aspects)

Stephen van Staden completed an undergraduate degree in Zoology, Geography and Environmental Management at RAU. On completion of this degree, he undertook an honours course in Aquatic health through the Zoology department at RAU. In 2002 he began a Master's degree in environmental management, where he did his mini dissertation in the field of aquatic resource management, also undertaken at RAU. At the same time, Stephen began building a career by first working at an environmental consultancy

specialising in town planning and infrastructure developments, after which he moved to a larger firm in late 2002. From 2002 to the end of 2003, he managed the monitoring division and acted as a specialist consultant on water resource management issues and other environmental processes and applications. In late 2003, Stephen started consulting as an independent environmental scientist, specialising in water resource management under the banner of Scientific Aquatic Services. In addition to aquatic ecological assessments, clients started enquiring about terrestrial ecological assessments and wetland assessments. Stephen, in conjunction with other qualified ecologists, began facilitating these studies as well as highly specialised studies on specific endangered species, including grass owls and arachnids and invertebrates and various vegetation species. Scientific Aquatic Services soon became recognised as a company capable of producing high quality turnkey biodiversity assessments. Stephen soon began diversifying into other fields, including the facilitating and managing the WULA process, rehabilitation studies, and development of design criteria for infrastructure developments to meet environmental objectives.

Stephen has experience on well over 1000 environmental assessment projects with specific mention of aquatic and wetland ecological studies as well as terrestrial ecological assessments and project management of environmental studies. Stephen has a professional career spanning more than 13 years, of which almost 12 years have been as the owner and managing member of Scientific Aquatic Services and the project manager on most projects undertaken by the company.

Stephen is registered by the SA RHP as an accredited aquatic bio monitoring specialist and is also registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) in the field of ecology. Stephen is also a member of the Gauteng Wetland Forum and South African Soil Surveyors Association (SASSO) and the International Association of Impact Assessors (IAIA).

Nelanie Cloete (Environmental Aspects)

Nelanie Cloete is a botanist with a Master's degree in Botany and Environmental Management. Since 2008 to the current date she acted as a specialist consultant on floral and wetland assessments and other environmental processes and applications such as permit applications for Red Data Listed (RDL) floral and protected tree species. Currently Nelanie is also involved as a junior project manager for numerous projects within the company, managing specialist within and outside of the company, arranging and managing site assessments, project administration, guidance and interpretation of field data and liaising with clients.

Nelanie is registered at the South African Association of Botanists (SAAB) and is also registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). Nelanie is also a professional member of the Grassland Society of South Africa (GSSA) and member of the South African Affiliate of the International Association for Impact Assessment (IAIAsa) group.

3 LOCATION OF THE ACTIVITY

3.1 PROVINCE:

The road is situated in the Free State Province along the Lesotho and Free State border (see Figure 3-1 on next page). A plan which locates the proposed linear activity, including the 21 digit Surveyor General code (ID) of each cadastral land parcel / farm portion is detailed in **Appendix B.**

3.2 MUNICIPALITIES:

District Municipalities:	Thabo Mofutsanyana District Municipality Xhariep District Municipality
Local Municipalities and Ward numbers:	Dihlabeng Local Municipality: FS192 (W20 & W12) Setsotso Local Municipality: FS191 (W15 & W9) Mantsopa Local Municipality: FS196 (W2 & W3) Mangaung Metropolitan Municipality: FS164 (W1 & W3) Mokohare Local Municipality: LM - FS163 (W3)

3.3 TOWNS

Nearest towns:	Fouriesburg Ficksburg Clocolan Ladybrand Maseru Hobhouse Wepener Zastron.

3.4 FARM NAME(S) AND NUMBER(S)

Farm names, numbers and Portion numbers	The proposed road comprises a length of approximately 520 km, traversing 262 properties.

Figure 3-1: Map of proposed border road route

4 LISTED ACTIVITIES TO BE AUTHORISED IN TERMS OF NEMA

Environmental Authorisation (EA) is required for the infrastructure components of the project. The purpose of the Scoping and EIA is to assess the components of the project that are listed as controlled activities by the National Environmental Management Act (NEMA) and associated regulations, the National Water Act (NWA) and the National Mineral and Petroleum Resources Development Act (MPRDA).

The project activity triggers several listed activities in Listing Notices 1, 2 and 3 which requires Environmental Authorisation before a developer can undertake any of the project-specific activities listed in the table below.

Table 4-1: List of activities to be authorised in terms of NEMA

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
GN R.983, Activity 12 The development of- (i) canals exceeding 100 square metres in size. (ii) channels exceeding 100 square metres in size. (iii) bridges exceeding 100 square metres in size. (iv) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size; (v) bulk storm water outlet structures exceeding 100 square metres in size; (vi) buildings exceeding 100 square metres in size. or (vii) infrastructure or structures with a physical footprint of 100 square metres or more. where such development occurs- (a) within a watercourse. (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. - excluding- (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves.	<u>Repair and Reconstruction of Bridges and Small Water Crossings</u> Small, full width concrete drifts will be constructed across minor streams. Concrete culverts and clear span bridges will be constructed across major crossings. The drainage design will dictate the appropriate measures to be employed. <u>Development within Wetland and Riparian Zones</u> Where it is not possible to divert the proposed linear development to avoid wetland/riparian resources, consideration shall be given to the placement of infrastructure within such resources in order to minimise impacts such as in stream flow modifications and bed modifications. Consideration of the locality of wetland/riparian resources shall be ensued in the planning the final route alignment of the road in order to avoid, as far as feasible, the placement of infrastructure within these resources. In this regard, the applicable flood lines shall also be considered and avoided where possible.
GN R.983, Activity 14: The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in	<u>Construction Camps</u> Construction camps will be positioned on land close to the proposed linear development. Materials and equipment (i.e. aboveground fuel storage tanks)

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres	will be used temporarily during the construction of the proposed linear development, and rehabilitated once the construction phase has been completed. Exact locations of the construction camps will be determined later in the EIA phase.
GN R.983 Activity 19: 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; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.	<u>Wetlands and Rivers</u> Where it is not possible to divert the proposed linear development/upgrade to avoid wetland resources or utilise existing water crossings, consideration shall be given to the placement of infrastructure within such resources in order to minimise impacts such as in stream flow modifications and bed modifications. <u>Maintenance Management Plan</u> It is proposed that a maintenance management plan be developed for future maintenance required for the proposed border road and fence system. The maintenance management plan will focus on providing guidance on preventative maintenance for road sections that require such measures including the requirement and control of alien and invasive plants within observation zones and along the border fence.
GN R.983 Activity 21: Any activity including the operation of that activity which requires a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	<u>Utilisation of Natural Resources for the Construction of the Roadway from New and Existing borrow pits</u> The construction of the road will require suitable construction material, inter alia, to be sourced from new and/or existing borrow pits.
GN R.983 Activity 22 The decommissioning of any activity requiring – (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent	<u>Utilisation of Natural Resources for the Construction of the Roadway from New and Existing borrow pits</u> The construction of the road will require suitable construction material to be sourced from new and/or preferably existing borrow pits.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
authority has in writing agreed that such reduction in throughput does not constitute closure.	
GN R.983 Activity 24 The development of- (i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding- (a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or (b) roads where the entire road falls within an urban area.	<u>Proposed Road and Fence Reserve</u> The project aims to secure the required and defined reserve (Right of Way) in favour of the state for the road reserve. Therefore, the main objective of this project is to determine and establish the site for the road and to obtain "site clearance" for the road and fence reserve. The road and fence reserve will vary depending on the topography and local conditions and will comprise the following: The road, The observation zones, and The fence. The road surface area is 4 m wide throughout the entire length of the proposed route (excluding the road infrastructure such as storm water channels etc.). The SANDF require a minimum of a 5 m wide clear observation zone on each side of the road. The most important part of the observation zone is a clear line of sight between the road and the international boundary. The 5 m wide observation zone is not a fixed width and can be reduced to a minimum of 1 m to accommodate the topography and local conditions. The average road reserve width can therefore comprise 14 m (5 m observation zone + 4 m road + 5 m observation zone) depending on the topography and local conditions. Under certain conditions the road reserve area could increase to 33 metres or even more where the fence deviates from the road. Where the road and al fence deviate of necessity, a separate fence reserve of 5 m will be created.
GN R.983 Activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	<u>Fence and Road Reserve</u> Clearance of indigenous vegetation will be required for the road and fence reserve. The clearance of vegetation will also be applicable for the minimum of a 5 m wide clear line of sight required for the observation zone on each side of the road. Plaese refer to **Appendix E:** Proposed Road and Fence Reserve Drawings.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
	Maintenance Management Plan It is proposed that a maintenance management plan be developed for future maintenance required for the proposed border road and fence system. The maintenance management plan will focus on providing guidance on preventative maintenance for road sections that require such measures including the requirement and control of alien and invasive plants within observation zones and along the border fence.
GN R.983 Activity 45 The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and a. where the facility or infrastructure is expanded by more than 1000 metres in length; or b. where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion- (aa) relates to transportation of water or storm water within a road reserve; or (bb) will occur within an urban area.	The repair and reconstruction of bridges and small water crossings Concrete culverts and clear span bridges will be constructed/ upgraded/ expanded across major river and wetland crossings. The drainage design will dictate the appropriate measures to be employed.
GN R.983 **Activity** 48 The expansion of- . (i) canals where the canal is expanded by 100 square metres or more in size; (ii) channels where the channel is expanded by 100 square metres or more in size; (iii) bridges where the bridge is expanded by 100 square metres or more in size; (iv) dams, where the dam, including infrastructure and water surface area, is expanded by 100 (v) square metres or more in size; (vi) weirs, where the weir, including infrastructure and water surface area, is expanded by 100 square metres or more in size;	Repair and Reconstruction of Bridges and Small Water Crossings Existing concrete drifts will be upgraded across minor streams. Concrete culverts and clear span bridges will be upgraded across major crossings.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
(vii) bulk storm water outlet structures where the bulk storm water outlet structure is expanded by 100 square metres or more in size; where such expansion or expansion and related operation occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding- (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such expansion occurs within an urban area; or (ee) where such expansion occurs within existing roads or road reserves.	
GN R.983 **Activity** 49 The expansion of – (iii) buildings by more than 100 square metres;or (v) infrastructure or structures where the physical footprint is expanded by 100 square metres or more where such expansion or expansion and related operation occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding- (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such expansion occurs within and urban area; or (ee) where such expansion occurs within existing roads or road reserves.	<u>Wetlands and Rivers</u> Where it is not possible to divert the proposed linear development/upgrade to avoid wetland resources or utilise existing water crossings, consideration shall be given to the placement of infrastructure within such resources in order to minimise impacts such as instream flow modifications and bed modifications <u>Repair and Reconstruction of Bridges and Small Water Crossings</u> Existing concrete drifts will be constructed and/or upgraded across minor streams. Concrete culverts and clear span bridges will be constructed and/or upgraded across major crossings.
GN R.984 Activity 15	<u>Maintenance Management Plan</u>

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	It is proposed that a maintenance management plan be developed for future maintenance required for the proposed border road and fence system. The maintenance management plan will focus on providing guidance on preventative maintenance for road sections that require such measures including the requirement and control of alien and invasive plants within observation zones and along the border fence.
GN R. 984 Activity 27: The development of - (i) a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act [No. 7 of 1998] (ii) a road administered by a provincial authority (iii) a road with a reserve wider than 30 metres (iv) a road catering for more than one lane of traffic in both directions; but excluding the development and related operation of a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010, in which case activity 24 in Listing Notice 1 of 2014 applies.	Development of a road administered by a provincial authority and that has a reserve wider than 30 metres.
GN R. 985 Activity 4: The development of a road wider than 4 metres with a reserve less than 13, 5 metres. (a) In Free State province ii. Outside urban areas, in; (aa) A protected area identified in terms of NEMPAA, excluding disturbed areas (bb) National Protected Area Expansion Strategy Focus areas (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (dd) Sites or areas identified in terms of an International Convention (ee) Critical biodiversity areas as identified in systematic biodiversity plans	<u>Road Reserve</u> The road is 4 m wide throughout the entire length of the proposed route. The SANDF require a 5 m wide observation zone on each side of the road. The most important part of the observation zone is a clear line of sight between the road and the international boundary. The 5 m wide observation zone/reserve is not a fixed width and can be reduced to a minimum of 1 m to accommodate the topography. The road reserve will therefore vary depending on the topography between the fence and the road. Plaese refer to **Appendix E**: Proposed Road and Fence Reserve Drawings.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
adopted by the competent authority or in bioregional plans (ff) Core areas in biosphere reserves (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas (hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.	
GN R. 985 Activity 10: The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. (a) In Free State province: ii. Outside urban areas, in: (aa) A protected area identified in terms of NEMPAA, excluding conservancies (bb) National Protected Area Expansion Strategy Focus areas (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (dd) Sites or areas identified in terms of an International Convention (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (ff) Core areas in biosphere reserves (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas	<u>Construction Camps</u> Construction camps will be positioned on land close to the proposed linear development. Materials and equipment (i.e. above ground fuel storage tanks and fuel bowsers) used during the construction of the proposed linear development will be temporarily stored in these areas, and rehabilitated once the construction of the proposed linear development has been completed. Exact locations of the construction camps will be determined later in the EIA phase.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
(hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.	
GN R. 985 Activity 12: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (a) In Free State provinces; i. Within any critically endangered or endangered prior to the publication of such a list, within an area that ecosystem listed in terms of section 52 of the NEMBA or has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004 ii. Within critical biodiversity areas identified in bioregional plans iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.	<u>Repair and Reconstruction of the Road, Bridges and Small Water Crossings</u> Where it is not possible to divert the proposed linear development/upgrade to avoid indigenous vegetation and wetland resource, consideration shall be given to the placement of infrastructure within such resources in order to minimise impacts such as instream flow modifications and bed modifications <u>Maintenance Management Plan</u> It is proposed that an alien invasive plant management plan and a general road maintenance management plan be developed for future maintenance required for the proposed border road and fence system. The maintenance management plan will focus on providing guidance on preventative maintenance for road sections that require such measures including the requirement and control of dense populations of alien and invasive plants within the observation zone and along the border fence.
GN R. 985 Activity 14: The development of; (i) canals exceeding 10 square metres in size (ii) channels exceeding 10 square metres in size (iii) bridges exceeding 10 square metres in size (iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size	<u>Repair and Reconstruction of the Road, Bridges and Small Water Crossings</u> Where it is not possible to divert the proposed linear development/upgrade to avoid indigenous vegetation and wetland resource, consideration shall be given to the placement of infrastructure within such resources in order to minimise impacts such as instream flow modifications and bed modifications.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
(vi) bulk storm water outlet structures exceeding 10 square metres in size (vii) marinas exceeding 10 square metres in size buildings exceeding 10 square metres in size (viii) boardwalks exceeding 10 square metres in size (ix) Infrastructure or structures with a physical footprint of 10 square metres or more, Where such development occurs; a) within a watercourse b) in front of a development setback c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse Excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	
GN R. 985 Activity 18: The widening of a road wider than 4 metres, or the lengthening of a road by more than 1 kilometre. (a) In Free State province ii. Outside urban areas, in; (aa) A protected area identified in terms of NEMPAA, excluding disturbed areas (bb) National Protected Area Expansion Strategy Focus areas (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (dd) Sites or areas identified in terms of an International Convention (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (ff) Core areas in biosphere reserves (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a	<u>Reconstruction of the Border Road</u> The road itself covers a distance of approximately 520 km.

Listed activity as described in General Notice (GN) R.983, 984 and 985	Description of project activity that triggers listed activity
biosphere reserve, excluding disturbed areas (hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.	

5 ACTIVITIES TO BE UNDERTAKEN

The proposed development activities to be undertaken is summarised below and will be discussed in detail in the sections to follow.

The overall length of the proposed linear development is 520 km. A full-width gravel wearing course will be feasible for 85% of the road and is generally the cheapest to construct, but requires maintenance and periodic re-gravelling which is usually the highest cost involved.

Approximately 8% of the road is located in mountainous areas (longitudinal slope >8%). Erosion becomes problematic on steep inclines, as paving blocks and concrete strips start to shove downhill. It is recommended that a full-width concrete pavement be constructed on steep inclines or downhill sections.

Approximately 18% of the road is located within the 1:100 year flood line. It should be noted that various alternative alignments and pavement designs were considered to ensure the proposed development is feasible, constructible and sustainable.

Approximately 5% of the road is affected by wetlands. The proposed pavement method will vary, depending on the availability of rock. The road will be lifted approximately 1.5 m to 2.0 m above the natural ground line. The exact level will be checked and placed depending on the estimated flood volume of surface water. Appropriately sized culverts will be placed at low points to ensure that the road does not impede the flow of water, even in the event that the rock matrix clogs up.

The feasibility of the stormwater design will deliberate the following:

- Minimise disaster management associated with floods
- Prevent accidents and loss of human lives
- Reduction or mitigation of adverse impacts on the natural watercourse
- Enhance social, ecological and amenity value of the water course and its floodplain.

The Geotechnical Hub (professional consultant) has commenced with investigations to identify possible borrow pit sites in close proximity to the project area including the possible volumes of material to be sourced from these borrow pits. From the investigations done, it was found that 42 borrow pits could potentially provide enough material to construct the road.

A number of factors or descriptors need to be considered before making a decision whether maintenance is or would be required. An experienced route manager will need to rate and consider the aspects on the gravel road before recommending or doing maintenance: after one or a few descriptors are found to trigger maintenance, the specific maintenance action plan shall commence to maintain the functional condition of the road.

5.1 PROPOSED ROAD DESIGN

5.1.1 SANDF REQUIREMENTS

In terms of the South African National Defence Force Safeguarding Operations, the general requirements for border road infrastructure are as follows:

- It must provide patrol and reaction capabilities throughout the calendar year (365 days) under all weather conditions (bare extreme situations or cases of force major) during the day and night. Provision must be made for provincial/area unique situations i.t.o. specific weather occurrences and terrain features.
- The utilisation of the roads will be for operational and support purposes utilizing 4x4 vehicle categories.
- A width of 5 m is an important requirement, but it is accepted that this will not be possible in all cases.
- Thick vegetation directly next to the road that can obscure sight/observation from a vehicle must be controlled or removed to distances that are tactically applicable for that specific portion of the road.
- Borderline roads must be next to/close to the designated border fence or in close proximity. Where it is not possible for the road to be close or next to the fence, vegetation between the road and fence must be controlled or removed to allow for observation of the border fence from the road.
- Steep inclines/declines must be addressed in such a manner that it will allow safe negotiability under rainy conditions.
- Depending on the terrain, sufficient passing space for vehicles travelling in opposite directions at regular intervals will be required.
- The surface should be able to allow reaction vehicles to attain a speed of 50 km/h. Patrol speed will be approximately 25-30 km/h.

5.1.2 DESIGN STANDARDS

The geometric design standards, extracted from *Guidelines for Human Settlement Planning and Design*, 2000, better known as the *Red Book*, have been adopted. Two design speeds have been identified to lower design speed only where the higher design speed is not practical or feasible. See below Table 5-1 the geometric design standards summarised.

Table 5-1: Geometric design standards

DESIGN SPEED	50 KM/H	30 KM/H
Min. centreline radius	95 m	30 m
Min. longitudinal gradient	0.5 %	0.5 %
Max. longitudinal gradient	9 %	9 %
Min. K-value: Crest Sag	11 12	6 8
Min. vertical length	80 m	80 m

DESIGN SPEED	50 KM/H	30 KM/H
Camber	2 %	2 %
Max. superelevation	4 %	4 %
Max. superelevation runoff	40 m	30 m

5.1.3 ROAD CROSS SECTION

During the course of the project, the total carriageway width was reduced from 5 m to 4 m. The lane width was not reduced, only the shoulder width on each side of the road was reduced from 1 m to 0.5 m. See Table 5-2 the new road cross section summarised.

Table 5-2: Road cross section

ASPECT	DESCRIPTION
Lanes per direction	1
Lane width	3 m
Shoulder width	0.5 m on either side
Total carriageway width	4 m
Road camber	2 %
Cut slope finish	1: 1.5
Fill slope finish	1: 2.0

5.2 PROPOSED BORDER FENCE

The purpose of a fence is to indicate land or farm boundaries, protect crops planted on the arable lands from the livestock and to enable a camp grazing system. There are a few factors to consider when a fence is to be constructed such as topography, types of animals to control, material choice and availability of funds.

5.2.1 REQUIREMENTS OF AN EFFECTIVE FENCE

The following requirements are necessary for an effective fence:

- It should be impenetrable for the animals.
- If possible it should restrict the movement of people.
- The fence must be visible to the livestock but should be aesthetically acceptable.
- All fences must be kept clear of vegetation to prolong its lifespan and for ease of maintenance.
- Straining posts are the foundation of the fence and should be planted properly. These poles must not only carry the vertical weight of the fence, but also withstand the horizontal strain. The poles must be planted into the ground with soilcrete (a dry mixture of soil and cement).

- The function of the intermediates and line posts are to support the fence and keep it upright. Y-standards are knocked into the ground and are therefore cheaper than pipe posts or wooden poles that have to be planted.
- The function of the corner posts is to successfully change the position of the fence line along the given route of the international border.
- The function of the droppers or hangers is to space the wires at an even distance apart and to minimize the distance between the intermediate posts. The droppers must also be placed upright and then tied to the straining wires.
- The function of cladding is to provide an impenetrable division or barrier along the border to inhibit the movement of livestock.
- As far as possible, the gates must be the same height as the fence, supported with stays in the fence direction. No straining wires must run overhead across the gate, as it will restrict the thoroughfare.
- For the Lesotho border fence no gates will be allowed in the fence except on the border posts where movement can be controlled and where access is granted for livestock watering points and pump facilities in the river systems.

The agreed specifications for the fence comprise a minimum of 1.8 m high fence with four (4) cables to increase strength and to prohibit/hinder the entrance of illegal immigrants, livestock and vehicles.

It is recommended to install the 2.2 m Jackal Proof Fence as the inner border fence. This provides the most comprehensive security for the current situation. While deciding to go for a 2.2 m high fence, it is recommended to use the steel corner, posts configuration rather than that of the hardwood option. Furthermore it is recommended to install a 4th galvanised cable to increase strength and rigidity of the fence.

5.2.2 PROPOSED FENCE CONFIGURATION

The fence height will be 2.2 m, with steel Corner, Slip and Straining posts (3.1 m X 100 mm Ø X 3 mm wall thickness). These posts must be concreted into the ground to a minimum depth of 900 mm, the horizontal pole of the configuration must be welded to the vertical posts and all vertical poles must be capped to prevent water from entering the pole.

Straining posts may not exceed 300 m intervals therefore can be erected at shorter intervals as needed to suite the relief.

Corner posts must be erected at every corner where the obtuse angle of directional change is less than 140˚ and can function as a Straining post.

Slip posts to be erected at every corner where the obtuse angle due to directional change is more than 140˚ these poles cannot be used as Straining posts but must rather be seen as Anchor posts.

Anchor posts (2.8 m X 75 mm Ø X 2mm wall thickness) to be placed at 75 m intervals between the Straining posts. These posts must be concreted to a minimum depth of 600 mm into the ground and capped to prevent water from entering and accumulating in the poles.

Intermediates must be 2.8 m X 45 mm Y or I- standards according to SANS standards and will be placed at 15 m intervals between the Anchor posts. These standards must be knocked into the ground to a minimum depth of 600 mm.

Droppers (2.2 m steel droppers according to SANS standards) must be placed at intervals of 1.5 m between the Intermediate posts.

The cladding must be 15 strands, fully galvanized double strand, high tensile steel barb wire according to SANS. The strands must be spaced with an additional strand spaced 100 mm above the last strand. Furthermore four (4) additional 12 mm, 7x4 mm hot dipped galvanized stay wire cables can be added starting 350 mm from the ground, spaced 300 mm apart. Fully galvanized jackal proof netting (1.2 m x 75 mm hexagonal pattern with a minimum strand diameter of 1.6 mm according to SANS) to be fixed to the three (3) bottom strands (double twisted fully galvanized barbed wire, according to SANS). The wire netting must be tied horizontally at 500 mm intervals to each strand using 1.6 mm fully galvanized binding wire.

5.3 PROPOSED GATES AND CATTLE GRIDS

5.3.1 GATES

The following are instances where gates will be applicable for installation:

- Access to the river where owners have a water use licence
- Access to the river where cattle graze
- Access to arable land
- Access to infrastructure or farm activities.

The figure below illustrates the general design of gates that can be used dependant on the height of the fence.

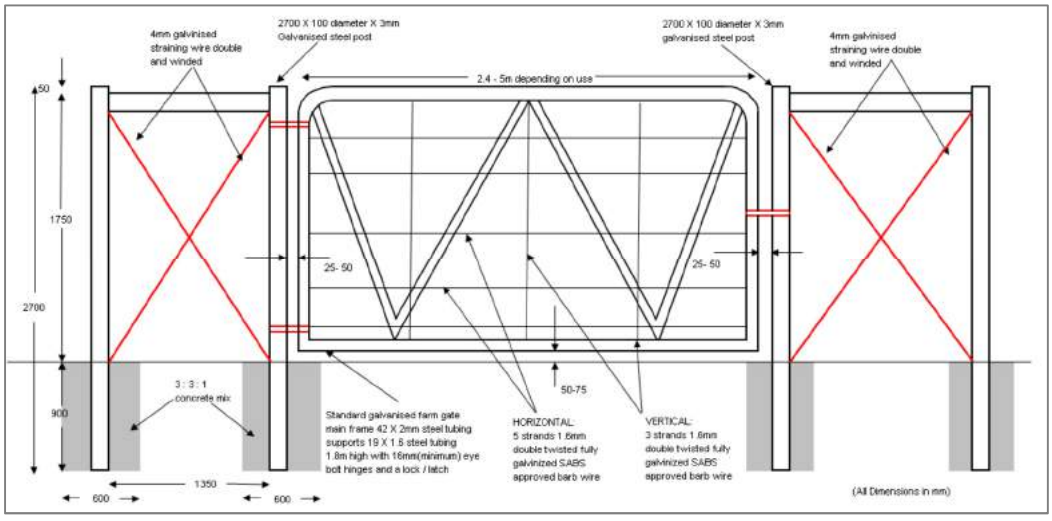


Figure 5-1: General Gate Design

Standard farm gates can be used to ensure access for vehicles and animals. To manufacture the gates the following specifications must be adhered to:

- Frame material = 42 mm Ø X 2 mm galvanised round tubing

- Inside support = W pattern with 19 mm Ø X 1.6 mm galvanised round tubing
- Wire support:
  - Horizontal = 5 sets of 1.6 mm fully galvanized double twisted high tensile steel wire
  - Vertical = 3 sets of 1.6 mm fully galvanized double twisted high tensile steel wire
- Gate hanger = 16 X 50 X 300 mm eye bolts with 200 mm thread starting 50 mm from eye bolt
- All material must be galvanized

5.3.2 CATTLE GRIDS

Cattle grids will be installed where the border road crosses farm boundaries.

5.4 PROPOSED ROAD AND FENCE SYSTEM

The proposed typical road and fence system (see Figure 5-2) will generally comprise:

- The **outer fence** (international border fence) as applicable.
- An **Observation Control Zone** of 5 metres that ensures a clear line of sight, located between the international border and the border road, with an outer fence. This is also an area that need to be protected from general movement and that provide for the installation of border monitoring equipment and technology in the future.
- The **Inner Fence** (also referred to as the secondary fence). It must be noted that the inner fence could be constructed according to the discretion of the Department.

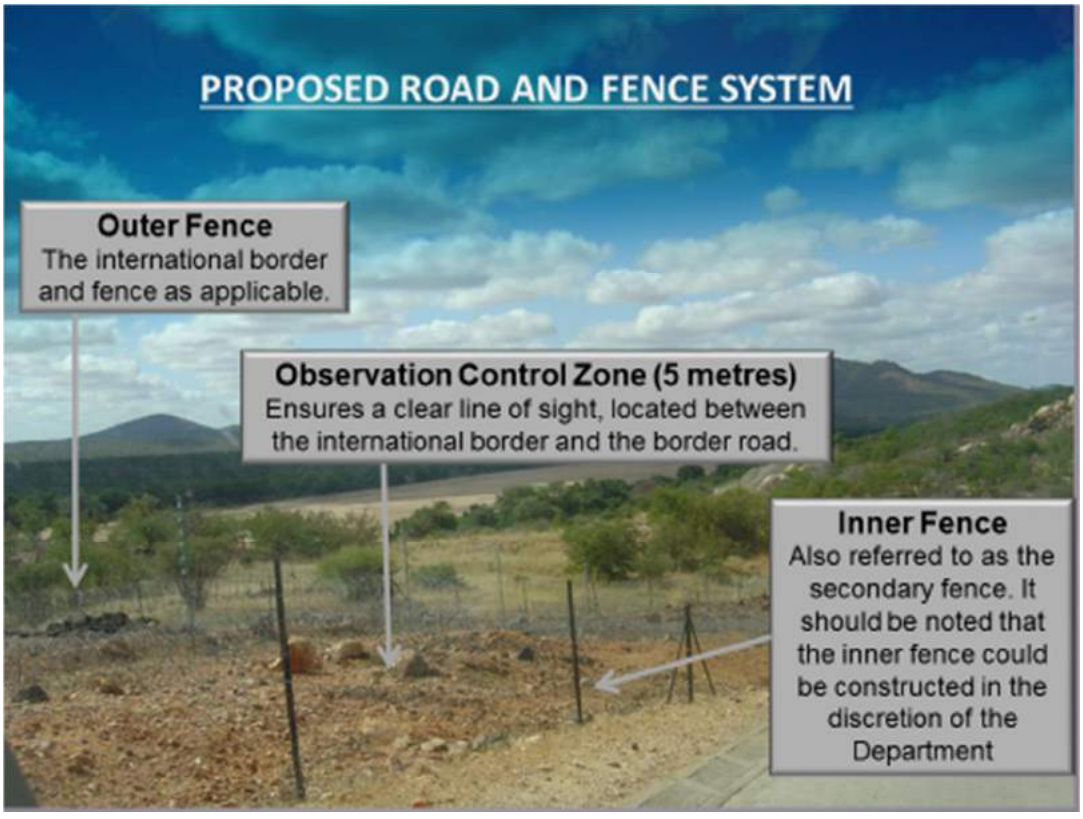


Figure 5-2: Proposed Road and Fence System

The inner and outer fence must be a minimum of 1 m away from the road surface to provided adequate space for the road infrastructure. The road is also not required to be in the centre of the single reserve and can be offset closer to the inner fence allowing for a bigger area between the outer fence and the road.

5.5 PROPOSED ROAD AND FENCE RESERVE

Right of way/land access for the road and fence reserve will have to be secured and registered. To achieve this, written communication with the registered landowners and the consent and/or communication with registered bond holders are required where applicable.

The road and fence reserve will vary depending on the topography and local conditions. The road and fence reserve will comprise of the following:

- The road
- The observation zones
- The fence.

The road surface area is at least 4m wide throughout the entire length of the proposed route (excluding the road infrastructure such as storm water channels etc.).

The SANDF require a minimum of a 5 m wide clear observation zone on each side of the road. The most important part of the observation zone is a clear line of sight between the road and the international boundary. The 5 m wide observation zone is not a fixed width and can be reduced to a minimum of 1m to accommodate the topography and other local conditions.

The road reserve can therefore vary between a minimum of 5 m and an average of 14 m (5 m observation zone + 4 m road + 5 m observation zone) depending on the topography and other local conditions. Under certain conditions the road reserve area could increase to 33 metres or even more.

Where the road and animal fence deviate from each other of necessity, a separate fence reserve of 5 m will be created.

5.5.1 CROSS SECTIONS OF TYPICAL ROAD AND FENCE RESERVE SCENARIOS

Due to the large difference in the topography and other local conditions of the proposed road along the border, six cross sections has been drawn up to illustrate the different scenarios for the proposed border road and fence.

Scenario 1A to C represent the different scenarios along that part of the road that is located next to the Mohokare (Caledon) and Makhaleng (Kornetspruit) river as the international border.

Scenario 2A to C represent the different scenarios that is not next to the river as the international border and that also traverse mountainous terrain.

The six scenarios (Scenario 1A to C and Scenario 2A to C) are discussed below:

5.5.1.1 Scenario 1A: Standard Single Reserve Next to the River

Scenario 1 A represents the situation where the proposed border road is in close proximity to the river and only one reserve is required for the road and fence system. Scenario 1 A is applicable to the majority of the proposed road next to the river. Scenario 1 A is shown in Figure 5-3 below. A Google Earth snapshot of Donside NO.109 depicting Scenario 1A is shown in Figure 5-4 below. (Note that any reference to reserve refers to the road reserve.)

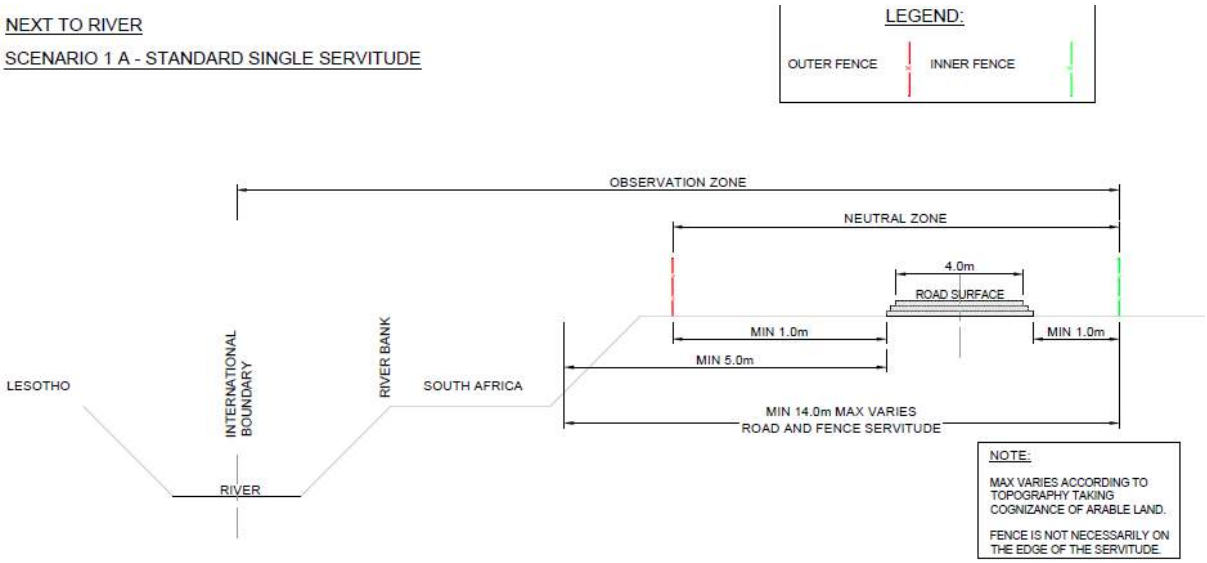


Figure 5-3: Scenario 1A - Standard single road and fence reserve

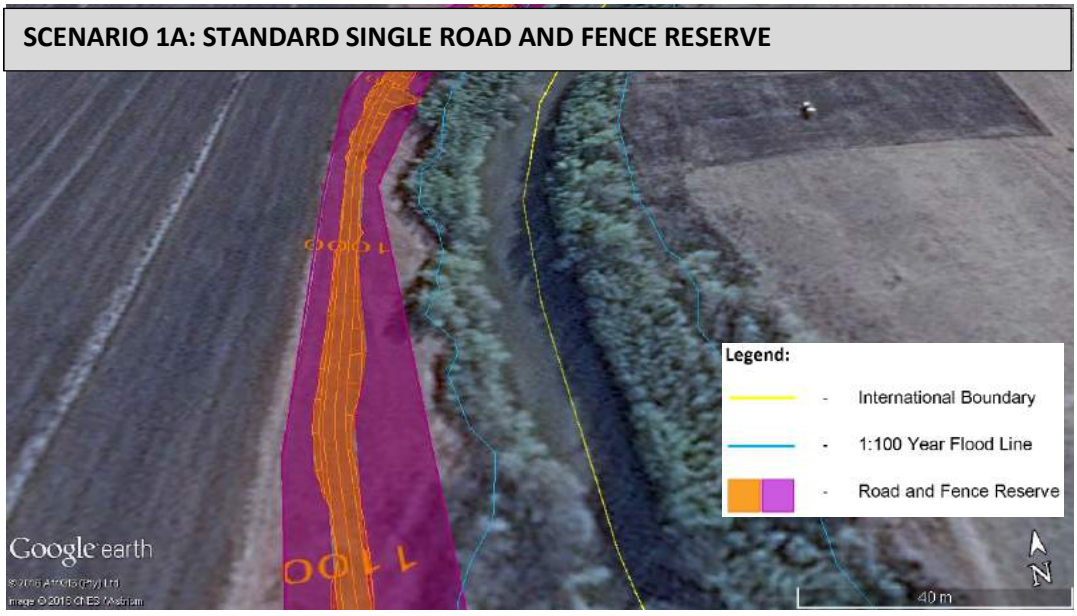


Figure 5-4: Scenario 1A depicted on Google Earth

Typical examples of Scenario 1A is:

- *Donside No.109; and*
- *Ficksburg's Dorp Gronden No.75.*

This scenario represents the situation where the road is close to the international border (the river). The road is mostly located on the existing alignment (the route of the old

military patrol road). This scenario is applicable to the majority of the proposed route next to the river.

A standard single reserve will be registered for the road and fence system with a minimum width of 14m and the maximum width varying taking cognisance of arable land. A minimum of 1m on each side of the road should be allowed for a monitoring systems planned by SANDF in the near future.

The observation zone is defined from the inner fence to the international boundary. It should be noted that the fence is not necessarily on the edge of the reserve.

5.5.1.2 Scenario 1B: Separate Road and Fence Reserve

Scenario 1 B represents the situation where the proposed border road deviates from the river resulting in two separate reserve for the fence and the road system. Scenario 1 B is shown in in Figure 5-5 below. A Google Earth snapshot of Killarney NO.181 depicting Scenario 1B is shown in Figure 5-6 below.

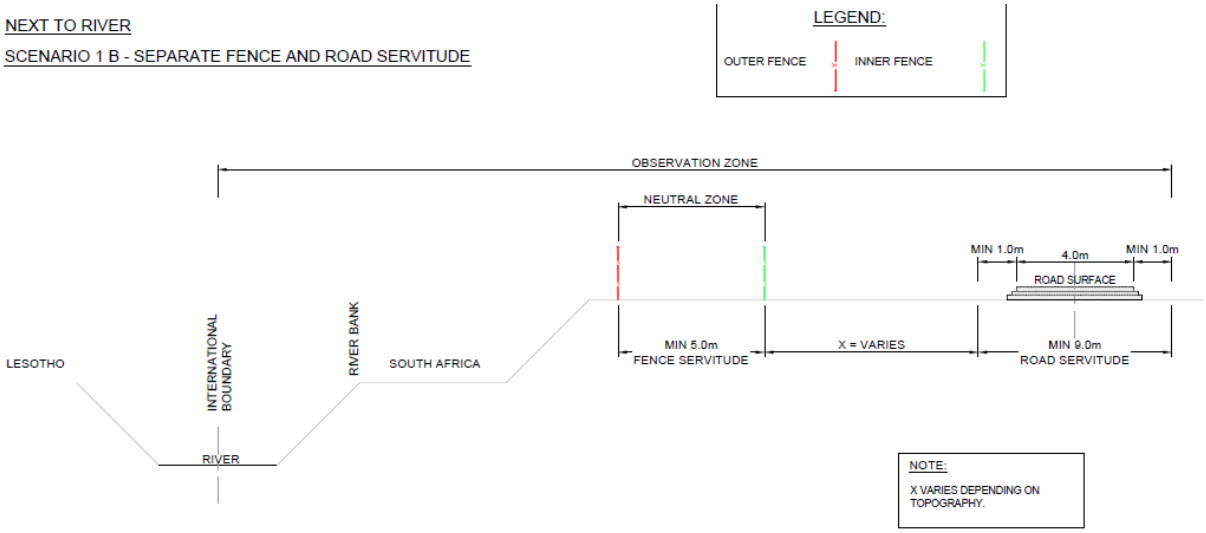


Figure 5-5: Scenario 1B - Separate road and fence reserve

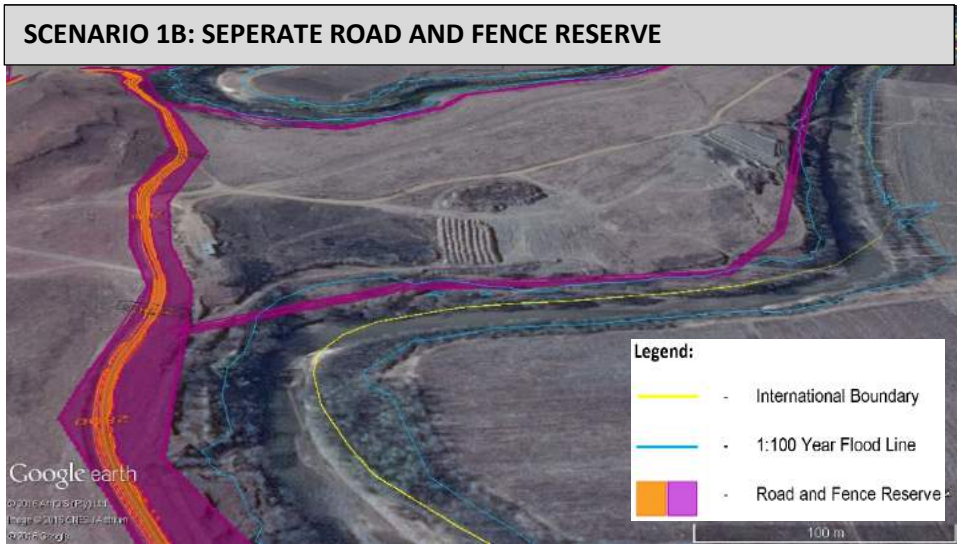


Figure 5-6: Scenario 1B depicted on Google Earth

Typical examples of Scenario 1B is:

- *Killarney NO.181*
- *Langkloof NO.34.*

This scenario represents the situation where the road is located further away from the river. The scenario is applicable to a large part of the proposed route next to the river.

This scenario requires a separate road and fence reserve respectively.

In Figure 5-6, the road cut straight across the “fingers”/meanders of the river to shorten the length of the road, thus increasing the distance between the road and the international border. The fence system will follow the international boundary with the road deviating from the international boundary due to local conditions. The outer and the inner fence will be placed with the fence reserve. The fence system will require a s reserve with a minimum width of 5m. The distance between the fence and road reserve will be dependent on the topography and taking cognisance of arable land. The road system will require a minimum reserve of 9m.

The observation zone is defined from the edge of the road reserve to the international boundary.

5.5.1.3 Scenario 1C: Restricted Terrain

Scenario 1 C represent the situation where the proposed border road is in close proximity to the river and the space is limited. Scenario 1 C is shown in Figure 5-7 below. A Google Earth snapshot of Caledonspoort NO.190 depicting Scenario 1C is shown in Figure 5-8 below.

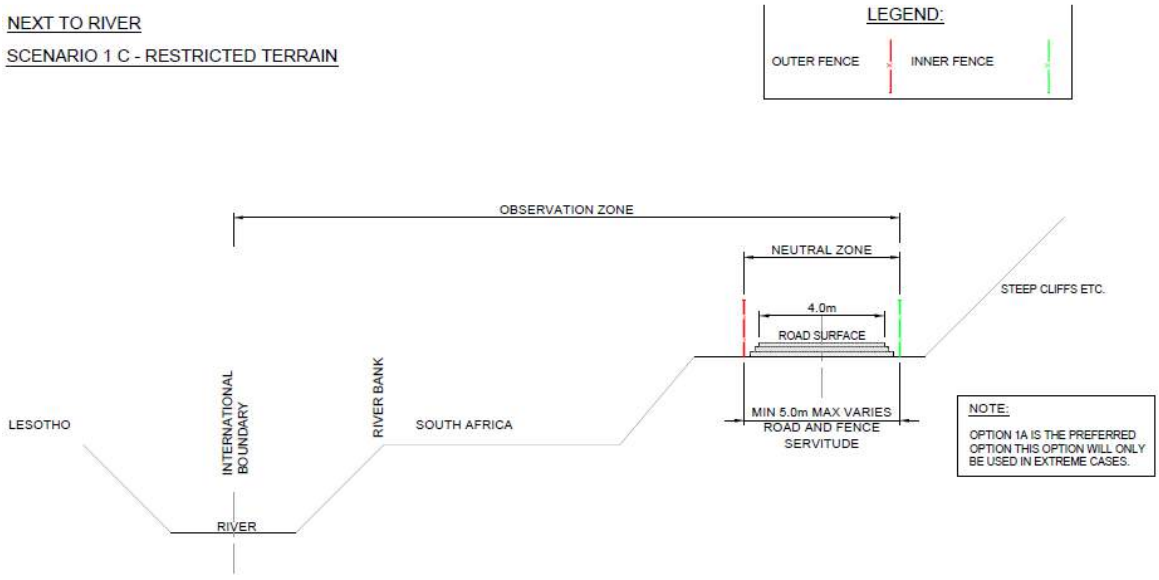


Figure 5-7: Scenario 1C - Restricted terrain

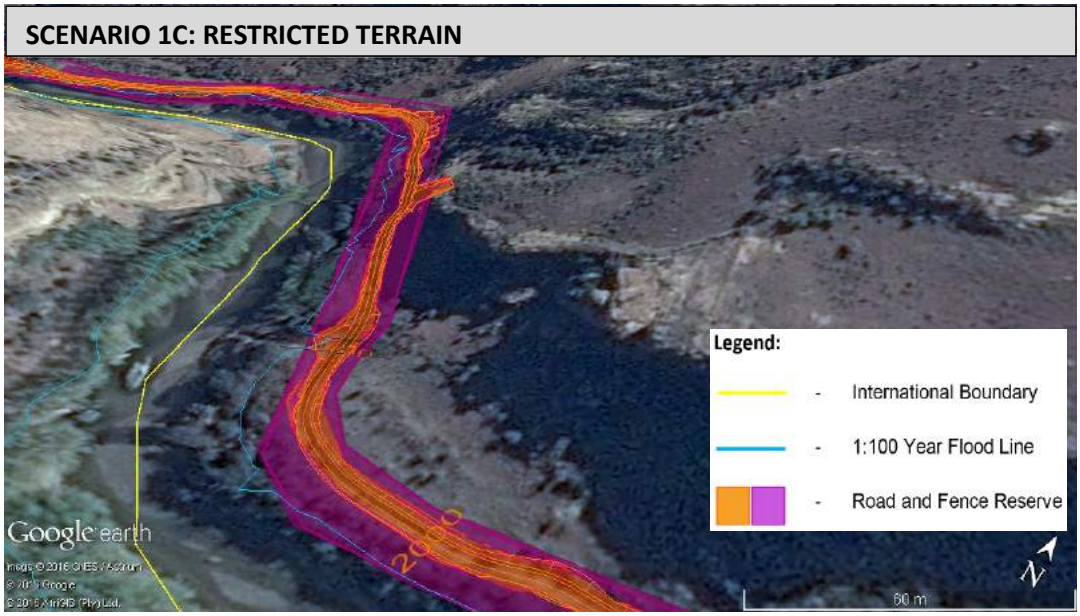


Figure 5-8: Scenario 1C depicted on Google Earth

Typical examples of Scenario 1C is:

- Caledonspoort NO.190; and
- Joel Mollapp NO.10

Scenario 1 C represent the situation where there is insufficient space for a standard single reserve of 14m. The scenario occurs in areas with steep slopes on both sides of the road and is only applicable to a few farms along the proposed road.

A single reserve will be required for the road and fence system with a minimum width of 5m and the maximum width dependant on the topography. It should be noted that the fence will be placed next to the road and not on top of the steep cliffs to reduce the unusable land. The observation zone is defined from the inner fence to the international boundary.

It should be noted that Scenario 1 A is the preferred option and that Scenario 1 C will only be used in extreme cases.

5.5.1.4 Scenario 2A: Standard Single Reserve

Scenario 2 A represent the situation where the proposed road is in close proximity to the international border and only one reserve is required for the road and fence eserve. Scenario 2 A is applicable to the majority of the proposed border road next to the international border. Scenario 2 A is shown in Figure 5-9 below. A Google Earth snapshot of Ursla NO.120 depicting Scenario 1C is shown in Figure 5-10 below.

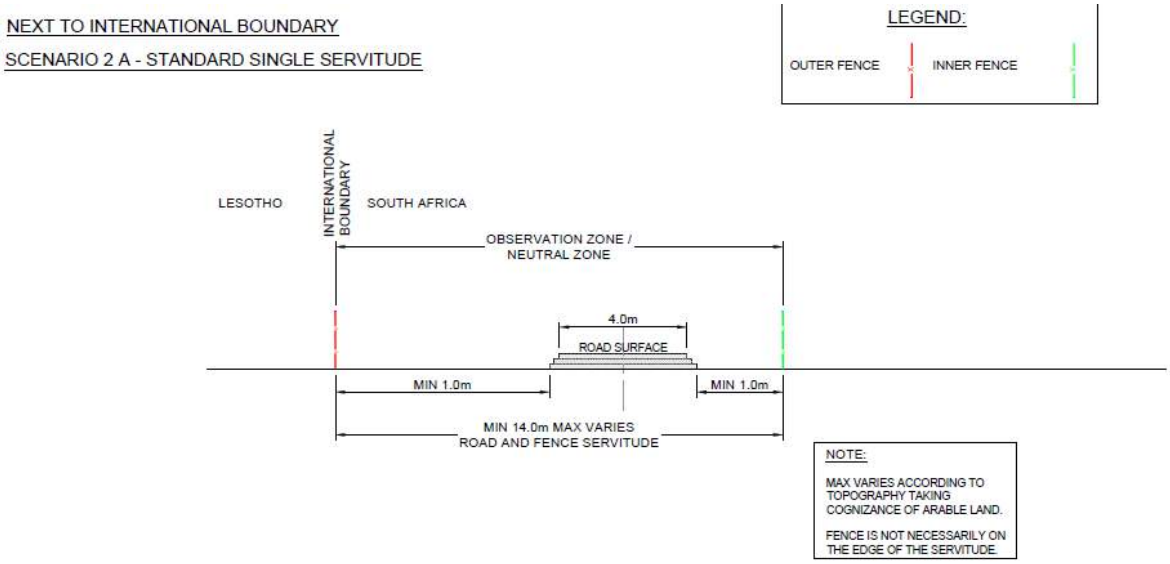


Figure 5-9: Scenario 2A - Standard single reserve

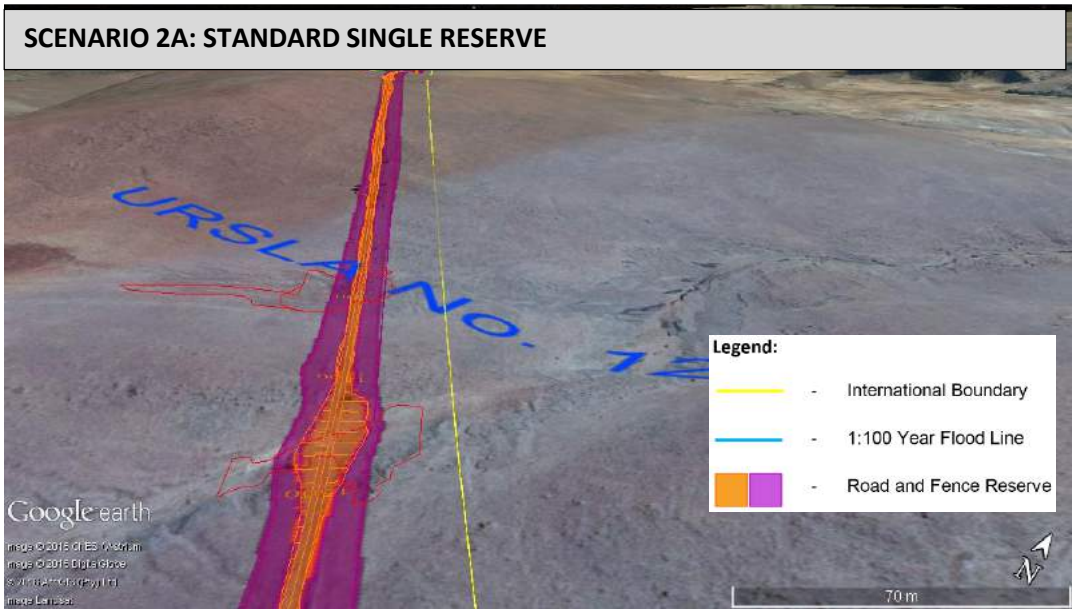


Figure 5-10: Scenario 2A depicted on Google Earth

Typical examples of Scenario 2A is:

- *Ursla NO.120*
- *Breypaal NO.15.*

Scenario 2 A represent the scenario where the proposed road is in close proximity to the international boundary and the majority of the road is on the existing alignment. This scenario describe the majority of the proposed border road next to the international border.

A standard single reserve will be registered for the road and fence system with a minimum width of 14m and the maximum width varying taking cognisance of arable land. A minimum of 1m on each side of the road should be allowed for a monitoring systems planned by SANDF in the near future.

The neutral and observation zone is defined from the inner fence to the international boundary. It should be noted that the fence is not necessarily on the edge of the reserve.

5.5.1.5 Scenario 2B: Separate Road and Fence Reserve

Scenario 2 B represent the situation where the proposed border road deviates from the international boundary resulting in two separate reserves for the fence and the road system. Scenario 2 B is shown in Figure 5-11 below. A Google Earth snapshot of Holywell NO.42 showing Scenario 1C is shown in Figure 5-12 below.

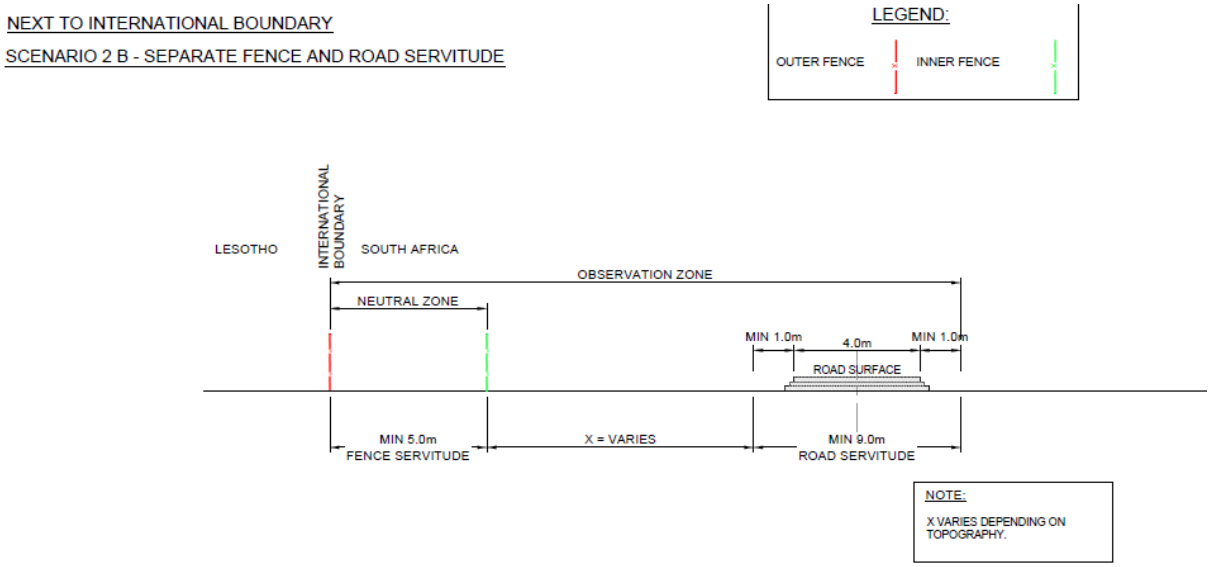


Figure 5-11: Scenario 2B - Separate road and fence reserve

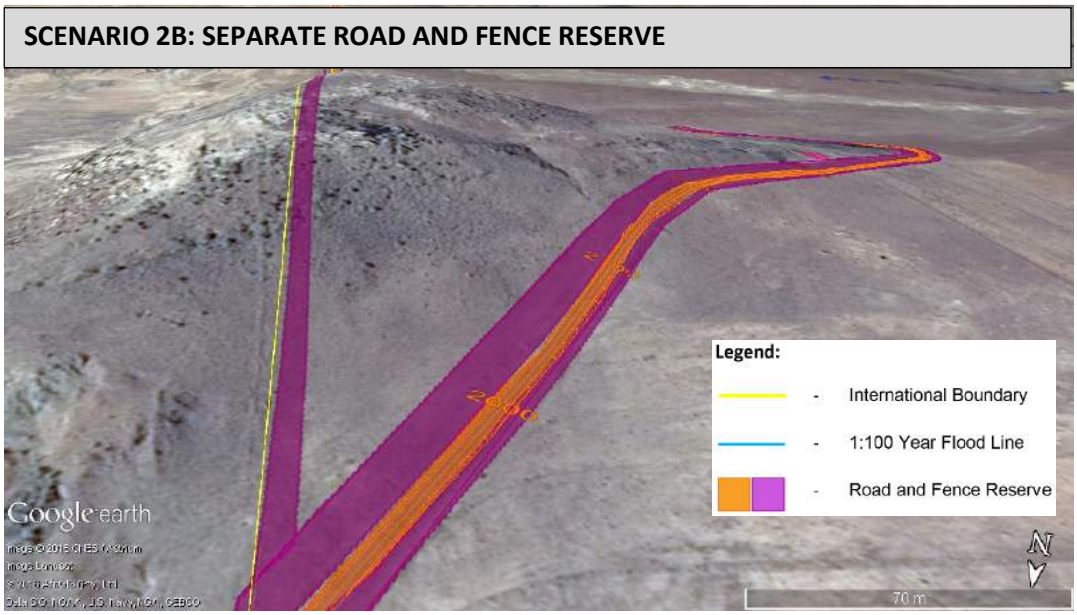


Figure 5-12: Scenario 2B depicted on Google Earth

Typical examples of Scenario 2B is:

- *Cavallo NO.20; and*
- *Holywell No.42*

The fence system will follow the international boundary with the road deviating from the international boundary due to local conditions. The outer and the inner fence will be placed with the fence reserve. The fence system will require a reserve with a minimum width of 5m. The distance between the fence and road reserve will be dependent on the topography and taking cognisance of arable land. The road system will require a minimum reserve of 9m.

The observation zone is defined from the edge of the road reserve to the international boundary.

5.5.1.6 Scenario 2C: Restricted Terrain

Scenario 2 C represent the situation where the proposed border road is in close proximity to the international boundary and the space is limited. Scenario 2 C is shown in Figure 5-13 below. A Google Earth snapshot of Van der Hoven's Rust NO.68 showing Scenario 2C is shown in Figure 5-14 below.

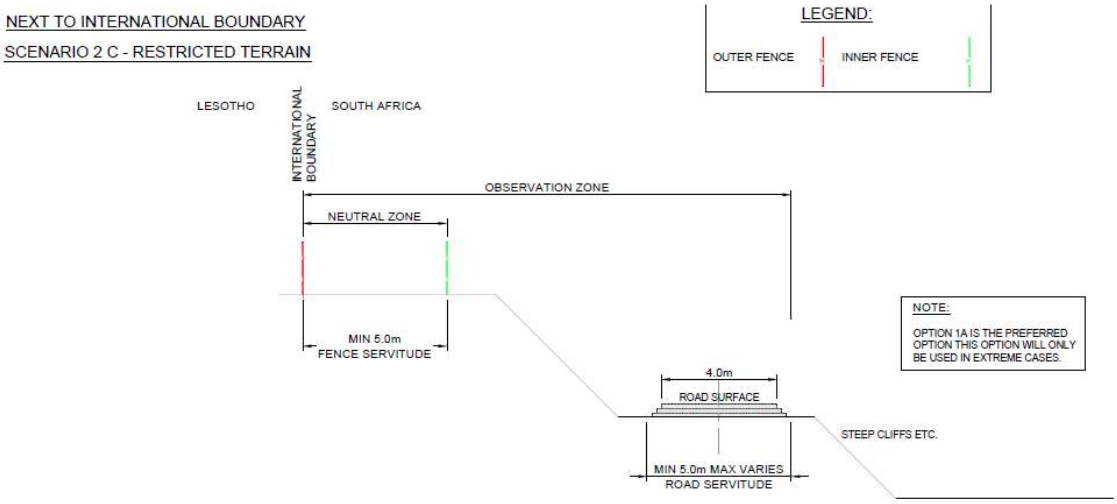


Figure 5-13: Scenario 2C - Restricted terrain

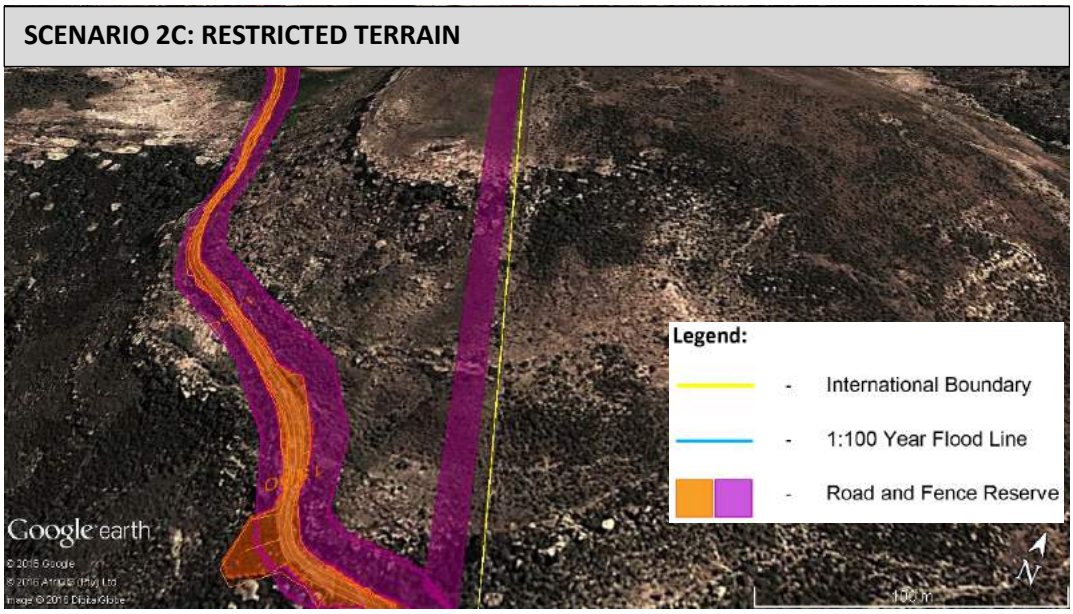


Figure 5-14: Scenario 2C depicted on Google Earth

Typical examples of Scenario 2B is Van der Hoven's Rust NO.68

Scenario 2 C represent the situation where there is insufficient space for a standard single reserve of 14m. The scenario occurs in areas with steep slopes on both sides of the road and is only applicable to a few farms along the proposed road.

A single reserve will be required for the road and fence system with a minimum width of 5m and the maximum width dependant on the topography. It should be noted that the fence will be placed next to the road and not on top of the steep cliffs to reduce the unusable land. The observation zone is defined from the inner fence to the international boundary.

It should be noted that Scenario 2 A is the preferred option and that Scenario 2 C will only be used in extreme cases.

Please refer to Appendix E for the proposed road and fence reserve drawings.

5.6 PROPOSED SITE CAMPS

Through a series of desktop studies and site visits potential locations for construction camps have been identified.

It was assumed that each road section would require:

- 1 x Main camp (Approximately 1.5ha)
- 2 x Sub- camps (Approximately 0.75ha)

The above approach would result in each camp servicing approximately 25-30km of road and fence construction. The positioning of each of the required main and sub camps was done taking into account the need for good access to the existing roads in the area as well as the border road, water and electricity. The proximity to local villages, both on the South African and Lesotho sides of the border was also taken into account.

As various options exist for each camp, a short list of 48 potential locations for construction camps was determined. **Table 5-3** below shows the position of each road section as well as the associated construction camps. A preferred position for each construction camp, main and sub camps, is shown as well as alternatives for each.

Table 5-3: Potential Sites for Construction Site Camps

SECT.	NO.	FARM NAME	OPTION	ACCESS	CAMP TYPE	PROXIMITY TO VILLAGE	LAND USE
A	1	Robyn NO.143	Alternative 2	Good R711 Access to Via Secondary Tar Road	Sub Camp	< 1 km	Grazing Land
	2	Vreugde NO.296	Alternative 3	Good R711 Access Via Secondary Tar Road Onto Unamed Dirt Road	Main Camp	< 1 km	Grazing Land
	3	The Poplars NO.199	Preferred	Good R711 Access Via R711 to Dirt Access Road at Caledonspoort	Sub Camp	< 1 km	Cultivated Land
	4	Killarney NO.181	Alternative 3	Good R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	5	Catjasberg NO.175	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
B	6	Diepkloof NO.609	Alternative 2	Fair R26 Access Via Dirt Access Road	Sub Camp	> 1 km - 5km <	Grazing Land
	7	Kromdraai NO.118	Preferred	Fair R26 Access Via Dirt Access Road And Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land
	8	Boschfontein NO.934	Alternative 3	Fair R26 Access Via Dirt Access Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	9	Ficksburg's Dorp Gronden 1 NO.75	Preferred	Good R26 Access Via Town Road (In Town)	Main Camp	< 1 km	Grazing Land
	10	Ficksburg's Dorp Gronden 2 NO.75	Alternative 2	Good R26 Access Via Unamed Dirt Access Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	11	Dougasdale NO.509	Alternative 2	Good R26 Access Via Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land
C	12	Gunton NO.480	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land
	13	Zwagershoek NO.27	Alternative 2	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	14	Waterval NO.6	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	15	Sandford NO.245	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Main Camp	> 1 km - 5km <	Grazing Land
	16	Alfa NO.382	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Main Camp	> 1 km - 5km <	Cultivated Land
	17	Saamwerk NO.856	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land
	18	Vorentoe NO.857	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	19	Zenobia NO.858	Preferred	Fair R26 Access Via Secondary Dirt Road and Unanmed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	20	Melrose NO.38	Alternative 3	Fair R26 Access Via Secondary Dirt Road and Unanmed Dirt Road	Sub Camp	< 1 km	Grazing Land
D	21	Driekop NO.305	Alternative 2	Good N8 Access Via Secondary Dirt Road	Sub Camp	< 1 km	Cultivated Land
	22	Pleasant View NO.107	Preferred	Good N8 Access Via Secondary Dirt Road	Sub Camp	< 1 km	Grazing Land
	23	Eensgevonden NO.14	Preferred	Good N8 Access Via Secondary Dirt Road	Sub Camp	< 1 km	Grazing Land

SECT.	NO.	FARM NAME	OPTION	ACCESS	CAMP TYPE	PROXIMITY TO VILLAGE	LAND USE
	24	Bankies NO.11	Preferred	Fair N8 Access Via Secondary Dirt Road	Sub Camp	< 1 km	Grazing Land
	25	Mooie Plaats NO.26	Alternative 2	Fair N8 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Grazing Land
	26	Bankies NO.11	Preferred	Fair N8 Access Via Secondary Dirt Road	Sub Camp	< 1 km	Grazing Land
	27	Welkom NO.1049	Alternative 3	Fair N8 Access Via Secondary Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	28	Moria NO.205	Alternative 3	Fair R26 Access Via Secondary Dirt Road and Unanmed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	29	Waimarino NO.406	Preferred	Fair R26 Access Via Secondary Dirt Road and Unanmed Dirt Road	Sub Camp	< 1 km	Grazing Land
	30	Olot NO.43	Preferred	Fair R26 Access Via Secondary Dirt Road and Unanmed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
E	31	Beauhill NO.8	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road and Farm Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	32	Mooihoek NO.218	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	33	Redcliffe NO.468	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	34	Zamenloop NO.215	Preferred	Good R26 Access Via Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	35	Gruisfontein NO.216	Alternative 3	Fair R26 Access Via Unanmed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	36	Dunse NO.225	Alternative 3	Good R26 Access Via Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	37	Rohallion NO.280	Alternative 2	Limited R26 Access Via R702, Dirt Access Road Currently Forming Part of Border Road	Sub Camp	> 1 km - 5km <	Grazing Land
	38	De Wepener Dorpsgronden	Alternative 3	Good R26 Access Via R702, Dirt Access Road Currently Forming Part of Border Road	Sub Camp	> 1 km - 5km <	Grazing Land
	39	Flodden NO.37	Alternative 2	Limited R26 Access Via R702, Dirt Access Road Currently Forming Part of Border Road	Sub Camp	< 1 km	Grazing Land
F	40	Breypaal NO.15	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	41	Yokohama NO.101	Alternative 2	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Grazing Land
	42	Van der Hoven's Rust NO.68	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Access Road	Sub Camp	< 1 km	Grazing Land
	43	Mooihoek NO.76	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land
	44	Eenzaam NO.69	Alternative 3	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Grazing Land

SECT.	NO.	FARM NAME	OPTION	ACCESS	CAMP TYPE	PROXIMITY TO VILLAGE	LAND USE
	45	Portersdale NO.56	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Grazing Land
	46	Maghaleen NO.287	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land
	47	Boomplaat NO.219	Alternative 2	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	> 1 km - 5km <	Cultivated Land
	48	Kornetspruit NO.399	Preferred	Limited R26 Access Via Secondary Dirt Road and Unamed Dirt Road	Sub Camp	< 1 km	Cultivated Land

5.7 ACCESS ROADS

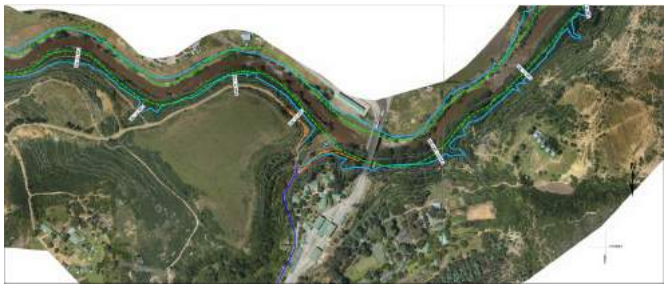
A base line traffic condition was determined by Delta BEC from an initial site investigation conducted from 23 November to 2 December 2014 on which the impact of the traffic generated by the proposed Border road can be assessed.

The study revealed that the existing road network within the study area is operating at well below its capacity and at a good Level of Service with all movements operating without congestion. Calculations of traffic generation showed that the construction and operational phase of the project will generate low volumes of traffic during the morning and afternoon peak hours.

It is expected that approximately 10 vehicles per day during construction, consisting of light vehicles and heavy vehicles, and two vehicles per day during operation will be generated.

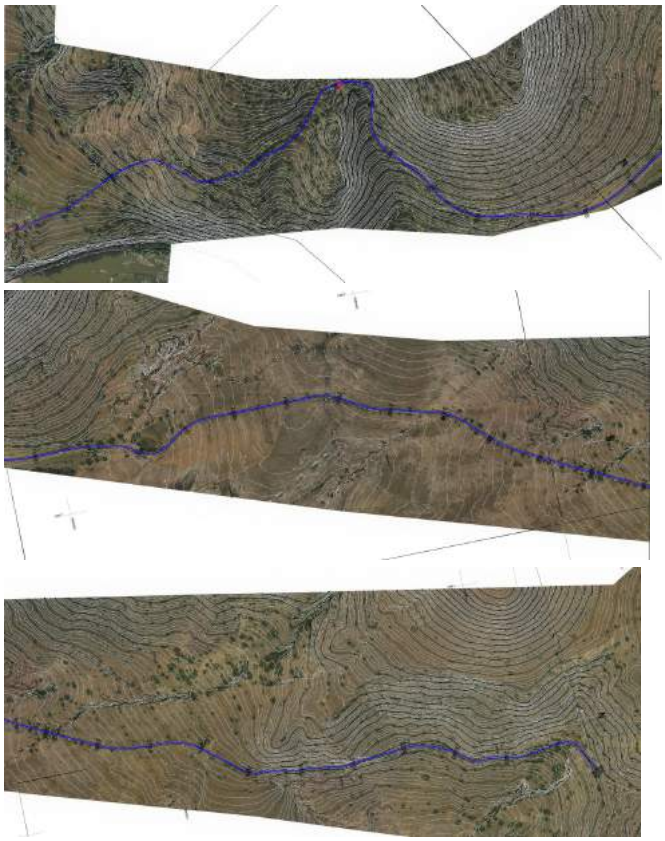
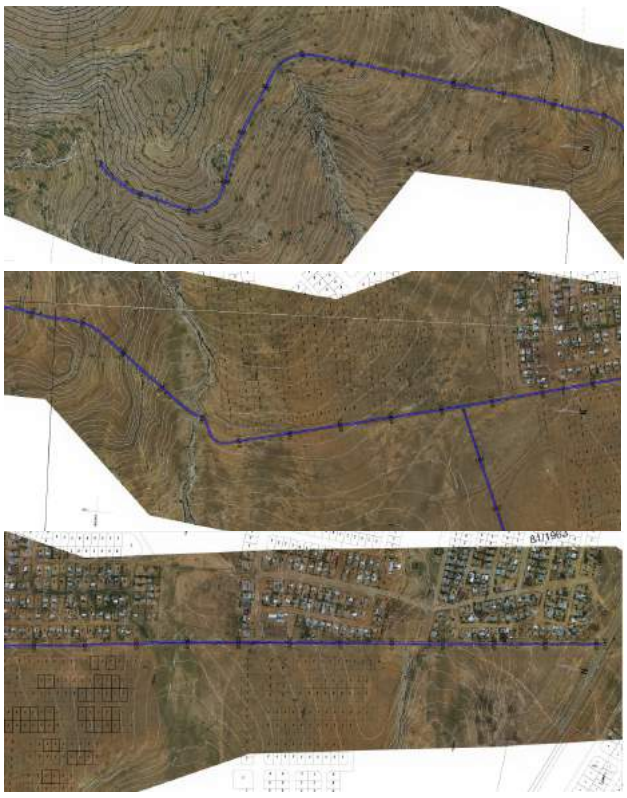
A total of 16 access roads have been identified to gain access to the border road and the various construction site camps. Table 5-4 shows the properties affected by access roads and the length of the access roads on each property.

Table 5-4: Access Roads to Border Road

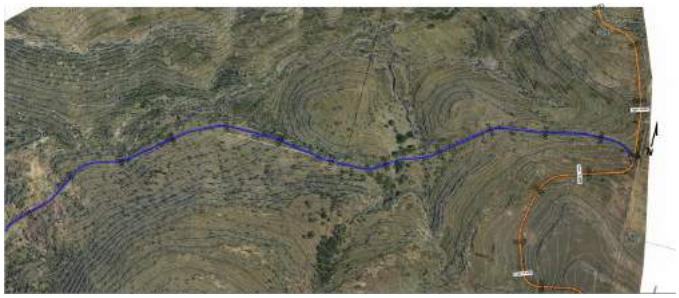
FARM NAME	Length (m)	Drawing Illustration
		ACCESS ROUTE / TOEGANGSROETE
BRAAMHOEK NO.345	11 815	
CALEDONSPOORT NO.190	298	

FARM NAME	Length (m)	Drawing Illustration ACCESS ROUTE / TOEGANGSROETE
BOSCHFONTEIN NO.934	10 287	    

FARM NAME	Length (m)	Drawing Illustration ACCESS ROUTE / TOEGANGSROETE
FICKSBURG'S DORP GRONDEN NO.75	1527	
L'ESPERANCE NO.194	1 097	
TUNIS NO.635	173	

FARM NAME	Length (m)	Drawing Illustration ACCESS ROUTE / TOEGANGSROETE
ROHALLION NO.280	3 606	
DE WEPENER DORPSGRONDEN NO.178	4 614	

FARM NAME	Length (m)	Drawing Illustration ACCESS ROUTE / TOEGANGSROETE
		
VAN DER HOVEN'S RUST NO.68	287	

FARM NAME	Length (m)	Drawing Illustration ACCESS ROUTE / TOEGANGSROETE
VAN DER HOVEN'S RUST NO.68	287	
CORUNNA NO.226	52	
ZAMENSTROOM NO.397	1 494	  

5.8 PROPOSED BORROW PITS

The construction of the road will require suitable construction material, inter alia, to be sourced from identified well located, accessible and preferably licensed borrow pits.

The site audit that was undertaken by The Geotechnical Hub, revealed a total of 41 potential borrow pit sites (new and proposed sites) within close proximity to the proposed border road route.

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) as amended, the Minister may grant a prospecting or mining right, if among other aspects, the mining activity 'will not result in unacceptable pollution, ecological degradation or damage to the environment'

The locations of the borrow pit sites identified is provided in the property description and the location of the individual sites identified for potential borrow pits, are provided in **Appendix C**. It should be noted that the utilisation of existing borrow pits should be encouraged in order to mitigate environmental impacts caused by the clearing of the sites for borrow pits.

In terms of potential borrow pits identified the following should be taken into consideration:

- It is expected that material for the infilling of depressions will be sourced from borrow pits along the proposed linear development.
- Confirmation is required on whether the existing borrow pits are authorised in terms of if a mining permit has been granted for them by the Department of Mineral Resources.
- The existing borrow pits should be further investigated in terms of the potential volume of material available that can be sourced.
- The number of new borrow pits need to be kept to a minimum. Wherever possible, existing facilities must be used and the location of facilities in ecologically intact areas must be avoided.
- If required that new borrow pits must be used, the following procedures will apply:
    - The mining area (borrow pit) should not exceed 1.5 hectares in extent.
    - Consideration of sensitive environments and accessibility to the sites.
    - Landowner(s) must be identified and consent obtained.
    - Archaeological or cultural heritage impact assessment might be required.
    - An application for Environmental Authorisation must be lodged with National DEA for all new sites.
    - An application for a mining permit must be lodged with the Department of Mineral Resources.
    - Closure and rehabilitation plan to be included in the Environmental Management Programme (EMPr).

6 POLICY AND LEGISLATIVE CONTEXT

The section provides a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.

6.1 POLICY AND LEGISLATIVE CONTEXT WITHIN WHICH THE DEVELOPMENT IS PROPOSED

6.1.1 EIA REGULATIONS, 2014 (GNR 982/2014 REGULATIONS 21 – 24)

6.1.1.1 Scoping and Environmental Impact Reporting Assessment Process

a) Submission of Scoping Report to Competent Authority

Within **44 days** of receiving the acknowledgement that the competent authority has received the application, the applicant must submit a scoping report to the competent authority that was subject to 30 days of public participation and contain all comments received during public participation from the public as well as from the competent authority (see figure below).

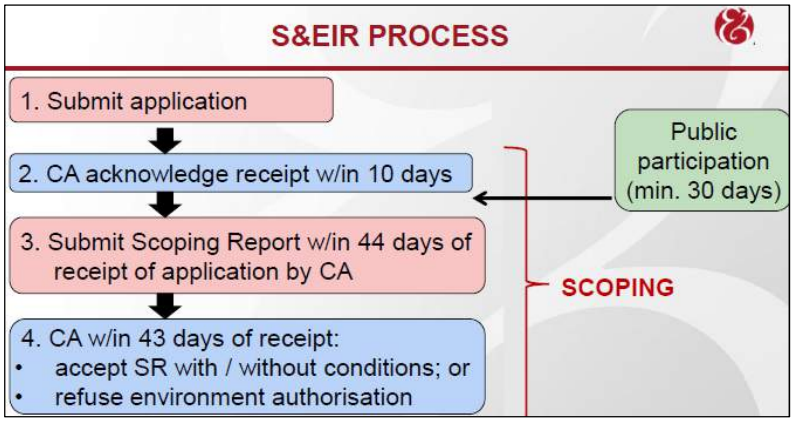


Figure 6-1: Scoping Report and Process

A **Scoping Report** must contain all information set out in **Appendix 2** of the EIA Regulations, 2014 GNR 982 (please refer to Table 1-1: Report content requirements in terms of Regulation 21 of GN 982 (Appendix 2) in the Executive Summary, which contain all information set out in Appendix 2).

b) Submission and Consideration of EIA Report and Environmental Management Programme

Within 106 days of the Scoping Report being accepted the applicant must submit the following to the competent authority:

- an EIA report inclusive of any specialist reports, and an EMPr (subjected to a public participation process of at least 30 days with all of comments: public and the competent authority) **OR**

- Written notification that the EIA report inclusive of any specialist reports, and an EMPr, will **be submitted within 156 days** of acceptance of the Scoping Report by the competent authority, as significant changes have been made to the EIA report or EMPr, which changes or information was not contained in the reports during the public participation process and that the revised EIA report or EMPr will be subjected to another public participation process of at least 30 days. The applicant must therefore ensure to submit amended EIA report and EMPr within 156 days of acceptance of the scoping report.

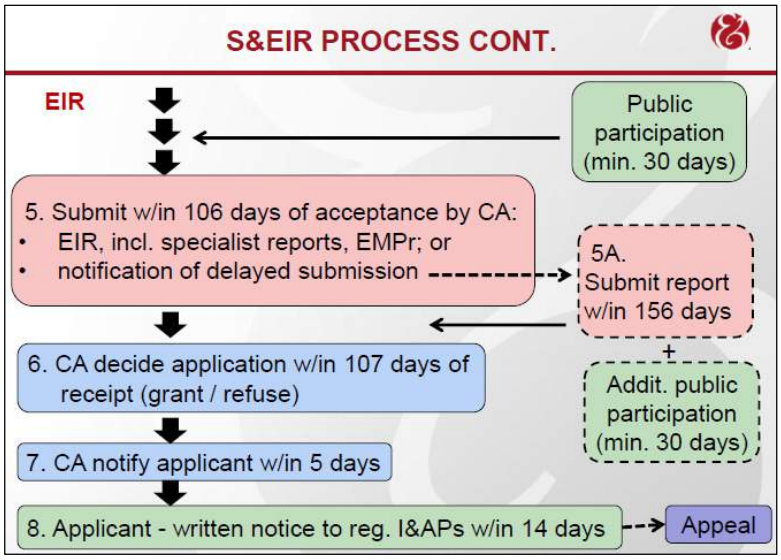


Figure 6-2: Submission of EIA report

An EIA Report **must contain all information set out in** Appendix 3 **to these Regulations.** Where the application is for an **EA for mining** (prospecting, exploration, extraction and primary processing of a mineral or petroleum resource or related activities) the EIA Report must address the requirements as determined in the regulations and NEMA pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, mining or production operations.

An **EMPr** must contain all information set out in **Appendix 4** to these Regulations and, where the application is for an EA is for mining (prospecting, exploration, extraction and primary processing of a mineral or petroleum resource or related activities) the EMPr must address the requirements as determined in the regulations and NEMA pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, mining or production operations.

A **Specialist Report** must contain all information set out in **Appendix 6** of the EIA Regulations, 2014 GNR 982.

c) Decision on S and EIR Application

The competent authority must grant, partly grant or refuse the EA within 107 days of receiving the EIA report and EMPr or closure plan. This must be done in writing to the applicant. The applicant must be provided with reasons and inform the applicant of a possible appeal.

Within **14 days** of the granting of decision, the applicant must:

- inform the all registered I&AP of the decision

- provide access and the reasons to the decision to I&AP
- inform the I&AP of the right to appeal.

Where an alternative is granted in the Environmental Authorisation rather than the proposed project applied for, it must be deemed that the alternative was consulted and the impacts investigated.

The Minister for Mineral Resources may only grant an Environmental Authorisation if financial provision has been provided for in terms of section 24P of NEMA.

6.1.2 NATIONAL WATER ACT 36 OF 1998

List of water uses that needs licensing in terms of Section 21 of the National Water Act

a) Taking water from a water resource

b) Storing water

c) Impeding or diverting the flow of a water course

d) Engaging in stream-flow reduction activities (the use of land for afforestation which has been or is being established for commercial purposes)

e) Engaging in a controlled activity:

   i. irrigation of any land with waste or water containing waste generated through any industrial activity or by a waterwork

   ii. an activity aimed at the modification of atmospheric precipitation

   iii. power generation activity which alters the flow regime or a water resource

   iv. intentional recharging of an aquifer with any waste or water containing waste or declared under Section.38(1).

f) Discharging waste or water containing waste into a watercourse through a pipe, canal, sewer or other conduit

g) Disposing of waste in a manner which may detrimentally impact on a water resource

h) Disposing in any manner of water containing waste

i) Altering the bed, banks, course or characteristics of a water course

j) Removing, discharging or disposing of groundwater if necessary for the efficient continuation of an activity or for human safety

k) Using water for recreational purposes.

Applicable water uses

The construction of the proposed road, fence and associated infrastructure involves a number of water uses listed in terms of Section 21 of the National Water Act (NWA). The following water uses will require licensing.

- Section 21(a): Taking water from a water resource

- Section 21(c): Impede or diverting the flow of water in a watercourse
- Section 21(i): Alter the bed, banks or characteristics of a watercourse.
- Any development within a 500 m radius from the boundary of any wetland constitutes a water use in terms of section 21 (c) and (i) of the National Water Act [No. 36 of 1998], and will require authorisation before any development may commence in terms of regulation GN1199 (December 2009) of the NWA.
- Any disturbance of a watercourse within the 1 in 100-year flood line needs to be licensed.

Legal Obligations

DWAF M1 guideline dealing with watercourse alterations and in particular Appendix 2 that sets out the information required that needs to be consulted.

GN 704 dealing with water management at mines also has restrictions that apply relating to mining near water resources.

Section 27(1) Requirement

The NWA includes considerations set out in section 27(1) that must be applied in the assessment of licence applications for water use. Although the Act states that this is the DWS's responsibility, the applicant should supply at least the minimum information required in terms of section 27(1) to allow the department to evaluate the application.

6.1.3 NATIONAL HERITAGE RESOURCES ACT 25 0F 1999

List of objects protected under the act

The Act is based on conserving and managing what it terms the "national state". This may include:

Section 3(2)

- places, buildings, structures and equipment of cultural significance
- historical settlements and townscapes
- archaeological and paleontological sites
- graves and burial grounds including
  - ancestral graves
  - royal graves and graves of traditional leaders
  - graves of victims of conflict
  - historical graves and cemeteries
  - other human remains which aren't covered in terms of the Human Tissues Act 65 of 1983.
- Any archaeological artefact, paleontological and rare geological specimens, and meteorites found in South Africa and its territorial waters and maritime cultural zone.
- Antiquities such as coins, utensils, pottery, jewellery, seals, weapons (including firearms) tools and inscriptions that have been in South Africa for more than 100 years.
- Original fabric removed from South African historical buildings.
- South African ethnographic art and objects.

  - Items relating to South African history, including the history of science and technology, military and social history, as well as to the life of peoples and national leaders, thinkers, scientists and artists and to events of national importance.
  - South African items of artistic interest that have been in South Africa for 50 years or more, including.
  - Paintings and drawings produced by hand on and in any material.
  - Original prints, posters and photographs, as the media for creative activity.
  - Original artistic assemblages and montages in any material.
  - Works of statuary art and sculpture in general.
  - works of applied art in such materials as glass, ceramics, metal and wood; and
  - objects of ritualistic and symbolic significance and personal adornment such as beads, leather or metalwork.
- South African items of numismatic (medals and coins) and philatelic (stamps and cancellations) interest that have been in South Africa for more than 100 years.
- Manuscripts, books, documents or publications of special interest to South African history and culture that have been in South Africa for 50 years or more; or that are otherwise deemed of special interest and importance to South African heritage as recommended by the National Archives Advisory Council.
- South African archives, including written records, maps and other cartographic materials, prints, photographs, cinematographic films, sound recordings and machine-readable records that have been in South Africa for more than 50 years; or that are listed in the national registers of manuscripts, photographs, audio-visual material or oral sources.
- South African furniture, tapestries, carpets, items of dress and musical instruments older than 100 years.
- South African zoological, botanical and geological specimens that have been in South Africa for more than 100 years.
- The above exclude any object made by any living person.

A **Heritage Impact Assessment** (HIA) is required prior to performing development activities that exceed the following parameters:

- The construction of a road, wall, powerline, pipeline, canal or similar form of linear development or barrier exceeding 300 m in length;
- The construction of a bridge or similar structure exceeding 50 m in length;
- Any development or other activity which will change the character of a site:
  - Exceeding 5000 m^2 in extent
  - Involving three or more existing erven or subdivisions thereof
  - Involving three or more erven or divisions thereof which have been consolidated within the past 5 years
  - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- The rezoning of a site exceeding 10 000 m^2 in extent
- Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.
- The above also includes all developments stipulated in NEMA and the Minerals and Petroleum Resources Development Act, which require the inclusion of an assessment of cultural heritage resources.

Section 38

- States that any person who intends on undertaking a development must at the very earliest stages of initiating such a development notify the responsible heritage authority and furnish it with details regarding the location, nature and extent of the proposed development.

- If the proposed development activity is a listed activity that requires an EIA, then heritage and cultural resources may be covered under a section within the report, and submitted to DEAT. However, should the development not require and EIA an HIA will need to be submitted to the relevant authority.

6.1.4 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002

Construction material such as sand, gravel and rock material will be required for the construction of the road. Existing licensed quarries and borrow pits in the area may not be adequate or suitable to provide all the required construction materials and it is estimated that new rock quarries and sand borrow pits will be necessary for the construction of the proposed road.

An application for a mining permit must be lodged with the Department of Mineral Resources (DMR) for all proposed borrow pits. Where the establishment and use of borrow pits result in a listed activity being undertaken, the impact of the new borrow areas and quarry will be investigated in the EIA, and an EMPr will be compiled for approval by the DMR.

An application for an Environmental Authorisation must when submitted in terms of regulation 19 or 21, be accompanied by-

- Proof of acceptance of an application for any right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002.

Exemptions from certain provisions of Act

Section 106

(1) The Minister, may by notice in the Gazette, exempt any organ of state from the provisions of sections 16, 20, 22 and 27 in respect of any activity to remove any mineral for road construction, building of dams or other purpose which may be identified in such notice.

(2) Despite subsection (1), the organ of state so exempted must submit an environmental management programme for approval in terms of section 39 (4).

(3) Any landowner or lawful occupier of land who lawfully, takes sand, stone, rock, gravel or clay for farming or for effecting improvements in connection with such land or community development purposes, is exempted from the provisions of [in] subsection (1) as long as the sand, stone, rock, gravel or clay is not sold or disposed of.

6.1.5 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT 59 OF 2009

Licensing of Waste Management Activities - Section 19 read together with the List of Waste Management Activities that have or are likely to have a detrimental effect on the Environment - GNR 921/2013

A person who wishes to commence, undertake or conduct a waste management activity listed under Category C, do not require a waste management license however, must comply with the requirements provided in the Norms and Standards for Storage of Waste, 2013 should any of the following thresholds be exceeded.

- The storage of general waste at a facility that has the capacity to store in excess of 100 m^3 of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste
- The storage of hazardous waste at a facility that has the capacity to store in excess of 80 m^3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste

6.1.6 INFRASTRUCTURE DEVELOPMENT ACT NO. 23 OF 2014

To provide for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the Republic; to ensure that infrastructure development in the Republic is given priority in planning, approval and implementation; to ensure that the development goals of the state are promoted through infrastructure development; to improve the management of such infrastructure during all life-cycle phases, including planning, approval, implementation and operations; and to provide for matters incidental thereto.

6.1.7 SPATIAL PLANNING AND LAND USE MANAGEMENT ACT 16 OF 2013 (SPLUMA)

The SPLUMA was signed into force by the President of the Republic of South Africa on 5 August 2013. SPLUMA is a framework act for all spatial planning and land use management legislation in South Africa. It seeks to promote consistency and uniformity in procedures and decision-making in this field. The other objects include addressing historical spatial imbalances and the integration of the principles of sustainable development into land use and planning regulatory tools and legislative instruments.

6.2 APPLICABLE LEGISLATION, POLICIES, PLANS, GUIDELINES, SPATIAL TOOLS, MUNICIPAL DEVELOPMENT PLANNING FRAMEWORKS AND INSTRUMENTS

The proposed project are to comply, where applicable, with the National Environmental Legal Framework and its Specific Environmental Management Acts (SEMAs) as illustration in the figure below.

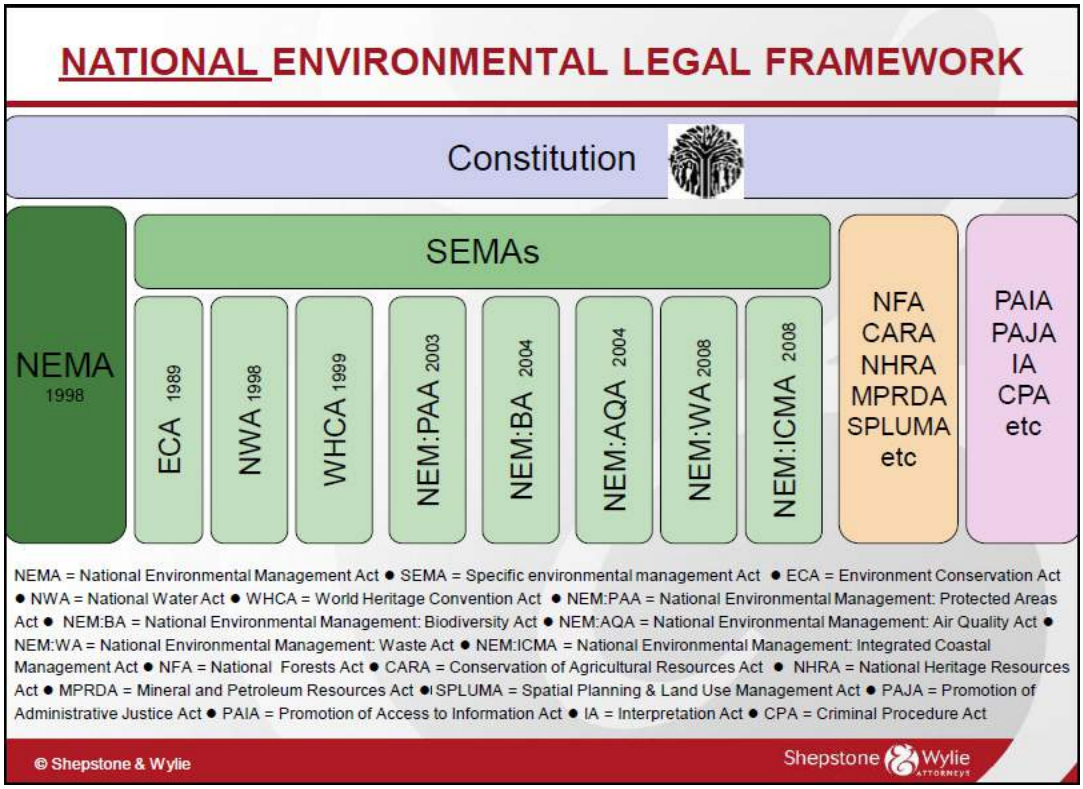


Figure 6-3: National Environmental Legal Framework

Other legislative compliance obligations in respect of the proposed development are listed in the table below.

Table 6-1: Legislative Owerview

Category	Act
Republic of South Africa:	The Constitution of the Republic of South Africa Act [No 108 of 1996]
	Disaster Management Act [No 57 of 2002]
EIA:	National Environmental Management Act [No 107 of 1998] (as amended)
Conservation:	Environment Conservation Act [No 73 of 1989]
Air:	National Environmental Management: Air Quality Act [No 39 of 2004]
Biodiversity:	National Environmental Management: Biodiversity Act [No 10 of 2004]
	National Environmental Management: Protected Areas Act [No 57 of 2003]
	National Environmental Management: Integrated Coastal Management Act [No 24 of 2008]
	National Veld and Forest Fire Act [No 101 of 1998]
	National Forests Act [No 84 of 1998]
Heritage:	National Heritage Council Act [No 11 of 1999]
	National Heritage Resources Act [No 25 of 1999]
Soil:	Soil Conservation Act [No 76 of 1969]
Agriculture:	Agricultural Pests Act [No 36 of 1983]
	Animals Protection Act [No 71 of 1962]
	Conservation of Agricultural Resources Act [No 43 of 1983]

Category	Act
	Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act [No 36 of 1947]
Communal Land:	Communal Land Rights Act [No 11 of 2004]
Land:	Land Survey Act [No 8 of 1997]
	Spatial Planning and Land Use Management Act [No 16 of 2013]
Water:	National Water Act [No 36 of 1998]
	Water Act [No 54 of 1956]
	Water Services Act [No 108 of 1997]
Catchment:	Mountain Catchment Areas Act [No 63 of 1970]
Mining and Minerals:	Minerals and Petroleum Resources Development Act [No 28 of 2002]
Waste:	National Environmental Management: Waste Act [No 59 of 2008]
	National Waste Information Regulations, Gazette 35583, No.R.625
Hazardous:	Hazardous Substances Act [No 15 of 1973]
Explosives:	Explosives Act [No 26 of 1956]
Fencing:	Fencing Act [No 31 of 1963]
Fire:	Fire Brigade Services Act [No 99 of 1987]
Transport:	National Railway Safety Regulator Act 2002
	National Road Traffic Act [No 93 of 1996]
	Road Traffic Act [No 29 of 1989]
	South African National Roads Agency Limited and National Roads Act [No 7 of 1998]
Health and Safety:	Occupational Health and Safety Act [No 85 of 1993]
	Mine Health and Safety Act [No 29 of 1996]
Public Administration:	Public Service Commission Act [No 46 of 1997]
	Public Service Act [No 103 of 1994]
Justice and Constitutional Development	Constitution of the Republic of South Africa Act [No 108 of 1996]
	Promotion of Access to Information Act [No 2 of 2000]
	Promotion of Administrative Justice Act [No 3 of 2000]

7 MOTIVATION FOR THE NEED AND DESIRABILITY

The DEA draft guidelines on need and desirability in terms of the EIA Regulations, 2014 (DEA, 2014) explains that, while it is essential that growth in the economy affect national policies and strategies, it is essential that the implementation of these social and economic policies take cognisance of strategic concerns such as climate change, food security as well as the sustainability in supply of natural resources and the status of our ecosystem services.

7.1 NEED FOR THE PROPOSED ACTIVITY

On 9 June 2010 a settlement agreement, and thereafter made an order of the High Court between AGRI FS and the President of South Africa were concluded. This order stipulates a negotiable patrol road and a border barrier along the Free State and Lesotho border that will prevent the movement of small and large livestock units from South Africa to Lesotho and *vice versa*. Due to the lack of commitment on the road construction AGRI FS has filed a contempt of court against the President and a revised agreement has seen the light on the 31st of August 2012.

Business reasons for the project (problems, needs and/or opportunities):

- To honour the High Court agreement
- To provide a negotiable road for the SANDF to perform a continuous patrolling of the entire Free State Lesotho border line
- To reconstruct a visible barrier between the Free State and Lesotho for the safe guarding of South Africans against foreign forces by the SANDF
- To construct a visible and impenetrable barrier between the Free State and Lesotho preventing livestock movement from one Country to the other, theft and to serve as a disease control barrier.
- To give the land owners an opportunity to increase the productivity of their business without the constant threat of violence and vandalism from foreign forces
- To empower the land owners to sustainably manage their own income in a safe and secure environment.

The following performance objectives explain the need to upgrade the proposed road:

- To improve the current state of the border road to be fully utilised for its purpose of patrolling the border between South Africa and Lesotho
- The safety of South Africans must not be compromised due to the poor condition and inaccessibility to the border road by the military
- To prevent undesirable elements such as theft of livestock and illegal drug trade within South Africa.
- To manage and control the possible trans-border spreading of animal disease, through managing and maintaining the border fence
- To increase grazing potential and use of land for agricultural production for the local Free State farmers, to stimulate the regional economy.

In addition, it must be noted that the road in its current state is prone to erosion and alien and invasive vegetation encroachment which could lead to on-going environmental degradation. Thus, by constructing and re-constructing the proposed road by means of

erosion prevention measures and the phase clearing of dense alien vegetation, it will improve the visual patrol and response time of the border.

To address the above need, the Defence Force as a client of the DPW, initiated a project that entails the preparation of a comprehensive site audit and obtaining of the required environmental authorizations that will form the basis for the redesign and re-construction of the road and to upgrade the road to allow improved functionality of the road for patrol purposes. In addition, the project aims to secure the required and defined access to the land in favour of the state of the road reserve. Therefore, the main objective of this project is to determine and establish the site for the road and to obtain “site clearance” for the road.

A Maintenance Management Plan will be prepared that incorporate maintenance on road sections, water crossings, bridges, etc. in order for the SANDF to have a 5 or 10-year maintenance plan that will exempt them from specific listed activities such as work within wetlands or water courses in future. As per GN R.983 Item 19(b), GN R.983 Item 27(ii), GN R.984 Item 15(ii), GN R.984 Item 27, GN R.985 Item 12.

7.2 DESIRABILITY OF THE PROPOSED ACTIVITY

Desirability is evaluated in terms of the suitability of the proposal under consideration, within the context of the location and prevailing circumstances, (e.g. locality, access, geotechnical compatibility, and service provision etc.), including its ability to meet the national, regional and local security objectives, and encompass the health, social, economic, and environmental objectives.

In the context of desirability, the re-construction, repair, upgrading and development of the road would be desirable if it would facilitate effective patrol of the border, facilitating access and cutting down on travel time, leading to more regular and safer border patrols.

This project will assist farmers and agri-food producers along the International border to improve their agricultural production systems and household income.

This project can be considered to be an issue of national importance with improved security of the border considered essential to reduce the risk of animal disease such as rabies outbreaks in South Africa and improved security of the Republic of South Africa from issues such as theft and illicit trade involving the distribution and sale of substances which are subject to drug prohibition laws.

This project will assist farmers and agri-food producers along the International border to improve their agricultural production systems and household income.

This project will prevent the movement of livestock over the international border.

8 ALTERNATIVES CONSIDERED

The proposed border road was designed to create a sustainable road for the SANDF to patrol the border road. The existing border road was used as the starting point for the proposed border road. The proposed border road was designed to minimise the environmental impact.

This section entails the comparison between the existing and the proposed border road that was done to determine the optimisation of the proposed border road. The various pavement design options, construction and maintenance costs are discussed. The layout of this section is as follows:

- Alignment optimisation;
- Construction and maintenance cost.

8.1 ALIGNMENT OPTIMISATION

To illustrate the outcome of the approach to optimise the proposed road design, we have highlighted a few key items being:

- Avoidance of 1:20 and 1:100 year floodlines
- Avoidance of the riparian zone
- Avoidance of wetlands
- Erosion protection
- Avoidance of water crossings
- Steep slope avoidance
- Arable land avoidance
- Proposed border road on the existing border road

Each of the items mentioned above is discussed in detail below:

8.1.1 AVOIDANCE OF 1:20 AND 1:100 YEAR FLOODLINES

The 1:20 and the 1:100 year floodlines were one of the major factors influencing the position of the proposed border road. The proposed border road was designed to be outside the 1:100 year flood line but this was not always possible. On numerous sections of the border road the proposed border road is below the 1:20 year flood line this is due to topographical restrictions and arable land next to the river limiting the space for the border road.

Table 8-1 below show the percentage the existing and proposed border road is within the 1:20 and the 1:100 year floodlines.

Table 8-1-Percentage within the 1:20 & 1:100 year flood line

Percentage within the 1:20 & 1:100 year flood line	Existing Border Road	Proposed Border Road
% within the 1:20 year flood line	**12.29%**	**12.48%**
% within the 1:100 year flood line	**13.53%**	**16.45%**

As seen from Table 8-1 there is no big optimisation of the border road with respect to the 1:20 and the 1:100 floodlines in fact the proposed border road was moved more into the 1:20 and 1:100 year floodlines. The road was moved closer to the border road to minimise the impact of the border road on the farms adjacent to the border and to decrease the sight distance to the border.

8.1.2 AVOIDANCE OF THE RIPARIAN ZONE

The riparian zone is the interface between a river or stream and the land. The riparian zone is the most sought-after area by animals offering them food, water and shelter. The border road was design to be outside the riparian zone minimising the environmental impact on the area. On a few occasions it was impossible for the proposed border road to avoid the riparian zone. In these instance the proposed border road was designed to be on the existing border road minimising the environmental impact on the riparian zone.

Table 8-2 below show the percentage the existing and proposed border road is within the riparian zone.

Table 8-2: Percentage within the riparian zone

Percentage within the riparian zone	Existing Border Road	Proposed Border Road
% within the riparian zone	**6.45%**	**6.41%**

8.1.3 AVOIDANCE OF WETLANDS

Wetland avoidance was measured as follows: were the proposed border road deviated from the existing border road to avoid a wetland area. The proposed border road was designed to minimise the impact on wetland areas. The proposed border road was not moved if the move created newly disturbed wetland areas.

Table 8-3 below show the percentage of wetland avoidance for the existing and proposed border road.

Table 8-3: Percentage of wetland avoidance

Percentage of wetland avoidance	Existing Border Road	Proposed Border Road
% of wetland avoidance	**0.71%**	**0.61%**

8.1.4 EROSION PROTECTION

Erosion protection was measured when the road was not deviated to miss badly eroded sections. The erode section will have to be rehabilitated and maintained to prevent the erode section from creating more damage.

Table 8-4 below show the percentage erosion protection for the existing and proposed border road.

Table 8-4: Percentage of erosion protection

Percentage of erosion protection	Existing Border Road	Proposed Border Road
% of erosion protection	**-**	**1.09%**

A small percentage of the road is within badly eroded sections. On these sections erosion protection measures will be applied to prevent further damage.

8.1.5 AVOIDANCE OF WATER CROSSINGS

Water crossings was measured where small streams crossed the border road.

Table 8-5 below show the percentage water crossing for the existing and proposed border road.

Table 8-5: Percentage of water crossings

Percentage of erosion protection	Existing Border Road	Proposed Border Road
% of water crossings	**0.54%**	**0.43%**

The percentage of water crossing was decreased to reduce the overall impact on aquatic and wetland areas.

8.1.6 STEEP SLOPE AVOIDANCE (STEEP SLOPES > 8%)

Slopes was consider steep if the gradient was more than eight (8) percent. It is difficult to construct roads on gradients steeper than twelve (12) percent by conventional methods. However, some sections the gradients goes as high as twenty (20) percent these steeper sections the road will be constructed of concrete.

Table 8-6 below show the percentage of steep slopes (>8%) for the existing and proposed border road.

Table 8-6: Percentage of steep slopes (>8%)

Percentage of steep slopes (>8%)	Existing Border Road	Proposed Border Road
% of steep slopes (> 8%)	**6.75%**	**6.77%**

It is clear that on steep sections, the proposed road deviated very little from the existing road. This is due to limited space on the steeper section to realign the proposed border road.

8.1.7 ARABLE LAND AVOIDANCE

Arable land is defined as land capable of being ploughed and used to grow crops. Along the border there is a number of farmers that farm up to the river creating minimum space for the border road. Avoidance of arable was measured as when the proposed road was moved of the existing road to minimise the land that will be taken from the farmer. However, this was not always possible as due to topographical restrictions.

Table 8-7 below shows the percentage of arable land avoidance.

Table 8-7: Percentage of Arable land avoidance

Percentage of Arable land avoidance	Existing Border Road	Proposed Border Road
% avoidance of arable land	**1.61%**	**1.68%**

As seen form Table 8-7 there is a small increase in the percentage the road was moved to avoid arable land and minimise the impact on the farmers' lands.

8.1.8 PROPOSED BORDER ROAD ON THE EXISTING BORDER ROAD

The existing border road was used as the start point for the design of the proposed border road. The objective of the proposed road was to stay on the existing alignment to minimising the environmental impact and the impact on the farms next to the international border. The proposed border road deviated from the exiting border road to shorten the road, avoid wetland crossing, and avoid the1:20 and the 1:100 year floodlines etc.

The following provides a summary of the proposed road alignment:

- 91.67% of the proposed border road follows the existing border road route.
- 41.86 km of the proposed border road is on a new route.
- The majority of the proposed border road is on the existing border road.

8.2 CONSTRUCTION AND MAINTENANCE COST

The construction and maintenance cost of the various options will affect the type of pavement opted for. This section is summarised below.

- Pavement type
- Specal cases
- Construction and maintenance cost
- Stormwater management

8.2.1 PAVEMENT TYPE

Due to the large difference in the topography along the border various pavement types was consider. This section discusses the various pavement types and the construction and maintenance cost of each pavement type to guide the client in making a decision.

The following pavement types are discussed in this section:

- Gravel road;
- Reduced width concrete pavement with grass shoulders;
- Surfaced Roads
- Concrete block pavement;
- Concrete strips;
- Full width concrete pavement.

8.2.1.1 Gravel Road (95% of overall road length)

This option comprises of the construction of a 4.0 m full-width gravel wearing course on top of a single or double selected layer (dependant on founding conditions). This proposal will be feasible for 95% of the road. See typical example in Figure 8-1 below.

Figure 8-1: Full width gravel wearing course

8.2.1.2 Reduced width concrete pavement with grass shoulders

In order to reduce construction costs, a reduced width concrete pavement will also make a durable road surface. The concrete pavement width will be 2.5m with 1m grass shoulders on either side of the concrete pavement. A typical example is presented in Figure 8-2 below.

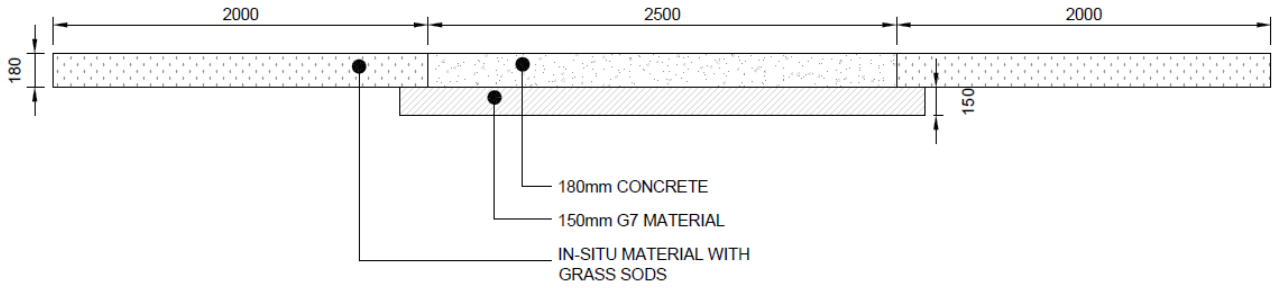


Figure 8-2: Reduced width concrete pavement with grass shoulders

8.2.1.3 Surfaced Road (Asphalt or seal)

This option comprised the construction of 4.0 m full-width surfaced road with a single or double selected layer, a sub-base and a base. If opted for, this proposal will be feasible for 99% of the road (1% will still require a full concrete pavement due to steep slopes).

8.2.1.4 Concrete block pavement

Concrete block pavements are usually used for municipal roads. The surface is durable and provides fair quality over the pavement's life span. This proposal will be feasible for 99% of the road (1% will still require a full concrete pavement due to steep slopes). See typical example in Figure 8-3 below.

Figure 8-3: Concrete paving blocks

8.2.1.5 Concrete strips

A durable road surface can be made from concrete strips laid along the wheel track of the proposed road. These roads can be built without expensive or sophisticated equipment and by comparatively unskilled labour that has received a little instruction. Strip roads are a particularly useful means of making roads passable in wet weather conditions. Its riding quality is lower when compared with full width construction, but its cost is significantly lower. This proposal will be feasible for 100% of the road. See typical example in Figure 8-4 below.

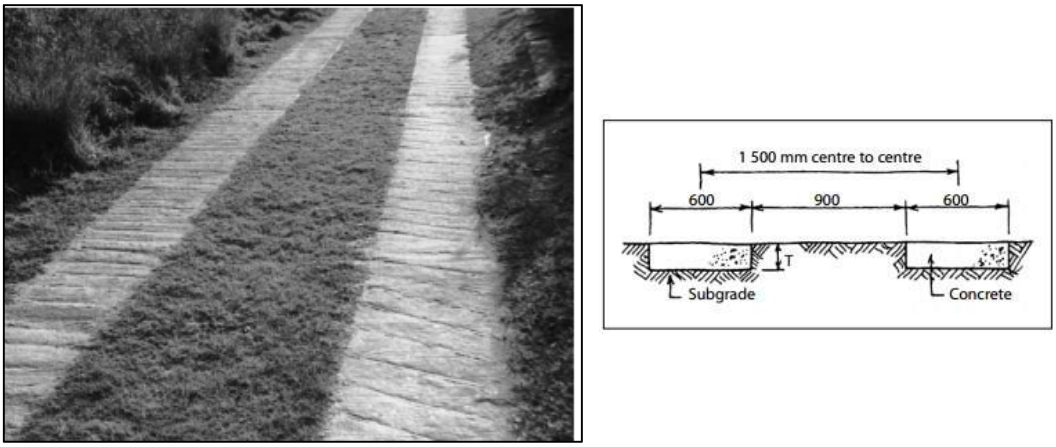


Figure 8-4: Concrete strip pavement on straight sections (Source:C &Ci)

8.2.1.6 Full width concrete pavement

Erosion becomes problematic on steep inclines as paving blocks and concrete strips start to shove downhill. It is recommended that the full width concrete pavement be constructed on steep inclines or downhill sections. Concrete must be rough to improve macro skid resistance of the surface. Side channels must be lined with stone pitching, hyson cells, concrete or any other reliable protection method.

8.2.2 SPECIAL CASES

Special cases are defined as sections where the normal pavement design cannot be constructed due to terrain and topographical conditions that require special measures. Special measures are discussed for the following situations:

- Steep inclines (>8%)
- Wetlands and marshy areas
- Minor stream crossings
- Major stream crossings.

The appropriate pavement design and cross-sectional measures for these cases are discussed below.

8.2.2.1 Steep incline (> 8%)

Erosion becomes problematic on steep inclines as paving blocks and concrete strips start to shove downhill. It is recommended that the full width concrete pavement be constructed on steep inclines or downhill sections. Concrete must be rough to improve macro skid resistance of the surface. Side channels must be lined with stone pitching, hyson cells, concrete or any other reliable protection method.

8.2.2.2 Wetlands and marshy areas

Free flow of water through wetland and marshes is required as recommended by the environmental specialist. The proposed pavement method will vary, depending on the availability of rock. If single-size rocks are freely available, the road will be lifted approximately 1.5 m to 2.0 m above the natural ground line. The exact level will be checked and placed depending on the estimated flood volume of surface water. Appropriately sized culverts will be placed at low points to ensure that the road does not impede the flow of water, even in the event that the rock matrix clogs up. The proposed method is illustrated in Figure 8-5 below.

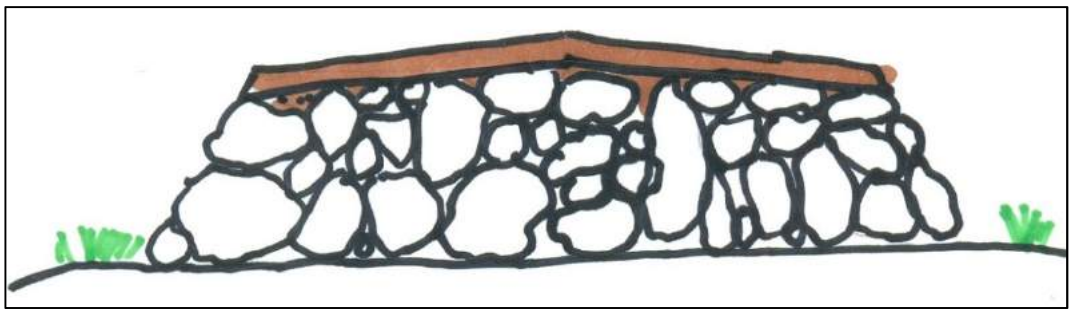


Figure 8-5: Single size rocks > 500mm diameter freely available

The second methodology will be implemented if rock is not freely available. For this scenario, the road will be lifted out of the water with fill material. Culverts will be placed at short intervals along the marsh. This method is not preferable, but material availability will dictate the final method. The proposed methodology is shown in Figure 8-6 below.

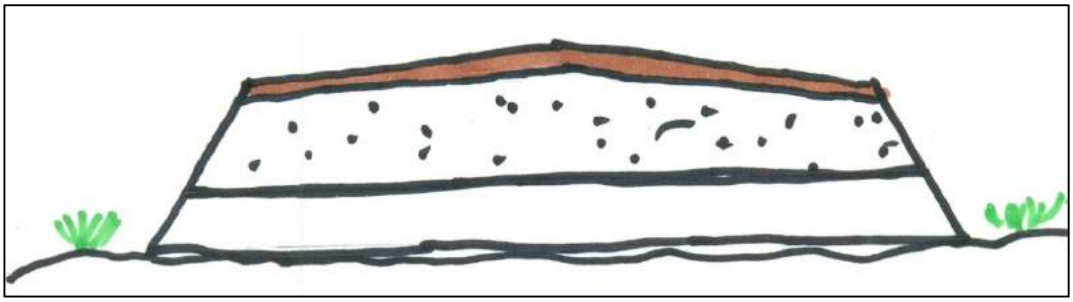


Figure 8-6: Single size rock not freely available

8.2.2.3 Minor stream crossings

Small, full-width concrete drifts will be constructed across minor streams. A minor stream is defined for purposes of this project as streams with a design flood volume of Q<5 m^3/s for the 1:5 year recurrence flood.

8.2.2.4 Major stream crossings

Concrete culverts and clear span bridges will be constructed across major crossings. The drainage design will dictate the appropriate measures to be employed.

8.2.3 CONSTRUCTION AND MAINTENANCE COSTS

In this section the following construction and maintenance cost are discussed for each of the following pavement types:

- Gravel road;
- Reduced width concrete pavement with grass shoulders;
- Surfaced Roads
- Concrete block pavement;
- Concrete strips;
- Full width concrete pavement.

8.2.3.1 Gravel Road (95% of overall road length)

The construction cost per km of such a road is presented below.

Gravel road construction cost	R 2 200 000 / km

This proposal is usually the cheapest to implement, but requires maintenance and periodic re-gravelling to ensure that ride ability is maintained. Its maintenance cost is presented below.

Gravel road maintenance cost according to RRM's – Low	R 15 000 / km / annum
Gravel road maintenance cost according to RRM's – Average Provincial standard.	R 20 000 / km / annum
Gravel road maintenance cost according to RRM's – High SANRAL standard	R 28 000 / km / annum

8.2.3.2 Reduced width concrete pavement with grass shoulders

The construction cost per km of such a road is presented below.

Reduced width concrete pavement with grass shoulders construction cost	R 3 850 000 / km

Reduced width concrete pavement with grass shoulders are initially expensive to construct, but requires very little surface maintenance when constructed although the shoulders do need regular maintenance. The surface is durable and provides fairly good riding quality over the pavement's life span. If opted for, this proposal will be feasible for 100% of the road although such an approach will increase the overall construction cost of the road.

Reduced width concrete pavement with grass shoulders maintenance cost - Average	R 60 000 / km / annum

8.2.3.3 Surfaced Road (asphalt or seal)

The construction cost per km of such a road is presented below.

Surfaced road construction cost	R 3 950 000 / km

This proposal is more expensive to construct and requires surface maintenance and periodic patchwork to ensure that ride ability is maintained. Its maintenance cost is therefore normally the highest.

Surfaced road maintenance cost according to SANRALS's RRM Average	R 75 000 / km / annum

8.2.3.4 Concrete block pavement

The construction cost per km of such a road is presented below.

Concrete block pavement construction cost	R 3 080 000 / km

The paving blocks must be contained on each side by a 150 mm x 150 mm concrete edge beam or Figure 3 concrete kerb, dug into the subbase. The supply and delivery of concrete paving blocks can be problematic for this project, due to its remoteness but laying the blocks can create additional employment for semi-skilled workers.

Concrete block pavement maintenance cost - Average	R 45 000 / km / annum

8.2.3.5 Concrete strips

The construction cost per km of such a road is presented below.

Concrete strips construction cost	R 3 150 000 / km

Maintenance, such as mowing the centre and edges, will be required at least four times a year to ensure that the road remains passible. A disadvantage of this type of construction is that the material between strips tends to erode on steep slopes and when vegetation does not bind it. Erosion gullies will have to be repaired at least once annually.

Concrete strips maintenance cost - Average	R 65 000 / km / annum

8.2.3.6 Full-width concrete pavement

The construction cost per km of such a road is presented below.

Full-width concrete pavement construction cost	R 4 100 000 / km

Full-width concrete pavements are initially expensive to construct, but requires very little surface maintenance when constructed. The surface is durable and provides fairly good riding quality over the pavement's life span. If opted for, this proposal will be feasible for 100% of the road.

Full-width concrete pavement maintenance cost - Average	R 45 000 / km / annum

In summary, the best option for the road will be a gravel 4m wide gravel road which has the lowest construction cost as well as the lowest annual maintenance cost. It is important to note that annual maintenance needs to be done timeously as if annual maintenance is not done according to best practice, the maintenance cost of a gravel road can easily treble as preventative maintenance quickly turns into reactive maintenance.

8.2.4 STORMWATER MANAGEMENT ALTERNATIVES

There are several issues around the stormwater management for the upgrade of the border road. As further investigation and design take place, a greater understanding of these issues will be developed which will guide the development and formulation of an optimum design for the border road. The feasibility of the stormwater design proposed is to ensure the following:

- Minimise disaster management associated with floods
- Prevent loss of life
- Protection of natural floodplain
- Mitigation of adverse impacts on the natural watercourse
- Enhancement of the social, ecological and amenity value of the watercourse and floodplain.

8.3 FENCE ALTERNATIVES

Two scenarios have been identified with regards to the fence positions as outlined below.

8.3.1 FENCE BETWEEN THE RIVER AND ROAD (OUTER FENCE)

If the fence is placed between the river (International boundary) and the road, it will slow the movement of patrollers down due to the fact that gates will have to be opened and

closed between each farm property. The advantage of this scenario is that in portions where the road is not close to the river only one fence may be required.

8.3.2 FENCE BETWEEN THE ROAD AND THE REST OF THE FARM PROPERTY (INNER FENCE)

If the fence is placed between the road and the farm properties, the ease of movement of patrollers is increased, which will be an advantage. The disadvantage of this scenario is that where the road is not close to the river, a second fence will be required to ensure that the farm owner's portion of land is clearly shown and protected.

For both scenarios, the amount of gates will be more or less the same due to the fact that access needs to be given to farm owners to use the road.

There are several issues around the pavement design and geometry of the road for the upgrade of the border road. As further investigations and design take place, a greater understanding of these issues will be developed which will guide in the development and formulation of an optimum design for the border road.

Delta BEC held a workshop to discuss the requirements of the fence according to The Department of Agriculture, Forestry and Fisheries (DAFF) and The South African National Defence Force (SANDF). This workshop was held at the start of February 2016 where the requirements and other considerations were discussed under the following sections:

- Requirements of an effective fence
- Required Specification
- Considerations

8.3.3 FENCING OPTIONS

Delta BEC investigated multiple options of fences proposed by DAFF for the construction on the Lesotho Border Road. The following alternatives were received and reviewed:

- 1.5m Jackal Proof Fence
- 2.2m Jackal Proof Fence
- 2.1 m Hardwood Inner Fence.
- Dolosse (alternative option).

8.3.4 ALTERNATIVE TO FENCING

For the purpose of proposing alternative solutions it has been decided to look into dolosse as an alternative solution along certain vulnerable parts in the Lesotho Border Road.

A problem that was identified is on the southern part of the border where a river is no longer present to hinder the use of vehicles in order to cross the border into South Africa. It was here where we suggest adding a barrier of dolosse in order to prohibit vehicles crossing the border.

Figure 8-7: Dolosse as an alternative to fencing.

In order to evaluate the use of dolosse as an alternative or an additional barrier the following positive and negative aspects must be considered.

Positive aspects:

- Strong and immovable to prohibit vehicles
- Low Maintenance.

Negative aspects:

- Provides hiding space during patrol
- Hinders the observation zone
- Expensive
- Unsightly to the environment.

8.4 PROPOSED CATTLE GRIDS AND GATES

8.4.1 GATES

The following are instances where the gates will be applicable for installation:

- Access to the river where owners have water licence;
- Access to the river where cattle graze from the river; and
- Access to arable land.

Standard farm gates can be used to ensure access for vehicles and animals. To manufacture the gates the following specifications must be adhered to:

- Frame material = 42mm Ø X 2mm galvanised round tubing
- Inside support = W pattern with 19mm Ø X 1.6mm galvanised round tubing
- Wire support:
  - Horizontal = 5 sets of 1.6mm fully galvanized double twisted high tensile steel wire
  - Vertical = 3 sets of 1.6mm fully galvanized double twisted high tensile steel wire
- Gate hanger = 16 X 50 X 300mm eye bolts with 200mm thread starting 50mm from eye bolt
- All material must be galvanized

It should be noted that only access point per farm parcel will be provided if the above mentioned requirements are met.

8.4.2 CATTLE GRIDS

Cattle grids will be installed where the border road crosses farm boundaries.

8.5 NO-GO ALTERNATIVE

If the proposed linear development does not proceed the status quo will remain the same, i.e. the current road would remain in its current dilapidated condition. The use of the road by the military would be hampered which negates the utility of the road for its purposes of patrolling the border. This would make the Republic of South Africa vulnerable to be misused by the neighbouring inhabitants of the Kingdom of Lesotho. This in turn could lead to further impacts on the republic of South Africa to aspects such as:

- Theft and the associated loss of agricultural production along the border
- Abandonment of farm lands and the associated socio-cultural impact
- Loss of grazing potential
- Risk of the spread of foot and mouth disease as well as other potential agricultural pathogens
- Illicit trade
- State will be unable to fulfil its obligatory constitutional mandates.

In addition, it must be noted that the road in its current state is prone to erosion and alien and invasive vegetation encroachment which could lead to on-going environmental degradation. Thus, by constructing and re-constructing the proposed road by means of erosion prevention measures and the phase clearing of dense alien vegetation, it will improve the visual patrol and response time of the border.

9 PUBLIC PARTICIPATION PROCESS

The public participation process undertaken to date is detailed under the following headings:

- Site Notices
- Written Notices
- Newspaper Advertisements
- Public Information Open Days
- Authority Consultation
- Draft Scoping Report subjected to public participation process
- On-going Stakeholder Engagement.

9.1 NOTICES BOARDS

A total of 31 notice boards (in Afrikaans and English, see figures below) were placed between 5 October 2015 and 9 October 2015 at strategic locations along the route of the proposed linear development.

Figure 9-1:Notice Board in Afrikaans

Figure 9-2: Notice Board in English

The site notice in **Appendix D1,** provides details of the proposed application for environmental authorisation, the Scoping and Environmental Impact Assessment process and how to register as an I&AP.

9.2 WRITTEN NOTICES

Written notice was given between 5 October 2015 and 9 October 2015 to key stakeholders (affected land owners, adjacent landowners, organs of state, municipal ward councillors,

and municipalities which have jurisdiction in the project area) by means of registered post, email and by SMS.

The written notice in **Appendix D2** was given to all I&APs containing a cover letter, Background Information Document (BID) and I&AP registration form.

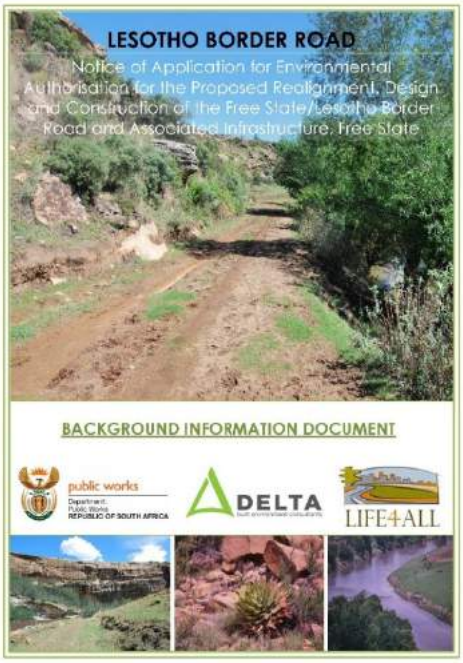


Figure 9-3: Background Information Document (BID)

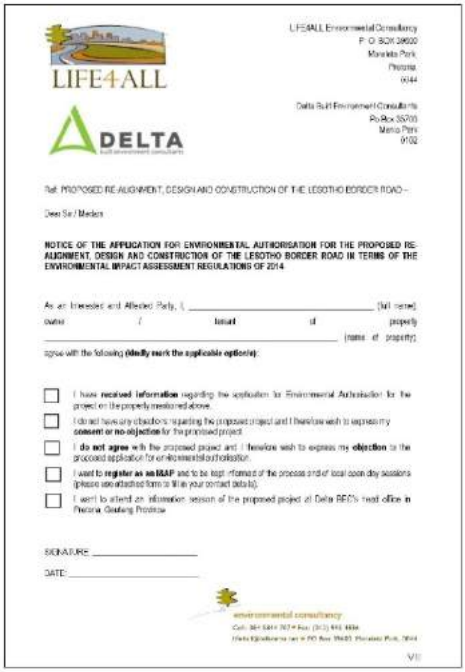


Figure 9-4: I&AP registration form

Please refer to **Appendix D2.1** (Proof of Written Notice to I&APs) and **Appendix D2.2** (Proof of Notice via Email to I&APs) for proof of notice given.

9.3 NEWSPAPER ADVERTISEMENTS

Notice of the application for environmental authorisation was advertised in one local and one provincial newspaper. Newspaper adverts were placed in the 8 October 2015 editions of the Volksblad (Local) and the Bloemfontein Courant (Provincial). Please refer to **Appendix D3** for the newspaper advertisements**.**

Figure 9-5: Volksblad (Appendix D3)

Figure 9-6: Bloemfontein Courant (Appendix D3)

9.4 PUBLIC PARTICIPATION OPEN DAYS

Public information open days were held between 16 and 20 November 2015, key stakeholders and Interested and Affected Parties were invited (refer to **Appendix D6**) a week prior to the public information open days held in the town of Zastron, Wepener, Ladybrand, Ficksburg and Fouriesburg.

A total of 55 people attended the open days, predominantly farmers along the route.

The material presented at the open days included drawings of the proposed and alternative route alignment on the individual farms/portions affected. The respective land owners were given the opportunity to provide comments and/or concerns in writing on the drawings.

Please refer to the following supporting documentation:

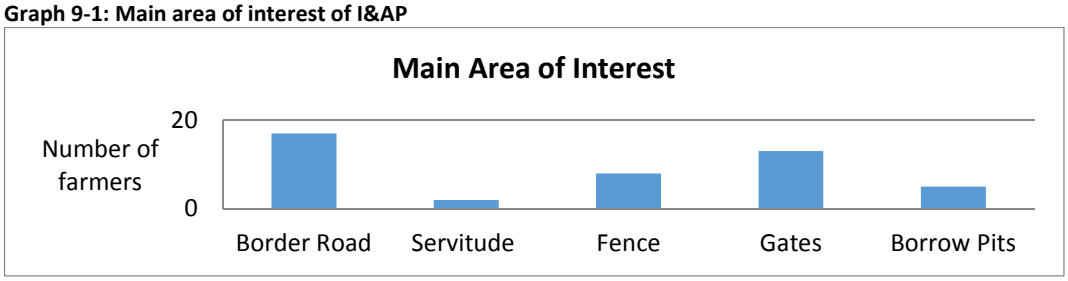
- **Appendix D4.1 -** Invite to Public Information Open Days
- **Appendix D4.2 -** Attendance Register for Public Information Open Days
- **Appendix D4.3 -** Comments Provided on Individual Farm Drawings
- **Appendix D4.4** - Comments Received During the Public Information Open Days
- **Appendix D4.5 –** I&AP Database.

9.5 SUMMARY OF THE ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

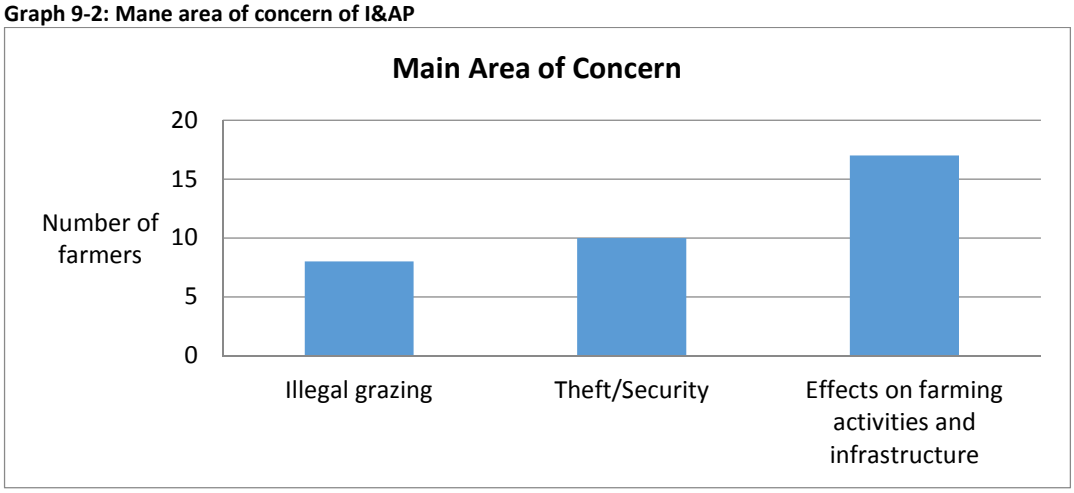
9.5.1 SUMMARY OF THE ISSUES RAISED IN I&AP REGISTRATION FORMS

The graphs below provide a summary of the main area of interest and concerns that I&APs provided in the registration forms returned to the EAP (total of 17 forms returned).

Graph 9-1: Main area of interest of I&AP



Graph 9-2: Mane area of concern of I&AP

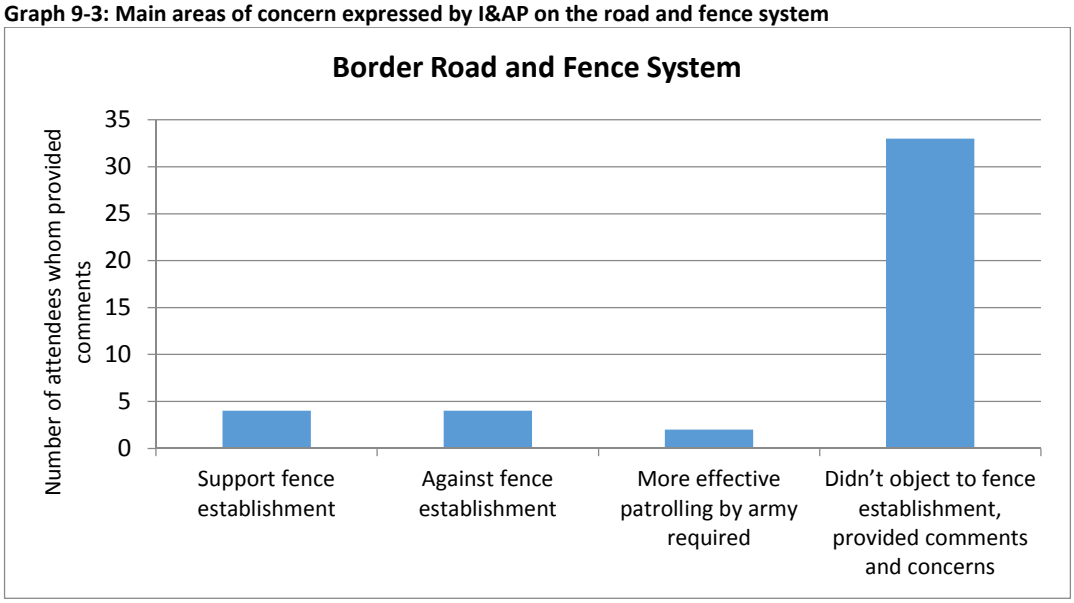


9.5.2 SUMMARY OF THE ISSUES RAISED DURING PUBLIC INFORMATION OPEN DAYS

This section provides a summary of the comments provided by attendees at the public information open days regarding the border road, proposed fence system and other aspects of concern related to the proposed linear development.

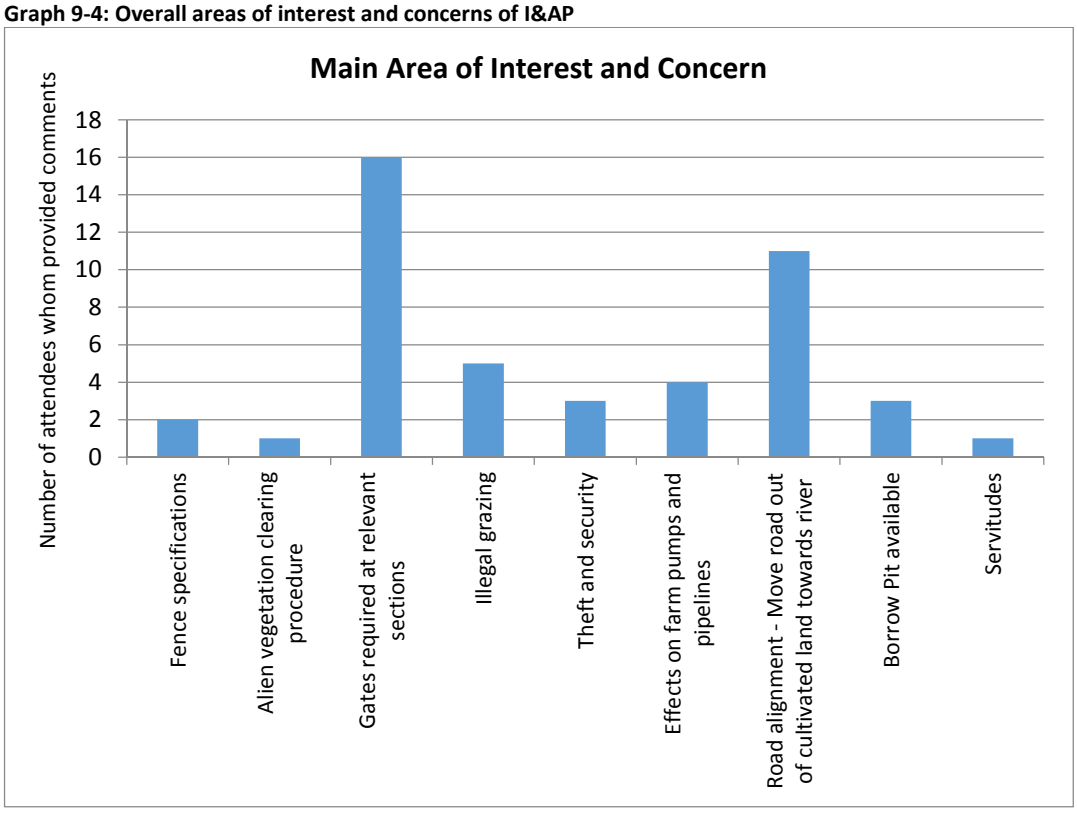
The graph below indicates that the majority of the attendees did not object to the fence establishment but however provided their concerns related to the fence establishment. An equal percentage of landowners supported-and were against the fence establishment. The lesser percentage of the landowners expressed that the border road and fence system required more effective patrolling by the army.

Graph 9-3: Main areas of concern expressed by I&AP on the road and fence system



The main areas of concern expressed (see graph below) include; gates required at specific sections for each farm, road alignment – many farmers requested that the road alignment be moved away from the farms towards the river, illegal grazing, effects on farm pumps and pipelines, availability of borrow pits on farmer's land, concerns regarding theft and security, fence specifications and the procedure for alien invasive species clearing.

Graph 9-4: Overall areas of interest and concerns of I&AP



Feedback received from stakeholders is recorded in the Issues and Responses Report (**Appendix D5**) and will be incorporated in the Final Scoping Report where applicable.

9.6 AUTHORITY CONSULTATION

A meeting was held with the Department of Water and Sanitation (DWS) on 16 January 2015 to discuss the GN1199 risk **assessment and/or Water Use Licence (WUL) exemption application.**

A pre-application meeting was held with the Department of Environmental Affairs (DEA) including the Department of Public Works (DPW) on 17 February 2016.

Please refer to **Appendix D6** for the minutes of meetings with key stakeholders.

9.6.1 ENVIRONMENTAL AUTHORISATION

A pre-consultation meeting was held with the Department of Environmental Affairs (DEA) in Pretoria on 17 February 2016. The purpose of this meeting was to give the DEA a general introduction of the project, proposed development and possible environmental impacts.

The following key points will be addressed in the Environmental Impact Assessment (EIA) report, based on the outcome of the meeting at head office:

- DEA commented that there should be a conclusion in terms of what would be the advantaged or disadvantages of the project continuing on the social economic of the specific area.
- DEA requested for a possible integrated impact assessment report, however DME needs to be in agreement, but still needs to be two separate applications.
- DEA requires proof that a water use license application has been submitted when submitting scoping report.
- They also suggested including Activity 19b for maintenance of the road, otherwise approval in the future will be required for the maintenance of the road through watercourses and sensitive areas.
- DPW & DEA discussed that it would be preferential to conduct a social economic impact assessment and there is a possibility to submit same on a later stage.

9.6.2 WATER USE

Two pre-consultation meetings were held at the Department of Water and Sanitation (DWS) offices in Pretoria and Bloemfontein on 16 January 2015 and 30 March 2015, respectively. The purpose of the meeting was to introduce the project to the DWS head office and the regional office, and agree on the proposal and programme to be followed as well as the associated roles and responsibilities.

As the project is of National Security and a priority for the DPW and the NDF, delays in the Water Use Authorisation process should be avoided as far as possible. The proposed route and key issues pertaining to the water use and resource impacts along the proposed linear development was discussed.

The following key points will be addressed in the Water Use License Application (WULA), based on the outcome of the meeting at head office and the regional office:

- Alternative layout and designs will be included in the Water Use License Application (WULA).
- The general design for the crossings that will be used to construct the crossings must be made available. All crossings must be marked on plans and minimum size A1 plans must be used to present the information.
- Construction within the flood line should be avoided where possible. In some of the areas the flood lines are wide and the areas al already eroded. The proposed road design will try to improve the current situation.
- Fence systems need to be designed in such a way to be safe from flooding, especially where the proposed fence and the proposed road are close to or within the flood line area.
- Only the wetlands that are physically crossed need to be delineated and that it is important if there is a wetland between a road and a river. The wetlands upslope are not as high a priority and need not be delineated unless they are directly affected;
- The Caledon River has the highest sediment concentration in South Africa and that mitigation to prevent erosion and sedimentation is essential.
- Determining the reserve (the quality and quantity of water required from the relevant water resource e.g. the Caledon River) will be an aspect that will form part of the WUL authorisation. The department has agreed that the reserve determination will be done through them, based on their information databases and available information in the technical document.

- A species list for rehabilitation and re-vegetation should form part of the rehabilitation plan and that there needs to be a conceptual planting plan included in the rehabilitation plan.

Please refer to **Appendix D6** for the minutes of meetings with key stakeholders.

9.7 DRAFT SCOPING REPORT MADE AVAILABLE FOR PUBLIC COMMENT

The draft Scoping Report was made available for I&AP to provide comments from 14 October 2016 up until 11 November 2016. A total of seven (7) hardcopies of the draft Scoping Report were made available at the following public venues:

- Dihlabeng Municipality (Clarens)
- Dihlabeng Municipality (Fouriesburg)
- Clocolan Public Library
- Ladybrand Public Library
- Dipelaneng Public Library
- ZNR Public Library (Wepener)
- Zastron Public Library.

Refer to **Appendix D7** for the notifiction to I&APs to provide comments on the draft Scoping Report and **Appendix D5** forthe comments and responses on the draft Scoping Report**.**

9.8 ON-GOING I&AP STAKEHOLDER ENGAGEMENT

Scoping Report subjected to public participation

Within 44 days of receipt of the application by the DEA, the scoping report must be submitted to the DEA which has been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority.

Consideration of scoping report

The competent authority must, within 43 days of receipt of a scoping report-

(a) accept the scoping report, with or without conditions, and advise the applicant to proceed or continue with the tasks contemplated in the plan of study for environmental impact assessment; or

(b) refuse environmental authorisation if-

(i) the proposed activity is in conflict with a prohibition contained in legislation; or

(ii) if the scoping report does not substantially comply with Appendix 2 of the EIA Regulations, 2014 (as amended) and the applicant is unwilling or unable to ensure compliance with these requirements within the prescribed timeframe.

Registered interested and affected parties entitled to comment on reports and plans

(a) A registered Interested and Affected Party is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in the EIA Regulations and to bring to the attention of the proponent

or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

10 PHYSICAL ENVIRONMENT

This section provides a summary of the scoping studies that have already been undertaken which includes:

- Invasive Alien Species Control and Eradication Plan
- Aquatic Study
- Wetland Study
- Faunal Study
- Floral Study
- Land and Soil Capability Study
- Palaeontological Study.

10.1 GEOGRAPHICAL ASPECTS

The spatial context of the proposed linear development is presented in the table below.

Table 10-1: Spatial context of the proposed linear development.

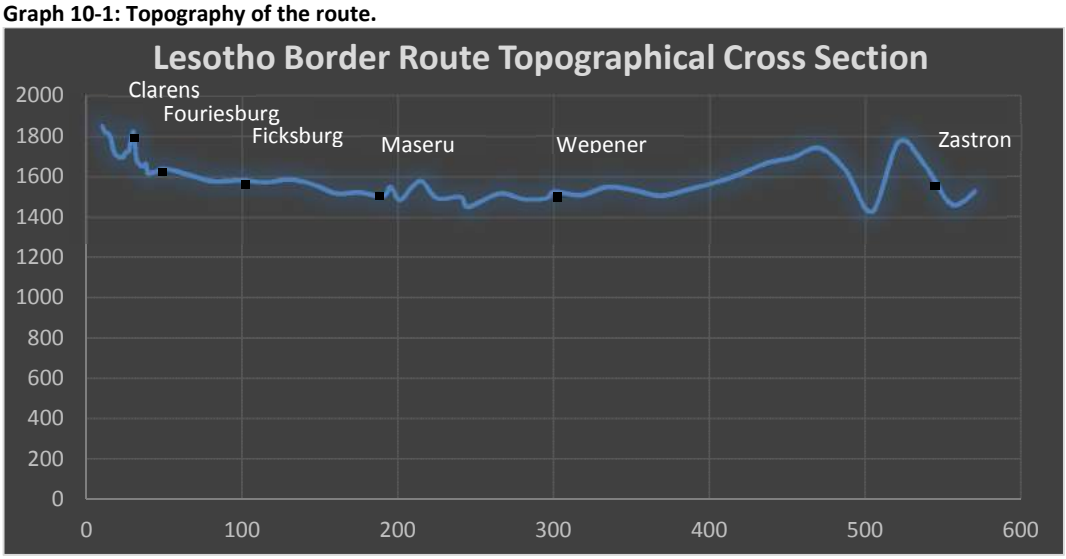
Spatial Context	Description
Province	Free State Province
District municipality	Thabo Mofutsanyana District Municipality Xhariep District Municipality
Municipalities	Dihlabeng Local Municipality – FS192 Setsotso Local Municipality – FS191 Mantsopa Local Municipality – FS196 Mangaung Metropolitan Municipality – FS164 Mokohare Local Municipality – FS163
Towns	Fouriesburg Ficksburg Clocolan Ladybrand Maseru Hobhouse Wepener Zastron
Border Posts	Caledonspoort Border Post (RSA) Ficksburg Bridge Border Post (RSA) Peka Bridge Border Post (RSA) Maseru Bridge Border Post (RSA) Van Rooyens Gate Border Post (RSA)

10.2 TOPOGRAPHY

Several sections of the proposed road are affected by severe mountainous areas, steep slopes, and embankments. These areas require detailed surveys and research

to enable finalising/determining of the most cost effective route alignment – as well as the optimal engineering solution to ensure constructability and long term road sustainability.

Graph 10-1: Topography of the route.



10.3 LAND USE

Land use is one of the main aspects to consider as part of the project. During the initial site visit, it was noticed that the majority of the road route runs along the river banks of the Caledon River. Other land uses along the route of the road consist of farming activities of which include grazing, game, and crops (soya, corn, etc.). There were also several farms on which no farming activity takes place. In these cases, the land use was captured as natural. Other land uses that were visible during the site visit include:

- Mining activities of which include sandstone mining and sand mining:
- Urban areas
- Cemetery
- Large areas of Poplar plantations to the southern extent of the border road
- In areas next to a steep cliff no land use was captured.

A detailed orthophoto was taken of the entire route which was analysed and interpreted in order to identify and confirm the land uses on each farm. The distance covered in the analyses of the land uses was based on a distance of 250 metres inland from the South Africa / Lesotho border.

The existing land use type and infrastructure (approximate %) within close proximity of the proposed linear development along the Lesotho Border Road Project are captured in the table below.

Table 10-2: Land Use types along the Lesotho Border Road Project

Land Use Type	Description	Approximate (%)
Permanent Water	Surface water that is detectable on Imagery. Includes both natural and man-made water features	1.43%

Land Use Type	Description	Approximate (%)
Wetlands	Areas where the water table is at, near, or above the land surface for a significant part of most years. Wetland areas are primarily vegetated. Wetlands may be either temporarily, seasonal or permanently wet and/or saturated. Vegetation is predominately herbaceous. Includes but not limited to wetlands associated with seeps/springs, marshes, floodplains, lakes / pans, swamps, estuaries, and some riparian areas.	54.53%
Dense Bush	Natural / semi-natural tree and / or bush dominated areas. Includes dense bush.	3.17%
Open Bushland	Natural/Semi Natural tree dominated areas. Includes Sparse bush land	3.57%
Grassland	Natural/Semi-natural grass dominated areas	10.35%
Hilly/Mountainous	Steep and semi-steep terrain which is associated mainly with mountains/hills	7.99%
Cultivated Land & Pasture	Land used for agricultural functionality including cropland, harvested, cultivated land, idle cropland and pasture on land more or less permanently used for that purpose	8.18%
Erosion dongas and gullies	Non-vegetated donga and gully features, typically associated with significant natural or man-induced erosion activities along or in association with stream and flow lines	5.7%
Built-Up (Urban/Town/ Small Holdings)	Formal Urban/Town Areas which consist out of mainly housing and Urban characteristics for example shops, road and other infrastructure, community buildings etc.	0.14%

10.4 GEOLOGY

The route is located mainly on rocks of the Elliot Formation with deep valleys in some instances cutting through onto the underlying Molteno Formation of the Karoo Supergroup.

The Elliot Formation comprises an alternating sequence of near horizontally bedded mudrock and subordinate fine to medium grained sandstone. The red and green-grey mudrock units typically range in thickness between, 25 – 100 m in the type area and dinosaur remains are fairly common in it. The sandstone layers are yellowish grey to pale red and up to 22 m thick. Their bases are erosional and contain mudrock interclasts. Flat bedding and trough cross-bedding pre-dominate.

The Elliot Formation is typically a ‘red bed’ fluvial deposit. Initially the rivers had meandering channels, but progressive warming and aridity in the climate resulted in the depositing rivers becoming broader, shallower and more ephemeral. The sandstones towards the top of the Formation represent sheet sands deposited in large flood fans by short lived flash floods. The uppermost part of the Elliot Formation contains evidence of aeolian conditions.

The Clarens Formation that overlies the Elliot Formation is the final phase of Karoo sedimentation and is followed by the outpour of the Drakensberg basalts that form the

Lesotho Highlands. Sandstone of the Clarens Formation that overlies the Elliot Formation, form the impressive rock faces that sometimes can be seen above the route followed by the road. The Drakensberg basalts are not encountered along the route, although much of the boulder deposits in streams, are sourced from this rock from higher up in the topography.

With time – the Elliot Formation is Triassic in age, i.e. 213 to 248 million years ago – the sediments became indurated and intruded by dolerite sills and dykes which locally metamorphosed the sedimentary rocks, so that it became differentially resistant to the erosion that followed in years to come.

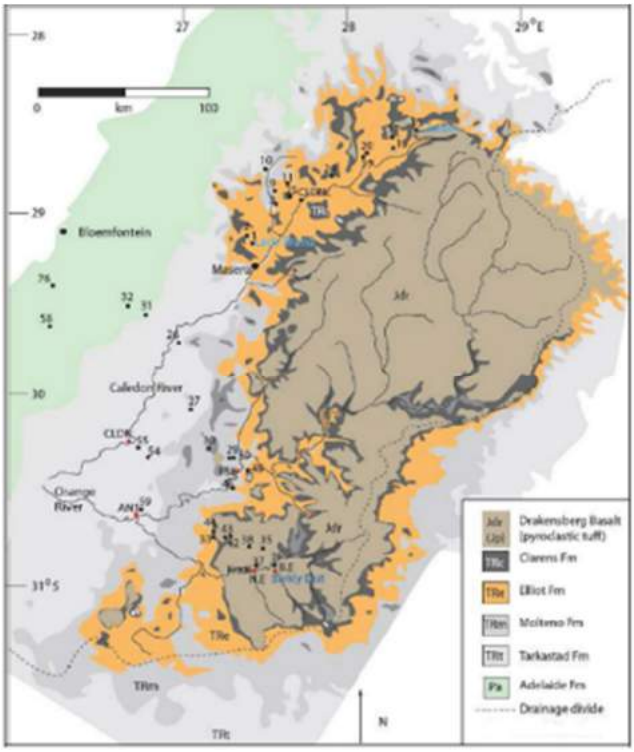


Figure 10-1: Geology of the Lesotho Border area.

10.5 GEOMORPHOLOGY

The geological maps of the area indicate that the entire proposed linear development is expected to be underlain by shale, sandstone or mudstone of the Karoo Supergroup, which is intersected by dolerite intrusions. The road will form a large part follow the Caledon River and will therefore also traverse alluvial deposits in the floodplain of the river. These conditions are ideal for application of the Total Engineering Geology approach, which aims to associate the shallow soil conditions with the landforms along the route.

Following the desk study and site reconnaissance investigation in 2015, a baseline Total Engineering Geology Model of the route was compiled which identified 20 Geotechnical related aspects, which may impact on the proposed road. This baseline model will be expanded and improved as the site investigation enters higher levels of data capturing, though the field investigation (test pitting and laboratory testing), which will commence when the most likely route is selected.

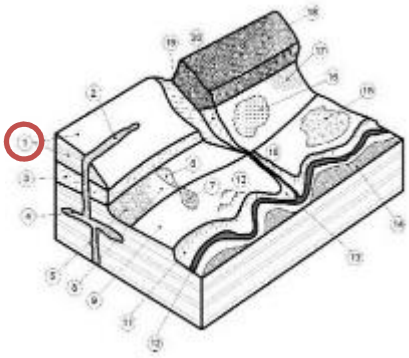
The following sections present considerations pertaining to each of the identified 20 Geotechnical related aspects, which may impact on the on the proposed road.

- Slopes on mudrock and siltstone

- Dolerite dykes
- Sandstone slopes/cliffs
- Dolerite sills
- Talus slopes
- Erosion of colluvial or talus slopes
- Deposition of transported material
- Colluvial slopes
- Terrace deposits (floodplain)
- Biotic or farming related re-working
- Steep river banks
- River
- Deep gullying
- Quaternary (alluvial) deposits
- Wetlands on floodplains
- Wetlands on colluvial or residual slopes
- Talus slope originating from caprock
- Resistant caprock
- Tributaries of main river
- Tributary river valley.

10.5.1 SLOPE ON MUDROCK

Slopes on mudrock are generally moderately steep, but do not behave well when cut into.



The natural tendency for such slopes, is to work itself back to the stable slope angle of about 35 degrees.

The red and green-grey mudstone, once stripped of the natural vegetation, tends to slake and become erodible.

Hummocky ground on mudstone slopes often point to paleo slips. These are best avoided when positioning the road alignment, because they are difficult to remediate when they occur below and adjacent to the road prism.

The following other problematic conditions may be associated with slopes on the mud rocks:

Figure 10-2: Mudstone side slopes tend to be 1 vertical in 1.5 horizontal but those present in sandstone are closer to vertical

- Softening of predominantly clayey residual soils with an increase of moisture content
- Poor traffic ability, when wet
- Ponding of water on bedrock and predominantly clayey residual soils
- Mudstone side slopes tend to be 1 vertical in 1.5 horizontal but those present in sandstone are closer to vertical.

10.5.2 DOLERITE DYKES

Dolerite dykes are the main source of base course and surfacing materials for roads in the area which is otherwise occupied by sedimentary rocks.

Depending on the degree of decomposition, the material may only be suitable for; fill, base course or surfacing layer material when sufficiently granular.

Locations where dolerite can be found, generate a lot of attention because of it being a scarce resource – that will have to be transported many kilometres – and thus constitutes an expensive element of the road construction.

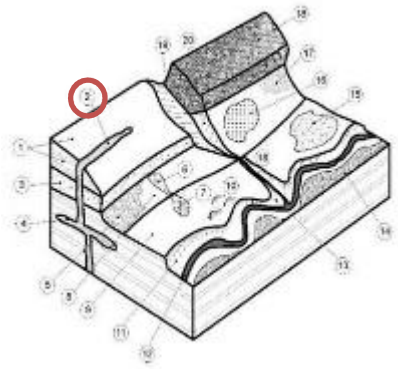


Figure 10-3: Dolerite dykes intrusions

10.5.3 SANDSTONE SLOPES/CLIFFS

Because the rock mass is jointed and the sandstone material is strong, in instances where it is underlain by mudstone (which crops out on the side of a mountain) the cliff face sometimes become unstable in toppling.

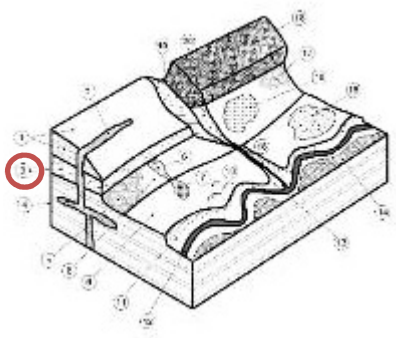


Figure 10-4: Topple blocks of Sandstone near the face of the cliff

Topple blocks, by virtue of their size and precarious balance, present a hazard to the road user. These blocks can cause significant damage when sliding down or rolling down the mountain side. Care should be taken in aligning the route to avoid such areas, as instability on this scale, is difficult to control and very expensive to correct. Undercutting of mudstone below the sandstone cliff face may aggravate the problem.

10.5.4 DOLERITE SILLS

Contrary to dolerite dykes, dolerite sills are intrusive rocks from a magma source at depth that intrude parallel to the bedding plane of horizontally bedded sediments.

Dolerite sills, like dolerite dykes, present a valuable source of road construction materials. Sills may sometimes be very extensive and thick and in these instances more likely to be a source of hard rock aggregate. In some instances, it is difficult to distinguish between sills and dykes.

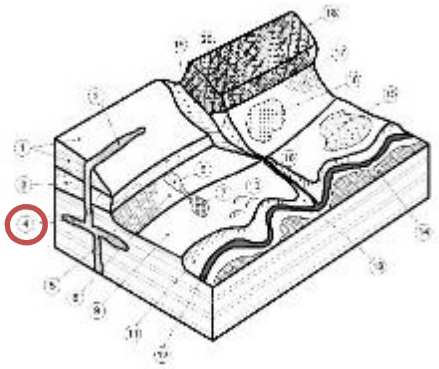


Figure 10-5: Dolerite gravel in borrow pit on sill

10.5.5 TALUS SLOPES

Talus slopes occur on slopes underlain by mudstones, sandstones and dolerite. It is a recent deposit of debris from higher lying ground formed under the influence, mainly of gravity and accompanied by some sheet flow.

Cutting into the deposit for creating road platforms often result in slope failure. In addition, the foundation materials in the roadbed in such locations are often collapsible, leading to distress in the pavement over the long term.

Excavatability of materials is sometimes unpredictable because of the large blocks of rock in the matrix. Blasting is likely to be required.

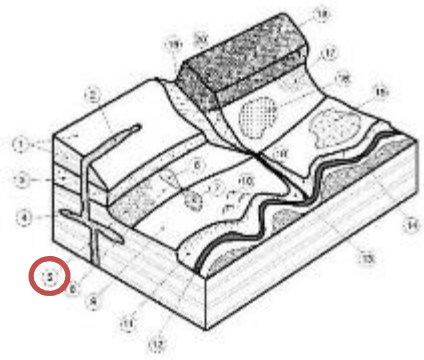


Figure 10-6: Talus slope with sandstone blocks exposed at surface

10.5.6 EROSION OF COLLUVIAL OR TALUS SLOPES

In areas of overgrazing and in locations where ephemeral streams exit from higher ground onto colluvial or talus slopes, erosion gullies are sometimes likely to form.

This type of erosion may be significant and may require remedial action – particularly where these streams exit onto slaking mudstone –so as to not endanger the approaches to culverts and bridges that may be required in such locations.

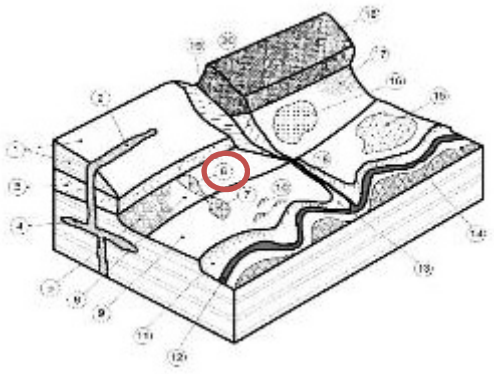


Table 10-3: Erosion of colluvial slope

10.5.7 DEPOSITION OF TRANSPORTED MATERIAL

Outwash fans that develop where ephemeral streams deposit the material gouged from colluvial or talus slopes, result in a hummocky appearance to the side slopes of mountains and ridges. The materials in these fans are typically deltaic deposits and variable in grain size.

The material may be compressible or collapsible and can influence the behaviour of the road bed. It may also trigger slope movement.

10.5.8 COLLUVIAL SLOPES

Colluvial slopes are the product of sheet wash and the material is generally finer grained than those with talus deposits. The slope gradient is also less and as a result, only requires low side cuts.

Generally, the cut should be in soft material which includes the top soil and pebble marker overlying transported sands and clays originating as hillwash.

It is possible that on lower slopes, side cuts will expose; bedrock mudstone, shale and sandstone. This may require that these materials must be protected against erosion – particularly the mudstone – and it is possible that a perched water table on top of the bedrock will be encountered. This may require that the exposed water must be drained.

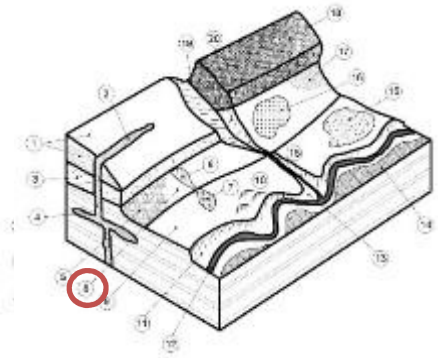
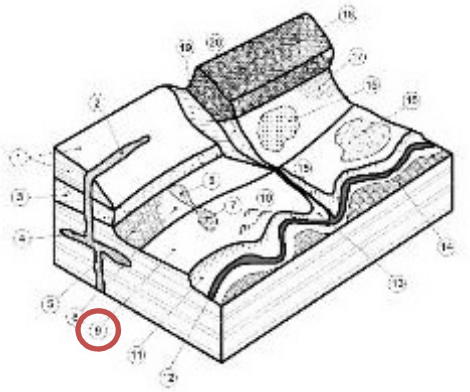


Figure 10-7: Colluvial Slope (area in reen) at Foothills of Mountain

10.5.9 TERRACE DEPOSITS (FLOODPLAIN)

Terrace deposits are present where the river overflows its banks from time to time, depositing flood sediments, as the water recedes and the river returns to its normal course. The same happens when the river temporarily, under high flood conditions, return to areas it occupied in the geological past, such as old river channels and cut off meanders. Alternatively, the terraces represent much older floodplain deposits that existed at higher elevation.

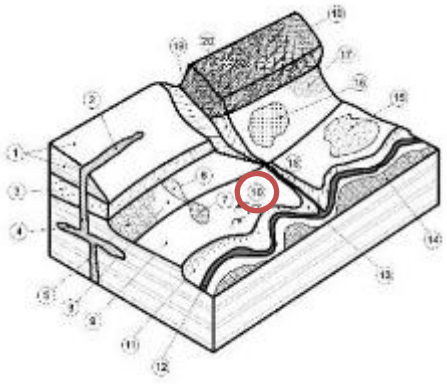


The soils deposited in terraces are variable – depending on the energy in the river at the time of the depositioning – but are generally fine grained sands, silts and clays.

Figure 10-8: Terrace deposits on low ground next to the course of river.

10.5.10 BIOTIC OR FARMING RELATED RE-WORKING

Biotic reworking refers to the mulching of soil by ants and termites. Plant roots are another agent that causes the deep soil generally present in the floodplains. Flat and near horizontal areas in the landscape need to be reworked so that pores, fissures and channels are present, sometimes to significant depth.



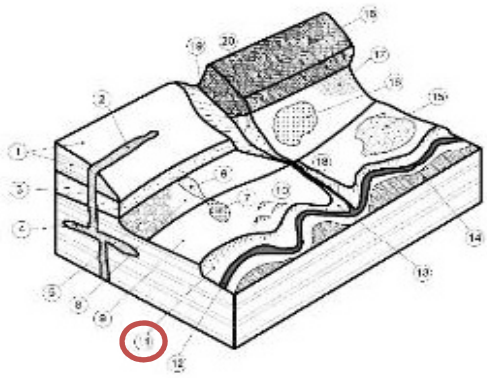
The overall effect is that the soil is at a lower density than what it otherwise would have been, this imparts compressibility/collapse potential of the material. The same applies to farming activities where the soil is ripped and ploughed, loosening it to significant depth.

Where loose or compressible soils are encountered below the roadbed, treatment will be necessary to prevent settlement under operational conditions.

Figure 10-9: Ploughed land in deep sandy soil.

10.5.11 STEEP RIVER BANKS

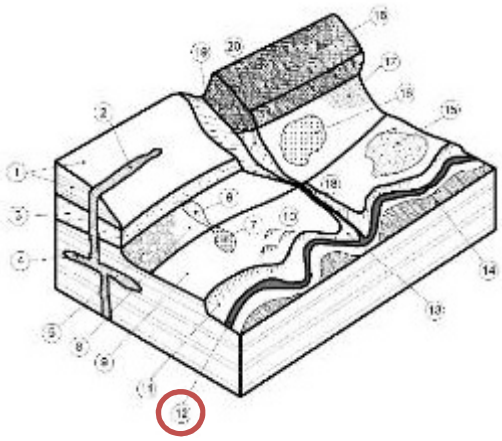
Steep river banks are associated with the Caledon River and tributaries where they actively erode and cut into virgin landscape or into the floodplain deposits left earlier by the rivers.



The obvious challenge presented by these steep river banks is that they are mostly in deep and loose alluvial sands and these materials are subject to erosion. The deposits may also be compressible.

Figure 10-10: Steep river bank cut into loose, erodible sand.

10.5.12 RIVER



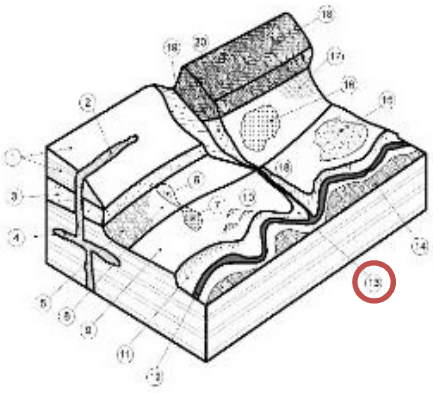
The Caledon River carries high sediment loads as it weaves its way downstream, meandering over its own floodplain. When the river is in flood it has significant erosion capability and the river is able to change its course under these conditions.

The obvious challenge is to remain sufficiently far away with the route alignment so that, in the event the river changes route or scours its banks, the road is not compromised.

Figure 10-11: Caledon Meandering over own floodplain deposits.

10.5.13 DEEP GULLYING/DONGA FORMATION

Because dongas grow rapidly upstream by way of back sapping and common erosion. They compromise higher lying infrastructure by undercutting their foundations. This eventually leads to collapse of the superstructures.



Combatting dongas is essentially a process of creating a series of barriers that raises the erosion baseline. Gabions are often used, but farmers have devised many novel ways of dealing with the problem, such as old tyres. Where the protection is located close to the infrastructure, it is intended to safeguard non-erodible material. Piling may have application in some instances.

Figure 10-12: Dongas feeding into river courses.

10.5.14 QUATERNARY (ALLUVIAL) DEPOSITS

The quaternary and recent alluvial deposits are noted in the floodplains of and those adjacent to the major streams, as well as deposits in gullies that flow to these rivers.

In the case of the latter, the deposits are typically thin. These materials are compressible and erodible.

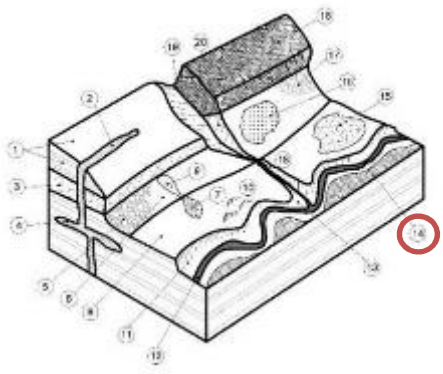


Figure 10-13: Quaternary and recent alluvial deposits.

10.5.15 WETLANDS ON FLOODPLAINS

Wetlands on floodplains are present in topographical lows associated with paleo river beds and cut off meanders. In the unlikely event that wetlands are crossed, drainage of the roadbed will be required and the floor of the future road will be constructed with a pioneer layer consisting of rockfill.

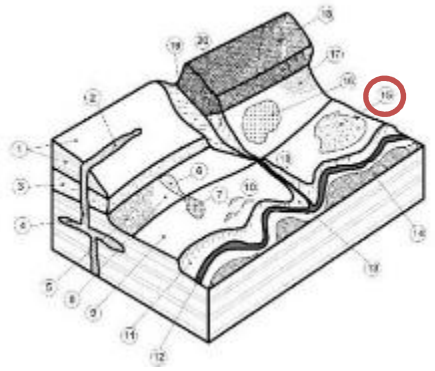


Figure 10-14: Lush green grass in wetland on floodplain

10.5.16 WETLANDS ON COLLUVIAL OR RESIDUAL SLOPES

Wetlands on colluvial slopes develop where the soil cover is thin and the underlying rock is an aquatard. In the instance depicted in the figure below the wetland is from anthropogenic intervention; the road bed causes subsurface damming up of the ground water to the left of the road.

As with other wetlands, crossing them will require drainage of the road prism and a pioneer rockfill at the base of the pavement to create a stable working platform.

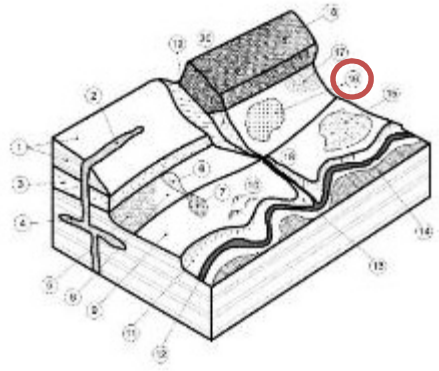
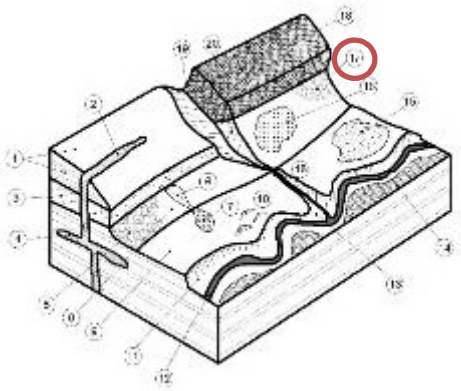


Figure 10-15: Subsurface damming up of the ground water to the left of the road.

10.5.17 TALUS SLOPE ORIGINATING FROM CAPROCK

Talus slopes at the base of caprock slopes are a special case associated with sandstone cliffs. Because of the state of limiting equilibrium in which these talus slopes are, any excavation into them or at their toes, will likely trigger slope movement. This is best avoided.



In a few instances the river on the outsides of the bends have come close to cutting into the mountain sides and as a result provide narrow passage for the road in proximity to the international border. In such instances it will be necessary, to provide lateral support to existing cuts as well as any new cuts.

10.5.18 RESISTANT CAPROCK

Resistant caprock can be either sandstone ledges or dolerite outcrop. Operations too close to the edge run the risk of triggering slope movement.

Crevasses associated with open joints near the cliff faces allow for the local loss of soil into cavities below (sinkholes). If the ground surface requires lowering on resistant caprock blasting is likely to be required.

To improve under-drainage below the road prism the rock also needs to be fractured by blasting otherwise water will accumulate and soften the pavement layers.

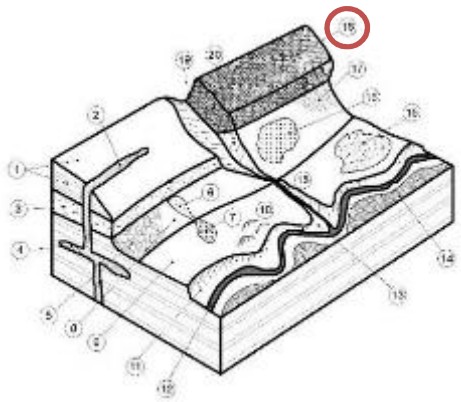


Figure 10-16: Resistant caprock in roadbed.

10.5.19 TRIBUTARY OF MAIN RIVER AND TRIBUTARY RIVER VALLEY

Smaller rivulets and drainage channels that feed to the Caledon and similar rivers present obstacles that all need to be crossed by the road. As most of these will be in the form of box culverts they will be found on the alluvial soils.

Care need be taken to ensure that floodwater does not erode the floors or side and in that way lead to undermining of the foundations.

Bridges and similar heavy structures will be founded on bedrock below the alluvium and this will likely be in end bearing on mudstone, shale, sandstone or dolerite.

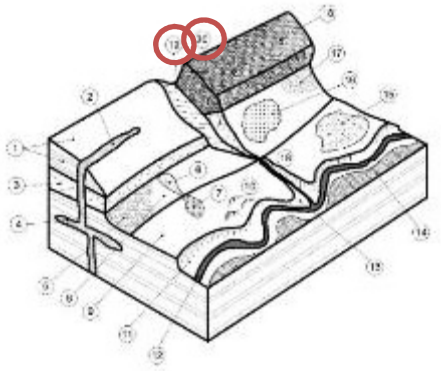


Figure 10-17: Tributary river flowing on sediment

10.6 SOIL, LAND CAPABILITY AND AGRICULTURAL POTENTIAL

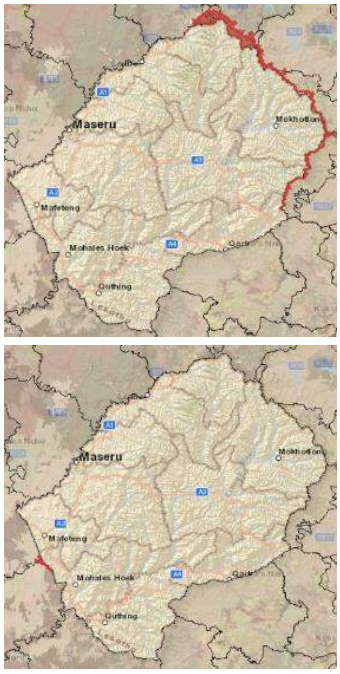
A Soil and Land Capability Impact Assessment was conducted in July 2015. The objective of this assessment was to classify soil forms (types) that occur within the proposed linear development area, and to assess their respective agricultural potential in terms of land capability, as part of the environmental impact assessment (EIA) and authorisation process for the proposed linear development (refer to Appendix D2 for the Specialist Scoping Report).

The preliminary findings of this assessment indicate that the majority of the proposed linear development comprised of Namib/Dundee (Nb/Du) and Valsrivier/Sepane (Va/Se) soil forms. Other identified soil types included the Hutton/Clovelly (Hu/Cv), Glenrosa/Mispah (Gs/Ms), Tukulu/Oakleaf (Tu/Oa), as well as Sterkspruit (Ss) and Westleigh (We) soil forms. The majority of the identified soils including Nb/Du, Va/Se, Hu/Cv, Tu/Oa, and We soil forms have arable land capability, with moderate agricultural potential under prevailing conditions. The Ss and Gs/Ms soil forms are best suited to grazing and wilderness, respectively.

The simplified baseline for the general soils of South Africa and the soil classes created for agricultural use (AGIS, 1996) is discussed in the sections to follow.

10.6.1 GENERAL SOILS AND SOIL CLASSES

Non Soil land classes



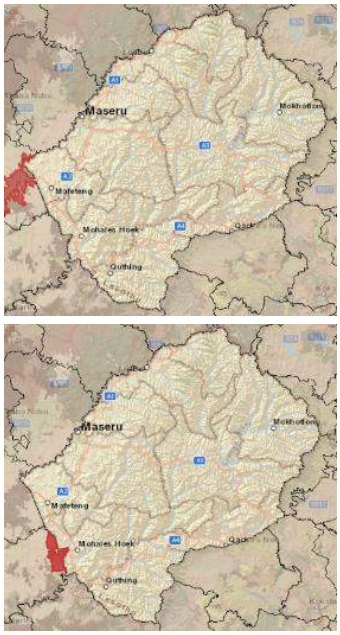
Class:
Non Soil land classes

Favourable properties:
May be water intake areas.

Limitation:
Restricted land use option.

Location:
North, near Clarens; and
South-west, near Zastron.

Undifferentiated texture contrast soils (Classes 7 and 14)



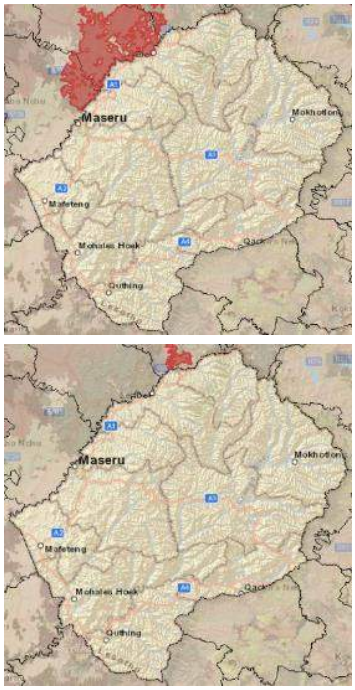
Class:
Undifferentiated texture contrast soils (Classes 7 and 14)

Favourable properties:
Somewhat high natural fertility or relative wetness favourable in dry areas.

Limitation:
One or more of, restricted effective depth; slow water infiltration; seasonal wetness; high erodibility.

Location:
West, near Wepener; and
South-west, near Zastron.

Undifferentiated structure less soils (Classes 1–4)



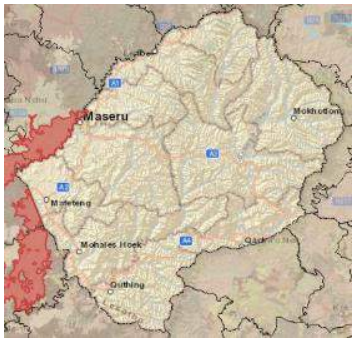
Class:
Undifferentiated structure less soils
(Classes 1 – 4)

Favourable properties:
Favourable physical properties.

Limitation:
One or more of; low base status, restricted soil depth, excessive or imperfect drainage, high erodibility.

Location:
North West

Texture contrast soils – often poorly drained



Class:
Texture contrast soils often poorly drained

Favourable properties:
Relative wetness favourable in dry areas.

Limitation:
Seasonal wetness, highly erodible

Location:
West of Maseru;
South-West

Structure less and textural contrast soils (Classes 17 and 19)

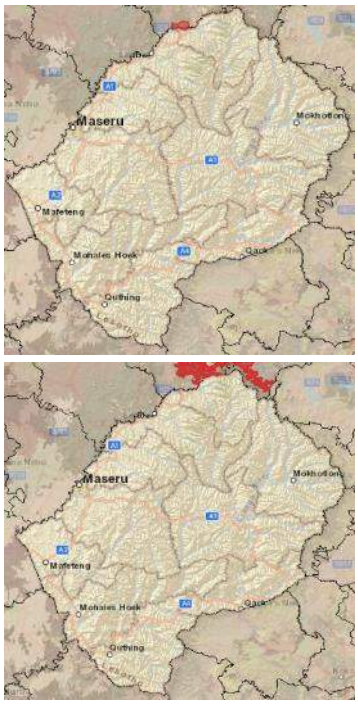
Class:
Structure less and textural contrast soils (Classes 17 and 19)

Favourable properties:
May have favourable physical properties, somewhat high natural fertility and relative wetness favourable in dry areas.

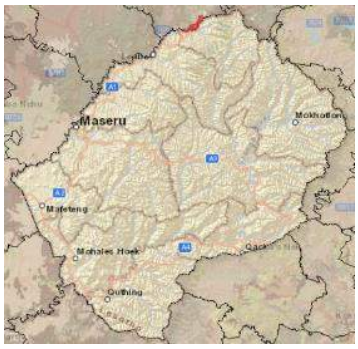
Limitation:
Restricted depth, imperfect drainage, high erodibility; slow water infiltration, seasonal wetness.

Location:
North

Undifferentiated shallow soils and land classes (Classes 13 and 16)

	**Class:** Undifferentiated shallow soils and land classes (Classes 13 and 16) **Favourable properties:** Soils may receive water runoff from associated rock water intake areas. **Limitation:** Restricted land use options **Location:** North

Freely drained structure less soils

	**Class:** Freely drained structure less soils **Favourable properties:** Favourable physical properties **Limitation:** May have restricted soil depth, excessive drainage, high erodibility and low natural fertility. **Location:** North

10.6.2 SOIL CLASSES FOR AGRICULTURAL USE

There are three (3) agricultural regions that form part of the proposed border road route these comprise regions classified as:

- Grains
- Cattle
- Sheep.

With reference to the figure below, the northern extent of the border route around Clarens and the area north and south of Hobhouse and Wepener has very low soil regeneration potential if badly eroded.

The remaining extent of the proposed route has moderate to high soil regeneration potential.

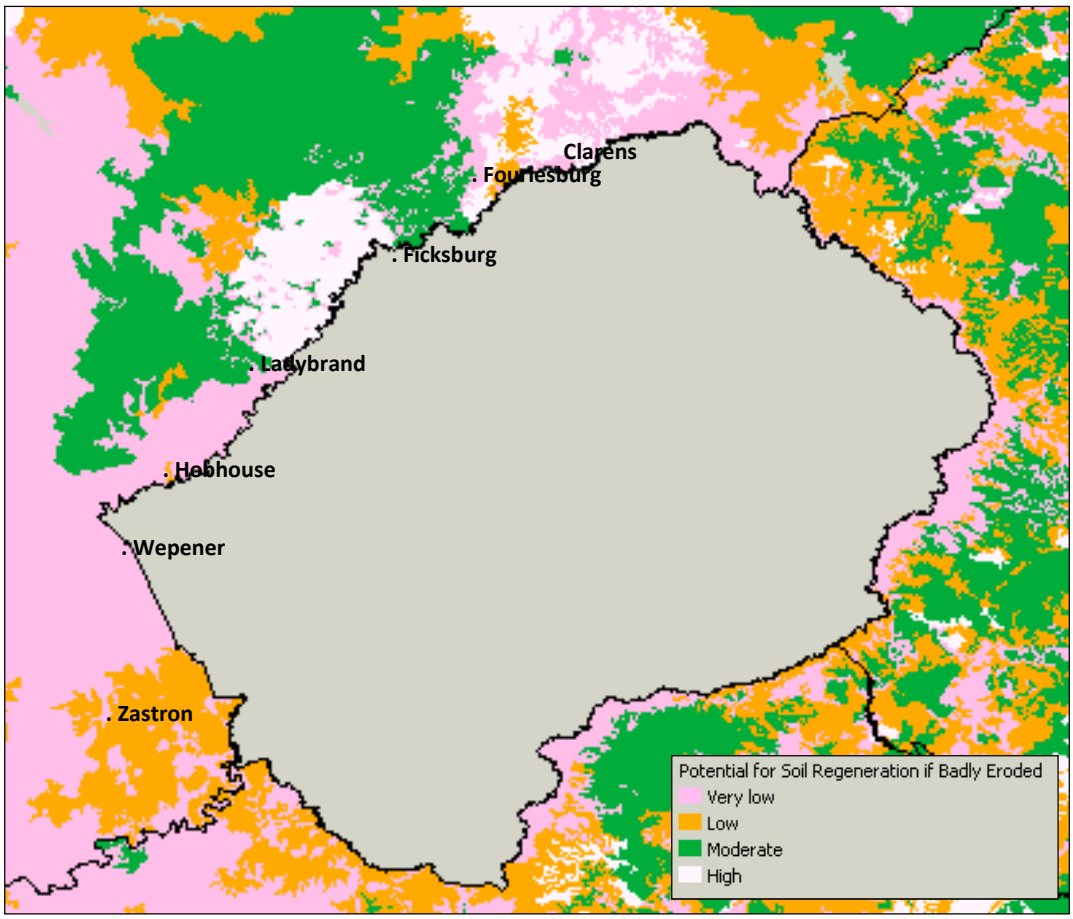


Figure 10-18: Soil regeneration potential

In the Government Gazette of 13 March 2015, the Minister of Agriculture published the Draft Policy and Bill on the Preservation and Development of Agricultural Land.

In addition, land which is categorised in classes 1 to 3, is defined to be high potential cropping land and land categorised in classes 4 to 8, is defined to be medium potential agricultural land.

The Bill states that the subdivision of high potential cropping land is prohibited unless approved by the Minister. The process of approval requires input from various role players, including municipalities, other government departments and traditional communities. In regard to medium potential agricultural land, the approval of the MEC is required. The exceptional circumstances criterion does not apply to agricultural land of moderate potential.

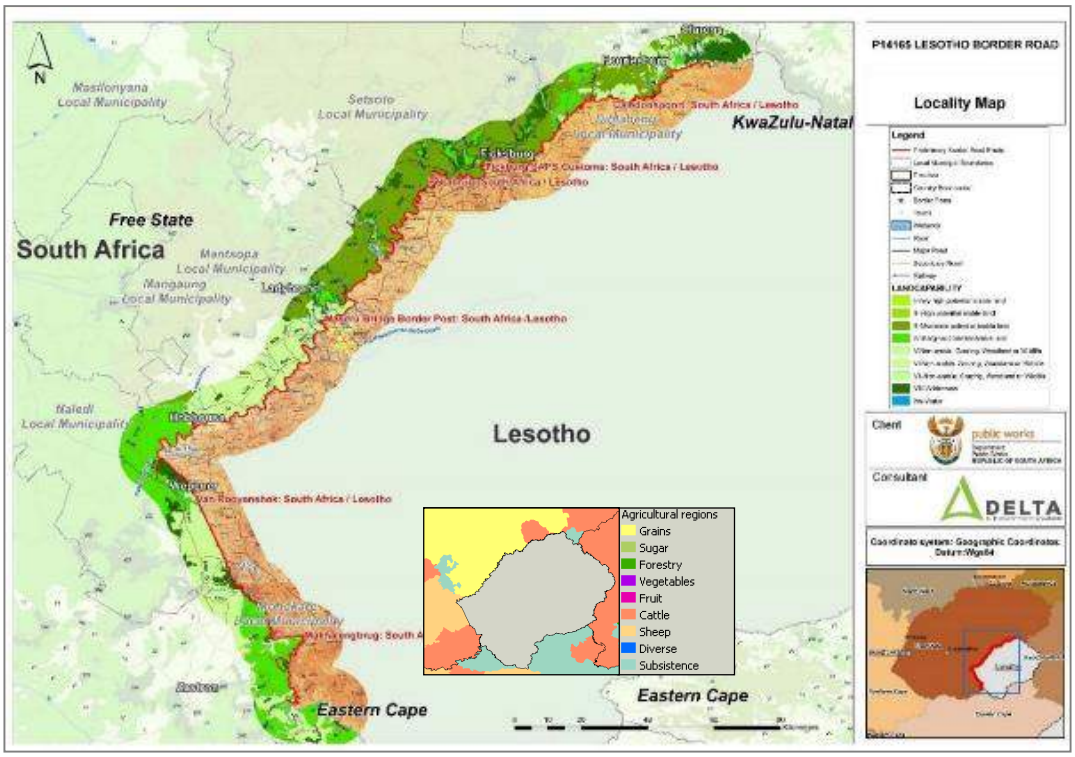


Figure 10-19: Map showing border route land capability; agricultural regions (www.agis.agric.za).

The proposed linear development traverses the following soil and land categories:

- **Clarens to Fouriesburg** – 10 percent of the route falls within Class VIII: Wilderness land capability, 45 percent within Class V – VII: Non arable, grazing, woodland or wildlife land capability and 45 percent within Class III: Moderate potential arable land
- **Ficksburg** to **Ladybrand** – Mainly contains Class III: Moderate potential arable land capability
- **Ladybrand** to **Hobhouse** – Mainly contains Class V – VII: Non arable, grazing, woodland or wildlife land capability
- **Hobhouse** to **Wepener** - Mainly contains Class IV: Marginal potential arable land, and a small area of Class VIII: Wilderness land capability
- **Wepener** to **Zastron** – Contains 45 percent Class V – VII: Non arable, grazing, woodland or wildlife land, 15 percent Class VIII: Wilderness land and 40 present Class IV: Marginal potential arable land.

The proposed linear development from Ficksburg to Ladybrand, falls mainly in *Class 3: Moderate potential arable land*. In terms of the Draft Policy and Bill on the Preservation and Development of Agricultural Land (March 2015), land which is categorised in classes 1 to 3, is defined to be high potential cropping land.

10.7 AGRICULTURAL PRODUCTION

Based on observations during the field assessment, the dominant agricultural land use in the vicinity of the proposed Lesotho Boarder construction area comprises of maize and soybean field crops, as well as cattle and sheep grazing. The majority of the surveyed area in the vicinity of the proposed border road construction area is currently used for grazing purposes. According to the interviewed Farmer representative(s) and observations, cultivated crops included maize, soybean, and Lucerne. Few of the cultivated fields were

observed to have an irrigation system in place and hence it is assumed that most of the lands are cultivated under dry land practices.

According to the published data Grain SA yield from the Department of Agriculture, Forestry and Fisheries, Average maize and soybean yield data in South Africa are presented under **Table 6-9** below, as obtained from a sample of producers. The historical data indicate that the average annual maize yield varied between 2.53 and 4.84 tons per hectare (t/ha), with an average of 3.84 t/ha over the past 10 years. Soybean yields varied from 1.12 and 2.17 t/ha, with an average of 1.65 t/ha over a period of 10 years.

Table 10-4: Maize and Soybean yield data in South Africa

Production year	Maize Total RSA Production			Soybeans		
	Hectare	Ton	Ton/ha	Hectare	Ton	Ton/ha
2005/06	2,032,446	6,935,056	3.41	240,570	424,000	1.76
2006/07	2,897,066	7,338,738	2.53	183,000	205,000	1.12
2007/08	3,296,980	13,164,069	3.99	165,400	282,000	1.70
2008/09	2,896,683	12,566,633	4.34	237,750	516,000	2.17
2009/10	3,263,340	13,420,864	4.11	311,450	566,000	1.82
2010/11	2,858,760	10,924,335	3.82	418,000	710,000	1.70
2011/12	3,141,114	12,759,119	4.06	472,000	691,050	1.46
2012/13	3,238,100	12,485,689	3.86	516,500	784,500	1.52
2013/14	3,096,000	14,982,050	4.84	502,900	948,000	1.89
2014/15	3,048,050	10,513,850	3.45	687,300	942,850	1.37
Average	2,976,854	11,509,040	3.84	373,487.00	606,940.00	1.65

Yield data obtained from a sample of local producers was also used to compute average maize yield data for the Free State Province, as presented in Table 2. Provincial metadata analysis collated for 10 years between 2004 and 2014 indicates that the average annual maize yield for the Free State province is approximately 3.94 tons per hectare (t/ha) (Trends in Agriculture, DAFF 2013), as presented under Table 6-10 below.

Table 10-5: Maize yield data for the Free State Province, South Africa

Period	**Free State Maize Production 2004 - 2014**				
	SA - Crop est.: Yield Free State: White maize (t/ha)	**SA - Crop est.: Yield Free State: Yellow maize (t/ha)**	**SA - Crop est.: Production Free State: Total maize (t)**	**SA - Crop est.: Area Free State: Total maize (ha)**	**SA - Crop est.: Yield Free State: Total maize (t/ha)**
2004/05	3.11	3	3 100 000	1 010 000	3.07
2005/06	4.03	3.78	4 113 000	1 045 000	3.94
2006/07	4.06	3.58	2 080 000	535 000	3.89
2007/08	3.01	2.45	2 855 000	1 020 000	2.8
2008/09	4.32	4.06	4 928 000	1 170 000	4.21
2009/10	4.65	4.87	4 527 250	955 000	4.74

Period	Free State Maize Production 2004 - 2014				
	SA - Crop est.: Yield Free State: White maize (t/ha)	SA - Crop est.: Yield Free State: Yellow maize (t/ha)	SA - Crop est.: Production Free State: Total maize (t)	SA - Crop est.: Area Free State: Total maize (ha)	SA - Crop est.: Yield Free State: Total maize (t/ha)
2010/11	4.6	4.08	5 076 000	1 156 000	4.39
2011/12	4.35	3.7	4 051 500	990 000	4.09
2012/13	4.2	3.88	4 730 000	1 160 000	4.08
2013/14	4.3	4	5 137 500	1 230 000	4.18
Average	4.063	3.74	4 059 825	1 027 100	3.94

10.7.1 SUMMARY OF KEY FINDINGS

It is required that a soil, land and agricultural potential study be undertaken to detail the impact and mitigation measures recommended for the area. Outcomes of the study are as follows:

- The direct impact of the proposed linear development comprising of 4 m wide dual road with a 33 m reserve over the approximate distance of 520 km, will collectively render 1,976 hectares (ha) of land inaccessible for agricultural use (excluding access roads).
- Furthermore, additional potentially arable land may be lost where the proposed linear development dissects through farm portions, most likely to occur in the northern section of the proposed linear development. Although the majority of the identified soils display moderately low erosion susceptibility under current veld conditions, erosion susceptibility will inevitably increase once the soils are exposed after vegetation has been cleared during the construction phase. Soil erosion risk is anticipated to be very high, particularly for the identified Namib/Dundee soil forms as the observed stratifications on some of these soil forms indicates that these soils are periodically flooded.
- Although the proposed linear development will inevitably result in substantial loss of arable land and grazing pastures; a net positive impact will be achieved in terms of agricultural productivity and sustainability through significant beneficial impacts including:
    - Reclamation of abandoned farm lands
    - Reduced livestock theft
    - Reduced cross-border disease infections.
- The subdivision of high potential cropping land is prohibited, unless approved by the Minister in accordance with section 12(4) of the Draft Preservation and Development of Agricultural Land Bill, published in Notice 210 No. 38545 Government Gazette on 13 March 2015.
- The rezoning, with associated subdivision if required, of high potential cropping land is prohibited, unless approved by the Intergovernmental Committee in accordance with section 12(5) of the Land Bill.

An applicant applying for the subdivision or rezoning of high potential cropping land must submit his or her application in the prescribed form to the Free State Department of Economic Development, Tourism, Environmental Affairs concerned.

11 ECOLOGICAL BASELINE ASSESSMENT

Site visits were undertaken by Scientific Aquatic Services from 23 November 2014 – 02 December 2014 and from 27-31 July 2015. The purpose of the site visits was to obtain an overview of the proposed linear development and as far as possible demarcate sensitive areas. This was completed in terms of; wetlands, aquatic environments, flora and fauna inventories along the proposed linear development, as well as to determine environmental aspects of concern that are present, which may be impacted by the development of the proposed linear development and which may pose constraints to the proposed project.

The following sections present data accessed as part of the desktop terrestrial assessment. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used not always provide an entirely accurate indication of the study area's actual site characteristics. This information is however considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and special attention will be afforded to areas indicated to be of higher conservation importance.

11.1.1 NATIONAL LIST OF THREATENED TERRESTRIAL ECOSYSTEMS FOR SOUTH AFRICA, 2011

The National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (South African National Biodiversity Institute [SANBI], Biodiversity Geographic Information System [BGIS]).

The proposed linear development falls within a vulnerable threatened ecosystem (**Figure 11-1**), according to the National List of Threatened Terrestrial Ecosystems (2011). The majority (approximately 70%) of the proposed linear development falls within the *Eastern Free State Clay Grassland* which is considered endangered according to Mucina and Rutherford (2006). The other vegetation types, namely the Zastron Moist Grassland (vulnerable), Eastern Free State Sandy Grassland (endangered), Aliwal North Dry Grassland (least threatened), Basotho Montane Shrubland (vulnerable), Senqu Montane Shrubland (least threatened) and the Northern Drakensberg Highland Grassland (least threatened), make up the remainder of the route.

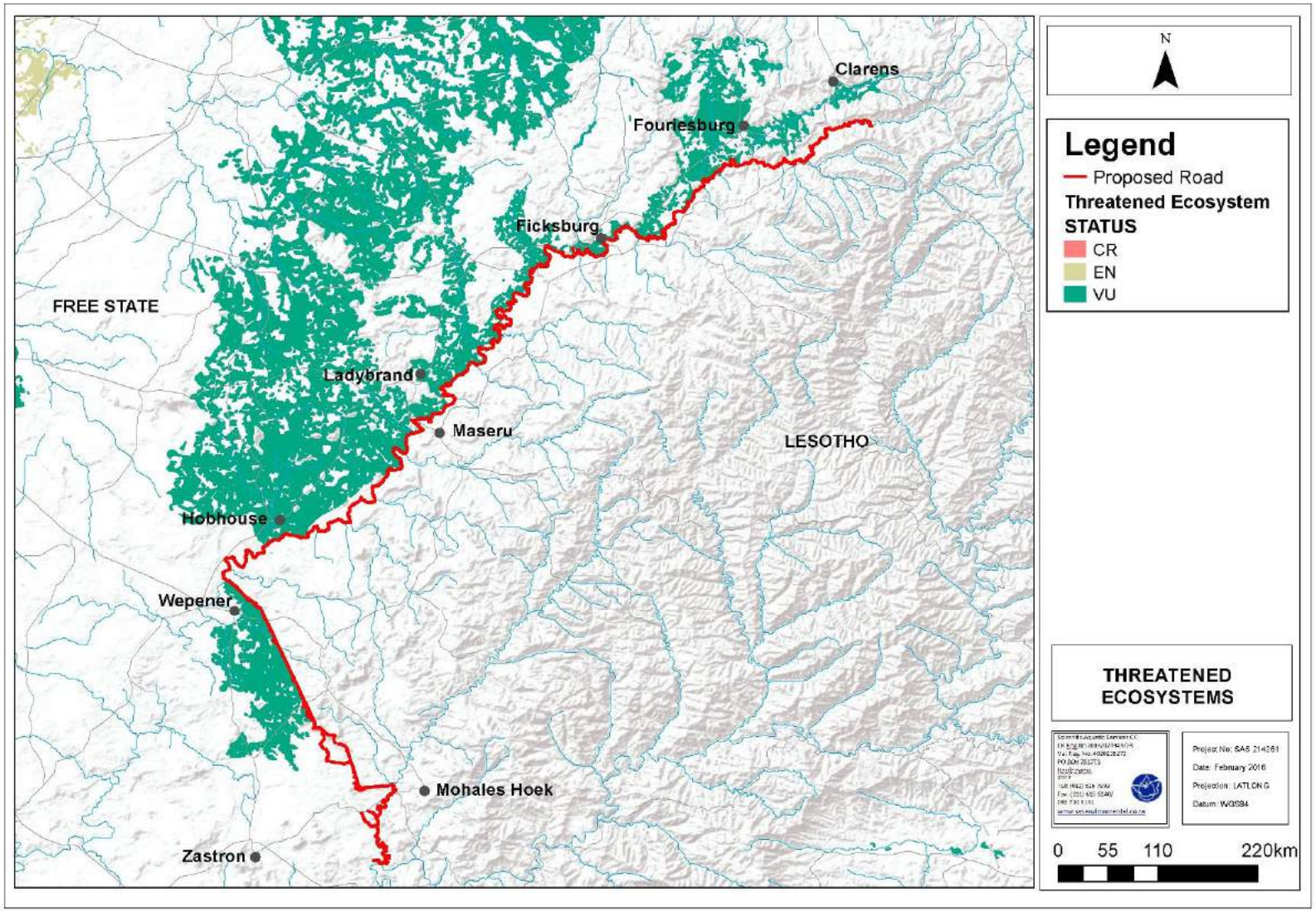


Figure 11-1: The threatened ecosystems associated with the proposed linear development.

11.1.2 THE NATIONAL PROTECTED AREAS EXPANSION STRATEGY (NPAES), 2010

The goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. It deals with land-based and marine protected areas across all of South Africa's territory (SANBI BGIS).

According to the NPAES database, the proposed linear development is not located within any NPAES area (as depicted in **Figure 11-2**). The closest formally protected area is the Golden Gate National Park, situated approximately 20 km from the northern portion of the proposed linear development. The closest Focus Areas are the Maluti Grasslands and the Senqu Caledon Focus Areas, situated approximately 10 km and 8 km respectively from the proposed linear development. Thus, the development footprint of the proposed linear development will not affect any formally or informally protected areas.

The Free State Protected Areas database showed similar results, where the Golden Gate National Park is situated approximately 20 km from the closest section of the road (**Figure 11-3**).

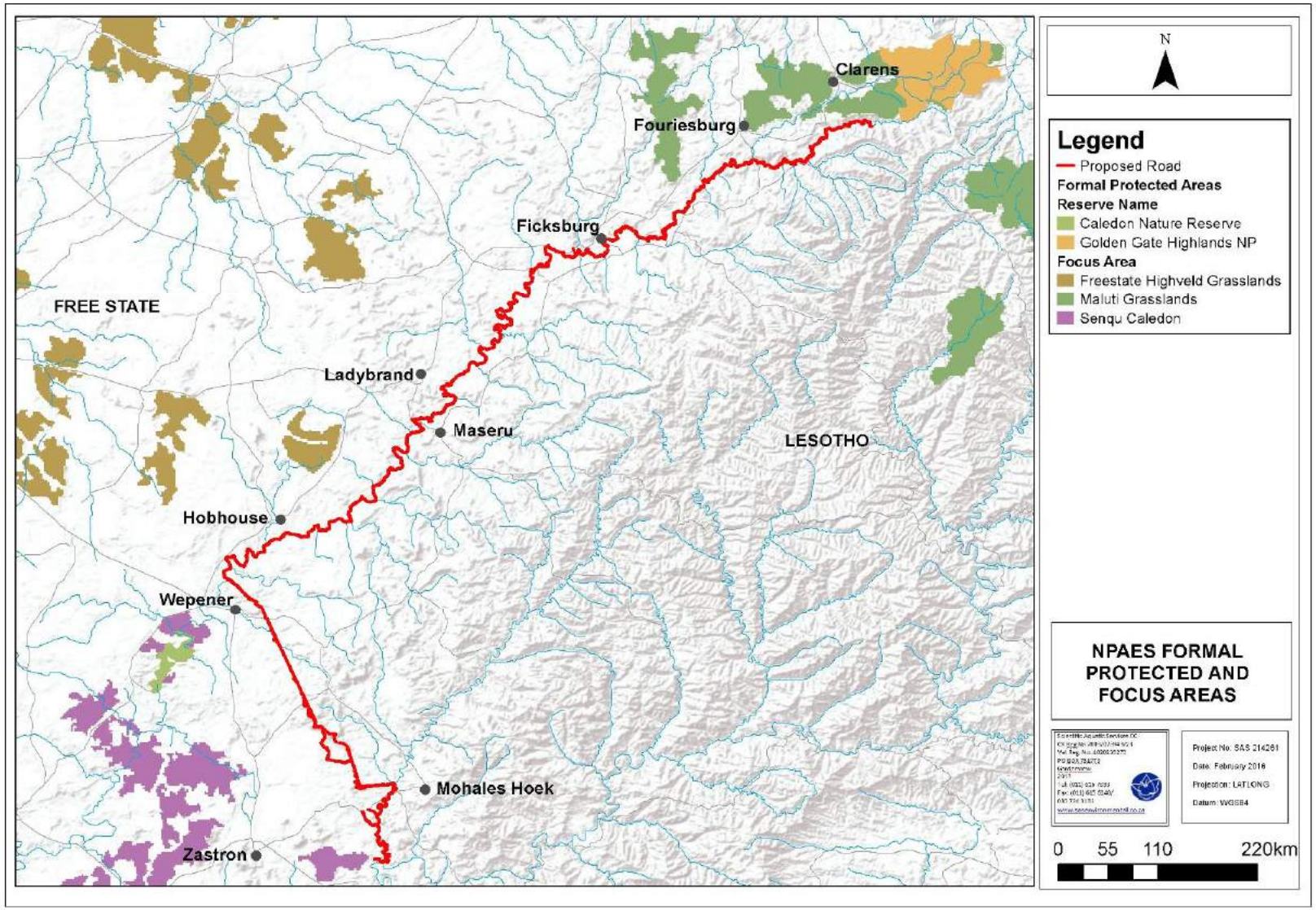


Figure 11-2: Formally protected and Focus Areas within the vicinity of the proposed linear development

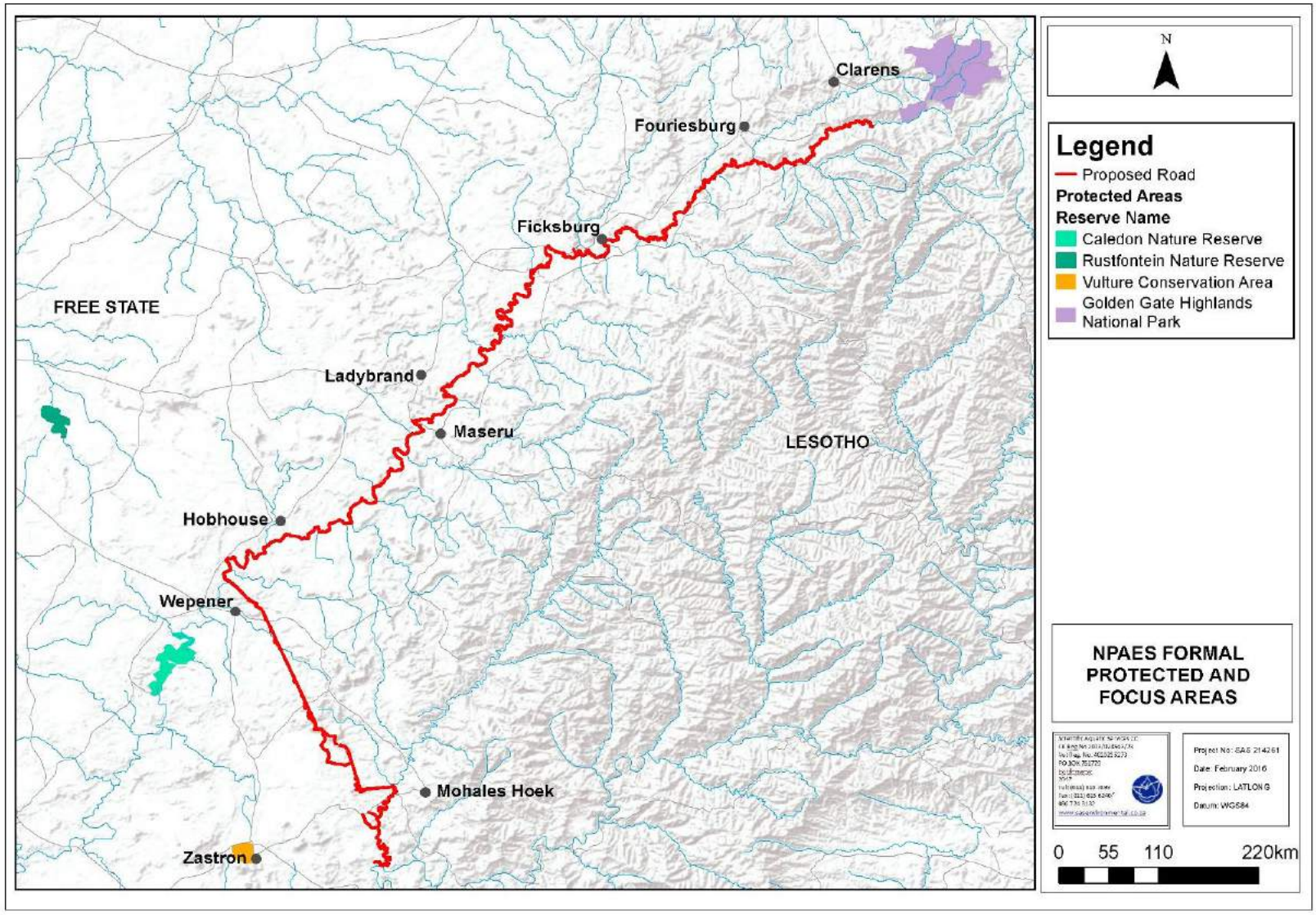


Figure 11-3: The Free State Protected Areas associated with the proposed linear development.

11.1.3 SOUTH AFRICA PROTECTED AREAS DATABASE (SAPAD), 2013

The South African Protected Areas Database (SAPAD) contains spatial data for the conservation estate of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. Data is collected by parcels which are aggregated to protected area level. Only outer boundaries are defined in this public release (Department of Environmental Affairs, 2015). The SAPAD produce and maintain a comprehensive spatial database on the conservation estate in South Africa. SAPAD is suitable for a wide range of planning, assessment, and analysis and display purposes. SAPAD should not be used for legal or other specific government actions.

According to the SAPAD, the following protected areas (**Figure 11-4**) are associated with the proposed linear development (Directorate Enterprise Geospatial Information Management, 2013)

- National park:
  - An area which was a park in terms of the National Parks Act, 1976 (Act No. 57 of 1976), immediately before the repeal of that Act by section 90(1) of the Environmental Management: Protected Areas Act, 2003, and includes a park established in terms of an agreement between a local community and the Minister which has been ratified by Parliament; or
  - An area declared or regarded as having been declared in terms of section 20 of the National Environmental Management: Protected Areas Act, 2003, as a national park.
- Nature reserve:
  - An area declared, or regarded as having been declared, in terms of section 23 of the National Environmental Management: Protected Areas Act, 2003, as a nature reserve; or
  - An area which before or after the commencement of this Act was or is declared or designated in terms of provincial legislation for a purpose for which that area could in terms of section 23(2) of the National Environmental Management: Protected Areas Act, 2003, be declared as a nature reserve.

Golden Gate Highlands National Park

The Golden Gates Highlands National Park is a formal land-based protected area located to the north of the farm, Pilgrim's Rest 78 (the most northern extent of the proposed route).

The park was established in 1963 to protect the sandstone rocks which were once shelters for Bushmen, these rocks have well preserved many of the Bushmen's cave paintings.

The park is also home to various rare and indigenous flowers including the Arum Lily, Watsonia spp, Fire Lilies and Red-Hot Pokers. The park serves as one of the last refuges of the Bearded Vulture and the rare Bald Ibis which breeds annually in Cathedral Cave.1

[1] Nature Reserve, 2015. Golden Gates Highlands National Park. [Online] http://www.nature-reserve.co.za/free-state-golden-gate-highlands-preserve.html

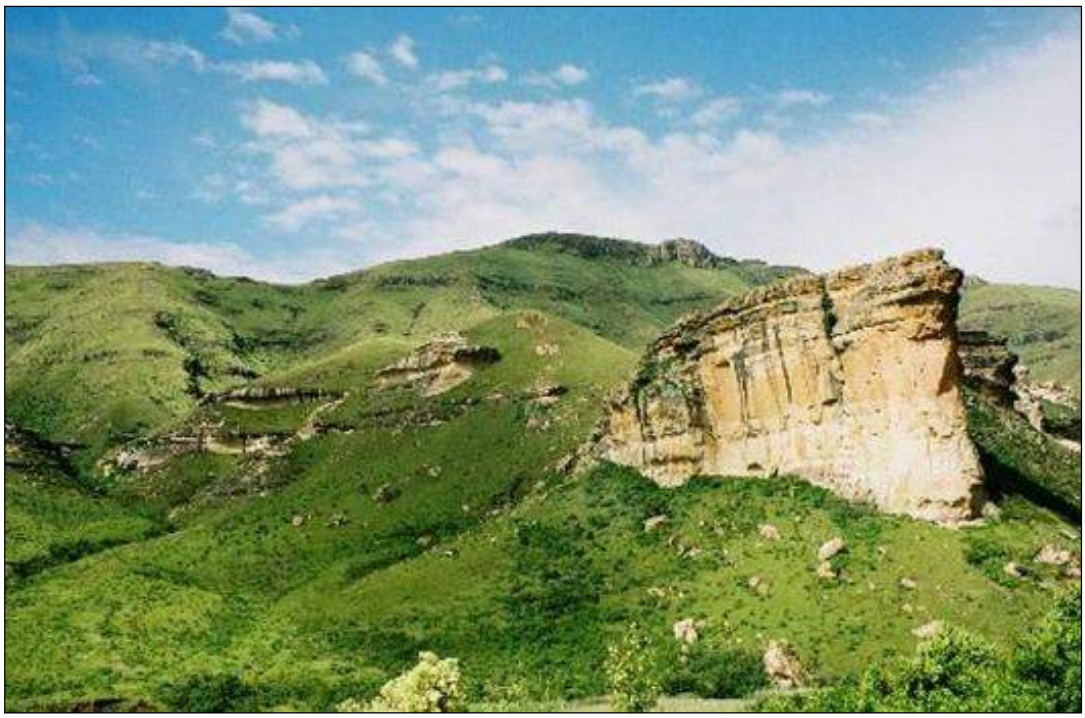


Figure 11-4: Golden Gate Highlands National Park.

11.1.4 IMPORTANT BIRD AREA

An Important Bird Area (IBA) namely Fouriesberg-Bethlehem-Clarens IBA is present in the northern portion of the proposed route. The site supports several *Geronticus calvus* (Southern Bald Ibis) breeding colonies. *G. calvus* occasionally forage alongside *Anthropoides paradiseus* (Blue Crane), *Balearica regulorum* (Grey Crowned Crane) and *Eupodotis caerulescens* (Blue Korhaan) in the grasslands. Bird species such as *Gyps coprotheres* (Cape Vulture), *Gypaetus barbatus* (Bearded Vulture) and *Polemaetus bellicosus* (Martial Eagle) also tend to forage in these areas, however they no longer breed in these regions.

The northern section of the proposed linear development is located along the border of the now Rooiberge-Riemland (previously Fouriesburg–Bethlehem–Clarens) IBA (SA048, **Figure 11-5**). Overall the natural habitat that once existed within this IBA has been largely degraded as a result of agricultural activities. Typically, natural habitats within this IBA include natural grasslands, rocky outcrops and sandstone cliffs which have been incised by river systems in the area. Threats to this IBA and the natural habitat include further transformation as a result of expanding agriculture, tourism activities as well as urban expansion.

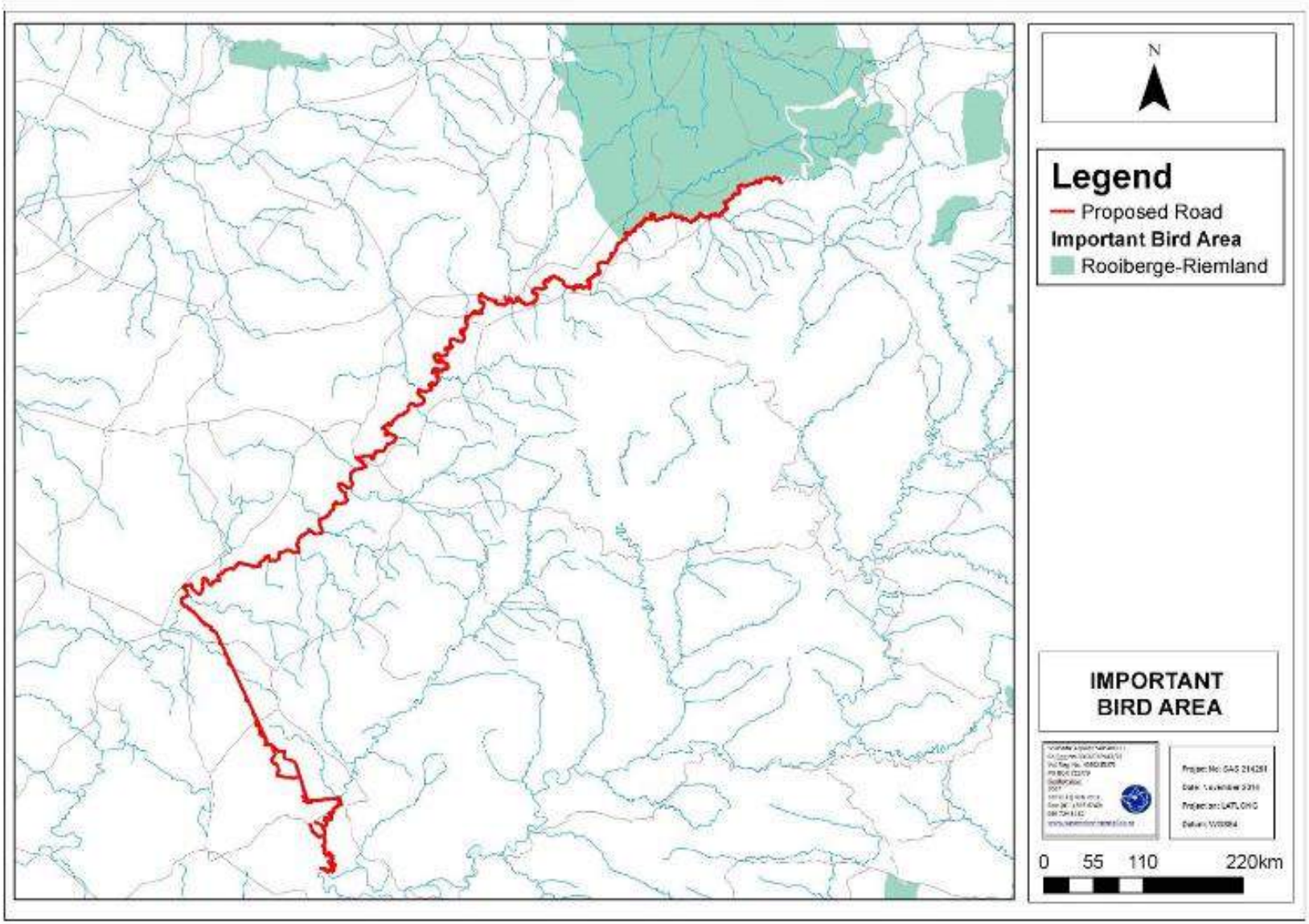


Figure 11-5: Map indicating the location of the proposed linear development in relation to the Golden Gate Highlands National Park and the Rooiberge-Riemland IBA's

11.1.5 NATIONAL BIODIVERSITY ASSESSMENT (NBA), 2011

The recently completed NBA (2011) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA (2011) was led by SANBI in partnership with a range of organisations, including the Department of Environmental Affairs (DEA), Council for Scientific and Industrial Research (CSIR) and SanParks. It follows on from the National Spatial Biodiversity Assessment (2004), broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA (2011) includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels (SANBI BGIS). The assessment of ecosystem level is then evaluated as the proportion of each vegetation type protected relative to the biodiversity target.

According to the NBA (2011), the proposed linear development is located primarily within none protected areas and approximately 10-15% of the vegetation within the proposed linear development is poorly protected. A small section of the northern portion of the proposed linear development falls under the well protected category, an area close to the Maluti Grassland focus areas and the Golden Gate National Park, as depicted in **Figure 11-6** and **Figure 11-7.**

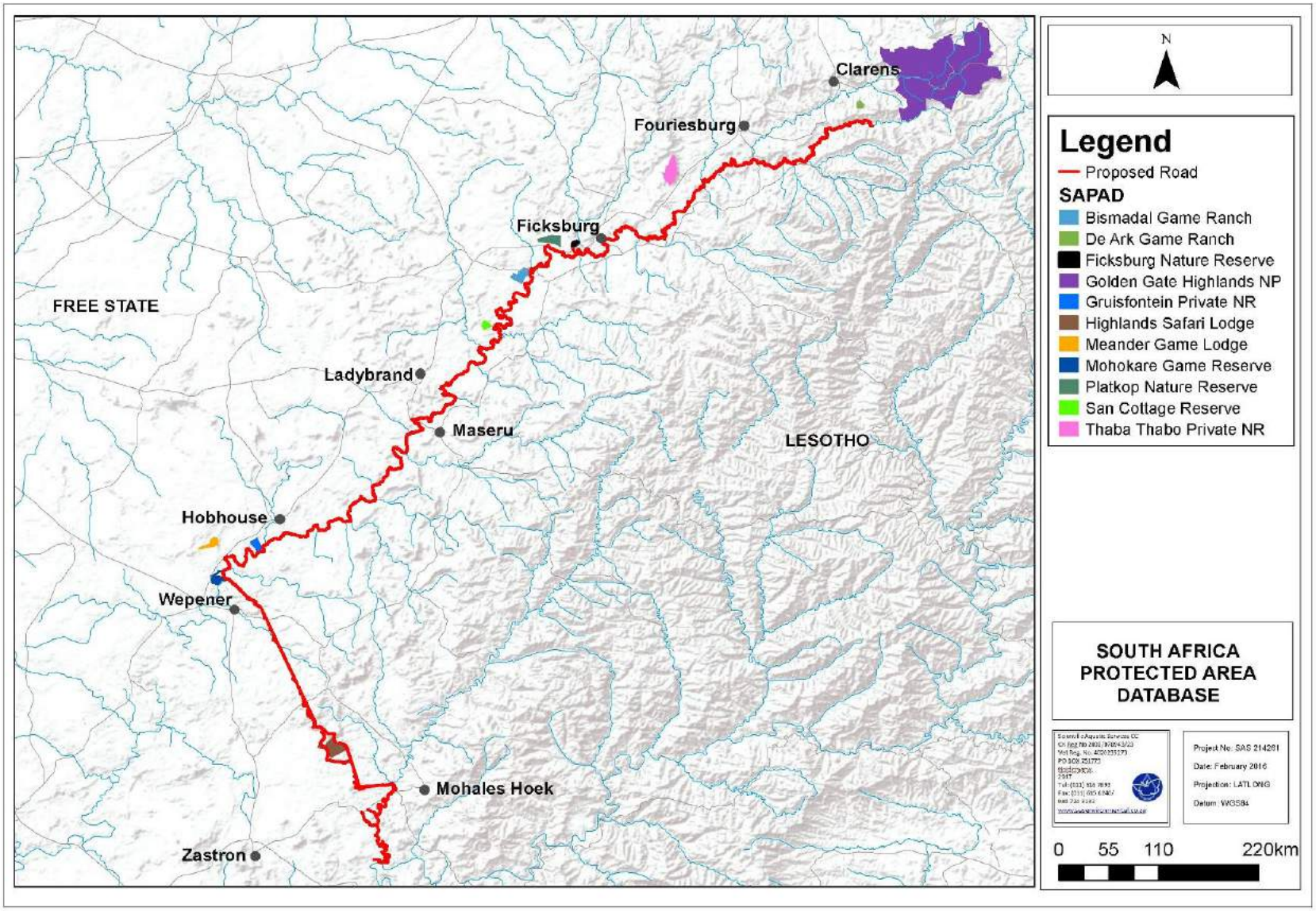


Figure 11-6: The South Africa protected Area Database indicating numerous smaller reserves along the proposed linear development.

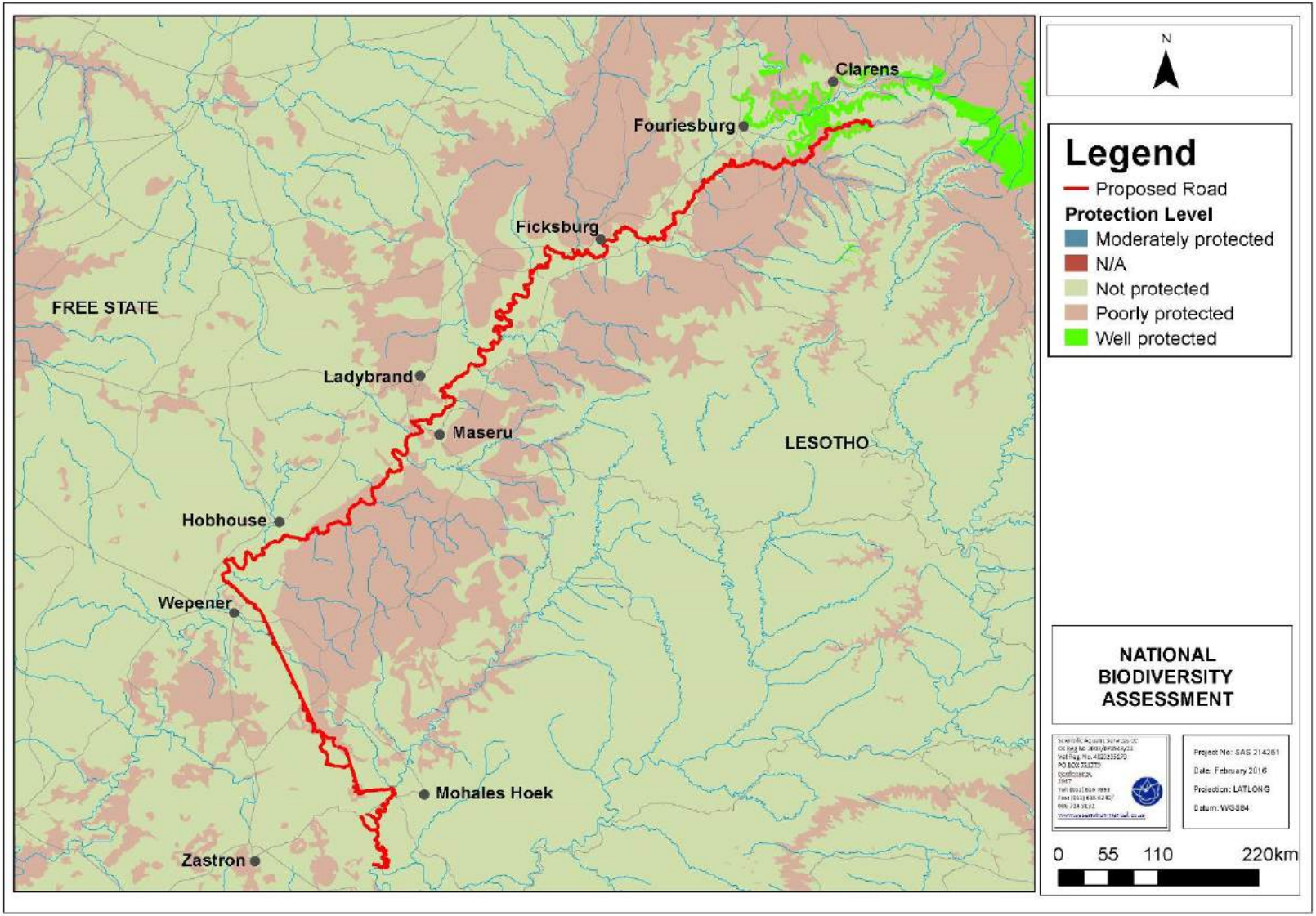


Figure 11-7: Biodiversity protection levels associated with the proposed linear development.

11.1.6 VEGETATION TYPE AND LANDSCAPE CHARACTERISTICS

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition, which can then be compared to the observed floral list and so give an accurate and timely description of the ecological integrity of the assessment site.

When the proposed linear development is superimposed on the vegetation types of the surrounding area, it is evident that the majority of the proposed linear development falls within the Zastron Moist Grassland, Eastern Free State Clay Grassland, Eastern Free State Sandy Grassland, Aliwal North Dry Grassland, Basotho Montane Shrubland, Senqu Montane Shrubland and the Northern Drakensberg Highland Grassland vegetation types (Mucina and Rutherford, 2006). The characteristic of these vegetation types is discussed in the **Table 9-1.**

Table 11-1: Vegetation types associated with the proposed linear development.

Vegetation type	Distribution	Climate	Important taxa	Conservation status	Modifiers
Aliwal North Dry Grassland	In the broad surrounds of Aliwal North, running in an east-west direction along the northern foothills of the Stormberg Plateau, extending northwards up the Calydon River Valley to around Wepener	Summer rainfall MAP: 510 mm MAT: 14.3°C	*Themeda triandra* *Tetrachne dregei* *Helichrysum dregeanum*	Least threatened	Cultivation Dams
Basotho Montane Shrubland	Free State Province, Lesotho and very marginally into KwaZulu-Natal Province: Foothills of the west-facing Drakensburg (also Maloti) and mainly on the slopes of mesas over a wide area in the vicinity of Zastron in the southwest, the surrounds of Mafeteng, Hob house, Maseru, Roma, Ladybrand, Clocolan, Excelsior, Ficksburg, Butha-Buthe, Fouriesburg, Paul Roux, Bethlehem, Phuthaditjhaba as far as Harrismith in the northeast	Summer rainfall MAP: 720 mm MAT: 13.7°C	*Rhus erosa* *Olea europaea subsp. africana* *Euclea crispa subsp. crispa* *Buddleja salviifolia, Leucosidea sericea* *Rhus burchellii* *Rhamnus prinoides Scutia myrtina Gymnopentzia buxifolia*	Vulnerable	Erosion

Vegetation type	Distribution	Climate	Important taxa	Conservation status	Modifiers
Eastern Free Sate Clay Grassland	Free State Province and marginally in Lesotho: low-lying areas of the eastern regions of the province, covering the vicinities of Wepener (south), Petrus Steyn (north), Excelsior and east of Winburg (west) and Warden (east) and a thin extension between Maseru and Fouriesburg	Summer rainfall MAP: 360 mm MAT: 14.4°C	*Eragrostis curvula Themeda triandra* *Cymbopogon pospischillii Eragrostis plana* *Setaria sphacelata* *Elionurus muticus* *Aristida congesta*	Endangered	Cultivation Dams Erosion Overgrazing
Eastern Free State Sandy Grassland	Free State Province, Lesotho and marginally into KwaZulu-Natal Province: Ladybrand (west) to the base of foothills of the Drakensburg (Maloti) and the Escarpment in the vicinity of Harrismith (east) and Mafeteng (south).	Summer rainfall MAP: 700 mm MAT: 13.6°C	*Eragrotis curvula, Tristachya leucothrix Themeda triandra.* *E. capensis,* *E. racemosa, Cymbopogon pospischillii, Elionurus muticus, Eragrostis plana* *Aristida junciformis*	Endangered	Cultivation Dams Alien vegetation Erosion
Northern Drakensburg Highland Grassland	Northeastern and eastern slopes of valleys and buttresses of the Drakensburg in KwaZulu-Natal where most of the region is locally known as Little Berg, from Giant's Castle to slopes in any direction in the surrounds of Clarens in the Free State	Summer rainfall MAP: 1017 mm MAT: 13.4°C	*Protea savannas'* *Setaria sphacelata* *Themeda triandra*	Least threatened	Cultivation Urban sprawl Dams Alien vegetation Erosion
Senqu Montane Shrubland	Lesotho as well as in Eastern Cape and Free State Provinces (only marginal patches). This shrubland unit covers the valley slopes of the Senqu River as well as its numerous tributaries	Summer rainfall MAP: 687 mm MAT: 13°C	*Rhus erosa* *Olea europaea* *Diospyros austro-africana. Kiggelaria africana Leucosidea sericea Rhamnus prinoides*	Least threatened	Cultivation Wood collection Erosion

Vegetation type	Distribution	Climate	Important taxa	Conservation status	Modifiers
Zastron Moist Grassland	Surrounds of Zastron, just short of Van Stadensrus to Mohales Hoek (northeast) and Rouxville (west)	Summer rainfall MAP: 615 mm MAT: 14°C	*Aristida congesta* *Cymbopogon pospischilii* *Digitaria argyrograpta* *Eragrostis chloromelas* *Microchloa caffra* *Setaria sphacelata* *Themeda triandra* *Dierama jucundum* *Helichrysum dregeanum*	Vulnerable	Cultivation Urban sprawl Overgrazing Erosion

11.1.7 SUMMARY OF DESKTOP TERRESTRIAL ECOLOGICAL FINDINGS

- According to the vegetation and ecosystem types, portions of the proposed route fall within the remaining extent of the Eastern Free State Clay Grassland ecosystem. This area is listed 'Vulnerable' under Criterion A1: Irreversible loss of natural habitat.
- The Golden Gate Highlands National Park is a formal land-based protected area located to the North of the farm Pilgrim's Rest 78 (the most northern extent of the proposed route).
- An Important Bird Area (IBA) namely Fouriesberg-Bethlehem-Clarens IBA is present in the northern portion of the proposed route

In support of the above, it is recommended that:

- Particular attention should be paid to areas of higher Ecological Importance and Sensitivity, which will be fed into the site sensitivity mapping and ultimately inform the EIA process

The EIA will include an ecological investigation of the final corridor/route, focusing on the floral and faunal integrity of the proposed site as well as species of conservational concern in the area.

12 FLORAL BASELINE ASSESSMENT

12.1 HABITAT UNITS

12.1.1 RIPARIAN ZONE HABITAT UNIT

The Riparian Habitat Unit consists of two riparian zones, namely an Intact Riparian Zone and an Alien Invader Riparian Zone.

The intact riparian zone is located along the Caledon River and tributaries thereof. The intact riparian zone is dominated by indigenous trees species such as *Celtis africana, Searsia pyroides, Combretum apiculatum* and *Gymnosporia buxifolia*. Very few alien and invader species were present within this habitat unit. A few graminoid species were noted in the understory of the indigenous trees, also indicating good vegetation cover for the riparian zone. This habitat unit has the potential to support a diversity of floral and faunal species, since very little disturbance has occurred resulting in less alien vegetation proliferation and increased species diversity. This habitat unit could be considered more sensitive compared to the other habitat units due to the undisturbed nature and the presence and suitable habitat for Species of Conservational Concern (SCC).

The Alien Invaded Riparian Zone is also located along the Caledon River and numerous tributaries thereof. This habitat unit consists of alien invader species and species associated with bush encroachment such as *Populus x canescens* (grey poplar), *Gleditsia triacanthos* (honey locust), *Acacia dealbata* (Silver wattle), *Acacia mearnsii* (Black wattle), *Melia azedarach* (Syringa) and *Salix babylonica* (Weeping willow). Dense stands of these species were noted along the banks of the riparian zone, replacing indigenous riparian vegetation. This has resulted in a significant vegetation transformation along the banks of the Caledon River. The dense stands also pose a high security risk and visual obstruction for border patrol activities.

12.1.2 WETLAND HABITAT UNIT

12.1.2.1 Channelled and Unchannelled Valley Bottom

The proposed linear development (proposed road, fence and road and fence reserve). The proposed linear development (proposed road, fence and reserve) traverses numerous channelled and unchannelled valley bottom wetland features. Valley bottom wetlands are features that are mostly flat and often connected to an upstream or adjoining river channel (Ollis et. al., 2013). Channelled wetland features were characterised by a channel flowing through the wetland. Water generally exits a channelled valley-bottom wetland in the form of surface or subsurface flow into the adjacent river, which was the case for most of the channelled valley bottom features, conferencing with the Caledon River

Unchannelled wetlands are generally formed when a channel loses confinement and spreads out over a wider area, causing the concentrated flow associated with the river channel to change to diffuse flow. This is typically due to a change in gradient brought about by a change in base level at the downstream edge of the wetland and the resulting accumulation of sediment. In some cases, an unchannelled valley-bottom wetland could occur at the downstream end of a seep, where a slope grades into a valley near the head of a drainage line, which was exactly the case of the type of unchannelled valley bottom features located within the proposed linear development. Numerous valley bottom features have been transformed mainly by erosion and soil disturbances and in some areas by alien and invader vegetation.

12.1.2.2 Hillslope Seeps

Numerous Hillslope seep wetlands were identified along the proposed linear development. Hillslope seeps are stretches of ground typically located on the side of a mountain hill of a valley, forming part of the valley floor (Ollis et. al., 2013). The vegetation diversity, function and state of the hillslope seep wetlands were relatively natural and in a good state.

12.1.2.3 Floodplain wetlands

Numerous floodplain wetlands were noted along the Caledon River. The majority of the floodplain wetlands were located within the 1:100-year flood line area, where some of the floodplain wetlands will be impacted upon by the construction of the proposed road and fence.

Floodplain wetlands generally occurs on a plain that are typically characterized by a suite of geomorphological features associated with river-derived depositional processes (Ollis et. al., 2013). It was important to note that the floodplain wetlands located along the Caledon River were flat surfaces along the margins of the River that were formed from sediment load or differing climate. These surfaces can also be referred to as terraces. Terraces are generally not geomorphologically active, meaning that it is not being built up be river depositional processes (Ollis et. al., 2013). It can be concluded that these floodplains are flooded several times a year, during moderate to high peak flow events. The terraces may be overtopped, but only by larger, less frequent floods (50-year or 100-year events).

12.1.2.4 Depression (including farm dams)

Depression wetlands were noted along the proposed linear development. These depression wetlands included natural and artificial depressions and bench wetlands.

Only a few natural depressions were noted along the proposed route. Most of these depressions will be within the 33 m reserve, therefore these pans are considered relevant in terms of the development footprint. The pans also provided suitable habitat for numerous avifaunal species, increasing the sensitivity of these systems.

Bench wetlands are discrete areas of mostly level or nearly level high ground, relative to the wider surroundings (Ollis et. al., 2013). Numerous bench wetlands were noted in the northern portions of the proposed route at the top of the smaller mountain areas, which were still considered to be in an intact and in a sensitive condition.

12.1.2.5 Moist Grassland Habitat Unit

The Moist Grassland Habitat Unit was noted in areas where fewer disturbances from grazing of livestock have occurred. The Moist Grassland Habitat Unit differed from the Wetland Habitat Unit in the type of vegetation found within the Habitat Unit. The Moist Grassland Habitat Unit has formed due to the presence of surrounding wetland features. Facultative species (are equally likely to grow in wetlands and non-wetland areas) were dominant within these habitat units but no other wetland characteristics such as soil mottling or true wetland floral species or water logged areas were noted. Species such as *Themeda triandra*, *Sporobulus africanus*, *Aristida junciformis* and *Eragrostis trichophora* were dominant within the moist grassland habitat unit. No soil mottling was also present within the Moist Grassland Habitat Unit, leading to the conclusion that the soil characteristics are not that of a typical wetland condition, therefore the Moist Grassland Habitat Unit, although containing similar vegetation to that found in wetland features,

cannot be classified as wetland habitat according to the classification of a typical wetland, as per DWA (2005 and 2008) guidelines.

12.1.2.6 Rocky Grassland Habitat Unit

The rocky grasslands were located along the proposed road and fence footprint area, in sections closer to high altitude ridges and hillslope thickets. These areas provided suitable habitat for numerous indigenous floral species (*Hypoxis angustifolia*, *Aloe sp., Felicia muricata* and numerous *Helichrysum* species).

Medicinally important species such as *Boophane disticha* and *Eucomis autumnalis* were recorded within this habitat unit. Should these species occur within the footprint area of the proposed road, a suitably qualified specialist needs to be assigned to rescue and relocate these species outside of the footprint area. No permit applications are however needed for these medicinally important species.

12.1.2.7 Hillslope Thickets Habitat Unit

Some areas along the proposed linear development can be described as hillslope thickets, where species such as *Gymnosporia buxifolia, Leucosidea sericea* and *Rosa rubiginosa* dominated. Although a decrease in floral diversity was noted within this habitat unit, suitable habitat is still present for smaller floral species such as *Helichrysum sp., Aloe sp., Hermannia transvaalensis, Ledebouria ovatifolia* and *Gnidia spp*. and smaller mammal, reptile and invertebrate species to occur.

12.1.2.8 High Altitude Ridge Habitat Unit

This habitat unit provided suitable habitat for numerous Aloe species and other succulents. Indigenous species for the habitat unit included *Cussonia paniculata, Cliffortia linearifolia and Searsia pyroides.* Erosion and soil disturbances within these high altitude ridges have occurred and will be identified as one of the important factors to consider when planning the design of the roads.

Numerous Aloe spp. were also noted to occur within this habitat unit. Two medicinal important species (*Boophane disticha* and *Hypoxis hemerocallidea*) were recorded within this habitat unit. Should these species occur within the footprint area of the proposed road, a suitably qualified specialist needs to be assigned to relocate these species outside of the footprint area. No permit applications are however needed for these medicinally important species.

12.1.2.9 Abandoned Agricultural Fields

This habitat unit was historically used as agricultural fields. Livestock is currently grazing within these areas leading to overgrazed veld and proliferation of alien and invader species, further decreasing the floral diversity and abundance within the habitat unit. Alien proliferation within this habitat unit has led to some areas being completely dominated by alien invader floral species such as *Argemone ochroleuca, Tagetes minuta, Seriphium plumosum* and *Papaver species*.

12.1.2.10 Cultivated fields

This habitat unit is currently used for activities related to agriculture such as the cultivation of maize. Therefore, large sections along the proposed road have undergone disturbance and overall habitat degradation due to agricultural fields being so close to the proposed

road. Thus, this habitat unit is not regarded as sensitive and does not provide an ecologically important function.

12.1.2.11 Other Transformed Land

This Habitat Unit consists mainly of areas that have undergone erosion, where bare soil is present due to historic vegetation clearance or overgrazed veld and homesteads or rural communities and residential dwellings. These areas have been completely transformed and are no longer representative of indigenous vegetation occurring in the area. The likelihood of any endangered, protected or medicinally important floral species to occur, is low. Therefore, due to the current and historic vegetation transformation and low diversity of floral species and suitable habitat, this habitat unit is not considered ecologically sensitive.

12.1.3 INVASIVE PLANT SPECIES

Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural "check" mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbance of soil through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area.

During the floral survey of the proposed linear development, all dominant alien and invasive species were identified and are listed in **Table 12-1**. For the purpose of the scoping report, these species were just listed. Further discussion will take place during the full EIA report, where a separate document /plan will be developed for the control of these alien and invader species. It will be recommended that these species be removed in phases along with the banks of the riparian systems or where they obstruct regular patrol view towards to the border. The map below depicts the average percentage of alien species density in the area of the Lesotho Border Road.

Table 12-1: Dominant alien vegetation species identified during the general site assessment.

Scientific name	Common name	NEMBA Category	Degree of infestation
Acacia dealbata	Silver wattle	2	Medium
Acacia mearnsii	Black wattle	2	Medium
Agave americana	Spreading century plant	1b	Low
Agave sisalana	Sisal hemp	2	Low
Argemone ochroleuca	Yellow-flowered Mexican poppy	1b	Low
Asparagus laricinus (Protasparagus laricinus)	Wild asparagus	*Weed	Low
Bidens bipinnata	Spanish blackjack	Weed	Low
Catharanthus roseus	Madagascar periwinkle	1b	Low
Cestrum aurantiacum	Yellow cestrum	1b	Low
Chloris virgata	Feathertop chloris	Problem plant	Low
Cirsium vulgare	Spear thistle	1	Low
Conyza bonariensis	Flax-leaf fleabane	Problem plant	Low

Scientific name	Common name	NEMBA Category	Degree of infestation
Cynodon dactylon	Couch grass	*Weed	Low
Cyperus esculentus	Yellow nutsedge	Weed	Low
Eucalyptus camaldulensis	Red river gum	1b	Low
Eucalyptus grandis	Saligna gum	2	Low
Foeniculum vulgare	Fennel	Problem plant	Medium
Gleditsia triacanthos	Honey locust	1b	Medium
Hibiscus trionum	Bladder weed	Problem plant	Low
Imperata cylindrica	Cotton wool grass	Weed	Low
Ipomoea purpurea	Common morning glory	3	Low
Melia azedarach	Syringa	1b	Medium
Morus alba	White mulberry	2	Low
Nocotiana glauca	Wild tobacco	1b	Low
Persicaria lapathifolia	Spotted knotweed	Weed	Low
Plantago lanceolata	Buckhorn plantain	Weed	Low
Populus x canescens	Grey poplar	2	High
Populus deltoides	Match poplar		Medium
Pinus patula	Patula pine	2	Low
Pyracantha angustifolia	Yellow firethorn	1b	Medium
Pyracantha crenulata	Himalayan firethorn	1b	Medium
Rosa rubiginosa	Eglantine	1b	Medium
Salix babylonica	Weeping willow	2	Medium
Schinus molle	Pepper tree	1b	Low
Senna septemfrionalis	Smooth Senna	1b	Low
Solanum elaeagnifolium	Silver-leaf bitter apple	1	Low
Solanum sisymbriifolium	Dense-thorned bitter apple	1b	Low
Tagetes minuta	Tall khaki weed	Weed	Medium
Typha capensis	Common bulrush	Possibly invasive	Low
Verbena bonariensis	Purple top	1b	Low
Xanthium strumarium	Large cocklebur	1b	Low
Zennia peruviana	Red star zinnia	Problem plant	Low

Figure 12-1, **Figure 12-2** and **Figure 12-3** illustrates the densities of alien and invasive plants along the route.

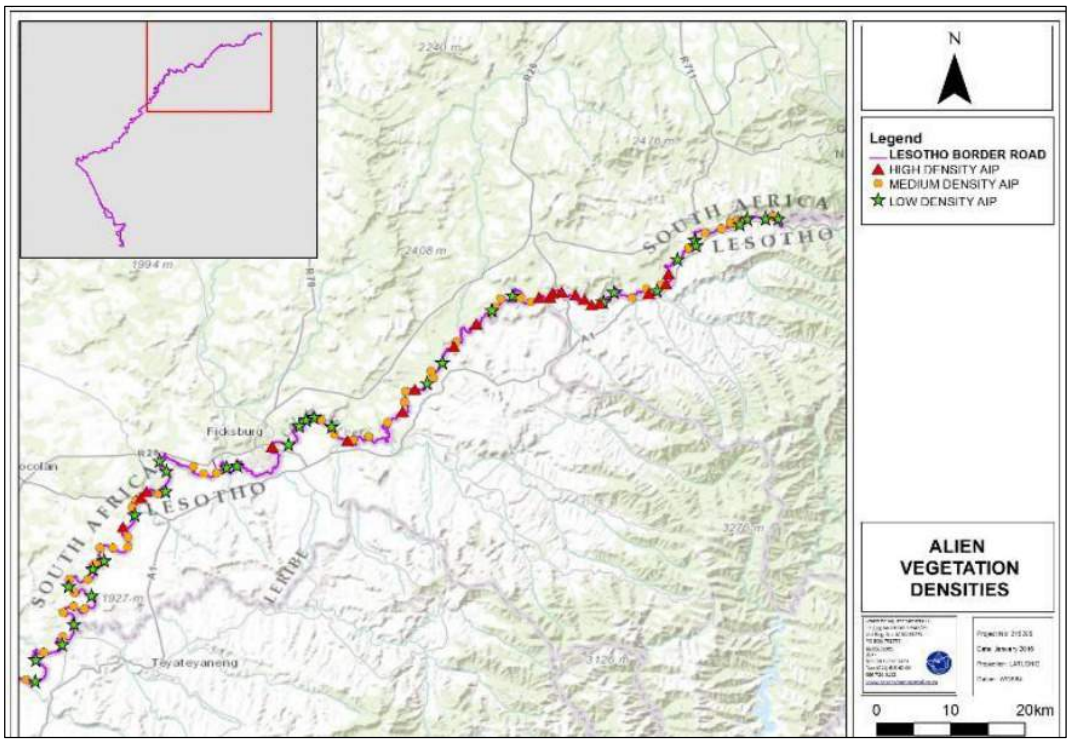


Figure 12-1: Alien vegetation densities within the northern portion of the project footprint.

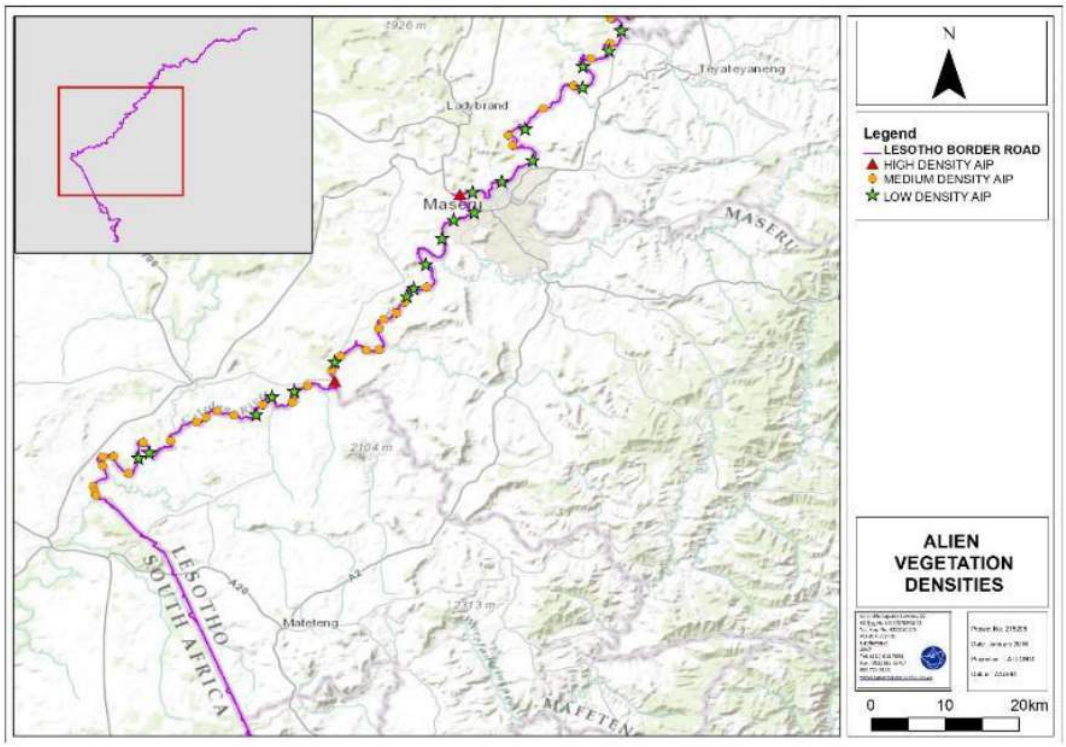


Figure 12-2: Alien vegetation densities within the central portion of the project footprint

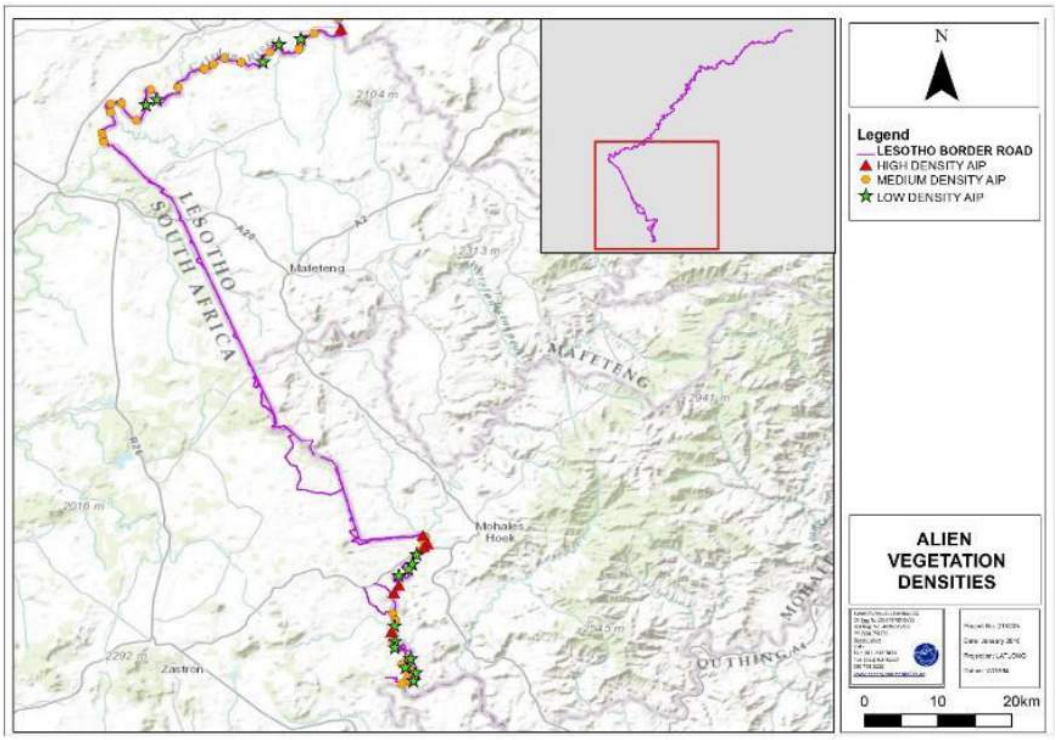


Figure 12-3: Alien vegetation densities within the southern portion of the project footprint.

12.1.4 SPECIES OF CONSERVATIONAL CONCERN

Several species were listed from national and provincial conservation list. From that list, numerous species were encountered, either within the development footprint or within the surrounding area of the proposed linear development. Species that have been positively identified were *Boophane disticha, Hypoxis hemerocallidea*, numerous *Aloe* spp., *Eucomis autumnalis*, *Cussonia* spp. including *Cussionia paniculata*, *Euphoribia* spp., *Kniphofia* spp. and *Crinum bulbispermum*.

Figure 12-4: Important (protected) species located within the Rocky Grassland Habitat Unit: *Eucomis autumnalis* (top left) and *Boophane disticha* (top right). *Aloe broomii* (bottom left) and *Hypoxis hemerocallidea* (bottom right) located within the High Altitude Ridge

During the EIA phase of the specialist floral assessment, further detail will be given on the habitat availability as well as the potential of these protected and important species to

occur within the footprint of the proposed linear development. Mitigation measures will be recommended to either avoid impacting these species, or where no alternative could be considered, mitigation measure on the relocation of these species to habitat units of similar character, outside of the footprint area.

13 FAUNAL BASELINE ASSESSMENT

Faunal habitat along the proposed linear development comprises a mix of active agricultural lands, old lands, rocky ridges, riparian zones, wetlands and pans as well disturbed and relatively intact grasslands. Although there is a diversity of faunal habitat available, this was not reflected in the species diversity and abundance along the linear development. The lower than expected diversity can be attributed to the level of anthropogenic activities evident along the proposed linear development from agricultural activities and poor veld management.

13.1 FIELD SURVEYS

Seventeen mammal species were observed during the assessment of the proposed linear development, ranging from small to medium sized mammals. All of these species are considered to be of least concern and are not listed as Species of Conservational Concern (SCC) within the Free State Province. The proposed development is not expected to have any negative impacts or pose any subsequent threats to the continued survival of mammals within the vicinity of the linear development;

Three avifaunal SCC was observed foraging within the vicinity of the linear development, namely (**Figure 13-1**). *Sagittarius serpentarius* (Secretary bird), *Eupodotis caerulescens* (Blue Korhaan) and *Geronticus calvus* (Bald Ibis). There remains the possibility that other SCC species may occur in the areas surrounding the linear development, namely *Mirafra cheniana* (Melodius Lark). However, following well contemplated, well implemented and well managed mitigation measures these species should not be impacted upon, nor should the proposed linear development pose any significant threat to the ongoing survival of these species;

Figure 13-1: *Sagittarius serpentarius* (Secretary bird) on the left and *Geronticus calvus* (Bald Ibis) on the right observed within the vicinity of the proposed linear development.

Only the more common reptile species were observed along the proposed linear development, of which none are listed as SCC. It is unlikely that the proposed linear development will pose a threat to reptile species within the vicinity of the development.

Four common amphibian species were observed along the proposed linear development within the nearby wetlands. There remains the possibility that *Pyxicephalus adspersus* (Giant Bullfrog) may be found within the wetland habitats, although there the previous recordings of this species in the area are fairly outdated. Should this species be encountered during the construction of the linear development it must be relocated to suitable habitat in the surrounding area.

Representatives of commonly encountered families in the Insecta class were observed during the assessment of the linear development. No invertebrate SCC was encountered along the linear development, nor is it expected that the linear development will pose a threat to invertebrates, both common and SCC.

A number of scorpion and spider species were observed along the proposed linear development route. Spider species were observed throughout all the habitat types, while scorpions observed were primarily located within the rocky ridge habitat. None of the species observed are listed as SCC, nor are the linear development expected to pose a significant threat to the conservation of arachnid species in the region.

13.2 SPECIES OF CONSERVATIONAL CONCERN

The SCC assessment of the linear development yielded a score of 54%, indicating a medium importance with regards to faunal SCC within the region. All species with a POC of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area. The species listed in Table 10-5 were the only species that attained a POC of greater than 60%. These species will most likely occur within the wetland and short intact grassland habitat units. As such, it is recommended that resultant edge effects be suitably managed and that all mitigation measures be adhered to in order to minimise any impacts to the above-mentioned species.

Table 13-1: Species with a POC of >60%.

Scientific Name	Common Name	IUCN Status	POC %
Sagittarius serpentarius	Secretary bird	VU	100
Eupodotis caerulescens	Blue Korhaan	NT	100
Mirafra cheniana	Melodious lark	NT	70
Pyxicephalus adspersus	Giant Bullfrog	VU	62
Metisella meninx	Marsh Sylph	VU	68
Geronticus calvus	Bald Ibis	VU	100

VU = Vulnerable, NT = Near Threatened

14 WATER CATCHMENT AREAS BASELINE ASSESSMENT

The SANBI Wetland Inventory (2006) NFEPA (2011), databases were consulted to define the aquatic ecology of the wetlands and river systems close to and within the road development that may be of ecological importance. Aspects applicable to the proposed development and surroundings are discussed in the paragraphs to follow.

14.1 WATER MANAGEMENT AREA

The project area falls within the Upper Orange Water Management Area (WMA). The following information on this WMA has been gleaned from Appendix D of the National water resource strategy (DWAF 2004, pages D13.1 and D 13.2).

The WMA area lies in the centre of South Africa, extending over parts of the Eastern and Northern Cape and southern Free State and provinces. It borders on Lesotho to the east, where the Orange River originates as the Senqu River. The latter river drains the Highlands of Lesotho and contributes close to 60% of the surface water associated with the WMA. The climate varies considerably over the region. Rainfall ranges from over 1 000 mm/a in the foothills of the mountains to as little as 200 mm/a in the west. Vegetation is mainly grassland and extensive cattle and sheep farming is characteristic throughout the area. Some dry-land cultivation occurs where the rainfall and soils are favourable, but sizeable areas are under irrigation below the main storage dams. Bloemfontein is the only large urban development in the water management area.

Water resources management in the area mainly revolves around the Orange River with the system also significantly utilized as the source for Interbasin Transfer schemes

Figure 14-1: Base map of the Upper Orange Water Management Area (WMA). Source: Department of Water Affairs and Forestry (2004) National water resource strategy, Appendix D.

Two of the highest dams in Africa have been constructed in the Orange (Senqu) catchment in Lesotho for the purpose of transferring water to the Upper Vaal water management area. The Gariep and Vanderkloof Dams in the water management area, where the two largest conventional hydropower installations in the country are located, also command the two largest storage reservoirs in South Africa. From the Gariep Dam a major inter-water management area transfer occurs via the 80 km long Orange-Fish Tunnel to the Fish to Tsitsikamma water management area. A significant portion of the yield of the Orange River is also released down the river for use in the Lower Orange water management area and by Namibia. In total, close to 70 per cent of the yield realised in the Upper Orange water management area and in Lesotho is used in other water management areas.

Even so, potential still exists for further large-scale development of the Orange River, with the most attractive sites for new dams being at the confluence of the Orange and Kraai Rivers, and at Mashai in Lesotho.

The Modder and Riet tributaries have been fully developed. Significant quantities of groundwater are used in parts of the water management area. Demographic projections show a small decline in rural population. As the expectations are that this will be balanced by population growth in the Bloemfontein area, little change in the total population of the water management area is anticipated within the period of projection. There are no strong stimulants for economic growth in the area.

14.2 ECOREGION

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data to be made, since reference information and representative species lists are often available on this level of assessment, which aids in guiding the assessment.

The proposed road, associated road and fence reserve falls within the Eastern Escarpment Mountain (quaternary catchments D21A, D21C, D21H, D22C, D22D and part of D22H) and Highveld (part of quaternary catchment D22H as well as quaternary catchments D22L, D23A and D23E) Aquatic Ecoregions; the key attributes of each of these are summarised in **Tables 14-1 and 14-2** respectively.

Table 14-1: Key Attributes of the Eastern Escarpment Mountains Aquatic Ecoregion (Source: A level 1 river ecoregional classification system for South Africa, Lesotho and Swaziland, DWAF 2005).

Main Attributes	Eastern Escarpment Mountains
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Moderate Relief (limited); Lowlands, Hills and Mountains; Moderate and High Relief Open Hills; Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief**
Vegetation types (dominant types in bold) (Secondary)	South Eastern Mountain Grassland; **AltiMountain Grassland; AfroMountain Grassland**; Moist Upland Grassland; North Eastern Mountain Grassland; **Moist Cold Highveld Grassland**; Moist Cool Highveld Grassland; Moist Sandy Highveld Grassland; Dry Sandy Highveld Grassland Natal Central Bushveld (limited); Patches Afromontane Forest.
Altitude (m a.m.s.l) Secondary	1100-3100; 3100-3500 limited
MAP (mm) (modifying)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	30 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	<8 to 18
Mean daily max. temp. (°C): February	<10 to 28
Mean daily max. temp. (°C): July	<10 to 22
Mean daily min. temp. (°C): February	<6 to 16
Mean daily min temp. (°C): July	<-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	10 to >250

Table 14-2: Key Attributes of the Highveld Aquatic Ecoregion (Source: A level 1 river ecoregional classification system for South Africa, Lesotho and Swaziland, DWAF 2005).

Main Attributes	Highveld
Terrain Morphology: Broad division (dominant types in bold) (Primary)	**Plains; Low Relief;** **Plains; Moderate Relief;** Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief
Vegetation types (dominant types in bold) (Primary)	Mixed Bushveld (limited); Rocky Highveld Grassland; **Dry Sandy Highveld Grassland**; Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland**; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited)
Altitude (m a.m.s.l) (secondary)	1100-2100, 2100-2300 (very limited)
MAP (mm) (modifying)	400 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 35
Rainfall concentration index	45 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	12 to 20
Mean daily max. temp. (°C): February	20 to 32
Mean daily max. temp. (°C): July	14 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min temp. (°C): July	-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	5 to >250

The proposed linear development is located entirely within a single primary catchment, namely the Orange River catchment. Twenty quaternary catchments are traversed by the proposed linear development as presented in **Figure 14-2**. Key information on background conditions (pertaining to the Present Ecological State [PES], ecological importance [EI] and ecological sensitivity [ES]) within these quaternary catchments as contained in the PES/EIS database developed by the DWS Resource Quality Services (RQS) department (with the exception of D21B and D22F as these are not included in the database) is summarised in **Table 14-3**.

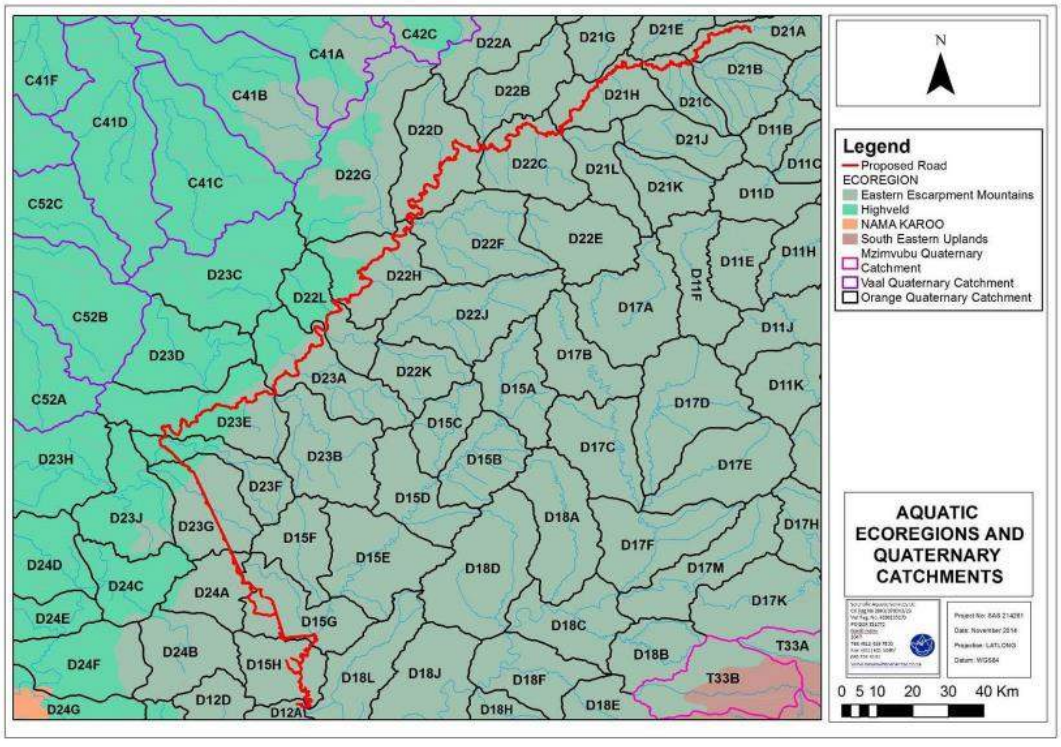


Figure 14-2: Aquatic Ecoregions and Quaternary Catchments applicable to the proposed linear development

Table 14-3: Summary of the ecological status of the quaternary catchments traversed by the proposed linear development (DWS, 2012) [2]

SQ* REACH	SQR* NAME	PES CATEGORY MEDIAN	MEAN EI *** CLASS	MEAN ES† CLASS	STREAM ORDER	DEFAULT EC# (BASED ON MEDIAN PES AND HIGHEST OF EI OR ES MEANS)
D15G-04784	Mantikoana	C	MODERATE	MODERATE	1.0	C
D15H-04878	Deklerkspruit	C	MODERATE	MODERATE	1.0	C
D15H-04889	Makhaleng	C	MODERATE	MODERATE	3.0	C
D15H-04944	Makhaleng	C	MODERATE	MODERATE	3.0	C
D15H-04945	Worsfonteinspruit	C	MODERATE	MODERATE	1.0	C
D15H-04995	Makhaleng	C	MODERATE	MODERATE	3.0	C
D21A-03178	Caledon	B	MODERATE	HIGH	1.0	B
D21A-03194	Caledon	B	HIGH	HIGH	2.0	B
D21A-03207	Caledon	C	HIGH	HIGH	2.0	B
D21C-03286	Caledon	C	MODERATE	HIGH	3.0	B
D21C-03293	Caledon	C	MODERATE	HIGH	3.0	B
D21E-03142	Little Caledon	C	MODERATE	MODERATE	2.0	C
D21G-03101	Brandwater	C	HIGH	HIGH	2.0	B
D21H-03278	Caledon	C	MODERATE	HIGH	3.0	B
D21H-03300	Caledon	B	HIGH	HIGH	3.0	B
D21H-03313	Caledon	C	HIGH	HIGH	3.0	B
D21H-03340	Caledon	C	MODERATE	HIGH	3.0	B
D22B-03442	Meulspruit	D	MODERATE	MODERATE	2.0	C
D22C-03437	Caledon	D	MODERATE	MODERATE	3.0	C
D22C-03483	Caledon	D	MODERATE	MODERATE	3.0	C
D22C-03502	Caledon	C	MODERATE	MODERATE	3.0	C
D22C-03524	Caledon	C	MODERATE	MODERATE	3.0	C
D22D-03304	Rantsho	C	MODERATE	MODERATE	1.0	C
D22D-03415	Caledon	C	MODERATE	MODERATE	3.0	C

[2]Present Ecological State, Ecological Importance and Ecological Sensitivity database for Primary Drainage Region D as developed by the RQS Department of the DWS. Available at http://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx retrieved 28th July 2014.

SQ* REACH	SQR* NAME	PES CATEGORY MEDIAN	MEAN EI *** CLASS	MEAN ES† CLASS	STREAM ORDER	DEFAULT EC# (BASED ON MEDIAN PES AND HIGHEST OF EI OR ES MEANS)
D22D-03550	Caledon	C	MODERATE	MODERATE	3.0	C
D22D-03585	Caledon	C	MODERATE	HIGH	3.0	B
D22H-03781	Caledon	C	MODERATE	MODERATE	4.0	C
D22H-03815	Caledon	D	MODERATE	MODERATE	4.0	C
D22H-03821	Caledon	C	MODERATE	MODERATE	4.0	C
D22L-04004	Tweelingspruit	D	MODERATE	MODERATE	2.0	C
D22L-04017	Caledon	D	MODERATE	MODERATE	4.0	C
D23A-04014	**0**	**C**	**MODERATE**	**MODERATE**	**1.0**	**C**
D23A-04026	**Appledore Spruit**	**C**	**MODERATE**	**MODERATE**	**1.0**	**C**
D23A-04069	**Caledon**	**D**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23A-04143	**Caledon**	**C**	**HIGH**	**MODERATE**	**4.0**	**B**
D23A-04182	**Caledon**	**C**	**HIGH**	**MODERATE**	**4.0**	**B**
D23A-04189	**Caledon**	**C**	**HIGH**	**MODERATE**	**4.0**	**B**
D23E-04171	**Caledon**	**C**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23E-04213	**Leeu**	**C**	**HIGH**	**HIGH**	**3.0**	**B**
D23E-04225	**Bokpoortspruit**	**C**	**MODERATE**	**MODERATE**	**1.0**	**C**
D23E-04232	**Caledon**	**C**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23E-04261	**Caledon**	**D**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23E-04265	**Caledon**	**C**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23E-04346	**Caledon**	**C**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23F-04361	**Caledon**	**C**	**MODERATE**	**MODERATE**	**4.0**	**C**
D23G-04501	**Montsoane**	**D**	**MODERATE**	**MODERATE**	**1.0**	**C**
D24A-04672	**Boesmanskopspruit**	**C**	**MODERATE**	**MODERATE**	**1.0**	**C**
D24A-04744	**Witspruit**	**B**	**MODERATE**	**MODERATE**	**1.0**	**C**

*SQ = Sub-quaternary; †ES = Ecological Sensitivity **SQR = Sub-Quaternary Reach; #EC = Ecological Class; ***EI = Ecological Importance

14.3 CURRENT LAND AND WATER USE

Extensive areas under dry land cultivation, mostly for the production of grains, are found in the north-eastern parts of the water management area. Ficksburg is famous for the cherry orchards in the region.

Large areas under irrigation for the growing of grain and fodder crops have been developed along the main rivers, mostly downstream of irrigation dams. There is no afforestation in the water management area.

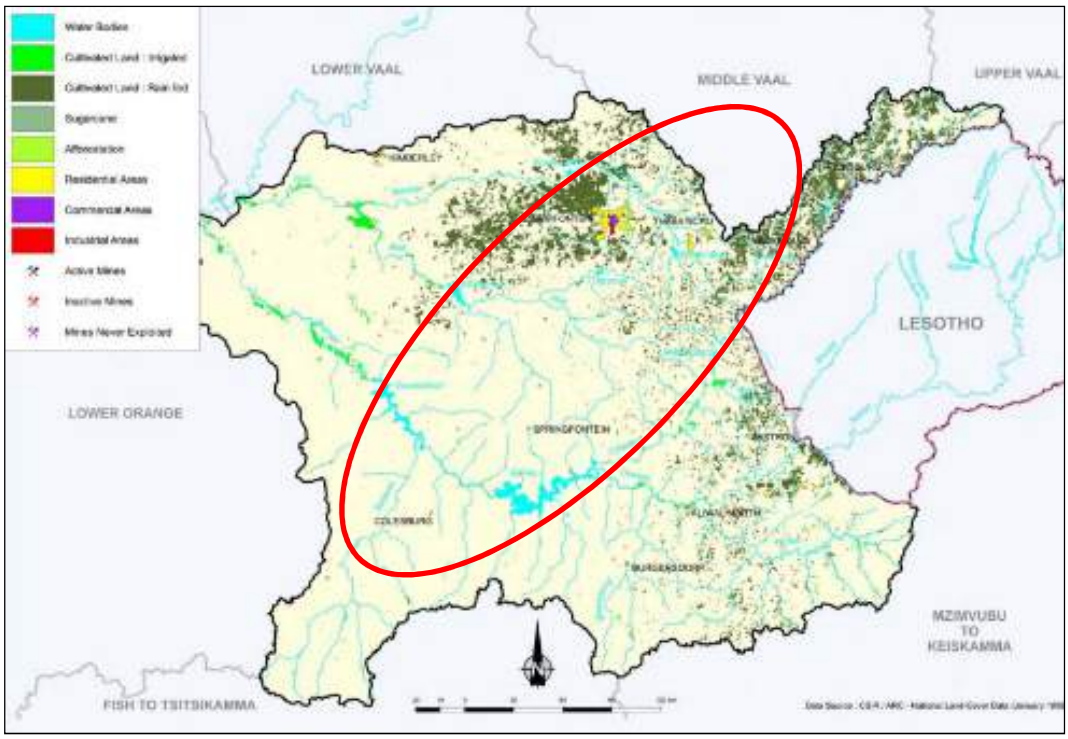


Figure 14-3: Upper Range WMA land uses (DWAF, 2003).

The figure below illustrates that a significant percentage of water in the Caledon and Kraai sub areas are used/required for irrigation and water transfers out of the Caledon sub area. Rural, mining and urban sectors water requirements make up a lesser percentage of the water requirements.

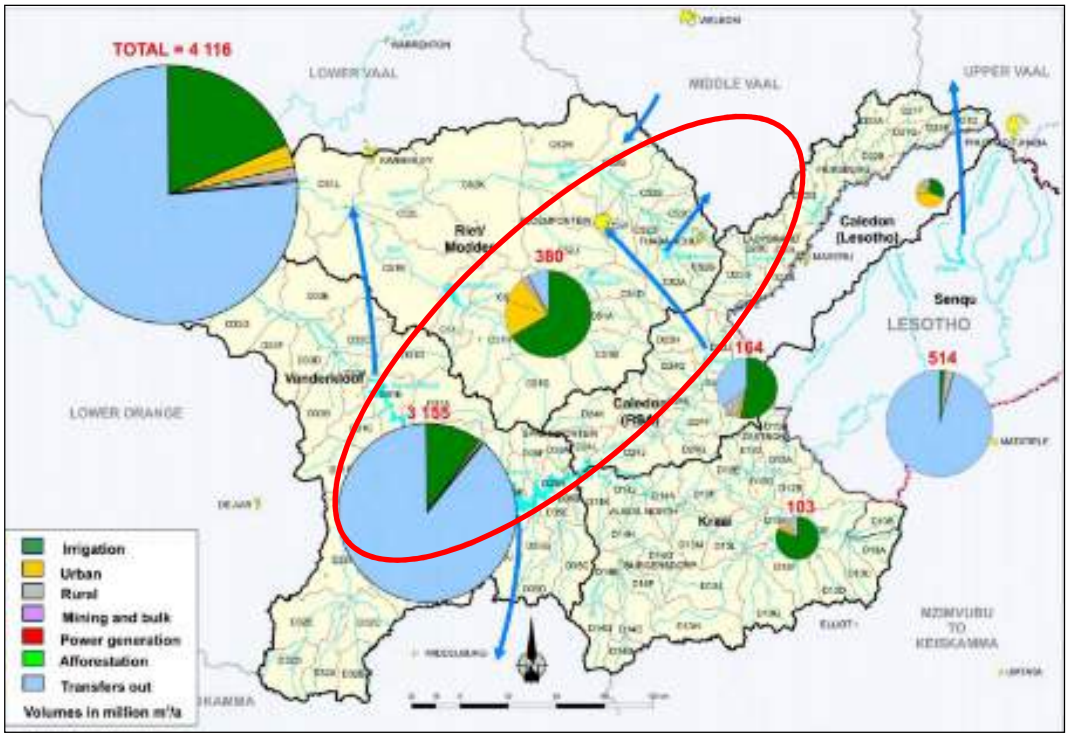


Figure 14-4: Upper Orange WMA – sectoral water requirements.

14.3.1 WATER AVAILABILITY

There's an overriding importance of surface water in the sub areas, this is predominantly a result of the high run-off from Lesotho and the catchments immediately adjoining Lesotho.

Groundwater is a small component of the water available in the sub area, it however constitutes the main source of water in many of the rural areas.

Factors that influence runoff and yield in the sub area include afforestation that takes up 958 hectares of the sub area and the reduction in run-off attributed to the reserve.

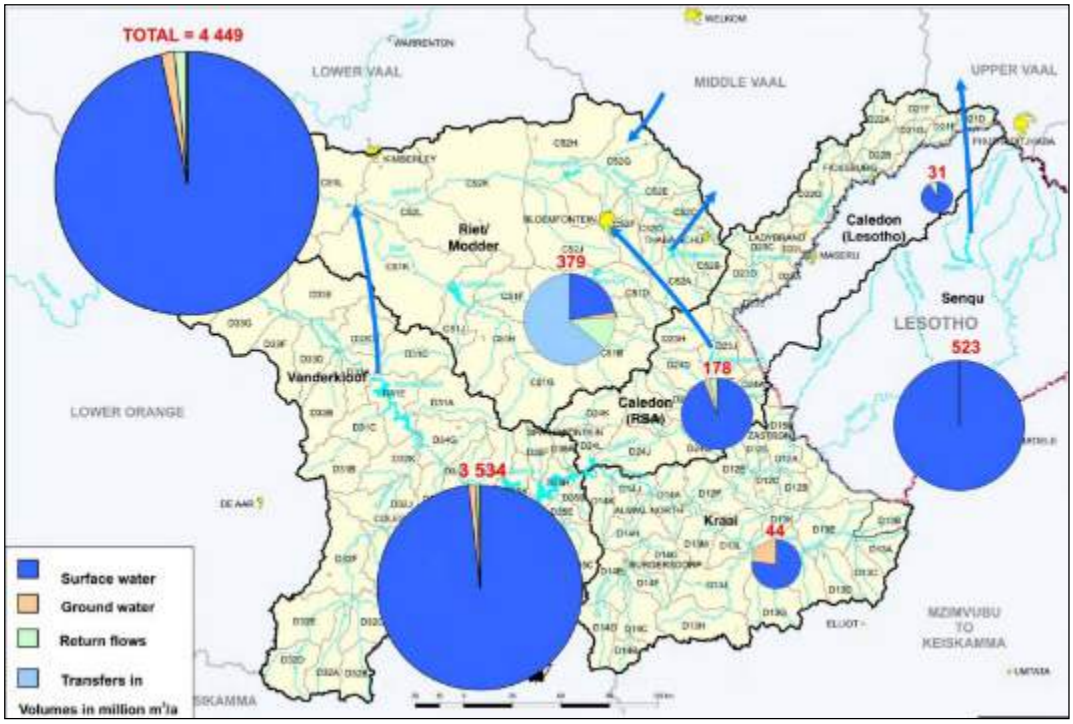


Figure 14-5: Upper Orange WMA – water availability

Table 14-4: Available water in year 2000 (million m3/a).

Sub-Area	Natural Resource		Usable Return Flow			Total Local Yield	Transfers in	Grand Total
	Surface Water	Ground-water	Irrigation	Urban	Mining and bulk			
Caledon	167	5	4	2	0	178	0	44
Kraai	34	10	0	0	0	44	0	44

14.3.2 GROUNDWATER

Due to the water management area being underlain by hard formations, no large porous aquifers are found in the area. Although relatively large quantities of groundwater are abstractable from fracture zones at dolerite intrusions, recharge rates and therefor sustainable yields are low over most of the water management area. Higher recharge occurs in localised areas, such as where lime bogs are found. In the drier parts of the water management area, groundwater constitutes the main, and in many cases the only, source of water for rural domestic supplies and stock watering.

Severe over-exploitation of groundwater is experienced in some peri-urban areas. Over-exploitation of groundwater also occurs due to increasing irrigation from groundwater.

The quality of groundwater is naturally good in the eastern high rainfall parts of the water management area, becoming more mineralised and brackish in the drier areas and in the vicinity of salt pans.

14.3.3 SURFACE WATER

A significant percentage of the surface run-off originates from Lesotho and a lesser percentage from the water management area. Due to the topography and climate in the area, there are no natural lakes or wetlands of significance in the area.

Land use impacts relate to cultivation and some grazing, mainly in the north-eastern parts of the water management area and western Lesotho, causing increased erosion of the naturally highly erodible soils which occur in these areas.

14.3.4 RIVERS

The proposed route traverses or is located within close proximity to several rivers identified by the National Freshwater Ecosystem Priority Areas (NFEPA) layer. The most significant river in the vicinity of the proposed development is the Caledon River and the proposed development route follows the banks of this river for approximately two thirds of the project extent. The Present Ecological State (1999) of the Caledon River falls within the Class C category, stating that the system is moderately modified.

Several rivers traversed by the proposed route are identified to be in almost pristine conditions (River Condition Class AB). In addition, five rivers have been identified as Freshwater Ecosystem Priority Areas (FEPA) and one is identified as a Fish Support Area.

In addition, the 13 rivers have been identified that will be traversed by the proposed route, these are as follows:

- **Caledon River**
  - PES 1999: Class D: Largely Modified
  - River Condition: C: Moderately Modified
  - Coordinates: 28°41’33’ S 28°14’10’E

- **Little Caledon River**
  - PES 1999: Class C: Moderately Modified
  - River Condition: C: Moderately Modified
  - Coordinates: 28°41’33’ S 28°14’10’E

- **Brandwater River**
  - PES 1999: Class D: Largely Modified
  - River Condition: C: Moderately Modified
  - Coordinates: 28°44’17’ S 28 6’ 49’E

- **Melspruit River**
  - PES 1999: Class D: Largely Modified
  - River Condition: D: Largely modified
  - Coordinates: 28°53’45’S 27°49’43’E

- **Rantsho River**

- PES 1999: Class C: Moderately Modified
- River Condition: Z: Tributary condition modelled as not intact
- Coordinates: 28°57’4’S 27°43’14’E

- **Mopeli River**
  - PES 1999: Class D: Largely Modified
  - River Condition: D:Largely Modified
  - Coordinates: 29°7’38’S 27°36’11’E

- **Tweelingspruit**
  - PES 1999: Class D: Largely Modified
  - River Condition: Z: Tributary condition modelled as not intact
  - Coordinates: 29°19’36’S 27°26’40’E

- **Unnamed River (Outside Fairfield)**
  - PES 1999: Class D: Largely Modified
  - River Condition: AB: Largely Natural with few modifications
  - Coordinates: 29°24’32’S 27°23’47’E

- **Appeldore Spruit**
  - PES 1999: Class D: Largely Modified
  - River Condition: AB: Largely Natural with few modifications
  - Coordinates: 29°27’3’S 27°21’22’E

- **Leeu River**
  - PES 1999: Class D: Largely Modified
  - River Condition: D: Largely Modified
  - Coordinates: 29°34’47’S 27°6’29’E

- **Bokpoortspruit**
  - PES 1999: Class C: Moderately Modified
  - River Condition: AB: Largely Modified
  - Coordinates: 29°36’45’S 27°1’28’E

- **Mantsoane**
  - PES 1999: Class D: Largely Modified
  - River Condition: D: Unmodified, natural or largely natural with few modifications
  - Coordinates: 29°48’23’S 27°7’49’E

- **Boesmanskopspruit**
  - PES 1999: Class C: Moderately Modified
  - River Condition: AB: Unmodified, natural or largely natural with few modifications
  - Coordinates: 29°56’34’S 27°11’46’E

14.4 FLOOD LINES AND HYDROLOGY

The existing border road is located within the 1:100-year flood line for most of the route's extent. This is because the Caledon River forms the boundary between South Africa and Lesotho. The road was built as close to the border as possible in order to allow for the efficient patrol of the border.

With the proposed road design, it may not be feasible to avoid being within the 1:100-year flood line due to the limited space or other terrain and/or topographical reasons.

Figure 14-6: Limited space along river bank

Figure 14-7: Moving the road outside the 1 in 100-year flood line may result in the road being far from the border

14.5 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA), 2011

The National Freshwater Ecosystem Priority Areas (NFEPA) 2011 database was consulted to define the aquatic ecology of the wetland systems traversed by or within the immediate vicinity of the proposed linear development that may be of ecological importance. Aspects applicable to the linear development and surroundings are discussed below.

- The Water Management Area (WMA) applicable to the proposed linear development is the Upper Orange WMA. Each Water Management Area is divided into several sub-Water Management Areas (subWMA), where catchment or watershed is defined as a topographically defined area, which is

drained by a stream, or river network. The subWMAs indicated for the proposed linear development include the following subWMAs:
    - Caledon Lesotho
    - Caledon RSA
    - Senqu Lesotho
    - Kraai
- The sections of the subWMAs traversed by the proposed linear development do not contain Upstream Management Areas;
- The sections of the subWMAs traversed by the proposed linear development are not considered important in terms of translocation and relocation zones for fish;
- A portion of the Caledon RSA subWMA, through which a small section of the southern end of the proposed linear development passes, is considered important in terms of fish sanctuaries and Fish Support Areas, and is therefore indicated as a FISHFEPA; and
- The proposed route traverses or is located within close proximity to several rivers identified by the NFEPA database. The most significant river in the vicinity of the proposed linear development is the Caledon River. The proposed route of the linear development follows the banks of this river for approximately two thirds of the project extent. The Present Ecological State (2011) of the Caledon River falls within two PES Categories, being PES Category C and PES Category D, indicating that the system is considered to have undergone moderate to large modifications.

Furthermore, the NFEPA database indicates that wetland resources are in abundance in the area traversed by the proposed linear development. The following points are relevant to the wetland resources indicated in the vicinity of the linear development:

- The Caledon River is classified as a WETFEPA feature, indicating that the resource is considered to be ecologically important and sensitive, as WETFEPAs are those identified by the NFEPA database as being important for biodiversity. This classification highlights the need to ensure that care is taken in the execution of this project from design through to operation and potential decommissioning to minimise impacts on the receiving environment;
- The NFEPA database indicates numerous artificial and natural wetlands in the vicinity of the proposed linear development;
- Although several small wetlands are indicated by the NFEPA database to be important in terms of threatened Crane species conservation none are located closer than 1km to the proposed linear development; and

It is important to note that no RAMSAR wetlands are present in along the proposed route of the linear development, nor are any of the wetlands regarded essential in terms of threatened frog species conservation according to the NFEPA database.

15 WETLAND AND AQUATIC BASELINE ASSESSMENT

15.1 WETLAND BASELINE ASSESSMENT

The wetland delineations undertaken indicated that there are more than 385 wetlands along the proposed route. The Caledon River is also classified as a WETFEPA feature, stating that it is categorized as a FEPA. This classification highlights the importance and sensitivity of this feature and highlights the need to ensure that care is taken in the execution of this project from design through operation and potential decommissioning to minimise impacts on the receiving environment.

Numerous wetland and riparian resources were identified within the study area, and all were classified as Inland Systems, i.e. ecosystems that have no existing connection to the ocean but which are inundated or saturated with water, either permanently or periodically. The wetland resources fall within the Highveld and the Eastern Escarpment Mountains Aquatic Ecoregions. The majority of the linear development falls within the Mesic Highveld Grassland Group 2 WetVeg group (classified as “Critically Endangered by SANBI, 2013), although portions of the route also traverse the Mesic Highveld Grassland Group 1 (“Endangered”) and Dry Highveld Grassland Group 1 (“Critically Endangered” WetVeg groups.

The wetland resources were classified according to the classification system, and encompass five broad HGM units, namely:

- Channelled valley bottom wetland
- Unchannelled valley bottom wetland
- Hillslope seep wetland
- Floodplain wetlands
- Depression (including farm dams)
- Rivers.

The extent, degree, and nature of impacts on the wetland resources vary widely, depending on their proximity to various anthropogenic activities such as agriculture or poor veld management resulting in overgrazed areas. However, many of the wetland resources, in particular the hill slope seep and depression wetlands are considered to be ecologically intact and have not been significantly impacted upon by anthropogenic activities.

15.2 AQUATIC BASELINE ASSESSMENT

Based on current assessment results, the Caledon River can be considered to be a system of high (Upper Reaches) to moderately reduced (Middle and Lower Reaches) Ecological Importance and Sensitivity.

Table 15-1: Summary of the aquatic assessment results for site LR1 assessed January 2015.

Reach	IHIA	IHAS*	SASS5*		MIRAI*	FRAI*	EIS
			Dickens and Graham (2001)	Dallas (2007)			
Upper	**C**	**Adequate**	**C**	**B**	**C**	**F**	**High**
Middle	**D**	-	-	-	-	-	**Moderate**
Lower	**D**	-	-	-	-	-	**Moderate**
Tributaries	**C**	-	-	-	-	-	**Moderate**

*** Site LR1 assessed in upper reaches**

Ecological drivers, such as seasonal flow compounded by flow and channel modifications resulting from water abstraction as well as water quality impacts from human settlements, are anticipated to have an increasing negative effect on the diversity and sensitivity of the macro-invertebrate aquatic communities in a downstream direction within this system (i.e. Middle and Lower Reaches). This is confirmed by the increasing severity of impacts as determined during application of the IHIA. The system is also deemed important in terms of the provision of services to the terrestrial fauna of the area as well as from a socio-cultural point of view. It is deemed essential that all effort is made to ensure that impacts on the Caledon River are minimized should the proposed project continue in order to ensure that the REC of the system is supported.

The current assessments indicate that conditions in the project area is very similar to those which could be expected based on the desktop assessment. Conditions at the time of assessment were accurately reflected by available desktop analysis data. As a result, it is believed that a comprehensive desktop review of available PES/EIS database information will provide an accurate and relevant reflection of current conditions in the study area. Furthermore, it is believed that such information will be adequate to comply with EIA and water license use requirements in order to guide future assessment plans.

Table 15-2: Quaternary catchment desktop EIS/PES assessment indicated the following:

Catchment	Resource	EIS	PES	DEMC
D21A	Caledon	High	Class C: Moderately modified	Class B: Sensitive systems
D21C	Caledon	High	Class D: Largely modified	Class B: Sensitive systems
D21H	Caledon	High	Class D: Largely modified	Class B: Sensitive systems
D22C	Caledon	High	Class C: Moderately modified	Class B: Sensitive systems
D22D	Caledon	High	Class C: Moderately modified	Class B: Sensitive systems
D22H	Caledon	Moderate	Class D: Largely modified	Class C: Moderately sensitive systems
D22L	Caledon	Moderate	Class D: Largely modified	Class C: Moderately sensitive systems

Catchment	Resource	EIS	PES	DEMC
D23A	Caledon	Moderate	Class D: Largely modified	Class C: Moderately sensitive systems
D23E	Caledon	Moderate	Class D: Largely modified	Class C: Moderately sensitive systems

EIS = Ecological Importance and Sensitivity
PESC = Present Ecological Sensitivity Class
DEMC = Desired Ecological Management Class

The upper reaches (quaternary catchments D21A to D22D) have a higher EIS and DEMC classification. This is attributed to proximity to proposed biosphere reserves (as well as Golden Gate with specific reference to D21A and D21C) and also a greater species diversity which also includes more sensitive species. Of particular importance in the Caledon River is the Maluti minnow (*Pseudobarbus quathlambae*) as well as yellowfish species (*Labeobarbus aeneus*). The importance of these two taxa is specifically highlighted for upper reaches (quaternary catchments D21A to D22D).

The upper reaches (quaternary catchments D21A to D22D) presented with fewer and less severe **PES** impacts compared to the middle and lower reaches. The impacts specified for QCs D21A to D22D (middle and lower reaches) included trout as introduced biota and irrigation resulting in flow modifications. For QCs D22H to D23E (middle and lower reaches), carp (*Cyprinus carpio*) was specified with reference to introduced biota whilst abstraction for agriculture is the main cause of flow modification. Weirs and dams cause inundation whilst run-off and effluent discharges are indicated as the main cause of water quality impacts.

Table 15-3: Sub-quaternary catchment (SQR) desktop EIS/PES assessment for the Caledon River indicated the following:

SQRs on Caledon River along the Lesotho border	PES	Mean EI	Mean ES	Default EC
D21A-03207	C	High	High	B
D21A-3178	B	Moderate	High	B
D21A-03194	B	High	High	B
D21C-03286	C	Moderate	High	B
D21C-03293	C	Moderate	High	B
D21H-03278	C	Moderate	High	B
D21H-03300	B	High	High	B
D21H-03313	C	High	High	B
D21H-03340	C	Moderate	High	B
D22C-03483	D	Moderate	Moderate	C
D22C-03437	D	Moderate	Moderate	C
D22C-03524	C	Moderate	Moderate	C
D22C-03502	C	Moderate	Moderate	C
D22D-03415	C	Moderate	Moderate	C
D22D-03585	C	Moderate	High	B
D22D-03550	C	Moderate	Moderate	C

SQRs on Caledon River along the Lesotho border	PES	Mean EI	Mean ES	Default EC
D22H-03781	C	Moderate	Moderate	C
D22H-03821	C	Moderate	Moderate	C
D22H-03815	D	Moderate	Moderate	C
D22L-04017	D	Moderate	Moderate	C
D23A-04069	D	Moderate	Moderate	C
D23A-04143	C	High	Moderate	B
D23A-04182	C	High	Moderate	B
D23A-04189	C	High	Moderate	B
D23A-04265	C	Moderate	Moderate	C
D23E-04171	C	Moderate	Moderate	C
D23E-04232	C	Moderate	Moderate	C
D23E-04261	D	Moderate	Moderate	C
D23E-04346	C	Moderate	Moderate	C
D23F-04361	C	Moderate	Moderate	C

PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
EI = Ecological Importance;
ES = Ecological Sensitivity
EC = Ecological Category; default based on median PES and highest of EI or ES means

The Caledon River flows together with the Maklaheng River which then flows out of Lesotho. From this point downstream the river is referred to as the Maklaheng River and hence was included in PES/EIS frequency calculations for the Caledon River SQRs.

Table 15-4: Maklaheng River PES/EIS frequency calculations for the Caledon River SQRs

SQRs on Maklaheng/ Caledon River along the Lesotho border	PES	Mean EI	Mean ES	Default EC
D15H-04889	C	Moderate	Moderate	C
D15H-04944	C	Moderate	Moderate	C
D15H-04995	C	Moderate	Moderate	C

PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
EI = Ecological Importance;
ES = Ecological Sensitivity
EC = Ecological Category; default based on median PES and highest of EI or ES means.

The SQR desktop analysis follows the same trend as that reported for the quaternary catchment, in that mean ES and default EC for the Upper Reaches generally has a higher classification compared to the Middle and Lower reaches.

When viewing the entire river section assessed as a whole (i.e. pooled for reaches), the percentage of SQRs that obtained a specific rating or score could be calculated (i.e. “prevalence” of scores for individual criteria calculated). Based on this the following summary provides an overview of study area impacts and scores, with only the most prevalent score (i.e. highest percentage of SQRs that presented with that score) reported.

15.2.1 THE CALEDON RIVER

PES criteria frequency summary for the Caledon River:

- For the majority of the SQRs (55% of total) there were no instream habitat continuity impacts. The same trend was observed for all three reaches (Upper, Middle and Lower). For all other impacts pertaining to the PES determination, impacts were rated as small to large with the majority (45% to 64% of total) reported as moderate:
- Riparian/wetland zone habitat impacts were indicated as large in the Upper Reaches and mostly moderate in the Middle and Lower Reaches;
- Riparian/wetland zone continuity modification impacts were indicated as mostly moderate in the Upper, Middle and Lower Reaches;
- Potential flow modification impacts were indicated as mostly moderate in the Upper and Middle Reaches and mostly moderate to large in the Lower Reaches;
- Potential in-stream habitat modification impacts were indicated as mostly small to moderate in the Upper and Middle Reaches and mostly moderate in the Lower Reaches;
- Potential physico-chemical modification impacts were indicated as mostly small to moderate in the Upper Reaches and mostly moderate in the Middle and Lower Reaches.

EI criteria frequency summary for the Caledon River

For the majority of the SQRs, based on highest percentage obtained per category, the following can be concluded:

- **Very low scores**: Habitat size class (64% of total SQRs). It is important to note that this criterion is assessed relative to the length of the SQR with the highest length in the secondary catchment. The criterion employed to measure habitat size is thus length and not necessarily habitat structure or availability, explaining why this criterion result is variable and differs from that obtained employing the IHIA and IHAS indices at site LR1:
  - For the Upper Reaches scores varied from very low to high;
  - For the Middle and Lower Reaches scores were mostly very low.
- **Low scores:** Fish rarity per secondary class (64% of total SQRs):
  - For the Upper and Middle Reaches the scores were mostly low;
  - For the Lower Reaches the scores were mostly moderate.
- **Low scores**: Habitat diversity class (55% of total SQRs):
  - For the Upper and Middle Reaches the scores were mostly very low to low;
  - For the Lower Reaches the scores were mostly low.
- **Moderate scores**: Fish representivity per secondary class (82% of total SQRs):
  - For the Upper Reaches the scores were mostly low;
  - For the Middle and Lower Reaches, the scores were mostly moderate.
- **Moderate scores**: Riparian-wetland natural vegetation rating based on expert opinion (58% of total SQRs):
  - For the Upper and Middle Reaches the scores were mostly moderate;
  - For the Lower Reaches the scores were mostly low to moderate.
- **High scores:** Invertebrate representivity (48% of total SQRs):
  - For the Upper Reaches the scores were mostly very high;
  - For the Middle Reaches the scores were mostly high;
  - For the Lower Reaches the scores were mostly moderate to high.

- **High scores:** EI importance to vertebrates other than fish (91% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were mostly high;
- **High scores:** Riparian-wetland zone migration link class (48% of total SQRs):
  - For the Upper and Middle Reaches the scores were mostly high;
  - For the Lower Reaches the scores were mostly moderate to high.
- **High scores:** Riparian wetland zone habitat integrity (61% of total SQRs):
  - For the Upper Reaches the scores were mostly moderate;
  - For the Middle and Lower Reaches, the scores were mostly high.
- **High scores:** In-stream habitat integrity (55% of total SQRs):
  - For the Upper and Middle Reaches the scores were mostly high to very high;
  - For the Lower Reaches the scores were mostly high.
- **Very high scores**: Invertebrate rarity per secondary class (94% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were mostly very high.
- **Very high scores:** In-stream migration link class (85% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were mostly very high.
- **Very high scores:** Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500 m (61% of total SQRs):
  - For the Upper Reaches the scores were mostly very high;
  - For the Middle and Lower Reaches, the scores were mostly high to very high.

ES criteria frequency summary for the Caledon River

For the majority of the SQRs, based on highest percentage obtained per category, the following can be concluded:

For the majority of the SQRs, based on highest percentage obtained per category, the following can be concluded:

- **Low scores:** Stream size sensitivity to modified flow/water level changes (91% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were mostly low.
- **Moderate scores**: Fish physical/chemical sensitivity (100% of total SQRs)
  - For the Upper, Middle and Lower Reaches the scores were mostly moderate.
- **Moderate scores**: Riparian-wetland vegetation intolerance to water level changes (76% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were mostly moderate.
- **High scores**: Fish no-flow sensitivity (97% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were high.
- **High scores**: Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes (100% of total SQRs):
  - For the Upper, Middle and Lower Reaches the scores were high.
- **Very high scores**: Invertebrate physical/chemical sensitivity (48% of total SQRs):
  - For the Upper Reaches the scores were mostly very high;
  - For the Middle Lower Reaches, the scores were mostly moderate to very high;
  - For the Middle and Lower Reaches, the scores were mostly moderate to high.

- **Very high scores**: Invertebrate velocity sensitivity (61% of SQRs).
  - For the Upper Reaches the scores were mostly very high;
  - For the Middle and Lower Reaches, the scores were mostly high to very high.

Table 15-5: Sub-quaternary catchment desktop EIS/PES assessment for the tributaries of the Caledon River indicated the following

Tributary Reach	Resource	SQRs on tributaries of the Caledon River along the Lesotho border	PES	Mean EI	Mean ES	Default EC
Middle Reaches of Caledon River	Little Caledon	D21E-03142	C	High	High	C
	Brandwater	D21G-03101	C	High	High	B
	Meulspruit	D22B-03442	D	Moderate	Moderate	C
	Rantsho	D22D-03304	C	Moderate	Moderate	C
	Mopeli	D22G-03714	D	Moderate	Moderate	C
	Tweeling	D22L-04004	D	Moderate	Moderate	C
	0	D23A-04014	C	Moderate	Moderate	C
	Appledore	D23A-04026	C	Moderate	Moderate	C
Lower Reaches of Caledon River	Leeu	D23E-04213	C	High	High	B
	Bokpoort	D23E-04225	C	Moderate	Moderate	C
	Riet	D23H-04469	E	Low	Moderate	C
	Vaal	D24D-04756	B	Moderate	Moderate	C
	Vinkel	D24E-04658	C	High	Moderate	B
	Skulp	D24H-05022	C	Moderate	Moderate	C
	Slyk	D24L-05100	C	Moderate	Moderate	C
	Montsoane	D23G-04501	D	Moderate	Moderate	C
	Boesmankop spruit	D24A-04672	C	Moderate	Moderate	C

Tributary Reach	Resource	SQRs on tributaries of the Caledon River along the Lesotho border	PES	Mean EI	Mean ES	Default EC
	Witspruit	D24A-04744	B	Moderate	Moderate	C
	Mantikoana	D15G-04784	C	Moderate	Moderate	C
	Deklerkspruit	D15H-04878	C	Moderate	Moderate	C
	Worsfontein spruit	D15H-04945	C	Moderate	Moderate	C

15.2.2 TRIBUTARIES OF THE CALEDON RIVER

The DWS RQIS database results for the tributaries correspond with that of the quaternary catchment results, in that the Upper Reaches presented with a higher ES and default EC classification. However, PES classification indicates that some negative impact has already occurred in both the Middle and to a lesser extends the Lower Reaches.

PES/EIS category frequency summary: Tributaries of the Caledon River

For the majority of the SQRs (71%) the PES is classified as moderately modified (Class C). A single SQR in the Lower Reaches presented with a largely natural (Class B classification). In the Middle Reaches three SQRs presented with largely modified (Class D) conditions whilst one in the Lower Reaches presented with a critically modified (Class E) condition.

For the majority of the SQRs (71%) the EI is classified as moderate. A number of SQRs (two in the Middle Reaches and two in the Lower Reaches) was awarded a high EI classification, whilst one in the Lower Reaches presented with a low EI classification.

For the majority of the SQRs (81%) the ES is classified as moderate. Two SQRs in the Middle Reaches and one in the Lower Reaches were awarded a high ES classification. None of SQRs were awarded a low ES classification.

For the majority of the SQRs (81%) the EC is classified as Class C. A number of SQRs (one in the Middle Reaches and two in the Lower Reaches) was awarded a Class B classification.

PES criteria frequency summary: Tributaries of the Caledon River

For riparian/wetland zone continuity modification impact was indicated as small for the majority of SQRs (48%). Impact was indicated as small to moderate in the Middle Reaches and small to large in the Lower Reaches;

For all other impacts pertaining to the PES determination, impacts were rated as small to serious with the majority (48% to 67% of total) reported as **moderate**:

- Instream habitat continuity impacts were indicated as mostly moderate (one serious) in the Middle Reaches, and varied (small to serious) in the Lower Reaches;
- Riparian/wetland zone habitat impacts were indicated as small to large in the Middle Reaches and mostly moderate in the Lower Reaches;

- Potential flow modification impacts were indicated as small to large in the Middle Reaches and mostly moderate in the Lower Reaches;
- Potential in-stream habitat modification impacts were indicated as moderate to serious in the Middle Reaches and mostly moderate to large in the Lower Reaches;
- Potential physico-chemical modification impacts were indicated as mostly moderate in the Middle and Lower Reaches.

EI criteria frequency summary: Tributaries of the Caledon River

For the majority of the SQRs, based on highest percentage obtained per category, the following can be concluded:

- **Low scores:** Fish representivity per secondary class (33% of total SQRs):
  - For both the Middle and Lower Reaches the scores were variable and ranged between very low to very high;
- **Low scores**: Habitat size class (33% of total SQRs). It is important to note that this criterion is assessed relative to the length of the SQR with the highest length in the secondary catchment. The criterion employed to measure habitat size is thus length and not necessarily habitat structure or availability, explaining why this criterion result is variable.
  - For the Middle Reaches scores varied from very low to very high;
  - For the Lower Reaches scores varied from very low to very high, however, the majority presented with a very low score.
- **Low scores:** Invertebrate representivity per class (62% of total SQRs):
  - For the Middle Reaches the scores varied between low, high and very high;
  - For the Lower Reaches the scores varied from low (four out of seven SQRs to very high.
- **Low scores**: Habitat diversity class (48% of total SQRs):
  - For the Middle Reaches the scores varied between very low to moderate, with the majority low;
  - For the Lower Reaches the scores varied from very low to high, with the majority low.
- **Low scores**: Riparian-wetland natural vegetation rating based on expert opinion (52% of total SQRs):
  - For the Middle Reaches the scores were mostly moderate;
  - For the Lower Reaches the scores were mostly low.
- **High scores:** EI importance to vertebrates other than fish (71% of total SQRs):
  - For the Middle and Lower Reaches, the scores were mostly high;
- **High scores:** In-stream migration link class (48% of total SQRs):
  - For the Middle Reaches the scores were mostly high;
  - For the Lower Reaches the scores varied from low to very high.
- **High scores:** Riparian-wetland zone migration link class (57% of total SQRs):
  - For the Middle Reaches the scores varied between moderate (three out of six SQRs) and very high;
  - For the Lower Reaches the scores were mostly high (four out of six SQRs).
- **High scores:** Riparian wetland zone habitat integrity (52% of total SQRs):
  - For the Middle Reaches the scores varied between moderate and very high;
  - For the Lower Reaches the scores were mostly high.
- **High scores:** In-stream habitat integrity (48% of total SQRs):

  - For the Middle and Lower Reaches, the scores were mostly high to very high.
- **Very high scores**: Fish rarity per secondary class (38% of total SQRs):
  - For the Middle Reaches the scores were mostly very high;
  - For the Lower Reaches the scores were mostly moderate.
- **Very high scores**: Invertebrate rarity per secondary class (43% of total SQRs):
  - For the Middle Reaches the scores were mostly very high;
  - For the Lower Reaches the scores varied between low to very high.
- **Very high scores:** Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500 m (76% of total SQRs):
  - For the Middle and Lower Reaches, the scores were mostly very high.

ES criteria frequency summary for tributaries of the Caledon

For the majority of the SQRs, based on highest percentage obtained per category, the following can be concluded:

- **Very low (variable)**: Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes (48% of total SQRs):
  - For the Middle Reaches the scores were mostly high;
  - For the Lower Reaches the scores were mostly very low.
- **Low scores:** Stream size sensitivity to modified flow/water level changes (81% of total SQRs):
  - For the Middle and Lower Reaches, the scores were mostly low.
- **Moderate scores**: Fish physical/chemical sensitivity (67% of total SQRs)
  - For the Middle Reaches the scores were mostly high;
  - For the Lower Reaches the scores were mostly moderate.
- **Moderate scores**: Invertebrate physical/chemical sensitivity (76% of total SQRs):
  - For the Middle Reaches the scores were moderate to very high;
  - For the Lower Reaches the scores were mostly moderate.
- **Moderate scores**: Riparian-wetland vegetation intolerance to water level changes (76% of total SQRs):
  - For the Middle and Lower Reaches, the scores were mostly moderate.
- **High scores**: Fish no-flow sensitivity (76% of total SQRs):
  - For the Middle and Lower Reaches, the scores were mostly high.
- **High scores**: Invertebrate velocity sensitivity (76% of total SQRs).
  - For the Middle Reaches the scores were high to very high;
  - For the Lower Reaches the scores were mostly high.

PES/EIS category frequency summary synopsis: Caledon River compared to Tributaries of the Caledon River

- The PES/EIS data for the tributaries largely correspond with that of the Caledon River in terms of PES (mostly Class C), EI (mostly Moderate), ES (mostly Moderate) and EC (mostly Class C) classifications;
- The EC in the Upper Reaches of the Caledon River is higher than that in the Middle and Lower Reaches. The Upper Reaches also generally presented with a slightly higher diversity of macro-invertebrate taxa. Whilst fish species diversity increased in a downstream direction, species tolerant of higher temperatures and poorer water quality were evident in the Middle and Lower Reaches;
- A similar trend is observed for the tributaries, where one of the largest tributaries (Little Caledon) enters the Caledon in the Middle to Upper Reaches.

Larger tributaries presented with a greater diversity of macro-invertebrate taxa. Because all the tributaries were located in the Middle to Lower Reaches, fish fauna was very similar at the majority of tributaries. As could be expected the smallest tributaries presented with the lowest fish diversity (only small barb species present in some cases).

- Scores within categories were much more variable for the tributaries. This could be expected for two reasons. Firstly, a series of assessment points on a single major aquatic resource such as the Caledon River is expected to exhibit a fair degree of local homogeneity. In comparison the various tributaries exhibit much variability in terms of size, available habitat etc. Secondly smaller systems are often less robust. Because of size constraints ecological interactions and processes are unable to withstand impacts compare to a larger, more inter-connected system such as the Caledon River. This likely to contribute to the considerable variation between the smaller tributaries.

16 HERITAGE RESOURCES

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by Delta Built Environment Consultants, to conduct a cultural heritage impact assessment to determine if any sites, features or objects of cultural heritage significance occur within the project area (refer to Appendix D3 for the specialist scoping report).

The cultural landscape qualities of the region essentially consist of a two components.

- The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age and Iron Age) occupation and a much later colonial (farmer) component.
- The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less.

This human occupation has given rise to a variety heritage sites in the larger region, ranging across the spectrum from Stone Age sites through to the Iron Age and sites of historic significance;

- The Stone Age sites are known to contain rock art and are therefore viewed to have high significance on a regional level.
- Less is known about the Iron Age sites, but, based on available information they are considered to have medium significance on a regional level.
- The historic sites are mostly related to the early pioneering and farming days and are viewed to have high significance on a regional level.

16.1 STONE AGE SITES IDENTIFIED

The Stone Age sites identified in the larger region of the study area is described in the table below.

Table 16-1: Stone Age sites identified.

No. A 4.1.1 – Small area where Later Stone Age material is eroding out. It consists mostly of flakes, with a few formal tools, all of fine-grained material such as agates and quartz.	Grade III	Pietersdal 8, S 28.97935, E 27.71788  This site is located on the current border patrol road.

16.2 IRON AGE SITES IDENTIFIED

The Iron Age sites identified in the larger region of the study area is described in the table below.

Table 16-2: Iron Age sites identified.

No. A 4.3.1 – Sandstone built farmstead.	Grade III – High on a regional level	Braamhoek 345, S 28.60387, E 28.49646  Currently the border patrol road passes about 40 m from this feature.
No. A 4.3.2 – Ruins of farmstead.	Grade III – High on a regional level	Riverland 93, S 28.78582, E 28.09055  Currently the access road to the border patrol road passes between the various structures.
No. A 4.3.3 – Farm labourer homestead, consisting of some outer stone walling and the remains of house structures built with clay.	Grade III – High on a regional level	Frognal 13, S 28.60580, E 28.48782  Located within 10 m of the border patrol road.
No. A 4.3.4 – Rectangular structure of packed stone, probably served as a stock pen for cattle of sheep.	Grade III – Low on a regional level	Frognal 13, S 28.61095 E 28.48622  Feature is located within 10 m of the border patrol road.
No. A 4.3.5 – Ruins of a farmstead, consisting of different structures, all built with dressed sandstone. The main house does not exist anymore and it is only outbuildings that remain.	Grade III – High on a regional level	Mombasa 419, S 28.64277, E 28.3978

		 Feature is located within 80 m of the military road, on top of a low ridge.
No. A 4.3.6 – Extensive farmstead, consisting of a main house, a number of outbuildings and stock pens.	Grade III – High on a regional level	Kornetspruit 399, S 30.28166, E 27.37969  Currently the border patrol road passes through this feature.
No. A 4.3.7 – The remains of a smallish house structure. It is likely that the structure was built from wattle and daub.	Grade III – Low on a regional level	Vincennes 353, S 30.19524, E 27.36852  Currently the border patrol road passes about 20 m from this feature.
No. A 4.3.8 – Farmstead consisting of number of buildings in different styles.	Grade III - High on a regional level	Aloe Port 194, S 30.2168, E 27.36493   Currently the border patrol road passes through the farmstead.
No. A. 4.3.9 – Sandstone built house farm house, with associated outbuildings. All have been stripped of fixtures and the roofs.	Grade III – High on a regional level	Zamestroom 397, S 30.31584, E 27.37040  Currently the access road to the border patrol road passes about 40 m from this feature. If upgraded.

16.3 GRAVES AND BURIAL PLACES IDENTIFIED

The graves and burial places identified in the larger region of the study area are described in the table below.

Table 16-3: Graves and burial places identified.

No. A 4.4.10 – Single grave.	Grade III – High on a regional level	Boschfontein 934, S 28.85812, E 27.96893  Feature is located in proximity of the access road leading to the border patrol road.
No. A 4.4.2 – Large informal burial place with possibly more than 100 graves.	Grade III – High on a regional level	Kromdraai 106, S 28.66468, E 28.36579  The current border patrol road passes very close to the graves: < 10 m.
No. A 4.4.3 – Appears to be a single grave fenced off with a stone wall.	Grade III – High on a regional level	Kromdraai 106, S 28.65850, E 28.37008  Feature is about 500 m away from the proposed border patrol road and border fence.
No. A 4.4.4 – Small informal burial site, probably containing graves of former farm owners or farm labourers.	Grade III – High on a regional level	Boomplaat 219, S 30.28166, E 27.37969  It is uncertain about the relation of this feature to the border patrol road and border fence.

16.4 PUBLIC MONUMENT AND BATTLEFIELDS IDENTIFIED

The public monument and battlefields identified in the larger region of the study area, is described in the table below.

Table 16-4: Public Monument and battlefields identified.

No. A 4.5.1 – Cross marking, the spot where a helicopter crashed and one SANDF member died – November 2007.	Grade III – High on a regional level	Holywell 42, S 29.88173, E 27.16817  Feature is currently located within the boundary of the border patrol road and in close vicinity of the border fence.

16.5 INFRASTRUCTURE AND INDUSTRIAL HERITAGE

The infrastructure and industrial heritage identified in the larger region of the study area is described in the table below.

Table 16-5: Infrastructure and Industrial Heritage identified.

No. A 4.6.1 – Old bridge used by Lesotho people to cross the Caledon river to get to the old mill close by.	Grade III – Medium on a regional level	Beginsel 346, S 28.61380, E 28.45618  Feature is about 50 m away from the proposed border patrol road and border fence.
No. A 4.6.2 – Peka Border Bridge: a three span single lane steel truss bridge across the Caledon River.	Grade III – Medium on a regional level	Schuttes Draai South 768, S 28.94490, E 27.73442  Feature is located about 200 m away from the proposed border patrol road and border fence.
No. A 4.6.2 - Maghaleen Border Bridge: a two span single lane steel truss bridge across the Caledon River.	Grade III - Medium on a provincial level	Maghaleen 287, S 30.16414, E 27.39977

		 Feature is located about 300 m away from the proposed border patrol road and border fence.
No. A 4.6.3 - Old stamp mill used to grind maize, especially for the people from Lesotho who crossed the Caledon River at the bridge. It formed part of the larger trading post.	Grade III - Medium on a provincial level	Beginsel 346, S 28.61025, E 28.45351  This is a complex site with the existing border patrol road passing through it, dividing the complex in two.
No. A 4.6.4 – Don Don Farm Watermill, originally dating to the late 1880s. Most of the machinery is of Swedish origin.	Grade III - Medium on a provincial level	Don Don 52, S 29.52154, E 27.30252  This is a complex site with the existing border patrol road passing through it, dividing the complex in two.
No. A 4.6.5 – Watermill	Grade III - Medium on a provincial level	Maghaleen 287, S 30.16006, E 27.40115  Site is located approximately 90m from the current border patrol road.

16.6 URBAN ENVIRONMENT IDENTIFIED

The urban environment identified in the larger region of the study area is described in the table below.

Table 16-6: Urban environment identified.

No. A 4.7.1 – Old sandstone built church. Only the walls and roof that remains. A number of other structures, probably part of a larger farmstead occurs about 100 m to the west of the church. Two old graves occur to the southwest of the church, below the ridge.	Grade III – High on a regional level	Alpha 112, S 29.11430, E 27.64572   The current military road passes approximately 80 m to the east of the church, below the ridge.

16.7 SUMMARY OF KEY FINDINGS

From the initial cultural heritage impact assessment (February 2015), the following recommendations were made:

- It is recommended that all the heritage sites identified to be fenced off with danger tape during construction of the border patrol road and border fence.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible.
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.
- If the heritage sites cannot be avoided, the heritage feature (i.e. house and surrounding yard) should be documented (mapped and photographed) in full.
- It is recommended that a qualified Stone Age archaeologist do a surface collection on site **No. A 4.1.1** (Pietersdal 8, S 28.97935, E 27.71788) and that this material is then deposited in a national repository.
- If at all possible, the following site should be avoided by rerouting the road more to the east of site **No. A 4.3.3** - Frognal 13, S 28.60580, E 28.4878.

- If at all possible, the following sites should be avoided by rerouting the road more to the south of the site in order to bypass:
  - **No. A 4.3.1** – Braamhoek 345, S 28.60387, E 28.49646);
  - **No. A 4.3.2** – Riverland 935, S 28.78582, E 28.09055;
  - **No. A 4.3.4** – Frognal 13, S 28.61095; E 28.48622; and
  - **No. A. 4.3.9** – Zamestroom 397, S 30.31584, E 27.37040.
- If at all possible, the following sites should be avoided by rerouting the road more to the east or west of the site in order to bypass.
- **No. A 4.3.6** (Kornetspruit 399, S 30.28166, E 27.37969).
- If at all possible, the following sites should be avoided by rerouting the road more to the west of the site in order to bypass:
  - **No. A 4.3.7** – Vincennes 353, S 30.19524, E 27.36852;
  - **No. A 4.3.8** – Aloe Port 194, S 30.2168, E 27.36493;
  - **No. A 4.6.3** – Beginsel 346, S 28.61025, E 28.45351; and
  - **No. A 4.6.3** – Don Don 52, S 29.52154, E 27.30252.
- If the following sites cannot be avoided, it is recommended that the graves are relocated after the proper procedure has been followed – see **Appendix D3: Relocation of Graves:**
  - **No. A 4.4.1** – Boschfontein 934, S 28.85812, E 27.96893; and
  - **No. A 4.4.2** – Omdraai 106, S 28.66468, E 28.36579.
- It is recommended that the memorial at site No. A 4.5.1 (Holywell 42, S 29.88173, E 27.16817) is moved a few metres to the west, away from the border patrol road and border fence.

Although this feature is not protected under the NHRA, it is recommended that SAHRA should be informed of its existence and relocation. The SANDF as 'owners' of this feature should also agree to relocate the memorial away from road and border fence.

17 PALEONTOLOGICAL RESOURCES

A Palaeontological Impact Assessment: Phase 1 was conducted in August 2015 to ascertain if any palaeontological sensitive material was present within the proposed linear development (refer to Appendix D1 for the Specialist Scoping Report). The scope of the study was to ascertain if any paleontologically sensitive material is present in the development area. This study will advise on the impact of the proposed development on fossil heritage and present mitigation or conservation requirements necessary, if any.

During the survey it was found that the site is directly underlain by siltstone, sandstone, and mudstone of the Karoo Supergroup. Recent structures are present such as bridges, as well as the Lesotho informal settlements and fences nearby. The site is located on a sloping topography. The development of the road includes several projects that will need foundations, footings, channels and trenches to be developed.

According to the fossil sensitivity map below, a tool made available by the South African Heritage Resources Authority (SAHRA) for the management of palaeontological and geological heritage resources, it is evident that the vast majority of the proposed route falls within a high to very high sensitive palaeontological area.

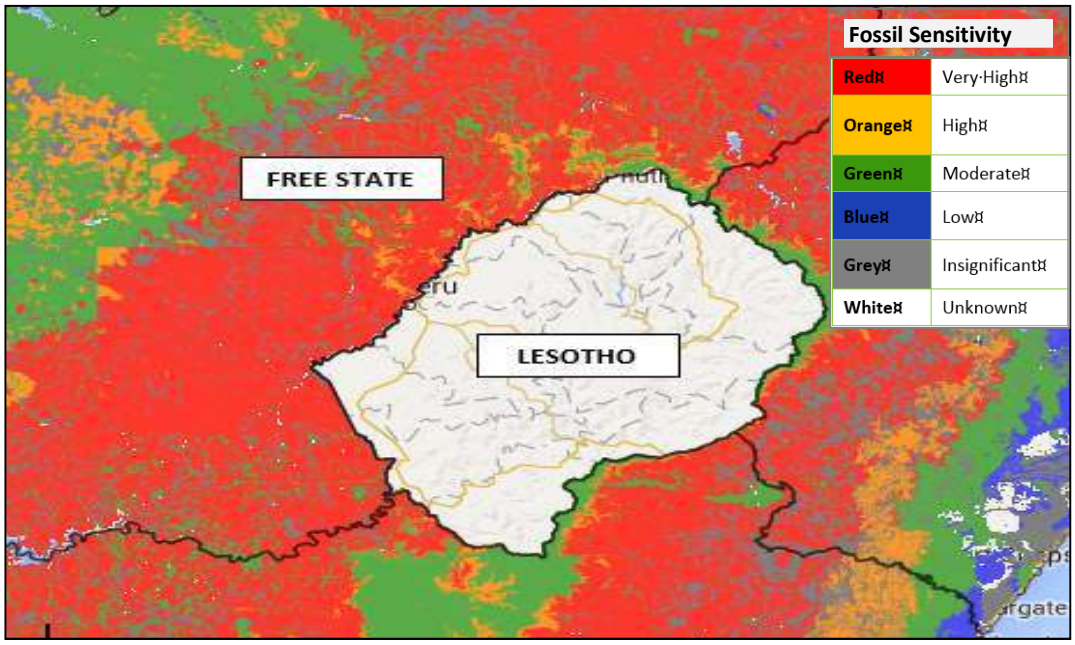


Figure 17-1: Fossil sensitivity map[3]

With reference to the fossil sensitivity map above and the table below, it is likely that paleontological impacts may occur along the proposed development route i.e. the proposed road and fence system, borrow pits, laydown areas and construction camps. SAHRA therefore requires that a field assessment and a protocol for finds are undertaken within the proposed linear development.

Formations present are part of the Karoo Supergroup. The Karoo Supergroup is renowned for its fossil wealth (Kent 1980, Visser 1989). Large areas of the southern African continent are covered by the Karoo Supergroup. An estimated age is 150 – 180 Ma. and a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group,

[3] www.sahra.org.za

they are the Molteno, Elliot and Clarens Formations. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, and basalts. (Kent 1980, Snyman 1996).

The Tarkastad Subgroup of the Beaufort Group consists of a lower predominantly arenaceous Katberg Sandstone Formation and a predominantly upper argillaceous Burgersdorp Formation (Kent 1980, Cole *et al*. 2004). It is Early Triassic in age. Fossils are abundant. Reptile, mammal-like reptile, trace fossils, dinosaurs, the earliest known tortoise in Gondwana, small, early mammals, and wood, are plentiful in the Molteno Formation (Snyman 1996, Visser 1989, Norman and Whitfield 2006). The Clarens Formation has a maximum thickness of 250 m in the south and consists of pink and yellow sandstone which is fine and never coarse. Cave and cliff formation is common. Fossils are scarce, but dinosaurs are found with the fish *Semionotus capensis* (Snyman 1996, Visser 1989, Norman and Whitfield 2006).

Table 17-1: Criteria used (Fossil Heritage Layer Browser/SAHRA).

Rock Unit	Significance/ vulnerability	Recommended Action
Tarkastad Subgroup	Very High	Field assessment and protocol for finds is required
Molteno Formation	Very High	Field assessment and protocol for finds is required
Elliot Formation	Very High	Field assessment and protocol for finds is required
Clarens Formation	High	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
Drakensberg Basalt	Low	No palaeontological studies are required however a protocol for finds is required

17.1.1 INVENTORY OF IDENTIFIED PALAEONTOLOGICAL SITES

Figure 17-2 and **Table 17-2** presents areas identified during the site assessment that could have a high impact on palaeontological resources.

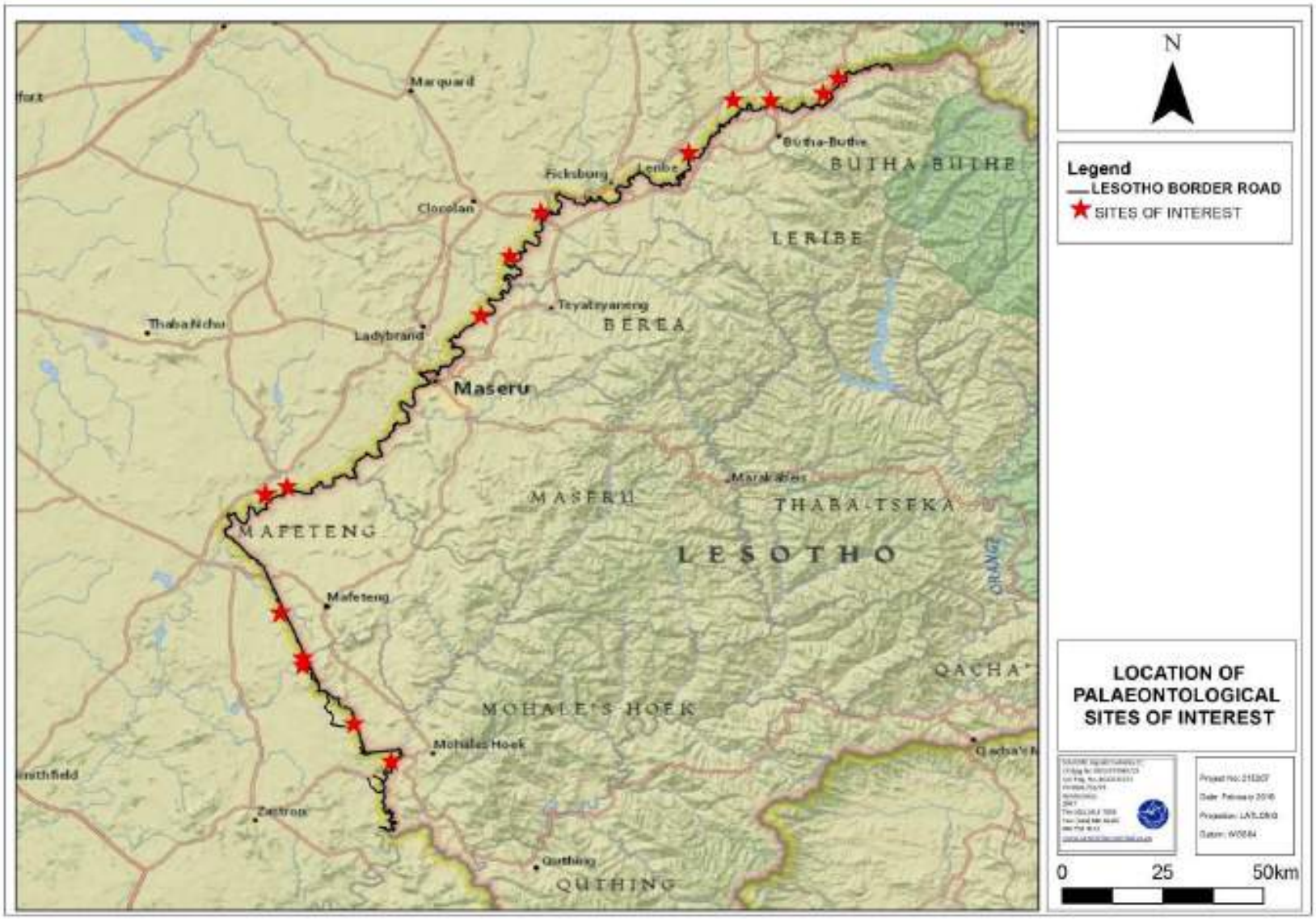


Figure 17-2: The location of identified Palaeontological sites along the proposed linear development.

Table 17-2: Sites identified during the site assessment with potential impact ratings.

Sites	Photograph	Location and Description
1		S 30˚10’ 2.22” E 27˚ 23’ 4.67” 1419 m Old Zastron District Sandstone outcrop next to road. Geology: Molteno and Elliot Formations. Potential impact: Very High. The Elliot Formation is on the Triassic-Jurassic boundary and can provide insight into a mass extinction event.
2		S 30˚ 05’ 0.67” E 27˚ 18’ 3.19” 1518 m Klaarwater basecamp. Road mostly sandstone sand. Zastron. Geology: Molteno and Elliot Formations. Potential impact: Very High. The Elliot Formation also provides evidence for early dinosaur diversification on Gondwana.
3		S 29˚ 57’ 5.47” E 27˚ 11’ 8.00” 1660 m Road very gravelly with scattered dolerite and sandstone flakes. This section is to the south of the Makhaleng Bridge border post. Zastron. Geology: Molteno and Elliot Formations. Potential impact: Very High.
4		S 29˚ 56’ 7.22” E 27˚ 11’ 8.99” 1619 m The road continues south over the hill. zastron. Geology: Molteno and Elliot Formations. Potential impact: Very High. The Molteno Formation provides information on Triassic biota.

Sites	Photograph	Location and Description
5		S 29˚ 50’ 2.13” E 27˚ 08’ 8.27” 1504 m This section of road is on sandstone. It is a straight section with a well maintained fence next to it. Seville. South of Wepener. Old Wepener District. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High. The Tarkastad Subgroup provides information on the Late Permian Mass Extinction Event.
6		S 29˚ 50’ 2.13” E 27˚ 08’ 8.27” 1504 m Wepener. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. 6 km from border road. Potential impact: Very High. Sandstone thickness will vary and may contain fossils – Burgersdorp Formation. Red mudstones – Burgersdorp Formation (Cynognathus Assemblage Zone).
7		Wilgedraai basecamp. North of Wepener. Very sandy road surface. Wepener. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High.
8		S 29˚ 33’ 5.16” E 27˚ 09’ 5.19” 1444 m Kroonbult near Hobhouse. This section of road is to the north. Lots of agates on road surface. Below surface is a hard bank of sandstone. Block 5. Old Wepener District. Geology: Tarkastad Subgroup and Karoo Dolerite.

Sites	Photograph	Location and Description
		Potential impact: Very High, but Zero for the Dolerite.
9		S 29˚ 34’ 3.55” E 27˚ 06’ 8.33” 1438 m Near Hobhouse. Sandstone bank in side stream of river. Geology: Tarkastad Subgroup and Karoo Dolerite. Potential impact: Very High, but Zero for the Dolerite.
10		S 29˚ 34’ 8.85” E 27˚ 06’ 9.76” 1446 m Section north of Hobhouse. Tarkastad Subgroup is present below road. Palingkloof Member. Dolerite on road surface. Old Hobhouse and Ladybrand Districts. Geology: Tarkastad Subgroup, the Molteno, Elliot and Clarens Formations. Potential impact: Very High, but High for the Clarens Formation.
11		S 29˚ 10’ 1.39” E 27˚ 35’ 5.96” 1499 m Waverley. North of Ladybrand. Old Ladybrand District. Geology: Molteno and Elliot Formations. Potential impact: Very High.
12		S 29˚ 02’ 4.22” E 27˚ 39’ 0.74” 1518 m Caledonia close to Clocolan. Road on sandstone. Old Ficksburg and Clocolan Districts. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High.

Sites	Photograph	Location and Description
13		S 28˚ 56’ 9.73” E 27˚ 43’ 6.97” 1529 m Road just south of Peka Bridge Border Post. Ficksburg Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High.
14		S 28˚ 48’ 8.87” E 28˚ 03’ 3.80” 1580 m Francois. Ficksburg. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High.
15		S 28˚ 48’ 8.87” E 28˚ 03’ 3.80” 1580 m Road surface over sandstone bank. Francois. Kommandonek. North of Ficksburg. Geology: Tarkastad Subgroup, Molteno and Elliot Formations. Potential impact: Very High.
16		S 28˚ 41’ 7.11” E 28˚ 14’ 3.89” 1624 m Camelrock on the Caledonspoort Border Post. Road on steep hill. Sandstone surface. Old Fouriesburg District. Geology: Molteno, Elliot and Clarens Formations, Drakensberg Basalts. Potential Impact: Very High, but High for the Clarens and Zero for the Drakensberg.

Sites	Photograph	Location and Description
17		S 28˚ 41' 3.11" E 28˚ 09' 0.55" 1588 m This section of road is north of the Bethlehem Sand & Klip mine. Old Fouriesburg District. Geology: Molteno, Elliot and Clarens Formations, Drakensberg Basalts. Potential Impact: Very High, but High for the Clarens and Zero for the Drakensberg
18		S 28˚ 40' 9.72" E 28˚ 21' 7.75" 1645 m Near Fouriesburg and Surrender Hill. Glen Lyon. Geology: Molteno, Elliot and Clarens Formations, Drakensberg Basalts. Potential Impact: Very High, but High for the Clarens and Zero for the Drakensberg
19		S 28˚ 38' 5.29" E 28˚ 23' 7.92" 1691 m Clarens Road S 1356. Geology: Molteno, Elliot and Clarens Formations, Drakensberg Basalts. Potential Impact: Very High, but High for the Clarens and Zero for the Drakensberg

17.1.2 SUMMARY OF KEY FINDINGS

From the initial investigations conducted, the following key concerns regarding palaeontological resources were identified:

- Impacts of earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance.
- It is required for a Phase 1 Palaeontological and Archaeological Impact Assessment, to be undertaken to determine and document the actual extent of fossiliferous outcrops that may be present within the particular node, i.e. the road, border fence, roads, borrow pits, lay-down areas and construction camps, and the likely impacts that may occur as a result of the proposed development.
- The impact of the development on fossil heritage is very high and high and therefore a field survey or further mitigation or conservation measures may be necessary for this development (according to SAHRA protocol). A Phase 2 Palaeontological Impact Assessment and or mitigation may be recommended.

The overburden and inter-burden consisting of Karoo rocks must be surveyed for fossiliferous outcrops (mudstone, shale). Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers.

18 SOCIO-ECONOMIC BASELINE

18.1 POPULATION DYNAMICS

18.1.1 DIHLABENG LOCAL MUNICIPALITY

The Dihlabeng Local Municipality (DLM) population accounts for 17% of the total population of the Thabo Mofutsanyane District Municipality.

Figure 18-1: Boundary of Dihlabeng Local Municipality – Free State Province.

The population in the DLM was recorded as 128 704 people during the 2011 census. (Stats SA, 2011).

The below figure provides an illustration of the population density within DLM (Musvoto et al. 2010). It is evident from the illustration that the towns of the DLM are the most densely populated.

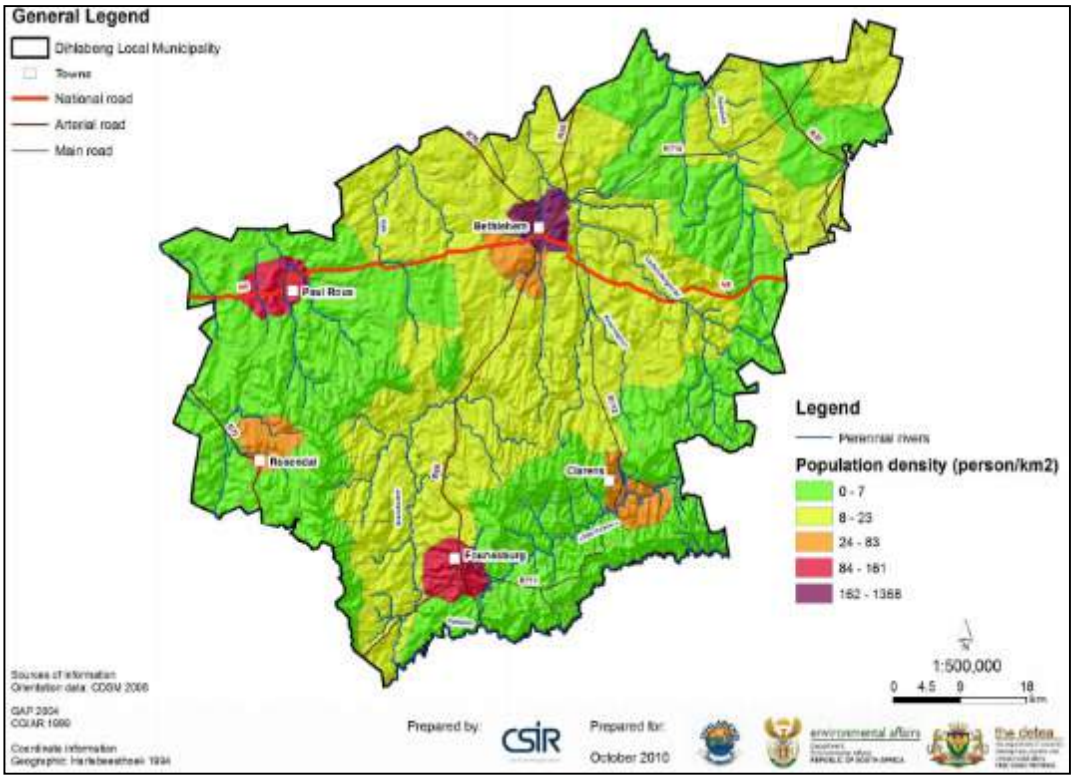


Figure 18-2: Population density within the Dihlabeng Local Municipality (Musvoto et al. 2010).

Age and gender profile

The majority of the population is the working-age (15 to 64) and is mainly female dominated (65.5%). This can be attributed to young male workers, relocating to larger economic centres, such as Bloemfontein and Johannesburg, for better employment opportunities (Stats SA, 2011).

Education

The level of adult education indicates that 12.5% has completed secondary school or attained a higher education qualification, while 3.2% have received no schooling (Stats SA, 2011).

Living Conditions

There are 38 593 households in DLM with an average household size of 3.3 persons. The majority of households (56%) do not have access running water inside the dwelling unit and a large part of the population (26%) is without access to flush sanitation systems. The majority of the population (80.2%) refuse is removed by the local authority or a private company on a weekly basis (Stats SA, 2011).

Health Services

There is one regional hospital and one district hospital in the Greater Bethlehem urban area. There are also two private hospitals located in Bethlehem. These hospitals serve the entire DLM as there are no hospitals in Clarens, Paul Roux, Fouriesburg and Rosendal. There are clinics in each of the five towns in DLM. Health facilities are mainly concentrated in the urban centres and the provision of health services is regarded as poor in the rural areas. Health services are normally provided on a monthly basis in rural areas through mobile clinics which provide services at different visiting points within DLM (Musvoto et al. 2010).

18.1.2 SETSOTSO LOCAL MUNICIPALITY

Setsotso Local Municipality (SLM), situated within the boundaries of the Thabo Mofutsanyane District Municipality has population of 110 335 individuals (Stats SA, 2011).

Age and gender profile

The majority of the population (62%) of SLM is the working age (15 to 64). The age Group 0 – 14 years, accounts for 32% of the population (Stats SA, 2011).

Education

The level of adult education during 2011 survey, indicates the majority of the SLM population has some primary schooling (44.4%), whilst 10.5% of adults has completed secondary school or attained a higher education qualification and 4.1% of the population has no schooling at all (Stats SA, 2011).

Living conditions

There are 21 388 households in the SLM municipality with an average of 3.5 individuals per household. Almost half of the households (49.8%) have access to piped water inside the dwelling and 35.4% have access to water in their yard. The minority of households (4.3%) do not have access to piped water. The majority of households (89.5%) have access to electricity. The local authority or a private company remove 88.9% of the population refuse on a weekly basis (Stats SA, 2011).

Health services

SLM has three hospitals, one in each town except in Marquard. There are thirteen clinics spread all over the four towns of SLM. The provision of health services is a challenge faced within rural and farming areas, as most of these people travel more than five kilometres to reach a clinic. The poor road conditions make some of the health care facilities inaccessible. The shortage of staff at the clinics plays a role in SLM incapacity to provide sustainable health services to the population (SLM Integrated Development Plan, 2014/2015).

18.1.3 MANTSOPA LOCAL MUNICIPALITY

Mantsopa Local Municipality is the second largest local municipal area within the Thabo Mofutsanyana district, but only accommodates 7% of the total population. The population was recorded as 51 056 people in the 2011 census (Stats SA, 2011).

Figure 18-3: Boundary of Mantsopa Local Municipality – Free State Province.

Age and Gender profile

The working-age population of Mantsopa Local Municipality is the largest portion (62.8%) of the population (Stats SA, 2011).

Education

The level of adult education during the 2011 census survey, indicates than 11.5% of adults within Mantsopa Local Municipality has completed secondary school or attained a higher education qualification, while 4.6% have attended no schooling. The majority of the population has some primary school education (43.3%) (Stats SA, 2011).

Living conditions

There are 15 170 households in Mantsopa Local Municipality. The average household size is 3.4 individuals per household. The majority of households (67%) do not have access to piped water inside the dwelling unit, 32% are without access to flush toilets, and 9% are without access to electricity. The local authority or a private company remove 78.2% of the population refuse on a weekly basis (Stats SA, 2011).

Health Services

Mantsopa Local Municipality has one hospital, in Ladybrand. Eight clinics are located within the municipality, with four being located in Ladybrand. Six mobile base station clinics are spread over the municipal area.

18.1.4 NALEDI LOCAL MUNICIPALITY

Naledi Local Municipality (NLM) is located within the Xhariep District Municipality, sharing its eastern border with the country of Lesotho.

Figure 18-4: Boundary of Naledi Local Municipality – Free State Province.

The population of NLM was estimated to be 24 314 individuals in 2011 (Stats SA, 2011).

Age and gender profile

The age and gender profile appears to have a large portion (32.5%) of the population under 15 years of age. The population is dominated by the working-age, constituting 60.7% of the population (Stats SA, 2011).

Education

The 2011 census survey, indicates that 8.8% of adults has completed secondary school or attained a higher education qualification, while 3.3% of the NLM population have no schooling at all. The majority of the population has some primary school education (47.1%) (Stats SA, 2011).

Living Conditions

There are 7 690 households in the municipality, with an average household size of 3.1 persons per household. The majority of NLM households (93.8%) have access to electricity. Only 31.5% of households have access to piped water that is accessible from within the dwelling.

Only 46% of the population refuse is removed by the local authority or a private company on a weekly basis. The majority of the population uses their own refuse dumps.

Health Services

NLM has one hospital located in the town, Vryburg. There are also two clinics, a mobile clinic and Community Health Centre available to provide health services (Musvoto et al. 2010).

18.1.5 MOKOHARE LOCAL MUNICIPALITY

The Mokohare Local Municipality (MLM), is situated in the Xhariep District.

Figure 18-5: Boundary of Mokohare Local Municipality – Free State Province.

The population of MLM was estimated to be 34 146 people in 2011 (Stats SA, 2011).

Age and gender profile

The population is dominated by the working-age, constituting 61.4% of the population (Stats SA, 2011).

Education

The 2011 census survey, indicates that 7.3% of adults in MLM has completed secondary school or attained a higher education qualification, while 4.3% have no schooling at all. The majority of the population has some primary school education (47.2%) (Stats SA, 2011).

Living Conditions

There are 10 793 households in the municipality, with an average household size of 3.1 persons per household. 37.2% of households have access to piped water either in their dwelling or in the yard. Only 1.2% of households do not have access to piped water. Refuse

is removed by the local authority or a private company at least once a week, for 63% of the households in the NLM population (Stats SA, 2011).

Health Services

MLM has two hospitals located in Zastron and Smithfield respectively. Clinics have daily consulting hours between 7:00 and 15:00 making it less accessible for people who are employed during the day. However, there are mobile clinics that are available for areas that are far from the clinics located in Matlakeng, Mofultsepe and Roleleathunya, farm areas. There is a shortage of staff at clinics, which hampers the extension of operating hours. Doctors are also not available full time at clinics (Mokohare Local Municipality Annual Report 2011/2012).

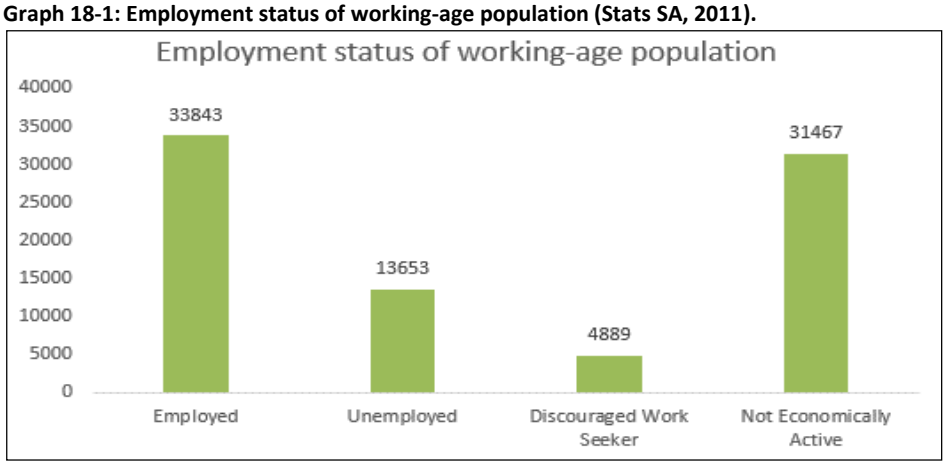
18.2 ECONOMIC POTENTIAL

18.2.1 DIHLABENG LOCAL MUNICIPALITY

Employment and Income status

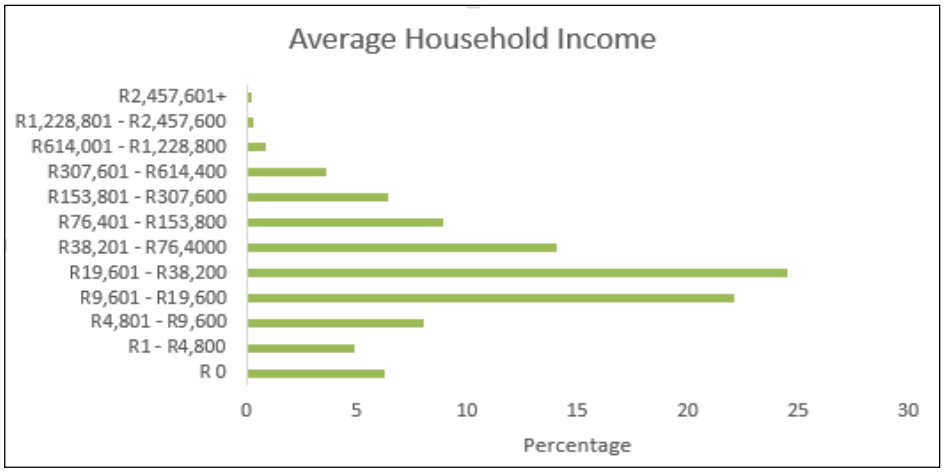
The majority of the working-age population of DLM is employed (67.5%), while the second most of the working-age population is not economically active (31.5%). The graph below illustrates the employment status of the working-age population.

Graph 18-1: Employment status of working-age population (Stats SA, 2011).



The majority of DLM population (60.7%) household income rage is between R9 601 and R76 4000. The graph below illustrates the average household income of the population.

Graph 18-2: Average Household income (Stats SA, 2011).



DLM GDP contribution to the Thabo Mofutsanyana District was the second most (24.0%) of the four municipalities located in the district (Stats SA, 2011).

Main economic activities

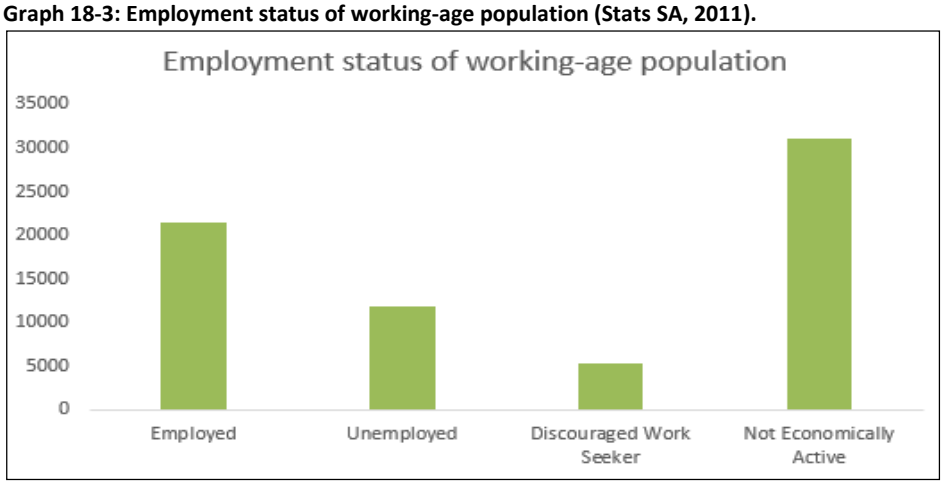
The economic activities within DLM are dominated by farming and private business. The agricultural sector of the DLM region is extremely prominent and the majority of the population is employed in the agricultural sector. As part of Government's Land Reform Programme, emerging farmers are trained and supported to ensure productive farming practices, which ensures economic growth in DLM (Stats SA, 2011).

18.2.2 SETSOTO LOCAL MUNICIPALITY

Employment and Income status

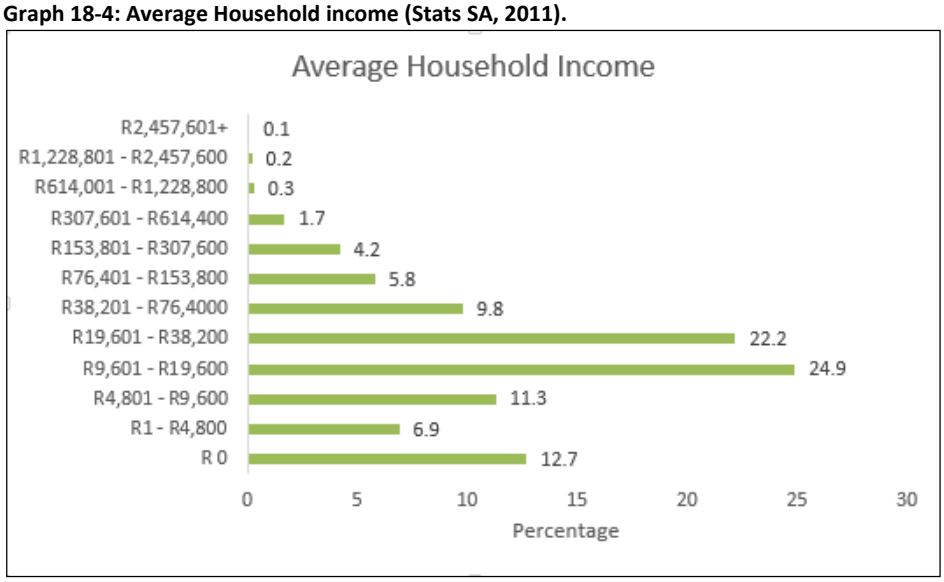
The majority of the working-age population of SLM is not economically active (46.1%). The graph below illustrates the employment status of the working-age population (Stats SA, 2011).

Graph 18-3: Employment status of working-age population (Stats SA, 2011).



The majority of the population (58.4%) household income range is between R4 801 and R38 200. The graph below illustrates the average household income of the population.

Graph 18-4: Average Household income (Stats SA, 2011).



Main economic activities

The main economic activities within SLM are dominated by finance, insurance, real estate and business (21,2%), manufacturing (17,62%), wholesale and retail trade (13,07%), agriculture, hunting, forestry and fishing (11.83%), government services (11.45%), community, social and personal services (11.31%), transport, storage and communication (6.79%), electricity, gas and water (3.5%) and construction (2.17%).

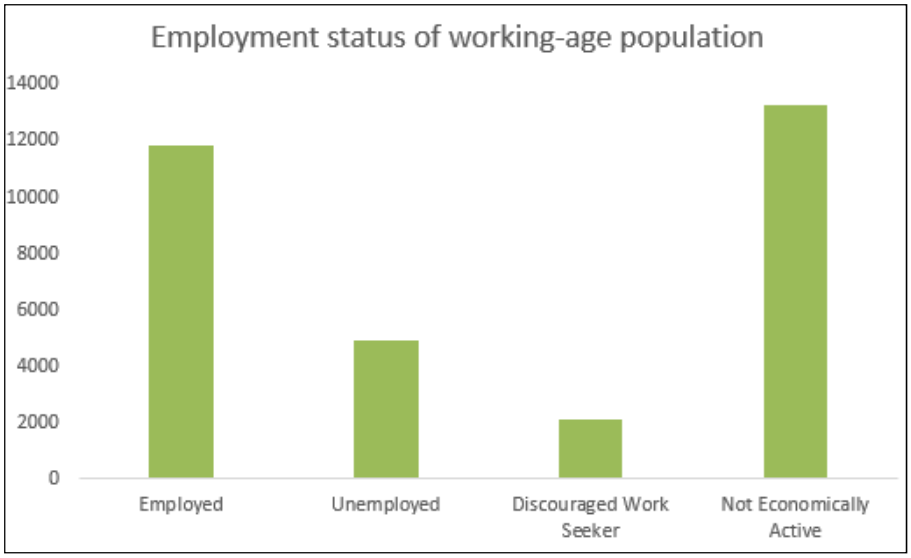
18.2.3 MANTSOPA LOCAL MUNICIPALITY

Employment and Income status

The majority of the working-age population is not economically active (41.3%) whilst the second most of the working-age population is employed (36.9%). The figure below illustrates the employment status of the working-age population.

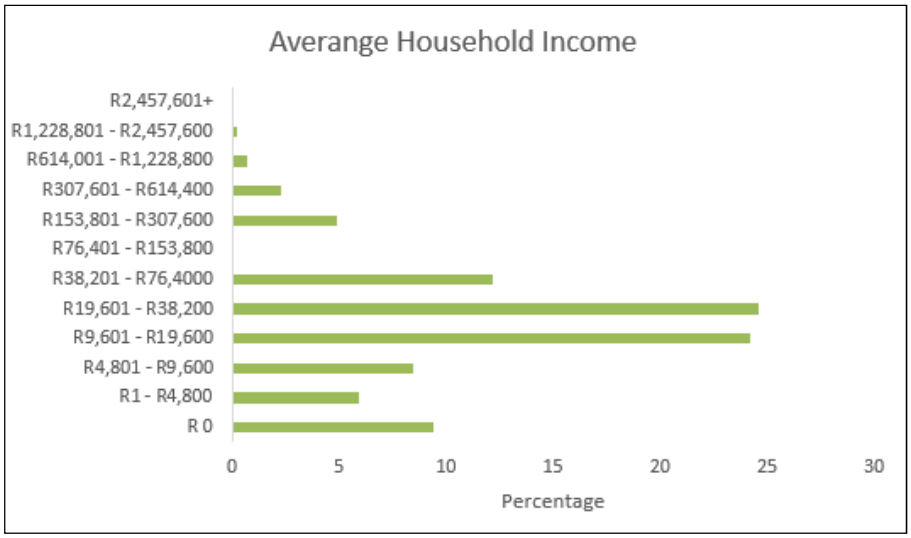
The graph below illustrates the employment status of the working-age population.

Graph 18-5: Employment status of working-age population (Stats SA, 2011).



The majority of the population (58.4%) household income rage is between R 9601 and R76 400. The graph below illustrates the average household income of the population.

Graph 18-6: Average household income (Stats SA, 2011).



Main Economic Activities

The economy of Mantsopa Local Municipality is largely based on the commercial farming sector, which employs many of the community. The private businesses and public sector also employs a number of the community. Tourism also plays an attraction point within the municipality.

18.2.4 NALEDI LOCAL MUNICIPALITY

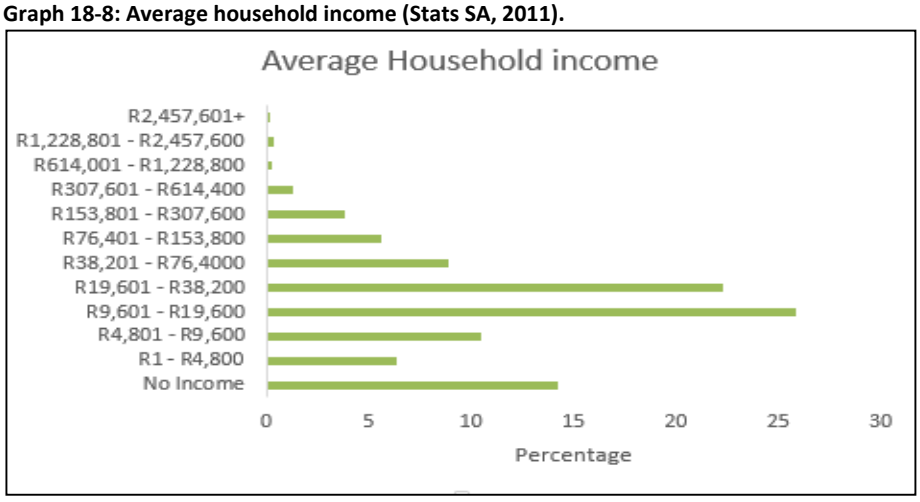
Employment and Income status

The majority of the working-age population is not economically active (44.32%). The second most of the population (32%) is employed. The graph below illustrates the employment status of the population.

Graph 18-7: Employment status of working-age population (Stats SA, 2011).

The majority of the population (58.7%) household income rage is between R4 801 and R38 200. The graph below illustrates the average household income of the population.

Graph 18-8: Average household income (Stats SA, 2011).



Main Economic Activities

The main economic activities within NLM are agriculture and hunting.

18.2.5 MOKOHARE LOCAL MUNICIPALITY

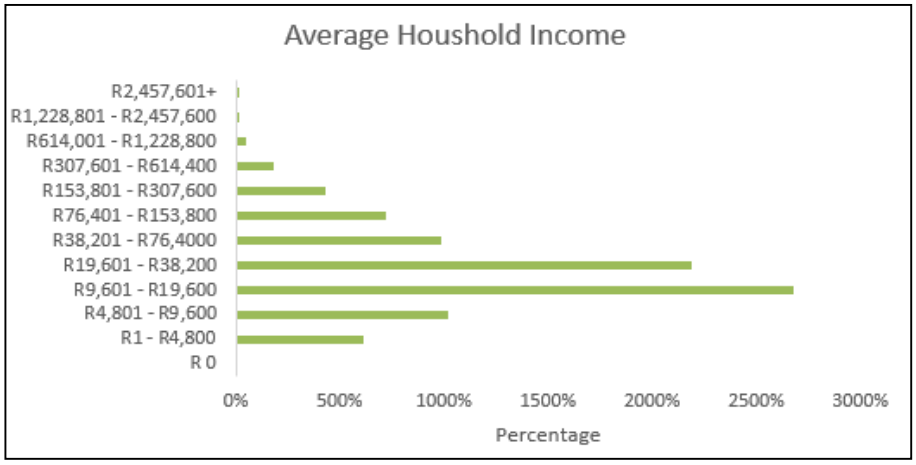
Employment and Income status

The majority of the working-age population is not economically active (39.1%). The second most of the population (36.6%) is employed. The graph below illustrates the employment status of the population.

Graph 18-9: Employment status of working-age population (Stats SA, 2011).

The majority of the population (26.8%) household income rage is between R9,601 and R19,600. The graph below illustrates the average household income of the population.

Graph 18-10: Average household income (Stats SA, 2011).



Main Economic Activities

The main economic activities within MLM are agriculture and tourism.

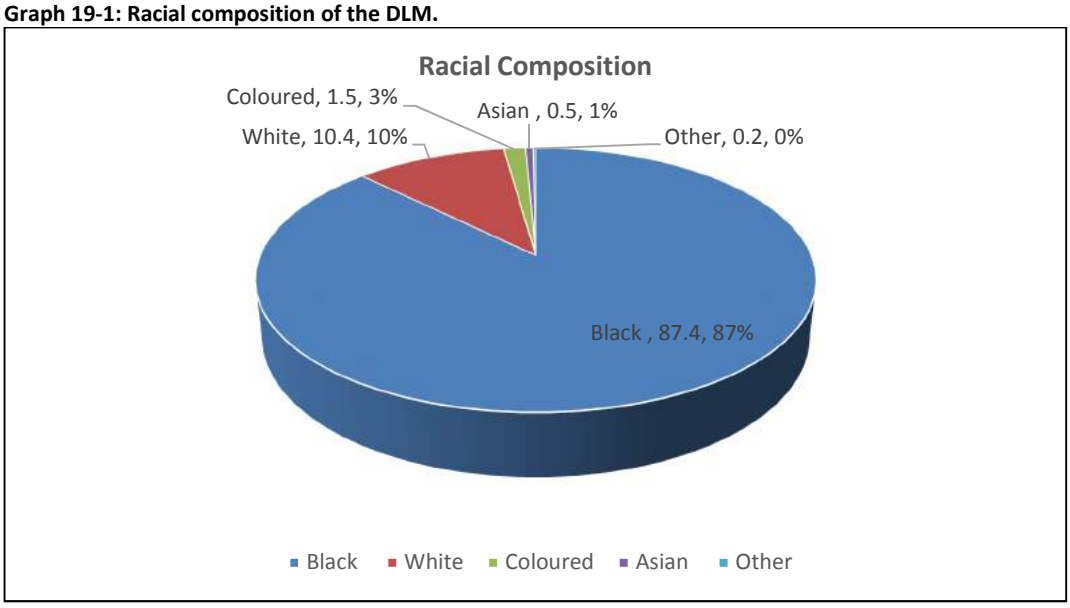
19 SOCIO-CULTURAL BASELINE

19.1 DIHLABENG LOCAL MUNICIPALITY

19.1.1 RACIAL COMPOSITION

The racial composition of DLM is presented in the graph below (Stats SA, 2011).

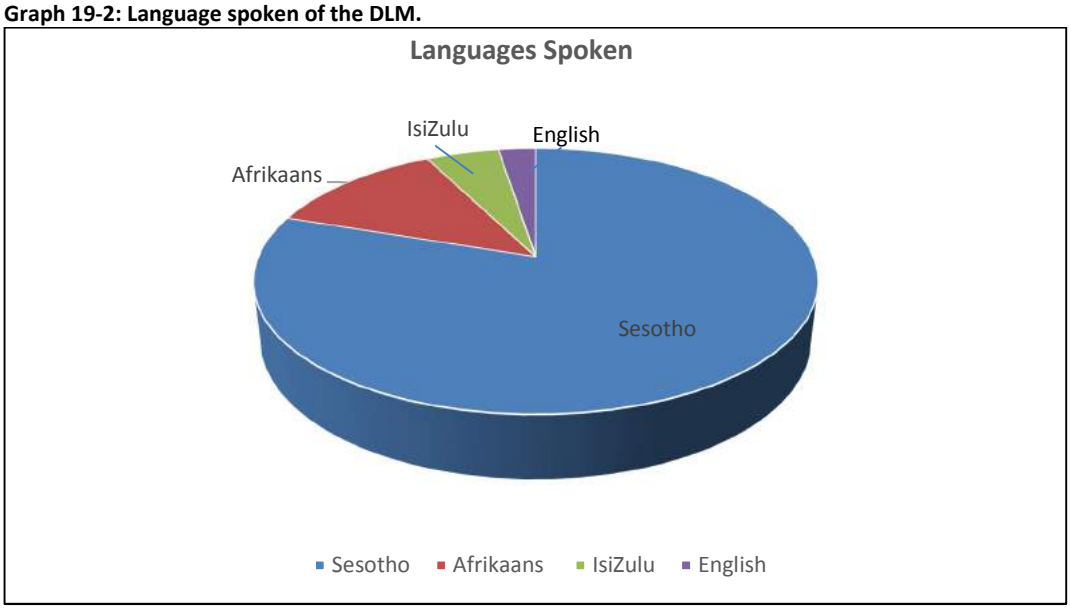
Graph 19-1: Racial composition of the DLM.



19.1.2 LANGUAGE

The languages that are mainly spoken by the DML population are illustrated in the graph below (Stats SA, 2011).

Graph 19-2: Language spoken of the DLM.

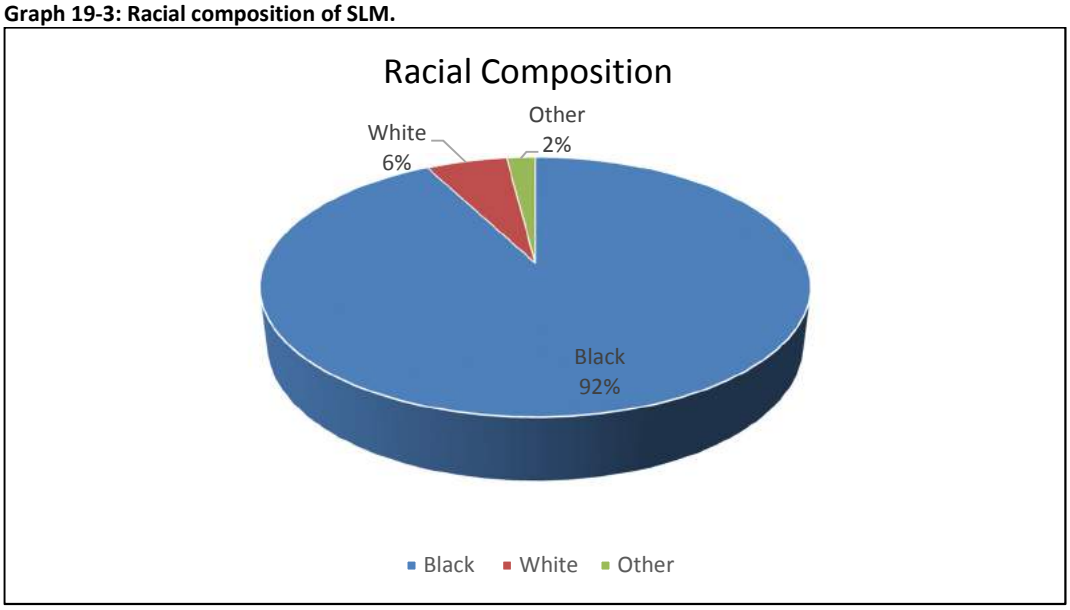


19.2 SETSOTO LOCAL MUNICIPALITY

19.2.1 RACIAL COMPOSITION

The population of the SLM racial composition is illustrated in the graph below (Stats SA, 2011).

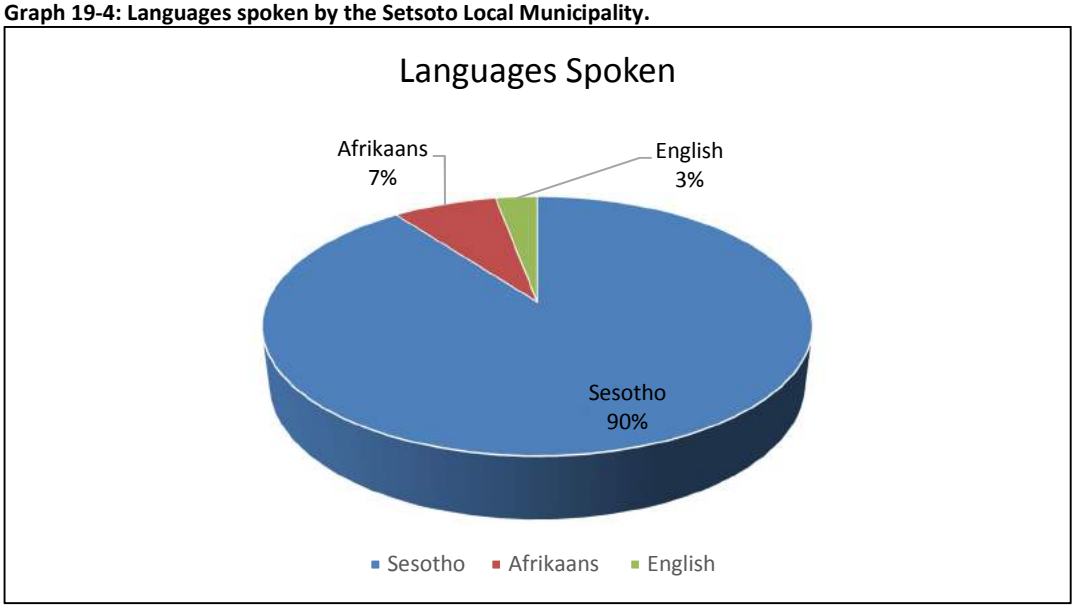
Graph 19-3: Racial composition of SLM.



19.2.2 LANGUAGE

The languages that mainly spoken by the SLM population are presented in the graph below (Stats SA, 2011).

Graph 19-4: Languages spoken by the Setsoto Local Municipality.

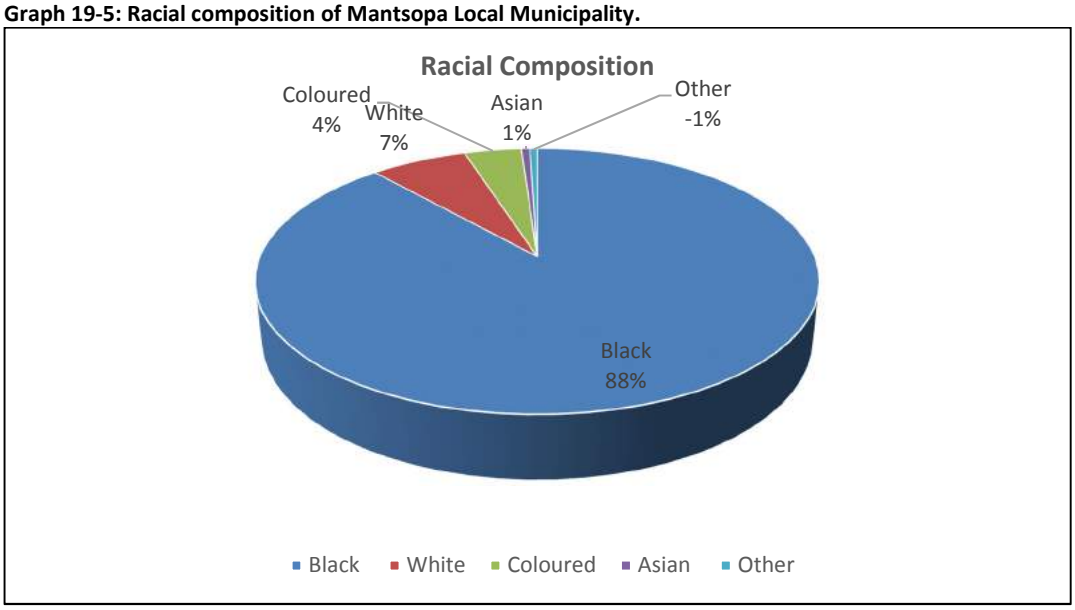


19.3 MANTSOPA LOCAL MUNICIPALITY

19.3.1 RACIAL COMPOSITION

The population of the Mantsopa Local Municipality racial composition is illustrated in the graph below (Stats SA, 2011).

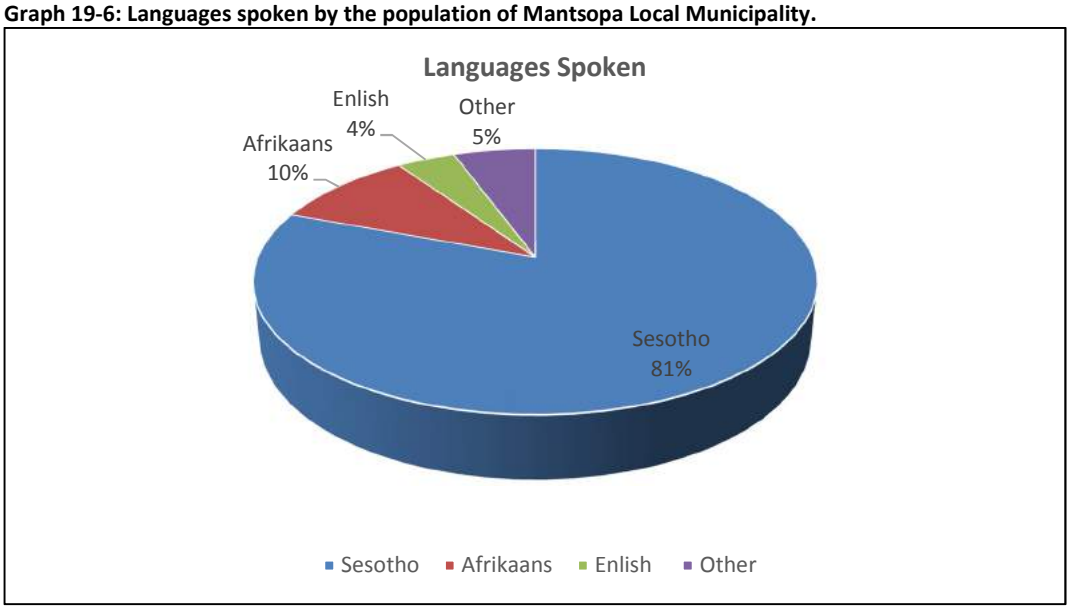
Graph 19-5: Racial composition of Mantsopa Local Municipality.



19.3.2 LANGUAGE

The languages that mainly spoken by the Mantsopa Local Municipality population are presented in the figure below (Stats SA, 2011).

Graph 19-6: Languages spoken by the population of Mantsopa Local Municipality.

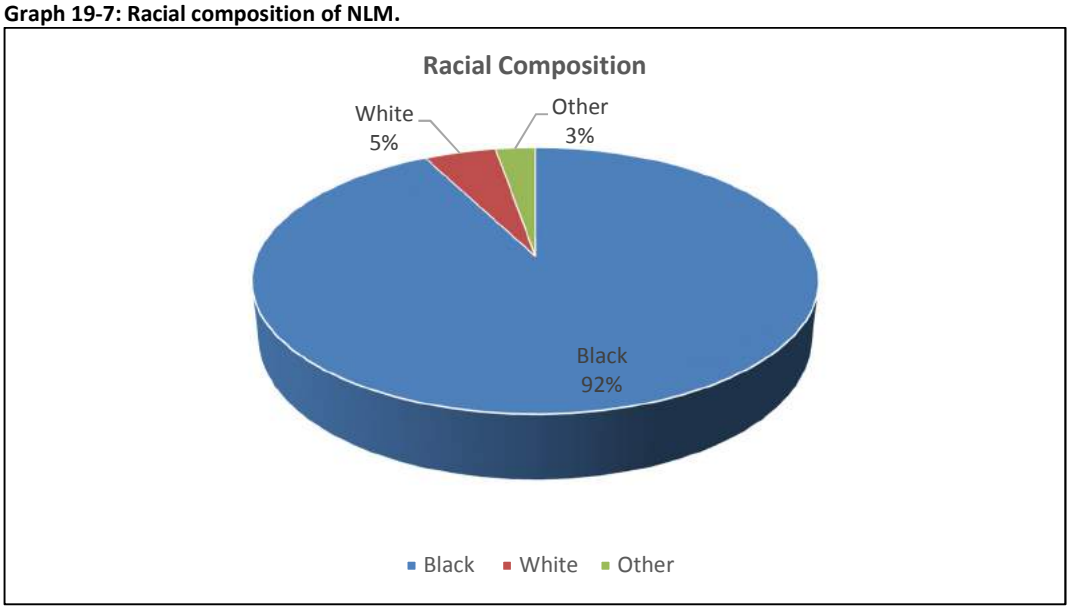


19.4 NALEDI LOCAL MUNICIPALITY

19.4.1 RACIAL COMPOSITION

The population of NLM racial composition is illustrated in the graph below (Stats SA, 2011).

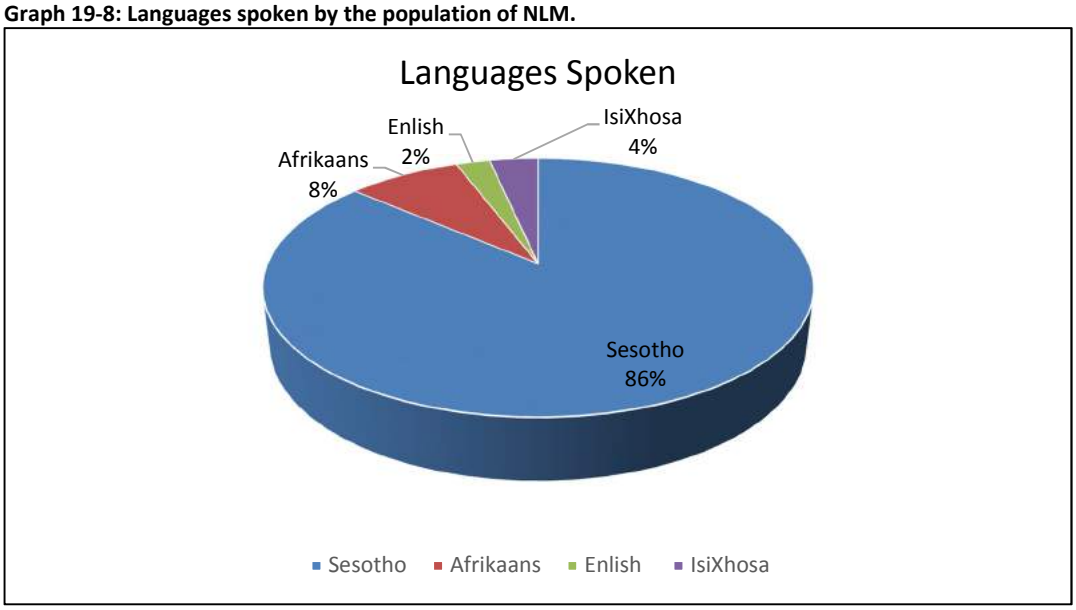
Graph 19-7: Racial composition of NLM.



19.4.2 LANGUAGE

The languages that mainly spoken by the population of NLM is presented in the graph below. (Stats SA, 2011).

Graph 19-8: Languages spoken by the population of NLM.

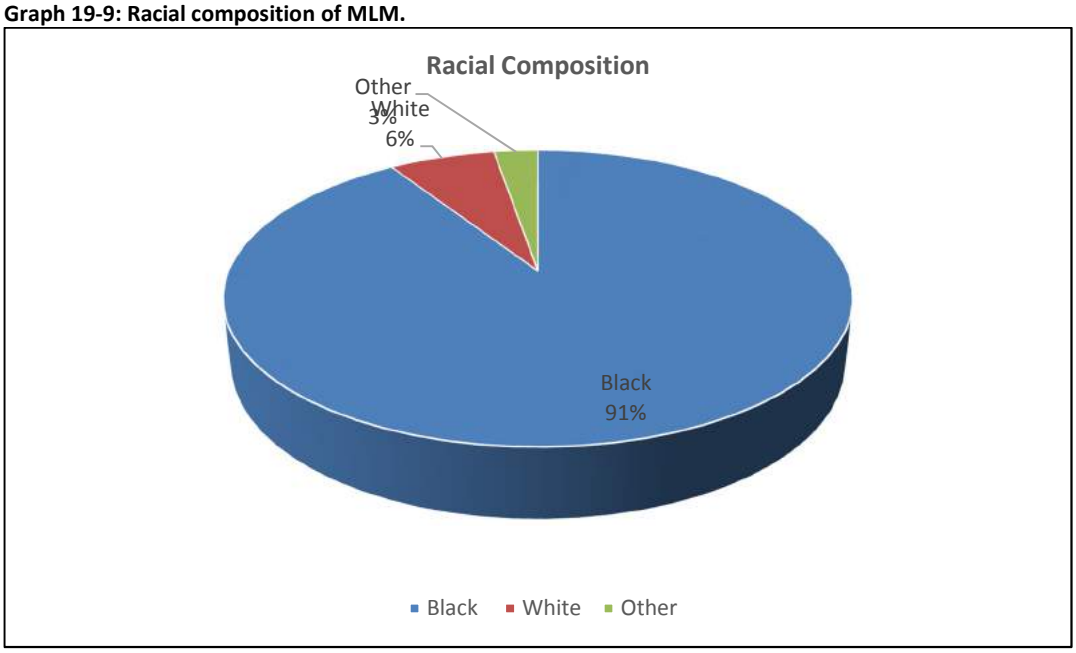


19.5 MOKOHARE LOCAL MUNICIPALITY

19.5.1 RACIAL COMPOSITION

The population of MLM racial composition is illustrated in the graph below (Stats SA, 2011).

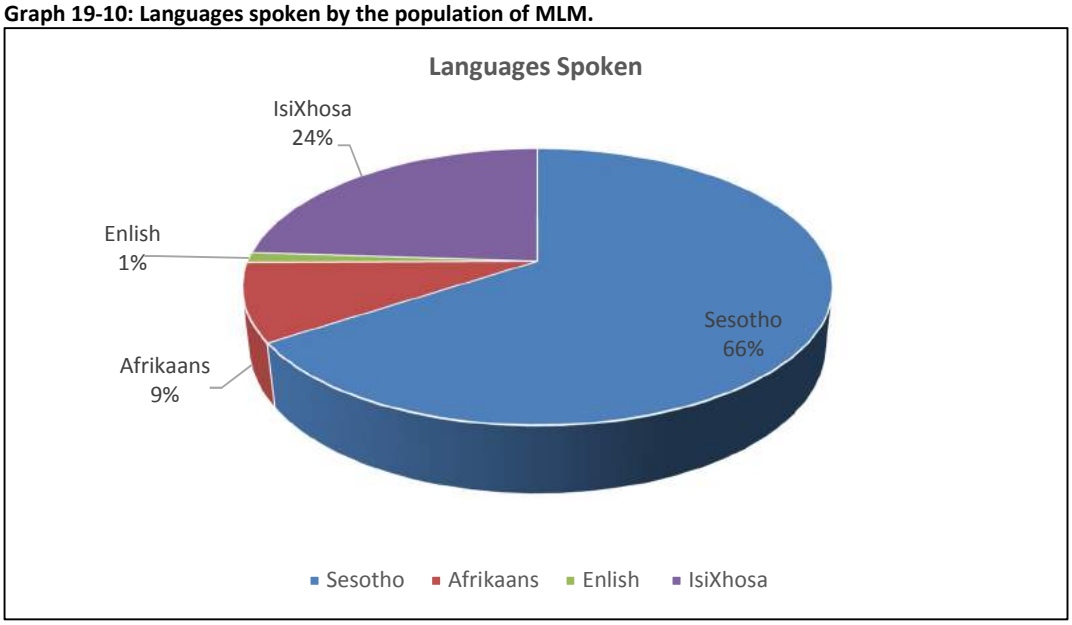
Graph 19-9: Racial composition of MLM.



19.5.2 LANGUAGE

The languages that mainly spoken by the population of MLM is presented in the graph below. (Stats SA, 2011).

Graph 19-10: Languages spoken by the population of MLM.



19.6 SUMMARY OF GENERAL SOCIAL CONSTRAINTS AND OPPORTUNITIES

The constraints and opportunities resulting from social, cultural and economic factors within the different municipalities may influence the positive or negative impacts that may result from the proposed development. These factors should be considered when assessing and evaluating social economic and social cultural impacts.

The paragraphs below, list the key municipal objectives, stated in the Integrated Development Plans (IDP) in terms of social, economic and cultural development pressures.

19.6.1 DIHLABENG LOCAL MUNICIPALITY

- Sustainable use and management of tourism resources.
- The need to create employment opportunities.
- Need to provide basic services such as water, sanitation and electricity.
- Upgrade of roads, for the main purpose of promoting economic growth and tourism.

19.6.2 SETSOTO LOCAL MUNICIPALITY

- Need to provide basic services such as water and sanitation.
- Create sustainable economic growth and alleviate poverty by maximising local agricultural, tourism and industrial opportunities and exploitation of international export markets.

19.6.3 MANTSOPA LOCAL MUNICIPALITY

- Promote job retention and creation of sustainable jobs focused investment in the agricultural sector and promote tourism.
- Create sustainable job opportunities filled with appropriately skilled staff/workforce.
- Promote rural development.
- Promote and attract investment in the MLM.

19.6.4 NALEDI LOCAL MUNICIPALITY

- Provide water, sanitation and electricity to the community.
- Provide roads and upgrades to existing road infrastructure.
- Achieve a safe and healthy environment by regularly collecting refuse.

19.6.5 MOKOHARE LOCAL MUNICIPALITY

- Promote sustainable living environments.
- Promote through health and hygiene awareness the management of waste.
- Promote through the green economy, job creation with the assistance of the Local Economic Development Department of the Municipality.

20 IMPACTS AND RISKS IDENTIFIED

The following sections summarises the foreseen and anticipated impacts and risks identified in the scoping phase and provides initial measures to mitigate negative impacts. The EIA phase will further focus on assessing these impacts, determining their significance, and recommending appropriate measures to mitigate negative impacts and enhance benefits. Where required, this will involve specialist input.

20.1 NEGATIVE IMPACTS ON THE ENVIRONMENT AND ON THE COMMUNITY

20.1.1 WETLAND RESOURCES

Perceived impacts on wetland resources include, but are not limited to, the following:

- Increased runoff entering riparian and wetland resources, transporting with it toxicants and sediment from the road surface;
- Increased risk of erosion and incision of riparian and wetland resources as a result of higher volumes entering the resources due to decreased permeable surface area;
- Increased sedimentation and pollution of the resources as a result of the above and also as a result of disturbances to soils during construction;
- Compaction of wetland and riparian soils due to indiscriminate movement of construction vehicles within wetland/riparian areas;
- Loss of connectivity of riparian and wetland resources as a result of road and fence crossings through wetland/riparian habitat, resulting in altered hydrological patterns and fragmented habitats;
- Altered instream flow patterns and ponding within riparian zones as a result of the placement of piers within rivers;
- Possible alterations to vegetation community composition as a result of alien vegetation proliferation due to disturbances to soil profiles and clearing of indigenous vegetation in the vicinity of wetlands and riparian areas;
- Altered topography due to earthworks associated with construction of the road, resulting in areas of artificial ponding in turn leading to altered habitat; and
- Increased risk of flooding, since the proposed route is located within the 1:100 year floodline of the Caledon River. Regular monitoring of culverts and the fence will be necessary in order to remove blockages and reduce flood risk, and the implementation of Sustainable Drainage Systems (SuDS) will aid considerably in reducing the volume of stormwater entering the Caledon River (and its tributaries) thus further reducing flood risk.

The extent, degree, and nature of impacts on the wetland resources varies widely, depending on their proximity to various anthropogenic activities such as agriculture or urban developments. However, many of the wetland resources, in particular the hillslope seep and depression wetlands are considered to be ecologically intact and have not been significantly impacted upon by anthropogenic activities.

Key mitigation measures to consider during the scoping phase include:

- Consideration of the locality of wetland/riparian resources when planning the final route of the road in order to avoid, as far as feasible, the placement of

infrastructure within these resources. In this regard, the applicable floodlines must also be avoided;

- Where it is not possible to divert the proposed linear development to avoid wetland/riparian resources, consideration must be given to the placement of infrastructure within such resources in order to minimise impacts such as instream flow modifications and bed modifications. In this regard, very careful attention must be paid to the design criteria and bridge design, in order to minimise turbulent flow, upstream ponding, downstream scouring and erosion, and the retention of connectivity of resources and migration corridors;
- Consideration should be given to the use of Sustainable Drainage Systems (SuDS) and suitable attenuation facilities in order to reduce the impacts associated with increased stormwater runoff (including sediment and pollutant transportation) into downgradient wetland/riparian systems;
- The locality of wetland and riparian systems must be considered when finalising the location of the construction camps, new borrow pits and access roads; these must be located a minimum distance of 32m away from any wetland or riparian resource and must not encroach into the 1:100 year floodline;

20.1.2 AQUATIC AND RIPARIAN RESOURCES

Based on current assessment results, the Caledon River can be considered to be a system of high (Upper Reaches) to moderately reduced (Middle and Lower Reaches) Ecological Importance and Sensitivity (EIS).

Several potential risks to the receiving environment by the proposed road construction have been identified which relate to the physical attributes of the riverine resources as well as their hydrological, biological and physic-chemical properties. The following preliminary list of potential impacts has been identified:

- Erosion and incision of stream banks and sedimentation of watercourses;
- Increased surface runoff and the creation of preferential flow paths;
- Increased turbidity, the risk of hydrocarbon spills and general impacts on water quality;
- Changes to the hydrological functioning of the Caledon River, especially under high flow events, due to the road being aligned close to the river banks;
- Changes to the hydrological functioning of the tributaries of the Caledon River due to bridge crossings;
- Impacts on instream and riparian habitat;
- Impacts on instream biota and riparian vegetation; and
- Impacts on the PES and EIS of the river systems.

These impacts will be assessed in detail in the impact assessment phase of the project and as far as possible mitigatory recommendations will be presented in line with the mitigation hierarchy as advocated by the DMR (2013) in order to ensure informed decision making and improved sustainable development in the area.

20.1.3 FAUNAL ECOLOGY

Perceived impacts on these aspects of the faunal ecology include, but are not limited to the following:

- Site clearance and removal of faunal habitat resulting in a decrease of faunal species diversity within the surrounding.

- Blasting within the rocky ridge habitat unit will result in altered faunal habitat and possible loss of small species within the rocky ridges affected.
- Alien plant proliferation in disturbed areas will lead to altered faunal habitat that will lead to a lower carrying capacity.
- Proposed road (site) clearance: Runoff from the proposed linear development construction area, resulting in erosion and sedimentation which will lead to habitat alteration and a decrease in faunal diversity.
- Unsuitable rehabilitation in disturbed areas may lead to habitat changes and further decreasing viable faunal habitat.

Key mitigation measures to consider during the scoping phase include:

- All informal fires should be prohibited.
- No trapping or hunting of fauna is to take place.
- No areas falling outside of the linear development footprint area may be cleared for construction purposes.

20.1.4 TERRESTRIAL ECOSYSTEMS

Perceived impact on these aspects of the ecology include, but are not limited to the following:

- Site clearance and removal of indigenous vegetation leading to endemic species being removed and a further decrease in the vegetation diversity within the surrounding area.
- Blasting within the rocky ridge habitat unit, altering the vegetation structure and habitat.
- Proliferation of alien and invasive weed species in disturbed areas will lead to altered vegetation communities.
- Changes to floral communities due to alien invasive vegetation leading to habitat alteration.
- Proposed road (site) clearance: Runoff from the proposed linear development construction area, resulting in erosion and sedimentation, causing habitat and vegetation changes.
- Excavations: Soil profile disturbance and loss of vegetation habitat. The formation of gullies and the change in drainage patterns could alter habitat units.
- Removal of medicinal important species during the clearing and construction.
- Infective rehabilitation of exposed and impacted areas, resulting in a change in vegetation.

Key mitigation measures to consider during the scoping phase include:

- Ensure that the planning of the proposed linear development does not encroach into sensitive floral habitat areas such as ridges or riparian and wetland habitat. The design of the proposed linear development should be optimised and kept to historically disturbed places.
- All protected species or species of conservational concern should be rescued and relocated to similar habitat areas, should they occur within the development footprint of the proposed linear development.
- Prohibit the collection of plant material, outside of the proposed linear development, for firewood or for medicinal purposes during the construction phase by construction staff.

- Minimise the need for cut and fill to minimise erosion activities.
- Minimise the number of river and wetland crossings.

20.1.5 LAND AND SOIL CAPABILITY

The direct impact of the proposed linear development comprising of 5 m wide dual road over the approximate distance of 520 km, will collectively render 1,976 hectares (ha) of land inaccessible for agricultural use (excluding access roads).

Furthermore, additional potentially arable land may be lost where the proposed linear development dissects through farm portions, most likely to occur in the northern section of the proposed linear development.

Although the majority of the identified soils display moderately low erosion susceptibility under current veld conditions, erosion susceptibility will inevitably increase once the soils are exposed after vegetation has been cleared during the construction phase.

Soil erosion risk is anticipated to be very high particularly for the identified Namib/Dundee soil forms as the observed stratifications on some of these soil forms indicates that these soils are periodically flooded. Furthermore, compacted surfaces of the road and associated infrastructure will inevitably increase runoff volumes during the operational phase, which may exacerbate soil erosion and potentially sedimentation of the Caledon River downstream. This will need to be effectively mitigated through a stormwater management plan specifically designed for this linear development.

20.1.6 AGRICULTURAL POTENTIAL LAND

Perceived impact on agricultural potential land include, but are not limited to the following:

- The development of the proposed route will lead to the loss of agricultural land.
- Although the identified soils display moderately low susceptibility to erosion under current veld conditions, vegetation clearance will increase overland flow and erosion susceptibility once the soils are exposed.
- Heavy equipment traffic during construction activities is anticipated to cause severe soil compaction, which would exacerbate overland flow (runoff) and ultimately sedimentation of the adjacent Caledon River.
- Road access control may lead to socio-cultural impacts such as fragmentation of farms and increased opportunities for trespassers and illegal immigrants to move along the route.

Key recommendations and mitigation measures to consider during the scoping phase include:

- The proposed route from Ficksburg to Ladybrand, falls mainly in *Class 3: Moderate potential arable land*. In terms of the Draft Policy and Bill on the Preservation and Development of Agricultural Land, land which is categorised in classes 1 to 3 is defined as high potential cropping land.
- A further detailed soil, land and agricultural potential study will be undertaken with a detailed impact assessment and mitigation measures recommended for the area. The study should report in detail the following:
- A characterisation and rating of the land capability and agricultural potential within the study area(s);
- Determination of the impacts of the development on the capability and use of the land; and

- Management strategies for the areas of concern.

20.1.7 ALIEN AND INVASIVE PLANTS

Removal of alien and weed species need to comply with the existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998).

It is recommended that a detailed alien species removal plan be developed and considering the following;

- Herbicide use taking cognisance of the proximity to the Caledon River
- Footprint control and vehicle movement control
- Disposal of alien vegetation material.

20.1.8 BORROW PITS

From the initial investigations conducted, the following concerns regarding borrow pits were identified.

- It is expected that material will be sourced from borrow pits for the infilling of depressions along the route of the road. In terms of Activity 21 in Listing Notice 1 (list of activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998, any activity including the operation of that activity which requires a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act [No. 28 of 2002], including associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 [No. 28 of 2002] require environmental authorisation.
- Confirmation on whether the 10 existing borrow pits identified are authorised in terms of if a mining permit granted by the Department of Mineral Resources.
- The existing borrow pits should be further investigated in terms of the potential volume of material available that can be sourced.
- The number of new borrow pits needs to be kept to a minimum. Wherever possible existing facilities must be used and facilities located in more ecologically intact areas must be avoided.
- If required that new borrow pits must be used the following procedures will apply;
    - The mining area (borrow pit) should not exceed 1, 5 hectares in extent;
    - Consideration of sensitive environments and accessibility to the sites;
    - Landowner(s) must be identified and consent obtained;
    - Archaeological or cultural heritage impact assessment might be required;
    - An application for environmental authorisation must be lodged with National DEA for all new sites;
    - An application for a mining permit must be lodged with the Department of Mineral Resources; and
    - Closure and rehabilitation plan to be included in the Environmental Management Programme (EMPr).

20.1.9 CONSTRUCTION

- Contractor laydown areas will need to be well located, planned and managed to minimise the impact on the receiving environment.
- Ablution facilities during construction will be required to minimise impacts on the receiving environment.
- The number of new borrow pits, needs to be kept to a minimum. Wherever possible existing facilities must be used and facilities located in more ecologically intact areas must be avoided.

20.1.10 VISUAL IMPACT

- Dust suppression techniques must be in place within development footprint and along the access roads at all times during the construction.
- Where feasible, vegetation screens (a combination of indigenous trees and shrubs) should be maintained along the boundaries of the proposed development to screen sensitive viewing areas from the development area.
- Light pollution should be kept to a minimum whenever possible as light travels great distances at night.

20.1.11 AIR QUALITY

Construction Phase

Dust pollution will be mainly a result of surface scraping and excavation during the early stages of construction and vehicular transport on access roads and the construction area.

Spoil material and topsoil stockpiles with less specific gravity, are prone to be disturbed and generate dust.

The following will contribute to dust pollution;

- The loading and unloading process, and secondary dust emissions caused by passing vehicles on access roads
- The transportation of construction materials

General road work activities such as material handling, topsoil removal, site clearance and wind erosion will be the main dust generating sources. The volume of excavated material and the rate of excavation are anticipated to be high and it is therefore expected that the dust impact due to the overall development will be high.

Operational Phase

During the operational phase of the propose road, military vehicles will be travelling during patrol activities, where dust pollution is likely to occur, especially within the drier seasons. Methods of dust suppression during the operational phase will be investigated during the EIA phase of the project.

20.1.12 NOISE POLLUTION

Construction Phase

Noise can be expected during construction due to construction machinery operation and transport activities. Construction activities will include; bulldozers, graders, excavators, rollers, and other heavy machinery.

Foundation construction is considered as the highest stage of noise impact. In addition, during the foundation construction, radiated noises may be caused by transport vehicles loaded with building materials. Construction equipment noise can be basically considered as a point source noise.

Road construction noise has a greater impact on the environment which is within 50 m around the construction site, and also causes noticeable noise impacts on areas within 100 m around the construction site.

Operational Phase

During the operational phase, noise is also expected from vehicles patrolling the border road.

20.1.13 VISUAL IMPACT

Visual impacts during the construction phases are not considered significant as the period of activity is of relatively short duration, localized, and easily mitigated at the end of the phase. The fact that disturbed areas, e.g. construction camps are rehabilitated also reduces the impacts of these phases.

The operational phase presents the most significant long term visual impact. This is due primarily to the scale and form of the proposed linear development. It is predicted that negative visual impacts will result from the construction of the road development.

The most sensitive receptors may include:

- Users of all outdoor recreational facilities along the river whose intention or interest may be focused on the landscape;
- Communities where development results in changes in the landscape setting; and
- Occupiers of residential properties with views affected by the development.

The main views will be from the properties that the border road will traverse, local roads, access roads and all roads that leads to the proposed development area.

The visual receptors of high sensitivity close to the proposed development area include:

- Visitors of game farms/lodges on the properties along the route; and
- Occupiers of the properties affected by the development.

The visual receptors of moderate sensitivity close to the proposed development area include:

- People engaged in outdoor sport or recreational activities on the banks of the Caledon River; and
- People travelling through or past neighbouring and link roads.

20.1.14 SOCIAL CULTURAL AND ECONOMIC ASPECTS

The proposed project may have a number of social economic and cultural impacts, but are not limited to the following:

- Impact on the community:
  - Influx of construction workers may lead to a temporary change in the number and composition of the local community, impact on the local economy, health, safety and social well-being of communities.
- Impact on employment and income:
  - Potential conflict between the local communities (long term residents) and temporary newcomers; and
  - The required skills might not be available in the local area, which means that the appropriate skills might have to be 'imported', thereby causing a limited contribution jobs and income opportunities available to local residents.
- Impact on landowners and farmers:
  - Safety and security;
  - Impact on farm operations and land; and
  - Impact on landowners and farmers.

20.1.15 EMPLOYMENT AND INCOME

The proposed project may impact on the following employment and income aspects:

- Conflict between the local communities (long term residents) and newcomers.
- Employment opportunities provided by the proposed development.
- Opportunities and increase in personal income.
- An increase in income in the local economy and GDP.
- Reduction in poverty.
- Development of skills.
- The required skills might not be available in the local area, which means that the appropriate skills might have to be 'imported', thereby causing a reduction in the job and income opportunities available to local residents.

20.1.16 INFRASTRUCTURE AND SERVICES

The proposed project may have the following impacts on infrastructure and services.

- Influx of construction workers will require additional health services.
- The temporary disruption of farm infrastructure, electricity networks and access roads.

20.1.17 CULTURAL HERITAGE RESOURCES

The proposed development will have an impact on cultural and heritage resources that will need to be taken into consideration. The cultural and heritage resource impacts can be summarised as the loss, physical disturbance and damage of significant cultural and heritage resources.

From the initial cultural heritage impact assessment conducted in February 2015, the following recommendations were made:

- It is recommended that all the heritage sites identified to be fenced off with danger tape during construction of the border patrol road and border fence.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible.

- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken.
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.
- If the heritage sites cannot be avoided, the heritage feature (i.e. house and surrounding yard) should be documented (mapped and photographed) in full.

20.1.18 PALAEONTOLOGICAL RESOURCES

Further investigations will need to be undertaken to understand and determine the extent of potential impact of the proposed development on palaeontological resources. From the literature reviewed it can be assumed that the following palaeontological resource impacts are likely;

- Destruction, disturbance or sealing-in of surface or subsurface fossil material during construction activities.
- Loss of palaeontological resources of significant value.

It is required for a Phase 1 Palaeontological and Archaeological Impact Assessment to be undertaken to determine and document the actual extent of fossiliferous outcrops that may be present within the particular node i.e. the road, border fence, roads, borrow pits, laydown areas and construction camps, and the likely impacts that may occur as a result of the proposed development.

In addition to the above, the actual construction of the road will expose several kilometres of very sensitive geological formations which will require a Phase 2 PIA (collection and rescue of fossils during construction) in the plan of works for construction.

20.2 POSITIVE IMPACTS AND NEGATIVE IMPACTS

The following sections summarise the foreseen and anticipated positive impacts of the proposed linear development;

- Temporary employment opportunities provided by the proposed development
- Opportunities and increase in personal income
- An increase in income in the local economy and GDP
- Reduction in poverty
- Development of skills
- Reclamation of abandoned farm lands
- Protection of land from overgrazing
- Improved border protection, safety and security
- Reduction in crime e.g. reduced livestock theft
- Reduction in loss of income
- Improved control of spreading of animal diseases
- Improved control of alien and invasive vegetation within the riparian zone of the Caledon River.

21 PLAN OF STUDY FOR THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIA)

21.1 SCOPE OF EIA

The EIA will investigate the impacts of, and recommend mitigation and enhancement measures for the following project components:

- Proposed road design
- Proposed road and fence reserve
- Finalisation of flood lines
- Bridge crossings and erosion prevention measures
- Upgrading of bridges and existing access roads
- Possible locations for borrow pits
- Possible construction of new access roads
- Fence specifications
- Miscellaneous constructions camps, laydown areas and storage sites.

21.2 PROPOSED APPROACH

The EIA will build on the Scoping report and will focus on assessing the key impacts, determining their significance, and recommending appropriate measures to mitigate negative impacts and enhance benefits. Where required, this will involve specialist input. The contents of the Environmental Impact Report (EIR) will be as prescribed in the EIA Regulations, 2014 (Appendix 3).

21.3 SPECIALIST STUDIES

Some of the key issues identified during the scoping phase will require further investigation by appropriately qualified and experienced specialists. The specialist studies to be undertaken during the EIA phase are detailed below. These studies will be synthesised and integrated into the overall impact assessment (full reports will be included as appendices to the EIR), and recommendations for mitigation will be included in the EMPr. The contents of all specialist reports will include information as prescribed in the EIA Regulations, 2014 (Appendix 6).

21.3.1 ALIEN AND INVASIVE PLANT MANAGEMENT PLAN

The Alien and Invasive Plant (AIP) Management Plan aims to address current impacts associated with the operation of the proposed development as well as anticipated impacts that the development is likely to have on the Caledon River. Therefore, certain objectives should be developed to guide the development of the AIPMP. The objectives of the AIPMP are to:

- Identification of AIP within the project footprint;
- Meet the requirements of relevant local and regional authorities;
- Stabilisation of banks to prevent further degradation of the wetland and riparian areas;
- Ensure that erosion is not promoted in the project footprint throughout the construction and operational phase;

- Storm water control methods must be implemented to slow water velocity and prevent further incisions into slopes; and
- Controlling AIP in a phased manner as to not encourage further erosion but also to eradicate all alien vegetation along the wetland area that falls within the proposed road upgrade footprint.

21.3.2 FLORAL IMPACT ASSESSMENT

- Vegetation surveys for each habitat unit will be discussed in further details, identifying and analysing the floral species composition. Species identified during the site assessment will be listed and compared to the vegetation expected to be found in the seven vegetation types.
- To conduct a Species of Conservation Concern and Protected Species Assessment, including potential for species to occur within the proposed linear development and immediate surroundings.
- To define the Ecological Importance and Sensitivity (EIS) of the botanical resources on the vicinity of the proposed linear development.
- An impact assessment, using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client, will be carried out in order to enable the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts and for all involved to understand the process and rationale upon which risks/impacts have been assessed.

21.3.3 FAUNAL IMPACT ASSESSMENT

An impact assessment, using a using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client, will be carried out in order to enable the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts and for all involved to understand the process and rationale upon which risks/impacts have been assessed.

21.3.4 WETLAND IMPACT ASSESSMENT

- Wetland ecological and socio-cultural service provision will be assessed using the method described by Kotze *et al.* 2009;
- Wetland Present Ecological State (PES) will be determined using the Wet-Health (MacFarlane *et al.*, 2008) or Index of Habitat Integrity (IHI) (DWAF, 2007) as applicable to the wetland type;
- Ecological Importance and Sensitivity (EIS) determination as adapted from the method as provided by DWA (1999) for floodplains will be carried out;
- A suitable Recommended Ecological Category (REC) will be recommended once results for all assessments have been obtained;
- An impact assessment, using a using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client, will be carried out in order to enable the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts and for all involved to understand the process and rationale upon which risks/impacts have been assessed.

21.3.5 AQUATIC IMPACT ASSESSMENT

An impact assessment, using a using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client, will be carried out in order to enable the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts and for all involved to understand the process and rationale upon which risks/impacts have been assessed.

21.3.6 LAND AND SOIL CAPABILITY IMPACT ASSESSMENT

The agricultural potential of identified soil types in terms of land capability, as well as potential impacts of the proposed linear development will be evaluated in detail during the EIA phase. In addition, individual impacts of the associated upgrade and/or construction of new access roads will be assessed during the EIA phase once the respective locations have been finalised.

21.3.7 PALAEONTOLOGICAL IMPACT ASSESSMENT

This study aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

21.3.8 CULTURAL HERITAGE IMPACT ASSESSMENT

An impact assessment, using a using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client, will be carried out in order to enable the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts and for all involved to understand the process and rationale upon which risks/impacts have been assessed.

21.3.9 GEOTECHNICAL IMPACT ASSESSMENT

From the initial investigations conducted the following key geotechnical concerns will be identified:

- Availability of suitable natural materials for construction of the proposed road.
- Evaluation of the stability of natural slopes and erosion protection measures required.
- The stability of cut and fill sections must be considered.
- The geotechnical investigation must consider the road related infrastructure, such as culverts and bridges required for the project.

21.3.10 HYDROLOGICAL ASPECTS

The project and specialist team shall consider the current hydrological patterns and connectivity of riparian and wetland resources within or at areas/sections where the proposed road and fence are to traverse t wetland/riparian habitats. These considerations will be incorporated in all facility designs to mitigate the potential altering of hydrological regimes and to avoid creating fragmented habitats.

21.4 IMPACT ASSESSMENT METHODOLOGY

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts are assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[4]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the **Table 21-1** and **Table 21-2**. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact.

[4] The definition has been aligned with that used in the ISO 14001 Standard.

LIKELIHOOD DESCRIPTORS

Table 21-1: Criteria for assessing likelihood of the impact occurring

Probability of impact	**RATING**
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**RATING**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Table 21-2: Criteria for assessing consequence of the impact occurring

Severity of impact	**RATING**
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**RATING**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and

consequence of the impact are then read off a significance rating matrix (see **Table 21-3** and **Table 21-4**) and are used to determine whether mitigation is necessary[5].

Table 21-3: Significance rating matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)														
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 21-4: Positive/Negative Mitigation Ratings

Significance Rating	Value	Negative Impact management recommendation	Positive Impact management recommendation
Very High	**126 - 150**	Consider the viability of the project. Very strict measures to be implemented to mitigate impacts according to the impact mitigation hierarchy if the project is to proceed.	Actively promote the project
High	**101 - 125**	Consider alternatives in terms of project execution and location. Ensure designs take environmental sensitivities into account and Ensure management and housekeeping is maintained and attention to impact minimisation is paid according to the impact mitigation hierarchy.	Promote the project and monitor ecological performance
Medium High	**76 – 100**	Consider alternatives in terms of project execution and Ensure management and housekeeping is maintained and attention to impact minimisation is paid according to the impact mitigation hierarchy.	Implement measures to enhance the ecologically positive aspects of the project while managing any negative impacts
Medium Low	**51 - 75**	Ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Implement measures to enhance the ecologically positive aspects of the project while actively managing any negative impacts

[5] Some risks/impacts that have low significance will however still require mitigation

Significance Rating	Value	Negative Impact management recommendation	Positive Impact management recommendation
Low	**26 - 50**	Promote the project and ensure management and housekeeping is maintained.	Monitor ecological performance and pay extensive attention to minimising potential negative environmental impacts
Low Very	**1 - 25**	Promote the project.	Actively seek measures to implement impact minimisation according to the impact mitigation hierarchy and identify positive ecological aspects to be promoted

The assessment of significance is undertaken twice. Initially, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts is then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes will be adjusted.

The following points are considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
- Primary project site and related facilities that the client and its contractors develops or controls;
- Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
- Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
- Pre-construction
- Construction and;
- Operation.
- Latent impacts will be assessed;
- Cumulative impacts on the local resources will be considered;
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.

- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

An impact assessment following the above methodology will be undertaken where the anticipated impacts on the ecological environment arising from the project will be assessed. The significance of each impact will be determined for each phase of the project life cycle. Following the assessment of impacts, mitigatory measures will be developed which will aim to lessen or negate the significance of the identified impacts. Possible impacts which have been conceptually identified are listed below:

- Encroachment of infrastructure or construction or operational waste materials into sensitive areas could occur and would affect the habitat integrity of these areas.
- Ineffective rehabilitation of riparian habitat areas could cause siltation and changes in the hydrological functioning of these areas.
- Vehicles may impact upon sensitive areas during construction, operation and rehabilitation, resulting in a loss of habitat.
- Ineffective removal of alien invader species and exposed areas could lead to re-establishment of invasive species, impacting on floral community rehabilitation efforts.
- Ineffective rehabilitation and monitoring of disturbed areas could lead to loss of species diversity.

Please note that the above list is not exhaustive, and during the detailed impact assessment phase additional impacts may be identified.

21.5 DEVELOPMENT OF SUITABLE MEASURES TO AVOID, REVERSE, MITIGATE OR MANAGE IDENTIFIED IMPACT

The following points present the key concepts considered in the development of mitigation measures for the construction and operation of the proposed linear development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[6] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
- Avoidance or prevention of impact;
- Minimisation of impact;
- Rehabilitation; and
- Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.

Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

21.6 ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

Based on the findings of the Environmental Impact Report (EIR), a practical and feasible Environmental Management Programme (EMPr) will be compiled. The draft EMPr will

[6] Mitigation measures should address both positive and negative impacts

outline how negative environmental impacts will be managed and minimized, and how positive impacts will be maximised, during and after construction. The EMPr will fulfil the GN 982 requirements and will include mitigation measures required during the planning, construction and operational phases of the project as well as a framework for social and environmental monitoring. Recommendations will be given with regard to the responsible parties for the implementation of the EMPr.

21.7 STAKEHOLDER ENGAGEMENT PROCESS

Public participation in an Environmental Impact Assessment (EIA) plays a critical role in integrating economic, social and environmental objectives. It assists in moving towards more sustainable development through strengthening and increasing public awareness of the economic and environmental trade-offs, minimizing or avoiding public controversy, confrontation and delay, and assists with obtaining traditional and local information about the project and the project area.

The requirements of the NEMA EIA Regulations (2014) for the Public Participation Process (PPP) will be adhered to. Delta BEC will provide feedback to stakeholders throughout the process. I&APs and the public will be informed of the availability of the draft EIA report (through written notification to registered Interested and Affected Parties), as well as of the authorities' decision and the appeal process in respect of the various applications (through newspaper advertisement and written notification to all registered stakeholders).

The draft reports will be distributed and made available for a 30 days (calendar days) for public comment. Draft and final reports will be made available for download on the Delta BEC website. Should any draft reports be required to be presented at stakeholder meetings where I&APs will be able to confirm if their issues have been captured correctly and properly understood by the environmental team, the requirement thereof will be confirmed an arranged (if applicable) .

All issues and comments received from the stakeholder consultation process are captured in the Comments and Responses Register (**Appendix D**) and will be expanded on in the EIA Report.

21.8 AUTHORITY CONSULTATION

The relevant authorities will be kept up to date with progress on the EIA through the Authorities Forum.

22 PROJECT CONCLUSION AND WAY FORWARD

The proposed road is mostly located on the existing alignment (the route of the old military patrol road). The main areas of concern expressed by many farmers is the requested that the road alignment be moved away from the farms towards the river. In addition, several sections of the proposed road are affected by severe mountainous areas, steep slopes, and embankments. The above matters will require detailed surveys and research to enable finalising/determining of the most feasible and cost effective route alignment – as well as the optimal engineering solution to ensure constructability and long term road sustainability.

Based on the assessments to date the proposed methods of further investigation are deemed adequate to ensure that an Environmental Impact Report (EIR) can be produced which provides sufficient information on the conditions prevalent the receiving environment, design considerations and impact analyses to ensure that informed decision making can take place by the relevant authorities.

23 DECLARATION OF THE EAP

DECLARATION OF THE EAP

I, Roelien du Plessis declare that –

General declaration:

- I act as the independent environmental practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the Regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence in terms of regulation 48 of the Regulations and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;
- I have a vested interest in the proposed activity proceeding, such vested interest being:

R du Plessis

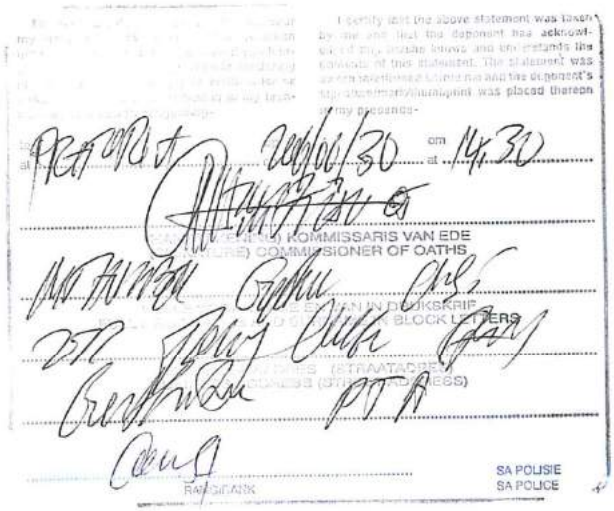
Signature of the environmental assessment practitioner:

Life4all

Name of company:

30/6/2016

Date:



24 REFERENCES

Cole, D.I., Neveling, J., Hattingh, J., Chevallier, L.P., Reddering, J.S.V. and Bender, P.A. 2004. Geology of the Middelburg Area. Council for Geoscience, South Africa, Explanation Sheet 3124, 1:250 000. Pp 1-43

Department of Water Affairs, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999* [Appendix W3]

Department of Water Affairs and Forestry. 2003. The management of complex waste water discharges, introducing a new approach – Toxicity-based Ecological Hazard Assessment (TEHA). Discussion document, third draft.

Department of Water Affairs and Forestry (2004) National water resource strategy, Appendix D

Department of Water Affairs (DWA). 2005. "A practical field procedure for identification and delineation of wetlands and riparian areas

Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES, EI and ES database for desktop assessment.
https://www.dwaf.gov.za/iwqs/rhp/eco/peseismodel.aspx

Dihlabeng Local Municipality.2011. Stats South Africa

Fourie, H. September 2015. Palaeontological Assessment: Phase 1 for the Proposed Lesotho Border Road, Free State Province

Kent, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei and Venda. SACS, Council for Geosciences, *Stratigraphy of South Africa. 1980. South African Committee for Stratigraphy.* Handbook 8, Part 1, pp 690

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2008. *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.* WRC Report No. TT 339/09. Water Research Commission, Pretoria

Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2008. *WET-Health: A technique for rapidly assessing wetland health.* WRC Report No. TT 340/08. Water Research Commission, Pretoria

Mantsopa Local Municipality.2011. Stats South Africa

Mokohare Local Municipality.2011. Stats South Africa

Mokohare Local Municipality Annual Report. 2011/2012

Musvoto, C., Trotter, D. CSIR: Natural Resources and the Environment. 2010. Environmental Management Framework (EMF) for the Dihlabeng Local Municipality

Naledi Local Municipality.2011. Stats South Africa

National Environmental Management Act (NEMA) 107 of 1998

National Water Act 36 of 1998.

Norman, N. and Whitfield, G., 2006. *Geological Journeys.* De Beers, Struik, Pp 1-320

Ollis, DJ; Snaddon, CD; Job, NM & Mbona, N. 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria

Republic of South Africa, 2003. Upper Orange Water Management Area, *Overview of Water Resources Availability and Utilisation*. Department of Water Affairs and Forestry, South Africa, Pretoria

Scientific Aquatic Services. September 2015. Aquatic Assessment for the Proposed Lesotho Border Road, Free State Province: Scoping Report

Scientific Aquatic Services. September 2015. Land and Soil Assessment for the Proposed Lesotho Border Road, Free State Province: Scoping Report

Scientific Aquatic Services. September 2015. Wetland Assessment for the Proposed Lesotho Border Road, Free State Province: Scoping Report

Scientific Aquatic Services. September 2015. Floral Assessment for the Proposed Lesotho Border Road, Free State Province: Scoping Report

Scientific Aquatic Services. September 2015. Fauna Assessment for the Proposed Lesotho Border Road, Free State Province: Scoping Report

Setsoto Local Municipality.2011. Stats South Africa

Setsoto Local Municipality Draft Integrated Development Plan. 2014/2015

Snyman, C. P., 1996. *Geologie vir Suid-Afrika*. Departement Geologie, Universiteit van Pretoria, Pretoria, Volume 1, Pp. 513

South African Heritage Authority. SAHRIS Fossil Sensitivity Database

South African National Biodiversity Institute: BGIS: www.bgis.sanbi.org

van Schalkwyk, J. February 2015. Cultural Heritage Assessment for the Proposed Lesotho Border Road, Free State Province. Delta Built Environment Consultants (Pty) Ltd

Visser, D.J.L. (ed) 1989. *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland*. South African Committee for Stratigraphy. Council for Geoscience, Pretoria

25 GLOSSARY OF TERMS

Glossary of terms

Biodiversity: The diversity of genes, species, ecosystems and landscapes on Earth, and the ecological and evolutionary processes that maintain this diversity.

Bioregional plan (published in terms of the Biodiversity Act): A map of biodiversity priority areas (Critical Biodiversity Areas and Ecological Support Areas), for a municipality or group of municipalities, accompanied by contextual information, land- and resource-use guidelines and supporting GIS information. The map must be produced using the principles and methods of systematic biodiversity planning. A bioregional plan represents the biodiversity sector's input to planning and decision-making in a range of other sectors. The development of a bioregional plan is usually led by the relevant provincial conservation authority or provincial environmental affairs department. A bioregional plan that has not yet been published in the Government Gazette in terms of the Biodiversity Act is referred to as a biodiversity sector plan**.**

Borrow Pit: A land use involving the excavation or digging of material for use as fill at another site and incudes the pit area, stockpiles, haul roads, entrance roads, scales, crusher, and all related facilities.

Catchment: The area (a geographical region) where water from rain (or snow) becomes concentrated and drains downhill into a river or lake. The term includes all land surface, streams, rivers, and lakes between the source and where the water enters the ocean.

Condition: The ecological health or integrity of an ecosystem, assessed using categories that describe the degree of modification from natural condition. For NFEPA, condition was assessed using all available data, including present ecological state data (Kleynhans, 2000), River Health Programme data, reserve determination data and modelling of land cover where no other data existed, as well as expert knowledge. (Also see 'ecological category')

Conservation: An inclusive approach which balances utilisation and sustainable development across the entire landscape through appropriate land-use management. Conservation goals can be achieved not only through formal protection but also through a range of other management approaches and tools outside the network of formal protected areas.

Critical Biodiversity Areas: Those areas required to meet quantitative targets for biodiversity, as determined by an integrated terrestrial and aquatic systematic biodiversity plan. These areas are critical for conserving biodiversity and maintaining ecosystem functioning in the long term. These areas differ from FEPAs in that they are usually determined at a finer, sub-national scale and integrate terrestrial and aquatic priority areas.

Ecological category: A simplified measure of the extent that an ecosystem has been altered from natural condition due to human impact. There are six ecological categories (Table 1)) ranging from A (natural) to F (critically/extremely modified), derived using expert assessment of specific criteria. Also referred to as Present Ecological State or EcoStatus. (Also see 'condition').

Ecological processes: The processes that operate to maintain and generate biodiversity and ensure the continued functioning of ecosystems. Ecosystems function because they are maintained by ecological processes such as nutrient cycling, natural disturbance regimes (e.g. flow regime), groundwater recharge, filtering of pollutants and migration of species.

Systematic biodiversity plans seek to map and set targets for spatial components of these ecological processes, such as large-scale landscape corridors, groundwater recharge areas or the buffer of natural vegetation area around a wetland or river. Ecological processes often form the foundation of ecosystem service delivery for people.

Ecological Support Areas: Those areas that play a significant role in supporting ecological functioning of Critical Biodiversity Areas and/or delivering ecosystem services, as determined in a systematic biodiversity plan.

Ecosystem: Refers to the assemblage of living organisms, the interactions between them and with their physical environment. Every ecosystem is characterised by its composition (living and non-living components of which it consists), the structure (how the components are organised in space and time) and the ecological processes (functions such as nutrient cycling) that maintain the structure and composition and so maintain the ecosystem as a functioning unit. Ecosystems can operate at different scales – from very small (a pond) to whole landscapes (an entire Water Management Area).

Ecosystem services: The benefits that people obtain from ecosystems, including provisioning services (such as food, water, reeds), regulating services (such as flood control), cultural services (such as recreational fishing), and supporting services (such as nutrient cycling, carbon storage) that maintain the conditions for life on Earth.

Fatal flaw: An environmental or social negative impact that is not possible to mitigate and significant enough to prevent the scheme from being able to be implemented.

Freshwater ecosystems: All inland water bodies whether fresh or saline, including rivers, lakes, wetlands, sub-surface waters and estuaries.

Free-Flowing Rivers: Rivers that flow undisturbed (rivers without dams) from their source to the confluence with a larger river or to the sea. Dams prevent water from flowing down a river and disrupt ecological functioning, with serious knock-on effects for downstream river reaches and users. Free-flowing rivers are a rare feature in the South African landscape and part of our natural heritage.

Fish sanctuaries: Rivers that are essential for protecting threatened and near-threatened freshwater fish that are indigenous to South Africa.

General Authorisations: Various forms of water use may be 'generally authorised' for particular areas or catchments, and under specified conditions, by means of a general notice in the Gazette. These are larger volumes of water than those of Schedule 1 of the Water Act, with some potential for negative impacts on the water resource. This exempts such users from having to apply for a licence for that use, but they are required to register the use, and pay for that registration.

Freshwater Ecological Priority Areas (FEPAs): FEPAs are often tributaries and wetlands that support hard-working large rivers, and are an essential part of an equitable and sustainable water resource strategy. FEPAs need to stay in a good condition to manage and conserve freshwater ecosystems, and to protect water resources for human use.

'**Local open space nodes**' means open space areas that have a distinct character that are meant primarily for the use or enjoyment of specific communities.

'**Metropolitan open space nodes**' means open space areas that have a distinct character that are meant for the use or enjoyment of all persons in the metropolitan area and even beyond.

'**Mining belt open space**' means undeveloped land on undermined areas that can be used for open space purposes.

'**Other/neighbourhood natural open spaces**' means natural areas that should remain as open spaces, but does not constitute nodes or corridors, that should be incorporated in the planning and development of neighbourhoods.

Protection: A term generally used for formal protection recognised in terms of the Protected Areas Act, and implies the establishment of a protected area managed mainly for biodiversity conservation purposes.

Phase 2 Freshwater Ecosystem Priority Areas (Phase 2 FEPA): Identified as moderately modified rivers (C ecological category). The river condition of Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed.

Protected areas: Areas of land or sea that are formally protected by law (i.e. recognised in terms of the Protected Areas Act) and managed mainly for biodiversity conservation.

Quaternary catchment: South Africa has a system of catchment delineations used extensively in water resource assessment, planning and management. These catchments are nested hydrological units from the primary drainage basin, through to secondary and tertiary catchments, with the smallest operational unit being the quaternary catchment (Midgley et al., 1994).

Rehabilitation/restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed, which involves the repair of the natural environment to a state close to its original state. For example, this can be achieved through the removal of invasive alien plants, or the repair of eroded sites and the replanting of indigenous plants. Restoration involves not only the rehabilitation of ecosystem processes, productivity and services, but also the reestablishment of species composition and community structure.

The **Red List Plant Species** Guidelines refers to a list of species of special concern in Gauteng that have been ranked according to: i) those unique to a given area, ii) distribution size and iii) threat from urbanisation. Those endemic (unique) to the province of Gauteng are afforded the utmost protection, as they occur nowhere else in the world.

River ecosystem types: River reaches with similar physical features, comprising unique combinations of landscape features, flow variability and channel slope. Rivers with the same ecosystem type are expected to share similar biological responses under natural conditions. For NFEPA, river ecosystem types were used to represent natural examples of the diversity of river ecosystems across the country. They were mapped using unique combinations of Level 1 eco-regions (Kleynhans et al., 2005), slope categories (Rowntree and Wadeson, 1999) and permanence of flow (DLA, 2005-2007).

Riparian areas or habitat: The area that is directly influenced by the river. Includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Sub-quaternary catchment: These are sub-catchments that are broadly nested in the quaternary catchments used by DWA (Midgley et al., 1994). The watershed is delineated around each river reach, where a river reach is defined as the portion of river between the confluences on the 1:500 000 river network GIS layer. (Also see 'quaternary catchment').

Water Management Area: South Africa has 19 Water Management Areas used as administrative and management units for implementing water policy and legislation. Catchment Management Agencies are in the process of being established for Water Management Areas or groups of Water Management Areas. Water Management Areas are delineated using catchment boundaries and do not match provincial or municipal boundaries.

Wetland: an area of marsh, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed ten meters [adaptation of Ramsar definition, which is far broader than the definition of a wetland according to the National Water Act].

26 APPENDIXES

APPENDIX A: CURRICULUM VITAE OF EAP

APPENDIX B: 21 DIGIT SURVEYOR GENERAL CODES

APPENDIX C: BORROW PIT INVESTIGATION REPORT

APPENDIX D: PUBLIC PARTICIPATION MATERIAL

Appendix D1: Proof of notice boards
Appendix D2: Written notice to i&aps
Appendix D3: Newspaper adverticements
Appendix D4: Public participation information open days
Appendix D5: Summary of I&AP comments and responses
Appendix D6: Minutes of meetings with key stakeholders
Appendix D7: Notice of draft Scoping Report for commenting

APPENDIX E: PROPOSED ROAD AND FENCE RESERVE DRAWINGS