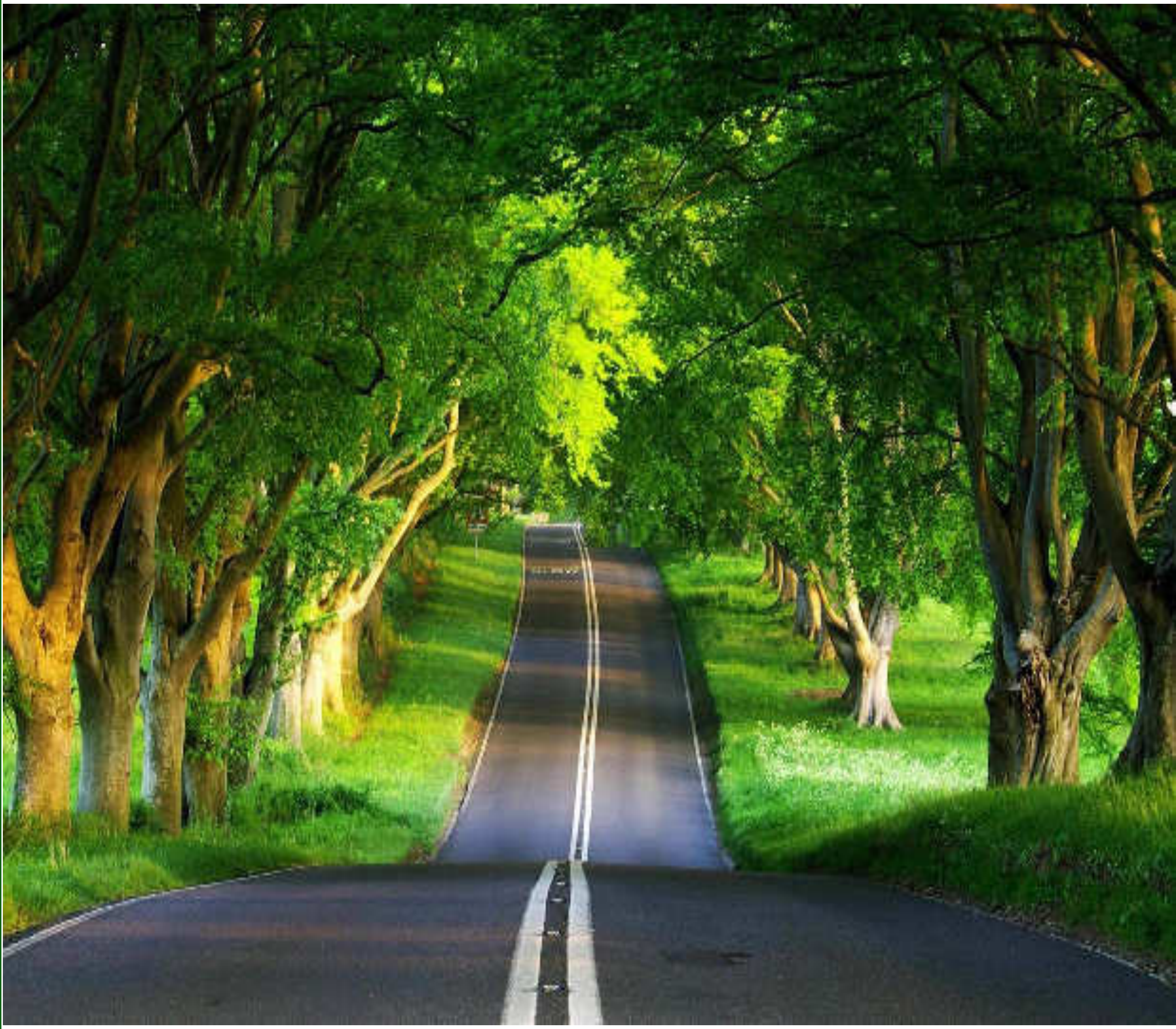
Draft Environmental Impact Assessment Report for Olievenhoutbosch Road

GAUT: 002/11-12/E0135 **November 2014**



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Bokamoso

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LIST OF ABBREVIATIONS

CBD: Central Business District

C-Plan: Conservation Plan

DEAT: Department of Environmental Affairs and Tourism

DFA: Development Facilitation Act

EAP: Environmental Assessment Practitioner

ECA: Environmental Conservation Act

EIA: Environmental Impact Assessment

IEMA: Institute of Environmental Management and Assessment

EIAR: Environmental Impacts Assessment Report

EMM: Ekurhuleni Metropolitan Municipality

CoT: City of Tshwane

DWAF: Department of Water Affairs and Forestry

EMP: Environmental Management Plan

GAPA: Gauteng Agricultural Potential Atlas

GDARD: Gauteng Department of Agriculture, Conservation and Environment

GSDF: Gauteng Spatial Development Framework

I&AP: Interested and affected party

IDP : Integrated Development Plan

MOU: Memorandum of Understanding

NSBA: National Spatial Biodiversity Assessment

NEMA : National Environmental Management Act

ORTIA: O.R. Tambo International Airport

PoS: Plan of Study

RDM: Resource Directed Measures

SACLAP: The South African Council of the Landscape Architects Profession

SAHRA: South African Heritage Resources Agency

SR: Scoping Report

SDF: Spatial Development framework

TIA: Traffic Impact Assessment

UNCED : United Nations Conference on Environment and Development

WMA: Water Management Area

GLOSSARY OF TERMS

Agricultural Hub: An area identified for agricultural use by GDARD according to the Draft Policy on the Protection of Agricultural Land (2006).

Alien species: A plant or animal species introduced from elsewhere: neither endemic nor indigenous.

Applicant: Any person who applies for an authorisation to undertake an activity or to cause such activity to be undertaken as contemplated in the National Environmental Management Act (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2006.

Biodiversity: The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are apart.

Conservation of Agricultural Resources Act (Act No. 43 of 1983): This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.

C-Plan: The GDARD's C-Plan focuses on the mapping and management of biodiversity priority areas within Gauteng. The C-plan includes protected areas, irreplaceable and important sites due to the presence of Red Data species, endemic species and potential habitat for these species to occur. GDARD C- Plan Version 2, 2005.

Development Facilitation Act (DFA) 1995 (Act 67 of 1995): This Act formulates a set of general principles to serve as guidelines for land development.

Ecology: The study of the inter relationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object and/or organism. Also defined as the surroundings within which humans exist and are made up of the land, water, atmosphere, plant and animal life (micro and macro), interrelationship between the factors and the physical or chemical conditions that influence human health and well-being.

Environmental Impact Assessment: Assessment of the effects of a development on the environment.

Environmental Management Plan: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

GDARD Draft Ridges Policy, 2001: According to the GDARD Draft Ridges Policy no development should take place on slopes steeper than 8.8%.

GDARD Draft Red Data Species Policy, 2001: A draft policy to assist with the evaluation of development applications that affected Red Data plant species.

GDARD Requirements for Biodiversity Assessments Version 2 (March 2008) (Draft): GDARD requirements for biodiversity assessments.

National Environmental Management Act (NEMA), 1998 (Act No 107 of 1998): NEMA provides for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

National Environmental Management: Air Quality Act (Act No. 39 of 2004): The purpose of the Act is "To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incident thereto".

National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004): The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003): The purpose of this Act is to provide the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.

National Heritage Resource Act, 1999 (Act No 25 of 1999): The National Heritage Resources Act legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

National Veld and Forest Fire Act, 1998 (Act No. 101, 1998): The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

National Road Traffic Act, 1996 (Act No. 93 of 1996): This Act provides for all road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith.

National Water Act, 1998 (Act No 36 of 1998): The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled.

Open Space: Areas free of building that provide ecological, socio-economic and place- making functions at all scales of the metropolitan area.

Study Area: Refers to the entire study area compassing the total area of the land parcels as indicated on the study area map.

Sustainable Development: Development that has integrated social, economic and environmental factors into planning, implementation and decision making, so as to ensure that it serves present and future generations.

Water Services Act, 1997 (Act No 108 of 1997): The purpose of this Act is to ensure the regulation of national standards and measures to conserve water.

Agricultural Hub: An area identified for agricultural use by GDARD according to the Draft Policy on the Protection of Agricultural Land (2006).

1. INTRODUCTION, BACKGROUND AND WAY FORWARD

1.1 Introduction

JR 209 Investments (Pty) Ltd appointed **Bokamoso Landscape Architects and Environmental Consultants,** to compile an Environmental Scoping Report and Environmental Impact Assessment (EIA) for the proposed construction of the road and its associated listed activities. The application is made for authorization for the construction of a section of Olievenhoutbosch from Main Road in the west to proposed Road K54 in the east. Centurion is becoming a high-density busy node with mixed land uses (Commercial, Residential and Office).

The traffic through the area surrounding the study area is becoming more concentrated and due to developments such as Highveld X 49 and Eco-Park development, more roads are needed in order to reduce the loads on several roads. The construction of Olievenhoutbosch Road will alleviate the traffic problems experienced in the area.

The proposed road under consideration only represents a section of the larger Olievenhoutbosch Road (from Main Road in the west to proposed Road K54) and is approximately 4km in extent. The involved section of Olievenhoutbosch Road is located in Centurion and falls within the jurisdiction of the City of Tshwane municipal area ***(refer to Figure 1: Locality Map and Figure 2: Aerial Map).***

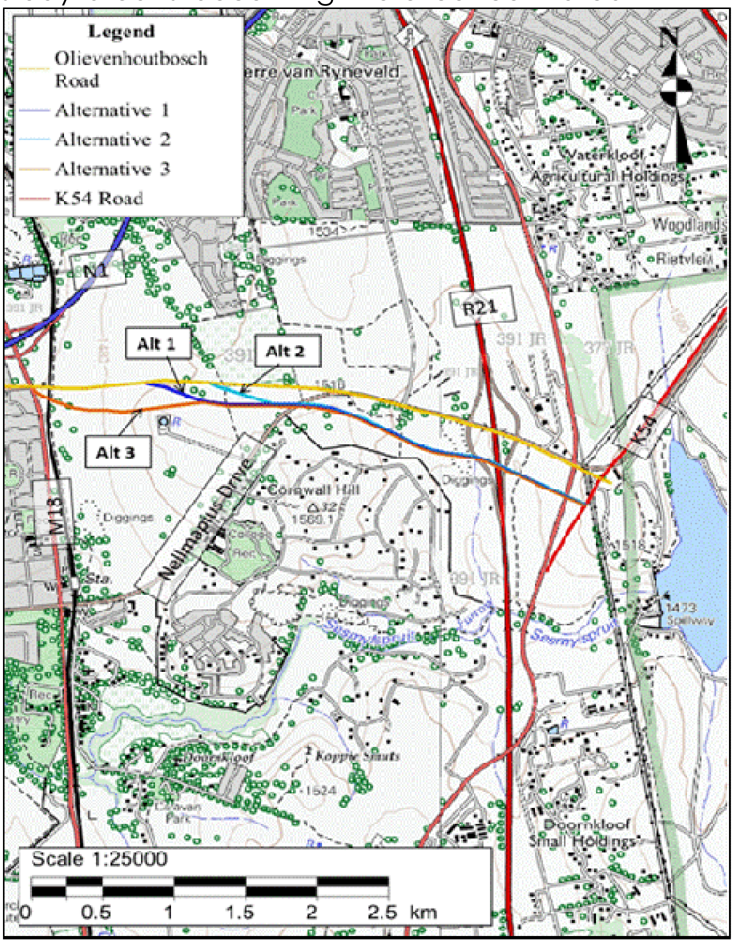


Figure 1 – Locality Map

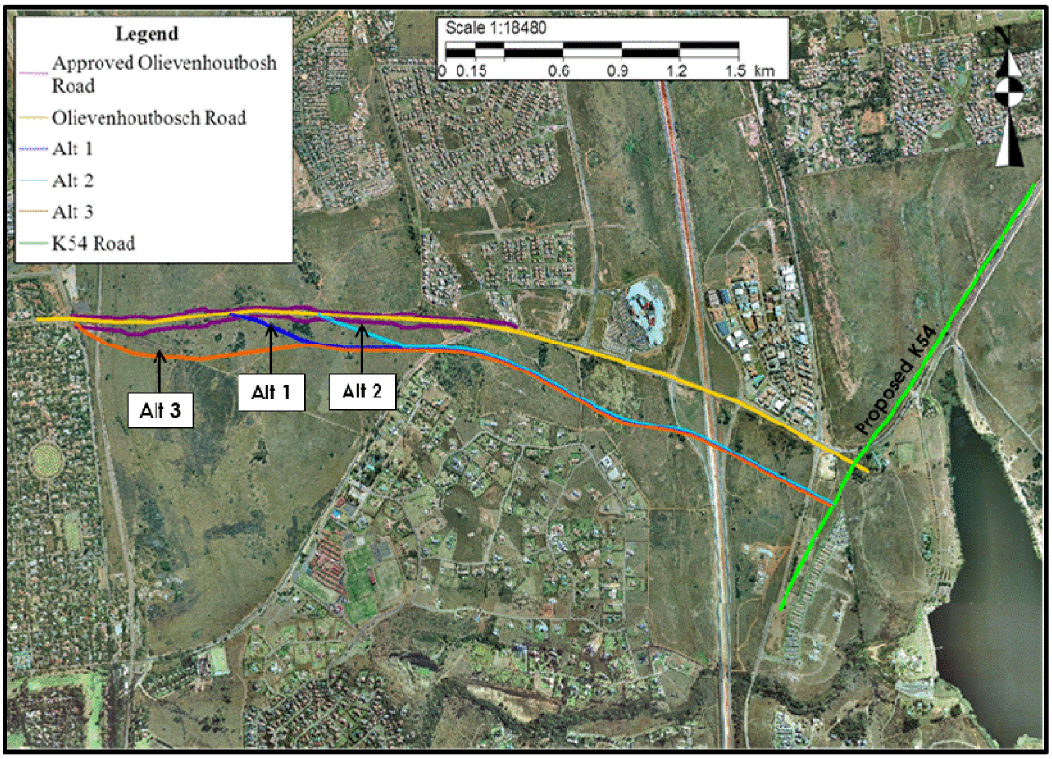


Figure 2 – Aerial Map

Note: Enlarged copies of the figures inserted in between the text below are included in Annexure A of this report.

The application is made in terms of Government Notice No. R544, R545 and R546 published in the Government Gazette no. 33306 of 18 June 2010 of the National Environment Management Act, 1998 (Act No. 107 of 1998).

According to the above mentioned Regulations and Notices, an Environmental Impact Assessment Process is required for the above-mentioned project, due to the following listed activity/ activities:

Table 1: Listed activities in terms of Notice No. R 544

Listing No. 1 R. 544, 18 June 2010	Activity 11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs;

		(vi) bulk storm water outlet structures; (vii) marinas (viii) jetties exceeding 50 square meters in size; (ix) slipways exceeding 50 squares meters in size; (x) buildings exceeding 50 square meters in size; or more where such construction occurs within 32 meters of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
Listing No. 1 R. 544, 18 June 2010	Activity 18	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 from: (i) a watercourse; (ii) the sea; (iii) the seashore (iv) the littoral active zone, an estuary or a distance of 100 metres inland of high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing, dredging, excavation, removal or moving (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line

Table 2: Listed activities in terms of Notice No. R 545

Listing No. 2 R. 545, 18 June 2010	Activity 18	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No.385 of 2006, - (i) It is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (ii) It is a road administered by a provincial authority; (iii) The road reserve is wider than 30 meters, or (iv) The road will cater for more than one lane of traffic in both directions.

Table 3: Listed activities in terms of Notice No. R 546

Listing No. 3 R. 546, 18 June 2010	Activity 4	The construction of a road wider	**(b) In Gauteng:** i. A protected area identified in

		than 4 meters with a reserve less than 13.5 meters.	terms of NEMPAA, excluding conservancies; ii. National Protected Area Expansion Strategy Focus area; iii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; iv. Sites identified in terms of the Ramsar Convention; v. Sites identified as irreplaceable or important in the Gauteng Conservation plan; vi. Areas larger than 2 hectares zoned for use as public open space; vii. Areas zoned for a conservation purpose. viii. Any declared protected area including Municipal or Provincial Nature Reserves as contemplated by the Environmental Conservation Act, 1989 (Act No. 73 of 1989) and the Nature Conservation Ordinance (Ordinance 12 of 1983); Any site identified as land with high agricultural potential located within the Agricultural Hubs or important Agricultural Sites identified in terms of the Gauteng Agricultural Potential Atlas, 2006
Listing No. 3 R. 546, 18 June 2010	Activity 13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (1) The	**(d)In Gauteng:** i. A protected are identified in terms of NEMPAA, excluding conservancies; ii. National Protected Area Expansion Strategy Focus areas; ii. Any declared protected area including Municipal or Provincial Nature reserves as contemplated by the Environmental Conservation Act, 1989 (Act No. 73 of 1989), the Nature Conservation Ordinance (Ordinance 12 of 1983);

		undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Management Act, 2008(Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list. (2) The undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010	v. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; v. Sites or areas identified in terms of an International Convention vi. Sites identified as irreplaceable or important in the Gauteng Conservation plan;
Listing No. 3 R. 546, 18 June 2010	Activity 19	The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer.	**(b)In Gauteng:** i. A protected are identified in terms of NEMPAA, excluding conservancies; ii. National Protected Area Expansion Strategy Focus areas; iii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; v. Sites or areas identified in terms of an International Convention; v. Any site identified as land with high agricultural potential located within the Agricultural Hubs or Important Agricultural Sites identified in terms of the Gauteng Agricultural Potential

			Atlas, 2006. vi. All sites identified as irreplaceable or important in the Gauteng Conservation plan; vii. Any declared protected area including Municipal or Provincial Nature reserves as contemplated by the Environmental Conservation Act, 1989 (Act No. 73 of 1989), the Nature Conservation Ordinance (Ordinance 12 of 1983) and the NEMPAA.

1.2 Background

Olievenhoutbosch Road is a planned road situated on Portion 198, Remainder of Portion 330 and Portion 355 of the farm Doornkloof 391-JR. The yellow line in ***Figure 1*** represents the approved Olievenhoutbosch road that links up with Nellmapius Drive that is currently being constructed; the proposed road under consideration will add additional lanes and thus help with congestion on the currently approved Olievenhoutbosch Road. The proposed alignment traverses approved townships **Irene X 89, 90, 91 & 92** as indicated in ***Figures 3 and 4 (also attached as Annexures B and C).***

Centurion and Irene are situated west and south-west of the proposed alignment with Cornwall Hill to the south and Pierre van Ryneveld to the north. The road will be a direct-link from these areas and N1 National freeway to the K54 and also the R21 National freeway. This Environmental Impact Assessment Report (EIAR) has been prepared to comply with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).

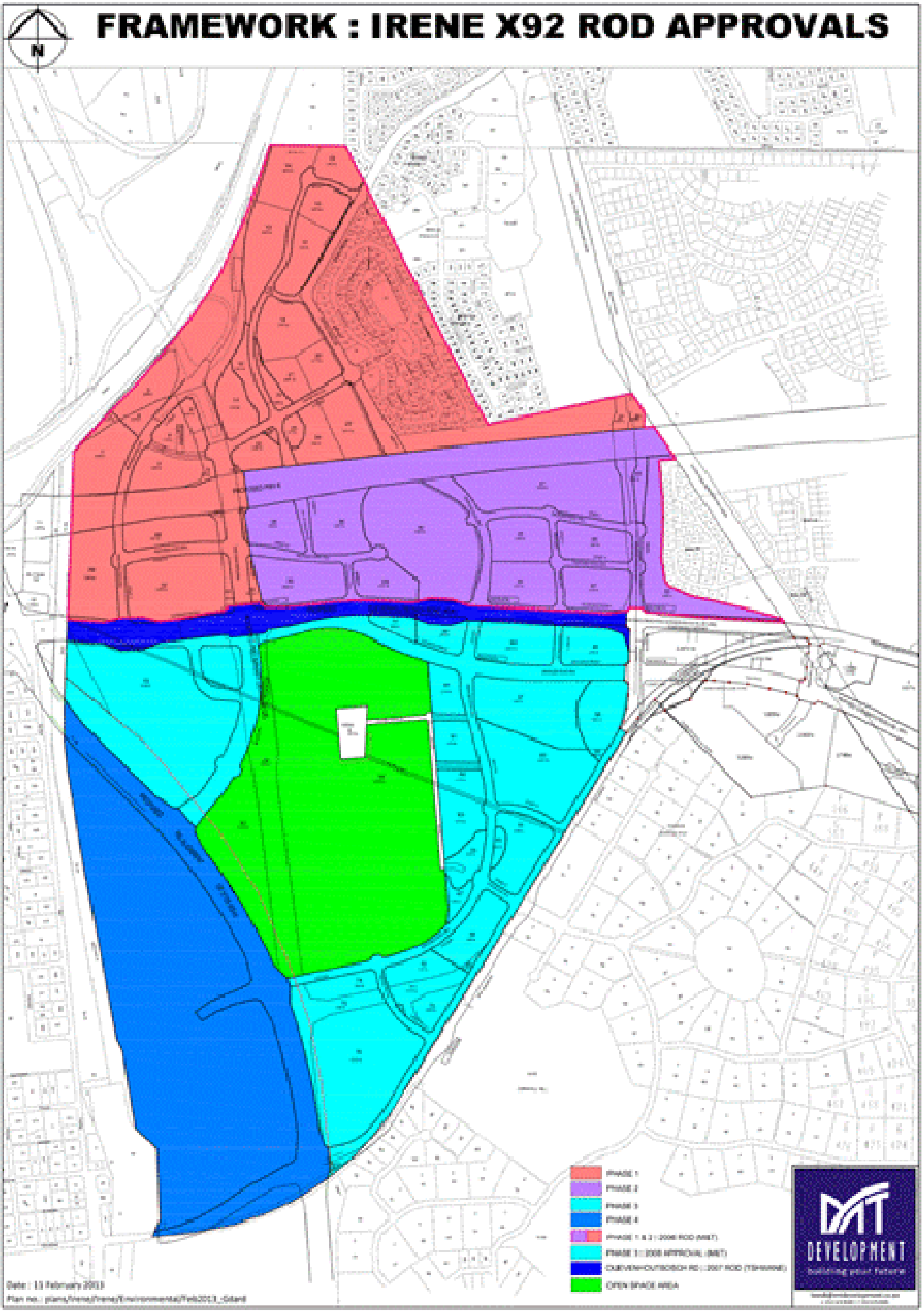


Figure 3 – Irene X 92 Framework

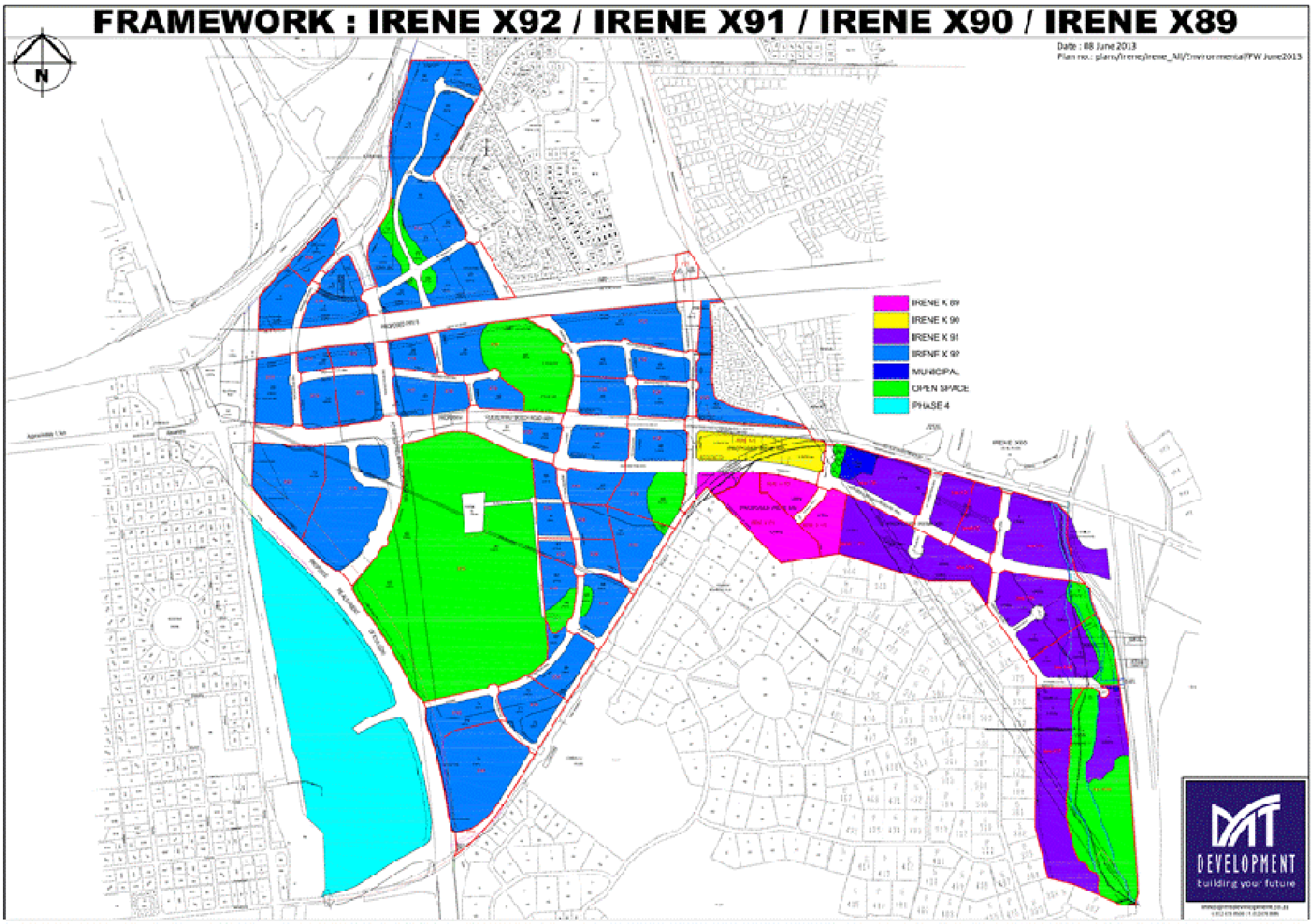


Figure 4 – Irene X89, 90, 91 & 92 Framework

The Gauteng Department of Agriculture and Rural Developments (GDARD) approved the Plan of Study for Environmental Impact Assessment (EIA) and Scoping Report for EIA, which was submitted by Bokamoso Landscape Architects and Environmental Consultants and received by the Department on 26 June 2013. GDARD requested that the following information requirements be addressed in the EIAR: ***Refer to Annexure D***

1. The Ecological Sensitivity Study must cover both fauna and flora and must meet the Department's Directorate of Biodiversity Management requirements for Biodiversity assessments.
2. The EIAR must report on the possible impacts on the subject site, which in terms of Conservation Plan Version 3.3 part of the proposed site is designated as an important and irreplaceable area with patches of suitable habitat for *Hebenaria*

mossii which is a red listed plant, *Hebenaria barbertoni* which is an orange listed plant, *Rhinolophus clivosus* which is a priority red listed mammal and Gauteng grassland which is a primary vegetation.

3. Sensitivity map reflecting all good natural vegetation, including form of habitat and ridge systems along the entire alignment of the proposed road must be provided for the Department to determine the extent of impacts associated with the proposed road.
4. The road designs must show the interconnection with the proposed and existing township(s). It must also be overlaid with a sensitivity map and must be clear and legible and be printed on a readable scale map with distinctive legend in solid colours.
5. An assessment of alternatives must include a comparative assessment of all alternatives and must reflect environmental and socio-economic impact of each alternative along the entire route alignment. Further, the assessment of alternatives must be discussed in relation to the approved Olievenhoutbosch road alignment traversing the sensitive 5 O' Clock site and how is it going to affect the other phased activities in the area.
6. It must be noted that there are areas which, as a result of environmental sensitivities, were excluded from 5 O' Clock development and this road and any of its proposed alternative alignments must not begin to start new discussion to encroach on such areas.
7. The stormwater management plan must indicate all points of inlet and outlet as well as connections with the existing municipal systems (if there are any) and must comply with the standard and requirements of the City of Tshwane Roads and Stormwater Division.
8. The Department noted with great concern that the Plan of Study for EIA is very vague owing to the view that there are studies that have been done not long ago in the area and information from such studies will be used for this activity. The Department will like to draw the EAP's attention to the fact that each activity is decided on its own merits and as such the evaluation of this activity will be done based on the information collected specifically for this activity. Should there be any

deviation from this principle, kindly ensure that such information is updated and is relevant to make a decision on this activity. Further, the Department expects an EIA process to be undertaken using all accepted methods of impact assessment and not according to the subject plan of study contained in the Scoping Report submitted for this road and all relevant stakeholders must be directly consulted during all phases of the EIA process.

9. All issues raised by interested and affected parties must be addressed during the EIA process.
10. A detailed project and site specific Environmental Management Plan (EMP) must be compiled and included in the EIAR.

2 ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) - (In Line with Section 32 (2) (a) (i) & (ii)

The new Environmental Regulations require that relevant details of the Environmental Assessment Practitioner be included as part of the EIA Report. In this regard, attached as ***Annexure E***, is a copy of the CV of the EAP for this project, Ms. Lizelle Gregory from Bokamoso Landscape Architects and Environmental Consultants CC. In summary details of the EAP are indicated below:

- **Name:** Lizelle Gregory
- **Company:** Bokamoso Landscape Architects and Environmental Consultants.
- **Qualifications:** Registered Landscape Architect and Environmental Consultant (degree obtained at the University of Pretoria) with 18 years' experience in the following fields:
    - Environmental Planning and Management;
    - Compilation of Environmental Impact Assessments;
    - Landscape Architecture; and
    - Landscape Contracting

Ms. L. Gregory also lectured at the Technicon of South Africa and the University of Pretoria. She is a registered member of the South African Council of the Landscape Architects Profession (SACLAP), the International Association of Impact Assessments (IAIA) and the Institute of Environmental Management and Assessment (IEMA).

3 SCOPE OF WORK AND APPROACH TO THE STUDY

An application form for environmental authorisation of the relevant activity as well as an Environmental Scoping Report has been submitted to Gauteng Department of Agriculture, and Rural Developments (GDARD). An investigative approach was followed and the relevant physical, social, economic and institutional environmental aspects were assessed.

The scope of work includes the necessary investigations, to assess the suitability of the study area and the surrounding environment for the proposed activities. The scoping exercise identified the anticipated environmental aspects in an issues matrix and it also supplied a preliminary significance rating for the impacts identified. The scoping process also assessed the possible impacts of the proposed Road on the surrounding environment (including the interested and affected parties).

This document represents the EIA for the proposed Road. The EIA must be in line with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) and the Approved Plan of Study for EIA that was submitted as part of the Scoping Report.

The EIA takes into consideration the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity. A description of the property on which the activity is to be undertaken and the location of the activity on the property are described. A description of the proposed activity and any feasible and reasonable alternatives were identified. In addition, a description of the need and desirability of the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have, on the environment and community that may be affected by the activity are included.

An identification of all legislation and guidelines that Bokamoso is currently aware of is considered in the preparation of this EIA Report. Furthermore a description of environmental issues and potential impacts, including cumulative impacts, are identified and discussed. Information on the methodology that will be adopted in assessing the potential impacts is furthermore identified, including any specialist studies or specialised processes that were/ should be undertaken. The EIA Report eventually determines whether a proposed project should receive the "go-ahead" or whether the "no-go" option should be followed. If the EAP recommends that the project receive the "go-ahead", it will (in most cases) be possible to mitigate the issues identified to more acceptable levels. Reference is also made to the mitigation of identified impacts or for further studies that may be necessary to facilitate the design and construction of an environmentally acceptable facility.

Details of the Public Participation Process (in terms of Sub-Regulation 1) are also included. Sub-Regulation 1 requires that the following information be included as part of the Public Participation Section of the EIA report:

- (i) The steps undertaken in accordance with the Plan of Study For EIA,
- (ii) A list of persons, organisations and government organs that were registered as interested and affected parties;
- (iii) A summary of comments received from, and a summary of issues raised by the interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments;
- (iv) Copies of any representations, objections and comments received from the registered interested and affected parties.

The mitigation measures and guidelines that are listed in the EIA Report are also summarised in a user-friendly document named an Environmental Management Plan

(EMP). A Draft EMP is also a requirement of the EIA Process (Section 32 and 34 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)).

4. DESCRIPTION OF THE PROPOSED ACTIVITY

4.1. Name of Activity

The construction of a section of Olievenhoutbosch Road from **Main Road** in the west to **K54** in the east. The involved section of Olievenhoutbosch road is approximately **4 km** in extent.

4.2. Particulars of Applicant

Applicants Name:	Mr. Barry Hertzog On behalf of JR 209 Investments (Pty) Ltd
Physical Address:	Witchhazel Avenue 340 Eco Court Building Highveld Centurion Pretoria
Postal Address:	P.O. Box 39727 Faerie Glen 0043 Tel: (012) 676 8594 Fax: 086 570 5659
Contact Person:	Mr. Barry Hertzog

4.3 Background of the Route

Although this Scoping/EIA process will only be done for a section of Olievenhoutbosch Road, the proposed section of Olievenhoutbosch forms part of a larger entity to be viewed holistically to understand the function of the road. The future road network in the south-eastern section of Centurion is shown on ***Figure 5.***

The main purpose of the Olievenhoutbosch alignment will be to reduce the concentration of traffic on the National Highway N1, and to accommodate increased traffic generated by new developments in the surrounding area (residential, commercial, industrial).

Olievenhoutbosch Road is a Metropolitan Class 2 Road that will link the Samrand Interchange on the Ben Schoeman freeway (N1) with the R21 route (Kempton Park freeway) in the east. This will eventually entail that Olievenhoutbosch Road will be a major parallel route to the National N1 route and will have five (5) access points to the N1 through existing interchanges and will distribute flows in the south-eastern section of Tshwane.

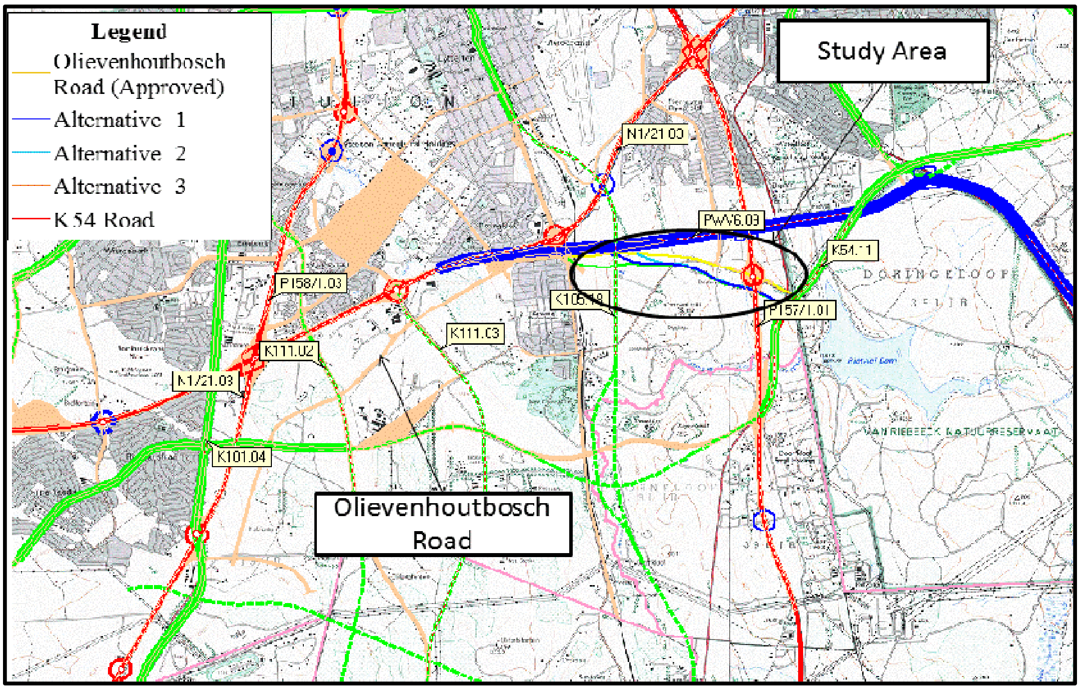


Figure 5 – Future Road Network

These access points are on the Samrand interchanges, Rooihuiskraal interchange, John Voster Drive interchange, Botha Avenue interchange and Nellmapius Avenue interchange.

This road will also be linked to several existing and proposed K-routes running through the area, namely K101, K54, K111, K109 and K105. ***(Refer to Figure 5: Future Road Network)***

4.4 Particulars of Activity

4.4.1 Nature of Activity

The proposed activity is the **Construction of a section of Olievenhoutbosch Road from Main Road in the west to the proposed Road K54 in the east.**

4.4.2 Location of Activity

Refer to Figure 1 for Locality Map and Figure 2 for Aerial Map

The involved section of Olievenhoutbosch road lies on the boarder of quarter degree grid square 2528CC and 2528CD (Centurion) and stretches in a west-east direction from **Main Road to the proposed Road K54**.

4.4.3 Delineation of the study area

The section of Olievenhoutbosch Road investigated in this EIA Report is only a small section **(approximately 4km)** of a Route which forms an important link in the Gauteng Road Network system ***(refer to Figure 5).***

Although the Gauteng Transport Infrastructure Act, 2001, requires that all listed roads be accommodated in the layouts of new developments, EIA authorisation in terms of the new NEMA regulations must still be obtained for the roads and if any "fatal flaws" / significant environmental issues along the listed alignment are identified the regulations provides for alignment alternatives and even for the "no-go" alternative. This variable makes it difficult to finalise development layouts around such roads or only small portions of a larger road.

There were cases in the past where GDARD considered and authorised only isolated sections of K-routes / Freeways to accommodate the layouts and planning of surrounding developments affected by such roads. Unfortunately, these isolated decisions compromised the option of investigating alternative alignments if significant environmental issues / "fatal flaws" were identified along other sections of the road not applied for as part of a specific development. ***Refer to Diagram 1 below for a conceptual illustration of Study Area.***

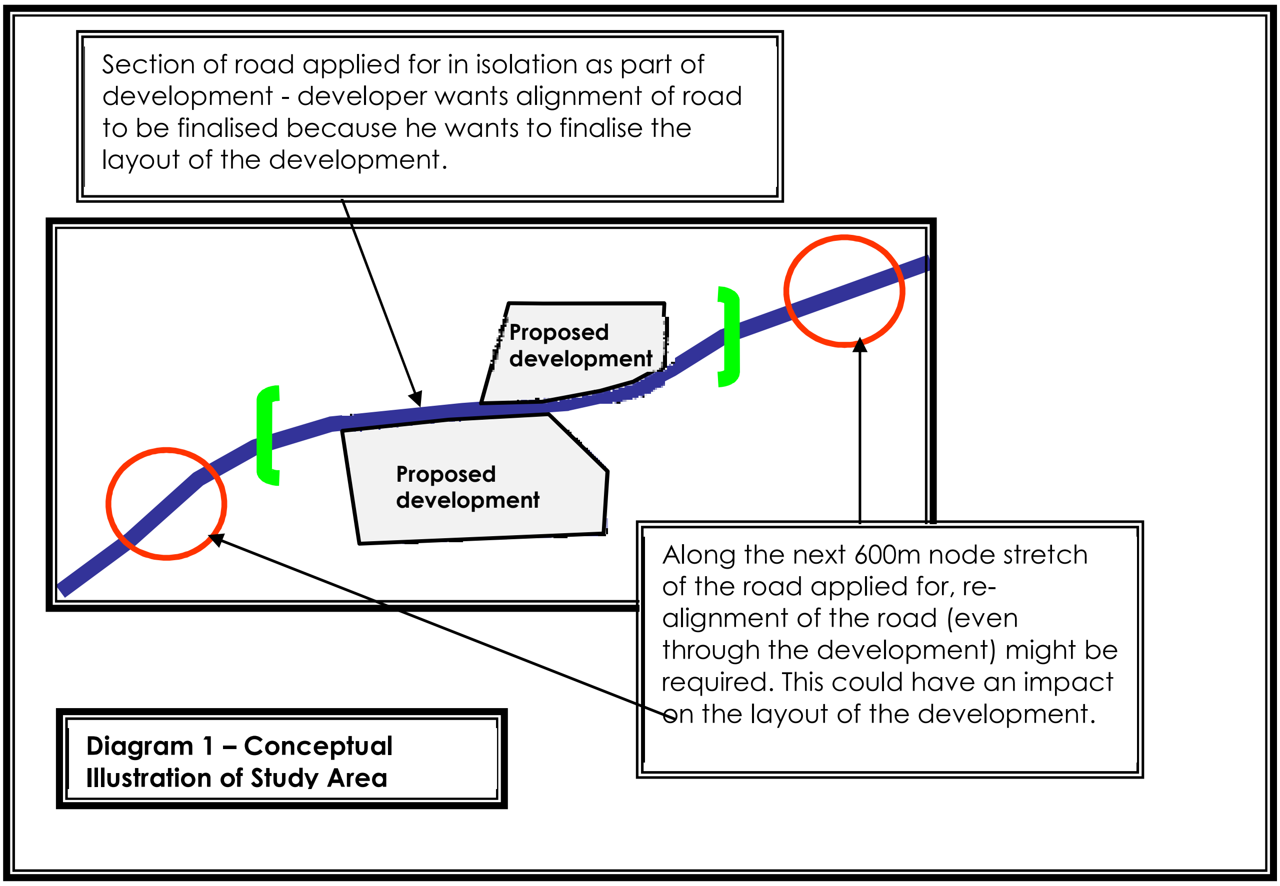


Diagram 1 – Conceptual Illustration of Study Area

In order to prevent such cases, GDARD now requires that EAPs not only limit their environmental assessments to the portion of a road applied for, but that they also extend their investigations to incorporate a longer section of the road (to both sides of the involved portion of the road). This will allow for two options: (i) amendments in the alignment or (ii) to investigate a portion of road that can easily terminate into existing roads and act as an independent internal / local road if "fatal flaws" prevent the remainder of the route from happening. ***Refer to Diagrams 2 and 3*** for conceptual illustrations.

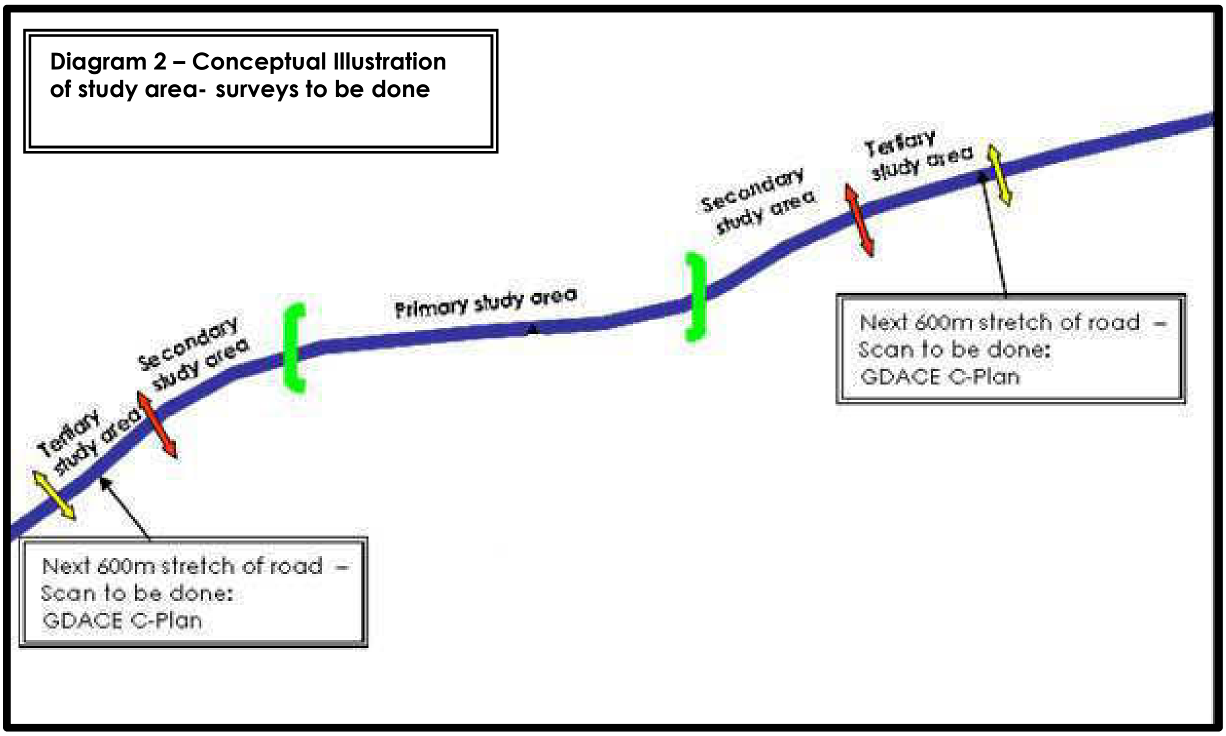


Diagram 2 – Conceptual Illustration of study area- surveys to be done

According to a traffic engineer an acceptable distance which would allow for an amendment in the alignment is 600m from a node (distance from one intersection to the next potential intersection)[1].

In the case of this application the EAPs investigated the 600m node extensions of the involved section of Olievenhoutbosch Road and identified **irreplaceable sites to the east** of the involved section of the route that could result in a "fatal flaw" ***(refer to Figure 6).***

[1] Provincial / national roads are divided into 600m nodes which allows for intersections or termination of a road.

However, Olievenhoutbosch Road terminates onto the proposed K54 as indicated on ***Figure 5*** and therefore the presence of irreplaceable sites on the eastern extension is not regarded as a fatal flaw.

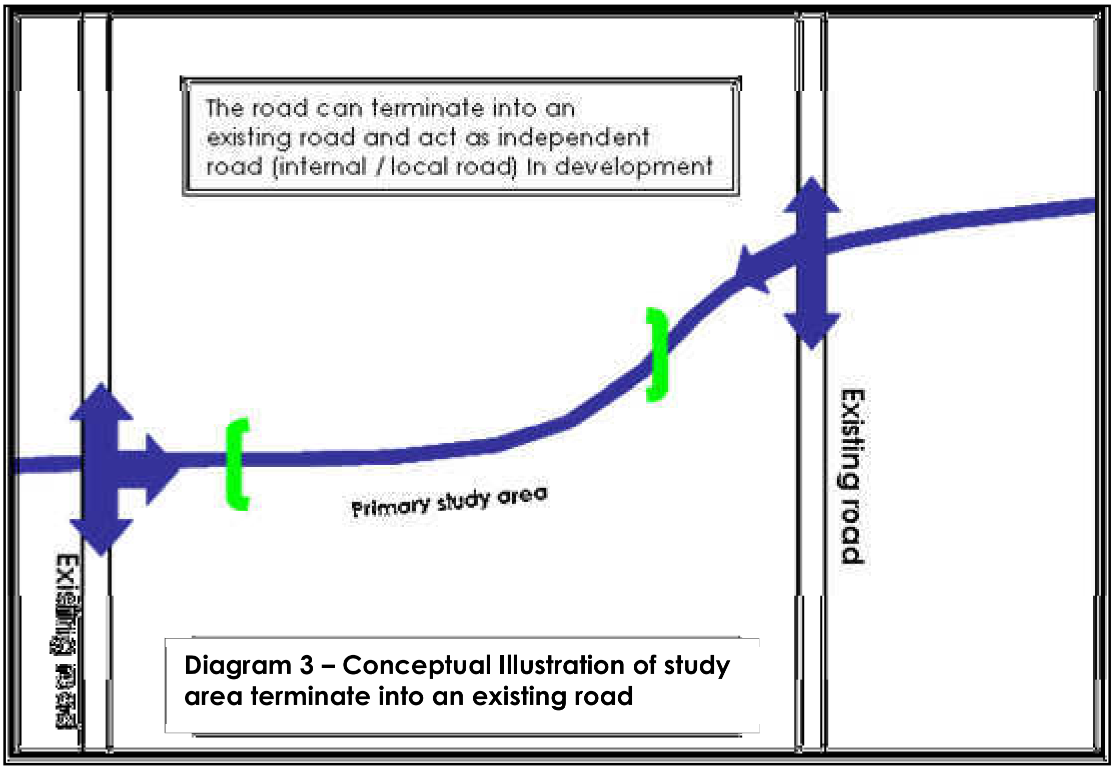


Diagram 3 – Conceptual Illustration of study area terminate into an existing road

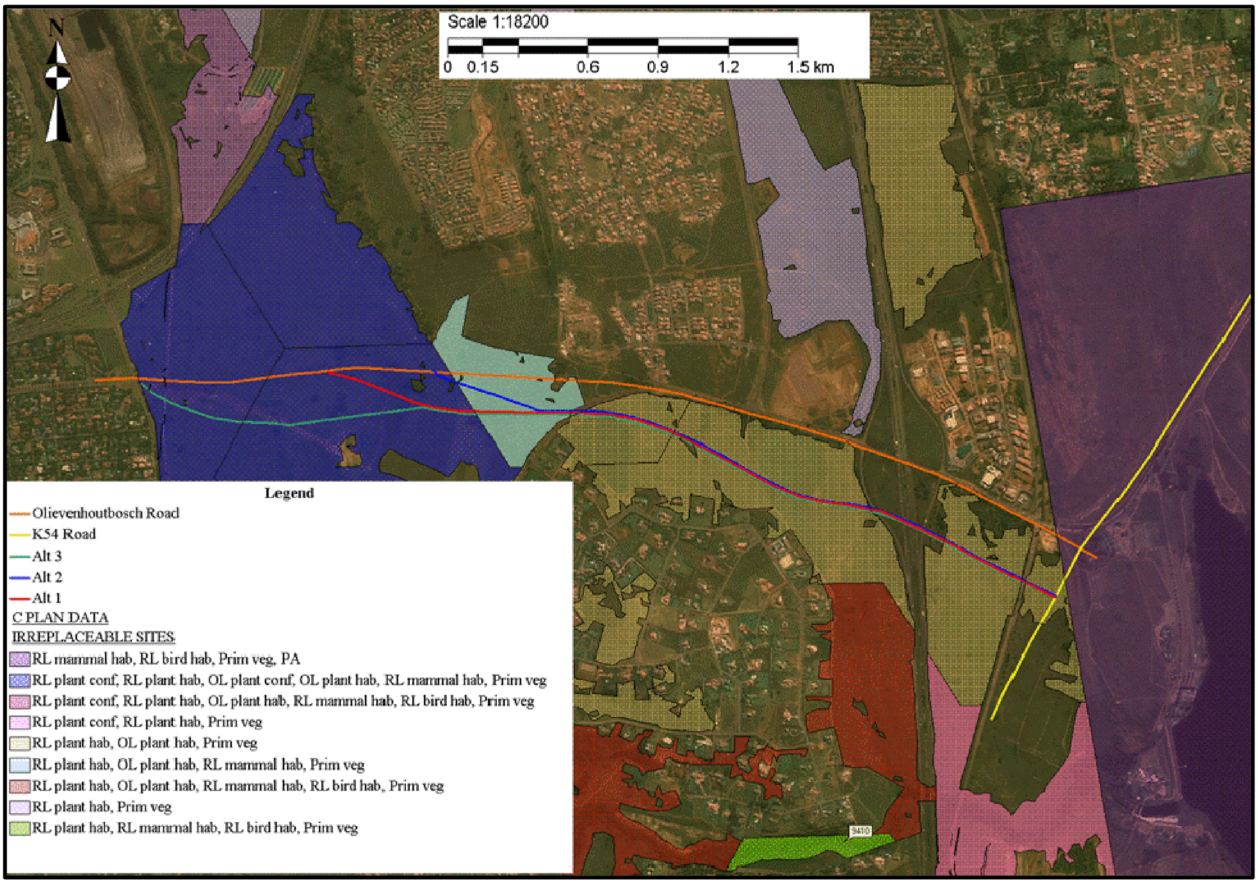


Figure 6 – Irreplaceable Sites Map
GDARD C Plan 3

4.4.4 The role of Olievenhoutbosch Road in the in the Gauteng Road Network and the importance of the proposed road for the City of Tshwane.

Refer to Figure 5 for locality of the proposed Olievenhoutbosch Road within the larger Gauteng Road Network System

The road network in Gauteng is under increasing pressure due to a number of factors, including:

- The economic growth of the province which currently stand at almost double the national growth rate;
- Increased car ownership;
- Increased urbanization towards the major cities; and

- Increased job opportunities resulting in more people entering the business market thereby increasing their personal wealth through property and car ownership.

Amongst others this has resulted in increased demand for road capacity in general in Gauteng. The current system has over the last couple of years become notorious for the lack of capacity, with great congestion, huge delays, and severe safety concerns raised by various sectors, including the public, all spheres of government, and other institutions. Due to the lack of building new infrastructure to create a balanced road network or transport system the system has also resulted in increased pollution due to the congestion on the network.

The overall objectives of the Gautrans road network are to provide mobility and access in the Gauteng province. Olievenhoutbosch Road plays an important role in achieving these objectives. In a regional context, Olievenhoutbosch Road provides west-east mobility through the eastern parts of Centurion and Irene. Olievenhoutbosch Road also distributes traffic from the N1-R21 to areas such as Irene, Pierre van Ryneveld, Doringkloof, Lyttelton and Kloofsig. It also provides additional access to the Centurion CBD and the Gautrain Station via River Road / Lenchen Avenue.

A further function of the road is to open the land adjacent to it for development.

With the tremendous increase in population and employment opportunities in these areas, traffic volumes between Centurion and Kempton Park will increase significantly within the next few decades. It is important that the planned routes between these two areas should be preserved to ensure sufficient linkage. Olievenhoutbosch Road as one of these planned routes plays an essential role in the establishment of the linkage.

4.4.5 The Need For Olievenhoutbosch Road

A reassessment of the major road network in the area and its development potential has indicated the need to strengthen the regional network. The proposed road network link will divert traffic from existing road network links and thereby alleviate congestion on the existing road network system. As already mentioned it will play a supporting role to the R21 Albertina Sisulu Freeway to the east. It would also provide local accessibility by means of well-spaced intersections with minor arterials and collector roads and in a few instances give direct access to minor tracts of land.

In the south it comes from the SAMRAND light industrial and business area situated on the west of the N1. Then it moves through a massive concentration of warehouses that constitutes a distribution point of commercial goods on a provincial scale. Moving northwards there are manufacturing, transport and commercial orientated land uses located between the spine road and the N1. There are also huge residential estates being developed just east of it. The area north of the K54`s crossing of the N1 is the Eco-Park development. Further to the east of the K109`s crossing of the N1 the nearly fully developed Highveld Technopark is situated as well as a Denel weapons manufacturing plant. The Highveld residential precinct is also situated within this district. Moving the intersection of the R21 more commercial/office orientated uses can be found.

Apart from serving an important west-east mobility function, Olievenhoutbosch road will also provide additional regional access towards the Gautrain station in West Street.

4.4.6 *Intersecting roads*

The involved section of Olievenhoutbosch road intersects with other important routes including the N1 – R21 Freeway, Nellmapius Drive, proposed PWV 6, K105 and K54 as well as the Pretoria- Germiston railway line.

4.4.7 End Points And Length

Olievenhoutbosch Road to be constructed is proposed to be from the K54 in the east and connect to Main Road in the west. The involved section of the proposed Road is approximately **4km** in extent.

4.4.8 Design Standards Of The Proposed Route

Design Speed

Vela VKE Engineers stated that the road design is for a class 3 road with a design speed of 80 -100 km/h.

Road reserve width

The involved Engineers propose that Olevenhoutbosch Road be developed as a one-way couplet. The eastbound leg of the one-way couplet adjacent to the Irene x91 township will follow the alignment of the existing Nellmapius Drive. The westbound leg of the one-way couplet passes through the Irene x91 Irene Township inside a 40m road reserve. The required road reserve widths for the two legs of the one-way couplet must be confirmed by the City of Tshwane.

Cross section

For the first phase the road will only consist of one lane. At a later stage an additional lane will be added if needed. As previously mentioned, this lane will only direct traffic from east to west, and the approved Olievenhoutbosch road will direct traffic west to east.

Horizontal and vertical alignment

All 3 of the Alternatives have a horizontal alignment.

4.4 The Gautrans Network Planning And The Gautrans Road Planning Stages

- **Network Planning at 1:50 000 scale.**

During the mid-seventies a grid network covering the traditional PWV area compiled by GAUTRANS was planned on a 1: 50 000 scale and maintained ever since. The grid network concept was based on a road hierarchy system comprising of a range of mobility and access routes.

- **Route Determination at 1: 10 000 scale.**

During the Route Determination phase each route is investigated in more detail. Amongst others, the following aspects receive attention:

- The purpose of the route;
- Delineation of study area;
- Collection and interpretation of environmental information;
- Site visit;
- Literature study;
- The description, analyses and interpretation of physical, biotic, socio-economic and environmental procedures; and
- Consultation with major landowners, local and other affected authorities.

- **Preliminary Design Phase - (Basic Planning).**

During this stage of planning, the issues addressed during the preceding stage are re-evaluated. Normally a long time period has passed between the above two stages and therefore revision is required.

The main purpose of Preliminary Design is to establish the road reserve and to conduct a cost framework. This phase includes also detail regarding bridge structures, culverts road fillings and road reserve boundaries. The commencement of this phase is normally dependant on either/ both the traffic demand and land use development pressure within the area.

Traffic congestion problems are currently experienced on the existing road network system and even more traffic congestion and accessibility problems will be experienced when more developments in the area take place. The construction of the K220 will divert traffic from existing road network links and thereby alleviate congestion. It will provide regional access to properties along the route.

- **Detail Design and Construction.**

During this phase all physical, environmental and socio-economic issues are integrated with the road planning. Land will be expropriated and detailed design of the road will depend on the priority of the route and the available funding.

- **The Design Phase Of This Application**

The involved section of Olievenhoutboch Road is currently at the detail design and construction stage. As already mentioned the proposed alignment falls mostly within approved township ***(refer to figure 3 and 4.)***

5. ALTERNATIVES IDENTIFIED *[Regulation 29(b)]*

5.1 The "No-Go" Alternative

The proposed Olievenhoutbosch Drive traverses an area with high development potential and the "No-Go" alternative was not considered viable from a road planning point of view. The "No-Go" alternative is therefore not considered as a viable alternative from a road planning point of view.

From an environmental point of view the impact of the construction and operational phase of the involved section of Olievenhoutbosch Road can be mitigated to acceptable levels and is not regarded as significant. According to GDARD C-Plan 3, the study area is regarded as **ecologically sensitive**. ***Refer to Figure 6, Irreplaceable Sites map.***

To follow now are tables that represent a preliminary comparison between the "No-Go" alternative and the development alternative.

Diagram 4: Environmental issues - "No-Go" Option

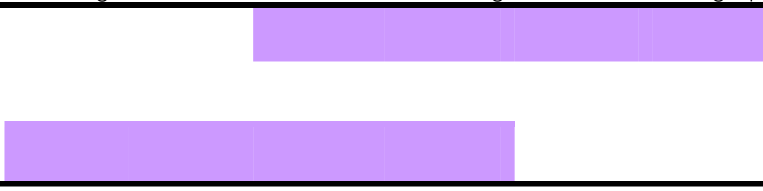
Issue	Short term	Medium term	Long Term	Impact
Geology and soils				Positive Neutral Negative
If no development there will be no significant impacts on the geology or hydrology of the study area, especially in the short term. Indirect impacts created by the edge effects of the surrounding developments could however, in the long term, lead to a decrease in vegetative coverage and even to exposed areas. Erosion, siltation and water pollution problems could then be caused. Changes in the surface drainage patterns could also occur.				
Hydrology				Positive Neutral Negative
If no development there will be no significant impacts on the geology or hydrology of the study area, especially in the short term. Indirect impacts created by the edge effects of the surrounding developments could however, in the long term, lead to a decrease in vegetative coverage and even to exposed areas. Erosion, siltation and water pollution problems could then be caused. Changes in the surface drainage patterns could also occur.				
Vegetation				Positive Neutral Negative
If no development takes place around the linear strip of land earmarked for the involved section of Olievenhoutbosch Drive, the impacts on the vegetation will not be significant. If developments take place around the linear strip of land earmarked for Olievenhoutbosch Drive (i.e. Irene X 70 & 71 development (5 'O Clock Site)), the edge effects could, in the long term, have an impact on the ecological potential and bio-diversity of the vegetation of the study area. fauna in this area.				
Fauna				Positive Neutral Negative
If no development takes place around the linear strip of land earmarked for the involved section of Olievenhoutbosch Drive, the impacts on the fauna and flora and bio-diversity will not be significant. If developments take place around the linear strip of land earmarked for Olievenhoutbosch Drive (i.e. Irene X 70 & 71 development (5 'O Clock Site)), the edge effects could, in the long term, have an impact on the ecological potential and bio-diversity of the vegetation of the study area. fauna in this area.				
Social				Positive Neutral Negative

The No-Go alternative is not viable from a road planning traffic point of view. If the road will not be developed there will still be a significant traffic impact on the surrounding roads. Therefore the no-go option will in long term be a negative impact. The traffic numbers will increase and there will be no alternative road for the traffic increase.		
Economic		Positive Neutral Negative
The No-Go alternative is not viable from a road planning traffic point of view. The economic impact will be neutral from short term until long term, due to the fact that if there is n development there will be no negative or positive impact on the economic. With no development there will not be any job opportunities.		

Note: *The "no-go" option is predominantly neutral in the short and medium term, and turns negative in the long term.*

Diagram 5: Environmental issues of the proposed section of Olievenhoutbosch Drive

Issue	**Short term**	**Medium term**	**Long Term**	**Impact**
Geology and soils				Positive Neutral Negative
In the short term (the construction phase), the proposed Olievenhoutbosch Drive will have a negative impact on the geology and soils of the study area. It is, however possible to mitigate the impacts to acceptable levels. If well planned, the long term impacts on the geology and soils will be neutral or even positive.				
Hydrology				Positive Neutral Negative
In the short term (the construction phase), the proposed Olievenhoutbosch Drive will have a negative impact the hydrology of the study area. It is, however possible to mitigate the impacts to acceptable levels. If well planned, the long term impacts on the hydrology will be neutral or even positive. Effective temporary and permanent storm water management and guidelines to reduce impacts on the water courses as well as a dolomite risk management plan will have to be implemented during all the development phases				
Vegetation				Positive Neutral Negative
The proposed Olievenhoutbosch Drive will have a negative impact on the vegetation of the study area in the short and medium term. The natural grassland vegetation will be permanently lost, but the proposed vegetative coverage of the road reserves could be natural vegetation that will create habitats for fauna species adaptable to the urban environment. In the long term the vegetative coverage will also prevent erosion, siltation and water pollution. It will also assist with softening of the road reserves and the screening of the road at strategic points.				

Fauna	Positive Neutral Negative
The proposed Olievenhoutbosch Drive will have a negative impact on the vegetation and fauna and bio-diversity of the study area in the short and medium term. The natural grassland vegetation will be permanently lost, but the proposed vegetative coverage of the road reserves could be natural vegetation that will create habitats for fauna species adaptable to the urban environment. In the long term the vegetative coverage will also prevent erosion, siltation and water pollution. It will also assist with softening of the road reserves and the screening of the road at strategic points.	
Social 	Positive Neutral Negative
From a social, institutional and economical point of view, the implementation of the proposed Olievenhoutbosch Drive could have significant positive impacts. However, the proposed road could have an impact on the Sense of Place of the Irene area. The construction phase could cause some social impacts during the construction phase, but in the long term the surrounding community and the larger region will benefit from the road. The construction of the road will create some temporary job opportunities.	
Economic 	Positive Neutral Negative
From an economical point of view, the implementation of the proposed Olievenhoutbosch Drive could have a neutral impact. However, the proposed road could have an impact on the Sense of Place of the Irene area. The construction of the road will create some temporary job opportunities which will benefit the community.	

Note: *From the preliminary information it is anticipated that the proposed section of Olievenhoutbosch Drive is predominantly negative in the short term, but turns neutral and positive in the medium term and long term. The Economic issues will be positive from the short term to the long term.*

5.2 Alignment Alternatives

Refer to Figure 7 for Alternative Alignments

Three alternative routes for the involved section Olievenhoutbosch road were investigated.

Alternative 1: Deviates secondly towards the north of the existing Olievenhoutbosch Road.

Alternative 2: Deviated first towards the north to join the existing Olievenhoutbosch Road.

Alternative 3: Only joins the existing Olievenhoutbosch Road at the intersection with Main road.

The approved Olievenhoutbosch road that is being constructed stretches from the Main road in the west and connects to Nellmapius Drive in the east. The alternatives in ***Figure 7*** will direct traffic from the east to west and the approved Olievenhoutbosch Road will let traffic flow from west to east.

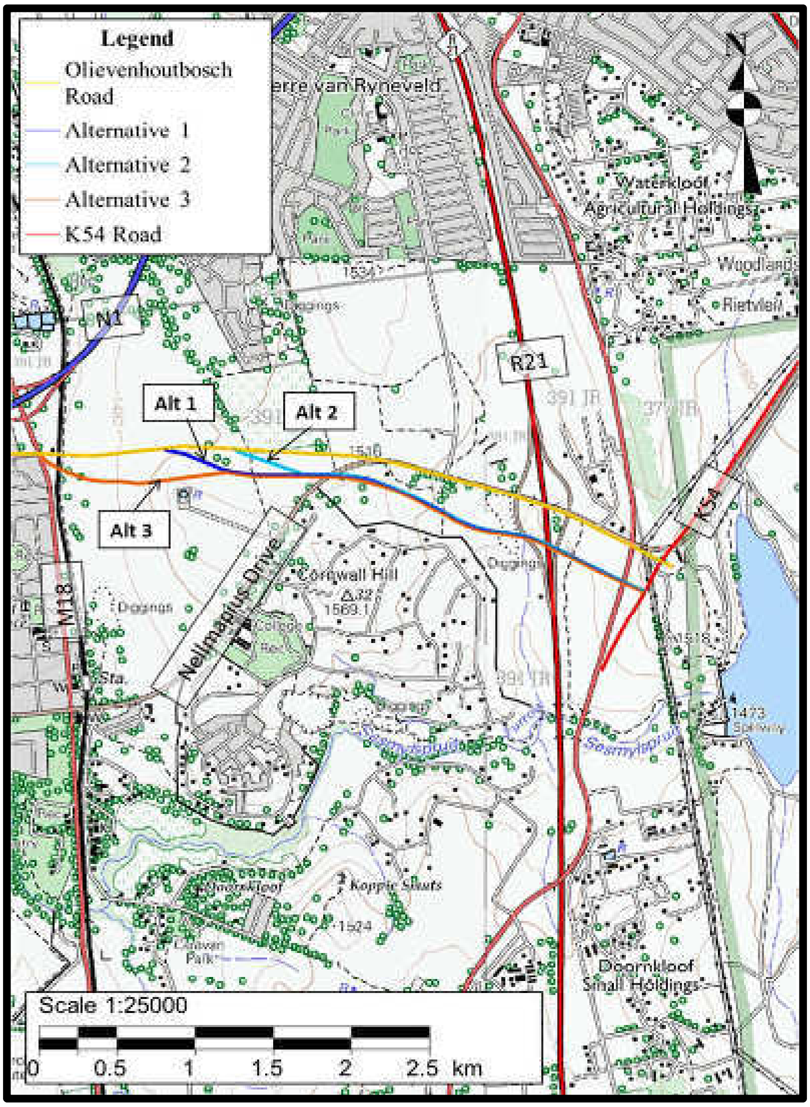


Figure 7: Alignment Alternatives

Alternative 1: The Alternative will deviate secondly towards the north of the existing Olievenhoutbosch Road. The ecological impact of Alternative 1 is higher than that of Alternative 2 since a large section of route traverses irreplaceable site, natural grassland areas and a large part of a ridge. ***Alternative 1*** follows the alignment of a proposed road in the approved township of **Irene x92, Irene x91 and Irene x89.**

The socio-economic impacts of the alternatives 1 are more or less similar to alternative 2 and 3.

Alternative 2: The alternative will deviate first towards the north to join the existing Olievenhoutbosch Road. Alternative 2 do have minor impacts on the ecosystem as this alternative also traverses irreplaceable site, natural grassland areas, but from an ecological point of view most of the appointed specialist prefer ***Alternative 2.***

The socio-economic impacts of alternatives 2 are more or less similar to Alternative 1 and 3.

Alternative 3: Alternative 3 aligns with alternative 1 and 2, south of the existing Olievenhoutbosch Road. This road only joins the existing Olievenhoutbosch Road at the intersection with Main road. Alternative 3 has the highest impact from an ecological point of view since large section of the route traverses irreplaceable sites, natural grassland areas and a large part of a ridge.

The socio-economic impacts of the three alternatives are more or less similar.

All three alternatives are in line with the institutional environment including the IDP, the Gauteng Densification Strategy Policy and the Development Facilitation Act.

6. THE DESCRIPTION OF THE BIOPHYSICAL AND SOCIO-ECONOMICAL ENVIRONMENTS – (In line with Section 32 (d)

6.1. THE PHYSICAL ENVIRONMENT

This section briefly describes the biophysical and socio-economical environments. It also lists the anticipated adverse and beneficial impacts of the proposed development on the environment. Where possible, mitigation measures were supplied for the adverse impacts and the significance of the impacts listed was also indicated in specific impact tables. In some cases the impacts have already (during the planning phase) been addressed to such an extent that it was not regarded as necessary to carry the impacts over to the significance rating section of the report.

Although it was not necessary to mitigate the positive impacts listed in the impacts tables, the positive impacts identified in this section of the report will also automatically be carried over to the significance rating section of the report to indicate the specific benefits associated with the proposed development. This will also make it possible to compare the severity of the adverse impacts with the advantages of the beneficial impacts and to eventually make an informed decision regarding the proposed development.

The following section incorporates the most important information supplied by specialist studies and reports.

6.1.1. Geology and Soils

Due to the fact that the study area is underlain by dolomite, some Geological constraints are expected ***(refer to Figure 8: Dolomite Map).***

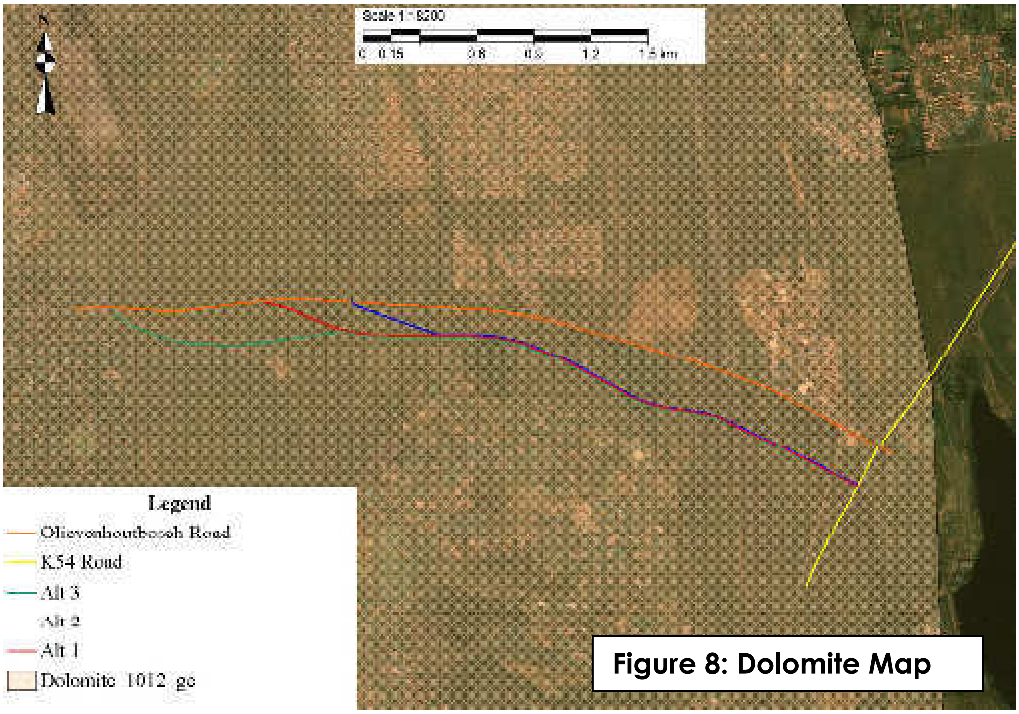


Figure 8: Dolomite Map

A large part of the proposed road falls within an area with, rocky outcrops with limiting soils depth, and to the east there is a small area which consists of Limiting soil depth and high clay content. ***(refer to Figure 9: Soils Map)***

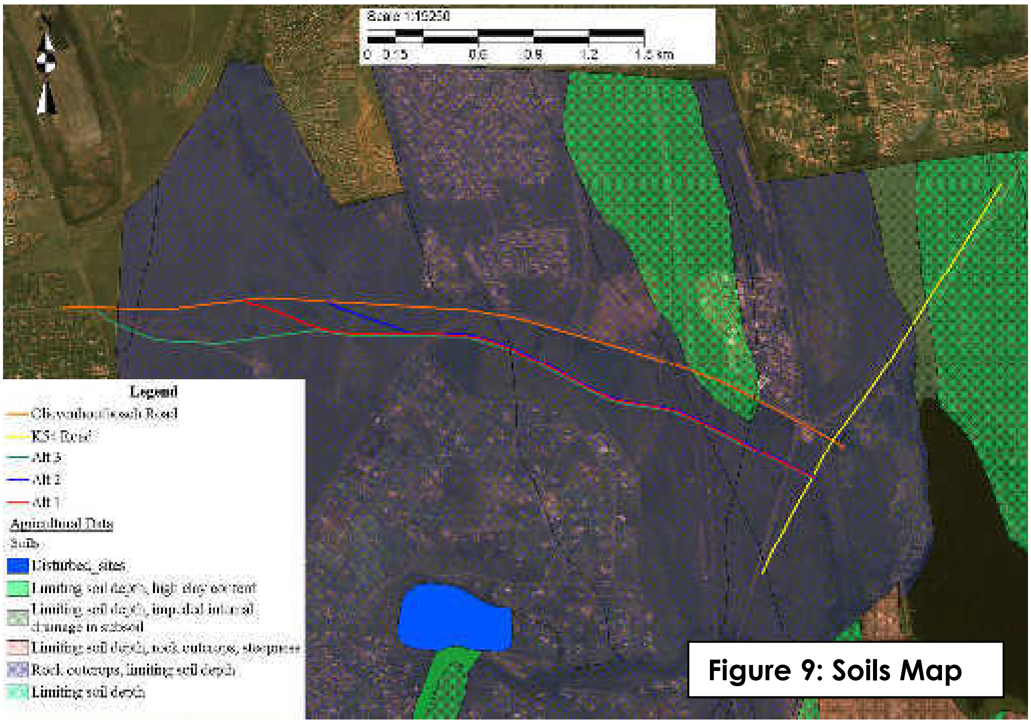


Figure 9: Soils Map

Table 4: Issues and Impacts – Geology and Soils

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼
1)	Risk for formation of sinkholes and dolines	-	☺
2)	Stability of road and structures	-	☺
3)	Excavatability problems are foreseen and some blasting exercises may be required	-	☻
4)	Potential damage to metallic elements placed underground due to corrosive soils in dolomitic areas	-	☻
5)	Erosion	-	☺
6)	Stockpile areas for construction materials and topsoil	-	☺

6.1.1.a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation – geology and soils

1) Risk for formation of sinkholes and dolines

The entire route, approximately **4Km,** is underlain by dolomite and the development of sinkholes and dolines are possible if poor water management takes place. Where the blanket cover is removed during road construction and changes in the ground and surface water regime occur, the potential risk for the development of sinkholes and dolines is increased.

Table 5: Significance of Issue 1 (Risk for formation of sinkholes and dolines) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate,

		but not regarded as a fatal flaw **NP**
Medium ☺	**P & C –** The NHBRC precautionary measures for development in dolomitic areas must be implemented. **P, C & O** – Stormwater management is extremely important and must be designed to prevent the concentrated ingress and ponding of water. **P, C & O** –The road should preferably be at ground level to facilitate drainage i.e. the natural drainage paths should not be disturbed and the road should be used to facilitate storm water drainage. **P, C & O** – Wet surfaces such as water supply lines must preferably not run close to (within 10m) along the road. Where such a service crosses the road alignment, all due care should be taken to ensure that the pipe does not leak. **O -** A monitoring plan must form part of the general maintenance plan for the road and allowance must be made for stability problems to be addressed immediately.	**M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

2) Stability of road and structures

Transported collapsible material covers much of the area and colluvium and residual material on the dolomitic areas may also be collapsible.

Table 6: Significance of Issue 2 (Stability of structures) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P & C –** The precautionary measures and foundation design from the involved geotechnical engineers must be implemented to ensure the stability of structures and embankments. **P & C** – The dolomite stability along the route must be determined. **P & C** – More detailed foundation investigations should be conducted for structures such as bridges and culverts.	**M** **-** To be included in EMP **M** **-** To be included in EMP **M** **-** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

3) Excavatability problems are foreseen and some blasting exercises may be required

Excavation problems are expected on the areas underlain by quartzite and andesite and blasting may be required for deep excavations.

Table 7: Significance of Issue 3 (Excavatability problems are foreseen and some blasting exercises may be required) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** – Surrounding residents must be informed of blasting exercises at least one week in advance. **C** – Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.	**M -** To be included in EMP **M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

4) Corrosive nature of the soils

Potential damage to metallic elements placed underground due to corrosive soils in dolomitic areas.

Table 8: Significance of Issue 4 (Corrosive nature of the soils) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P & C –** All metallic elements used must be galvanised or protected by other anti-corrosive methods.	**L -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

5) Erosion

Unnecessary clearing of vegetation could lead to exposed soils prone to erosive conditions. Insufficient soil coverage after placing of topsoil, especially during construction where large surface areas are applicable could also cause erosion. To cause the loss of soil by erosion is an offence under the Soil Conservation Act (Act No 76 of 1969). The management of surface water run-off during construction is very important to prevent soil erosion on the site. If construction takes place during the rainy season, sufficient storm water management will be required to manage water runoff.

Table 9: Significance of Issue 5 (Erosion) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P & C –** A storm water management plan must be compiled for the construction and operational phases of the proposed road.	**H - To be included in EMP**
	P & C – Cut-off drains should be excavated up- and down-hill of denuded areas to reduce run-off across these areas.	**M -** To be included in EMP
	P & C – Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.	**M -** To be included in EMP

	P & C - Rehabilitate exposed areas immediately after construction in these areas is completed (not at the end of the project).	**L -** To be included in EMP
	P & C – Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.	**L -** To be included in EMP
	P – Specifications for topsoil storage and replacement to ensure sufficient soil coverage as soon as possible after construction must be implemented.	**L -** To be included in EMP
	P & C – All embankments must be adequately compacted and planted with grass to stop any excessive soil erosion and scouring of the landscape.	**L -** To be included in EMP
	C – Storm water diversion measures are recommended to control peak flows during thunder storms.	**M -** To be included in EMP
	P & C – The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas.	**M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

6) Stockpile areas for construction materials and topsoil

Designated areas for stockpiling of construction materials must be specified by the Environmental Control Officer in an area that is already disturbed. Stockpiling in the wrong areas might be detrimental to fauna and flora and will deplete the soil quality. Topsoil should be stockpiled as specified in the EMP to ensure that the soil quality doesn't deplete and that the grass seed remain in the soil for later rehabilitation of the disturbed areas.

In addition to the impact discussed in the paragraph above, rainwater falling onto stockpiles may become polluted with dust originating from aggregate and other construction material, such as bitumen from pre-mix stockpiles. Therefore stockpiles of topsoil should be correctly covered to prevent this as well as loss of topsoil by wind erosion.

The footprint of stockpile areas will be contaminated with the stored material and will require cleaning before rehabilitation.

Table 10: Significance of Issue 6 (*Stockpile areas for construction materials and topsoil)* After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**C** - Remove vegetation only in designated areas for construction.	**M** - To be included in EMP
	C - Rehabilitation works must be done immediately after the involved works are completed	**M** - To be included in EMP
	C -All compacted areas should be ripped prior to them being rehabilitated/landscaped;	**M** - To be included in EMP
	P/C - The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled	**M**- To be included in EMP

	material should be used for the rehabilitation of the site and for landscaping purposes **C** - Strip topsoil at beginning of works and store in stockpiles no more than 1,5 m high in designated materials storage area. **C** – Stockpiles should be covered correctly	 **M-** To be included in EMP **M-** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

6.1.2 Hydrology

(Refer To Figure 10: Hydrology Map).

6.1.2.1 Surface Hydrology

The Olievenhoutbosch Road reserve falls within the Crocodile catchment basin. The route slopes towards the Sesmylspruit is situated to the south of the involved section of the route.

Floodlines

The involved section of Olievenhoutbosch Road does not cross any rivers and is not influence by 1:100 year floodlines. However, a non-perennial river flows just to the south of the proposed alignments as indicated on ***Figure 10, Hydrology Map***

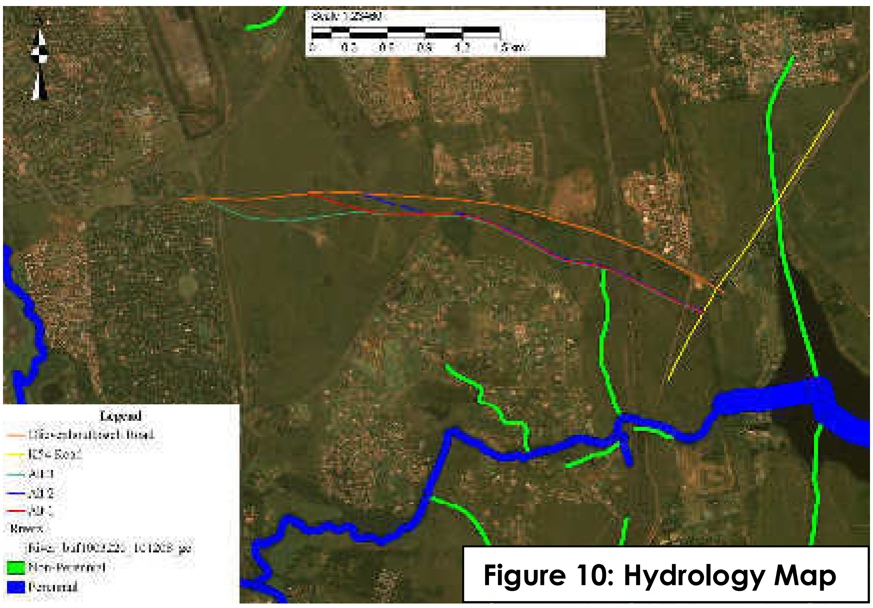


Figure 10: Hydrology Map

6.1.2.2 Sub-Surface Hydrology

The study area is underlain by dolomite, which is regarded as a valuable aquifer that must be protected. The dolomitic formation is regarded as the best aquifer in South Africa and ground water pollution risks in dolomitic areas are high. Dolomite has very high yielding and storage capacity. It also has high recharge potential estimated at 10 to 20% of the annual rainfall. When development takes place in and around dolomitic areas, ground water pollution management plays an important role in the planning, construction and operational phases.

It is known that karst features develop in the dolomites and the occurrence of sinkholes and dolines are mainly due to disturbance in the natural surface drainage. This occurs especially in areas where the overburden is relatively thin.

Table 11: Issues and Impacts – Hydrology

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact/ Neutral - Not Necessary To Mitigate ☼**
7)	Siltation, erosion and water pollution could occur in the Sesmyl Spruit and associated wetlands and systems lower down in the catchment area if a stormwater management plan is not implemented.	-	☺
8)	Groundwater pollution and contamination of the Sesmyl Spruit and associated wetlands.	-	☺
9)	Perched water conditions	-	☺
10)	Increased storm water runoff from road into surrounding natural areas	-	☻

6.1.2.2.c Discussion of issues identified, possible mitigation measures and significance of issue after mitigation - Hydrology

7) Siltation, erosion and water pollution could occur in the Sesmylspruit and associated wetlands due to a lack of suitable storm water management measures during construction and operational phases.

If erosion, siltation and water pollution is not addressed, the sustainability of the wetlands crossed by the proposed road and the open space systems lower down in the catchment area can be negatively impacted by the development.

More impermeable surfaces will lead to an increase in the speed, quantity and quality of the storm water and erosion could be caused at discharge points of storm water.

Table 12: Significance of Issue 7 (Siltation, erosion and water pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/ C / O –** The storm water design for the proposed road must be designed to: - Reduce and/ or prevent siltation, erosion and water pollution. - Storm water runoff should not be concentrated as far as possible and sheet flow should be implemented.	**M -** To be included in EMP

	- The vegetation must be retained as far as possible, and rehabilitated if disturbed by construction activities to ensure that erosion and siltation do not take place.	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

8) Groundwater pollution and contamination of Sesmylspruit

The dolomitic formation is regarded as one of the best aquifer in South Africa and it has a very high yielding and storage capacity as well as a high recharge potential. The ground water pollution potential on the study area is regarded as high and if not planned and managed correctly, the construction and operational phases of the proposed road could cause sub-surface water pollution as discussed below.

Uncontrolled construction activities could cause run-off contaminated with silt or cement to reach the wetlands, streams and spring, leading to water contamination. Accidental spillages of diesel, oil or other hazardous substances could contaminate soil, leach into the groundwater or reach the water bodies through run-off.

The storm water management plan must be designed to:

- Reduce and/ or prevent siltation, erosion and water pollution; and
- Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area.

Table 13: Significance of Issue 8 (Ground water pollution and contamination of Sesmylspruit) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after

High ☻ **Medium** ☺ **Low** ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C/O** - Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project. **P/C** – Bridges or other infrastructure to cross the stream and drainage line should be constructed first to allow the remainder of the work to be undertaken on grade and should preferably be constructed during the dry season. **P/C** – Containment of run-off from construction areas should be implemented and the streams closed off from access by construction workers. **P/C** – Cut-off drains should be trenched between the streams and the construction activities and hay bales should be stacked along the trenches where possible to contain siltation. **P/C/O** – All spillages must be cleaned up and contaminated soil removed as hazardous waste.	**M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP **M** - To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

9) Perched water

A perched water table may be locally present on the mudrock areas, especially during wet seasons.

Table 14: Significance of Issue 9 (Perched water) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C/O** - Special drainage designs will be required in mudrock areas, especially during wet seasons. **P/C** – Precautionary measures to prevent seepage of groundwater into excavations should be implemented.	**M** - To be included in EMP **M** - To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

10) Increased storm water run-off from the proposed road into surrounding natural areas.

The proposed road will add a large amount of hard surfaces and will also lead to the compaction of soils. The soil layers will thus become less permeable, storm water will be canalised rather than evenly spread. The quantity and speed of the storm water will increase significantly and the quality of the surface water will deteriorate, because of the lack of vegetative coverage. Erosion and siltation will also become a problem.

In order to address this issue, it will be necessary to compile a storm water management plan/ system for the proposed development.

Table 15: Significance of Issue 10 (Increased storm water run-off from the proposed road into surrounding natural areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P -** Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project. **P/ C / O -** The storm water management plan must be designed to: • Reduce and/ or prevent siltation, erosion and water pollution. • Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area; and • Ensure that no ponding of water and concentrated ingress of water take place.	**M - T**o be included in EMP and conditions of approval **M - T**o be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

6.1.3 Topography

According to the GDARD C-plan version 2 the proposed route is not located on a ridge in the western and eastern areas **(refer to Figure 11, Ridges and Figure 12, Preliminary Visual Assessment**) The route slopes towards the Sesmylspruit as indicated on ***Figure 10, Hydrology Map.*** Due to the gently undulating topography only sections of the proposed road will be visible from the various view sheds that surround the study area. It will be partially visible from the proposed 5'o Clock Site situated to the North. ***Refer to Figure 12, Visual Assessment.***

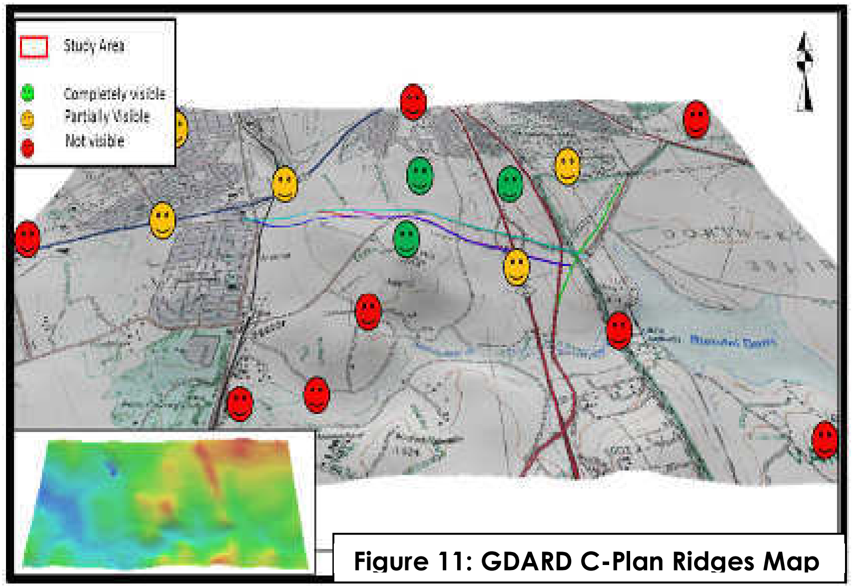


Figure 11: GDARD C-Plan Ridges Map

The proposed Olienenhoutbosch Road will be in line with the development planning for the area.

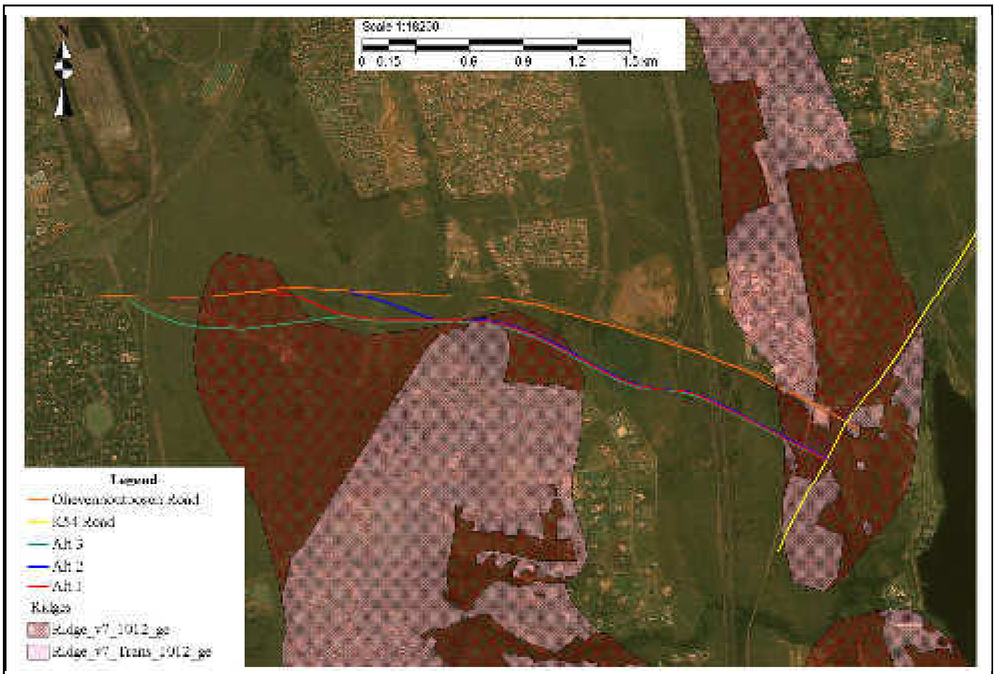


Figure 12: Preliminary Visual Assessment

Table 16: Issues and Impacts – Topography

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼**
11)	Due to the topography only section of the proposed road will be visible from the surrounding view-sheds. It will be partly visible from the proposed 5 O' Clock Site situated to the north.	**-/+** Depending on the architectural style and finishes	☺

6.1.4.a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

11) Due to the topography only sections of the proposed road will be visible from surrounding view-sheds.

Mitigation measures to restrict/ prevent the visual impacts of the road will have to be implemented.

Table 17: Significance of Issue 11 (only sections of the proposed road will be visible from surrounding view-sheds in the Flatter Areas around the Study Area) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal

		flaw **NP**
Medium ☺	**P/C/O -** Possible mitigation measures that could be considered are the establishment of dense vegetation at strategic points to screen-off the most visible sections of the roads / construction of berms adjacent to the road/ a combination of berms with vegetation.	**M –** To be incorporated as part of the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.1.4 Climate

The climate is typical of the Transvaal Highveld. The summers are mild to hot and the winters are mild. It is a summer rainfall region with a mean annual precipitation of approximately 700mm. The moisture index is between 0 – 20, indicating a sub-humid area. The climatological data for the site was taken from the weather station in Irene.

Wind

Summer prevailing winds northwest, winter winds southeast.

Temperature °C

Maximum 26.7 °C, minimum 14.4 °C in summer. Winter temperature maximum 18.2 C, minimum 2.7°C.

Rain

Maximum rainfall 960mm, minimum 559mm, with an average of 717mm.

Mist

10 Days

Lighting

87 Days

Hail

4 Days

Table 18: Issues and Impacts – Climate

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼**
12)	Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes road construction and environmental rehabilitation works extremely difficult.	-	☻
13)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem.	-	☻

6.1.5.a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

12) Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas.

These wet conditions often cause delays to building projects and the draining of water away from the construction works (in the case of high water tables) into the Sesmylspruit and associated wetlands, could (if not planned and managed correctly) have an impact on the water quality of these water bodies.

It is recommended that the construction of bridges/culverts over stream crossings be scheduled for the dry season to decrease the impact on the environment and to prevent damage to structures due to flooding.

Table 19: Significance of Issue 12 (Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C** – Construction workers and construction vehicles and machinery must stay out of the soggy areas during the wet periods. Barrier tape should be used to demarcate the areas that are drenched with water (especially the ecologically sensitive wetland area and the areas covered with valuable topsoil) and it should only be removed when the appointed Environmental Control Officer (ECO)/ site supervisor/ project manager/ main contractor regard the conditions in the affected areas as favourable. **P/C** – It is recommended that the construction of	**M** - To be included in EMP **M** - To be included in EMP

	bridges/culverts over stream crossings be scheduled for the dry season.	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

13) If dry and windy conditions occur during the construction phase, dust pollution could become a problem.

Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes road construction and environmental rehabilitation works extremely difficult especially in flood line and wetland areas.

If dry and windy conditions occur during the construction phase, dust pollution could become a problem. During the summer months dust pollution could be carried over the properties to the north of the study area (i.e. the 5 O' clock Site) and during the winter months dust could be carried over the R21 freeway and properties to the south of the study area (i.e. the proposed Irene and Cornwall areas).

Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day.

Table 20: Significance of Issue 13 (Dust Pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High** ☻ **Medium** ☺ **Low** ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal

		flaw **NP**
High ☻	**P/C –** Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day.	**L - T**o be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.2 The Biological Environment

Biodiversity Requirements

GDARD required specialist biodiversity studies to investigate the following aspects:

- Plants, with specific reference to *Cheilanthes deltoid, Brachycorythis anica, Habenaria mossii, Gnaphalium nelsonii, Herbenaria kraenzliniana, Trachyandra erythrorrhiza and Lithops lesliei;*
- Birds, with specific reference to *Eupodotis senegalensis;*
- Mammals, with specific reference to *Aterlerix frontalis*;
- Wetlands;
- Rivers;
- Caves, and
- Vegetation.

Refer to Annexure F for Biodiversity information received from GDARD.

Galago Environmental CC was appointed to conduct a flora, mammal, bird, reptile and amphibian survey for the involved section of Olievenhoutbosch Road *(refer to Annexure G1 for the report).*

6.2.1 Vegetation

The proposed route lies in the quarter degree grid cell 2528CC (Centurion) and 2528CD (Rietvlei Dam) passes through two vegetation units that Mucina and Rutherford (2006) classified as Rand Highveld Grasssland (the eastern most part of the route) and Carletonville Dolomite Grassland. Small parts of this unit are conserved in statutory reserves and a few private conservation areas. Cultivation, urbanization, mining and the building of two dams already transform almost a quarter of the unit.

Carletonville Dolomite Grassland was described as a species-rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges. This vegetation unit was considered vulnerable. Small parts of this unit are conserved in statutory reserves and a few private conservation areas. The conservation target of both units is 24%. Almost 50% of the Rand Highveld Grassland unit and almost a quarter of the Carltonville Dolomite Grassland have already been transformed by cultivation, plantations, mining, urbanization and dam-building.

The Rand Highveld Grassland is according to the authors a highly variable landscape with extensive sloping plains and a series of slightly elevated ridges. The vegation is species-rich, wiry, sour grassland, characterized by *Themeda, Eragrostos, Heteropogon* and *Elionurus,* alternating whit low sour scrubland on rocky outcrops and steeper slopes. Typical herbs mostly belong to the Asteraceae and rocky ridges carry sparse woodlands with *Acacia caffra* and *Celtis africana* accompanied by rich suite of shrubs with the genus *Searsia* most prominent.

Both vegetation units fall within a warm-temperate summer-rainfall region with high summer temperatures and severe frequent winter frosts.
Six plant communities were identified during the vegetation survey ***(refer to Figure 13)***:

- *Eragrostis - Hyparrhenia grassland;*
- *Tristachya – Monocymbium Chert;*
- Mixed alien and indigenous vegetation;

- Quartz slope vegetation;
- Acacia Karroo woodland; and
- Mixed grassland on shallow dolomite.

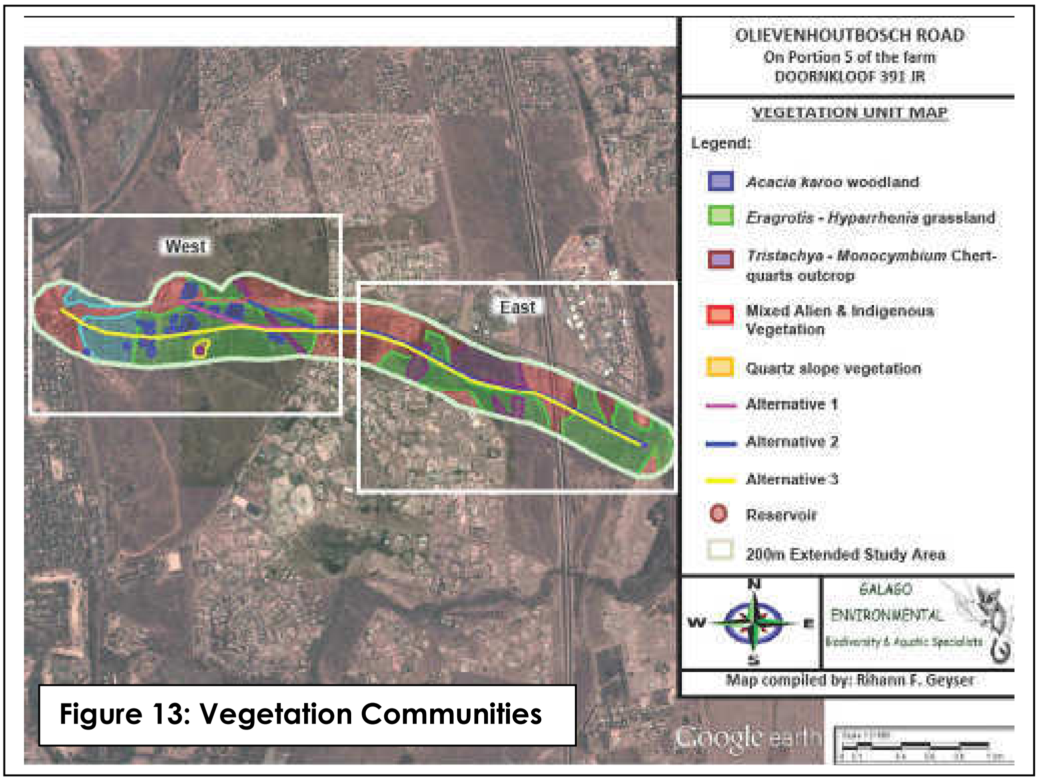


Figure 13: Vegetation Communities

- ***Eragrostis* - Hyparrhenia grassland**

<u>Compositional aspects</u>

According to Galago Environmental the study unit comprised dense natural grassland that straddled the R21 highway. Connectivity with natural grassland existed to the south, but was limited by various roads and the Sesmyl Spruit. Of the 239 plant species recorded along the proposed road 138 were recorded in the *Eragrostis - Hyparrhenia grassland*, 131 were indigenous species ***(refer to Annexure G1, Appendix A, Section 6.6.1).***

<u>Red – and orange-listed species</u>

The habitat of the study unit was **suitable for two of the Red-listed plant species** known to occur in the quarter degree grid square, but none, however, founded in this study unit within 200 metres of the proposed route. A few specimens of the Organge List were found: ***Boophone disticha, Eucomis autumnalis and Hypoxis hemerocallidea.***

<u>Medicinal and alien species</u>

Twenty-eight of the 43 medicinal species recorded in the vicinity of the proposed route were found in the study unit. Of the 23 alien species recorded in the vicinity of the proposed route 7 were found in this vegetation community. Of these, one species were **Category 1 Declared weeds**.

Connectivity and Sensitivity

This vegetation community was **not considered sensitive** by Galago Environmental.

Figure 14: *Eragrostis* - Hyparrhenia grassland east of the highway R21

Refer to Table 3, Appendix A, Annexure G1 for plants recorded in the Eragrostis - **Hyparrhenia grassland**

- ***Tristachya – Monocymbium Chert;***

Compositional aspects

This study unit comprised natural primary grassland on outcrops of chert and quartz. Large areas of the study unit were disturbed by roadworks, especially south of Nellmapius Road. Roads and township development limited connectivity with natural grassland. Of the 239 plant species recorded along the proposed route 61 were recorded in the Tristachya – Monocymbium Chert – Quartz outcrop study unit. Of these, 59 were indigenous species. ***(refer to Annexure G1, Appendix A, Section 6.7.1).***

Red – and orange-listed species

According to Galago Environmental the habitat of the study unit was suitable for the Red-listed *Cheilanthes deltoidea subsp silicicola* known to occur in the quarter degree grid square. A few specimens of this species were found in the chert outcrop northwest of the endpoint of Alternative route 2. None were found in those parts of the *Tristachya – Monocymbium Chert – Quartz outcrop* study unit east and south of Nellmapius Road. The habitat is suitable for the Orange-listed *Callilepis leptophylla,* but none were found.

Medicinal and alien species

Nine medicinal species and two alien species were recorded in this study unit within 200 metres of the proposed route. Of the alien species one was a **Category 1 Declared weed.**

Connectivity and Sensitivity

The study unit was considered **sensitive** by Galago Environmental.

Figure 15: ***Tristachya – Monocymbium Chert south of Nellmapuis Road***

Refer to Table 4, Appendix A, Annexure G1 for plants recorded in the Tristachya – Monocymbium Chert

- **Mixed alien and indigenous vegetation**

<u>Compositional aspects</u>

Areas along the proposed route where alien species have invaded as a result of introduced soil and areas were the ground was cleared and road construction have started were included in this study unit together with thickets of Black wattle and Eucalyptus sp.

The species diversity was low. Of the 239 plant species recorded, 52 were in the Mixed alien and indigenous vegetation study unit. Of these, 32 were indigenous species. ***(refer to Annexure G1, Appendix A, Section 6.8.1).***

Red – and orange-listed species

The habitat was **not suitable** for any of the Red List or Orange List species known to occur in the quarter degree grid cell.

Medicinal and alien species

Seven medicinal species were recorded in this study unit. Twenty of the 23 alien species were **Category 1 Declared weeds**, two were **Category 2 Declared invaders** and two were **Category 3 Declared invaders**.

Connectivity and Sensitivity

The study unit was not considered sensitive by Galago Environmental.

Refer to Table 5, Annexure G1 for a list of the plants recorded in the Alien and indigenous vegetation and cultivated fields.

Figure 16: Mixed alien and indigenous vegetation

- **Quartz slope vegetation**

Compositional aspects

The study unit comprised a quartz koppie with a large water reservoir in its centre. Access and service roads for the reservoir disturbed the natural vegetation. Connectivity with natural grassland existed in all directions.

Of the 239 plant species recorded, 34 were in the Quartz slope vegetation study unit. Of these, 33 were indigenous species. ***(refer to Annexure G1, Appendix A, Section 6.9.1).***

Red – and orange-listed species

The habitat was **suitable** for any of the Red List species *Holothrix randii* known to occur in the quarter degree grid cell, but none were found during the site visit. The habitat was suitable for three of the Orange List species, two of these species, *Boophone disticha* and *Hypoxis hemerocallidea* were found on the study unit.

Medicinal and alien species

43 medicinal species were recorded in this study unit. Fifteen were found in the Quartz slope vegetation study unit. One alien species that was not a declared invader was recorded on the study unit.

Connectivity and Sensitivity

As the habitat was suitable for the presence of the Red List *Holothrix randii* and no declared invaders were present, this study unit was considered **sensitive** by Galago Environmental. ***Refer to Table 6, Annexure G1 for a list of the plants recorded in the Alien and indigenous vegetation and cultivated fields.***

Figure 17: Quartz slope vegetation on reservoir koppie

- **Acacia Karroo woodland**

Compositional aspects

This study unit comprised copses of indigenous trees and shrubs in natural grassland. Connectivity with natural grassland existed to the south. The species diversity of this study unit was high.

Of the 239 plant species recorded along the proposed route 81 were recorded in the Acacia karroo woodland study unit. Of these, 75 were indigenous species. ***(Refer to Annexure G1, Appendix A, Section 610.1).***

Red – and orange-listed species

The habitat was not **suitable** for any of the Red List species known to occur in the quarter degree grid cell, but was suitable for three of the Orange List species *Hypoxis hemerocallidea*, but none were found on the study unit.

__Medicinal and alien species__

43 medicinal species were recorded in this study unit. Twenty were found in the Acacia Karroo woodland study unit. Six alien species of which one was a **Category 1 Declared weed** was recorded on the study unit.

__Connectivity and Sensitivity__

The study area was **not considered sensitive** by Galago Environmental. ***Refer to Table 7, Annexure G1 for a list of the plants recorded in the Alien and indigenous vegetation and cultivated fields.***

Figure 18: Copes of trees in the *Acacia karroo woodland*

- **Mixed grassland on shallow dolomite**

__Compositional aspects__

This study unit comprised natural primary grassland that was severely disturbed by road works. The species diversity of the mixed grassland on shallow dolomite study unit within 200 meters of the proposed route was much lower than that recorded during earlier unrelated surveys. Of the 239 plant species recorded along the proposed route 89 were recorded in mixed grassland on shallow dolomite the study unit. Of these, 87 were indigenous species. ***(Refer to Annexure G1, Appendix A, Section 6.11.1).***

Red – and orange-listed species

The habitat was **suitable** for two of the Red List species known to occur in the quarter degree grid cell. A specimen of the Red List *Melolobium subspicatum* and a few specimens of the Orange List *Hypoxis hemerocallidea* were found in this study unit.

Medicinal and alien species

43 medicinal species were recorded in this study unit. Seventeen were found in mixed grassland on shallow dolomite the study unit. Two alien species of which one was a **Category 1 Declared weed** was recorded on the study unit.

Connectivity and Sensitivity

The study area was considered **sensitive** by Galago Environmental. A 200-meter buffer should be maintained around the Red List species. ***Refer to Table 8, Annexure G1 for a list of the plants recorded in the Alien and indigenous vegetation and cultivated fields.***

Figure 19: Mixed grassland on shallow dolomite

Findings by Galago Environmental and Potential Implications

From the vegetation assessment **six plant communities** were identified:

- *Eragrostis - Hyparrhenia grassland;*
- *Tristachya – Monocymbium Chert;*
- Mixed alien and indigenous vegetation;
- Quartz slope vegetation;
- Acacia Karroo woodland; and
- Mixed grassland on shallow dolomite.

The **vegetation study** stated that the Red List *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. The *Tristachya – Monocymbium Chert* – Quartz outcrop, the Quartz slope vegetation and the Mixed grassland on shallow dolomite study units were considered **sensitive** and construction activities within these areas should be kept strictly within the pipeline reserve. All Declared Weeds and invaders and other alien species in the vicinity of the proposed pipeline must be removed and a management plan for the continuing control of the aliens be implemented. **Alternative route 2** will have the least negative impact on the grassland of the study site and is the preferred route. ***Refer to Figure 20, Fauna and Flora Sensitivity map.***

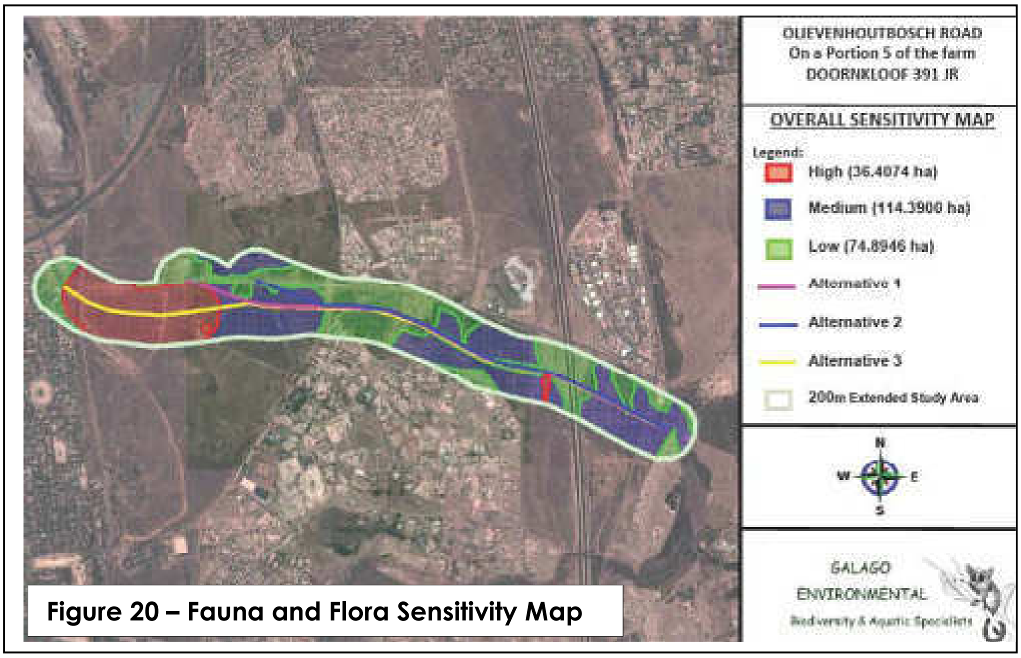


Figure 20 – Fauna and Flora Sensitivity Map

6.2.2 Fauna

6.2.2.1 Mammals

The mammal study conducted by Galago Environmental found that the alternative routes will not affect any significant mammal habitats warranting species consideration, or ecologically sensitive areas. The route along the suggested route, together with other roads under construction and suburbs under consideration will further partition the area into smaller and ecologically less viable units.

The local occurrences of mammals are, on the other hand, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. Sight records and information from residents or knowledgeable locals audit such deductions.

Even during historical times the three alternative routes together with their adjacent 500 meters extended study areas were depauperate of mammals, considering the absence of arboreal, rupiculous and wetland habitats providing 'lebensraum' for discerning species. With the advent of civilization and escalating land-use practices not conducive to nature conservation, natural biota declined dramatically and continuing to do so.

Mammal Habitat Assessment

According to Galago Environmental Terrestrial habitat dominates along the combined and individual alternative routes. Generally the basal cover existed of mature stands of indigenous grass, which judged by detritus on the ground are regularly subjected to winter fires. During the end of summer the grass cover provide ample cover and nourishment to small mammals. Within the 500 meters extended study area of Alternative 3 is a solitary wooded koppie. Considering the isolated nature of this habitat type only very robust rupiculous species can be expected such as the Namaqua rock rat and rock elephant shrew. Galago stated that no Red Data species can be expected such as the rock dormouse. According to Galago there are no significant wetlands and/or permanent streams. Exotic trees predominate, whereas indigenous trees are solitary and geographically too isolated to allow for the occurrence of arboreal mammals.

There are no bat caves requiring special consideration.

Findings by Galago Environmental

The mammal study found that the alternative routes will not affect any significant mammal habitats warranting species consideration, or ecologically sensitive areas. It is recommended that Alternative 2 is selected since it is shorter and since it will not affect the isolated koppie.

6.2.2.2 Avifauna

Avifaunal Habitat Assessment

Two major avifauna habitat systems were identified:

- **Open grassland**

The largest portion of the study site consists of a mixture of disturbed and undisturbed grassland with scattered trees and rocky outcrops with hardy woody vegetation. Open grassland is the most important habitat type for South Africa's threatened bird species in the region with a proportional importance of 27%. The highest diversity of threatened bird species occurs within this grassland habitat of which many are in the highest category of threat (Barnes, 2000). The presence and abundance of bird species in this habitat will vary from season to season being lush and green in summer after summer rains and dry and brown or burnt during winter. The area will favour ground living bird species such as lapwings, francolins, pipits, long claws, larks and chats that either hunt for insects or breed on the ground, in barrows in the ground or between the grasses. Weavers and widow-birds will make use of this area for feeding (seeds) during late summer and early winter when the grass is not burst and widow-birds and cisticolas will also breed in the tall grass during summer. Aerial feeding birds such as martins, swifts and swallows will hunt for insects over the grasslands.

- **Exotic vegetation**

Exotic alien tress species has taken over an area with open natural grassland vegetation, these alien species largely consisting of mainly *Eucalyptus* and Wattle Trees. Exotic vegetation usually does not offer a large variation in plant communities and these trees are mostly unpalatable in their growing and live stage for insect and game species. As a result only a few insect-eating bird species will occur within these plantations. A number of nectar feeding species such as white-eyes and sunbirds will feed on the nectar produced by the flowers of these trees. Some birds also make nest in these trees. A few bird of prey species, which requires tall trees for nest building, ranges have increased due to the presence of these trees. These include Black Sparrow Hawk and Ovambo Sparrow Hawk. No or little grass growth takes place on the ground where these trees grow and seed-eating species are few. These trees are known to extract large volumes of water daily and the surrounding ground is normally hard and dry.

Findings by Galago Environmental and Potential Implications

The **avifauna** assessment found that although the natural open grassland area offers habitat for Red Data avifaunal species (Lesser Kestrels), they are only likely to move through the area on rare occasions. This is attributed to disturbance of the area on and surrounding the study site due to human presence and human related activities and also development surrounding the study site and the fragmented state of the natural grassland.

This alternative 2 is recommended since this will have a minimum impact on the natural vegetation on the study site and the avifaunal species recorded on or that are likely to occur on the study site.

6.2.2.3 Invertebrate survey

The **herpetological** study found that the proposed development routes are relatively small, but there is a chance that at least one of the three Red Data herpetofaunal species of the Gauteng Province may occur on the site. The man-made dam/wetland adjacent to the study site is a potential breeding site for the giant bullfrog and there is a good possibility that giant bullfrogs may use the study site as a dispersal area, which combines feeding and aestivation.

If the proposed development should go ahead, an important indirect effect would be the likely impact that the proposed development might have on the surface water runoff and water quality of the catchment area. This could have a negative impact on the herpetofauna. This is especially true for the drainage line which flows into the Sesmyl Spruit.

The effects could be ameliorated by the construction of retention ponds, which would retard discharge into the catchment area and improve the water quality of the discharge.

6.2.2.3 Ecological conditions of the ridge

The **ecological conditions of the ridge** assessment found that transformation of vegetation owing to present excavations, scraping or other disturbances are clear at the site. Exotic weeds and annual pioneer grass species invade such disturbed patches.

• Overall Alternative 2 appears to be ecologically the least sensitive strip.

• Alternative 3 is not preferred. This proposed alternative 3 passes the quartzite ridge and the lower dolomitic slopes near areas where a Threatened plant species, *Melolobium* *subspicatum* are present. Furthermore alternative 3 crosses sensitive ecosystems notably the ***Acacia robusta – Panicum maximum as well as the Sporobolus festivus – Hyparrhenia*** hirta assemblages. The slopes of the quartzite koppie as well as the intersection between the dolomite and chert approaches a habitat which may be suitable for the rare and threatened fruit chafer beetle, Ichnestoma stobbiai.

• Ichnestoma stobbiai is an endangered fruit chafer (Scarabaeidae: Cetoniinae) that occurs in small habitat fragments of South Africa (Kryger & Scholtz, 2008). The adults of this species are short-lived and the females are flightless. Thus, the vagility of these beetles is extremely low (Kryger & Scholtz, 2008). The species I. stobbiai (Holm, 1992) is thought to occur in a very restricted area in and around Gauteng Province and all habitat patches should be protected (Kryger & Scholtz, 2008; Deschodt, Scholtz & Kryger, 2009). Unlike most cetoniine larvae, the larvae of this species usually occur in dolomitic to cherty, well-drained soils (Deschodt, Scholtz & Kryger, 2009).

• A Class 3 rocky ridge is present at all the intersections of rocky ridges with the proposed strip allocated for the development.
• Fire and frost probably play an important role in maintaining the grassland at the ridge and therefore a burning programme is desirable.
• In an increasingly urbanised area, the possible conservation importance value of rocky ridges is underlined at the site both in terms of remarkable diversity and as refuge for threatened species.
• Though a class 3 rocky ridge is present it is believed that near pristine patches of rocky ridge may still be conserved at the site.
• Proper ecological planning and actions are urgent and include:

- ➢ The eradication of invasive exotic plant species at the site.
- ➢ Development of conservation infrastructure that would avoid the continuous trampling, excavations and informal dumping which are present in the area.
- ➢ The zoning of habitats where threatened species occur as a no-go area for any developments.

It appears that Alternative 3 will have an undesirable impact on an ecosystem of high conservation priority and that Alternative 2 in terms of biodiversity and ecosystem functioning is the preferable option.

Recommended mitigation measures from Galago Environmental

- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the proposed route, but would otherwise be destroyed during construction, should be used for re-vegetation / landscaping purposes.
- Should hedgehogs be encountered during the construction phase, these should be relocated to natural grassland areas in the vicinity.
- Should Bullfrogs or any herpetological species be encountered during the construction phase of the proposed development, these should be relocated to natural grassland areas in the vicinity or the Rietvlei Nature Reserve nearby.
- The contractor must ensure that no herpetofaunal species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed.
- All storm water structures should be designed so as to block amphibian and reptile access to the road surface.
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the road development (during both the construction and operational phases) will be

managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.

- Where the roads traverse the drainage line, an underpass should provide for the movement of aquatic as well as terrestrial species.
- A barrier (either prefab concrete wall or galvanized sheeting that extends as a continuous sheet above ground for at least 40cm and below ground for at least 30cm) that will physically block animals from accessing the road surface should be constructed for a distance of 200m on either side of all aquatic and terrestrial underpasses. Holes under barriers should be routinely filled in and areas directly adjacent to the barrier should be kept free of vegetation.

Table 21: Issues and Impacts – Flora and Fauna

	Issue/ Impact	**Positive/ Negative / Neutral ±**	**Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼**
14)	Impact on natural grassland areas	-	☺
15)	Impact on Sesmyl Spruit and associated wetland	-	☺
16)	The eradication of weeds and exotic invaders	+	☼
17)	If the entire road alignment area is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.	-	☺
18)	Noise of construction machinery could have a negative impact on the fauna species during the construction phase.	-	☺
19)	During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.	-	☻

20)	Loss of habitat can lead to the decrease of fauna numbers and species.	-	◘

6.2.2.a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

14) Impact on natural grassland areas

The largest portion of the study site consists of a mixture of disturbed and undisturbed grassland with scattered trees and rocky outcrops with hardy woody vegetation. Alternative 2 is recommended since this will have a minimum impact on the natural vegetation.

Table 22: Significance of Issue 14 (Impact on natural grassland areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C/O** – No plants not indigenous to the area or exotic plant species, especially lawn grasses and other ground-covering plants should be used as soil-binding agents along new road verges as they will drastically interfere with the nature of the area. **P/C/O** – All Category 1 Declared Weeds and other	**M** -To be included in EMP **M** -To be included in EMP

	alien species must be removed from the vicinity of the proposed route.	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

15) Impact on Sesmylspruit and associated wetland

The route slopes towards the Sesmylspruit situated to the south of the involved section of the route and associated wetland and will have an impact on the riparian vegetation in these areas.

Table 23: Significance of Issue 15 (Impact on Sesmylspruit and associated wetland) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High** ☻ **Medium** ☺ **Low** ◘ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C/O** – It is suggested that where work is to be done close to the drainage lines, these areas **be fenced off during construction** to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system. **P/C -** Care must be taken to	**M -T**o be included in EMP **M -T**o be included in EMP

	ensure that construction activities remain within the boundary of the planned road reserve.	
	P/C - Site offices, parking areas for construction vehicles, etc. should be confined to non-sensitive areas.	**M -T**o be included in EMP
	P/C - No vehicles must be allowed to move in or across the wet areas or spruit and possibly get stuck. This leaves visible scars and destroys habitat. It is important to conserve areas where there are tall reeds or grass and areas where there are short grass and mud.	**M -T**o be included in EMP
	P/C/O – No plants not indigenous to the area or exotic plant species, especially lawn grasses and other ground-covering plants should be used as soil-binding agents along new road verges as they will drastically interfere with the nature of the area.	**H -T**o be included in EMP
	P/C/O – All Category 1 Declared Weeds and other alien species must be removed from the vicinity of the proposed route.	**H -T**o be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

16) The proposed development will result in the eradication of exotic invaders and weeds.

Category 1 Declared weeds, Category 2 Declared invaders and Category 3 Declared invaders were recorded in the vicinity of the proposed route. All Category 1 weeds and other alien species must be eradicated on a continuous basis.

Table 24: Significance of Issue 16 (The eradication of invasive species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Positive Impact - Not Necessary To Mitigate ☼	**P/C/O** – All Category 1 weeds and other alien species must be eradicated prior to construction and throughout the operational phase of the road. **P/C/O** – No plants not indigenous to the area or exotic plant species, especially lawn grasses and other ground-covering plants should be used as soil-binding agents along new road verges as they will drastically interfere with the nature of the area.	**L** **-T**o be included in EMP **L** **-T**o be included in EMP

Result: *Positive impact, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

17) If the entire road alignment area is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories

Due to the length of the proposed road it is unlikely that the entire area to be constructed will be cleared as once.

Table 25: Significance of Issue 17 (If the entire road alignment area is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C -** Where possible, work should be restricted to one area at a time.	**L -**To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

18) Noise of construction machinery could have a negative impact on the fauna species during the construction phase

If not managed correctly, noise pollution (i.e. by machinery without noise muffing devices) could have a negative impact on the fauna and birds in the area. This will however only be a short-term impact and it is expected that many of the birds will return to the area during the operational phase.

Table 26: Significance of Issue 18 (Noise of construction machinery could have a negative impact on the fauna species during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/ C -** Noise should be kept to a minimum and the construction of the road should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.	**L -T**o be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

19) During the construction phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.

There is always a risk that construction personnel may disturb, trap, hunt or kill fauna on the study area. This will have a detrimental impact on the local biodiversity and will decrease fauna numbers. The issue can be mitigated if this issue is included in conservation-orientated clauses that may be built into contracts of construction personnel and if council prosecutes offenders of these actions.

Caught animals should also be relocated to conservation areas in the vicinity.

Table 27: Significance of Issue 19 (During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C/O** - The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed. Caught animals should be relocated to the conservation areas in the vicinity. Council shall prosecute offenders. **C/O** - Fencing or at least a suitable temporary barrier should be erected around the site before construction is initiated. **C/O** - The speed of vehicles around a breeding site should be restricted (by traffic calming measures etc.) to a maximum of 60km/h. **P** - Conservation-orientated clauses should be built into contracts for construction personnel complete with penalty clauses for non-compliance.	**L** -To be included in EMP **M** -To be included in EMP **M** -To be included in EMP **L** -To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

20) Loss of habitat can lead to the decrease of fauna numbers and species

All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.

This impact is not expected to be of high significance with regard to loss of bird habitat due to lack of sufficient breeding and foraging habitat.

Table 28: Significance of Issue 20 (Loss of habitat can lead to the decrease of local fauna numbers and species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**P/ C / O** – All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.	**M** - In terms of local fauna population **L** - In terms of the global conservation status of fauna

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

7. DESCRIPTION OF THE SOCIAL ENVIRONMENT *[Regulation 29(c) (d)]*

7.1 Cultural and Historical

In terms of the legation, it is necessary to identify and list the specific legislation and permit requirements, which potentially could be infringed upon by the proposed project. The necessity and possibilities for the implementation of mitigation measures should also be identified.

It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or material.

Also important is that Section 34(1) of this act states that no person may alter or demolish any structure of part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.

As indicated on ***figure 21, Preliminary Sensitive Issues Map,*** the proposed Olievenhoutbosch road form Main road to K54 does not traverse any cultural and historical features. ***(Refer to Annexure H for correspondence from SAHRA).***

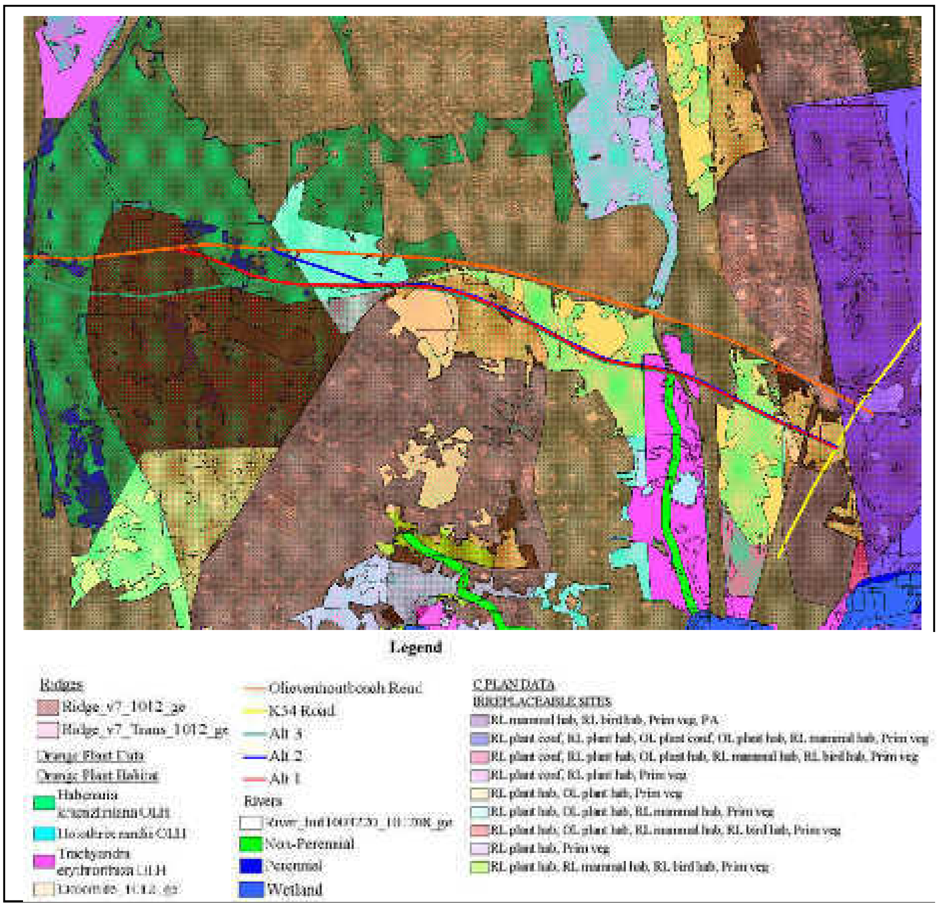


Figure 21: Sensitive Issues Map

Comments from SAHRA

The development of the proposed road is approved by SAHRA subject to the following conditions:

- Anybody can appeal the decision within 30 days from receipt of the letter from SAHRA. The authorisation should be displaced on the site.
- The applicant must observe all heritage resource management recommendations as per page 6 of the Heritage Survey Report.
- The approval does not exempt the applicant from obtaining other necessary authority approvals as prescribed by other relevant legislation and regulations.

7.1.a Issues & Impact Identification – Cultural and Historical

Table 29: Issues and Impacts – Cultural and Historical

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼
21)	Structures of cultural and historical significance may be destroyed.	-	☻

7.1.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

21) Structures of cultural and historical significance may be destroyed.

As no sites, features or object of cultural significance were identified in the study area, there would be no impact resulting from the proposed alignment of Olievenhoutbosch Rd.

If any archaeological sites or graves are exposed during construction work, it should immediately be reported to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made.

Table 30: Significance of Issue 21 (Structures of cultural and historical significance may be destroyed) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Positive ☼ Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/ C / O** - It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or material **P/ C** - Also important is that Section 34(1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.	**L** – To be included in the EMP **L** – To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

7.2 Agricultural Potential

According to GAPA 3 the involved section of the route traverses areas ranging from **moderate to low agricultural potential soils *(Refer to Figure 22)*** and does not fall within an Agricultural Hub, an area identified for agricultural use by GDARD according to the **Draft Policy on the Protection of Agricultural Land (2006) *(refer to Figures 23)***

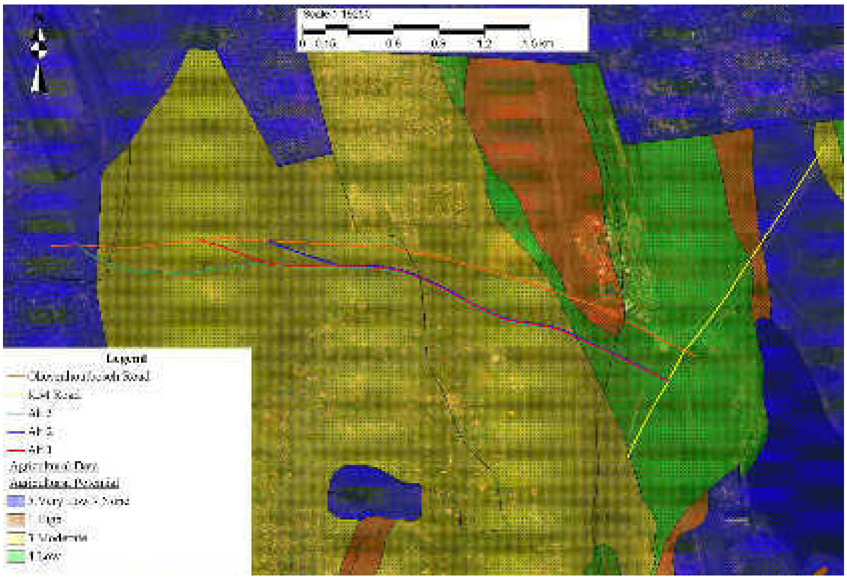


Figure 22 – GAPA 3 Agricultural Potential

Figure 23 – Kungwini/Ekurhuleni Agricultural Hub

7.2.a Issues & Impact Identification – Agricultural Potential

Table 31: Issues and Impacts – Agricultural Potential

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◘** **Positive Impact - Not Necessary To Mitigate ☼**
22)	Loss of agricultural land	-	◘

7.2.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

22) Loss of agricultural land

The soils along the proposed alignment of the involved section of the route range from very moderate to low agricultural potential and does not falls within the Kungwini/Ekurhuleni Agricultural Hub.

Table 32: Significance of Issue 22 (Loss of agricultural land) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction	Significance of Issue after mitigation Positive ☼ Low/ eliminated **L / E**

	and/ or operational phase **P/ C / O**	Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/ C / O** – Some agricultural land will be loss due to the proposed road.	Not possible to mitigate, but not regarded as a fatal flaw **NP**

Result: *The significance of this impact need to be determined/confirmed and assessed in the Significance Rating Table*

7.3 Institutional Environment *[Regulation 29(e)]*

The capital costs for the road will essentially be borne by the developer. Relative to this, however there lies an obligation on the local authority to support proposals in its interest (expansion of its tax base) as well as those in the interest of the community (investment and ensuring sustainability of development over time) and the environment.

The construction of Olievenhoutbosch Road is part of the Local Authority and Provincial Government's road network planning for the larger areas.

7.3.1 On an International Level

Relevant International Conventions to which South Africa is party:

- **Convention relative to the Preservation of Fauna and Flora** in their natural state, 8 November 1993 (London);
- **Convention on Biological Diversity**, 1995

(provided and added stimulus for a re-examining and harmonization of its activities relating to biodiversity conservation. This convention also allows for the in-situ and ex-situ propagation of gene material); and

- **Agenda 21** adopted at the United Nations Conference on Environment and Development (UNCED) in 1992.
  (An action plan and blueprint for sustainable development).

7.3.2 On a National Level

National Environmental Management Act (NEMA), 1998 (Act No 107 of 1998)

In terms of Regulation no. R387 and R386 published in the Government Notice no. 28753 of 21 April 2006 of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environmental Impact Assessment Process is required for the construction of the proposed road.

NEMA provides for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

This Act formulates a set of general principles to serve as guidelines for land development and it is desirable that:

- The law develops a framework for integrating good environmental management into all development activities;
- The law should promote certainty with regard to decision-making by organs of state on matters affecting the environment;
- The law should establish principles guiding the exercise of functions affecting the environment;

- The law should ensure that organs of state maintain the principles guiding the exercise of functions affecting the environment;
- The law should establish procedures and institutions to facilitate and promote co-operative government and intergovernmental relations;
- The law should establish procedures and institutions to facilitate and promote public participation in environmental governance; and
- The law should be enforced by the State and that the law should facilitate the enforcement of environmental laws by civil society.

If the involved authorities do not take the principles of NEMA into consideration when evaluating an environmental report/ document, the involved authority can be held responsible for any damage to the environment (social, ecological and economical).

The proposed development is listed under the activities as regulated under NEMA.

The Development Facilitation Act (DFA) 1995 (Act 67 of 1995)

This Act formulates a set of general principles to serve as guidelines for land development inter alia revolving around:

- The promotion of integration of the social, economic, institutional and physical aspects of land development;
- The promotion of integrated land development in rural and urban areas in support of each other;
- The promotions of the availability of residential land and employment opportunities in close proximity to or integrated with each other;
- The promotion of a combination of diverse land-uses, with each proposed land development area to be judged on its own merit and no specific use, whether residential, commercial, conservation etc., to be regarded as less important;
- Discouraging urban sprawl to promote more compact towns/ cities;
- Encouraging environmentally sound land development practices; and
- Promoting sustained protection of the environment.

The Green Paper on Development Planning - 1999

The Green Paper deals with how decision-making should be approach, i.e. political or technical. Pre-1994 legislation allocated land development decision-making responsibilities exclusively to elected representatives. The DFA makes a clear distinction between policy-making and implementation and decision-making power. It introduced a system whereby elected representatives approve policies and plans and skilled officials and others with technical skills interpret and apply these.

There was agreement, however, that decisions should be made according to the policies and plans drawn up through the integrated development planning process and should be able to be defended on those grounds. The City of Tshwane implemented this approach, but there is not yet a clear set of relevant land development policies that is debated, tested and implemented over time that can provide a clear guideline to developers and officials. For this reason it is essential that the DFA spatial principles continue to provide a knowledge base and interpretational framework.

Integrated Environmental Management

Integrated Environmental Management (IEM) is a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process. This philosophy aims to achieve a desirable balance between conservation and development (Department of Environmental Affairs, 1992). The IEM guidelines intend endearing a pro-active approach to sourcing, collating and presenting information at a level that can be interpreted at all levels.

The National Water Act, 1998 (Act No 36 of 1998)

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Reducing and preventing pollution and degradation of water resources;
- Facilitating social and economic development; and
- Providing for the growing demand for water use.

In terms of the Section 21 of the National Water Act, the developer must obtain water use licenses if the following activities are taking place:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity contemplated in section 36;
e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall 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 which contains waste from or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a water course;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

The study area is not affected by water resources, flood lines and wetlands. Section 21 water use licences will not be required for any development which may take place within and/or impact any water resource and or floodlines.

National Environmental Management: Air Quality Act (Act No. 39 of 2004)

This act replaced the Atmospheric Pollution Prevention Act (Act No. 45 of 1965), however Part 2 of the act is still applicable. Part 2 deals with the control of noxious or offensive gases and has relevance to the proposed road.

The purpose of the Act is "To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incident thereto".

Water Services Act, 1997 (Act No 108 of 1997)

The purpose of this Act is to ensure the regulation of national standards and measures to conserve water taking into account, amongst other factors, the following:

- Basic sanitation;
- Basic Water supply;
- Interruption in provision of water services;
- Quality of potable water;
- Control of objectionable substances;
- Disposal of grey water;
- Use of effluent; and
- Quantity and quality of industrial effluent discharged into a sewerage system.

Interruption in provision of water services during the construction phase of Olievenhoutbosch Road must be according to national standards.

Mitigation measures must be implemented to prevent contamination of groundwater due to the construction and operational phase of the road.

National Heritage Resource Act, 1999 (Act No 25 of 1999)

The National Heritage Resources Act legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

According to the available information no obvious features, sites or artefacts of cultural significance that would be impacted on by the proposed development is traversed by the proposed road

It is important to note that in terms of the National Heritage Resources Act, (Act No 25 of 1999); all historical sites and materials older than 50 years are protected. It is an offence to destroy, damage, alter or remove such objects from the original site, or excavate any such site(s) or material without a permit from the National Monuments Council. Gravesites are subject to the requirements of Act 28 of 1969.

National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004)

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

Specialist ecological and wetland assessment studies were conducted for the study area. No red data fauna and flora species were identified, however the proposed route crosses a wetland and mitigation measures for the protection of this system must be implemented.

National Spatial Biodiversity Assessment

The National Spatial Biodiversity Assessment (NSBA) classifies areas worthy of protection based on its biophysical characteristics, which are ranked according to priority levels.

Specialist ecological and wetland assessment studies were conducted for the study area. No red data fauna and flora species were identified, however the proposed route crosses a wetland and mitigation measures for the protection of this system must be implemented.

National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003)

The purpose of this Act is to provide the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.

Specialist ecological and wetland assessment studies were conducted for the study area. No red data fauna and flora species were identified, however the proposed route crosses a wetland and mitigation measures for the protection of this system must be implemented.

National Veld and Forest Fire Act, 1998 (Act No. 101, 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

Mitigation measures for the prevention of fires must be implemented.

Conservation of Agricultural Resources Act (Act No. 43 of 1983)

This Act provides for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith. The removal of Category 1 Declared Weeds is ***compulsory*** in terms of this Act.

The proposed route traverses sections of moderate agricultural potential soils (according to GAPA 3)

Category 1 Declared weeds must be removed on a continuous basis, as indicated in the EMP attached as ***Annexure L..***

National Road Traffic Act, 1996 (Act No. 93 of 1996)

This Act provides for all road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith.

The design and construction of Olievenhoutbosch Road must comply with the National Road Traffic Act.

Mine Health and Safety Act, 1996 (Act 29 of 1996)

This Act introduced the concepts of risk assessment and occupational health and safety (OHS) management systems in the mining industry.

The alignment of Olievenhoutbosch Road must comply with the regulations of the Mine Health and Safety Act with regard to distance from mining operations.

7.3.3 On a Local Level

Planning Responsibilities of the Involved Local Authority

The prerogative to plan a development within its jurisdictional area has always constitutionally, in terms of the Local Government Transitional Act, 1993 and recently the Municipal Systems Act, 2000, vested in the local authority involved.

In order to ensure that the proposed developments comply with the standards and requirements of the involved local authority (Ekurhuleni Metropolitan Municipality and Kungwini Local Municipality), the relevant officials were involved in the planning of the project from the start.

Gauteng Spatial Development Framework (GSDF)

This document published by the Gauteng Department of Development Planning and Local Government provides a spatial development framework for the whole of the Gauteng Province, and focuses on growth and development on a broad level. This Document identifies several spatial development components, of which the following is relevant to the proposed development:

The GSDF also lists so-called interventions of which the following is applicable to the involved section of the proposed road:

- Containing and Compacting the City: The infill of vacant land contributes towards the optimizing of municipal infrastructure
- Access and Mobility: The easy access development areas, as well as the densification of the city, also encourage the optimizing of municipal resources.

The Gauteng Integrated Development Framework (Phase 3)

This document provides a development framework Gauteng Province and focuses on growth and development on a broader level. Several spatial development components as so-called interventions were identified, of which the following are relevant to the proposed development:

- Centurion is identified as a Growth Area,
- The study area is situated within the provincial Urban Edge where growth should be stimulated and encouraged.
- Containing and Compacting the City: The infill of vacant land contributes towards the optimization of municipal infrastructure.

Diagram 3 is an illustration of the Economic components of the IDF:

- The projections are based on various blue IQ projects like the Gautrain, JIA, Automotive Cluster, etc. functioning together within a regional context and plugging into the global economic thrust.

- The illustration indicates the strong relationships that exist between the

Tshwane east job opportunities and that of the Sandton / Randburg areas.

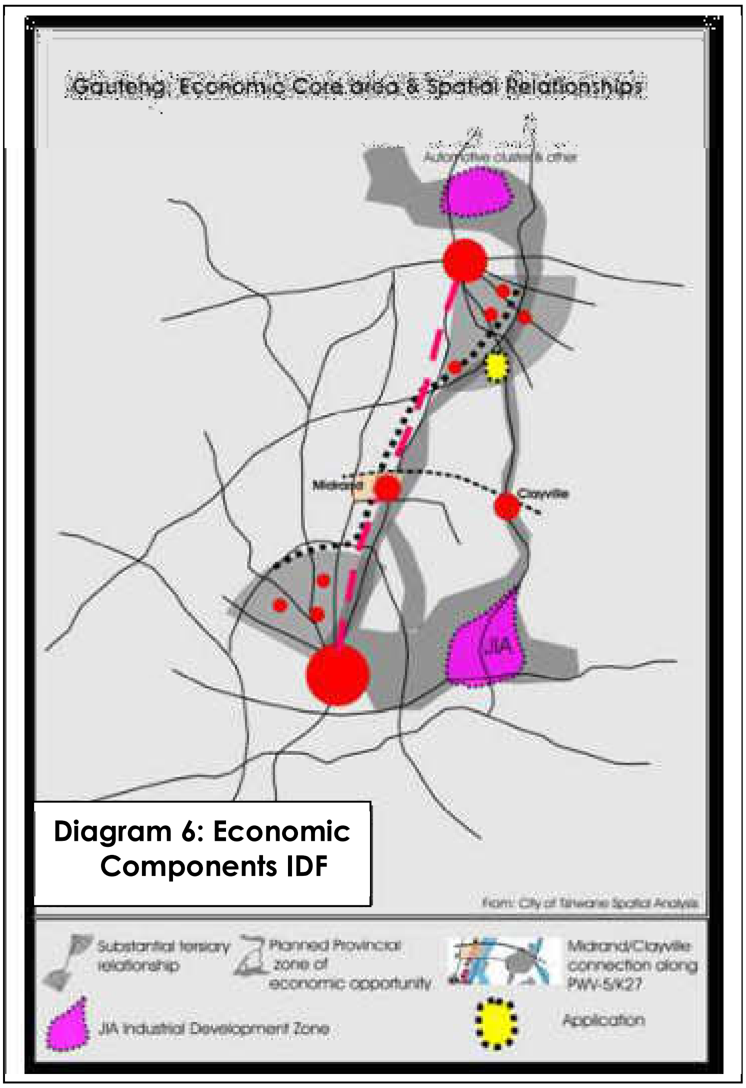


Diagram 6: Economic Components IDF

Areas situated along the N1-R21 within Centurion and the eastern Tshwane areas are residential focusing on tertiary related

job opportunities developing over a wide front in the south.
-The policy also containing the two corridors linking the southern and northern urban agglomerations (Johannesburg / Ekurhuleni/ Tshwane). The two corridors merge in the vicinity of the study area, which adds to its desirability.
-The Midrand (on the N1 corridor) and Clayville (on the R21 corridor) nodes already strengthen the corridor concepts and create more job opportunities south of the application.

Gauteng Transport Infrastructure Act, 2001 (Act No 8, 2001)

The purpose of this Act is to consolidate the laws relating to roads and other types of transport infrastructure in Gauteng. It provides for the planning, design, development, construction, financing, management, control, maintenance, protection and rehabilitation of provincial roads, railway lines and other transport infrastructure in Gauteng.

According to this provincial act, the proposed alignments for all the Gautrans roads on the Gautrans Grid Road Network Map must be honoured by planners.

GDARD C Plan 3, 2011

The environmental data contained in the GDARD C-Plan, 2011, was taken into consideration during the compilation of the scoping report. According to the GDARD CPlan, 2011, the involved section of the proposed Olievenhoutbosch road traverses irreplaceable sites.

GDARD Draft Red Data Species Policy, 2001

According to the GDARD C-Plan 3, 2011, the involved section of the proposed Olievenhoutbosch road traverses irreplaceable sites.

GDARD Draft Ridges Policy, 2001

According to the GDARD Draft Ridges Policy no development should take place on slopes steeper than 8.8%.

The involved section of the proposed Olievenhoutbosch road cuts across a ridge according to GDARD C-Plan 3, 2011 and therefore the Draft Ridges Policy is regarded as applicable.

Environment Conservation Act, 1989 (Act No. 73 of 1989): Gauteng Noise Control Regulations

The proposed Olievenhoutbosch Road must comply with the Provincial Noise Control requirements as outlined in the Provincial Notice, 5479 of 1999: Gauteng Noise Control Regulations.

Draft Policy on the Protection of Agricultural Land (2006)

The study area does not lie within an Agricultural Hub that was identified by GDARD in 20016. The Draft Policy on the Protection of Agricultural Land (2006) is therefore not applicable to the proposed road.

7.3.4 On a Local Level

Planning responsibilities of the involved Local Authority

The prerogative to plan development within its jurisdictional area has always constitutionally, in terms of the Development Facilitation Act, 1995, the Local Government

Transitional Act, 1993 and recently the Municipal Systems act, 2000 vested in the local authority involved.

In order to ensure that the proposed developments comply with the standards and requirements of the involved local authority, the relevant officials were involved in the planning of the project from the start.

Municipal Systems Act – No. 32 of 2000)

This Act clearly establishes the Integrated Development Plan and Integrated Spatial Development Framework as guidelines to inform development and processes in this regard.

City of Tshwane Spatial Development Framework (CTSDF)

This document includes valuable concepts regarding the movement system and the development lattice. According to the CTSDF the movement system in an urban environment is literally the arteries of the city and without these linkages there can be no economy and no inter-relatedness. Movement systems can be used to create access, structure settlements, and promote integration, diversity and mixed land use.

Movement (flows of people, finance, goods) defines the energy networks of settlements and more continuous lines of movement represent planes of greater accessibility and, therefore, become the more desirable planes of connection for intensive use.

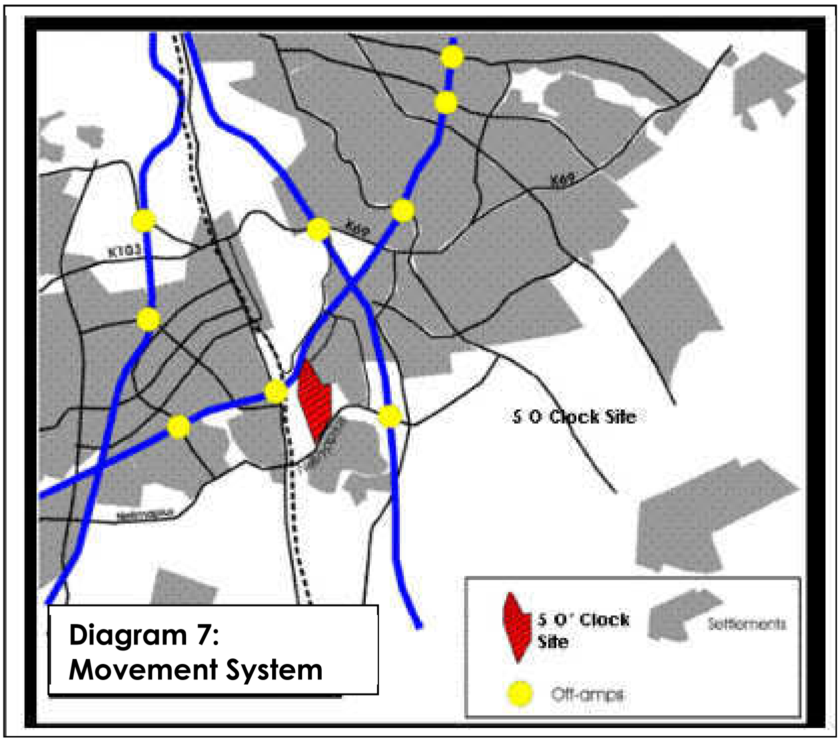


Diagram 7: Movement System

A complex and diverse pattern of accessibility offers all activities, both large and small, the opportunity to find a place within the structural system, depending on their need for accessibility and their ability to pay for it.

According to the CTSDF movement systems provide a powerful planning mechanism to bring about mixed, but broadly predictable, patterns of activity, provided activities are allowed to respond to them.

The present state of the movement system surrounding the study area is illustrated in Diagram 4.

The area is severely influenced by the existence of large interstitial areas (represented by white colour between areas of settlement) and interstitial elements like freeways. This affects the accessibility of certain areas by preventing connections on the lower planes of hierarchy. Although such areas are situated centrally within a large area their lower levels of accessibility prevent them from harbouring extensive economic opportunities.

The K103/K69 route (Hans Strijdom Ave) and Nellmapius Drive (Road 780) are significant as they interconnect the major roads providing the local movement systems and provide access to the major motorways. It is only with these roads that the urbanisation of the suburbs can occur. Nellmapius Drive therefore plays a very important role: connecting origins and destinations of various local nodes and precincts of different types of land uses. Capacity for movement on this road should be encouraged, as it will stimulate local economic development. The involved section of the proposed Olievenhoutbosch road will strengthen the movement system.

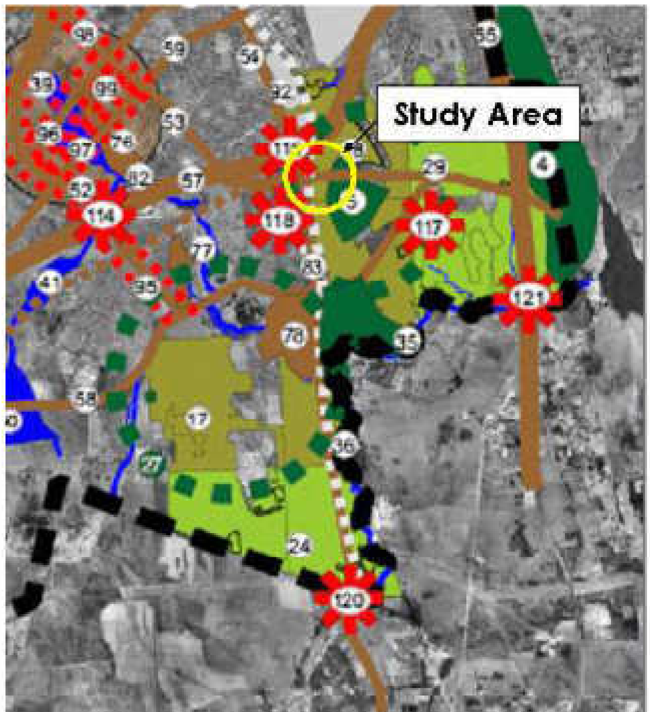


Diagram 8 – CoT Open Space Framework, 2005

7.3.a Issues & Impact Identification – Institutional

Table 33: Issues and Impacts – Institutional

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼
23)	The proposed construction of the Olievenhoutbosch Road will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	+	☼

7.4 Qualitative Environment

7.4.1 Noise Impact

The proposed section of the Olievenhoutbosch Road runs through a rural area where small scale agriculture is still practiced but which is changing to residential and commercial uses. Clay manufacturing, quarrying and brick making activities are located to the western end of the proposed route. It also crosses a number of provincial routes.

Pro-active planning in the area had already taken place around the proposed road alignment. The involved section of the route was taken into consideration during the layout designs of proposed new developments in the area.

7.4.1.a Issues & Impact Identification – Noise Impact

Table 34: Issues and Impacts – Noise Impact

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◘** **Positive Impact - Not Necessary To Mitigate ☼**
24)	Noise impact	-	◘

7.4.1.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

24) Noise Impact

Pro-active planning in the area had already taken place around the route alignment and the route was taken into consideration during the layout designs of proposed new developments in the area. If planned correctly, the proposed route should therefore not have a significant noise impact on the surrounding environment (currently and in future).

A noise impact assessment is not regarded as necessary due to pro-active planning in the area adjacent to the Olievnehoutbosch Road.

Table 35: Significance of Issue 24 (Noise Impact) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not**	Mitigation Already achieved √ Must be implemented during	Significance of Issue after mitigation Positive ☼

Necessary To Mitigate ☼	planning phase, construction and/ or operational phase **P/ C / O**	Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**P/ C / O –** The layout designs of proposed new developments in the area must take the noise impact from the route into consideration and mitigation measures must be implemented if necessary i.e. strategic placement of vegetation, berms etc.	**M –** to be included in the EMP

Result: *Although the impact can be mitigated, the significance of this impact still need to be determined/confirmed and assessed in the Significance Rating Table*

7.4.2 Visual Environment

The following visual assessment criteria ***(see Table 36)*** have been used to determine the impact of the proposed development on the state of the environment – the significance is indicated by the respective colour coding for each of the impacts, being high, medium and low:

From the visual assessment it is evident that only sections of the proposed road will be visible from the various view sheds that surround the study area. It will be partly visible from the proposed 5'o Clock Site. ***Refer to Figure 12, Visual Assessment.***

Table 36: Visual Impact Criteria

	IMPACT		
CRITERIA	**HIGH**	**MEDIUM**	**LOW**
Visibility	A prominent place with an almost tangible theme or ambience	**A place with a loosely defined theme or ambience**	A place having little or no ambience with which it can be associated
Visual quality	A very attractive setting with great variation and interest – no clutter	**A setting with some visual and aesthetic merit**	A setting with no or little aesthetic value
Compatibility with the surrounding landscape	Cannot accommodate proposed road without the development appearing totally out of place – not compatible with the existing theme	**Can accommodate the proposed road without it looking completely out of place**	The surrounding environment will ideally suit or match the proposed road
Character	The site or surrounding area has a definite character/ sense of place	**The site or surrounding environment has some character**	The site or surrounding environment exhibits little or no character/ sense of place
Visual Absorption Capacity	The ability of the landscape not to accept a proposed development because of a uniform texture, flat slope and limited vegetation cover	The ability of the landscape to less easily accept visually a particular type of development because of less diverse landform, vegetation and texture	**The ability of the landscape to easily accept visually a particular type of development because of its diverse landform, vegetation and texture**
View distance	If uninterrupted view distances to the site are > 5 km	If uninterrupted view distances to the site are < 5 km but > 1 km	**If uninterrupted view distances to the site are > 500 m and < 1000 m**
Critical Views	Views of the site seen by people from sensitive view sheds i.e. farms, nature areas, hiking trails etc.	**Some views of the site from sensitive view sheds**	Limited or partial views of the site from sensitive view sheds
Scale	A landscape with horizontal and vertical elements in high contrast to human scale	A landscape with some horizontal and vertical elements in some contrast to human scale	**Where vertical variation is limited and most elements are related to the human and horizontal scale**

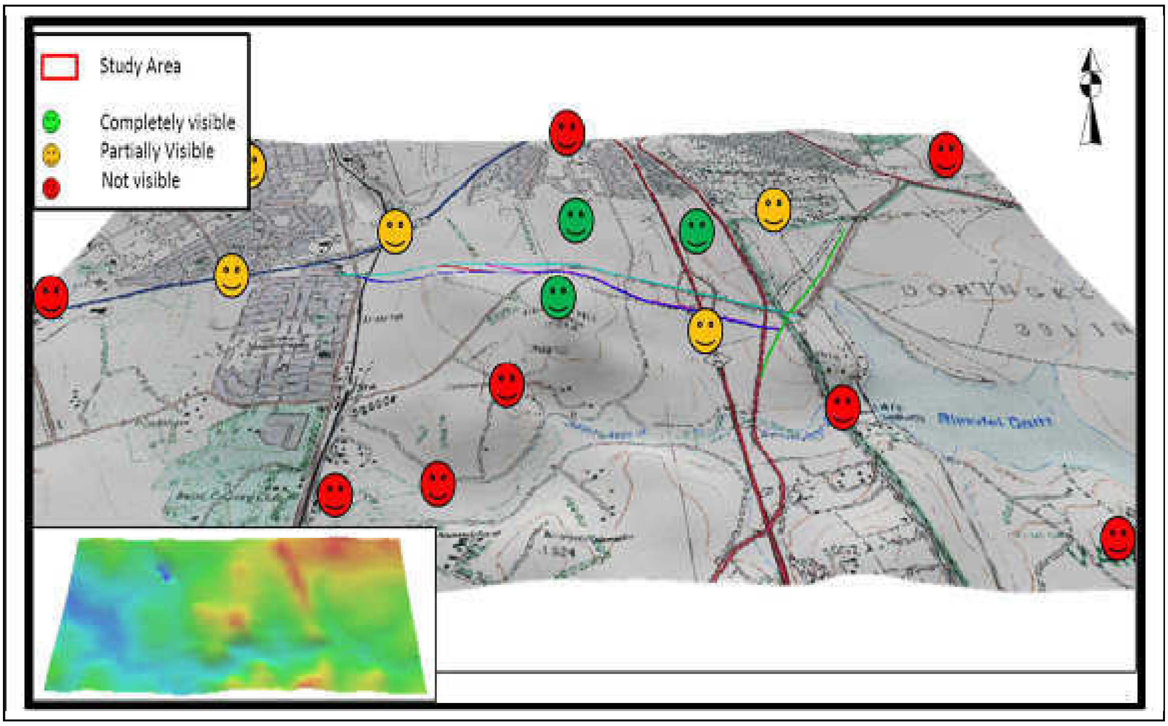


Figure 12: Visual Assessment

7.4.2.a Issues & Impact Identification – Visual

Table 37: Issues and Impacts – Visual

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼
25)	Due to the topography only sections of the proposed road will be visible from the various view sheds that surround the study area. It will be partly visible from the proposed 5'o Clock Site Development.	-/+	☺

7.4.3. "Sense of Place"

The concept of "a Sense of Place" does not equate simply to the creation of picturesque landscapes or pretty buildings, but to recognise the importance of a sense of belonging. Embracing uniqueness as opposed to standardisation attains quality of place. In terms of the natural environment it requires the identification, a response to and the emphasis of the distinguishing features and characteristics of landscapes. Different natural landscapes suggest different responses. Accordingly, settlement design should respond to nature.

In terms of the human made environment, quality of place recognises that there are points where elements of settlement structure, particularly the movement system, come together to create places of high accessibility and these places are recognised in that they become the focus of public investment, aimed at making them attractive, user-friendly and comfortable to experience.

The landscape is usually experienced in a sensory, psychological and sequential sense, in order to provide a feel and image of place ("genius loci").

A landscape is an integrated set of expressions, which responds to different influences. Each has its unique spirit of place, or "genius loci". Each landscape has a distinct character, which makes an impression in the mind, an image that endures long after the eye has moved to other settings.

If planned correctly the proposed road could enhance the genius loci of the broader area by establishing infrastructure for the future development of the area.

Sense of Place is the subjective feeling a person gets about a place, by experiencing the place, visually, physically, socially and emotionally. The "Sense of Place" of a property/ area within the boundaries of a city, is one of the major contributors to the "Image of a City/ City Image".

City Image consists of two main components, namely ***place structure*** and ***sense of place***. Place structure refers to the arrangement of physical place making elements within a space, whereas sense of place refers to the spirit of a place. It could be defined as follows:

- ***Place Structure*** refers to the arrangement of physical place making elements within a unique structure that can be easily legible and remembered.
- The ***Sense of place*** is the subjective meanings attached to a certain area by individuals or groups and is closely linked to its history, culture, activities, ambience and the emotions the place creates.

The Irene and Cornwall area is one of the areas in Pretoria with the best-defined image. People immediately think of the Irene Dairy, Irene Country Lodge, the Smuts House, and Irene Village, the Stonewalls, neat streets and lots of trees. This all contribute to a sense of an established fine balance and well-being within a special landscape where landscapes blend in with a vibrant loci urban life where each individual and element plays its role.

It should be noted that the area will not remain rural much longer due to developments planned in the area. With pro-active planning, the developments in the area (including the proposed roads) could help to improve the "Sense of Place" of the area and timeless architectural themes, landscaping concepts and finishes could help to create an area with a unique character.

If not planned correctly (i.e. though the holistic planning of the entire development area) the proposed road could have a negative impact on the "Sense of Place" to be created in this developing area.

7.4.3.a Issues & Impact Identification – "Sense of Place"

Table 38: Issues and Impacts – "Sense of Place"

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact - Not Necessary To Mitigate ☼
26)	If not planned and managed correctly (i.e. though the holistic planning of the entire development area) the proposed road could have a negative impact on the "Sense of Place" to be created in this developing area.	-	☻

6.4.3.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

26) If not planned and managed correctly (i.e. though the holistic planning of the entire development area) the proposed road could have a negative impact on the "Sense of Place" to be created in this developing area.

Table 39: Significance of Issue 26 (If not planned and managed correctly, the proposed development could have a negative impact on the "Sense of Place" of the study area and its surroundings) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High ☻ Medium ☺ Low ◘ Positive Impact/ Neutral - Not	Mitigation Already achieved √	Significance of Issue after mitigation Low/ eliminated L / E

Necessary To Mitigate ☼	Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C/O** - Landscaping guidelines should be provided for the linear strips of land adjacent to the proposed road.	**L/E –** To be included in the EMP

Result: *Although the impact can be mitigated, the significance of this impact still need to be determined/confirmed and assessed in the Significance Rating Table*

7.4.4 Services and Infrastructure

The Olievenhoutbosch road is a Metropolitan Class 2 road that will link the Samrand interchange on the N1 highway with the R21 route in the east. Services that are visible in the area include ESKOM overhead power lines that cross the study area and overhead TELKOM lines along existing roads. The involved section of Olievnhoutbosch road intersect with other important routes including N1-21,PWV6, K105, Nellmapius Drive, River Road and the Pretoria-Germiston railway line. ***(Refer to Annexure I: for the Storm water Master Plan)***

Services information available for the section of the proposed Olievenhoutbosch road crossing the Irene Extension 91 Development was complied with the ***Service Scheme report*** conducted by ***Vela VKE Engineers (Pty) Ltd for*** the Irene 91 Development. ***(Refer to Annexure J: Service Scheme Report)***

The traffic impact study proposes that Olievenhoutbosch Drive be developed as a one-way couplet. The eastbound leg of this one-way couplet adjacent to the Irene x91 township will follow the alignment of the existing Nellmapius Drive. The westbound leg of the one-way couplet passes through the Irene x91 township inside a 40m road reserve. The required road reserve widths for the two legs of the one-way couplet must be confirmed by the City of Tshwane.

The Irene x91 township layout makes provision for the road reserve of the future Olievenhoutbosch/R21 split diamond interchange. A public class 4 road will be constructed inside a 25m road reserve form an intersection on the westbound Olievenhoutbosch drive to a cul-de-sac at the entrance to erf 13.

The Olievnhoutbosch road Drive one-way is a Class 3 road and is therefore allocated to the City of Tshwane. A two lane single carriageway inside the westbound Olievenhoutbsoch road reserve, between the Link Road and the Class 4 public access road, will provide sufficient access to Irene x91.

7.4.4.a Issues and impacts identification - services and infrastructure

Table 40: Issues and Impacts – Services and Infrastructure

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◙** **Positive Impact - Not Necessary To Mitigate ☼**
27)	Impact on existing infrastructure and services during the construction of the proposed road.	-	☺
28)	The proposed Olievenhoutbosch road will improve regional accessibility in the area. The extension of the road links with the R21 and provides access to the surrounded developments.	+	☼

29)	The proposed Olievenhoutbosch road will divert traffic from existing road network links and thereby alleviate congestion on the existing road network system.	+	☼
30)	The construction phase of the proposed road will supply a number of temporary job opportunities.	+	☼
31)	The developer will deliver a large contribution to the infrastructure in the area	+	☼

7.4.4.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

27) Impact on existing infrastructure and services during the construction of the proposed road

The construction of roads often requires the relocation of services and/or temporary disruptions to existing services such as access roads, electricity, water, Telkom services, sewage etc.

Table 41: Significance of Issue 27 (Impact on existing infrastructure and services during the construction of the proposed road) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after mitigation
High ☻ **Medium** ☺ **Low** ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal

		flaw **NP**
High ☻	**P/ C** – Determine areas where services will be upgraded and relocated well in advance. Discuss possible disruptions with affected parties to determine most convenient times for service disruptions and warn affected parties well in advance of dates that service disruptions will take place. **C -** It is important to erect proper signs indicating the operations of heavy vehicles in the vicinity of dangerous crossings and access roads. **C –** Construction vehicles must avoid peak hour traffic, i.e. between 7am and 9am and again between 4pm and 6pm on weekdays. Routes should be planned to avoid construction vehicles travelling through residential areas where possible. **C –** It is important to erect warning signs on existing roads when impacted on by the construction of the Olievenhoutbosch road (i.e. construction of intersections/bridges). **C –** Traffic on existing roads should be controlled during construction activities impacting on these roads (i.e. construction works at intersections, construction of bridges). At least one lane should be open for traffic or alternatively a detour route must be available at all times. A traffic points man should be appointed.	**M –** To be included in the EMP **M –** To be included in the EMP **M –** To be included in the EMP **M –** To be included in the EMP **M –** To be included in the EMP **M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

7.4.5 Affected Properties

The following properties area affected by the involved section of the proposed Olievenhoutbosch Road:

- Portion 1, Portion 188 and the Remainder of Portion 330; Portion 335 and Portion 5 of the Farm Doornkloof 391-JR.
- The road reserve of Nellmapius Drive/M31 and;
- The Road servitude of the R21.

7.4.5.a Issues and Impacts – Affected Properties

Table 42: Issues and Impacts – Affected Properties

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**
32)	Expropriation of properties	-	◙
33)	Impact on agricultural land and agricultural holdings	-	◙
34)	Impact on property values	-/+	◙/☼
35)	Access to local roads and properties	-	☺

7.4.5.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

32) Expropriation of properties

The construction of the involved section of Olievenhoutbosch road will require the expropriation of a number of properties.

Table 43: Significance of Issue 32 (Expropriation of properties) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**P –** The expropriation of properties must be finalised prior to the construction of the road.	**M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

33) Impact on agricultural land and agricultural holdings

The study area has a moderate to low agricultural potential. As the proposed road travels thought some potential agricultural land, the potential is low. Currently there are no agricultural holdings in this study area that will be affected by the development.

Table 44: Significance of Issue 33 (Impact on agricultural land and agricultural holdings) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**P –** Expropriation of properties should be finalised prior to construction of the road.	**M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

34) Impact on property values

Although the proposed road could have negative impacts on the property values in the short and medium term, there is a possibility that the long-term impact of the route will be positive.

Properties currently valued as agricultural holdings could experience an increase in property value due to demand for higher density developments along the new route. Offices, commercial and retail properties adjacent to this type of route are much sought after by developers and property owners are often supplied with very high offers for their land.

Table 45: Significance of Issue 34 (Impact on property values) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High** ☻ **Medium** ☺ **Low** ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**P –** The properties affected by the proposed alignment must be taken into consideration during the planning phases.	High **H**

Result: *This issue could be negative in the short term but could turn positive in the long term, the significance of the impact should be determined / confirmed and assessed in the Significance Rating Table*

35) Access to local roads and properties

The proposed road could have an impact on access to local roads and properties during the construction and operational phase.

Mitigation measures must be implemented to ensure access to local roads and properties during the construction phase. The design of Olievenhoutbosch road must make provision for access to local roads and properties as well as future roads.

Table 46: Significance of Issue 35 (Access to local roads and properties) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◘** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P –** The design of the route must make provision for access to local roads and properties as well as future roads. **P/C –** Mitigation measures must be implemented to ensure access to local roads and properties. If access is restricted, alternative access/routes must be provided.	**M -** To be included in EMP **M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

7.4.6 Public Participation

(Refer to Annexure K for Public Participation)

Public Participation is a cornerstone of any environmental impact assessment. The principles of the National Environment Management Act, 1998 (Act No. 107 of 1998) govern many aspects of environmental impact assessments, including public participation. These include provision of sufficient and transparent information on an on-going basis to the stakeholders to allow them to comment and ensuring the participation of previously disadvantaged people, women and youth.

Effective public involvement is an essential component of many decision–making structures, and effective community involvement is the only way in which the power given to communities can be used efficiently. The public participation process is designed to provide sufficient and accessible information to interested and affected parties (I&APs) in an objective manner to assist them to:

- Raise issues of concern and suggestions for enhanced benefits.
- Verify that their issues have been captured.
- Verify that their issues have been considered by the technical investigations.
- Comment on the findings of the EIA.

In terms of the Guideline Document for Environmental Impact Assessment (EIA) Regulations promulgated in terms of the National Environmental Management Act (Act No.107 of 1998), stakeholders (I&APs) were notified of the Environmental Evaluation Process during the Scoping Phase through:

1) A site notice that was erected (at prominent points on and around the study area) on 18 October 2011 ***(Refer to Annexure K i).***

2) Notices were distributed to the surrounding land-owners and interested and affected parties by means of faxes, hand delivery and e-,mail on the 18 October 2011 ***(Refer to Annexure K ii)***

3) An advertisement was place in the Beeld newspaper on 18 October 2011 ***(Refer to Annexure Kiii)***

4) Refer to ***Annexure K iv*** for a list of the registered I&AP's and ***Annexure K v*** for the Issues Report.

5) The Scoping Report was available for review by I&AP's for a period of 21 days.

6) A site notice for the EIA phase was erected (at prominent points on and around the study area) on 22 October 2013 ***(Refer to Annexure K vi).***

7) Notices were distributed to the surrounding land-owners and interested and affected parties by means of faxes, hand delivery and e-,mail on the 22 October 2013 ***(Refer to Annexure K vii)***

8) The draft EIA Report was available for review by I&AP's for a period of 40 days.

Figure 24: Site Notice EIA Phase

The following persons/organisations registered as I & AP:

Table 47: List of registered interested and affected parties

	Name	Contact Details	Address
1	James AH Cambell	james.ah.cambell@gmail.com 083 457 3724 012 667 5187	9 lotus Street, Irene
2	Ross Howarth	rrhowarth@gmail.com	68 Main Rd, Irene

3	Beverley Wulff	tph@tph.co.za 012 809 2229 012 809 2090 (f)	98 Pony Street Tijger Vallei Office Park
4	Brian & Jenny Melvill-Smith	Brian.Melvill-Smith@barloworldmotor.com 011 552 9344 083 645 1504 012 667 2379	37 Alexandra Road, Irene
5	Chris Grobler	chrisg@bibletruths.co.za 083 415 7549	
6	Craig Comrie	ccomrie@mhg.co.za 011 381 2060	
7	Dirk Heyns	manager@cornwallhill.co.za 012 667 2938	
8	Gill Udal	gill.udal@telkomsa.net	16B Iris Lane, Irene
9	Gerard O' Rourke	gorourke@chieftain.ie 083 313 9671	75 Jean Avenue, Doringkloof
10	Wisan Justice Maluleke	MalulekeJ@dwa.gov.za 012 392 1409	
11	Cllr Christa Spoelstra	mwcspoel@mweb.co.za 082 880 5300	
12	Riaan Marais CoT **Rietveli Nature Reserve**	RiaanM@tshwane.gov.za	
13	Kobus Knoetze	kobus@dhkthinkspace.co.za 021 421 6803	1 Clifford Road, Irene
14	Hilton Bothma	hiltb@telkomsa.net 076 729 6931	31 Pioneer Rd, Irene
15	Dawie Gouws	dawie@gs2.co.za 083 635 6515 012 667 4630	1 Lesley Road. Irene
16	Malcolm Fawkes	FawkesMG@eskom.co.za 011 655 2552 082 652 7581	
17	Michelle Marais	michelle.marais@angloamerican.com 012 679 2058 083 608 0998	PO Box 129 Irene
18	David Larsen Salbu	dkoa@salbu.co.za	
19	Robert Hartman	robert@multicat.co.za 012 663 4660 083 414 4197	Cornwall Hill Estate
20	Lisa Trublet de Nermont	trublet@global.co.za 082 885 1554	Cornwall Hill Residents
21	Roger Trublet de Nermont	082 885 1554	Cornwall Hill Residents
22	Carlo Machinè	carlomach@absamail.co.za	350 Downderry Way

		082 521 1115	Cornwall Hill Estate
23	Tom Hannay	tomhannay.sa@gmail.com 083 447 9442 012 667 4520	15 Alexandra Road, Irene
24	Sonya Semmelink	semmelink@webmail.co.za	
25	Mara Temple	Mara.Temple@gpaa.gov.za 012 319 1004 012 319 3812 (f)	
26	Nina Strydom Nina Phillip	Nina.Strydom@up.ac.za 083 636 1399 072 449 1012	3C Iris Lane, Irene
27	Councillor Casper McDonald	CasperM@tshwane.gov.za 082 563 4570 086 503 5231	
28	Manda Botha	manda@soundandimage.co.za 083 760 4385	PO Box 227 Cornwall Hill, 0178
29	Mr Roux Shabangu	roux@rouxprops.co.za 012 667 2772	Erf 122, Irene
30	Marese Herbst	marese@rouxprops.co.za 012 667 2772	Erf 122, Irene
31	Bea Fletcher The Town Planning Hub (TPH)	bea@tph.co.za tph@tph.co.za	Erf 122, Irene
32	Natalie Koneight Rand Water	nkoneigh@randwater.co.za 011 724 9366	
33	James AH Cambell	james.ah.cambell@gmail.com 083 457 3724 012 667 5187	9 lotus Street, Irene
34	Lizette Visser Moo Zoo	visserliz@mweb.co.za 083 400 2804 012 667 2638	7 Alexandra Road, Irene
35	Raj Shunmugam	raj@glencarol.co.za	428 Shillingford Road Cornwall Hill
36	Cllr Christa Spoelsta Ward Councillor	mwcspoel@mweb.co.za 082 880 5300	
37	Eduard H.H. Meyer	edumeyer@iburst.co.za 012 667 5996 082 940 2958	2 Wellington Road, Irene
38	Richard Schuster	Rschuster@barloworld-equipment.com 083 625 6136 011 898 0000	29 Queen Street, Irene
39	Magda Oosthuizen	Magda.oosthuizen@seeff.com 082 411 7637 Magdafick@yahoo.co.uk	
40	At van Niekerk Irene Farm Village HOA	estatemanager@irenefarmvillages.co.za 012 662 3505 079 525 9281	
41	Jaco Vd Westhuizen	jaco.vdwesthuizen@me.com Cell: 082 460 2526	

42	Willem Hart **Ward councillor**	willem6060@gmail.com 082 900 8292	
43	Lizelle De Beer	wldebeer@gmail.com Cell: 082 805 5242/3	

The following comments were received from I & APs during the public participation phase of the Scoping and EIA Process:

SAHRA

The following comments were received from ***Andrew Salomon*** from ***SAHRA (refer to Annexure K viii):***

In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that prior to development it is incumbent on the developer to ensure that a Heritage Impact Assessment is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.

The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.

The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.

Where bedrock is to be affected, or where there are coastal sediments, or marine or river terraces and in potentially fossiliferous superficial deposits, a Palaeontological resources – or at least a letter of exemption from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary.

If the property is very small or disturbed and there is no significant site the heritage specialist may choose to send a letter to the heritage authority to indicate that there is no necessity for any further assessment.

Any other heritage resources that may be impacted such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscape or view scapes must also be assessed.

The following comments were received from ***J. Prinsloo*** from ***City of Tshwane (refer to Annexure K viii):***

In reviewing the application the Department made the following findings:

a) *According to the Tshwane Open Space Framework the proposed site is situated within and adjacent to the following open space typologies:*

- *A **Blue Node** namely Sesmylspruit and associated Wetlands (Linear Ecological Open space system associated with water) of Metropolitan significance. Blue nodes have a secondary socio-economic and place making function, therefore they must be conserved.*
- *A **Blue Way**, namely Sesmylspruit and associated wetlands. Blue ways are the most important elements in the provisioning of environmental goods and services, the protection of biodiversity, endangered species and ecological systems as well as eco-based activity. Blue ways must therefore be conserved.*
- *A Green Node, namely GDARD Important site: Between R21, Cornwall Hill and GDARD Irreplaceable Site: 5 O'Clock Site and Green nodes are the most important*

elements in the provisioning of environmental goods and services, the protection of biodiversity endangered species and ecological systems, as well as eco-based activity. Green nodes must be protected for conservation purposes.

- *A **Green Way** namely Cornwall Hill and Rietvlei Nature Reserve Ridges. These are protected areas which forms part of the strategically important ecological Structuring Elements within the Tshwane Open Space Network and must be conserved.*
- *A **Red Node**, namely the R21/Nellmapius Road Offramp, Nellmapius Road, R54 & Goedehoop Road, Boeing Road Intersection. The value of red Nodes lies in their place-making function and in creating a high quality urban environment that supports the image of a capital city.*
- *Gauteng Department of Agriculture and Rural Development Conservation Plan Version 3.*
- *Transformed Ridges.*

b) According to the Bioregional Plan for the Gauteng Metropolitan Municipalities the proposed site is situated within and adjacent to the following area:

- ***Formal Protected Areas:** Protected Areas include Provincial Nature Reserves (protected by the National Environment Management: Protected Areas Act 57 of 2003); Municipal Nature Reserves (including Bird Sanctuaries); other state protected areas (Meteorite Crater Reserve & portion of Botanical Gardens); and Private Nature Reserves and Natural Heritage Sites. Importantly, the areas include both areas that are formally proclaimed and protected by appropriate legislation and managed as such, as well as those that are either appropriately proclaimed and protected or that are managed primarily for biodiversity purposes according to a management plan.*
- ***Critical Biodiversity Area 1:** Any terrestrial or aquatic area required to meet biodiversity pattern and/or process thresholds. These include any area that is required for meeting pattern thresholds, namely remaining areas of Critically Endangered vegetation types and areas required to protect threatened species; any area that is required for meeting process thresholds such as areas important for*

climate change adaptation; and hydrological process areas such as high priority wetlands and catchments, pan clusters and pans within priority catchments. In addition to the above areas where there is little or no choice of area identified, CBAs include all 'best design' sites in terms of meeting pattern and process thresholds, identified by the iterative conservation planning process. 'Best design' refers to an identified network of natural sites that meet pattern and process thresholds in all vegetation types and features in a spatially efficient and ecologically robust way, and aim to avoid conflict with other activities (e.g. economic activity) where it is possible to achieve biodiversity thresholds elsewhere.

- ***Ecological Support Areas 1 & 2:*** *Supporting zone required to prevent degradation of Critical Biodiversity Areas and Protected Areas. These include remaining corridor, catchment, wetland and other process areas that are required to prevent degradation of Critical Biodiversity Areas and formal Protected Areas; and areas which would otherwise have been identified as Critical Biodiversity Areas except that have been transformed or degraded, but which are currently or potentially still important for supporting ecological processes e.g. floodplain areas that have transformed or degraded. These areas are a focus for rehabilitation rather that the intensification of land uses.*

c) According to the Report the proposed road will be additional lanes to the existing approved Olievenhoutbosch Road which is already in construction.

d) The Report indicated that the proposed road is needed to alleviate congestion on the approved Olievenhoutbosch Road.

e) The Report indicated that Olievenhoutbosch Road is a Metropolitan Class 2 Road that will link the Samrand Interchange on the N1 Highway with the R21 route in the east.

f) The Report indicated that 600, additional from the section of road will be scanned to ensure that the alignment extension will be possible to proceed without any environmental sensitivity.

g) According to the Report detailed surveys for the 600m node extensions to the south of the involved section of Olievenhoutbosch is regarded as necessary as the section to the east is identified as an irreplaceable site.

h) The Report indicated that should the road extension in future be extended from the proposed section of road, the road can terminate and act as an independent road should the extension be regarded as a "fatal flaw".

i) According to the Report the proposed alignment will only direct traffic from east to west. The already approved Olievenhoutbosch Road will direct traffic from west to east.

j) The Report indicated for the first phase the proposed section of rad will consist of only one lane. If needed, an additional lane will be added in future.

k) According to the Report the proposed road route proposal are located on dolomite soils.

l) GDARD Biodiversity requested additional specialist studies for possible red data flora. Fauna and avi-fauna species.

m) The Report indicated that according to the GDARD, GIDS, 2011 the proposed road traverses a ridge.

According to the Report Alternative 1 and 2 is less sensitive than Alternative 3 which traverses larger areas of grassland and ridge systems.

7.4.6.a Issues and Impacts – Affected Properties

Table 54: Issues and Impacts – Affected Properties

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◘**

			Positive Impact/ Neutral - Not Necessary To Mitigate ☼
35)	Access to local roads and properties	-	☺
36)	Safety during construction	-	☺

7.4.6.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

36) Safety during construction

Mitigation measures must be in place to ensure the safety of surrounding residents and businesses, pedestrians, motorists etc.

Table 48: Significance of Issue 36 (Safety during construction) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High** ☻ **Medium** ☺ **Low** ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**C** - Although regarded as a normal practice, it is important to erect proper signs indicating the operations of heavy	**M** - To be included in EMP

	vehicles in the vicinity of dangerous crossings and access roads.	
	C - With the exception of the appointed security personnel, no other workers, friend or relatives will be allowed to sleep on the construction site (weekends included)	**M -** To be included in EMP
	C - Construction vehicles and activities to avoid peak hour traffic times	**M -** To be included in EMP
	C – Surrounding residents must be informed of blasting exercises one week in advance. Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.	**M -** To be included in EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

8 Comparative Assessment between Alternative 1, 2 and Alternative 3

The route is underlain by Dolomite, which poses the risk of formation of sinkholes and dolines. Case could also be present due to underlying dolomite. According to GDARD C-Plan 3, 2011 the proposed road traverses a ridge. Ground water pollution potential due to underlying dolomite. As storm water management plan must be implemented during the construction and operational phase of the propose road.

According to GDARD C-Plan 3, 2011 the proposed alignments traverse irreplaceable sites. The proposed alignments of Olievnehoutbosch road could have noise impacts on existing and proposed developments. The proposed alignments could have visual impacts on the surrounding view sheds during the construction

The results of the environmental scan indicated that there are not any "fatal flaws" associated with the relevant section of the proposed Olievenhoutbosch route (Alternative 2 – proposal) and this was confirmed in the environmental impact assessment, as indicated in Sections 6, 7 and 9 of this report.

8.1 Anticipated impacts, including cumulative impacts

The impacts/ aspects (beneficial and adverse) of the proposed section of the Olievenhoutbosch road (Alternative 1,2 "Proposal" and Alternative 3) on the receiving environment were identified. The above impacts, as well as the affected environmental characteristics, are indicated in **Tables 56 and 57** below.

Table 49: Comparative Assessment between impacts of Alternatives 1, 2 and 3 before Mitigation

Environmental Aspects	Physical				Biological		Socio-Economical									Institutional				Total of Impacts
Key to impacts: ☺ l– Lower positive ☺ m– Medium positive ☺ h– Higher positive ☹ l– Lower negative ☹ m–Medium negative ☹ h– Higher negative 😐 - Neutral	Geology and Soils	Hydrology	Topography	Climate	Fauna	Flora	Qualitative Environment Visual, Noise, Pollution, Security	Compatibility of Land-Use	Availability of municipal services	Upgrading of Municipal Services	Economical Impact Local Authority	Economical Impact I&AP's	Economical Impact Private Sector	Cultural and Historical	Impact on high agricultural potential land	In line with IDP	In line with SDF or other frameworks And open space plans	In line with policies and guidelines	In line with Water Act and other legislation	
CONSTRUCTION PHASE **Preliminary Issues and Impacts**																				
Alternative 1	☹ m	☹ m	😐	☹ l	☹ m	☹ m	☹ l	☺ m	😐	☺ h	😐	☹ m	☺ h	😐	☹ m	☺ h	☺ h	☺ h	☺ h	😐 x 4 ☺ h x 6 ☺ m x 1 ☹ m x 6 ☹ l x 2
Alternative 2	☹ m	☹ m	😐	☹ l	☹ m	☹ m	☹ l	☺ m	😐	☺ h	😐	☹ m	☺ h	😐	☹ m	☺ h	☺ h	☺ h	☺ h	😐 x 4 ☺ h x 6 ☺ m x 1

																				☹ m x 6 ☹ l x 2
Alternative 3	☹ h	☹ h	☹ l	☹ l	☹ m	☹ m	☹ m	☺ m	😐	☺ h	😐	☹ m	☺ h	😐	☹ m	☺ h	☺ h	☺ h	☺ h	😐 x 3 ☺ h x 6 ☺ m x 1 ☹ h x 2 ☹ m x 5 ☹ l x 2

OPERATIONAL PHASE

Preliminary Issues and Impacts

	Geology/ soils	Hydrology	Topography	Climate	Fauna	Flora	Qualitative Env	Land-Use	Municipal Serv	Upgrading of Mun Serv	Econ Impact LA	Econ Impact I & AP's	Econ Impact Priv Sector	Cult & Hist	Agric Potential	IDP	SDF, Open Space Plan	Policies/ Guidelines	Acts other legislation	
Alternative 1	☹ h	☹ m	😐	☹ m	☹ m	☹ m	☹ l	☺ m	☺ h	☺ h	☺ h	☺ l	☺ m	😐	☹ m	☺ h	☺ h	☺ h	☺ h	😐 x 2 ☺ h x 7 ☺ m x 2 ☺ l x 1

																				☹ h x 1 ☹ m x 5 ☹ l x 1
Alternative 2	☹ h	☹ m	😐	☹ m	☹ m	☹ m	☹ m	☺ m	☺ h	☺ h	☺ h	☺ l	☺ m	😐	☹ m	☺ h	☺ h	☺ h	☺ h	☺ h x 7 ☺ m x 1 ☺ l x 2 😐 x 2 ☹ h x 1 ☹ m x 6
Alternative 3	☹ h	☹ m	😐	☹ m	☹ m	☹ m	☹ h	☺ l	☺ h	☺ h	☺ h	☺ l	☺ m	😐	☹ h	☺ h	☺ h	☺ h	☺ h	☺ h x 7 ☺ m x 2 ☺ l x 2 😐 x 2 ☹ h x 2 ☹ m x 4

Table 50: Comparative Assessment between impacts of Alternative 1, 2 and 3 after Mitigation

Environmental Aspects	**Physical**				**Biological**		**Socio-Economical**									**Institutional**				**Total of Impacts**
Key to impacts: ☺ l– Lower positive ☺ m– Medium positive ☺ h– Higher positive ☹ l– Lower negative ☹ m–Medium negative ☹ h– Higher negative 😐 - Neutral	Geology and Soils	Hydrology	Topography	Climate	Fauna	Flora	Qualitative Environment Visual, Noise, Pollution, Security	Compatibility of Land-Use	Availability of municipal services	Upgrading of Municipal Services	Economical Impact Local Authority	Economical Impact I&AP's	Economical Impact Private Sector	Cultural and Historical	Impact on high agricultural potential land	In line with IDP	In line with SDF or other frameworks And open space plans	In line with policies and guidelines	In line with Water Act and other legislation	
CONSTRUCTION PHASE **Preliminary Issues and Impacts**																				
Alternative 1	☹ l	☹ l	☹ l	☹ l	☹ m	☹ m	☹ l	☺ m	😐	☺ h	😐	😐	😐	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 5 ☺ m x 1 😐 x 6 ☹ l x 5 ☹ m x 2
Alternative 2	☹ l	☹ l	☹ l	☹ l	☹ m	☹ m	☹ l	☺ m	😐	☺ h	😐	😐	😐	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 5 ☺ m x 1 😐 x 6

																				☹ l x 5 ☹ m x 2
Alternative 3	☹ l	☹ l	☹ l	☹ l	☹ m	☹ h	☹ l	☺ m	😐	☺ h	😐	😐	😐	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 5 ☺ m x 1 😐 x 6 ☹ l x 5 ☹ m x 1 ☹ h x 1
OPERATIONAL PHASE **Preliminary Issues and Impacts**																				
	Geology/ soils	**Hydrology**	**Topography**	**Climate**	**Fauna**	**Flora**	**Qualitative Env**	**Land-Use**	**Municipal Serv**	**Upgrading of Mun Serv**	**Econ Impact LA**	**Econ Impact I & AP's**	**Econ Impact Priv Sector**	**Cult & Hist**	**Agric Potential**	**IDP**	**SDF, Open Space Plan**	**Policies/ Guidelines**	**Acts other legislation**	
Alternative 1	😐	😐	😐	☹ l	☹ l	☹ m	☹ l	☺ m	☺ h	☺ h	☺ m	☺ l	☺ h	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 7 ☺ m x 2 ☺ l x 1 😐 x 5 ☹ l x 3 ☹ m x 1

Alternative 2	😐	😐	😐	☹ l	☹ l	☹ m	☹ m	☺ m	☺ h	☺ h	☺ m	☺ l	☺ h	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 7 ☺ m x 2 ☺ l x 1 😐 x 5 ☹ l x 2 ☹ m x 2
Alternative 3	😐	😐	😐	☹ l	☹ m	☹ h	☹ l	☺ m	☺ h	☺ h	☺ m	☺ l	☺ h	😐	😐	☺ h	☺ h	☺ h	☺ h	☺ h x 7 ☺ m x 2 ☺ l x 1 😐 x 5 ☹ l x 2 ☹ m x 1 ☹ h x 1
Preferred Alternative	Based on the comparative impact assessment ***Alternative 1*** is regarded as the preferred alternative.																			

8.2 Comparative Assessment between Alternative 1, 2 and Alternative 3

The Tables above are preliminary comparative assessments based on the issues identified in the EIA phase.

The comparative assessment will assist the EAP with the identification of the preferred alternative.

Due to the fact that many of the high impact issues identified in the above mentioned tables can be mitigated to more acceptable levels, the issues ratings before and after mitigation could differ considerably. In many cases, high impact issues (mostly related to the construction phase of a development) can be mitigated completely. The comparative assessment after mitigation (Refer to table above) will therefore give a more accurate indication of the preferred alternative for the project.

Table 51: Summary - Comparative Assessment between Alternative 1 and Alternative 2 before Mitigation

Environmental Aspects	Physical	Biological	Socio-Economic	Institutional
Alternative 1	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 4 ☺ h x 0	☺ l x 0 ☺ m x 3 ☺ h x 5	☺ l x 0 ☺ m x 0 ☺ h x 8
	☹ l x 1 ☹ m x 4 ☹ h x 1	☹ l x 0 ☹ m x 0 ☹ h x 0	☹ l x 2 ☹ m x 3 ☹ h x 0	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 2	😐 x 0	😐 x 4	😐 x 0
Alternative 2	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 4 ☺ h x 0	☺ l x 0 ☺ m x 3 ☺ h x 5	☺ l x 0 ☺ m x 0 ☺ h x 8

	☹ l x 1 ☹ m x 4 ☹ h x 1	☹ l x 0 ☹ m x 0 ☹ h x 0	☹ l x 2 ☹ m x 3 ☹ h x 0	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 2	😐 x 0	😐 x 4	😐 x 0
Alternative 3	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 4 ☺ h x 0	☺ l x 2 ☺ m x 1 ☺ h x 5	☺ l x 0 ☺ m x 0 ☺ h x 8
	☹ l x 2 ☹ m x 2 ☹ h x 3	☹ l x 0 ☹ m x 0 ☹ h x 0	☹ l x 0 ☹ m x 2 ☹ h x 2	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 1	😐 x 0	😐 x 4	😐 x 0

Table 52: Summary - Comparative Assessment between Alternative 1, 2 and Alternative 23after Mitigation

Aspects	**Physical**	**Biological**	**Socio-Economic**	**Institutional**
Alternative 1	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 1 ☺ m x 2 ☺ h x 3	☺ l x 0 ☺ m x 0 ☺ h x 8
	☹ l x 5 ☹ m x 0 ☹ h x 0	☹ l x 0 ☹ m x 3 ☹ h x 0	☹ l x 2 ☹ m x 2 ☹ h x 1	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 3	😐 x 0	😐 x 8	😐 x 0
Alternative 2	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 2 ☺ h x 3	☺ l x 0 ☺ m x 0 ☺ h x 8

	☹ l x 5 ☹ m x 0 ☹ h x 0	☹ l x 1 ☹ m x 3 ☹ h x 0	☹ l x 0 ☹ m x 2 ☹ h x 1	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 3	😐 x 0	😐 x 8	😐 x 0
Alternative 3	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 0 ☺ m x 0 ☺ h x 0	☺ l x 1 ☺ m x 2 ☺ h x 3	☺ l x 0 ☺ m x 0 ☺ h x 8
	☹ l x 5 ☹ m x 0 ☹ h x 0	☹ l x 0 ☹ m x 2 ☹ h x 2	☹ l x 1 ☹ m x 1 ☹ h x 1	☹ l x 0 ☹ m x 0 ☹ h x 0
	😐 x 3	😐 x 0	😐 x 8	😐 x 0

Summary

From the comparison of the three alternatives it can be concluded that the ecological impact of Alternative 1 and 3 is higher than that of Alternative 2 since a large section of route traverses irreplaceable site, natural grassland areas and a large part of a ridge. ***Alternative 1*** follows the alignment of a proposed road in approved township **Irene x92, Irene x91 and Irene x89 and** is regarded as the preferred alternative, but from an ecological point of view most of the appointed specialist prefer ***Alternative 2.***

The socio-economical impacts of the three alternatives are more or less similar.

All three alternatives are in line with the institutional environment including the IDP, the Gauteng Densification Strategy Policy and the Development Facilitation Act.

To conclude, ***Alternative 2*** is the preferred alternative from an environmental point of view.

9. SIGNIFICANCE ASSESSMENT

9.1 Description of Significance Assessment Methodology

The significance of Environmental Impacts was assessed in accordance with the following method:

Significance is the product of probability and severity. Probability describes the likelihood of the impact actually occurring, and is rated as follows:

- Improbable - Low possibility of impact to occur either because of design or historic experience. Rating = 2
- Probable - Distinct possibility that impact will occur. Rating = 3
- Highly probable - Most likely that impact will occur. Rating = 4
- Definite - Impact will occur, in the case of adverse impacts regardless of any prevention measures. Rating = 5

The ***severity factor*** is calculated from the factors given to "intensity" and "duration". Intensity and duration factors are awarded to each impact, as described below.

The ***Intensity factor*** is awarded to each impact according to the following method:

- Low intensity - natural and man made functions not affected – Factor 1

- Medium intensity - environment affected but natural and man made functions and processes continue - Factor 2

- High intensity - environment affected to the extent that natural or man made functions are altered to the extent that it will temporarily or permanently cease or become disfunctional - Factor 4

Duration is assessed and a factor awarded in accordance with the following:

- Short term - <1 to 5 years - Factor 2

- Medium term - 5 to 15 years - Factor 3

- Long term - impact will only cease after the operational life of the activity, either because of natural process or by human intervention - factor 4.

- Permanent - mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient – Factor 4.

The ***severity rating*** is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. For example:

The Severity factor = Intensity factor X Duration factor
= 2 x 3
= 6

A ***Severity factor*** of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

TABLE 53: SEVERITY RATINGS

RATING	FACTOR
Low Severity (Rating 2)	Calculated values 2 to 4
Medium Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High severity (Rating 5)	Calculated values 13 to 16
Severity factors below 3 indicate no impact	

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating.

The ***significance rating*** should influence the development project as described below:

- Low significance (calculated Significance Rating 4 to 6)
  - Positive impact and negative impacts of low significance should have no influence on the proposed development project.

- Medium significance (calculated Significance Rating >6 to 15)
  - Positive impact:
    Should weigh towards a decision to continue
  - Negative impact:
    Should be mitigated to a level where the impact

would be of medium significance before project can be approved.

- High significance (calculated Significance Rating 16 and more)
  - Positive impact:
    Should weigh towards a decision to continue, should be enhanced in final design.
  - Negative impact:
    Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least medium significance rating.

In correspondence received from GDARD some officials were of the opinion that the significance methodology used by Bokamoso applies a simple mathematical formula to environmental aspects with significantly different sensitivity values, which might or might not give an inaccurate final significance value.

The significance methodology used by Bokamoso was prescribed to environmental consultants in courses in impact assessments. No methodology can be accurate to a numerical value where the environment is concerned, because it cannot be measured. Numerical values are only an indication of the significance or severance of impacts. If we do not agree with the outcome of the assessment, we will adjust the numerical value to reflect a more realistic significance. The methodology only acts as an aid to the environmental consultant and the consultant need to use his/her experience in the field together with the methods in order to reach a realistic significance of impacts. Bokamoso, in particular Ms. Lizelle Gregory, has extensive experience in the field of impact assessments.

9.2 Significance Assessment of Anticipated Impacts

Impacts indicated under each section of the environment were each assessed according to the above methodology. ***Table 54*** below contains the results of the significance assessment.

TABLE 54: RESULT OF SIGNIFICANCE ASSESSMENT OF IMPACTS IDENTIFIED TO BE ASSOCIATED WITH THE PROPOSED ROAD K220 (AFTER MITIGATION)

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
CONSTRUCTION PHASE						
Beneficial Impacts						
16. The eradication of weeds and exotic invaders	5	4	3	12	4	**20 High**
30. Creation of temporary Job opportunities.	4	4	2	8	3	12 Medium
Adverse Impacts						
1. Risk for formation of sinkholes and dolines if precautionary measures for construction on dolomite are not followed and if an effective storm water management plan is not implemented.	4	4	4	16	5	**20 High**
2. Stability of structures	3	4	4	16	5	15 Medium
3. Excavatability problems are foreseen and some blasting exercises may be required	3	4	4	16	5	15 Medium
4. Potential damage to metallic elements placed underground due to corrosive soils in dolomitic areas	3	4	4	16	5	15 Medium
5. Erosion	3	4	4	16	5	15 Medium
6. Stockpile areas for construction materials and topsoil	3	4	4	16	5	15 Medium

7. Siltation, erosion and water pollution could occur in the Sesmyl Spruit and associated wetlands as well as systems lower down in the catchment area if a stormwater management plan is not implemented.	3	4	4	16	5	15 Medium
8. Groundwater pollution and contamination of the Sesmyl spruit and associated wetlands.	3	4	4	16	5	15 Medium
9. Perched water conditions	4	2	4	8	3	12 Medium
10. Increased storm water runoff from road into surrounding natural areas	3	4	4	16	5	15 Medium
11. Due to the topography only sections of the proposed Olievenhoutbosch road will be visible from view sheds in the flatter areas around the study area.	4	2	4	8	3	12 Medium
12. Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes road construction and environmental rehabilitation works extremely difficult.	2	2	4	8	3	6 Low
13. If dry and windy conditions occur during the construction phase, dust pollution could become a problem. Although this impact will only be a short term impact, mitigation will be necessary during the construction phase.	2	2	4	8	3	6 Low
14. Impact on natural grassland areas	3	4	4	16	5	15 Medium
15. Impact on riparian vegetation of the Sesmyl spruit and associated wetland	3	2	4	8	3	6 Low

17. If the entire road alignment area is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.	2	4	2	8	3	6 Low
18. Noise of construction machinery could have a negative impact on the fauna species during the construction phase.	2	4	2	8	3	6 Low
19. During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.	3	4	4	16	5	15 Medium
20. Loss of habitat can lead to the decrease of fauna numbers and species.	3	4	4	16	5	15 Medium
21. Structures of cultural and historical significance may be destroyed.	2	4	4	16	4	8 Medium
22. Loss of agricultural land	3	2	4	8	3	9 Medium
27. Impact on existing infrastructure and services (i.e. electricity, water, damage to Telkom cables) during the construction of the proposed road.	3	4	4	16	5	15 Medium
32. Expropriation of properties	5	4	4	16	5	**25 High**
33. Impact on agricultural land and agricultural holdings	3	4	4	16	5	15 Medium
35. Access to local roads and properties	3	4	4	16	5	15 Medium
36. Safety during construction	3	4	4	16	5	15 Medium
OPERATION PHASE						
Beneficial Impacts						

25. The proposed construction of the involved section of Olievenhoutbosch road will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	5	4	4	16	5	**25 High**
28. The proposed Oilevenhoutbosch road will improve regional accessibility in the area. The extension of the road links with the R21 and provides access to the surrounded developments.	5	4	4	16	5	**25 High**
29. The proposed route will divert traffic from existing road network links and thereby alleviate congestion on the existing road network system.	5	4	4	16	5	**25 High**
31. The developer will deliver a large contribution to the infrastructure in the area	5	4	4	16	5	**25 High**
Adverse Impacts						
1. Risk for formation of sinkholes and dolines if precautionary measures for construction on dolomite are not followed and if an effective storm water management plan is not implemented.	4	4	4	16	5	**20 High**
2. Stability of structures	3	4	4	16	5	15 Medium
8. Siltation, erosion and water pollution could occur if a stormwater management plan is not implemented.	4	4	4	16	5	**20 High**
11. Due to the topography only sections of the proposed Olievenhoutbosch road will be visible from view sheds in the flatter	4	2	4	8	3	12 Medium

areas around the study area.						
26. If not planned and managed correctly (i.e. though the holistic planning of the entire development area) the proposed road could have a negative impact on the "Sense of Place" to be created in this developing area.	2	2	4	8	3	6 Low
32. Expropriation of properties	5	4	4	16	5	**25 High**
33. Impact on agricultural land and agricultural holdings	4	4	4	16	5	**20 High**
24. Noise impact	5	2	4	8	3	15 Medium
34. Impact on property values	3	4	4	16	5	15 Medium
35. Access to local roads and properties	5	2	4	8	3	15 Medium

9.3 Discussion of Significance Assessment

Six beneficial impacts associated with the proposed road are anticipated, of which five have a high significance rating. The Environmental Management Plan ***(Refer to Annexure L)*** contains measures to achieve maximum gain from the above beneficial impacts. Five of the anticipated beneficial impacts are Socio-economic related, and one relate to the physical environment. This indicates that the proposed development should contribute to an improvement in the quality of life of the people residing in the broader area and the quality of the physical environment.

Of the thirty-six anticipated adverse impacts associated with the construction and operational phases of the proposed road six of the anticipated impacts have a high significance rating, twenty four impacts have a medium significance rating and six have a low significance rating.

Measures that are recommended in this report and the Environmental Management Plan could mitigate the medium and high-anticipated adverse impacts to an acceptable level. No "fatal flaw" adverse impacts, or adverse impacts that cannot be adequately mitigated, are anticipated to be associated with the proposed construction of the involved section of Olievenhoutbosch road.

10 CONCLUSION

The purpose of the EIA (Environmental Impact Assessment) process was to investigate the Biophysical and Socio-economic environments further by means of specialist studies to identify further issues/impacts of the proposed Olievenhoutbosch road on these environments. Further, to provide mitigation measures for adverse impacts and to assess the significance of these impacts over the short and long term.

As environmental consultants Bokamoso feel satisfied that all site sensitivities were taken into consideration when the alignment was finalised and it is recommended that the proposed alignment (Alternative 2) be accepted as the alignment for the road.

The most significant environmental issues that were identified are the following ***(refer to Figure 22, Sensitivity Map):***

- **Geotechnical:** A large portion of the route underlain by dolomite which poses the risk of formation of sinkholes and dolines. There is also the possibility of caves present due to the underlying dolomite.
- **Hydrology:** All three alignments slope towards the Sesmyl Spruit and associated wetland. Groundwater pollution due to the underlying dolomite.
- **Ridges:** This proposed alternative 3 passes the quartzite ridge and the lower dolomitic slopes near areas where a Threatened plant species, *Melolobium subspicatum* are present.

- **Fauna and flora:** The Red list *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. The *Tristachya – Monocymbium chert-* Quartz outcrop, the Quartz slope vegetation and the Mixed grassland on shallow dolomite study units were considered sensitive. From all the biodiversity studies undertaken it is clear that the north-eastern section which mostly covers Alternative 3 of the route is highly sensitive.
- **Impact on agricultural land and agricultural holdings:** None of the alignments cut through agricultural land and the Kungwini/Ekurhuleni Agricultural Hub. However, the route traverses areas ranging from moderate to low agricultural potential.
- **Relocation of services:** The involved section of route will require the relocation of services.
- **Visual Impact:** Due to the topography only sections of the proposed road will be visible from surrounding view-sheds.
- **Noise Impact:** Pro-active planning in the area had already taken place around the Olievenhoutbosch road alignment. The involved section of the route was taken into consideration during the layout designs of proposed new developments in the area. If planned correctly, the proposed route should therefore not have a significant noise impact on the surrounding environment (currently and in future).
- **Access to local and Provincial roads and properties:** Access to local and provincial roads and properties could be restricted during the construction of the road. Links and access to existing local and Provincial roads as well as future Provincial roads must be provided according to requirements.
- **Access to properties:** The involved section of Olievnhoutbosch road intersect with other important routes including N1-R21, PWV6, K105, Nellmapius Drive, River Road and the Pretoria-Germiston railway line. These access routes will provide access to the surrounding properties as well as the approved Irene x91 development.
- **Blasting:** Some blasting may be required during the construction of the road and mitigation measures will have to be implemented.
- **Need and desirability:** The extension of Olievenhoutbosch road will provide access to the approved Irene x91 development as well as the surrounding residential

areas and will establish another element to facilitate a more balanced road network as well as improve regional access to the area.

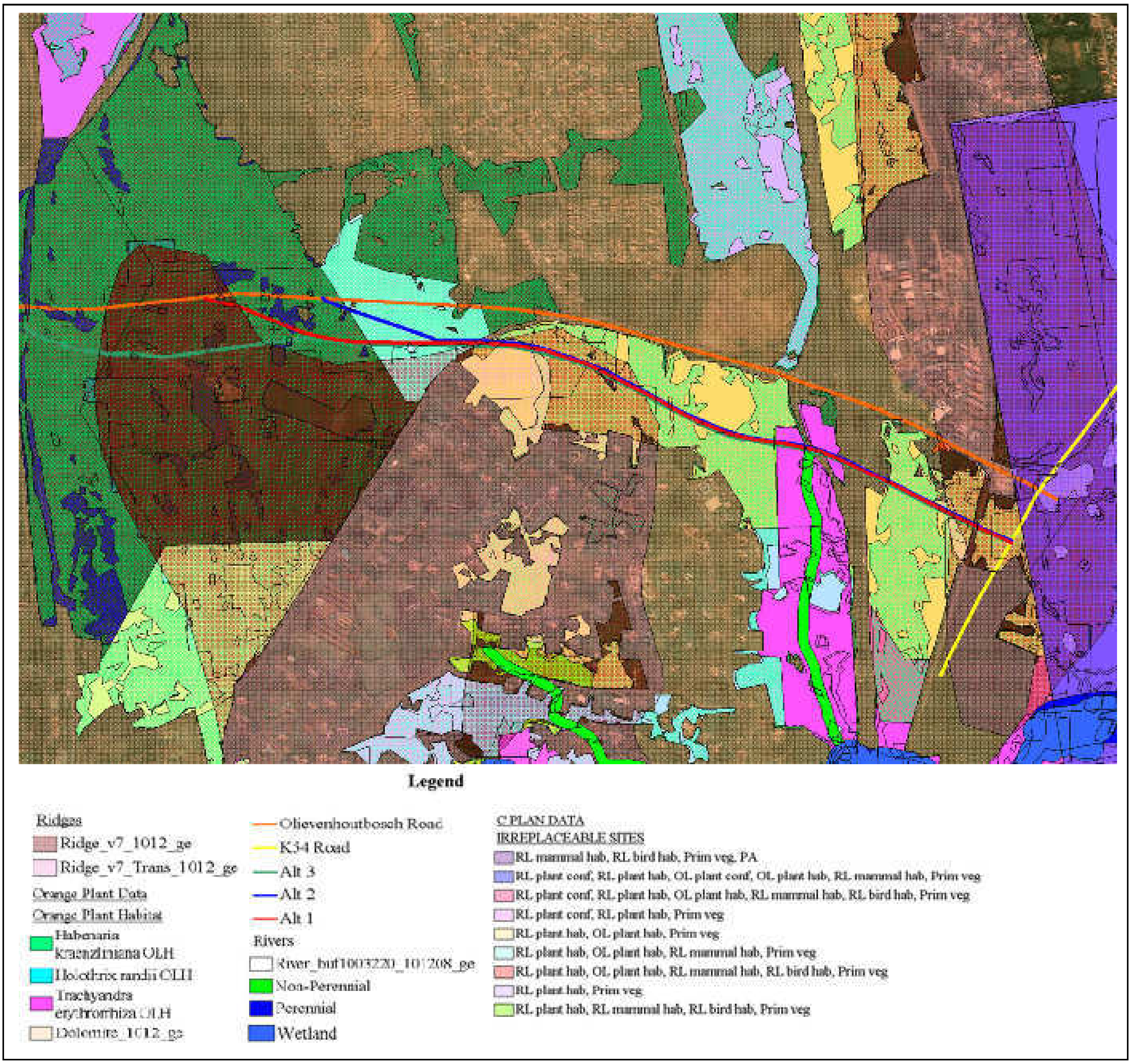


Figure 21 – Sensitivity Map

11. RECOMMENDATIONS

It is believed that the impacts identified have not been of such a nature that short and long term mitigation cannot occur and therefore it is recommended that the **Route Determination and Preliminary Design Phases** of the proposed road be approved subject to:

1) The implementation of the mitigation measures contained in the Environmental Management Plan ***(Annexure L)*** to achieve maximum advantage from beneficial impacts, and sufficient mitigation of adverse impacts;
2) The finalization of the access / interchanges during the detail design phase of the road;
3) The finalization of culvert/ridge details during the detail design phase of the road;
4) A detailed geotechnical study and the comments from the Council for Geosciences during the detail design phase of the road.

Annexure A

Enlargement of Figures

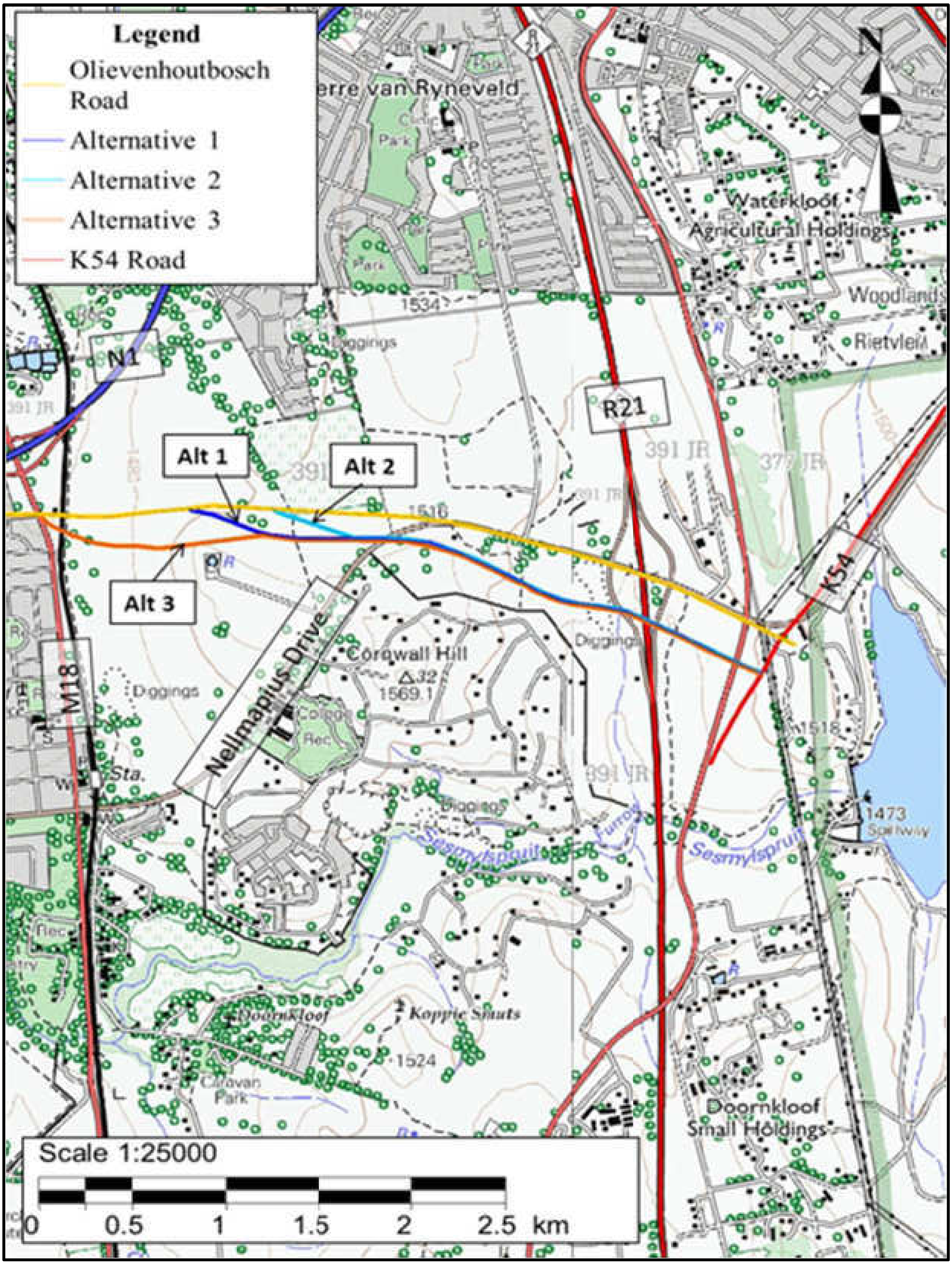


Fig 1: Locality Map

Olievenhoutbosch Road (Main Road to K54)

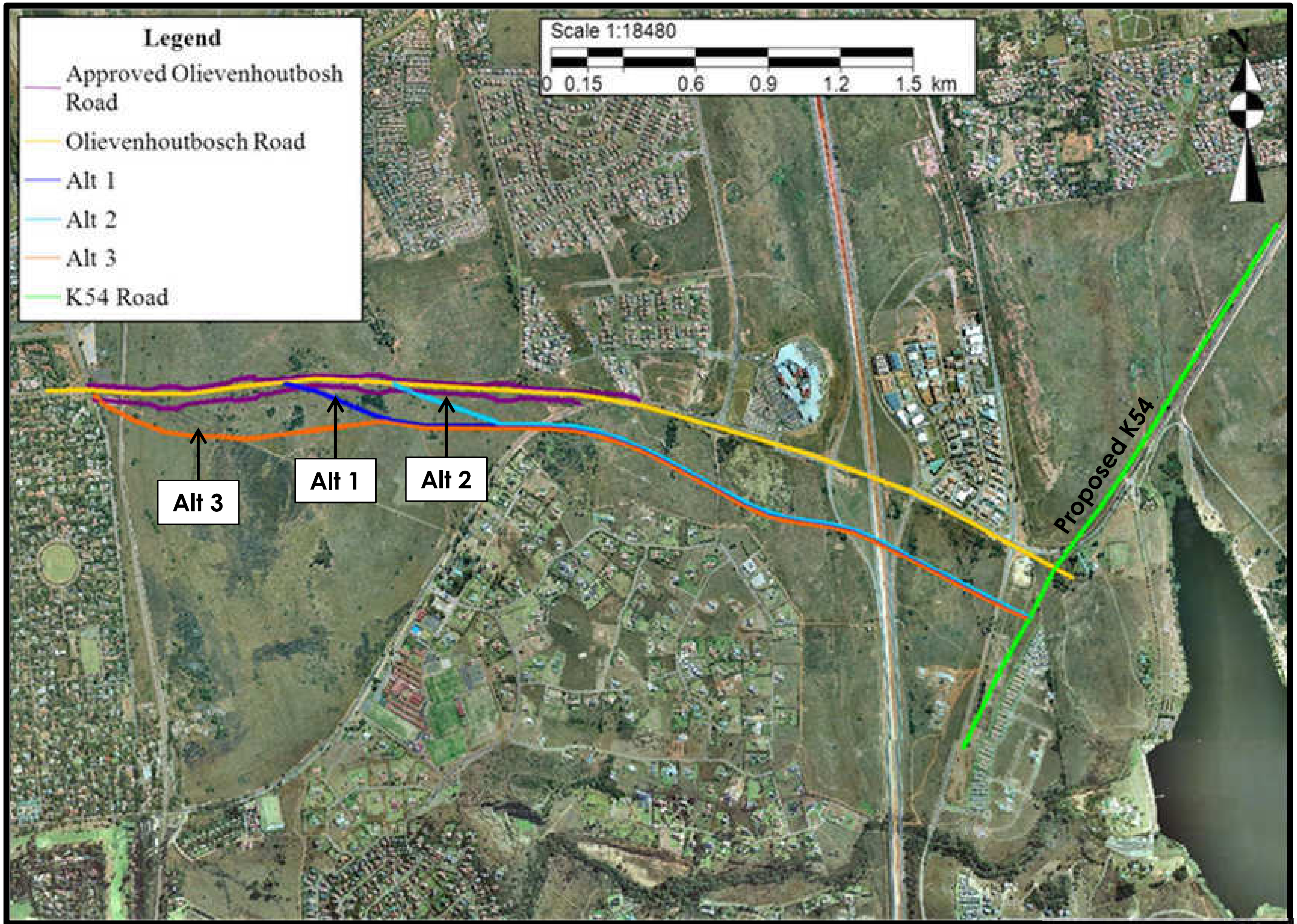


Fig 2: Aerial Map

Olievenhoutbosch Road
(Main Road to K54)

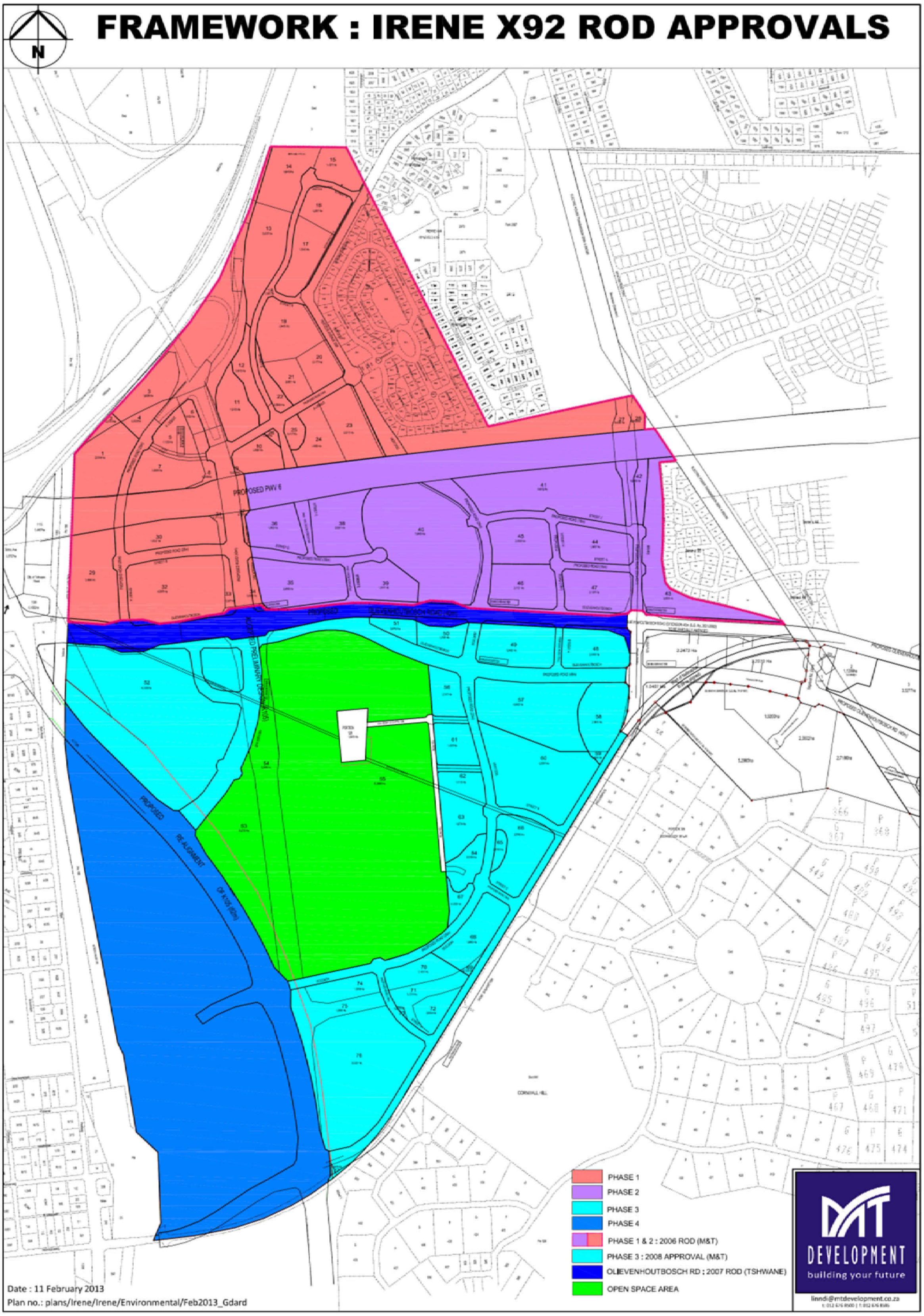


Fig 3: Approved Irene X 92 Layout Map

Olievenhoutbosch Road
(Main Road to K54)

Bokamoso

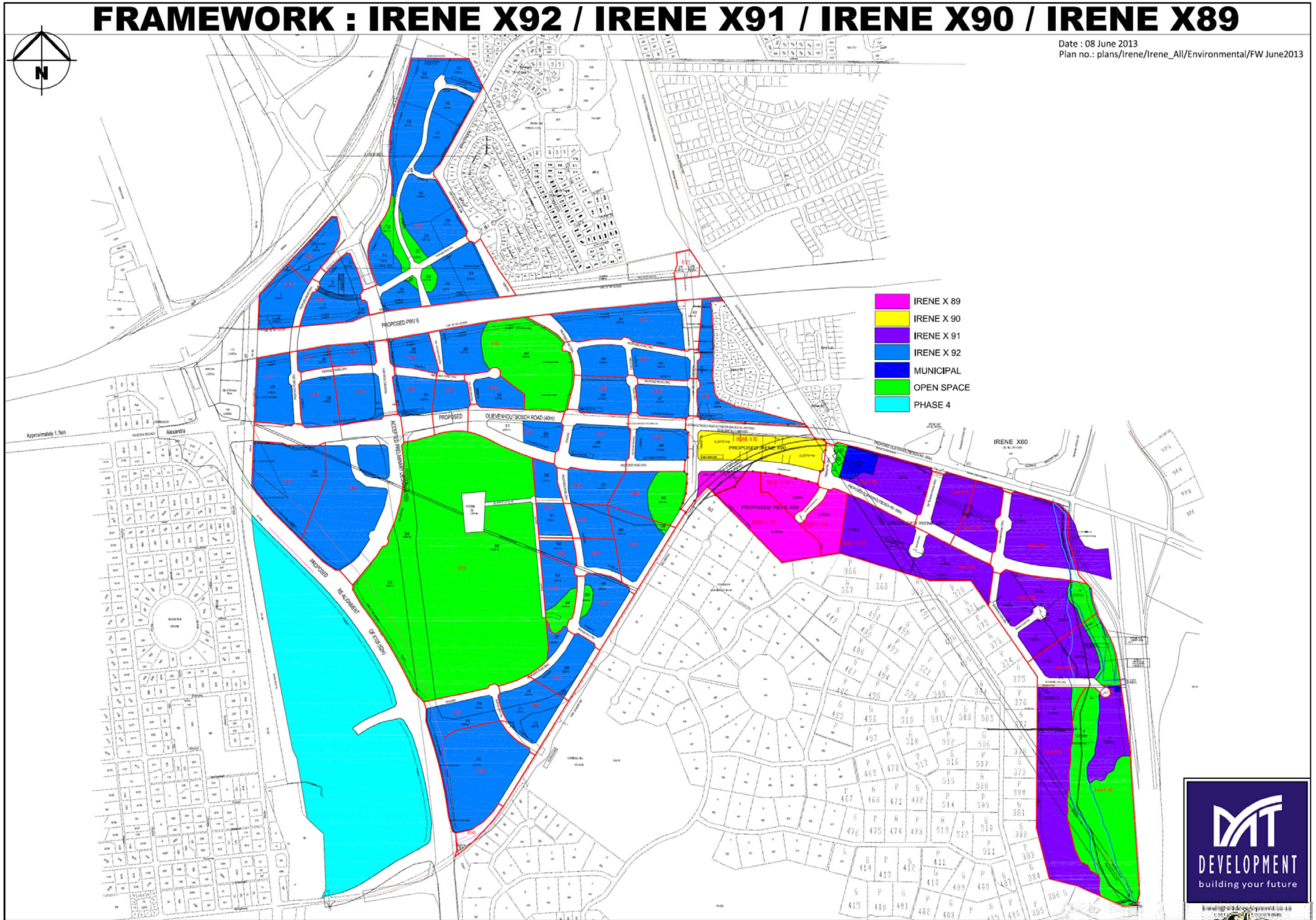


Fig 4: Framework:
Irene X92, X91, X90, X89

Olievenhoutbosch Road
(Main Road to K54)

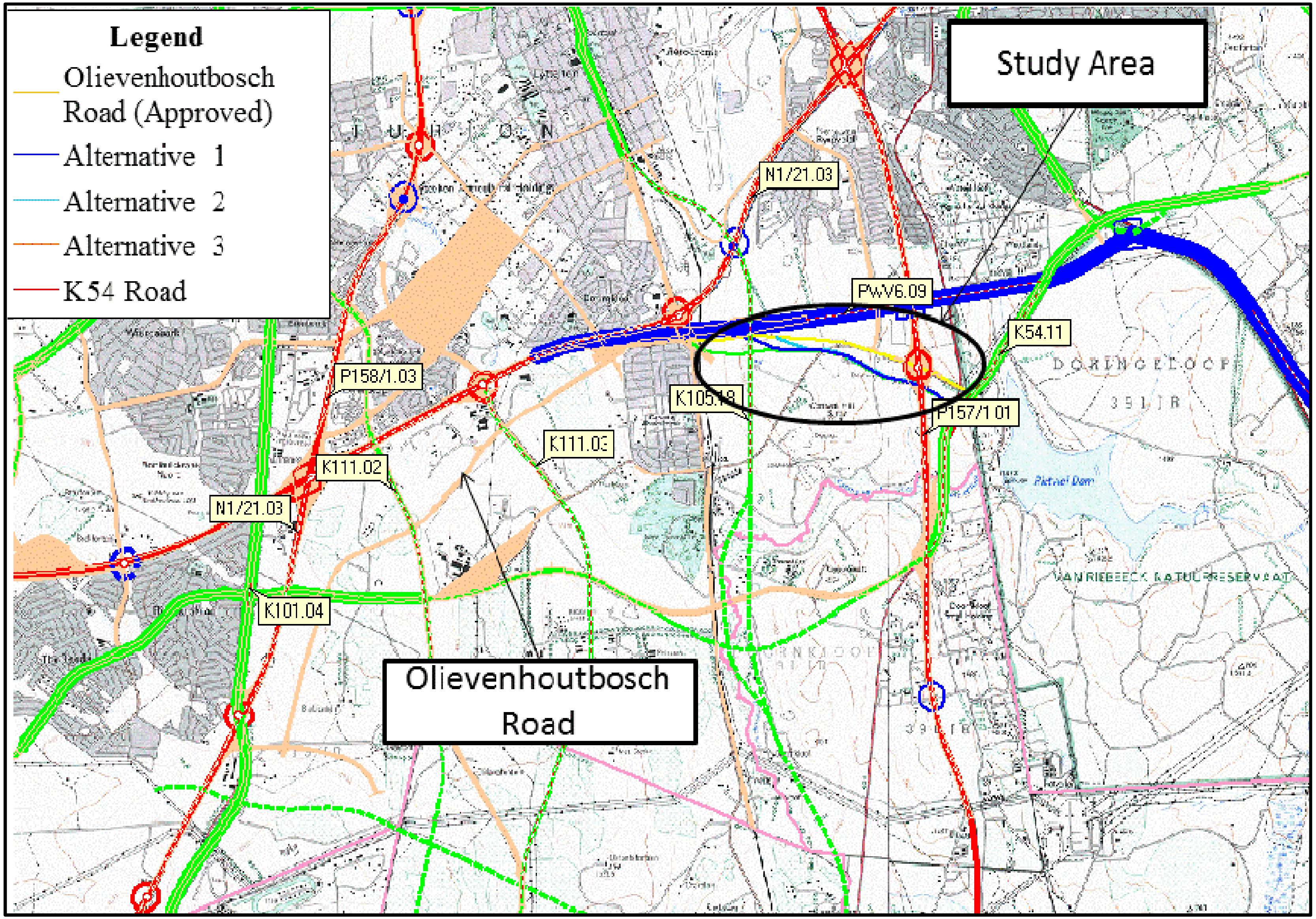


Fig 5: Future road network

Olievenhoutbosch Road (Main Road to K54)

Bokamoso Environmental

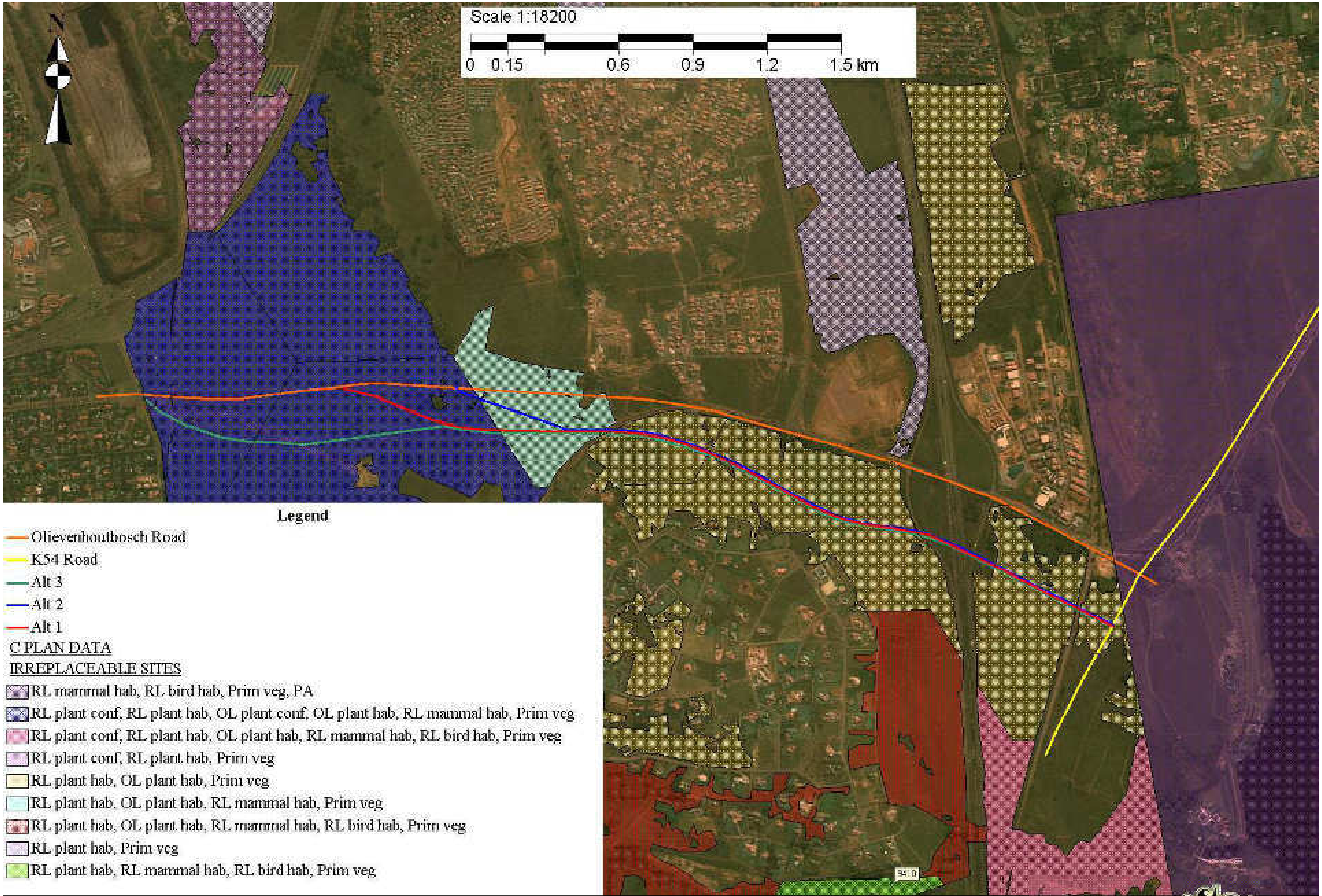


Fig 6: Irreplaceable Sites Map

Olievenhoutbosch Road (Main Road to K54)

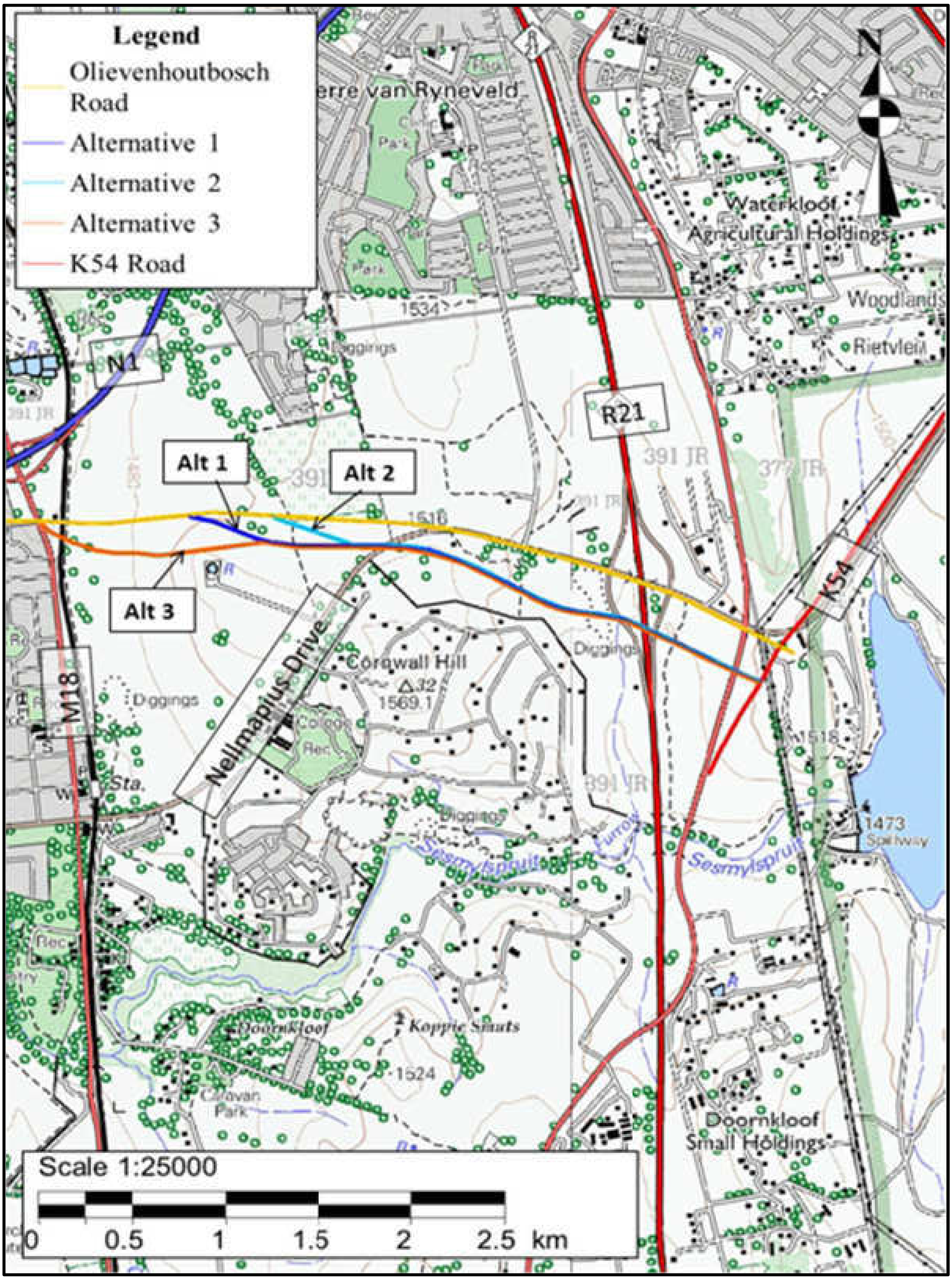


Fig 7: Alternative Alignments

Olievenhoutbosch Road
(Main Road to K54)

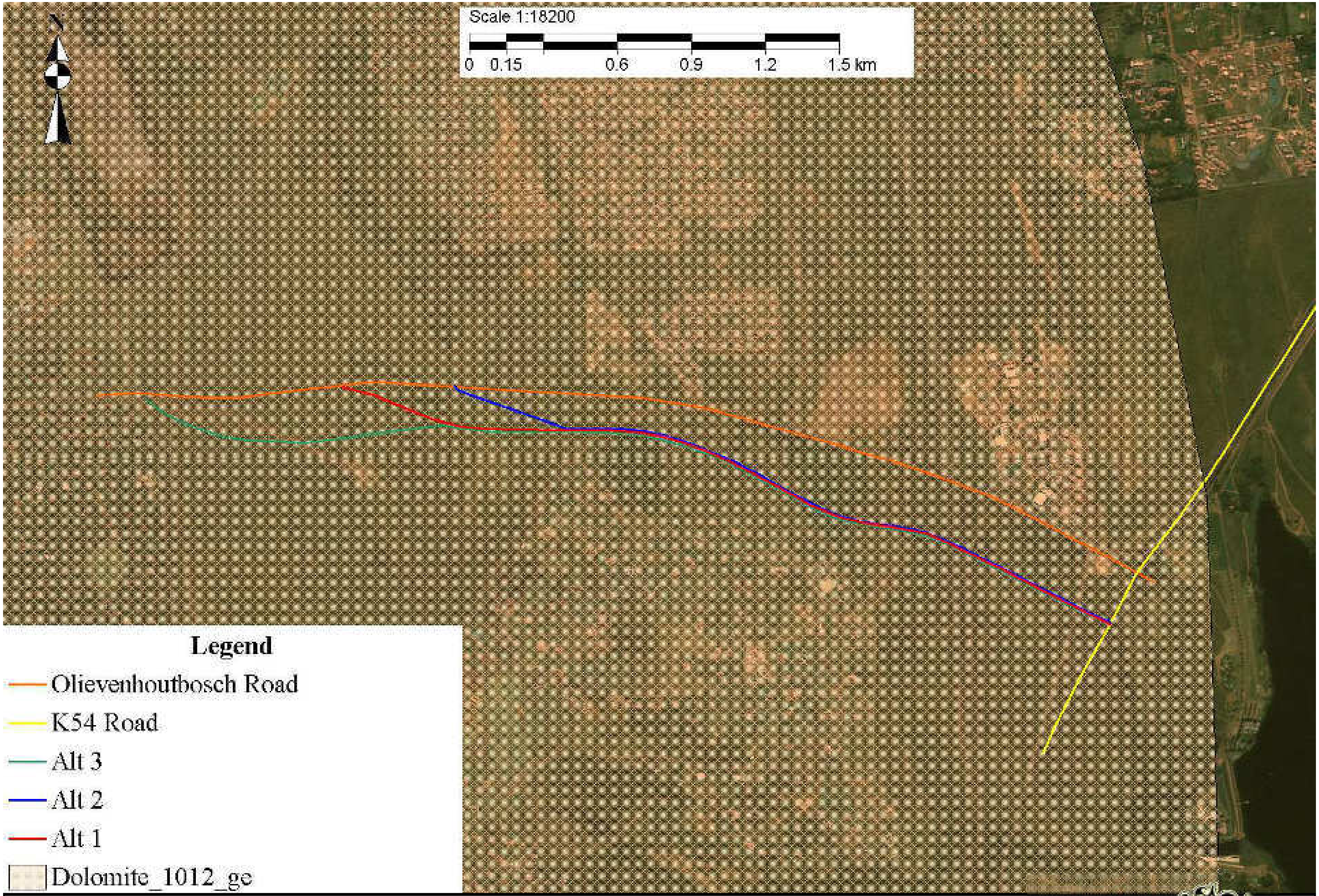


Fig 8: Dolomite Map

Olievenhoutbosch Road
(Main Road to K54)

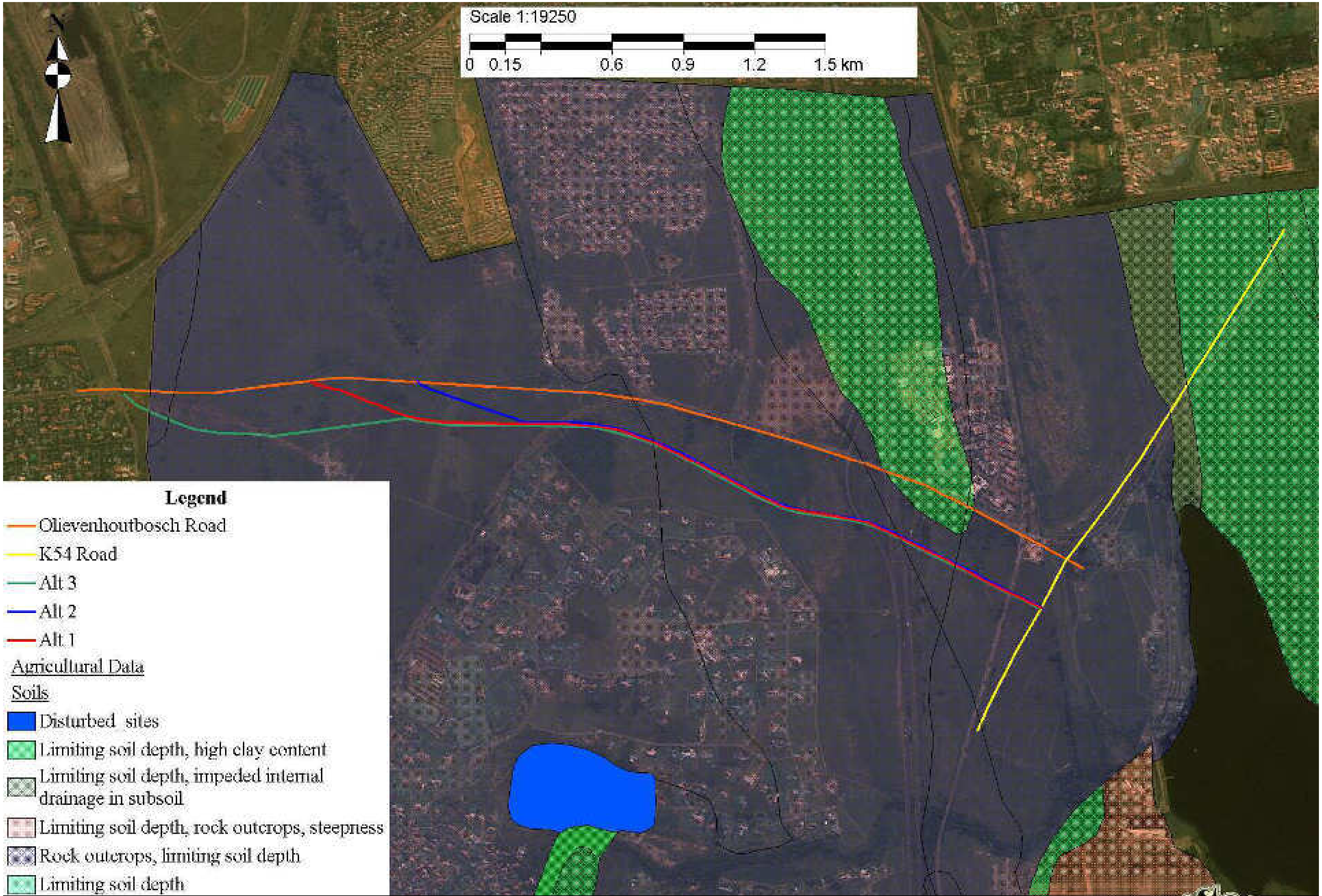


Fig 9: Soils Map

Olievenhoutbosch Road (Main Road to K54)

Bokamoso Environmental

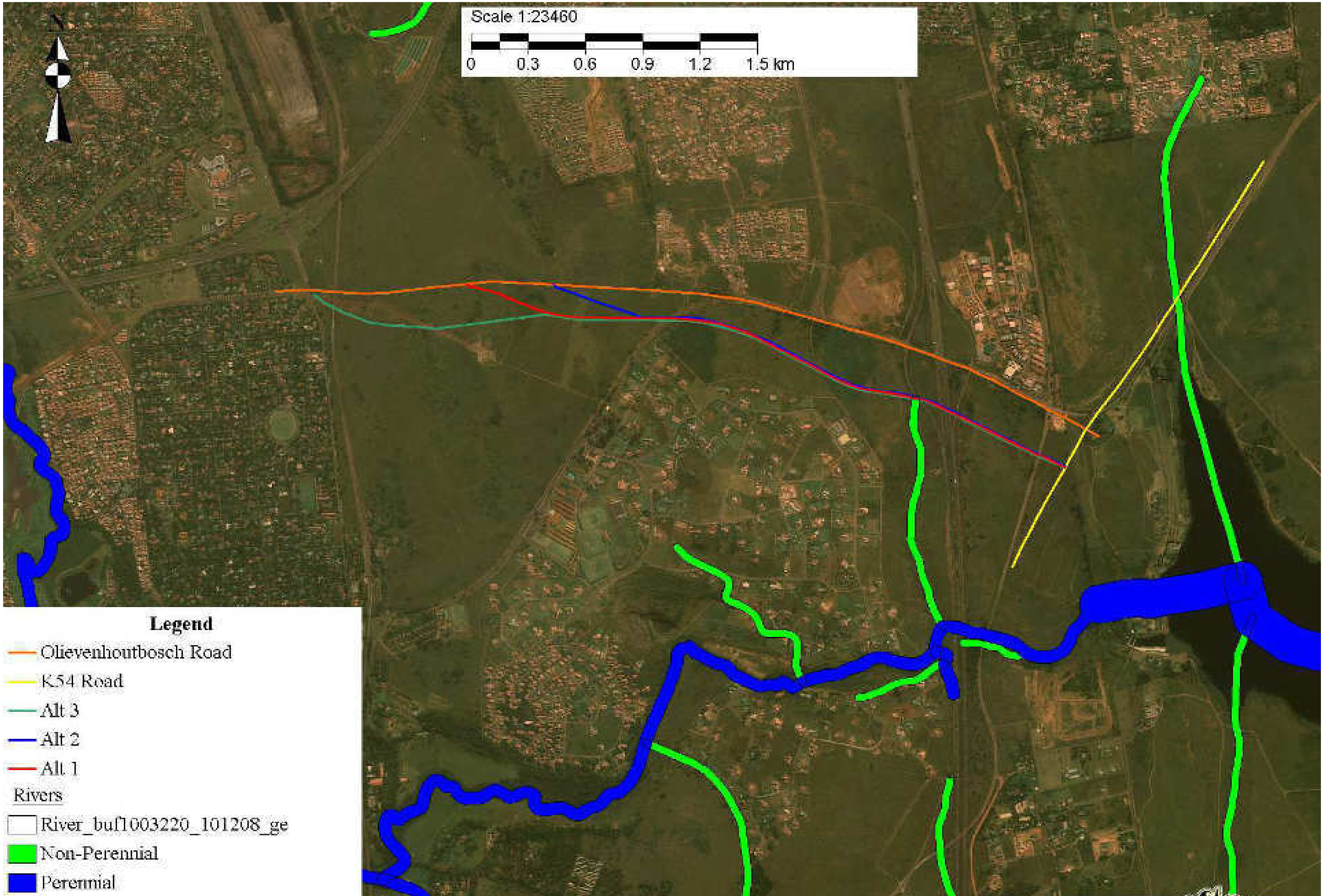


Fig 10: Hydrology Map

Olievenhoutbosch Road (Main Road to K54)

Bokamoso Environmental

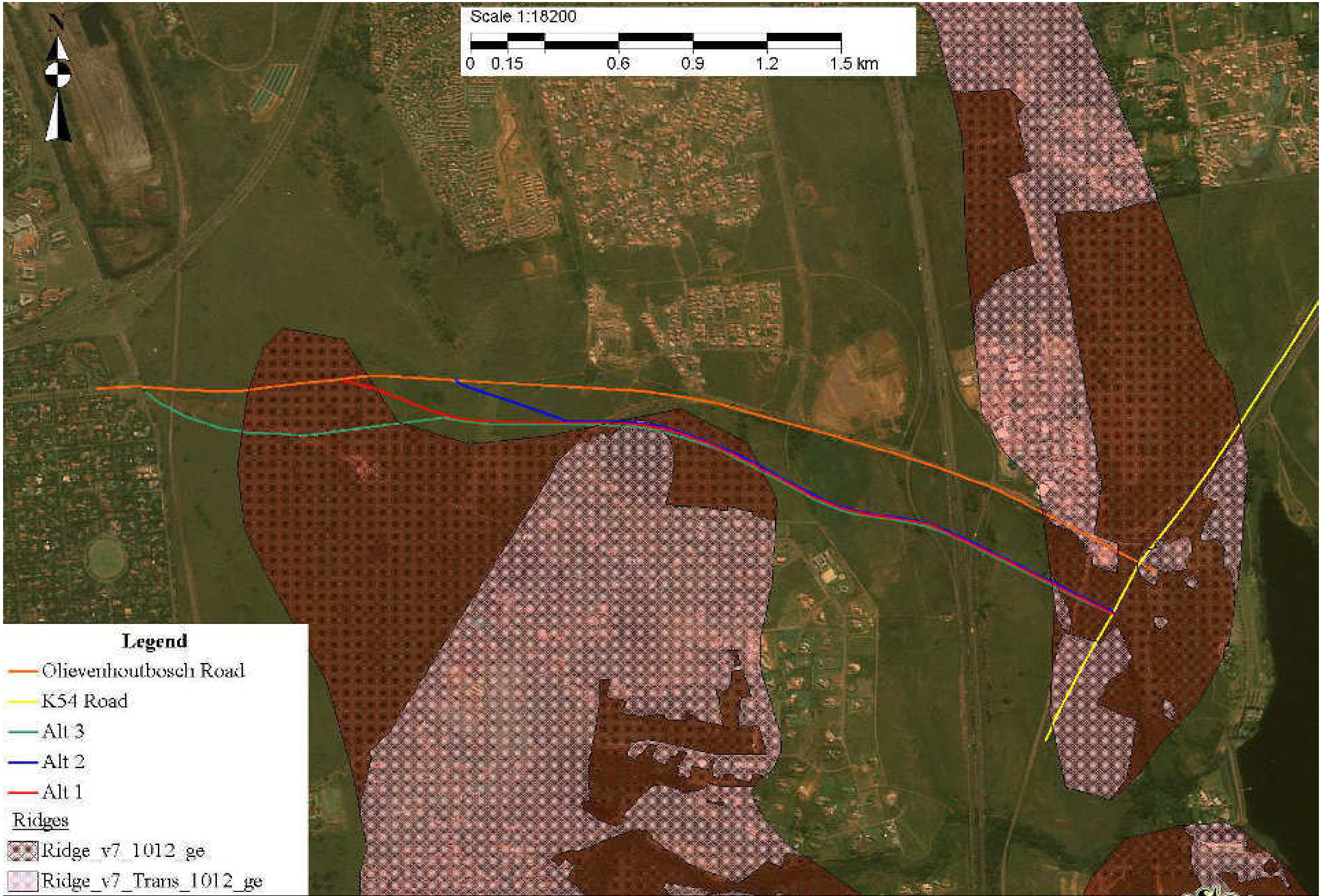


Fig 11: GDARD C-Plan Ridges Map

Olievenhoutbosch Road (Main Road to K54)

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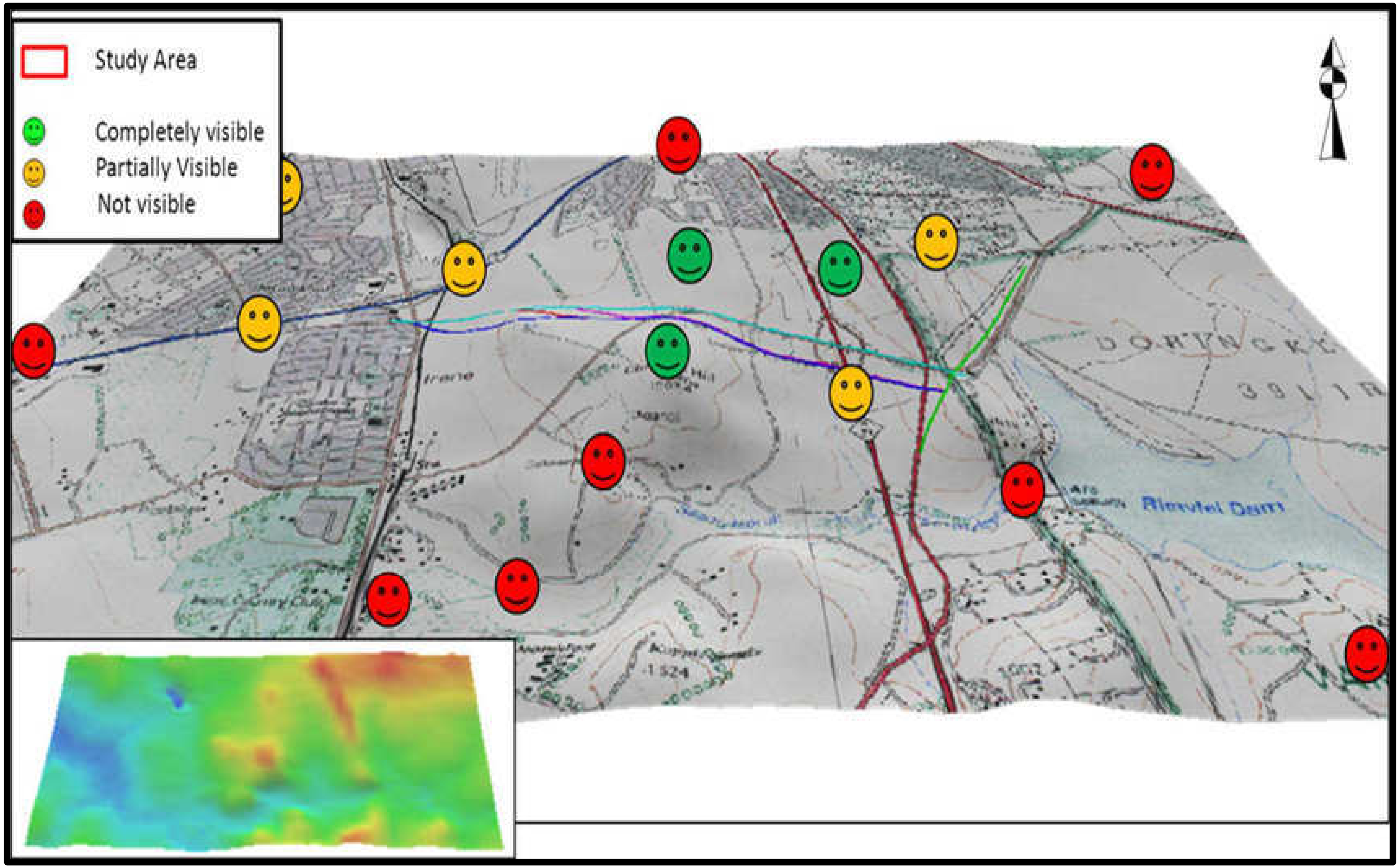


Fig 12: Visual Assessment Map

Olievenhoutbosch Road
(Main Road to K54)

Bokamoso Environmental

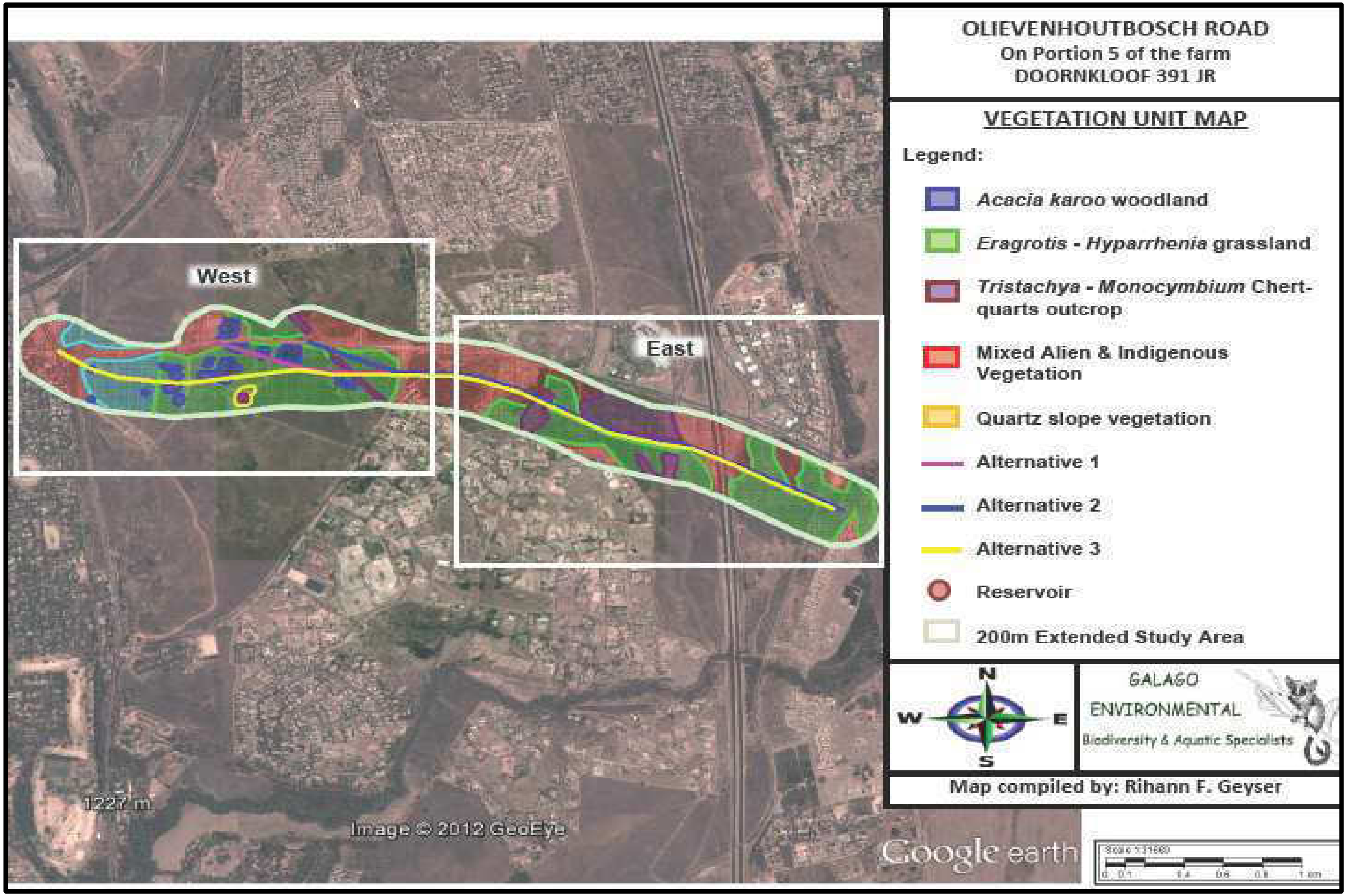


Fig 13: Vegetation Communities

Olievenhoutbosch Road (Main Road to K54)

Fig 14: *Eragrostis* - Hyparrhenia grassland east of the highway R21

Olievenhoutbosch Road
(Main Road to K54)

Bokamoso Environmental

Fig 15: *Tristachya – Monocymbium Chert south of Nellmapuis Road*

Fig 16: Mixed alien and indigenous vegetation

Olievenhoutbosch Road
(Main Road to K54)

Bokamoso Environmental

Fig 17: Quartz slope vegetation on reservoir koppie

Fig 18: Copes of trees in the *Acacia karroo woodland*

Olievenhoutbosch Road
(Main Road to K54)

Fig 19: Mixed grassland on shallow dolomite

Olievenhoutbosch Road
(Main Road to K54)

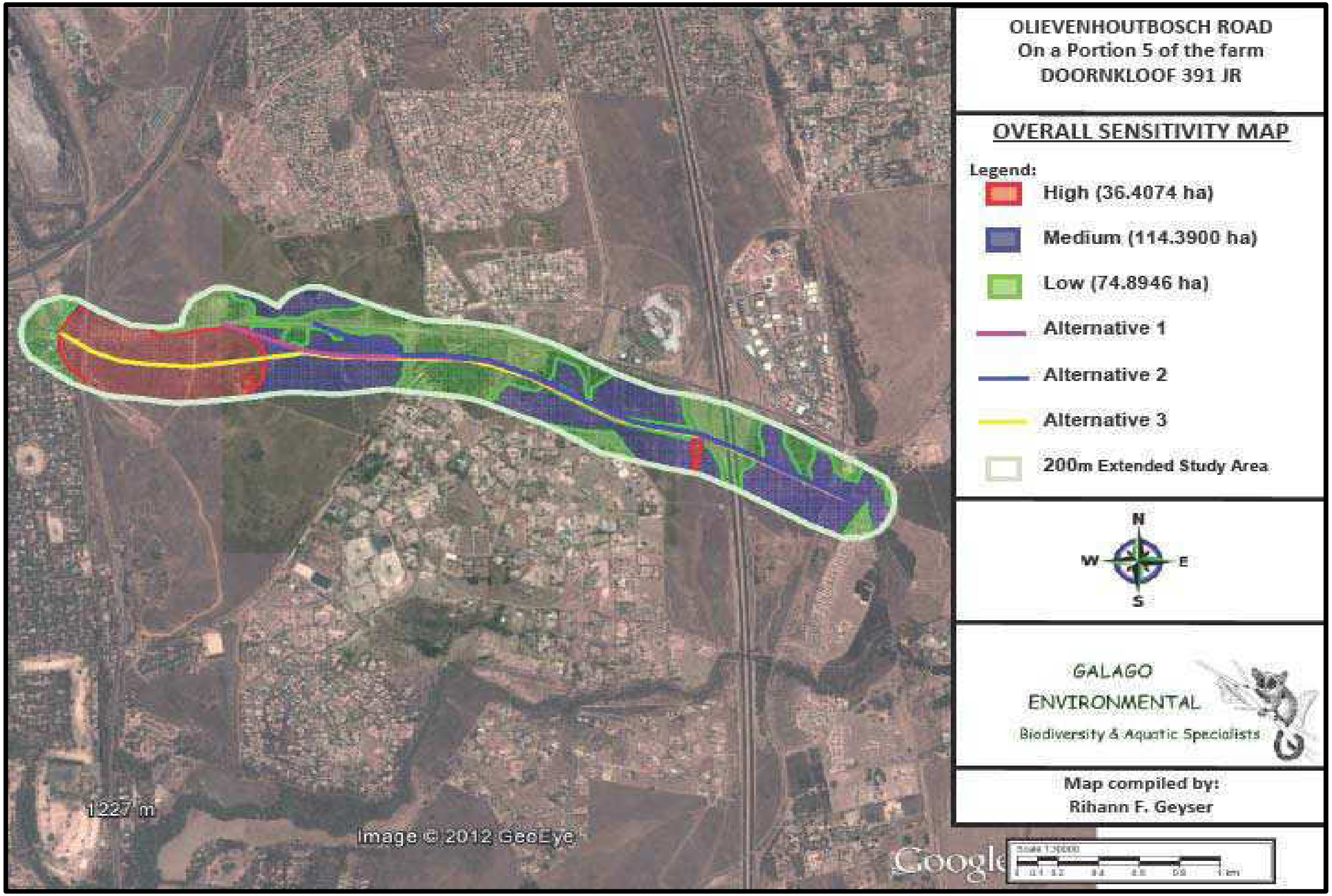
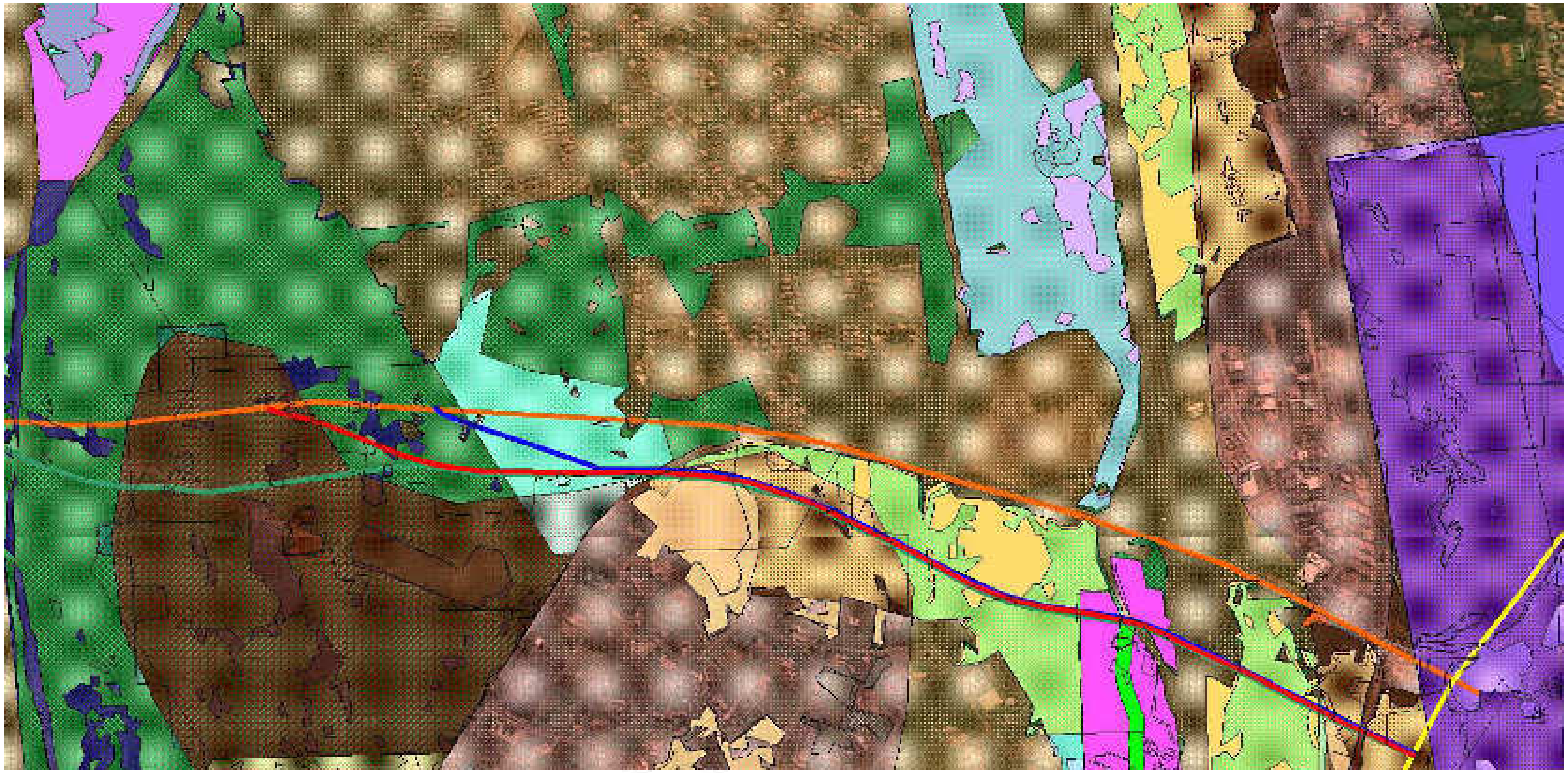


Fig 20: Fauna and Flora Sensitivity Map

Olievenhoutbosch Road (Main Road to K54)



Legend

Ridges
- Ridge_v7_1012_ge
- Ridge_v7_Trans_1012_ge

Orange Plant Data
Orange Plant Habitat
- Habenaria kraenzliniana OLH
- Holothrix randii OLH
- Trachyandra erythrorrhiza OLH
- Dolomite_1012_ge

- Olievenhoutbosch Road
- K54 Road
- Alt 3
- Alt 2
- Alt 1

Rivers
- River_buf1003220_101208_ge
- Non-Perennial
- Perennial
- Wetland

C PLAN DATA
IRREPLACEABLE SITES
- RL mammal hab, RL bird hab, Prim veg, PA
- RL plant conf, RL plant hab, OL plant conf, OL plant hab, RL mammal hab, Prim veg
- RL plant conf, RL plant hab, OL plant hab, RL mammal hab, RL bird hab, Prim veg
- RL plant conf, RL plant hab, Prim veg
- RL plant hab, OL plant hab, Prim veg
- RL plant hab, OL plant hab, RL mammal hab, Prim veg
- RL plant hab, OL plant hab, RL mammal hab, RL bird hab, Prim veg
- RL plant hab, Prim veg
- RL plant hab, RL mammal hab, RL bird hab, Prim veg

Fig 21: Preliminary Sensitivity Map

Olievenhoutbosch Road (Main Road to K54)

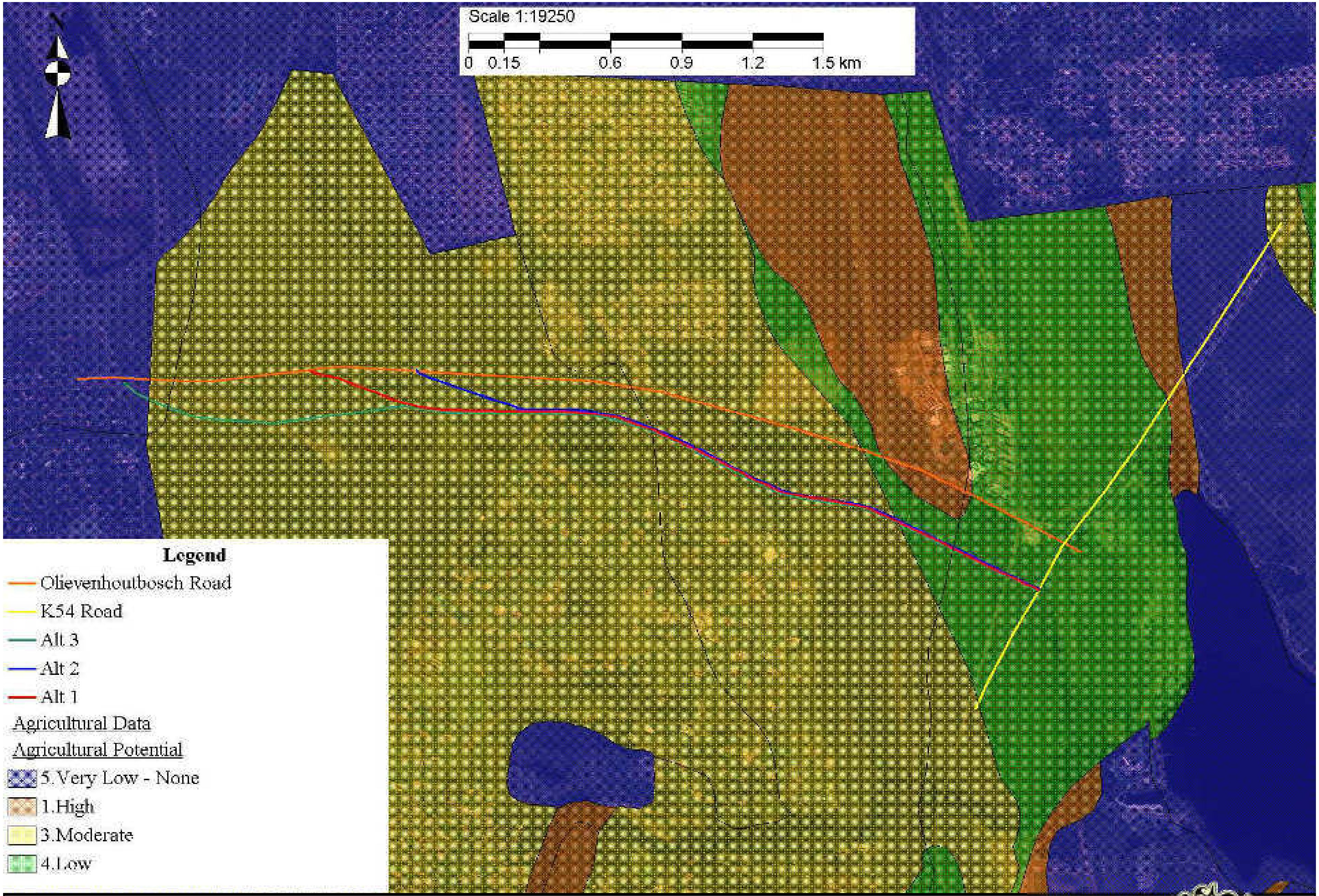


Fig 22: GAPA 3 Agricultural Potential Map

Olievenhoutbosch Road (Main Road to K54)

Bokamoso Environmental

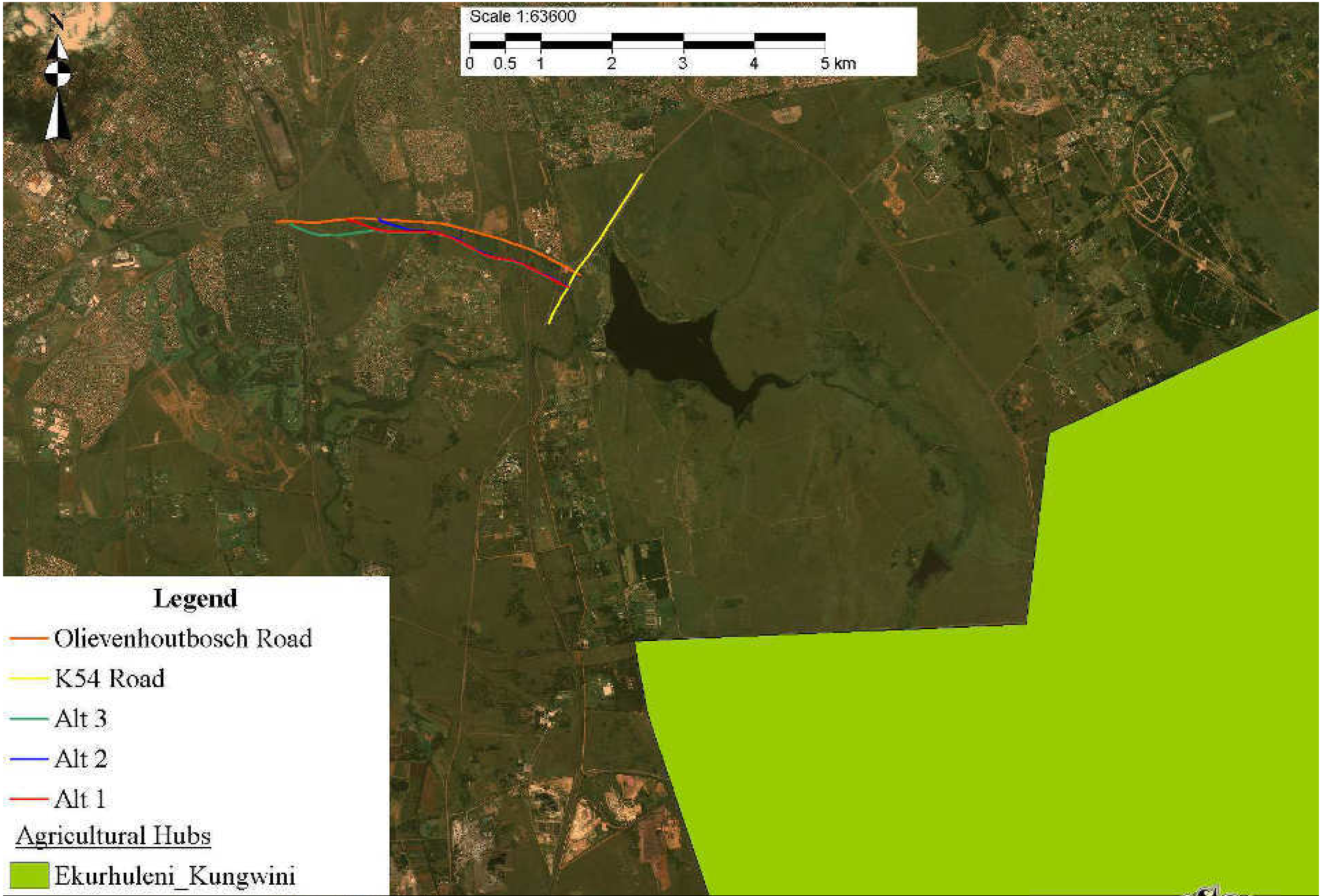


Fig 23: Agricultural Hubs

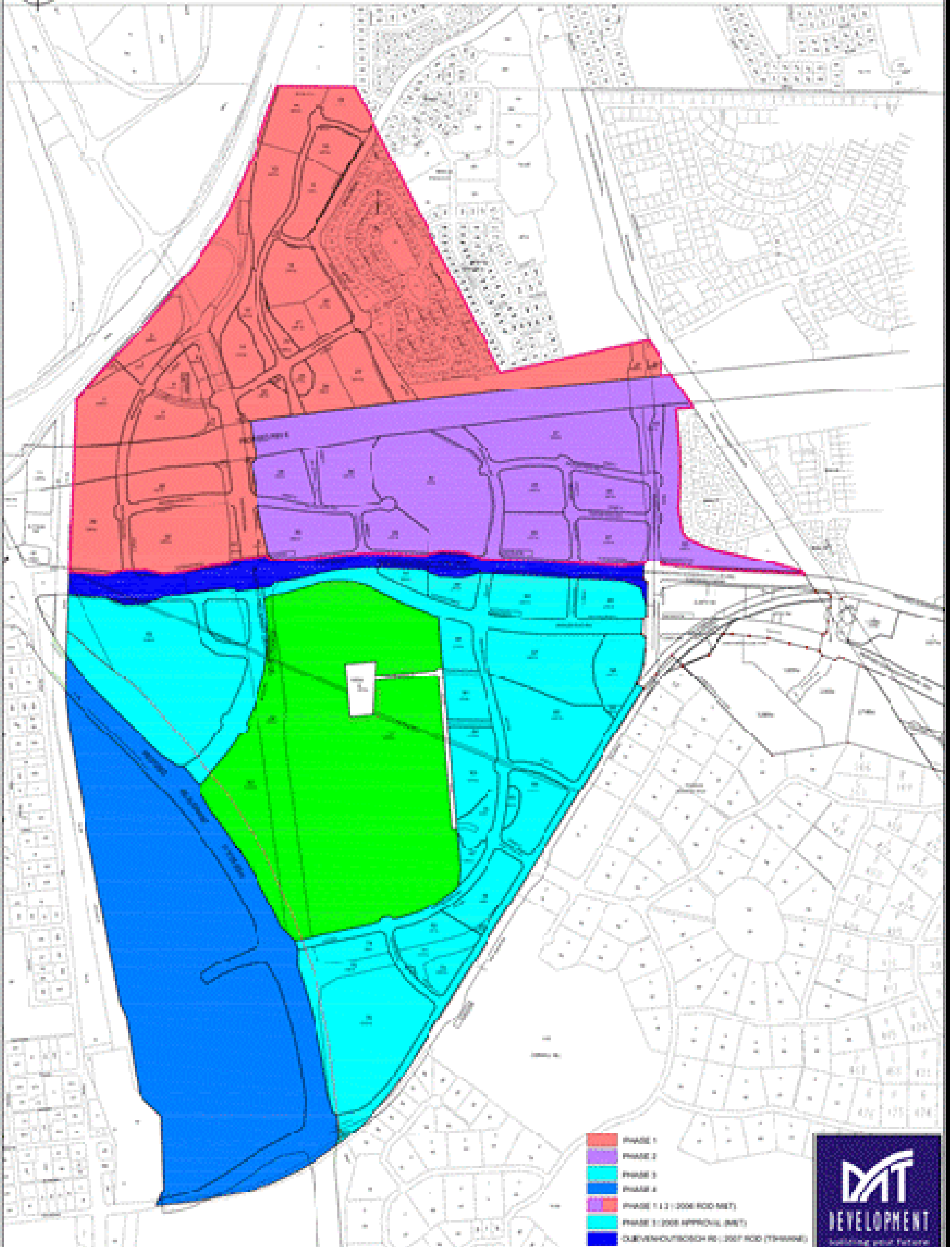
Olievenhoutbosch Road (Main Road to K54)

Bokamoso Environmental

Annexure B

Approved Irene x92 layout

FRAMEWORK : IRENE X92 ROD APPROVALS

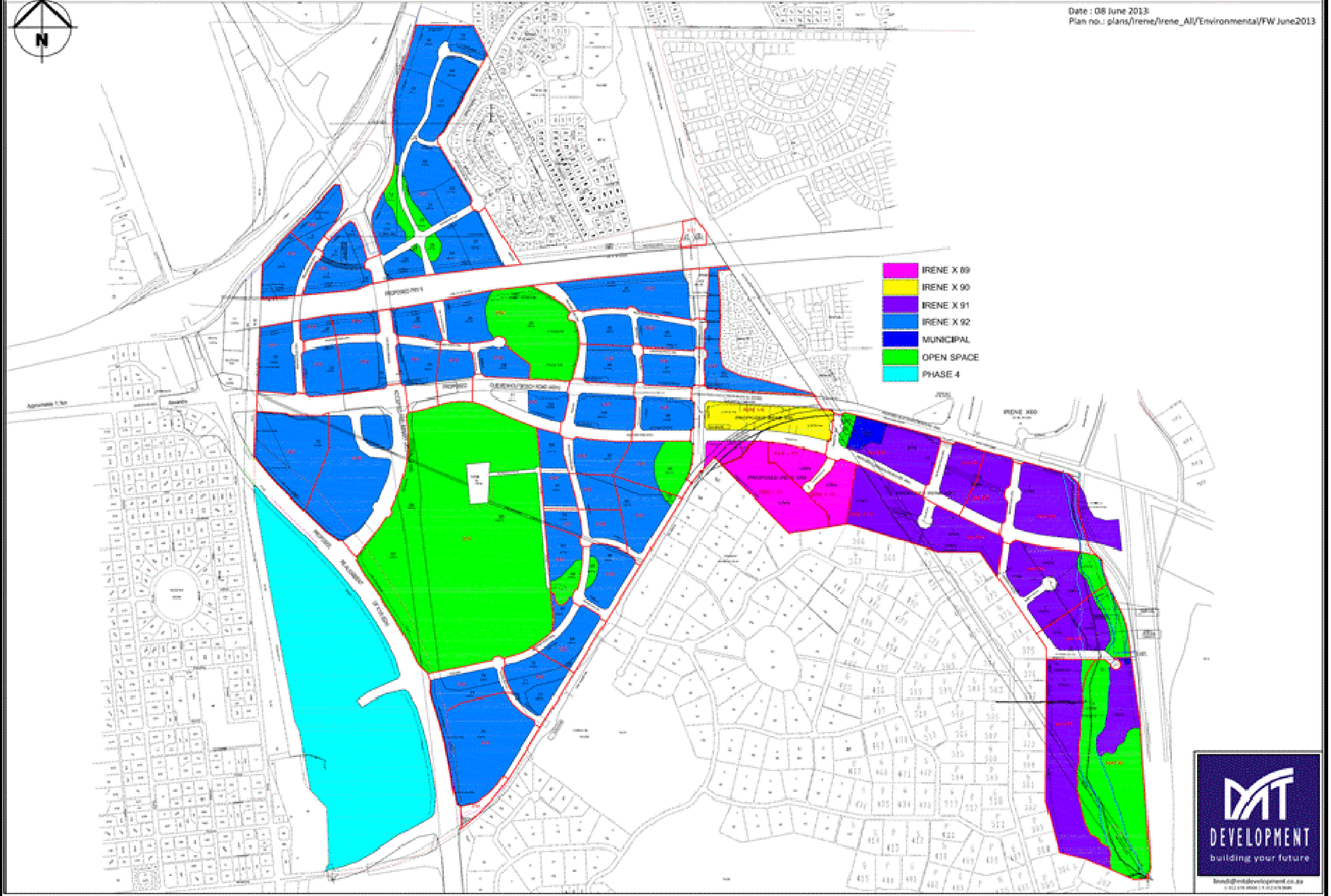


Date: 11 February2013
Plan no.: plans/Irene/Irene/Environmental/Feb2013_Gdard

Annexure C

Framework: Irene x92, x91, x90 and 89

FRAMEWORK : IRENE X92 / IRENE X91 / IRENE X90 / IRENE X89



Annexure D

Scoping Approval Letter from GDARD

GAUTENG PROVINCE
AGRICULTURE AND RURAL DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

Diamond Corner Building, 68 Eloff & Market Street, Johannesburg
P O Box 8769, Johannesburg, 2000

Telephone: (011) 355-1900
Fax: (011) 355-1000
Website: http://www.gdard.gpg.gov.za

FAX COVER SHEET

Receiver's Details		Sender's Details	
To:	Lizelle Gregory	**From:**	Tjatja Mosia
Company:	Bokamoso Landscape Architects and Environmental Consultants	**Section:**	EPIA
Fax no.	086 570 5659	**Floor:**	4th Floor, Diamond Corner
Tell no.	(012) 676 8594	**Tel:**	(011) 355-1447
Date:		**Pages:**	03 including fax cover sheet
SUBJECT:	**GAUT : 002/11-12/0135 SCOPING REPORT AND PLAN OF STUDY FOR EIA ACCEPTED FOR PROPOSED ZITHOBENI EXT 8 HOUSING DEVELOPMENT ON PORTION 11 AND THE REMAINDER OF THE FARM HONDSRIVIER 508-JR.**		

CC	City of Tshwane Metropolitan Municipality	Attn:	Rudzani Mukheli
		Tel:	(012) 358-8731
		Fax:	(012) 358-8934
	JR 209 Investments (Pty) Ltd	Attn:	Mr. Barry Hertzog
		Tel:	(012) 676-8594
		Fax:	(012) 570-5659
	NER-EPIA	Attn:	Hlobisile M'longo
		Tel:	(011) 355-1856
		Fax:	086 765 7212

GAUTENG PROVINCE
AGRICULTURE AND RURAL DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

Reference: Gaut 002/11-12/E0135
Enquiries: Tjatja Mosia
Telephone: (011) 355-1447
Email: Tjatja.Mosia@gauteng.gov.za

Bokamoso Landscape Architects & Environmental Consultants
P. O. Box 11375
Maroelana
0043

Attn: **Lizelle Gregory**
Fax no: **086 570 5659**
Tel no: **(012) 346-3810**

PER FACSIMILE / REGISTERED MAIL.

Dear Madam

SCOPING REPORT AND PLAN OF STUDY FOR EIA ACCEPTED FOR THE PROPOSED CONSTRUCTION OF A SECTION OF OLIEVENHOUTBOSCH ROAD FROM MAIN ROAD TO K54.

The Scoping Report and Plan of Study for Environmental Impact Assessment (EIA) which was submitted in respect of the above-mentioned application and received by the Department on 26 June 2013 has been accepted. You may accordingly proceed with undertaking the EIA in accordance with the tasks that are outlined in the plan of study.

Please note that the Department also requires that the following be considered as an amendment to the Plan of Study for EIA undertaken during the EIA process for submission to the Department accompanying the EIA report:

1. The Ecological Sensitivity Study must cover both fauna and flora and must meet the Department's Directorate of Biodiversity Management requirements for Biodiversity assessments.
2. The EIR must report on the possible impacts on the subject site, which in terms of Conservation Plan Version 3.3 part of the proposed sites is designated as an important and irreplaceable area with patches of suitable habitat for *Hebenaria mossii* which is a red listed plant, *Hebenaria barbertoni* which is an orange listed plant, *Rhinolophus clivosus* which is a priority red listed mammal and *Gauteng grassland* which is a primary vegetation.
3. Sensitivity map reflecting all good natural vegetation, including any form of habitat and ridge systems along the entire alignment of the proposed road must be provided for the Department to determine the extent of impacts associated with the proposed road.
4. The road designs must show the interconnection with the proposed and existing township(s). It must also be overlaid with a sensitivity map and must be clear and legible and be printed on a readable scale map with distinctive legend in solid colours.
5. An assessment of alternatives must include a comparative assessment of all alternative and must reflect environmental and socio-economic impact of each alternative along the entire route alignment. Further, the assessment of alternatives must be discussed in relation to the approved Olievenhoutbosch road alignment traversing the sensitive 5 O'clock site and how is it going to affect the other phased activities in the area.
6. It must be noted that there are areas which, as a result of environmental sensitivities, were excluded from 5 O'clock development and this road and any of its proposed alternative alignments must not begin to start new discussion to encroach on such areas.

68, Eloff Street, Cnr Market Street, Johannesburg, 2000. Tel: 011 355 1900 Fax: 011 355 1000
Website: www.gdard.gpg.gov.za

7. It was noted that a storm water management plan will also be undertaken as part of EIA; the plan must indicate all points of inlet and outlet as well as connections with the existing municipal systems (if there are any) and must comply with the standard and requirements of the City of Tshwane Roads and Stormwater Division.
8. The Department noted with great concern that the plan of study for EIA is very vague owing to the view that there are studies that have been done not long ago in the area and information from such studies will be used for this activity. The Department will like to draw your attention to the fact that each activity is decided on its own merits and as such the evaluation of this activity will be done based on the information collected specifically for this activity. Should there be any deviation from this principle, kindly ensure that such information is updated and is relevant to make a decision on this activity. Further, the Department expects an EIA process to be undertaken using all accepted methods of impact assessment and not according to the subject plan of study contained in the scoping report submitted for this road and all relevant stakeholders (which you are fully aware of) must be directly consulted during all phases of the EIA process.
9. All issues raised by interested and affected parties must be addressed during EIA process.
10. A detailed project and site specific Environmental Management Plan (EMP) must be compiled and included in the EIR.

Notwithstanding the above, your attention is drawn to the fact that the success of the application may be prejudiced by the perceived lack of thorough impact assessment using credible method(s) as required in terms of the EIA process.

If you have any queries regarding the contents of this letter, please contact the official of the Department at the number indicated above.

Yours faithfully

Mr. M. Nkosi
Director: Environmental Impact Management (NER)
Date: 15/10/13

Annexure E

Copy of CV of Lizelle Gregory and Company Profile

Bokamoso

**Landscape Architects &
Environmental consultants**

**P.O.BOX 11375
Maroelana
0161**

**Tel: (012) 346 3810
Fax: (086) 570 5559**

**E-mail: lizelleg@mweb.co.za
Website: www.bokamoso.net**

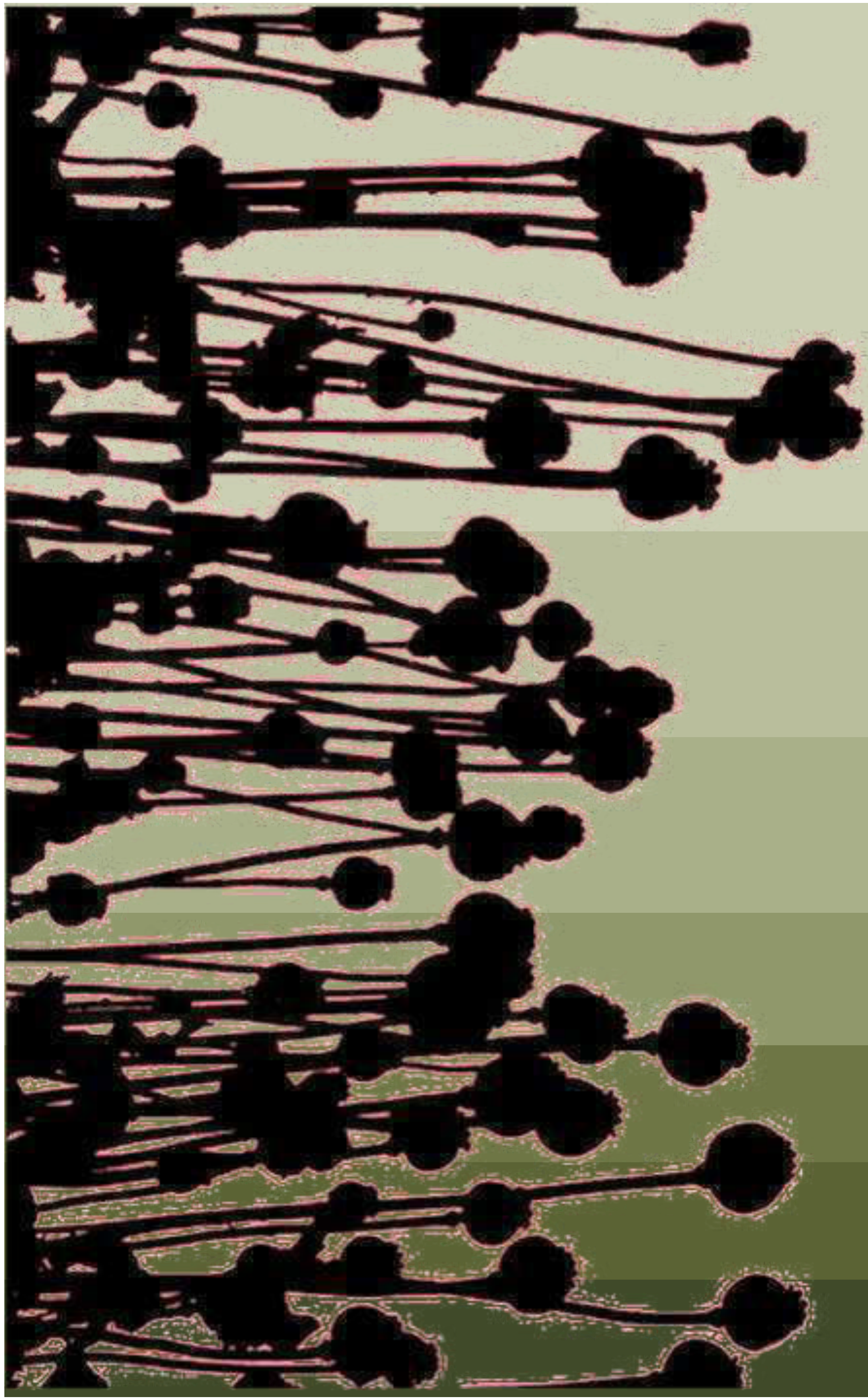
Table of Contents

Bokamoso specialises in the fields of Landscape Architecture and all aspects of Environmental Management and Planning. Bokamoso was founded in 1992 and has shown growth by continually meeting the needs of our clients. Our area of expertise stretches throughout the whole of South Africa. Our projects reflect the competence of our well compiled team. The diversity of our members enables us to tend to a variety of needs. Our integrated approach establishes a basis for outstanding quality. We are well known to clients in the private, commercial as well as governmental sector.

At Bokamoso we stand on a firm basis of environmental investigation in order to find unique solutions to the requirements of our clients and add value to their operations.

01 Executive Summary

011 Company Overview



Vision:

At Bokamoso we strive to find the best planning solutions by taking into account the functions of a healthy ecosystem. Man and nature should be in balance with each other.

Mission:

We design according to our ethical responsibility, take responsibility for successful completion of projects and constitute a landscape that contributes to a sustainable environment. We add value to the operations of our clients and build long term relationships that are mutually beneficial.

Values:

Integrity

Respect

Bokamoso

02 Vision, Mission & Values

Bokamoso stands on the basis of fairness. This include respect within our multicultural team and equal opportunities in terms of gender, nationality and race.

We have a wide variety of projects to tend to, from complicated reports to landscape installation. This wide range of projects enables us to combine a variety of professionals and skilled employees in our team.

Bokamoso further aids in the development of proficiency within the working environment. Each project, whether in need of skilled or unskilled tasks has its own variety of facets to bring to the table.

We are currently in the process of receiving our BEE scorecard. We support transformation in all areas of our company dynamics.

03 Human Resources

031 Employment Equity

Lizelle Gregory (100% interest)

Lizelle Gregory obtained a degree in Landscape Architecture from the University of Pretoria in 1992 and passed her board exam in 1995.
Her professional practice number is PrLArch 97078.

Ms. Gregory has been a member of both the Institute for Landscape Architecture in South Africa (ILASA) and South African Council for the Landscape Architecture Profession (SACLAP), since 1995.

Although the existing Environmental Legislation doesn't yet stipulate the academic requirements of an Environmental Assessment Practitioner (EAP), it is recommended that the Environmental Consultant be registered at the International Association of Impact Assessments (IAIA). Ms. Gregory has been registered as a member of IAIA in 2007.

Ms. Gregory attended and passed an International Environmental Auditing course in 2008.
She is a registered member of the International Environmental Management and Assessment Council (IEMA).

She has lectured at the Tshwane University of Technology (TUT) and the University of Pretoria (UP). The lecturing included fields of Landscape Architecture and Environmental Management.

Ms. Gregory has more than 20 years experience in the compilation of Environmental Evaluation Reports:
Environmental Management Plans (EMP);
Strategic Environmental Assessments;
All stages of Environmental input ;
EIA under ECA and the new and amended NEMA regulations and various other Environmental reports and documents.

Ms. Gregory has compiled and submitted more than 600 Impact Assessments within the last 5-6 years. Furthermore, Ms. L. Gregory is also familiar with all the GDARD/Provincial Environmental policies and guidelines. She assisted and supplied GAUTRANS/former PWV Consortium with Environmental input and reports regarding road network plans, road determinations, preliminary and detailed designs for the past 12 years.

Consulting

Anè Agenbacht

Introduction to Sustainable Environmental Management—An overview of Principles, Tools,& Issues (Potch 2006)
Leadership Training School (Lewende Woord 2010)
BA Environmental Management (UNISA 2011)
PGCE Education (Unisa 2013) - CUM LAUDE
Project Manager
More than 10 years experience in the compilation of various environmental reports

Mary-Lee Van Zyl

Msc. Plant Science (UP)
BSc (Hons) Plant Science (UP)
BSc Ecology (UP)
2years 7months working experience in the Environmental field
Specialises in ECO works, Basic Assessments, EIA’s, and Flora Reports
Compilation of various Environmental Reports

Dashentha Naidoo

BA Honours Degree in Environmental Management (UNISA) - CUM LAUDE
Bachelor Social Science in Geography & Environmental Management (UKZN)
More than 4 years experience in WUL Application& Integrated Environmental Management within water resource management.
Senior Environmental Practitioner & Water Use Licences Consultant
Specialises in Water Use License & Compilation of various Env. Reports

Ben Bhukwana

BSc Landscape Architecture (UP)
More than 5 years experience in the field of Landscape Architecture (Design, Construction, and Implementation).
Specialises in Landscape Design, ECO, Rehabilitation Plans and Compilation Basic Assessment Reports
Compilation of Tender documents

Anton Nel

B-Tech Landscape Technology (TUT)
N Dip Landscape Technology (TUT)
Hazardous Waste Management Short Course
2 years experience in ECO.
Specialises in Basic Assessment Reports.

Juanita de Beer

Diploma Events Management and Marketing (Damelin)
Specializes in Public relations and Public Participation Processes (3 years experience)

Alfred Thomas

CIW Foundation& Internet Marketing (IT Academy)
12 years experience in GIS and IT in general.
GIS Operator and Multimedia Specialist.

Bianca Reyneke

Applying SHE Principles and Procedures (NOSA)
Intro to SAMTRAC Course (NOSA)
SHEQ Coordinator and compilation of environmental reports
Specialises in compiling various environmental reports

Bokamoso

Elsa Viviers

Interior Decorating (Centurion College)
(Accounting/ Receptionist) and Secretary to Lizelle Gregory

Loura du Toit

N. Dip. Professional Teacher (Heidelberg Teachers Training College)
Librarian and PA to Project Manager

Merriam Mogalaki

Administration Assistant with in-house training in bookkeeping

Landscape Contracting

Elias Maloka

Site manager overseeing landscape installations.
Irrigation design and implementation.
Landscape maintenance
18 years experience in landscape contracting works.

The contracting section compromises of six permanently employed black male workers. In many cases the team consists of up to 12 workers, depending on the quantity of work.

01 Environmental Management Services

- Basic Assessment Reports
- EIA & Scoping Reports
- Environmental Management Plans
- Environmental Scans
- Strategic Environmental Assessments
- EMP for Mines
- Environmental Input and Evaluation of Spatial Development Frameworks
- State of Environmental Reports
- Compilation of Environmental Legislation and Policy Documents
- Environmental Auditing and Monitoring
- Environmental Control Officer (ECO)
- Visual Impact assessments
- Specialist Assistance with Environmental Legislation Issues and Appeals
- Development Process Management
- Water Use License applications to DWA
- Waste License Application

02 Landscape Architecture

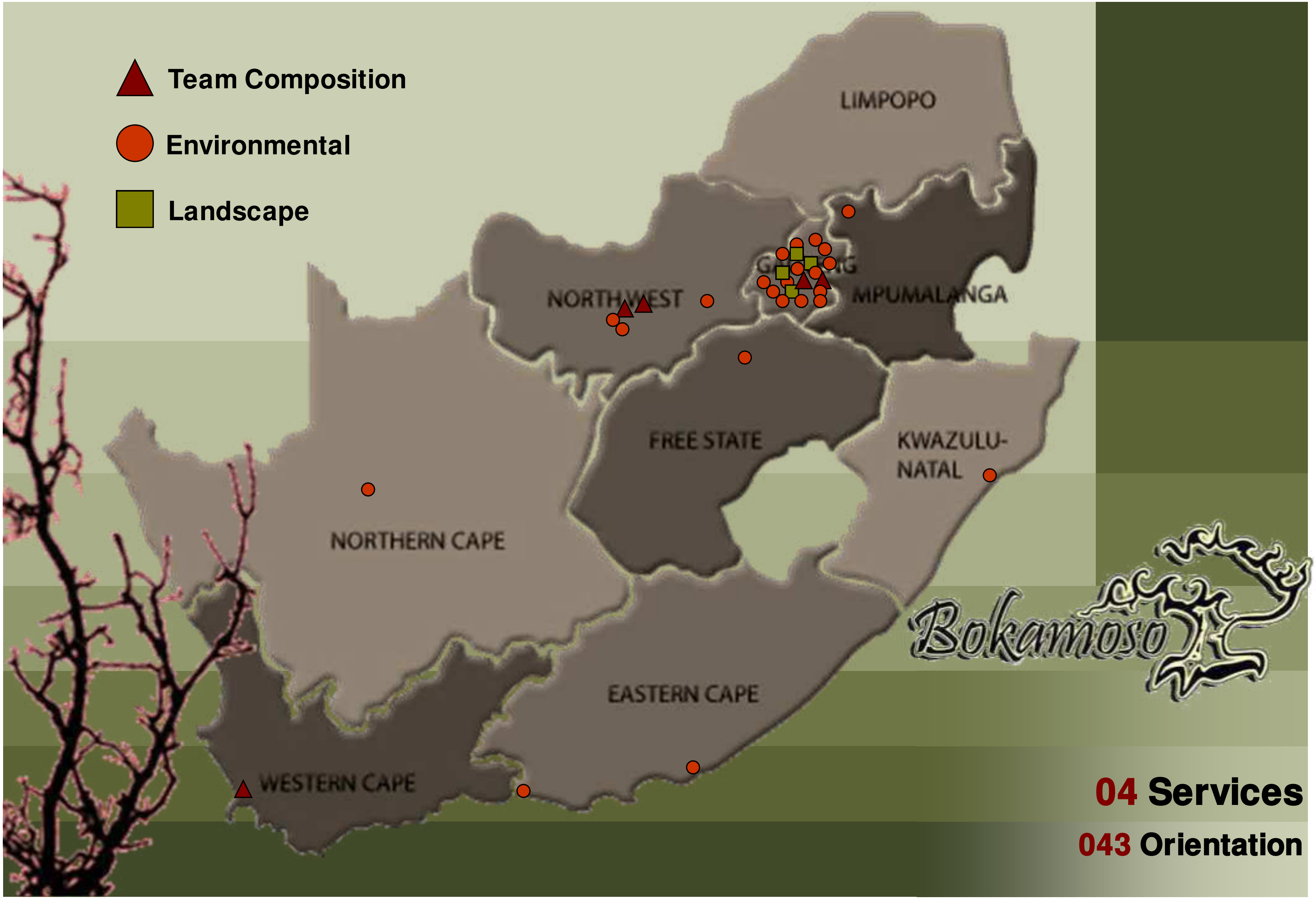
- Master Planning
- Sketch Plans
- Planting Plans
- Working Drawings
- Furniture Design
- Detail Design
- Landscape Development Frameworks
- Landscape Development Plans (LDP)
- Contract and Tender Documentation
- Landscape Rehabilitation Works

03 Landscape Contracting

Implementation of Plans for:

- Office Parks
- Commercial/ Retail / Recreational Development
- Residential Complexes
- Private Residential Gardens
- Implementation of irrigation systems

Bokamoso



04 Services

043 Orientation

01 Valpre Bottling Plant, Heidelberg

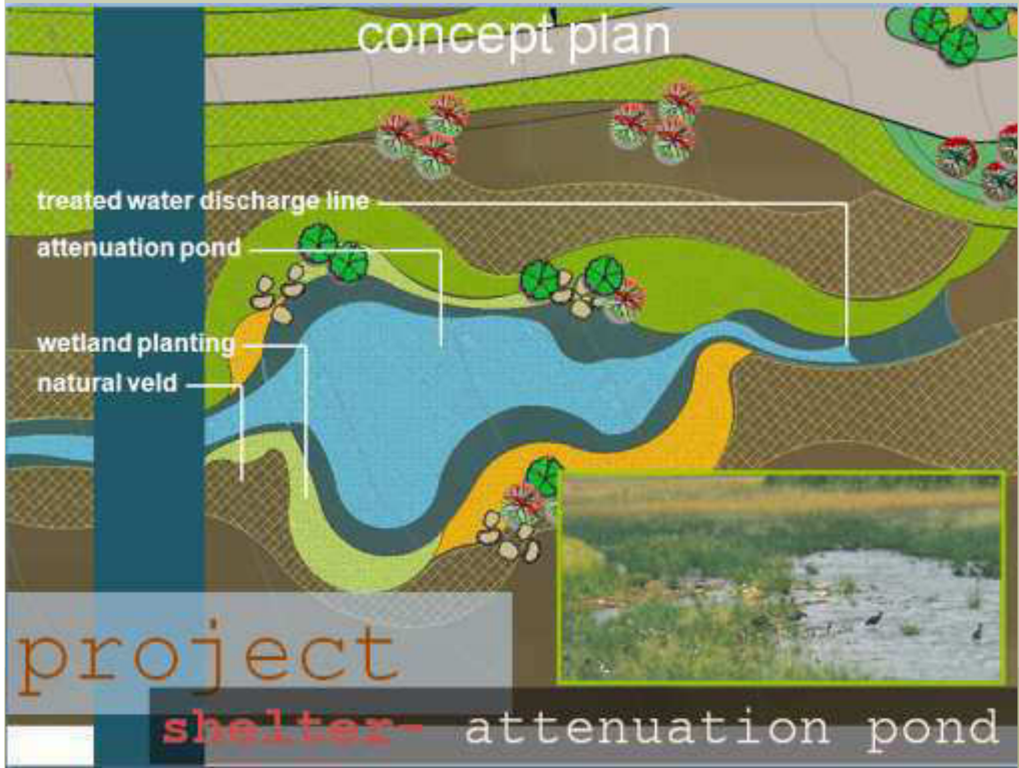
Bokamoso

project
shelter- site plan

05 Landscape Projects– Current

051 Commercial

01 Valpre Bottling Plant, Heidelberg

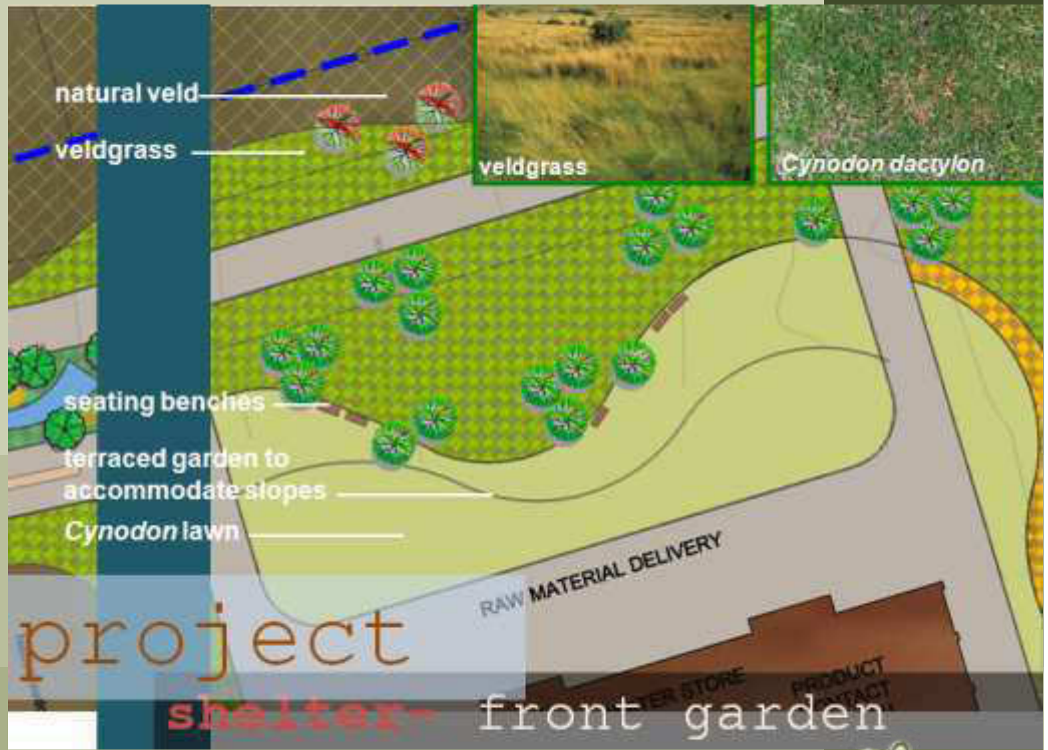


Bokamoso

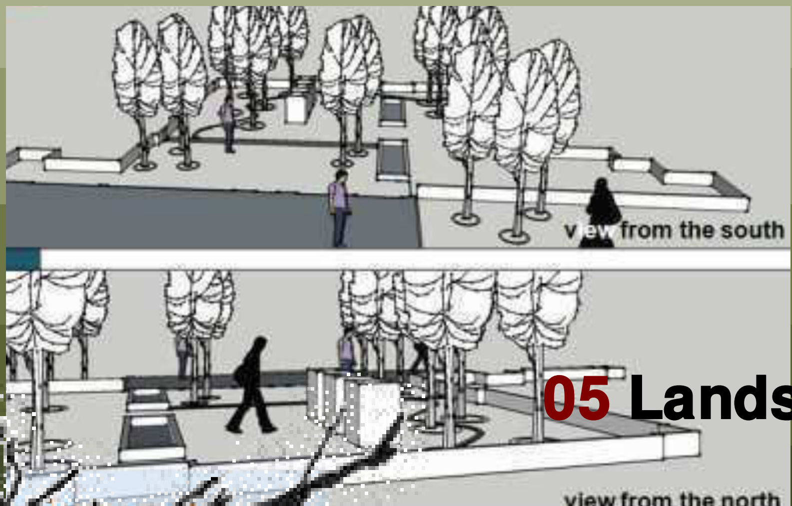
05 Landscape Projects– Current

051 Commercial

01 Valpre Bottling Plant, Heidelberg



01 Valpre Bottling Plant, Heidelberg

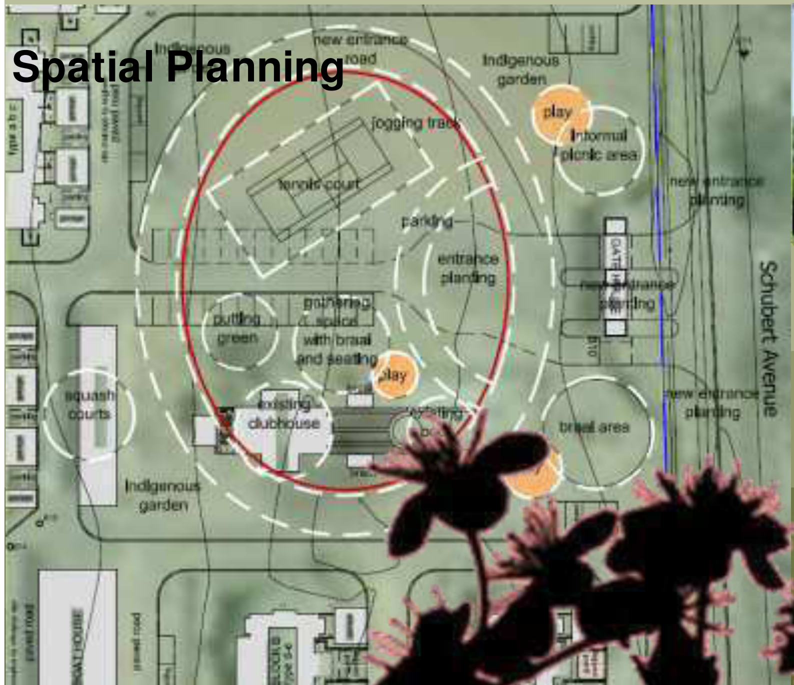


05 Landscape Projects– Current

051 Commercial

02 Melodie Waters, Hartebeespoortdam

Streetscape



Spatial Planning

Indigenous Planting

05 Landscape Projects – Current

052 Commercial/Recreational

02 Melodie waters, Hartebeestpoortdam

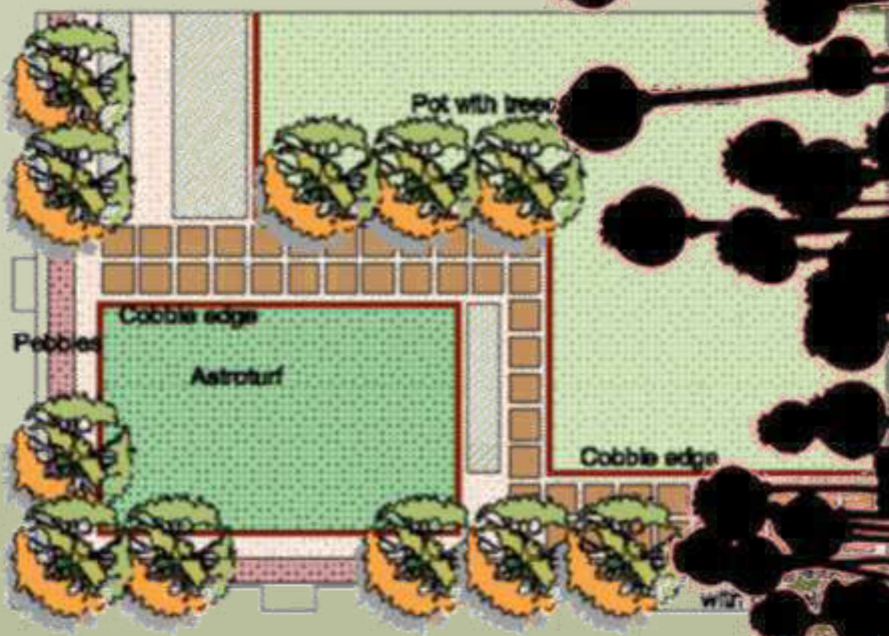
Rehabilitation

Area Layout

05 Landscape Projects– Current

052 Commercial/Recreational

03 Grain Building, Pretoria



Bokamoso

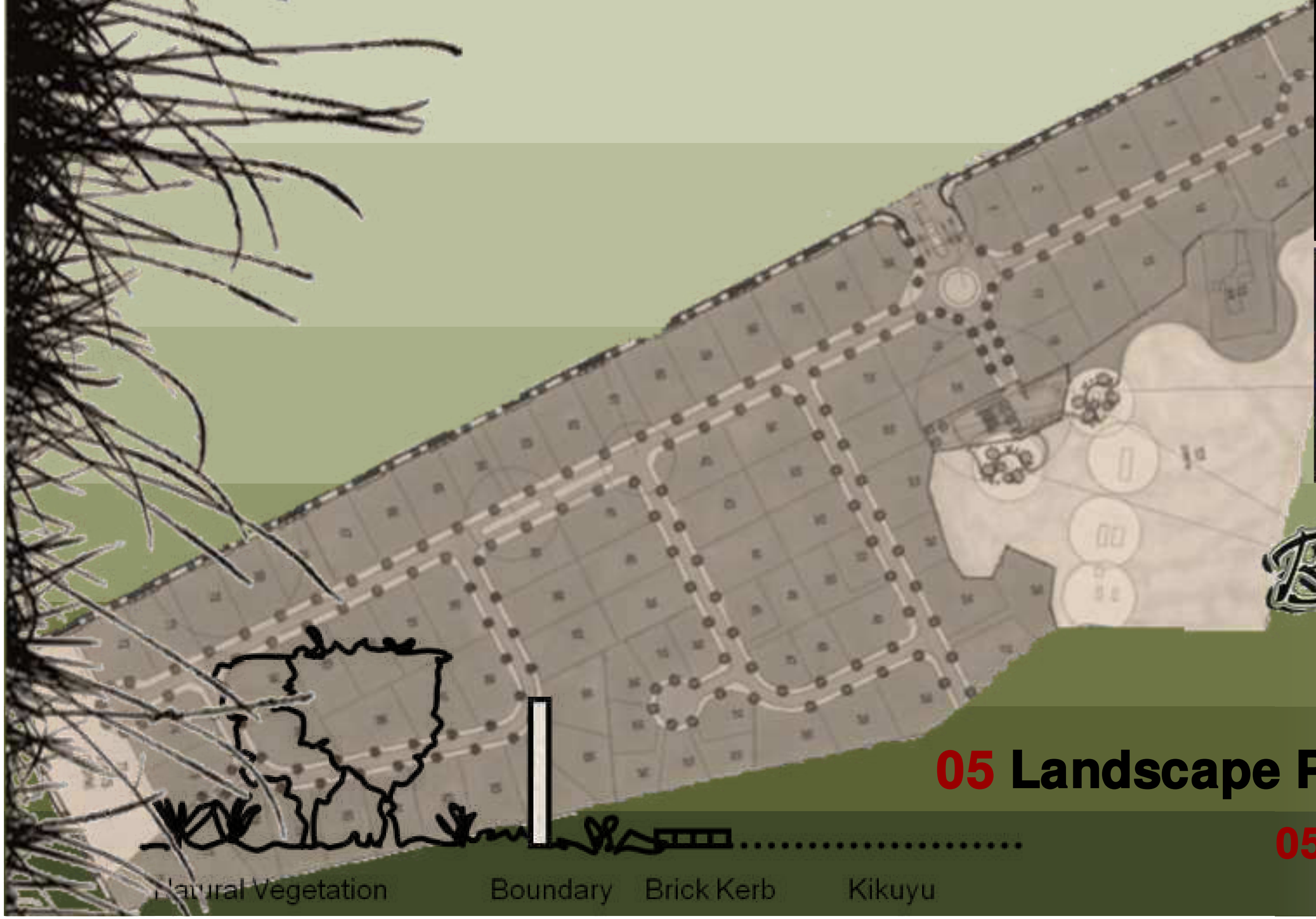
04 Ismail Dawson offices, Pretoria

05 Celtic Manor, Pretoria





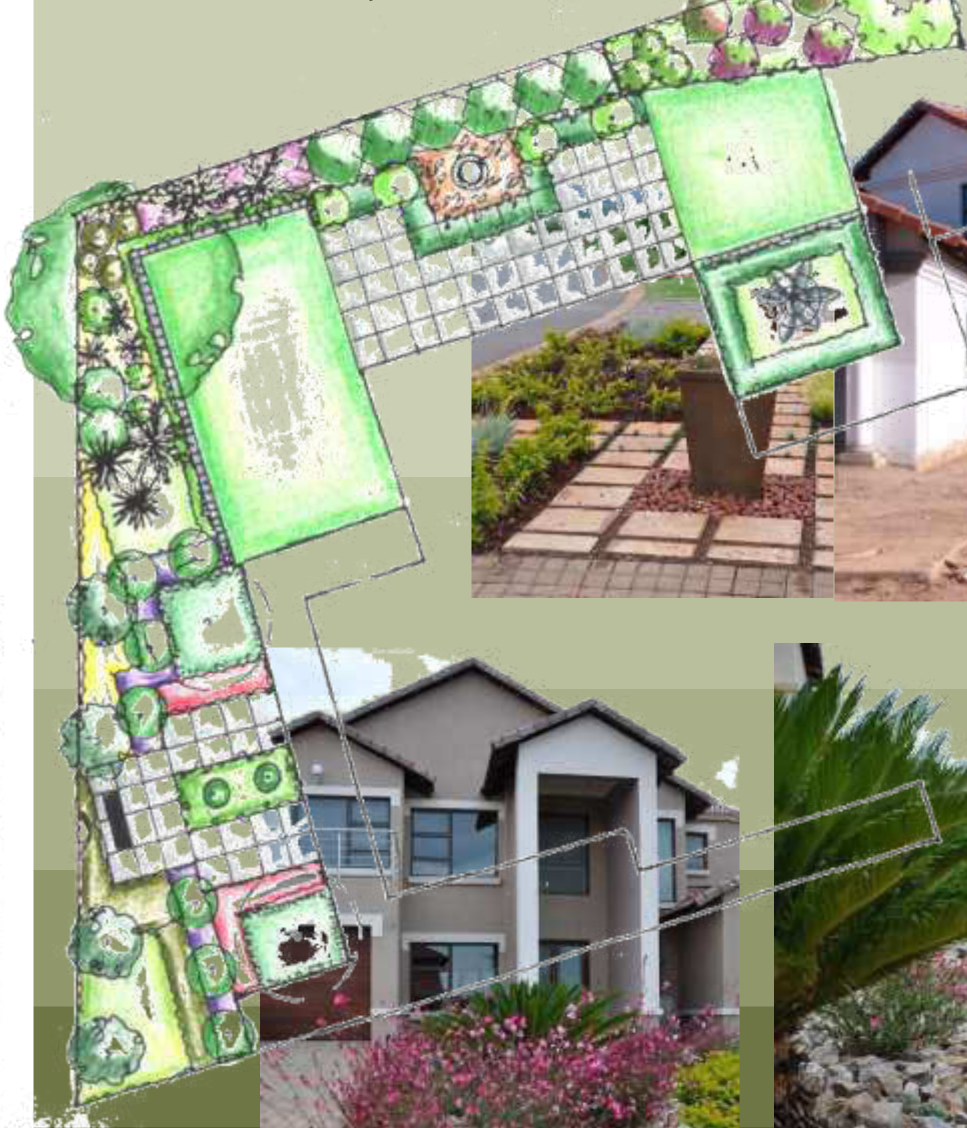




06 The Wilds, Pretoria

07 The Wilds, Pretoria

08 The Wilds, Pretoria



05 Landscape Projects – Completed

055 Residential

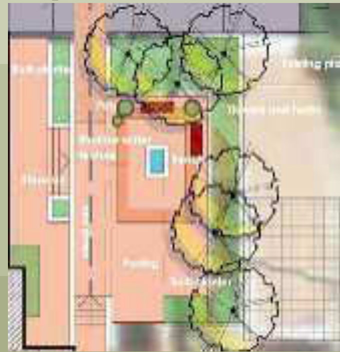
09 The Wilds, Pretoria

010 The Wilds, Pretoria

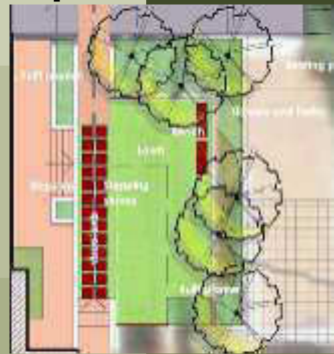
011 Governor of Reserve Bank's Residence, Pretoria

Plant Palette

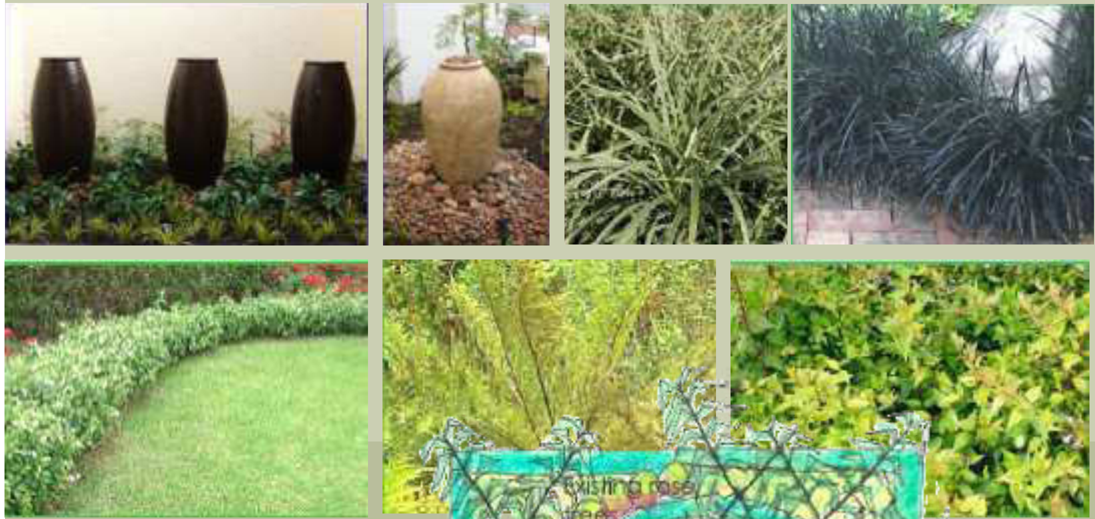
Option 1



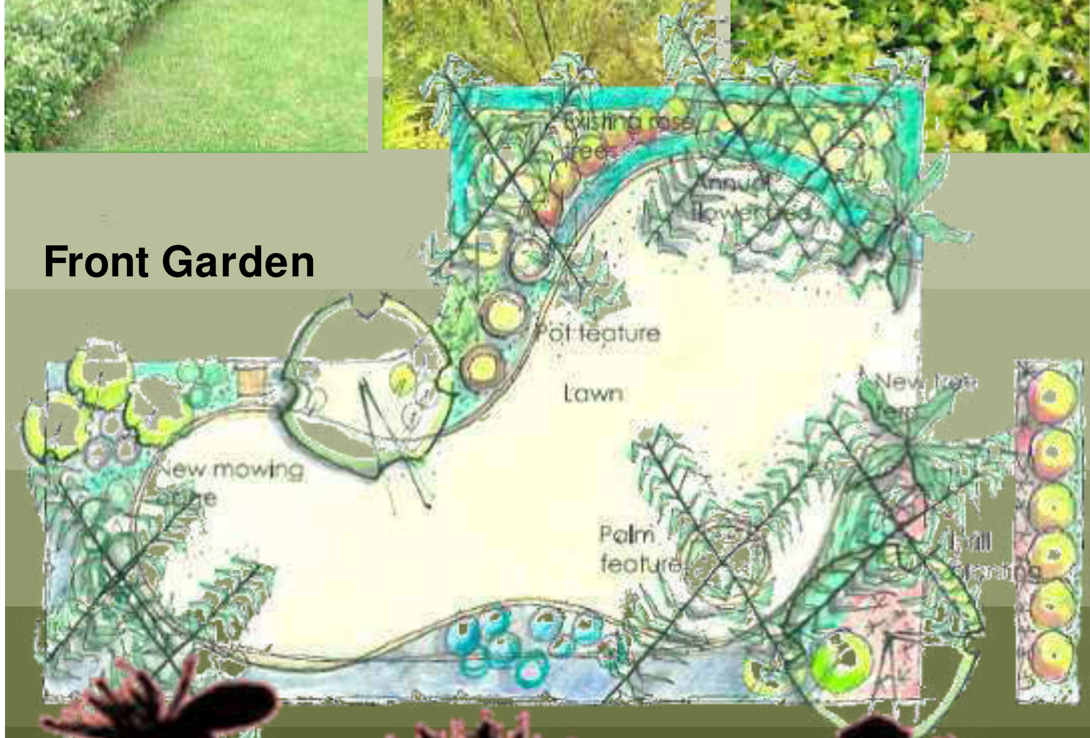
Option 2



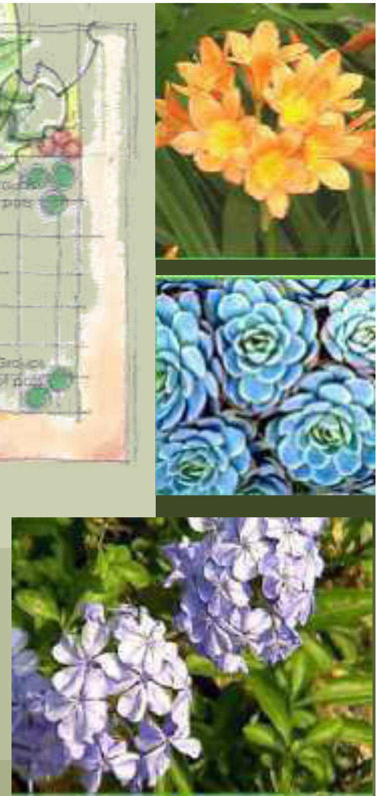
012 House Ismail, Pretoria



Front Garden



Back Garden



Bokamoso

05 Landscape Projects - Conceptual

055 Residential

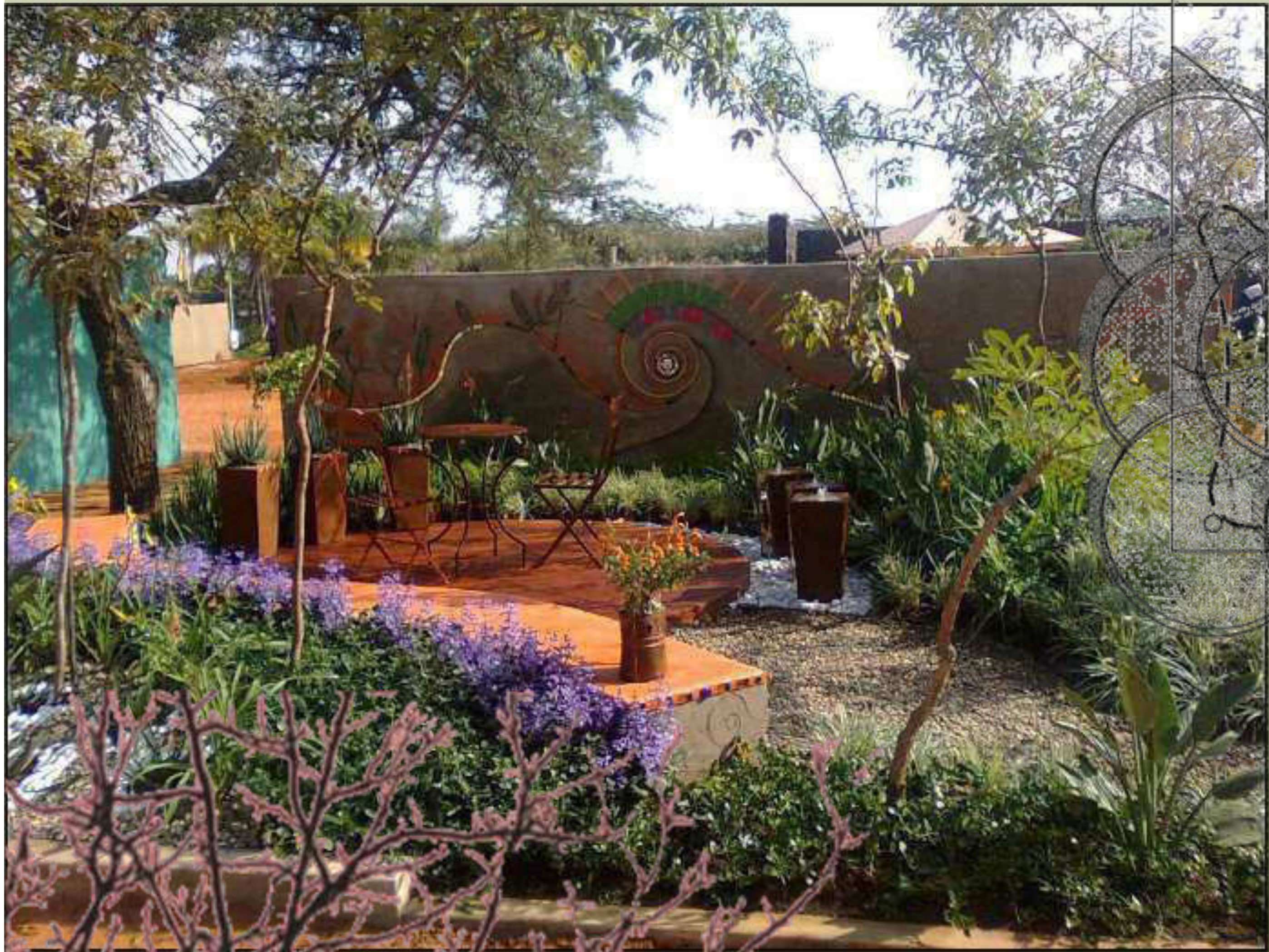
013 Forest Garden, Pretoria

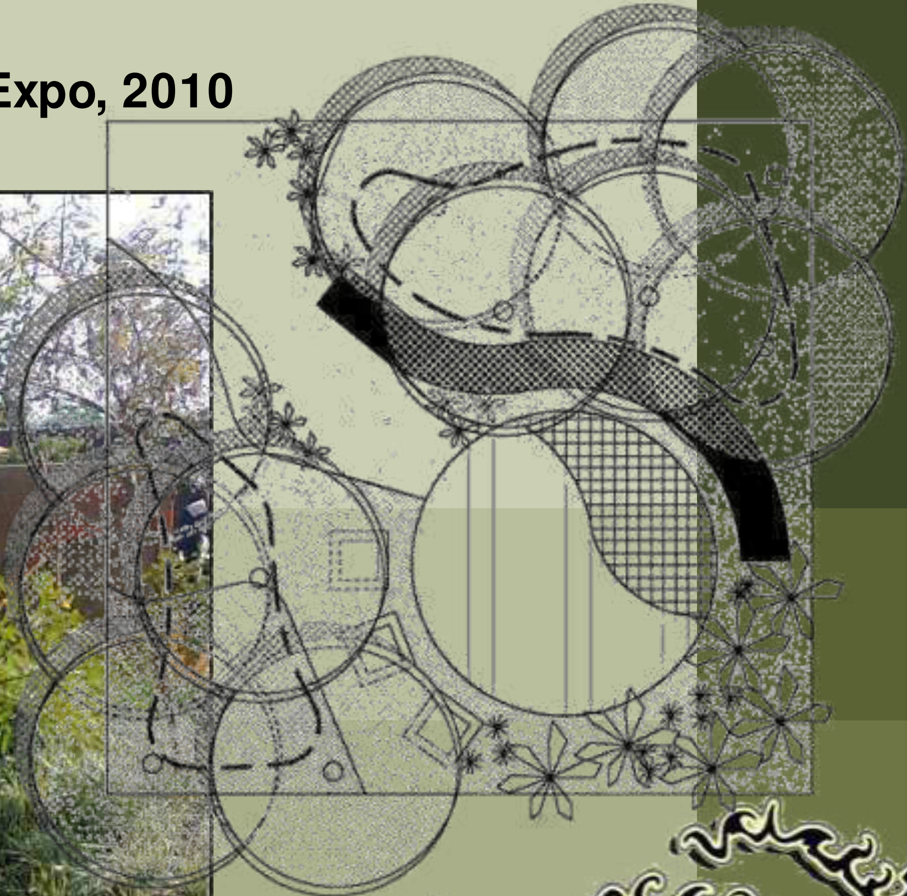
015 Forest Garden, Pretoria

Bokamoso

01 Safari Garden Expo

Received a Silver Certificate at the Safari Garden Expo, 2010

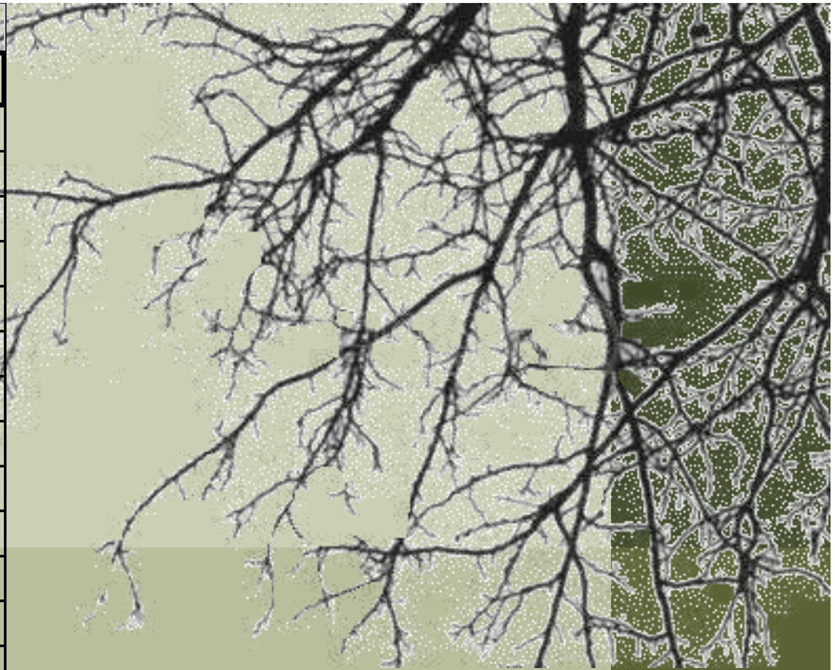




02 UNISA Sunnyside Campus, Pretoria

Best Commercial Paving Plan in Gauteng, 1997

Project Name	Status	Project
Environmental Impact Assessment(EIA) and Scoping Report		
Junction 21	ROD	EIA
5 O'clock site access	In Progress	EIA
Bokamoso X 1	In Progress	Scoping & EIA
Doornvallei Phase 6 & 7	In Progress	EIA
Engen Interchange	In Progress	Scoping & EIA
Erasmia X15	In Progress	EIA
Franschkloof	In Progress	EIA
K113	Amendment of ROD	EIA
K220 East	ROD	EIA
K220 West	ROD	EIA
K54 ROD conditions	In Progress	EIA
Knopjeslaagte 95/Peachtree	ROD	EIA
Knopjeslaagte portion 20 & 21	ROD	EIA
Lillieslief/Nooitgedacht	In Progress	EIA
Mooiplaats 70 (Sutherland)	In Progress	EIA
Naauwpoort 1 - 12/Valley View	In Progress	EIA
PeachTree X5	In Progress	EIA
Strydfontein 60	In Progress	EIA
Thabe Motswere	In Progress	Scoping & EIA
Vlakplaats	In Progress	EIA
Waterval Valley	In Progress	EIA
Environmental Opinion		
Doornkloof 68 (Ross)	In Progress	Opinion
Monavoni X 53	In Progress	BA & Opinion
Mooikloof (USN)	In Progress	Opinion
Norwood Mall/Sandspruit	In Progress	Opinion
Riversong X 9	In Progress	Opinion
Sud Chemie	In Progress	Opinion
USN Benjoh Fishing Resort	In Progress	Opinion



The adjacent list host the status of our current projects. Only a selected amount of projects are displayed.

07 Current Environmental Projects

071 EIA, Scoping& Opinion

Project Name	Status	Project
Basic Assessment(BA)		
Annlin X 138	In Progress	BA
Clubview X 29	ROD	BA
Darrenwood Dam	In Progress	BA
Durley Holding 90 & 91	In Progress	BA
Elim	In Progress	BA
Fochville X 3	In Progress	BA
Hartebeeshoek 251	In Progress	BA
Klerksdorp (Matlosana Mall)	In Progress	BA
Monavoni External Services	ROD	BA
Monavoni X 45	Amendment of ROD	BA
Montana X 146	In Progress	BA
Rooihuiskraal X29	In Progress	BA
Thorntree Mall	In Progress	BA
Environmental control officer (ECO)		
Grace Point Church	In Progress	ECO
R 81	In Progress	ECO
Highveld X 61	In Progress	ECO
Mall of the North	In Progress	ECO
Olievenhoutbosch Road	In Progress	ECO
Orchards 39	In Progress	ECO
Pierre van Ryneveld Reservoir	In Progress	ECO
Project Shelter	In Progress	ECO
S24 G		
Wonderboom	In Progress	S24 G
Mogwasi Guest houses	Completed	S24 G

Bokamoso

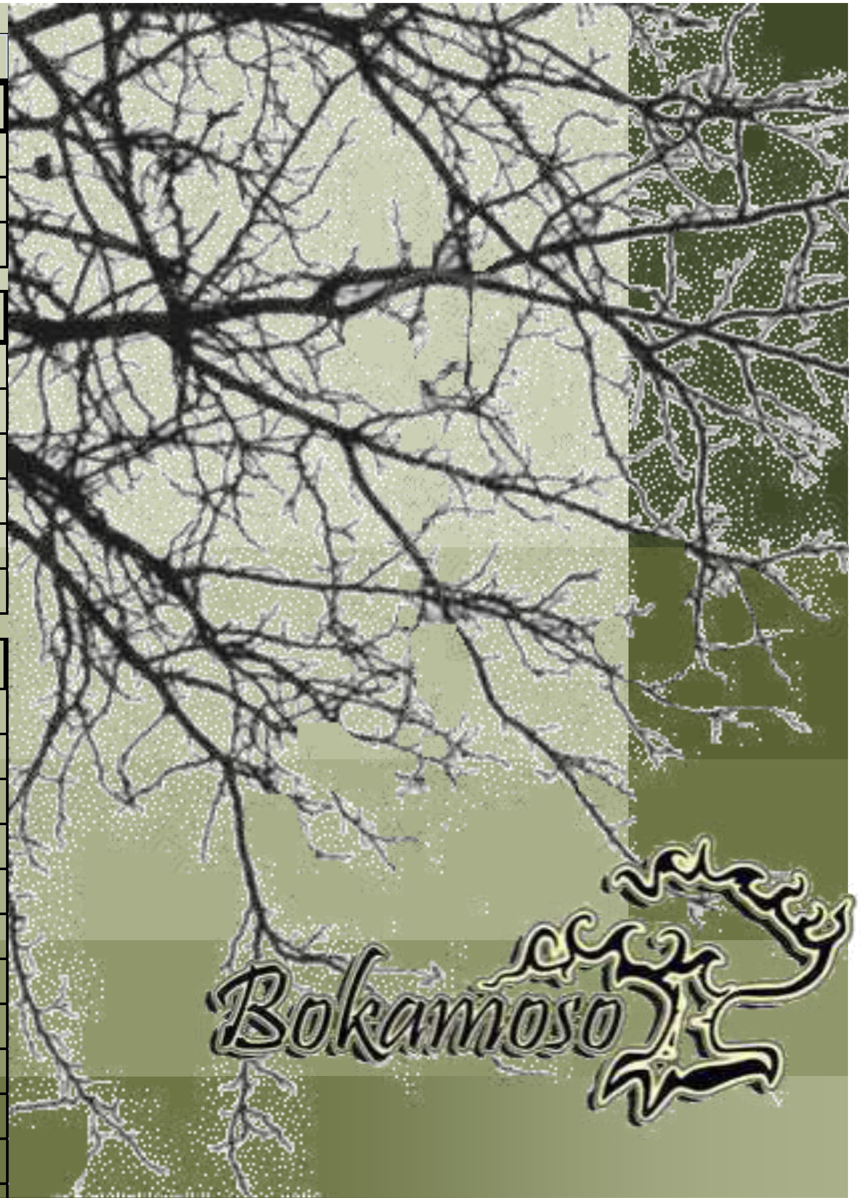
07 Current Environmental Projects

072 BA, ECO & S24 G

07 Current Environmental Projects

073 Objection, DFA & WULA

Project Name	Status	Project
Objection		
Colesberg WWTW	In Progress	Objection
Nigel Steelmill	Completed	Objection
Chantilly Waters	Completed	Objection
Development facilitation Act- Input (DFA)		
Burgersfort	In Progress	DFA & BA
Doornpoort Filling Station	In Progress	DFA & EIA & Scoping
Eastwood Junction	In Progress	DFA
Ingersol Road (Erf 78, 81 - 83)	In Progress	DFA
Roos Senekal	In Progress	DFA & EIA & Scoping
Thaba Meetse 1	In Progress	DFA & EIA & Scoping
Water Use License Act (WULA)		
Britstown Bulk Water Supply	In Progress	WULA
Celery Road / Green Channel	In Progress	WULA
Clayville X 46	In Progress	WULA
Dindingwe Lodge	In Progress	WULA
Doornpoort Filling Station	In Progress	WULA+DFA+EIA+SC
Eco Park Dam	In Progress	WULA
Groote Drift Potch	In Progress	WULA
Jozini Shopping Centre	In Progress	WULA+BA
K60	Completed	WULA
Maloto Roads	In Progress	WULA
Kwazele Sewage Works	In Progress	WULA
Monavoni External Services	In Progress	WULA+BA
Nyathi Eco Estate	In Progress	WULA
Prairie Giants X 3	In Progress	WULA
Waveside Water Bottling Plant	Completed	WULA



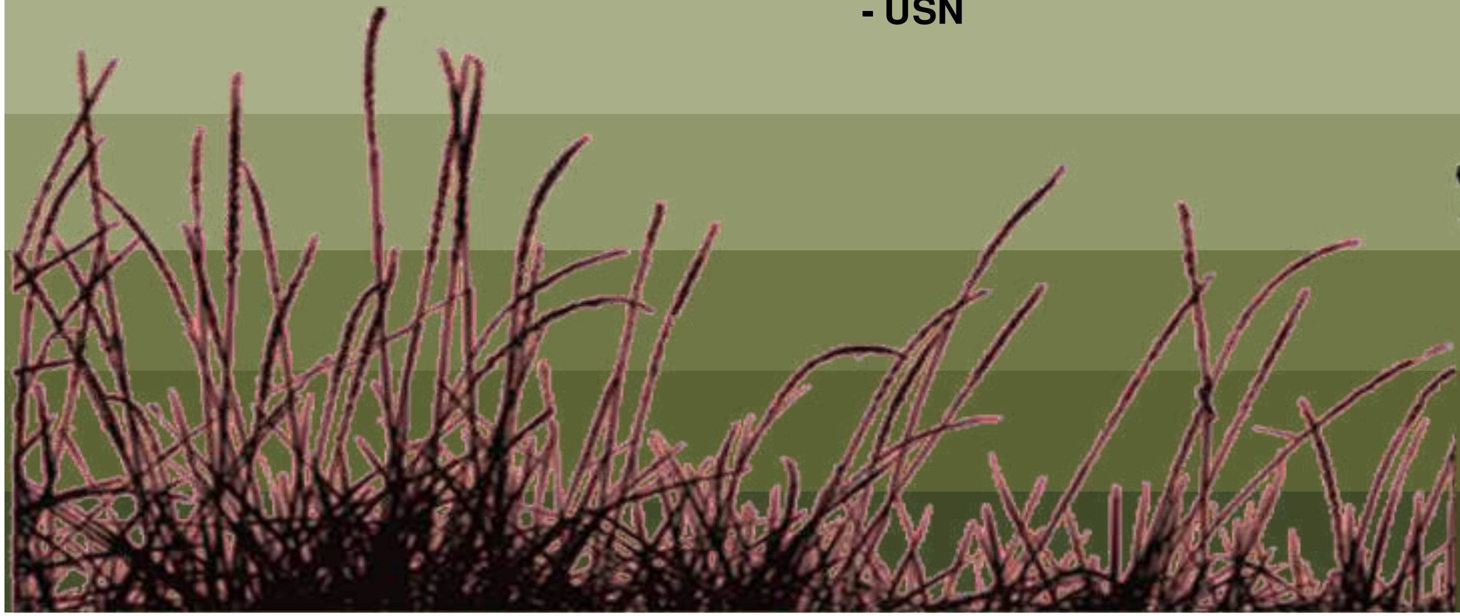
Project Name	Status	Project
Environmental Management Plan(EMP)		
Heidelberg X 12	ROD	EMP
Monavoni Shopping Centre	Completed	EMP
Forest Hill Development	Completed	EMP
Weltevreden Farm 105KQ	Completed	EMP+EIA
Raslouw Holding 93	Completed	EMP+BA
Durley Development	Completed	EMP+BA
Rooihuiskraal North X 28	Completed	EMP
Rehabilitation Plan		
Norwood Mall/Sandspruit	In Progress	Rehabilitation
Project Shelter Heidelberg	In Progress	Rehabilitation
Sagewood Attenuation Pond	ROD	Rehabilitation
Velmore Hotel	Completed	Rehabilitation
Grace Point Church	Completed	Rehabilitation
Mmamelodi Pipeline	Completed	Rehabilitation
Visual Impact Assessment		
Swatzkop Industrial Developme	Completed	Assessment +DFA
Erasmia	Completed	Assessment
Signage Application		
Menlyn Advertising	Completed	Signage
The Villa Mall	Completed	Signage+EMP+BA

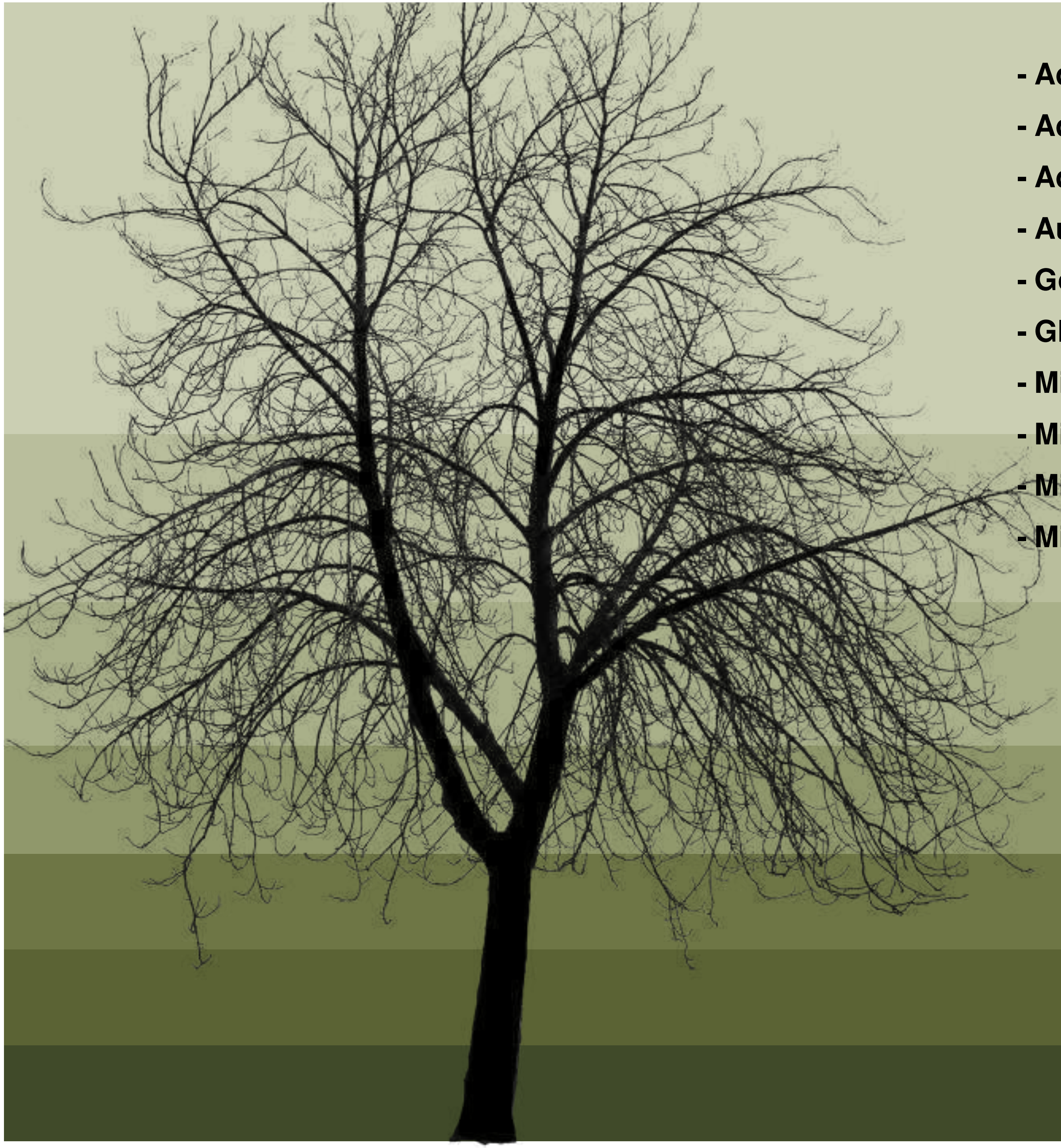
07 Current Environmental Projects

074 EMP, Rehabilitation , Waste Management & Signage Application

08 Indicative Clients

- Billion Property Group
- Cavaleros Developments
- Centro Developers
- Chaimberlains
- Chieftain
- Century Property Group
- Coca Cola
- Elmado Property Development
- Flanagan & Gerard
- Gautrans
- Hartland Property Group
- Moolman Group
- MTN
- M&T Development
- Old Mutual
- Property Investment Company
- Petroland Developments
- RSD Construction
- SAND
- Stephan Parsons
- Twin City Developments
- Urban Construction
- USN





- Adobe Illustrator CS3
- Adobe Photoshop CS3
- Adobe InDesign CS3
- AutoCAD
- Google SketchUP
- GIS
- Microsoft Office Word
- Microsoft Office Excel
- Microsoft Office Publisher
- Microsoft Office Power Point

09 Tools

Qualifications And Experience In The Field Of Environmental Planning And Management (Lizelle Gregory (Member Bokamoso)):

Qualifications:

-Qualified as ***Landscape Architect*** *at UP 1991;*
-Qualified as ***Professional Landscape Architect in 1997****;*
-A Registered Member at The ***South African Council for the Landscape Architect Profession (SACLAP)*** *with Practise Number:* ***PrLArch97078****;*
- A Registered Member at the ***International Association for Impact Assessment Practitioners (IAIA)****;*
- Qualified as an ***Environmental Auditor in July 2008*** *and also became a Member of the International Environmental Management Association (IEMAS) in 2008.*

Working Experience:

-Worked part time at Eco-Consult – 1988-1990;
-Worked part time at ***Plan Associates as Landscape Architect in training*** *– 1990-1991;*
-Worked as Landscape Architect at ***Environmental Design Partnership (EDP)*** *from 1992 - 1994*
-Practised under ***Lizelle Gregory Landscape Architects*** *from 1994 until 1999;*
*-****Lectured*** *at Part-Time at* ***UP*** *(1999) – Landscape Architecture and* ***TUT*** *(1998- 1999)- Environmental Planning and Plant Material Studies;*
-Worked as ***part time Landscape Architect and Environmental Consultant at Plan Associates*** *and* ***managed their environmental division for more that 10 years*** *– 1993 – 2008 (assisted the* ***PWV Consortium*** *with various road planning matters which amongst others included environmental Scans, EIA's, Scoping reports etc.)*
-Renamed business as ***Bokamoso in 2000*** *and is the only member of Bokamoso Landscape Architects and Environmental Consultants CC;*
*-****More than 20 years experience in the compilation of Environmental Reports,*** *which amongst others included the compilation of various* ***DFA Regulation 31 Scoping Reports****, EIA's for EIA applications in terms of the applicable environmental legislation, Environmental Management Plans, Inputs for Spatial Development Frameworks, DP's, EMF's etc. Also included EIA Application on and adjacent to mining land and slimes dams (i.e. Brahm Fisherville, Doornkop)*

Qualifications And Experience In The Field Of Landscape Architecture (Lizelle Gregory (Member Bokamoso)):

Landscape Architecture:

-Compiled landscape and rehabilitation plans for more than 22 years.

The most significant landscaping projects are as follows:
-Designed the Gardens of the Witbank Technicon (a branch of TUT). Also supervised the implementation of the campus gardens (2004);
-Lizelle Gregory was the Landscape Architect responsible for the paving and landscape design at the UNISA Sunnyside Campus and received a Corobrick Golden Award for the paving design at the campus (1998-2004);
-Bokamoso assisted with the design and implementation of a park for the City of Johannesburg in Tembisa (2010);
-The design and implementation of the landscape gardens (indigenous garden) at the new Coca-Cola Valpre Plant (2012-2013);
-Responsible for the rehabilitation and landscaping of Juksei River area at the Norwood Shopping Mall (johannesburg) (2012-2013);
-Designed and implemented a garden of more than 3,5ha in Randburg (Mc Arthurpark). Bokamoso also seeded the lawn for the project (more than 2,5 ha of lawn successfully seeded) (1999);
-Bokamoso designed and implemented more than 800 townhouse complex gardens and submitted more than 500 Landscape Development Plans to CTMM for approval (1995 – 2013);
-Assisted with Landscape Designs and the Masterplan at Eco-Park (M&T Developments) (2005-2011);
-Bokamoso designed and implemented an indigenous garden at an office park adjacent to the Bronberg. In this garden it was also necessary to establish a special garden for the Juliana Golden Mole. During a recent site visit it was established that the moles are thriving in this garden. Special sandy soils had to be imported and special indigenous plants had to be established in the natural section of the garden.

-Lizelle Gregory also owns her own landscape contracting business**. For the past 20 years she trained more than 40 PDI jobless people (sourced from a church in Mamelodi)** to become landscape contracting workers. All the workers are (on a continuous basis) placed out to work at nurserys and other associated industries;
-Over the past 20 years the Bokamoso team compiled more than 800 landscape development plans and also implemented most of the gardens. Bokamoso also designed and implemented the irrigation for the gardens (in cases where irrigation was required). Lizelle regarded it as important to also obtain practical experience in the field of landscape implementation.

Annexure F

Biodiversity Information Received by GDARD

Thabang Hlongwane

From:	Stephan Barkhuizen
Sent:	03 October 2011 02:36 PM
To:	Thabang Hlongwane
Subject:	FW: Olievenhoutbosch Road from road to K54

From: Ontvangs
Sent: 03 October 2011 02:36 PM
To: Stephan Barkhuizen; Karlien Van Zyl
Subject: FW: Olievenhoutbosch Road from road to K54

From: SETSIBA, ALBERTINA (GDARD) [mailto:ALBERTINA.SETSIBA@gauteng.gov.za]
Sent: 03 October 2011 12:47 PM
To: lizelleg@mweb.co.za
Subject: Olievenhoutbosch Road from road to K54

Dear Lizelle

With regard to the above project, specialist biodiversity studies are required to investigate the following aspects:

* Plants, with specific reference to

- *Cheilanthes deltoidea.*
- *Brachycorythis conica.*
- *Habenaria mossii.*
- *Gnaphalium nelsonii.*
- *Habenaria kraenzliniana.*
- *Trachyndra erythrorrhiza.*
- *Lithops lesliei.*

* Mammals, with specific reference to *Atelerix frontalis* (South African hedge).

* Birds, with specific reference to *Eupodotis senegalensis* (White-bellied korhaan).

* Vegetation.

* Wetlands.

* Ridges.

* Caves.

Please note that this information is relevant solely for the study site specified in your request. Red/Orange Listed plant species information relevant to a wider geographic area can be obtained from Lorraine Mills (Lorraine.Mills@gauteng.gov.za).

All specialist studies must comply with GDARD Requirements for Biodiversity Assessments. The most recent version of this document (currently version 2) can be obtained by e-mailing GDACE BiodiversityInfo@gauteng.gov.za.

Should the environmental assessment practitioner be of the opinion that any of the above specialist studies are unnecessary for the site/activity in question, then an ecologically-based motivation justifying why the studies are deemed unnecessary must be submitted to GDARD as part of the application. This submission will be evaluated and either accepted or returned to the applicant for the completion of the necessary studies.

Please do not send follow up inquiries to this message as they will not be processed. For further queries please contact Phuti Matlamela (phuti.matlamela@gauteng.gov.za).

Yours Sincerely
Bioregional Planning: EIAs
Nature Conservation

Ramokone Albertina Setsiba
Nature Conservation Scientist (EIAs)
GDARD
tel: 011 355 1743
website: http://www.gdard.gpg.gov.za
73 Market St, 14th floor Glencairn Building, JOHANNESBURG

" Vibrant, equitable, sustainable rural communities, food security for all, protected and enhanced environmental assets and natural resources"

agriculture and
rural development
Department: Agriculture and Rural Development
GAUTENG PROVINCE

Annexure G

Fauna and Flora Survey Report

GALAGO ENVIRONMENTAL

Biodiversity & Aquatic Specialists

638 Turf St
Wingate Park, 0181
Tel: 012-345 4891
Fax: 086 675 6136
Email: Vanessam@lantic.net

Biodiversity Assessment

of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

May 2012

GDARD reference number: Gaut: 002/11-12/E0135

Report Compiled and edited by:	Ms. Vanessa Marais of Galago Environmental
Report authors:	Dr. I.L. Rautenbach (Pri. Sci. Nat: Ph.D, T.H.E.D.), Mr. R. Terblanche (Pr.Sci.Nat: M.Sc) Mrs. P. Lemmer (Cert. Sci. Nat: B.Sc.) Mr. J.C.P. van Wyk (Pri. Sci. Nat: M.Sc), Mr. R.F. Geyser
Avifauna Report verified by:	Dr. Alan C. Kemp (Pri.Sci. Nat.)
Botany Report verified by:	Dr L.A. Coetzer (D.Sc., Pri. Sci. Nat.)

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FIGURES:

1. Introduction:

Galago Environmental CC was appointed to conduct a mammal, bird, reptile, amphibian and plant survey as well as a study on the ecological conditions of the ridge for the Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR, scheduled for construction.

2. Location of the study site:

The proposed route for the westbound lane of Olievenhoutbosch Road starts on the open ground between Road M57 and the Rietvlei Nature Reserve. This small part of the route falls within the Rand Highveld Grassland vegetation unit. The route, now entering the Carltonville Dolomite Grassland vegetation unit, then crosses highway R21 and runs west through the corridor between Cornwall Hill and Nellmapius Road. The proposed route then crosses Nellmapius Road to run parallel to the partly constructed eastbound lane of Olievenhoustbosch Road, ending at various proposed alternative joining points on the route of the eastbound lane. Alternative route 3 continues parallel to the eastbound lane until it ends at Main Road, Irene, opposite the present Alexandra Road.

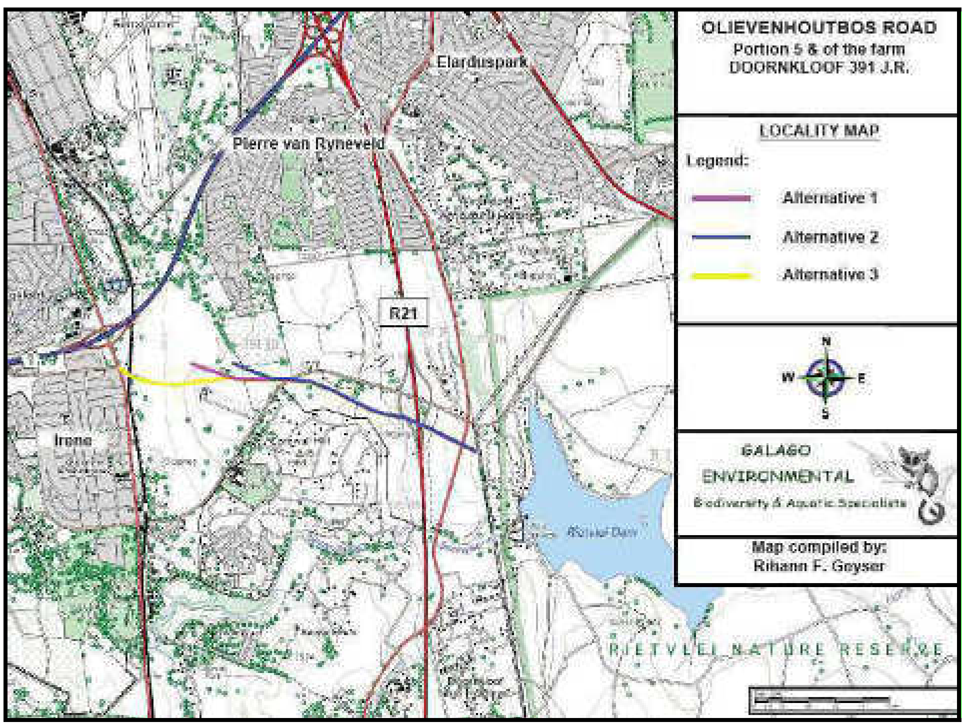

Figure 1: Locality map of the study area

3. Participating Specialists

This investigation was conducted by the following specialists:

Specialists	Aspect Investigated	Qualifications	Prof. Registration	Date of Field Survey
Rautenbach, I.L.	Mammalogy	Ph.D., T.H.E.D.	Pr. Nat. Sci.	5 April 2012
Terblanche, R.	Ecology & herpetology	M.Sc.	Pr. Nat. Sci.	1 April 2012
Van Wyk, J.C.P.	Herpetology	M.Sc. (Zoology)	Pr. Nat. Sci.	9 April 2012
Geyser, R.	Avifauna		Pending	5 April 2012
Lemmer, P.	Botany	B.Sc.	Cert. Sci. Nat	4 April 2012
Coetzer, L.A.	Botany Review	D.Sc.	Pr. Nat. Sci.	
Kemp, A.C.	Avifauna review	Ph.D.	Pr. Nat. Sci.	
Marais, V.	Environmental Impacts and maps	BL Landscape Architecture		5 April 2012

5. Vegetation assessment:

According to Mucina & Rutherford (2006) most of the route falls within the vegetation unit Carltonville Dolomite Grassland, with the easternmost part of the route for only a short distance in Rand Highveld Grassland. The former is a species-rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges. The Rand Highveld Grassland is according to the authors a highly variable landscape with extensive sloping plains and a series of slightly elevated ridges.

The Carltonville Dolomite Grassland is considered vulnerable. Its conservation target is 24%. The Rand Highveld Grassland is considered endangered. Its conservation target is 24%.

Six vegetation study units were identified:

- *Eragrostis – Hyparrhenia* grassland;
- *Tristachya – Monocymbium* Chert – Quartz outcrop;
- Mixed alien and indigenous vegetation;
- Quartz slope vegetation;
- *Acacia karroo* woodland; and
- Mixed grassland on shallow dolomite.

The **vegetation study** stated that the Red List *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. A 200-meter buffer should be maintained around the Red List species. The *Tristachya – Monocymbium* Chert – Quartz outcrop, the Quartz slope vegetation and the Mixed grassland on shallow dolomite study units were considered sensitive and construction activities within these areas should be kept strictly within the pipeline reserve. All Declared Weeds and invaders and other alien species in the vicinity of the proposed pipeline must be removed and a management plan for the continuing control of the aliens be implemented. Alternative route 2 will have the least negative impact on the grassland of the study site and is the preferred route. See Appendix A for the Flora report.

6. Fauna assessment:

The **mammal** study found that the alternative routes will not affect any significant mammal habitats warranting special consideration, or ecologically sensitive areas. The road along the suggested route, together with other roads under construction and suburbs under consideration will further partition the area into smaller and ecologically less viable units.

Even during historical times the three alternative routes together with their adjacent 500 meters extended study areas were depauperate of mammals, considering the absence of arboreal, rupiculous and wetland habitats providing 'lebensraum' for discerning species. With the advent of civilization and escalating land-use practices not conducive to nature conservation, natural biota declined dramatically and is continuing to do so.

It is recommended that Alternative 2 is selected since it is shorter (and thus more cost-effective), and since it will not affect the isolated koppie. See Appendix B for the Mammal report.

The **avifaunal** study found that although the natural open grassland area offers habitat for Red Data avifaunal species (Lesser Kestrels), they are only likely to move through the area on rare occasions. This is attributed to disturbance of the area on and surrounding the study site due to human presence and human related activities and also development surrounding the study site and the fragmented state of the natural grassland. This alternative is recommended since this will have a minimum impact on the natural vegetation on the study site and the avifaunal species recorded on or that are likely to occur on the study site. See Appendix C for the Avifauna report.

The **herpetological** study found that the proposed development routes are relatively small, but there is a chance that at least one of the three Red Data herpetofaunal species of the Gauteng Province may occur on the site.

The man-made dam/wetland adjacent to the study site is a potential breeding site for the giant bullfrog and there is a good possibility that giant bullfrogs may use the study site as a dispersal area, which combines feeding and aestivation.

If the proposed development should go ahead, an important indirect effect would be the likely impact that the proposed development might have on the surface water runoff and water quality of the catchment area. This could have a negative impact on the herpetofauna. This is especially true for the drainage line which flows into the Sesmyl Spruit. The effects could be ameliorated by the construction of retention ponds, which would retard discharge into the catchment area and improve the water quality of the discharge. See Appendix D for the herpetological report.

The study on the **ecological conditions of the ridge** found that:

- Transformation of vegetation owing to present excavations, scraping or other disturbances are clear at the site. Exotic weeds and annual pioneer grass species invade such disturbed patches.
- Overall Alternative 2 appears to be ecologically the least sensitive strip.
- Alternative 3 is not preferred. This proposed alternative 3 passes the quartzite ridge and the lower dolomitic slopes near areas where a Threatened plant species,

Melolobium subspicatum are present. Furthermore alternative 3 crosses sensitive ecosystems notably the *Acacia robusta – Panicum maximum* as well as the *Sporobolus festivus – Hyparrhenia hirta* assemblages. The slopes of the quartzite koppie as well as the intersection between the dolomite and chert approaches a habitat which may be suitable for the rare and threatened fruit chafer beetle, *Ichnestoma stobbiai*.

- *Ichnestoma stobbiai* is an endangered fruit chafer (Scarabaeidae: Cetoniinae) that occurs in small habitat fragments of South Africa (Kryger & Scholtz, 2008). The adults of this species are short-lived and the females are flightless. Thus, the vagility of these beetles is extremely low (Kryger & Scholtz, 2008). The species *I. stobbiai* (Holm, 1992) is thought to occur in a very restricted area in and around Gauteng Province and all habitat patches should be protected (Kryger & Scholtz, 2008; Deschodt, Scholtz & Kryger, 2009). Unlike most cetoniine larvae, the larvae of this species usually occur in dolomitic to cherty, well-drained soils (Deschodt, Scholtz & Kryger, 2009).
- A Class 3 rocky ridge is present at all the intersections of rocky ridges with the proposed strip allocated for the development.
- Fire and frost probably play an important role in maintaining the grassland at the ridge and therefore a burning programme is desirable.
- In an increasingly urbanised area, the possible conservation importance value of rocky ridges is underlined at the site both in terms of remarkable diversity and as refuge for threatened species.
- Though a class 3 rocky ridge is present it is believed that near pristine patches of rocky ridge may still be conserved at the site.
- Proper ecological planning and actions are urgent and include:
  - The eradication of invasive exotic plant species at the site.
  - Development of conservation infrastructure that would avoid the continuous trampling, excavations and informal dumping which are present in the area.
  - The zoning of habitats where threatened species occur as a no-go area for *any* developments.
- It appears that Alternative 3 will have an undesirable impact on an ecosystem of high conservation priority and that Alternative 2 in terms of biodiversity and ecosystem functioning is the preferable option.
- See Appendix E for the report on the Ecological Conditions of the ridge.

7. Mitigation:

Mitigation proposed is:

- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the proposed route, but would otherwise be destroyed during construction, should be used for re-vegetation / landscaping purposes.
- Should hedgehogs be encountered during the construction phase, these should be relocated to natural grassland areas in the vicinity.

- Should Bullfrogs or any herpetological species be encountered during the construction phase of the proposed development, these should be relocated to natural grassland areas in the vicinity or the Rietvlei Nature Reserve nearby.
- The contractor must ensure that no herpetofaunal species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed.
- All storm water structures should be designed so as to block amphibian and reptile access to the road surface.
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the road development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.
- Where the roads traverse the drainage line, an underpass should provide for the movement of aquatic as well as terrestrial species.
- A barrier (either prefab concrete wall or galvanized sheeting that extends as a continuous sheet above ground for at least 40cm and below ground for at least 30cm) that will physically block animals from accessing the road surface should be constructed for a distance of 200m on either side of all aquatic and terrestrial underpasses. Holes under barriers should be routinely filled in and areas directly adjacent to the barrier should be kept free of vegetation.

8. Environmental sensitivity:

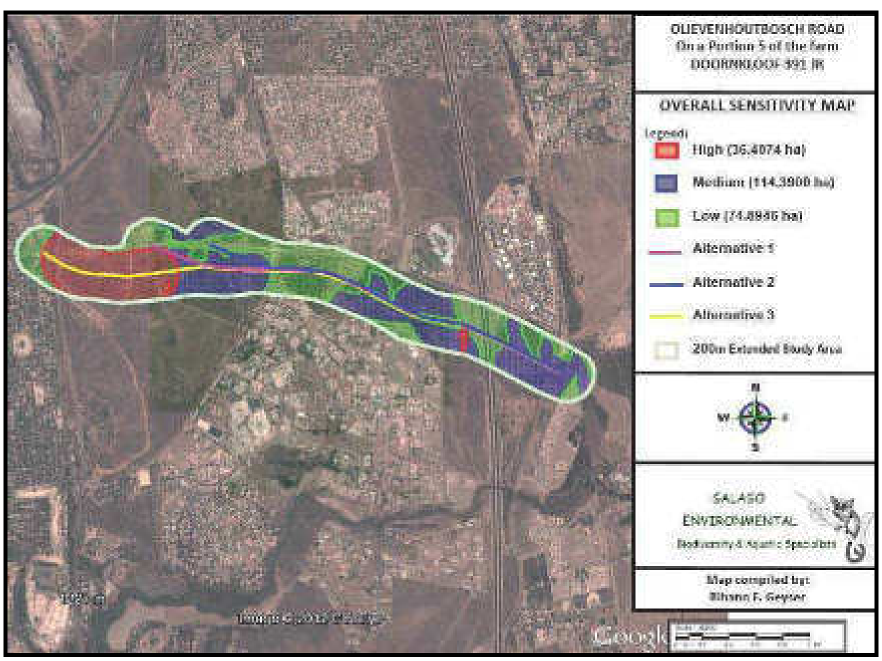

Figure 2: Combined environmental sensitivity map

Sensitivity mapping rules:

BIODIVERSITY ELEMENT	SENSITIVITY MAPPING RULE
Flora communities	Sensitive flora communities
Fauna habitat	Sensitive fauna habitat
Class 3 ridge	Sensitive ridge areas

9. Conclusion:

From all the biodiversity studies undertaken it is clear that the north-eastern section, which mostly covers Alternative 3 of the route is highly sensitive.

It is recommended that Alternative 2, which is the least sensitive of the three alternatives be implemented.

10. GDARD biodiversity requirements

From: GDARD Biodiversity Information (GDARD)
[GDACE_BiodiversityInfo@gauteng.gov.za]
Sent: 30 March 2012 09:14 AM
To: Madeleen Van Schalkwyk
Subject: RE: SUSPECT: Biodiversity request for Olievenhoutbosch road + alternatives

Dear Madeleen

With regard to the above project, specialist biodiversity studies are required to investigate the following aspects:

- Plants, with specific reference to
  - *Habenaria mossii*
  - *Cheilanthes deltoidea*
  - *Habenaria barbetoni*
  - *Habenaria kraenzliana*
  - *Holothrix randii*
- Mammals, with specific reference to *Atelerix frontaris* (Southern African hedgehog
- Vegetation.
- Wetlands.
- Ridges.

APPENDIX A: FLORA REPORT

APPENDIX B: MAMMAL REPORT

APPENDIX C: AVIFAUNA REPORT

APPENDIX D: HERPETOFAUNA REPORT

APPENDIX E: REPORT ON ECOLOGICAL CONDITIONS OF THE RIDGE

GALAGO ENVIRONMENTAL

Biodiversity & Aquatic Specialists

638 Turf Street
Wingate Park, 0181
Tel: 012-345 4891
Fax: 086 675 6136
Email: Vanessam@lantic.net

Flora Assessment

of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

May 2012

Report author: Mrs. P. Lemmer (Cert. Sci. Nat: B.Sc.)
Report verified/reviewed by: Dr. L.A. Coetzer (D.Sc., Prof. Nat. Sci.)

VERIFICATION STATEMENT
Petro Lemmer is a Certified Natural Scientist with the S.A. Council for Natural Scientific Professions. This communication serves to verify that the flora report compiled by Petro Lemmer has been prepared under my supervision, and I have verified the contents thereof.

Declaration of Independence: I, Dr. L.A. Coetzer (421009 5029 089) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them

- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions

- act as an independent specialist consultant in the field of botany

- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report

- have no financial interest in the proposed development other than remuneration for work performed

- have or will not have any vested or conflicting interests in the proposed development

- undertake to disclose to the Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2006.

L.A. Coetzer

Dr. L.A. Coetzer

DECLARATION OF INDEPENDENCE

I, Petro Lemmer (440129 0025 085) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them

- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions

- act as an independent specialist consultant in the field of botany

- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report

- have no financial interest in the proposed development other than remuneration for work performed

- have or will not have any vested or conflicting interests in the proposed development

- undertake to disclose to the Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2006.

Petro Lemmer

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1. INTRODUCTION

Galago Environmental was appointed to conduct a vegetation survey along the proposed route for the Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR, scheduled for construction. The objective was to determine which species might still occur in the vicinity of the proposed route. Special attention had to be given to the habitat requirements of all the Red Data species that may occur in the area. This survey focuses on the current status of threatened plant species occurring, or which are likely to occur in the vicinity of the proposed route, and a description of the available and sensitive habitats in the vicinity of the proposed route.

2. OBJECTIVES OF THE STUDY

- To assess the current status of the habitat component and current general conservation status of the area;
- To list the perceptible flora in the vicinity of the proposed route and to recommend steps to be taken should endangered, vulnerable or rare species be found;
- To highlight potential impacts of the proposed route on the flora in the vicinity of the route; and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed route be approved.

3. SCOPE OF STUDY

This report:

- Lists the more noticeable trees, shrubs, herbs, geophytes and grasses observed during the study and offers recommendations about the protection of the sensitive areas along the proposed route;
- Indicates medicinal plants recorded and lists alien species;
- Comments on connectivity with natural vegetation on adjacent sites;
- Comments on ecological sensitive areas;
- Evaluates the conservation importance and significance of the area along the proposed route with special emphasis on the current status of resident threatened species; and
- Offers recommendations to reduce or minimise impacts, should the proposed route be approved.

4. STUDY AREA

4.1 Regional vegetation

The proposed route lies in the quarter degree grid cells 2528CC (Centurion) and 2528CD (Rietvlei Dam). According to Mucina & Rutherford (2006) most of the route falls within the vegetation unit Carltonville Dolomite Grassland, with the easternmost part of the route for only a short distance in Rand Highveld Grassland. The former is a species-rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges.

The Carltonville Dolomite Grassland is considered vulnerable. Its conservation target is 24%. Small parts of this unit are conserved in statutory reserves and a few private conservation areas. Cultivation, urbanization, mining and the building of two dams already transform almost a quarter of the unit.

The Rand Highveld Grassland is according to the authors a highly variable landscape with extensive sloping plains and a series of slightly elevated ridges. The vegetation is species-rich, wiry, sour grassland, characterized by *Themeda, Eragrostis, Heteropogon* and *Elionurus*, alternating with low sour scrubland on rocky outcrops and steeper slopes. Typical herbs mostly belong to the Asteraceae and rocky ridges carry sparse woodlands with *Acacia caffra* and *Celtis africana* accompanied by a rich suite of shrubs with the genus *Searsia* most prominent. The area comprises quartzite ridges supporting shallow soils on rocky ridges and soils of various qualities elsewhere.

The Rand Highveld Grassland is considered endangered. Its conservation target is 24%. Poorly conserved (only 1%) in statutory reserves and a few private nature reserves. Almost 50% of the unit is already been transformed by cultivation, plantations, urbanization and dam-building.

Both vegetation units fall within a warm-temperate summer-rainfall region with high summer temperatures and severe frequent winter frosts

4.2 Portion 5 of the farm Doornkloof

The proposed route for the westbound lane of Olievenhoutbosch Road starts on the open ground between Road M57 and the Rietvlei Nature Reserve. This small part of the route falls within the Rand Highveld Grassland vegetation unit. The route, now entering the Carltonville Dolomite Grassland vegetation unit, then crosses highway R21 and runs west through the corridor between Cornwall Hill and Nellmapius Road. The proposed route then crosses Nellmapius Road to run parallel to the partly constructed eastbound lane of Olievenhoustbosch Road, ending at various proposed alternative joining points on the route of the eastbound lane. Alternative route 3 continues parallel to the eastbound lane until it ends at Main Road, Irene, opposite the present Alexandra Road.

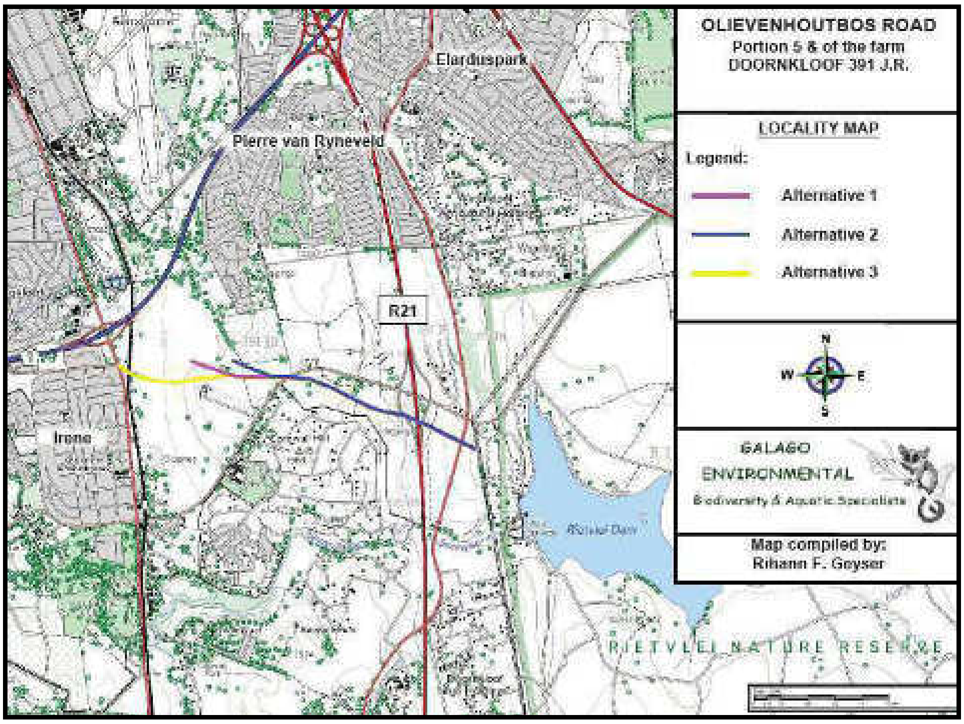

Figure 1: Locality map of the study area

5. METHOD

Information about the Red List and Orange List plant species that occur in the area was obtained from GDARD (GDACE). The Guidelines issued by GDARD (GDACE) to plant specialists were consulted to ascertain the habitat of the Red- and Orange List species concerned.

Information about the Red List species that occur in the area was obtained from SANBI. The various publications (see Section 11) as well as the Pretoria herbarium were consulted about the habitat preferences of the Red List species concerned.

The lists of plants recorded in the 2528CC and 2528CD quarter degree grid cells were obtained from SANBI and consulted to verify the record of occurrence of the plant species seen along the proposed route. The vegetation map published in Mucina and Rutherford (2006) was consulted about the composition of Rand Highveld Grassland and Carltonville Dolomite Grassland. A desktop study of the habitats of the Red List and Orange List species known to occur in the area was done before the site visit.

The area in the vicinity of the proposed route was first examined during surveys unrelated to the present study on 26 April 2004, 26 November and 8, 9 and 13 December 2004, 19 April 2006, 24 March 2009 and 16 November 2010, and the proposed route itself on 4 April 2012 to determine whether suitable habitat for the Red List species known to occur in the quarter degree grid cell existed and to survey the flora present within 200 meters of the proposed route.

The various study units within 200 meters of the proposed route were identified (see Figure 2) and inspected in a random zigzag fashion, paying particular attention to areas that at first sight appeared to be sensitive. These areas were meticulously searched for the presence of Red List species.

6. RESULTS

6.1 Vegetation Study units

Six vegetation study units were identified:

- *Eragrostis – Hyparrhenia* grassland;
- *Tristachya – Monocymbium* Chert – Quartz outcrop;
- Mixed alien and indigenous vegetation;
- Quartz slope vegetation;
- *Acacia karroo* woodland; and
- Mixed grassland on shallow dolomite.

Tables 3 to 8 list the trees, shrubs, geophytes, herbs and grasses actually found on each of the surveyed areas in the vicinity of the proposed route. See figure 2 for the study units

6.2 Medicinal plants

The names of known medicinal plants are marked with numbers to footnotes in Tables 3 to 8 and the footnotes themselves appear at the end of the last table. Of the 239 plant species recorded within 200 m of the proposed route, 43 species with medicinal properties were found. Their distribution in the five study units is as follows:

Table 1: Number of medicinal species in the various study units

STUDY UNIT	TOTAL NO OF SPECIES IN STUDY UNIT	NO OF MEDICINAL SPECIES IN STUDY UNIT
Eragrostis – Hyparrhenia grassland	138	28
Tristachya – Monocymbium Chert – Quartz outcrop	61	9
Mixed alien and indigenous vegetation	52	7
Quartz slope vegetation	34	15
Acacia karroo woodland	81	20
Mixed grassland on shallow dolomite	89	17

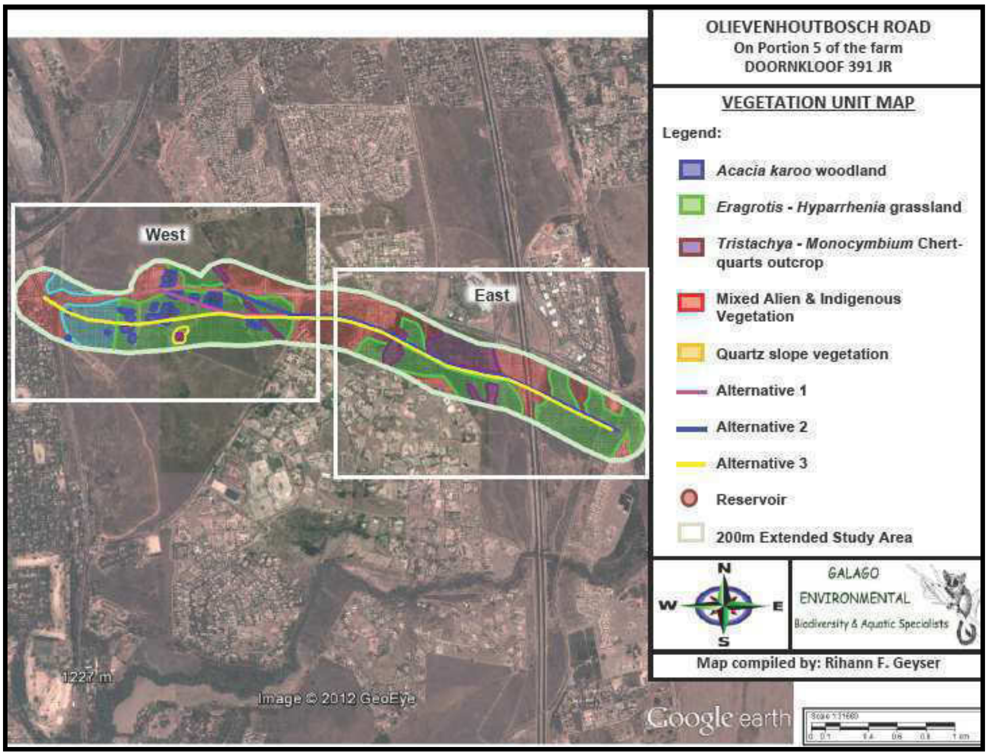

Figure 2: Vegetation study units of the entire Olievenhoutbosch Road

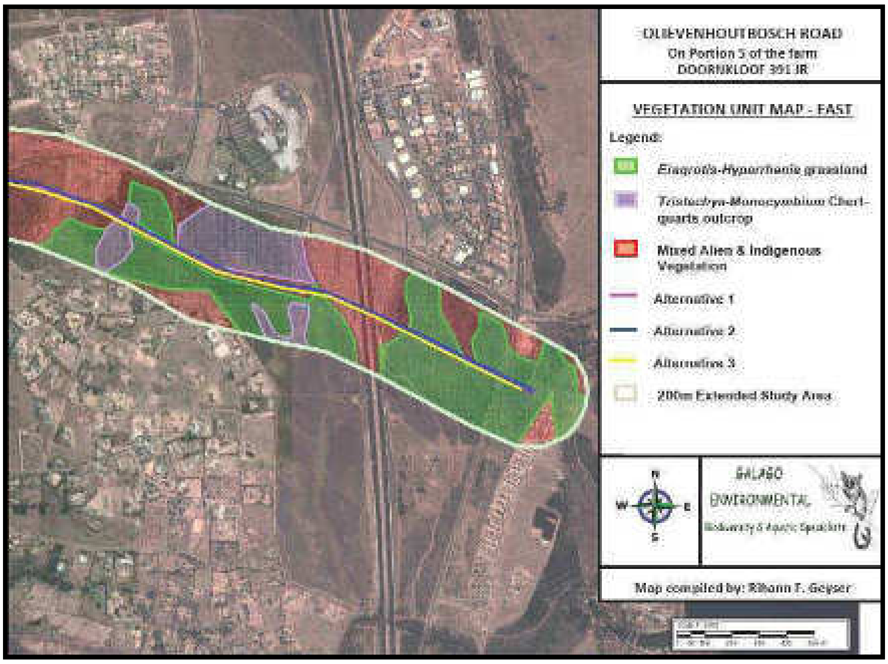

Figure 3: The vegetation study units in detail for the eastern section of the Olievenhoutbosh Road

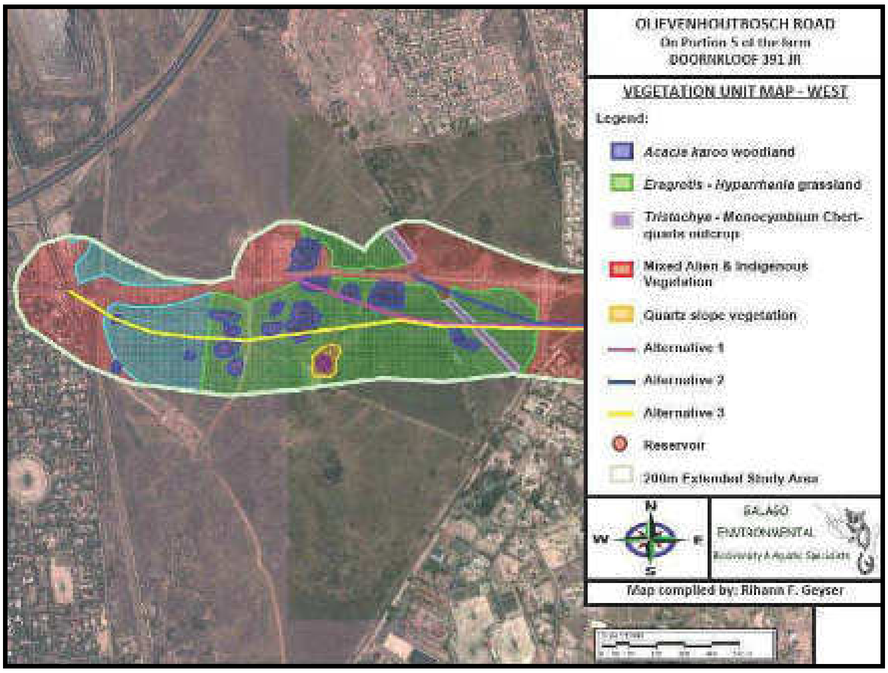

Figure 4: Vegetation study units in detail for the western section of the Olievenhoutbosch Road

6.3 Alien plants

Alien plants are not listed separately, but are included in the lists as they form part of each particular study unit. Their names are marked with an asterisk in Tables 3 to 8. Twenty-three alien plant species, of which five species were Category 1 Declared weeds, two were Category 2 Declared invaders and two were Category 3 Declared invaders, were recorded within 200 m of the proposed route. The number of alien species in each study unit is reflected in table 2.

Table 2: Number of Alien species in each study unit

STUDY UNIT	NO. OF ALIEN SPECIES	CAT 1	CAT 2	CAT 3	NOT DECLARED
Eragrostis – Hyparrhenia grassland	7	1	0	0	6
Tristachya – Monocymbium Chert – Quartz outcrop	2	1	0	0	1
Mixed alien and indigenous vegetation	20	4	2	2	12
Quartz slope vegetation	1	0	0	0	1
Acacia karroo woodland	6	1	0	0	5
Mixed grassland on shallow dolomite	2	1	0	0	1

The alien plant names printed in **bold** in the plant tables are those of Category 1 Declared Weeds and the removal of these plants is ***compulsory*** in terms of the regulations formulated under "The Conservation of Agricultural Resources Act" (Act No. 43 of 1983), as amended.

In terms of these regulations, Category 2 Declared invaders may not occur on any land other than a demarcated area and should likewise be removed.

Although the regulations under the above Act require that Category 3 Declared invader plants may not occur on any land or inland water surface other than in a biological control reserve, these provisions shall not apply in respect of category 3 plants already in existence at the time of the commencement of said regulations. If this is the case, a land user must take all reasonable steps to curtail the spreading of propagating material of Category 3 plants.

6.4 Orange List species

The habitat was suitable for four of the seven Orange List plant species known to occur in the 2528CC quarter degree grid cell. Three of these species were found. (See Annexure A for a list of the Orange- and Red List species known to occur in the quarter degree grid cell and subsections 6.6.2, 6.9.2 and 6.11.2 for Orange List species found in the various study units.).

6.5 Red List species

6.5.1 Species known to occur in the q.d.g.c.

Thirteen Red List plant species are known to occur in the 2528CC quarter degree grid cell, nine of these within 5 km of the proposed route and three of the nine species within a short distance from the route. The habitat along the proposed route was suitable for five Red List species, one of which was found during the present survey (see Annexure A.)

6.5.2 Flowering times

The site visits referred to in Section 5 covered the flowering times of all the species for which suitable habitat existed along the proposed route. One Red List species, *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit. The fern *Cheilanthes deltoidea* subsp *silicicola* was found in the chert outcrop just outside the 200 meter extended area northwest of the endpoint of Alternative route 2.

6.6 *Eragrostis – Hyparrhenia* grassland

6.6.1 Compositional aspects and Connectivity

This study unit comprised dense natural grassland that straddled the R21 highway. Connectivity with natural grassland existed to the south, but was limited by various roads and the Sesmyl Spruit. The species diversity of this study unit was high with 58% of all species recorded along the proposed route found in this unit. Of the 239 plant species recorded along the proposed route 138 were recorded in the *Eragrostis – Hyparrhenia* grassland. Of these, 131 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	74
Tree species	4
Shrubs and dwarf shrubs	14
Grasses	22
Geophytes	19
Sedges	2
Succulents	3
Total No of species	138

6.6.2 Red– and Orange List species

The habitat of this study unit was suitable for two of the Red List species known to occur in the quarter degree grid cell. None were, however, found in this study unit within 200 metres of the proposed route during the present site visit or during the November and December 2004 and the November 2010 site visits.

A few specimens of the Orange List *Boophone disticha, Eucomis autumnalis* and *Hypoxis hemerocallidea* were found in this study unit within 200 metres of the proposed route.

6.6.3 Medicinal and alien species

Twenty-eight of the 43 medicinal species and seven of the 23 alien species recorded within 200 meters of the proposed route were found in the *Eragrostis – Hyparrhenia* grassland study unit. Of the alien species, one was a Category 1 Declared weed.

6.6.4 Sensitivity

This study unit was not considered sensitive.

Figure 5: *Eragrostis – Hyparrhenia* grassland east of highway R21.

Table 3: Plants recorded in the Eragrostis – Hyparrhenia grassland

SCIENTIFIC NAME	COMMON NAMES
Abildgaardia ovata	
Acacia caffra	Common hook thorn / Gewone haakdoring
Acacia karroo[1,2]	Sweet thorn / Soetdoring
Acacia tortilis subsp *heteracantha*	Umbrella thorn / Haak-en-steek
Acalypha angustata	Copper leaf / Katpisbossie
Afrosciadium magalismontanum	Wild parsley / Wildepietersielie
Albuca setosa	Slymuintjie
Aloe greatheadii var davyana[1,2]	Kleinaalwyn
Aloe zebrina	
Andropogon schirensis	Stab grass / Tweevingergras
Anthospermum rigidum subsp *rigidum*	
Aristida congesta subsp barbicollis	Spreading three-awn grass / Witsteekgras
Artemisia afra[1,2]	Wild wormwood / Wildeals
Asparagus flavicaulis subsp flavicaulis	
Asparagus laricinus	Wild asparagus / Katbos
Asparagus suaveolens	Wild asparagus / Katdoring
Babiana bainesii	Bobbejaanuintjie
*Bidens pilosa**	Blackjack / Knapsekêrel
Bonatea antennifera	Terrestrial orchid / Grondorgidie
Boophone disticha[1,2,3]	Cape poison bulb / Seeroogblom, gifbol
Brachiaria brizantha	Common signal grass / Broodgras
Brachiaria serrata	Velvet grass / Fluweelgras
Brachystelma burchellii var *burchellii*	
Campuloclinium macrocephalum*	**Pom pom weed /Pompombossie**
Chaetacanthus costatus	
Chamaecrista comosa var *capricornia*	
Chascanum hederaceum var *hederaceum*	

SCIENTIFIC NAME	COMMON NAMES
Chlorophytum cooperi	
Chlorophytum fasciculatum	
Chlorophytum trichophlebium	
Commelina africana var. lancispatha	
Conyza podocephala	
Crabbea angustifolia[2]	
Crabbea hirsuta[2,3]	Prickle head
Crassula capitella subsp *nodulosa*	
Cucumis hirsutus	Wild cucumber / Suurkomkommer
Cucumis zeyheri	Wild cucumber / Wilde agurkie
Cyanotis speciosa	Doll's powder puff / Bloupoeierkwassie
Cymbopogon excavatus	Broadleaved turpentine grass / Breëblaar terpentyngras
Cynodon dactylon	Couch grass / Kweek
Cynoglossum lanceolatum	Forget-me-not
Digitaria diagonalis var. diagonalis	Brown-seed finger grass / Bruinsaadvingergras
Digitaria monodactyla	One-finger grass / Eenvingergras
Diheteropogon amplectens var. amplectens	Broadleaved bluestem / Breëblaar blougras
Diospyros lycioides subsp guerkei	Bushveld bluebush / Bosveldbloubos
Elephantorrhiza elephantina[1,2,3]	Elephant's root / Elandsboontjie
Elionurus muticus	Wire grass / Draadgras
Eragrostis chloromelas	Curly leaf / Krulblaar
Eragrostis curvula	Weeping love grass / Oulandsgras
Eragrostis plana	Tough love grass / Taaipoleragrostis
Eragrostis racemosa	Narrow heart love grass / Smalhartjiesgras
Eriosema burkei var *burkei*	
Eriosema cordatum	
Eucomis autumnalis[1,2,3]	Pineapple flower / Wilde pynappel
Eulophia hians var *hians*	
Felicia muricata subsp muricata[1,2,3]	White felicia
Gerbera viridifolia	
Gladiolus crassifolius	
Gnidia microcephala	Besembossie
Helichrysum caespititium	Speelwonderboom
Helichrysum rugulosum[2,3]	
Hermannia depressa[2,3]	Creeping red Hermannia / Rooiopslag
Heteropogon contortus	Spear grass / Assegaaigras
*Hibiscus trionum**	Bladder hibiscus / Terblansbossie
Hyparrhenia hirta	Common thatching grass / Dekgras
Hypoxis argentea var. argentea	Small yellow star flower
Hypoxis hemerocallidea[1,2,3]	African potato / Gifbol
Hypoxis interjecta	
Hypoxis iridifolia	
Hypoxis obtusa	
Hypoxis rigidula var rigidula	Silverleaved star flower / Wilde tulp
Indigastrum burkeanum	
Indigofera hedyantha	
Indigofera oxytropis	
Indigofera zeyheri	
Ipomoea crassipes var. crassipes[2,3]	Leafy-flowered Ipomoea / Wildewinde
Ipomoea oblongata[2]	
Ipomoea ommaneyi[2]	Beespatat
Jamesbrittenia burkeana	Bruinblommetjie
Justicia anagalloides	
Lantana rugosa[2,3]	Bird's brandy / Voëlbrandewyn
Ledebouria marginata	
Ledebouria revoluta[3]	Common ledebouria
Lippia javanica[1,2,3]	Fever tea / Koorsbossie
Macledium zeyheri subsp *zeyheri*	Doll's protea
Mariscus uitenhagensis	

SCIENTIFIC NAME	COMMON NAMES
Melinis nerviglumis	Bristle leaf red top / Steekblaarblinkgras
Melinis repens subsp repens	Red top grass
Monsonia angustifolia	Crane's bill / Angelbossie
Nidorella hottentotica	
Nolletia rarifolia	
Ocimum obovatum subsp obovatum var obovatum[2,3]	Cat's whiskers / Katsnor
*Oenothera rosea**	Pink evening primrose / Pienk aandblom
Osteospermum muricatum subsp *muricatum*	
Oxalis obliquifolia	Sorrel / Suring
Parinari capensis subsp capensis	Dwarf mobola / Grysappeltjie
Pearsonia sessilifolia subsp sessilifolia	Silwerertjietee
Pennisetum thunbergii	
Pentanisia angustifolia	Wild verbena / Sooibrandbossie
Phyllanthus sp.	
Pollichia campestris	Waxberry / Teesuikerbossie
Polygala rehmannii	
Protea caffra subsp caffra[1,2,4]	Common sugarbush / Gewone suikerbos
Pygmaeothamnus chamaedendrum var chamaedendrum	Sand apple / Goorappel
Raphionacme hirsuta[2]	Khadi root / Khadiwortel
Rhynchosia monophylla	
Rotheca hirsuta	Small violet bush
Scabiosa columbaria[1,2,3]	Wild scabiosa / Bitterbos
Schizachyrium sanguineum	Red autumn grass / Rooi herfsgras
Searsia pyroides var pyroides[4]	Common wild currant / Taaibos
Selago densiflora	
Senecio affinis	
Senecio erubescens var *crepidifolius*	
Senecio inornatus	
Senecio lydenburgensis	
Seriphium plumosum	Bankrupt bush / Bankrotbos
Setaria sphacelata var sphacelata	Small creeping foxtail / Kleinkruipmannagras
Sida dregei	Spider-leg
Sida rhombifolia subsp rhombifolia	Arrow leaf Sida / Taaiman
Solanum panduriforme	Poison apple / Gifappel
Sonchus dregeanus	
Sonchus wilmsii	Milk thistle / Melkdissel
Sphenostylis angustifolia	Wild sweetpea bush / Wilde ertjie
Striga elegans	Rooiblom
*Tagetes minuta**	Khaki weed / Kakiebos
Talinum caffrum[2]	Porcupine root / Ystervarkwortel
Tephrosia semiglabra	
Teucrium trifidum	Koorsbossie
Themeda triandra	Red grass / Rooigras
Triaspis hypericoides subsp nelsonii	Klapperbossie
Tulbaghia acutiloba	
*Verbena bonariensis**	Purple top / Blouwaterbossie
*Verbena brasiliensis**	
Vernonia natalensis[1,2]	Silver vernonia / Silwervernonia
Vernonia oligocephala[1,2]	Cape vernonia / Blounaaldetee bossie
Vigna vexillata var vexillata[3]	Narrowleaved wild pea / Wildeertjie
Xenostegia tridentata subsp *augustifolia* var *angustifolia*	
Ziziphus zeyheriana[2]	Dwarf buffalothorn / Dwergblinkblaar-wag-'n-bietjie

6.7 *Tristachya – Monocymbium* Chert – Quartz outcrop

6.7.1 Compositional aspects and Connectivity

This study unit comprised natural primary grassland on outcrops of chert and quartz. Large areas of the study unit were disturbed by roadworks, especially south of Nellmapius Road. Areas where alien species have invaded as a result of introduced soil and areas were the ground was cleared and road construction have started where designated “Mixed alien and indigenous vegetation” and are discussed under subsection 6.8.

Roads and township development limited connectivity with natural grassland. Of the 239 plant species recorded along the proposed route 61 were recorded in the *Tristachya – Monocymbium* Chert – Quartz outcrop study unit. Of these, 59 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	23
Shrubs and dwarf shrubs	7
Grasses	23
Geophytes	4
Sedges	2
Succulents	2
Total No of species	61

6.7.2 Red– and Orange List species

The habitat of this study unit was suitable for the Red List fern *Cheilanthes deltoidea* subsp *silicicola* known to occur in the quarter degree grid cell. A few specimens of this species was found in the chert outcrop just *outside* the 200 meter extended area northwest of the endpoint of Alternative route 2. None were found in those parts of the *Tristachya – Monocymbium* Chert – Quartz outcrop study unit east and south of Nellmapius Road.

The habitat of this study unit was suitable for the Orange List *Callilepis leptophylla* but none were found within 200 metres of the proposed route during any of the site visits.

6.7.3 Medicinal and alien species

Nine medicinal species and two alien species were recorded in this study unit within 200 metres of the proposed route. Of the alien species one was a Category 1 Declared weed.

6.7.4 Sensitivity

This study unit was considered sensitive.

Figure 6: *Tristachya – Monocymbium* Chert – Quartz outcrop south of Nellmapius Road.

Table 4: Plants recorded in the Tristachya – Monocymbium Chert – Quartz outcrop

SCIENTIFIC NAME	COMMON NAMES
Acalypha angustata	Copper leaf / Katpisbossie
Andropogon chinensis	Hairy blue grass / Harige blougras
Andropogon schirensis	Stab grass / Tweevingergras
Asparagus suaveolens	Wild asparagus / Katdoring
Brachiaria serrata	Velvet grass / Fluweelgras
Bulbostylis burchellii	Biesie
Bulbostylis contexta	Biesie
*Campuloclinium macrocephalum**	Pom pom weed /Pompombossie
Chaetacanthus costatus	
Chaetacanthus setiger	
Crassula capitella subsp *nodulosa*	
Cymbopogon excavatus	Broadleaved turpentine grass / Breëblaar terpentyngras
*Cymbopogon pospischilii**	Turpentine grass / Terpentyngras
Dianthus mooiensis subsp mooiensis var mooiensis [2,3]	Wild pink / Wilde angelier
Digitaria monodactyla	One-finger grass / Eenvingergras
Diheteropogon amplectens var. amplectens	Broadleaved bluestem / Breëblaar blougras
Elionurus muticus	Wire grass / Draadgras
Eragrostis chloromelas	Curly leaf / Krulblaar
Eragrostis inamoena	Tite grass
Eragrostis nindensis	Wether love grass / Hamelgras
Eragrostis racemosa	Narrow heart love grass / Smalhartjiesgras
Eulophia tuberculata	
Gladiolus crassifolius	
Helichrysum caespititium	Speelwonderboom
Helichrysum rugulosum [2,3]	
Hypoxis rigidula var rigidula	Silverleaved star flower / Wilde tulp
Indigastrum burkeanum	
Jamesbrittenia burkeana	Bruinblommetjie
Justicia anagalloides	
Kohautia amatymbica [2]	
Kohautia caespitosa subsp brachyloba	
Ledebouria ovatifolia	
Lippia javanica [1,2,3]	Fever tea / Koorsbossie

SCIENTIFIC NAME	COMMON NAMES
Loudetia simplex	Russet grass / Stingelgras
Melinis nerviglumis	Bristle leaf red top / Steekblaarblinkgras
Melinis repens subsp repens	Red top grass
Monocymbium ceresiiforme	Boat grass / Bootjiegras
Nidorella hottentotica	
Ocimum obovatum subsp obovatum var obovatum[2,3]	Cat's whiskers / Katsnor
Oldenlandia herbacea var *herbacea*	
Panicum natalense	Natal panicum / Suurbuffelsgras
Parinari capensis subsp capensis	Dwarf mobola / Grysappeltjie
Pearsonia sessilifolia subsp sessilifolia	Silwerertjietee
Pellaea calomelanos var calomelanos [1,2]	Black cliff brake / Swart kransruigtevaring
Pentanisia angustifolia	Wild verbena / Sooibrandbossie
Pollichia campestris	Waxberry / Teesuikerbossie
Protea welwitschii subsp *welwitschii*	
Schizachyrium sanguineum	Red autumn grass / Rooi herfsgras
Sebaea junodii	
Senecio oxyriifolius[2]	
Seriphium plumosum	Bankrupt bush / Bankrotbos
Sphenostylis angustifolia	Wild sweetpea bush / Wilde ertjie
Sporobolus pectinatus	Fringed dropseed / Kammetjiesgras
Syncolostemon pretoriae subsp pretoriae	Dwarf sage bush
Themeda triandra	Red grass / Rooigras
Trachypogon spicatus	Giant spear grass / Bokbaardgras
Tristachya biseriata	Trident grass / Drieblomgras
Urelytrum agropyroides	quinine grass / varkstertgras
Vernonia galpinii	Kwasbossie
Vernonia oligocephala[1,2]	Cape vernonia / Blounaaldetee bossie
Xerophyta retinervis[1,2]	Monkey's tail / Bobbejaanstert

6.8 Mixed alien and indigenous vegetation

6.8.1 Compositional aspects

Areas along the proposed route where alien species have invaded as a result of introduced soil and areas were the ground was cleared and road construction have started were included in this study unit together with thickets of Black wattle and *Eucalyptus* sp. The species diversity of this study unit was low. Of the 239 plant species recorded along the proposed route 52 were recorded in the Mixed alien and indigenous vegetation study unit within 200 meters of the proposed route. Of these, 32 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	28
Tree species	6
Shrubs and dwarf shrubs	4
Grasses	12
Geophytes	1
Succulents	1
Total No of species	52

6.8.2 Red– and Orange List species

The habitat of this study unit was not suitable for any of the Red List or Orange List species known to occur in the quarter degree grid cell.

6.8.3 Medicinal and alien species

Seven medicinal species were recorded in this study unit within 200 meters of the proposed route. Twenty of the 23 alien species recorded within 200 meters of the proposed route were found in this study unit. Of the alien species four were Category 1 Declared weeds, two were Category 2 Declared invaders and two were Category 3 Declared invaders.

6.8.4 Sensitivity

This study unit was not considered sensitive.

Figure 7: Mixed alien and indigenous vegetation.

Figure 8: Alien species invading along newly cleared route.

Table 5: Plants recorded in the Mixed alien and indigenous vegetation

SCIENTIFIC NAME	INV CAT	COMMON NAMES
Acacia caffra		Common hook thorn / Gewone haakdoring
Acacia karroo[1,2]		Sweet thorn / Soetdoring
*Acacia mearnsii**	2	Black wattle / Swartwattel
*Acanthospermum australe**		
Achyranthus aspera*	**1**	**Chaff flower / Langklits**
Aloe greatheadii var davyana[1,2]		Kleinaalwyn
*Amaranthus hybridus subsp hybridus var hybridus**		Common pigweed / Kaapse misbredie
Aristida congesta subsp barbicollis		Spreading three-awn grass / Witsteekgras
Artemisia afra[1,2]		Wild wormwood / Wildeals
Asparagus laricinus		Wild asparagus / Katbos
*Bidens pilosa**		Blackjack / Knapsekêrel
Chaetacanthus costatus		
Chamaecrista comosa var *capricornia*		
Chlorophytum fasciculatum		
Commelina sp.		
*Conyza albida**		Tall fleabane / Vaalskraalhans
Conyza podocephala		
Cymbopogon nardus		Giant turpentine grass / Reuse terpentyngras
*Cymbopogon pospischilii**		Turpentine grass / Terpentyngras
Cynodon dactylon		Couch grass / Kweek
Datura ferox*	**1**	**Large thorn apple / Groot stinkblaar**
Datura stramonium*	**1**	**Common thorn apple / Olieboom**
Eleusine coracana subsp africana		Goose grass / Osgras
Eragrostis curvula		Weeping love grass / Oulandsgras
Eragrostis plana		Tough love grass / Taaipoleragrostis
*Eucalyptus sp**	2	
Felicia muricata subsp muricata[1,2,3]		White felicia
*Flaveria bidentis**		Smelter's bush / Smelterbossie
Helichrysum rugulosum[2,3]		
*Hibiscus trionum**		Bladder hibiscus / Terblansbossie
Hyparrhenia hirta		Common thatching grass / Dekgras
Hypoxis rigidula var rigidula		Silverleaved star flower / Wilde tulp
Indigofera zeyheri		
*Ipomoea purpurea**	3	
Lippia javanica[1,2,3]		Fever tea / Koorsbossie
*Melia azedarach**	3	Syringa / Sering
Melinis repens subsp repens		Red top grass
*Mirabilis jalapa**		Four o'clock / Vieruurtjie
Monsonia angustifolia		Crane's bill / Angelbossie
Nidorella hottentotica		
*Paspalum urvillei**		Giant paspalum / Langbeen-paspalum
*Pennisetum clandestinum**		Kikuyu / Kikoejoe
Pentarrhinum insipidum		Donkieperske
Searsia lancea		Karee / Karee
Searsia pyroides var pyroides[4]		Common wild currant / Taaibos
Selago densiflora		
Seriphium plumosum		Bankrupt bush / Bankrotbos
Sporobolus africanus		Rat's tail dropseed / Taaipol
*Tagetes minuta**		Khaki weed / Kakiebos
Teucrium trifidum		Koorsbossie
*Verbena bonariensis**		Purple top / Blouwaterbossie
Xanthium strumarium*	**1**	**Large cocklebur / Boetebos**

6.9 Quartz slope vegetation

6.9.1 Compositional aspects and Connectivity

Although this study unit is not situated on the proposed route, it occurs within 200 meters of the route. It comprised a quartz koppie with a large water reservoir in its centre. Access and service roads for the reservoir disturbed the natural vegetation. Connectivity with natural grassland existed in all directions. Of the 239 plant species recorded along the proposed route 34 were recorded in the Quartz slope vegetation study unit. Of these, 33 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	4
Tree species	7
Shrubs and dwarf shrubs	13
Grasses	2
Geophytes	6
Succulents	2
Total No of species	34

6.9.2 Red– and Orange List species

The habitat of this study unit was suitable for the Red List species *Holothrix randii* known to occur in the quarter degree grid cell. Officials of GDARD recorded this species a few years ago on the southern slope of the koppie, but the plant specialist found none during any of the site visits.

The habitat was suitable for three Orange List species. Two of these species, *Boophone disticha* and *Hypoxis hemerocallidea* were found in the Quartz slope vegetation study unit.

6.9.3 Medicinal and alien species

Fifteen of the 43 medicinal species recorded within 200 meters of the proposed route were found in the Quartz slope vegetation study unit. One alien species that was not a declared invader was recorded in this study unit.

6.9.4 Sensitivity

As the habitat was suitable for the presence of the Red List *Holothrix randii* and no declared invaders were present, this study unit was considered sensitive.

Figure 9: Quartz slope vegetation on reservoir koppie.

Table 6: Plants recorded in the Quartz slope vegetation

SCIENTIFIC NAME	COMMON NAMES
Acacia caffra	Common hook thorn / Gewone haakdoring
Acacia karroo[1,2]	Sweet thorn / Soetdoring
Acacia robusta subsp robusta	Broad-pod robust thorn / Enkeldoring
Afrocanthium mundianum	Rock alder / Klipels
Aloe greatheadii var davyana[1,2]	Kleinaalwyn
Bonatea antennifera	Terrestrial orchid / Grondorgidie
Boophone disticha[1,2,3]	Cape poison bulb / Seeroogblom, gifbol
Combretum molle[4]	Velvet bushwillow / Fluweel boswilg
Crassula capitella subsp *nodulosa*	
Dovyalis zeyheri	
Ehretia rigida subsp nervifolia[2,4]	Puzzle bush / Deurmekaarbos
Eulophia ovalis var *bainesii*	
Eulophia tuberculata	
Freesia grandiflora	
Hypoxis hemerocallidea[1,2,3]	African potato / Gifbol
Jamesbrittenia burkeana	Bruinblommetjie
Lannea edulis var *edulis*[1,2]	Wild grape / Wildedruif
Lippia javanica[1,2,3]	Fever tea / Koorsbossie
Loudetia simplex	Russet grass / Stingelgras
Melinis repens subsp repens	Red top grass
Pearsonia sessilifolia subsp sessilifolia	Silwerertjietee
Pellaea calomelanos var calomelanos [1,2]	Black cliff brake / Swart kransruigtevaring
Protea welwitschii	Cluster-head sugarbush / Troshofie-suikerbos
Scolopia zeyheri	Thorn pear / Doringpeer
Searsia pyroides var pyroides[4]	Common wild currant / Taaibos
Sphedamnocarpus pruriens subsp *galphimiifolius*	
Stachys caffra	
Strychnos pungens[1,2]	
Triaspis hypericoides subsp nelsonii	Klapperbossie
*Verbena brasiliensis**	
Vernonia natalensis[1,2]	Silver vernonia / Silwervernonia
Xerophyta retinervis[1,2]	Monkey's tail / Bobbejaanstert
Zanthoxylum capense[1,2]	Small knobwood / Klein perdepram
Ziziphus mucronata subsp mucronata[1,2,4]	Buffalo-thorn / Blinkblaar-wag-'n-bietjie

6.10 *Acacia karroo* woodland

6.10.1 Compositional aspects and Connectivity

This study unit comprised copses of indigenous trees and shrubs in natural grassland. Connectivity with natural grassland existed to the south. The species diversity of this study unit was high. Of the 239 plant species recorded along the proposed route 81 were recorded in the *Acacia karroo* woodland study unit. Of these, 75 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	33
Tree species	8
Shrubs and dwarf shrubs	15
Grasses	19
Geophytes	4
Sedges	1
Succulents	1
Total No of species	81

6.10.2 Red– and Orange List species

The habitat of this study unit within 200 metres of the proposed route was not suitable for any of the Red List species known to occur in the quarter degree grid cell, but was suitable for the Orange List species *Hypoxis hemerocallidea,* but none was found in this study unit.

6.10.3 Medicinal and alien species

Twenty of the 43 medicinal species recorded along the proposed route were found in the *Acacia karroo* woodland study unit. Six alien species of which one was a Category 1 Declared weed were recorded this study unit.

6.10.4 Sensitivity

This study unit was not considered sensitive.

Figure 10: Copse of trees in the *Acacia karroo* woodland.

Table 7: Plants recorded in the Acacia karroo woodland

SCIENTIFIC NAME	COMMON NAMES
Acacia caffra	Common hook thorn / Gewone haakdoring
Acacia karroo[1,2]	Sweet thorn / Soetdoring
Acacia robusta subsp robusta	Broad-pod robust thorn / Enkeldoring
Acacia tortilis subsp *heteracantha*	Umbrella thorn / Haak-en-steek
Acalypha villicaulis	
Achyranthus aspera*	**Chaff flower / Langklits**
Aloe greatheadii var davyana[1,2]	Kleinaalwyn
*Amaranthus hybridus subsp hybridus var hybridus**	Common pigweed / Kaapse misbredie
Andropogon schirensis	Stab grass / Tweevingergras
Anthospermum rigidum subsp *rigidum*	
Aristida congesta subsp barbicollis	Spreading three-awn grass / Witsteekgras
Asparagus laricinus	Wild asparagus / Katbos
Asparagus suaveolens	Wild asparagus / Katdoring
*Bidens pilosa**	Blackjack / Knapsekêrel
Bonatea antennifera	Terrestrial orchid / Grondorgidie
Brachiaria serrata	Velvet grass / Fluweelgras
Chaetacanthus costatus	
Chamaecrista comosa var *capricornia*	
Chlorophytum fasciculatum	
Combretum molle[4]	Velvet bushwillow / Fluweel boswilg
*Conyza albida**	Tall fleabane / Vaalskraalhans
Conyza podocephala	
Crabbea angustifolia[2]	
Cymbopogon excavatus	Broadleaved turpentine grass / Breëblaar terpentyngras
*Cymbopogon pospischilii**	Turpentine grass / Terpentyngras
Cynodon dactylon	Couch grass / Kweek
Dichapetalum cymosum	
Digitaria diagonalis var. diagonalis	Brown-seed finger grass / Bruinsaadvingergras
Digitaria monodactyla	One-finger grass / Eenvingergras
Diospyros lycioides subsp guerkei	Bushveld bluebush / Bosveldbloubos
Dovyalis zeyheri	
Ehretia rigida subsp nervifolia[2,4]	Puzzle bush / Deurmekaarbos
Elionurus muticus	Wire grass / Draadgras
Eragrostis chloromelas	Curly leaf / Krulblaar
Eragrostis nindensis	Wether love grass / Hamelgras
Eragrostis plana	Tough love grass / Taaipoleragrostis
Eragrostis racemosa	Narrow heart love grass / Smalhartjiesgras
Eriosema burkei var *burkei*	
Euclea crispa subsp crispa[4]	
Eulophia ovalis var *bainesii*	
Felicia muricata subsp muricata[1,2,3]	White felicia
Helichrysum rugulosum[2,3]	
Heteropogon contortus	Spear grass / Assegaaigras
*Hibiscus trionum**	Bladder hibiscus / Terblansbossie
Hyparrhenia hirta	Common thatching grass / Dekgras
Hypoxis obtusa	
Hypoxis rigidula var rigidula	Silverleaved star flower / Wilde tulp
Indigofera hedyantha	
Indigofera oxytropis	
Ipomoea crassipes var. crassipes[2,3]	Leafy-flowered Ipomoea / Wildewinde
Ipomoea oblongata[2]	
Lannea edulis var *edulis*[1,2]	Wild grape / Wildedruif
Lantana rugosa[2,3]	Bird's brandy / Voëlbrandewyn
Lippia javanica[1,2,3]	Fever tea / Koorsbossie
Mariscus uitenhagensis	
Melinis repens subsp repens	Red top grass
Monsonia angustifolia	Crane's bill / Angelbossie
Nidorella hottentotica	

SCIENTIFIC NAME	COMMON NAMES
Ocimum obovatum subsp obovatum var obovatum[2,3]	Cat's whiskers / Katsnor
Parinari capensis subsp capensis	Dwarf mobola / Grysappeltjie
Pavetta gardeniifolia var gardeniifolia	Common bride's bush / Gewone bruidsbos
Pavonia burchellii	
Pentarrhinum insipidum	Donkieperske
Pollichia campestris	Waxberry / Teesuikerbossie
Rhynchosia monophylla	
Searsia lancea	Karee / Karee
Searsia pyroides var pyroides[4]	Common wild currant / Taaibos
Selago densiflora	
Senecio lydenburgensis	
Setaria sphacelata var sphacelata	Small creeping foxtail / Kleinkruipmannagras
Sida rhombifolia subsp rhombifolia	Arrow leaf Sida / Taaiman
Sphenostylis angustifolia	Wild sweetpea bush / Wilde ertjie
Sporobolus africanus	Rat's tail dropseed / Taaipol
Stachys caffra	
Talinum caffrum[2]	Porcupine root / Ystervarkwortel
Teucrium trifidum	Koorsbossie
Themeda triandra	Red grass / Rooigras
Vigna vexillata var vexillata[3]	Narrowleaved wild pea / Wildeertjie
Withania somnifera[1,2]	Winter cherry / Geneesblaarbossie
Zanthoxylum capense[1,2]	Small knobwood / Klein perdepram
Ziziphus mucronata subsp mucronata[1,2,4]	Buffalo-thorn / Blinkblaar-wag-'n-bietjie

6.11 Mixed grassland on shallow dolomite

6.11.1 Compositional aspects and Connectivity

This study unit comprised natural primary grassland that was severely disturbed by roadworks. Connectivity with natural grassland was limited by roadworks. The species diversity of the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route was much lower than that recorded during earlier unrelated surveys. Of the 239 plant species recorded along the proposed route 89 were recorded in the Mixed grassland on shallow dolomite study unit. Of these, 87 were indigenous species. The following number of species in each life form was noted:

LIFE FORM	NUMBER OF SPECIES
Annual & perennial herbaceous species	50
Shrubs and dwarf shrubs	7
Grasses	16
Geophytes	12
Sedges	1
Succulents	3
Total No of species	89

6.11.2 Red– and Orange List species

The habitat of this study unit was suitable for two of the Red List species known to occur in the quarter degree grid cell. A specimen of the Red List *Melolobium subspicatum* and a few specimens of the Orange List *Hypoxis hemerocallidea* were found in this study unit within 200 metres of the proposed route

6.11.3 Medicinal and alien species

Seventeen of the 43 medicinal species recorded along the proposed route were found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. Two alien species, of which one was a Category 1 Declared weed, was found in this study unit.

6.11.4 Sensitivity

Owing to the presence of the Red List species, the Mixed grassland on shallow dolomite study unit was considered sensitive. A 200-meter buffer should be maintained around the Red List species.

Figure 11: Mixed grassland on shallow dolomite.

Table 8: Plants recorded in the Mixed grassland on shallow dolomite

SCIENTIFIC NAME	COMMON NAMES
Acalypha villicaulis	
Aristida stipitata subsp graciliflora	Long awned three-awn / Langnaaldsteekgras
Asparagus flavicaulis subsp flavicaulis	
Barleria macrostegia	
Brachiaria serrata	Velvet grass / Fluweelgras
Brachystelma barberae	Platvoetaasblom
Bulbine capitata	
Campuloclinium macrocephalum*	**Pom pom weed /Pompombossie**
Chaetacanthus costatus	
Chamaecrista comosa var *capricornia*	
Chascanum hederaceum var *hederaceum*	
Chascanum pinnatifidum var pinnatifidum	
Chlorophytum fasciculatum	
Commelina sp.	
Conyza podocephala	
Crabbea angustifolia[2]	
Crassula capitella subsp *nodulosa*	
Cucumis hirsutus	Wild cucumber / Suurkomkommer
Cyanotis speciosa	Doll's powder puff / Bloupoeierkwassie
Cynodon dactylon	Couch grass / Kweek
Cyperus obtusiflorus var. obtusiflorus	Witbiesie

SCIENTIFIC NAME	COMMON NAMES
Digitaria monodactyla	One-finger grass / Eenvingergras
Dipcadi rigidifolium	Skaamblommetjie
Elephantorrhiza elephantina[1,2,3]	Elephant's root / Elandsboontjie
Elionurus muticus	Wire grass / Draadgras
Eragrostis chloromelas	Curly leaf / Krulblaar
Eragrostis plana	Tough love grass / Taaipoleragrostis
Eragrostis racemosa	Narrow heart love grass / Smalhartjiesgras
Eragrostis superba	Sawtooth love grass / Weeluisgras
Eriospermum porphyrovalve	
Euphorbia trichadenia var trichadenia	Melkbol
Felicia muricata subsp muricata[1,2,3]	White felicia
Geigeria burkei subsp burkei var intermedia	
Gnidia microcephala	Besembossie
Gnidia sericocephala	
Grewia flava[2]	Velvet raisin bush / Fluweelrosyntjiebos
Helichrysum caespititium	Speelwonderboom
Helichrysum callicomum	
Hermannia cordata	
Hermannia depressa[2,3]	Creeping red Hermannia / Rooiopslag
Heteropogon contortus	Spear grass / Assegaaigras
Hyparrhenia hirta	Common thatching grass / Dekgras
Hypoxis hemerocallidea[1,2,3]	African potato / Gifbol
Hypoxis obtusa	
Hypoxis rigidula var rigidula	Silverleaved star flower / Wilde tulp
Indigofera hedyantha	
Ipomoea bolusiana	
Ipomoea crassipes var. crassipes[2,3]	Leafy-flowered Ipomoea / Wildewinde
Ipomoea oblongata[2]	
Jatropha lagarinthoides	
Ledebouria revoluta[3]	Common ledebouria
Lippia javanica[1,2,3]	Fever tea / Koorsbossie
Lotononis calycina	Hairy lotononis
Lotononis laxa var laxa	
Melinis repens subsp repens	Red top grass
Melolobium subspicatum	
Neorautanenia ficifolius	
Nidorella hottentotica	
Ocimum obovatum subsp obovatum var obovatum[2,3]	Cat's whiskers / Katsnor
Ophioglossum polyphyllum	
Parinari capensis subsp capensis	Dwarf mobola / Grysappeltjie
Pelargonium luridum[1,2]	Stalkflowered pelargonium / Wildemalva
Pentanisia angustifolia	Wild verbena / Sooibrandbossie
Pollichia campestris	Waxberry / Teesuikerbossie
Raphionacme hirsuta[2]	Khadi root / Khadiwortel
Raphionacme velutina	
Rhynchosia monophylla	
Scabiosa columbaria[1,2,3]	Wild scabiosa / Bitterbos
Schizoglossum sp	
Searsia pyroides var pyroides[4]	Common wild currant / Taaibos
Selago densiflora	
Senecio coronatus	
Seriphium plumosum	Bankrupt bush / Bankrotbos
Setaria sphacelata var sphacelata	Small creeping foxtail / Kleinkruipmannagras
Solanum panduriforme	Poison apple / Gifappel
Sphenostylis angustifolia	Wild sweetpea bush / Wilde ertjie
Sporobolus festivus	Red dropseed / Rooifynsaad
Striga bilabiata subsp bilabiata	Small witch weed
Talinum caffrum[2]	Porcupine root / Ystervarkwortel
Tephrosia semiglabra	

SCIENTIFIC NAME	COMMON NAMES
Thesium sp. 2	
Thesium sp. 3	
Triraphis andropogonoides	
Urelytrum agropyroides	quinine grass / varkstertgras
*Verbena brasiliensis**	
Vernonia galpinii	Kwasbossie
Vernonia oligocephala[1,2]	Cape vernonia / Blounaaldetee bossie
Vigna unguiculata subsp stenophylla	
Xysmalobium brownianum	

1) Van Wyk, B-E., Van Oudtshoorn, B. & Gericke, N. 2002.
2) Watt, J.M. & Breyer-Brandwijk, M.G. 1962.
3) Pooley, E. 1998.
4) Van Wyk, B. & Van Wyk P. 1997.

7. FINDINGS AND POTENTIAL IMPLICATIONS

The proposed road runs mostly through *Eragrostis – Hyparrhenia* grassland and Mixed alien and indigenous vegetation. A single specimen of the Red List *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. Compared to the number of plants found during earlier unrelated surveys, the current construction of another road and infrastructure had a negative impact on this population, and any further road construction might destroy the entire population of this species within 200 meters of the proposed route.

8. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The study site was examined during surveys unrelated to the present study during the flowering seasons of all the Red List species known to occur in the quarter degree grid cell and, for the present commission, during the flowering season of all but four of the Red List species.

9. RECOMMENDED MITIGATION MEASURES

The following mitigation measures were developed by GDACE (Directorate of Nature Conservation, GDACE, 2008 and 2009) and are applicable to the study route. Where appropriate, Galago Environmental's specific elaborations are given in brackets.

- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation or landscaping exercise should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the proposed route, but would otherwise be destroyed during construction, should be used for re-vegetation / landscaping purposes.
- Prior to construction, fences should be erected in such a manner to prevent access and damage to any sensitive areas identified in a sensitivity mapping exercise.

10. CONCLUSION

The Red List *Melolobium subspicatum* was found in the Mixed grassland on shallow dolomite study unit within 200 meters of the proposed route. A 200-meter buffer should be maintained around the Red List species. The *Tristachya – Monocymbium* Chert – Quartz outcrop, the Quartz slope vegetation and the Mixed grassland on shallow dolomite study units were considered sensitive and construction activities within these areas should be kept strictly within the pipeline reserve. All Declared Weeds and invaders and other alien species in the vicinity of the proposed pipeline must be removed and a management plan for the continuing control of the aliens be implemented. Alternative route 2 will have the least negative impact on the grassland of the study site and is the preferred route.

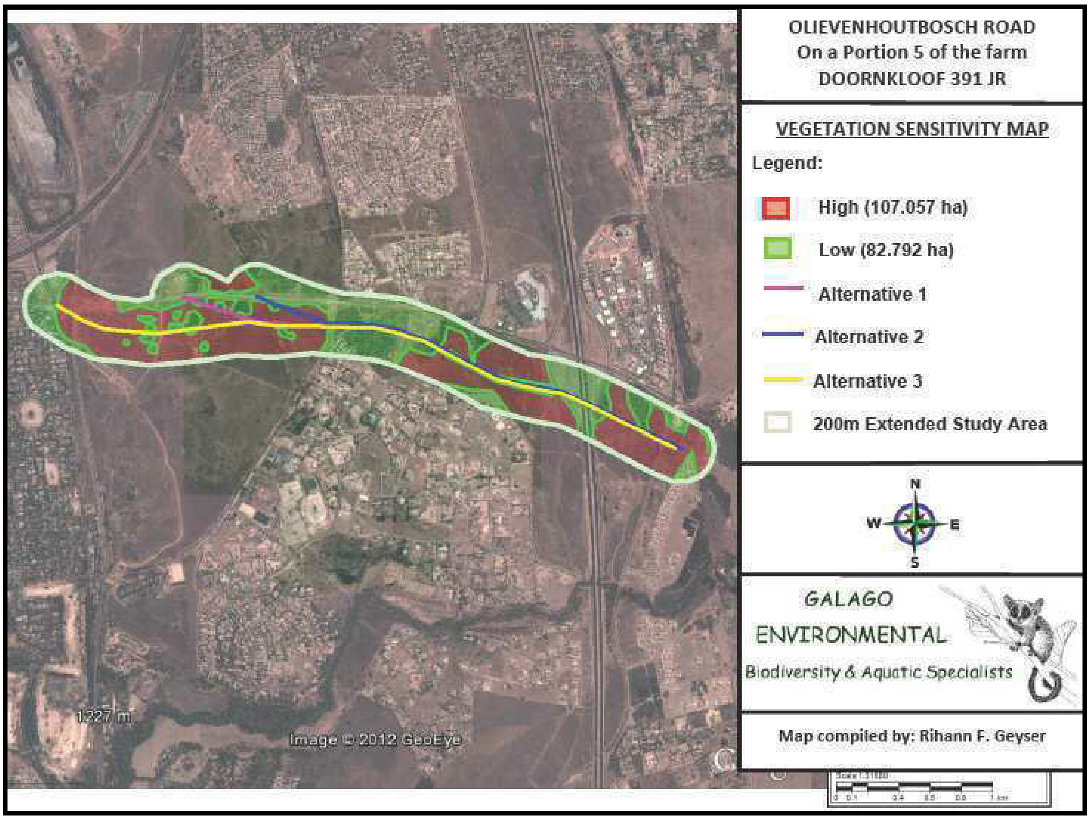

Figure 12: Vegetation sensitivity map

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ANNEXURE A: Red– and Orange List* plants of the 2528CC q.d.g.c.

Species	Flower season	Suitable habitat	Priority grouping	Conserv status	PRESENCE ON SITE
Adromischus umbraticola subsp *umbraticola*	Sep-Jan	Rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in shade of other vegetation.	A2	Near threatened[1]	Habitat not suitable
Boophone disticha	Oct-Jan	Dry grassland and rocky areas.	N/A	Declining[2]	**FOUND**
Bowiea volubilis subsp volubilis	Sep-Apr	Shady places, steep rocky slopes and in open woodland, under large boulders in bush or low forest.	B	Vulnerable[2]	Habitat not suitable
▲ *Brachycorythis conica subsp transvaalensis*	Jan-Mrt	Short grassland, hillsides,on sandy gravel overlying dolomite, sometimes also on quartzites, occasionally open woodland, 1000 – 1705m	A3	Vulnerable[1]	Habitat not suitable
Callilepis leptophylla	Aug-Jan & May	Grassland or open woodland, often on rocky outcrops or rocky hillslopes.	N/A	Declining[2]	**Habitat suitable**
Ceropegia decidua subsp. pretoriensis	Nov-Apr	Direct sunshine or shaded situations, rocky outcrops of the quartzitic Magaliesberg mountain series, in pockets of soil among rocks, in shade of shrubs and low trees, can be seen twining around grass spikes.	A1	Vulnerable[1]	Habitat not suitable
▲ *Cheilanthes deltoidea subsp silicicola*	Nov-Jun	Southwest-facing soil pockets and rock crevices in chert rocks.	A2	Vulnerable[1]	**Habitat suitable**
▲ *Cleome conrathii*	Dec-Jan Mar-May	Stony quartzite slopes, usually in red sandy soil, grassland or open to closed deciduous woodland, all aspects.	A3	Near Threatened[1]	**Habitat suitable**
Crinum macowanii	Oct-Jan	Grassland along rivers in gravely soil or on sandy flats	N/A	Declining[2]	Habitat not suitable
Drimia sanguinea	Aug-Dec	Open veld and scrubby woodland in a variety of soil types	B	Near threatened[2]	**Habitat suitable**
Eucomis autumnalis	Nov-Apr	Damp open grassland and sheltered places.	N/A	Declining[2]	**FOUND**
Gunnera perpensa	Oct-Mar	In cold or cool continually moist localities, mainly along upland streambanks.	N/A	Declining[2]	Habitat not suitable
▲ *Habenaria barbertonii*	Feb-Mar	In grassland on rocky hillsides.	A2	Near threatened[1]	Habitat not suitable
▲ *Habenaria kraenzliniana*	Feb-Apr	Terrestrial in stony, grassy hillsides, recorded from 1000 to 1400m.	A3	Near Threatened[1]	Habitat not suitable
▲ *Habenaria mossii*	Mar-Apr	Open grassland on dolomite or in black sandy soil.	A1	Endangered[1]	Habitat not suitable
▲ *Holothrix randii*	Sep-Jan	Grassy slopes & rock ledges, usually southern aspects.	B	Near Threatened[2]	**Habitat suitable**
Hypoxis hemerocallidea	Sep-Mar	Occurs in a wide range of habitiats. Grassland and mixed woodland.	N/A	Declining[2]	**FOUND**
Ilex mitis var mitis	Oct-Dec	River banks, stream beds, evergreen forests.	N/A	Declining[2]	Habitat not suitable
▲ *Lithops lesliei subsp. lesliei*	Mar-Jun	Primary habitat the arid grasslands in the interior of SA where it usually occurs in rocky places, growing under the protection of surrounding herbs and grasses.	B	Near threatened[2]	Habitat not suitable
▲ *Melolobium subspicatum*	Sep-May	Grassland.	A1	Vulnerable[1]	**FOUND**

[1)] global status
[2)] national status
* Orange listed plants have no priority grouping and are designated 'N/A'
▲ Has been recorded from the farm on which the study site is situated / within 5km of the study site. Should suitable habitat be present, it is highly likely that this species occur on the study site.

GALAGO
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Mammal
Habitat Assessment

of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

May 2012

Report author: I.L. Rautenbach Pr.Sci.Nat., Ph.D, T.H.E.D.

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DECLARATION OF INDEPENDENCE:

I, Ignatius Lourens Rautenbach (421201 5012 08 8) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to the Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2006
- My intellectual property in this report will only be transferred to the client (the party/ company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognise that written consent of the client will be required for release of any part of this report to third parties.

I.L. Rautenbach

1. INTRODUCTION

Galago Environmental CC. was appointed to undertake a mammal habitat survey for the Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR, along three alternative routes and if possible, suggest which route will cause least ecological damage.

This report focuses on the reigning status of threatened and sensitive mammals likely to occur on the proposed development site. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the development that is suggested. The secondary objective of the investigation was to gauge which mammals might still reside on the site and compile a complete list of mammal diversity of the study area.

This assignment is in accordance with the 2010 EIA Regulations (No. R. 543-546, Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the mammal habitat components and current general conservation status along the three routes;
- Comments on ecological sensitive areas;
- Comments on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of mammals which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the mammals of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

Presently the three alternative routes traverse disturbed natural grassland although it is known that some adjoining properties are earmarked for urban development in the near future.
The routes fall in the Carleton Dolomite Grassland & Rand Highveld Grassland vegetation units as defined by Mucina and Rutherford (2006). During the site visit the veld conditions appeared healthy, but an unqualified measure of ecological damage has been caused by regular fires, casual damage and land abuse. However, the dense and high stand of grass provides ample refuge and nourishment for small mammals. The topography of the terrain is typical undulating grassy plains typical of the Highveld grassland biome. For most of the routes the substrate consists of reddish soil imbedded with gravel and at places even rocks. There are no natural or manmade structures suitable to meet the demanding daytime roosting requirements for cave-dwelling bats.

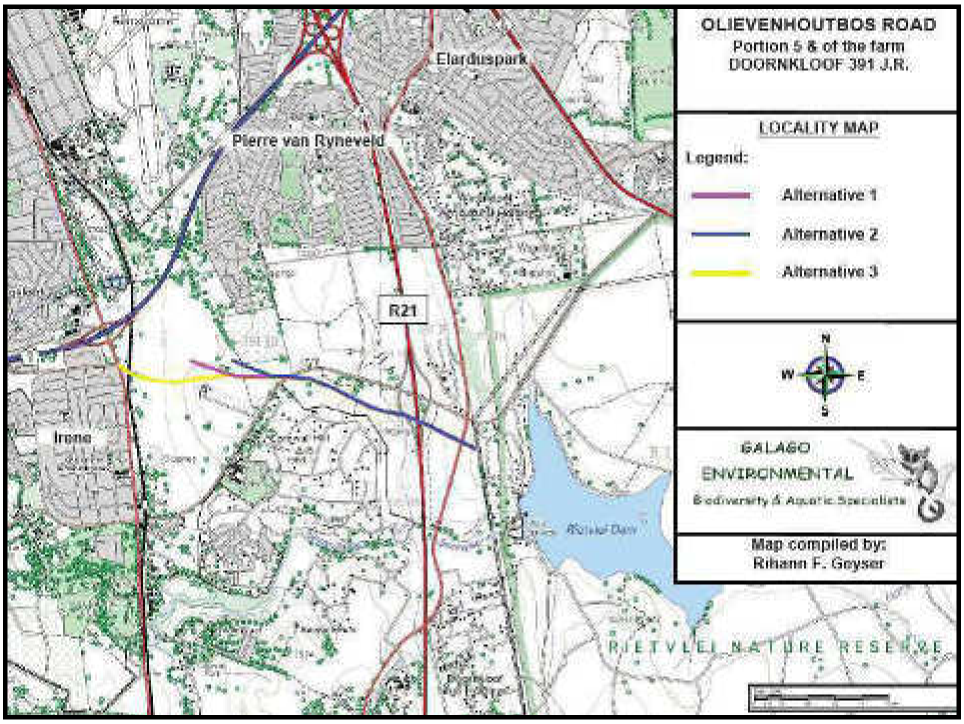

Figure 1: Locality map of the study area

4. METHODS

A six hour site visit was conducted on 5 April 2012. During this visit the observed and derived presence of mammals associated with the recognized habitat types of the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals, coupled to the qualitative and quantitative nature of recognized habitats.

The 500 meters of adjoining properties was scanned for important fauna habitats.

5.1 Field Surveys

During the site visit mammals were identified by visual sightings through random transect walks. No trapping or mist netting was conducted, as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites.

Three criteria were used to gauge the probability of occurrence of mammals on the study site. These include known distribution range, habitat preference and the qualitative and quantitative presence of suitable habitat.

5.2 Desktop Surveys

As the majority of mammals are secretive, nocturnal, hibernators and/or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season. During the field work phase of the project, this derived list of occurrences is audited.

The probability of occurrences of **mammal** species was based on their respective geographical distributional ranges and the suitability of on-site habitat. In other words, *high* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorised as *medium* normally do not occur at high population numbers, but cannot be deemed as rare. A *low* probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorised as *low* are generally deemed rare.

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5.3 Specific Requirements

During the visit the site was surveyed and assessed for the potential occurrence of Red Data and/or wetland-associated species such as:
Juliana's golden mole (*Neamblosomus juliana*), Highveld golden mole (*Amblysomus septentrionalis*), Rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Angoni vlei rat (*Otomys angoniensis*), Vlei rat (*Otomys irroratus*), White-tailed rat (*Mystromys albicaudatus*), a nember of shrews such as the Forest shrew (*Myosorex varius*), Southern African hedgehog *(Atelerix frontalis), a number of bats such as the* Short-eared trident bat (*Cloeotis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc.

5. RESULTS

Acocks (1988), Mucina and Rutherford (2006), Low & Rebelo (1996), Knobel and Bredenkamp (2006), SANBI & DEAT (2009) discuss the peculiar natural plant associations of the study area in broad terms. It should be noted that botanical geographers have made immense strides in defining plant associations (particularly assemblages denoted as veld types), whereas this cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant associations. Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006) as well Knobel and Bredenkamp (2006). Hence, although the former's work has been superseded by the work of the latter two, the definitions of biomes are similar and both remain valid for mammals and are therefore recognized as a reasonable determinant of mammal distribution.

The local occurrences of mammals are, on the other hand, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. Sight records and information from residents or knowledgeable locals audit such deductions.

Mammal Habitat Assessment
Terrestrial habitat dominates along the combined and individual alternative routes. Generally the basal cover existed of mature stands of indigenous grass, which judged by detritus on the ground are regularly subjected to winter fires. During the end of summer the grass cover provide ample cover and nourishment to small mammals.

Within the 500 meters extended study area of Alternative 3 is a solitary wooded koppie. Considering the isolated nature of this habitat type only very robust rupiculous species can be expected such as the Namaqua rock rat and rock elephant shrew. No Red Data species can be expected such as the rock dormouse.

There are no significant wetlands and/or permanent streams. Exotic trees predominate, whereas indigenous trees are solitary and geographically too isolated to allow for the occurrence of arboreal mammals.

There are no bat caves requiring special consideration.

Presently connectivity is good, but the general area will in the foreseeable future be subjected to fragmentation caused by more roads and urban development, which will curb connectivity.

Figure 2: Photo of where the route originates on the M57 near the Rietvlei Nature Reserve turnoff.
Note the mature stand of tall grass, exotic trees and in the distance the suburban character of the area.

Figure 3: The combined routes in an undeveloped area west of the R21 and south of Nellmapius road.

Note the suburb towards the south, the wattle trees and rubble in the foreground. The blacktop road is now in disuse.

Figure 4: The point north-west of Nellmapius Road where the three alternative routes split.

Each of the routes is planned to link with another road under construction and to link with Alexander Road in Irene.

Figure 5: The point where Alternative route 2 will meet the road under construction.

Figure 6: The point where Alternative 1 will meet the road under construction.

Figure 7: The solitary koppie close to Alternative 3.

Figure 8: Where Alternative 3 will join the road under construction and cross the railway line in the foreground and link with the double lane Alexander Road visible in the distance.

Expected and Observed Mammal Species Richness

All large mammals have more than a century ago been exterminated to make way for farming activities. More recently increased urbanization and human population densities with concomitant land-use practices (leisure, traditional hunting, etc.) have also extirpated medium-sized mammals (viz. black-backed jackal, aardvark, duiker, steenbok).

Of mammals extant thus close to Pretoria, all those narrowly reliant on arboreal and wetland habitats have been omitted from the list of potential occurrences (Table 1). However, the S.A. galago is included as this arboreal species has extended its natural range by utilizing the artificial forests created in the gardens of Gauteng.

It should be noted that potential occurrences is interpreted as to be possible over a period of time as result of expansion and contractions of population densities and ranges in response to environmental fluctuating conditions and which stimulate migration.

Only 18 mammals are recorded as potential occupants along the various routes and within the 500 meters extended study area which include the rupiculous habitat of the koppie near Alternative 3 (Table 1, Figure 7). All these are robust generalists with the ability to capitalize on disturbed environments. Many of these species are often found in suburban gardens and in fact may even invade residences to become a problem.

All feral mammal species expected to occur on the study site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these species normally associate with human settlements.

The small carnivores and the scrub hare listed are reticent in character and often persist on small holdings in the peri-urban zone. The bats listed are common and widespread in town and extended their natural ranges by capitalization on the various daytime roosting sites offered by manmade structures such as roofs. The listed rodents are equally common and inclined to persist in gardens and disturbed environments. The lesser red musk shrew may not be regarded as to be particularly common, but is nevertheless often found in rural settings.

Low mammal diversity is due to the presence of predominantly a terrestrial habitat restricting mammal diversity to those adapted to that habitat type, limited site size and adjoining areas, a suboptimal quality of conservation and fragmentation of the area.

Threatened and Red Listed Mammal Species

The listed shrew is not necessarily endangered. Although the lesser red musk shrew commonly occur in gardens it has not been adequately studied to provide quantitative field data to accurately assign a conservation ranking, and are thus as a precaution considered as 'Data Deficient'. Shrews operate at the apex of the food pyramid, which means that their population numbers are significantly lower than that of their prey species or of similar-sized herbivores/gramnivores. Because of their diet they are furthermore not readily trapped with conventional bait or traps, which may mean that their numbers are under-estimated compared to the use of the drift-fence technique of capturing.

Hedgehogs ('Near Threatened') are capable to withstand natural predation with their passive defence mechanisms. They became endangered directly as result of predation by humans and their pets; considering the semi-urban nature of the natural areas of the routes, its continued presence is possible.

Both the above mentioned species are widespread and capable to persist given healthy ecosystems.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

Table 1: The mammals which were observed or deduced to occupy the site
(Systematics and taxonomy as proposed by Bronner et.al [2003] and Skinner and Chimimba [2005])

	SCIENTIFIC NAME	ENGLISH NAME
?	*Elephantulus myurus*	Eastern rock elephant shrew
√	*Lepus saxatilis*	Scrub hare
*	*Cryptomys hottentotus*	African mole rat
√	*Rhabdomys pumilio*	Four-striped grass mouse
*	*Mus minutoides*	Pygmy mouse
√	*Mastomys natalensis*	Natal multimammate mouse
√	*Mastomys coucha*	Southern multimammate mouse
*	*Aethomys namaquensis*	Namaqua rock mouse
?	*Galago moholi*	South African galago
DD*	*Crocidura hirta*	Lesser red musk shrew
NT*	*Atelerix frontalis*	Southern African hedgehog
√	*Neoromicia capensis*	Cape serotine bat
√	*Scotophilus dinganii*	African yellow house bat
√	*Scotophilus viridis*	Greenish yellow house bat
*	*Genetta genetta*	Small-spotted genet
*	*Genetta tigrina*	SA large-spotted genet
√	*Cynictis penicillata*	Yellow mongoose
√	*Galerella sanguinea*	Slender mongoose

√ Definitely present or have a *high* probability to occur;
***** *Medium* probability to occur based on ecological and distributional parameters;
? *Low* probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 2: Mammal species positively confirmed from the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Lepus saxatilis	Scrub hare	Faecal pellets	Disturbed grassland

Scrub hares are exceptionally common, widespread, and with its reticent and nocturnal lifestyle capable of persisting in disturbed environments near human settlements.

6. FINDINGS AND POTENTIAL IMPLICATIONS

The alternative routes will not affect any significant mammal habitats warranting special consideration, or ecologically sensitive areas. Its value as an environmental conservation locality is virtually non existent. The road along the suggested route, together with other roads under construction and suburbs under consideration will further partition the area into smaller and ecologically less viable units.

Even during historical times the three alternative routes together with their adjacent 500 meters extended study areas were depauperate of mammals, considering the absence of arboreal, rupiculous and wetland habitats providing 'lebensraum' for discerning species. With the advent of civilization and escalating land-use practices not conducive to nature conservation, natural biota declined dramatically and is continuing to do so.

Considering the high level of ongoing biologically destructive land-use practices, the proposed development will be part of a larger development process and on its own will not result in a loss of ecological sensitive and important habitat units, ecosystem function (e.g. reduction in water quality, soil pollution), further loss of mammal habitat, nor of loss/displacement of threatened or protected species. Presently connectivity is rated as high but a new road will hamper connectivity. Over time other related developments not covered by this report will further impede connectivity.

It is recommended that Alternative 2 is selected since it is shorter (and thus more cost-effective), and since it will not affect the isolated koppie.

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN INFORMATION

The Galago Environmental team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on a site visit. In instances where doubt exists, a species is assumed to be a possible occupant; -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

8. RECOMMENDED MITIGATION MEASURES

- Should hedgehogs be encountered during the construction phase, these should be relocated to natural grassland areas in the vicinity.
- The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.

No other mitigation measures are deemed necessary other than those normal taken with road construction. There are no ecologically sensitive areas or threatened habitats along the recommended route. The conservation status of the two Red Data species is dubious and here considered as not credible. These species are widespread and the methodology used to ascertain their quantitative status is inappropriate for insectivores (trapping versus drift-fence assessment).

9. CONCLUSIONS

Although the study area is not sensitive in terms of mammals, the Alternative 2 route is recommended since is shorter and thus more cost-efficient, and it is furthest from the solitary koppie (which although not deemed sensitive has aesthetic value).

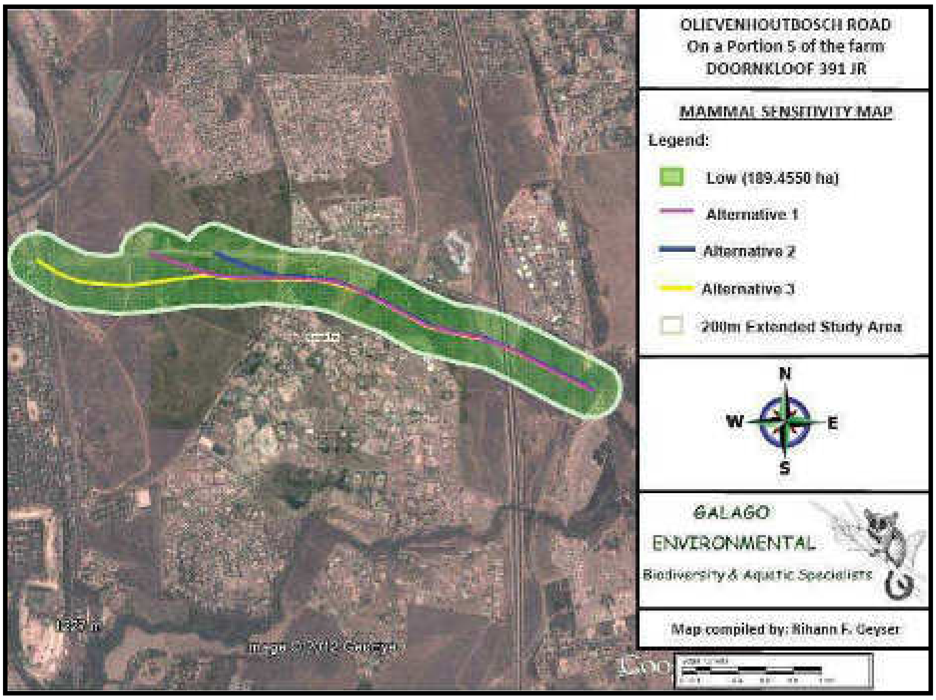

Figure 9: Mammal sensitivity map

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Avifaunal Habitat Assessment

of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

May 2012

Report author: Mr. R.F. Geyser
Report verified/reviewed by: Dr. A.C. Kemp (Ph.D., Pr.Sci. Nat. (Zoology & Ecology))

VERIFICATION STATEMENT
Mr R. Geyser is not registered as a Professional Natural Scientist with the S.A. Council for Natural Scientific Professions. This communication serves to verify that the bird report compiled by Mr R.F. Geyser has been prepared under my supervision, and I have verified the contents thereof.

Declaration of Independence: I, Alan Charles Kemp (4405075033081), declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- neither have nor will have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client, and the competent authority, any material information that has or may have the potential to influence decisions by the competent authority as required in terms of the Environmental Impact Assessment Regulations 2006

Dr. A.C. Kemp

DECLARATION OF INDEPENDENCE:

I, Rihann F. Geyser (690304 5248 084), declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- act as an independent specialist consultant in the field of zoology
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Rihann F. Geyser

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1. INTRODUCTION

Galago Environmental CC. was appointed to undertake an avifaunal habitat survey for the Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR (hereafter referred to as the study route), which is scheduled for the construction of a road. This is in accordance with the 2010 EIA Regulations (No. R. 543-546, Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The primary objective was to determine the presence of Red Data avifaunal species and to identify suitable habitat for these species. Direct observations and published data apart, qualitative and quantitative habitat assessments were used to derive the presence / absence of Red Data avifaunal species. A list of avifaunal species likely to be affected by the new development is compiled.

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the avifaunal habitat components, and current general conservation status of the property;
- To comment on ecologically sensitive areas;
- To comment on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of avifauna that occur or that are likely to occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the avifauna of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

3.1 Locality

The proposed road and alternative routes, ±4 km in length, is situated within the 2528CC and 2528CD quarter degree grid cell (q.d.g.c.) and 2550_2810 and 2550_2815 pentads respectively (SABAP2 protocol) and runs from the Goede Hoop Road (M57) just west of Rietvlei Nature Reserve (east end) to the Alexandra/Main Road (M18) intersection north of Irene (west end) within the Gauteng Province. The site is situated at an altitude of about 1 500 metres above sea level (m.a.s.l.).

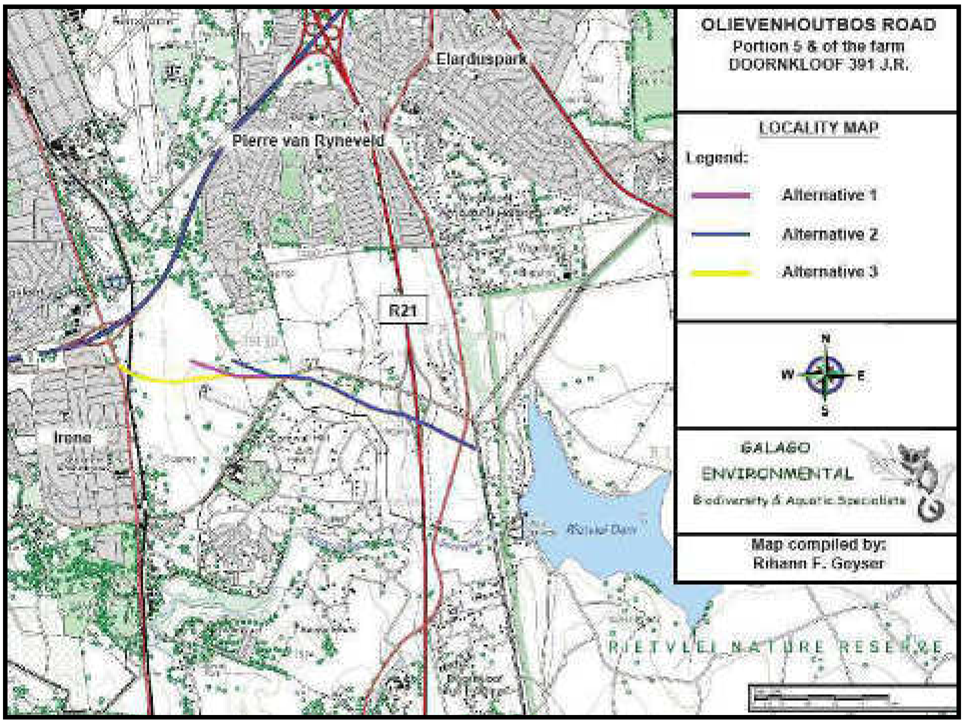

Figure 1: Locality map of the study area

3.2 Land Use

The largest portion of the study site consists of open grassland that has largely been disturbed by past and present human related activities and is not used for a specific purpose. This area used to consist of pristine grassland but has been degrade in a period of time. Human presence on site is high as a result of squatters that find temporally housing with the vegetation on the study site. Wetland habitat is limited to a small drainage line (see avifaunal habitat assessment, open grassland hereunder).

3.3 Biophysical Information

3.3.1 Vegetation type and landscape

The largest portion of the study site is situated within the Dry Highveld Grassland Bioregion of the Grassland Biome and more specifically within the Carletonville Dolomite Grassland vegetation type according to Mucina and Rutherford (2006).

The landscape is highly variable with extensive sloping plains and rocky ridges that are elevated slightly above the undulating surrounding plains. The plants within this vegetation type are species-rich, wiry, sour grassland with small shrubs growing on the rocky ridges and outcrops that occur in isolated areas within this vegetation type. Dominant grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. Another typical feature of this vegetation type is the high diversity of herbs, many of which belong to the Asteraceae, that grow between the grasses on the open plans. The open plains and rocky outcrops and ridges carry small pockets of sparse woodlands with *Protea caffra* and *P. welwitschii, Acacia caffra* and *Celtis Africana* trees, and with shrubs such as the genus *Rhus* that grow between these trees.

3.3.2 *Climate*

Summer-rainfall ranging between 570 mm to 730 mm per annum with warm summers and very cold winter temperatures.

3.3.3 *Geology*

3.3.4 *Conservation status of habitat*

This vegetation type is considered as endangered with a target of 24% and poorly conserved (1%). Small conservation areas can be found within this vegetation type such as Rietvlei Nature Reserve, Bronkhorstspruit NR, Boskop Dam NR and some small conservation areas such as Doornkop, Ezemvelo and Renosterpoort. Almost half of this vegetation type has been transformed mostly by agricultural croplands, plantations such as wattle, urbanisation and dam-building.

4. METHODS

An eight hour site visit was conducted on 5 April 2012 to record the presence of bird species associated with the habitat systems on the study site and to identify possible sensitive areas. During this visit the observed and derived presence of avifaunal species associated with the recognized habitat types of the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African avifauna, coupled to the qualitative and quantitative nature of recognized habitats.

4.1 Field Surveys

Birds were identified visually, using 10X42 Bushnell Legend binoculars and a 20X-60X Pentax spotting scope, and by call, and where necessary were verified from Sasol Birds of Southern Africa (Sinclair *et al.*, 2011) and Southern African Bird Sounds (Gibbon, 1991).

The 500 m of adjoining properties was scanned for important avifaunal species and habitats.

During the site visit, birds were identified by visual sightings or aural records along random transect walks. No trapping or mist netting was conducted, since the terms of reference did not require such intensive work. In addition, birds were also identified by means of feathers, nests, signs, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

4.2 Desktop Surveys

The presence of suitable habitats was used to deduce the likelihood of presence or absence of avifaunal species, based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The likely occurrence of key avifaunal species was verified according to distribution records obtained during the Southern African Bird Atlas Project 1 (SABAP1) period from 1981 to 1993 (Harrison *et al.* 1997). Earlier records of only Red Data avifaunal species were obtained from the period between 1974 and 1987 according to Tarboton *et al.* (1987). The most recent avifaunal distribution data were obtained from the current SABAP2 project which commenced on 1 July 2007.

The occurrence and historic distribution of likely avifaunal species, especially all Red Data avifaunal species recorded for the q.d.g.c. 2528CC and 2528CD q.d.g.c., were verified from SABAP1 (southern Africa Bird Atlas Project 1) data (Harrison *et al.* 1997), Tarboton *et al.* (1987) and the current SABAP2 project (SABAP2 data for the 2528CC and 2528CD q.d.g.c and for the 2550_2810 and 2550_2815 pentads). The reporting rate for each avifaunal species likely to occur on the study site, based on Harrison *et al.* (1997), was scored between 0 – 100% and was calculated as follows: Total number of cards on which a species was reported during the Southern African Bird Atlas SABAP1 and, Red Data species only, the current SABAP2 project period X 100 ÷ total number of cards for the particular q.d.g.c. (Harrison *et al.*, 1997) and pentad(s) (SABAP2). It is important to note that a q.d.g.c. (SABAP1 Protocol) covers a large area: for example, q.d.g.c. 2528CD covers an area of ±27 X 25 km (±693 km²) (15 minutes of latitude by 15 minutes of longitude, 15' x 15') and a pentad (SABAP2 Protocol) and area of ±8 X 7.6 km (5 minutes of latitude by 5 minutes of longitude, 5' x 5') and it is possible that suitable habitat will exist for a certain Red Data avifaunal species within this wider area surrounding the study site. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the q.d.g.c or pentad. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD, both of which are in the same q.d.g.c. Red Data bird species were selected and categorised according to Barnes (2000).

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An avifaunal diversity index, that gives an indication of which habitat system on the study site will hold the richest avifaunal species diversity, was calculated as the sum of the probability of occurrence of bird species within a specific habitat system on site. For each species and habitat, the probability of occurrence was ranked as: 5 = present on site, 4 = not observed on site but has a high probability of occurring there, 3 = medium probability, 2 = low probability, 1 = very low probability and 0 = not likely to occur.

4.3 Specific Requirements

During the site visit, the study site was surveyed visually and its habitats assessed for the potential occurrence of priority Red Data avifauna, according to GDACE's requirement for Biodiversity Assessments, Version 2 (2009), as well as for any other Red Data bird species: The priority Red Data bird species for Gauteng are (in Roberts VII order and nomenclature, Hockey *et al.* 2005):

- Half-collared Kingfisher (*Alcedo semitorquata*)
- African Grass-Owl (*Tyto capensis*)
- White-bellied Korhaan (*Eupodotis senegalensis*)
- Blue Crane (*Anthropoides paradiseus*)
- African Finfoot (*Podica senegalensis*)
- Cape Vulture (*Gyps coprotheres*)
- African Marsh-Harrier (*Circus ranivorus*)
- Martial Eagle (*Polemaetus bellicosus*)
- Secretarybird (*Sagittarius serpentarius*)
- Lesser Kestrel (*Falco naumanni*)
- Greater Flamingo (*Phoenicopterus ruber*)
- Lesser Flamingo (*Phoenicopterus minor*)
- White-backed Night-Heron (*Gorsachius leuconotus*)
- Black Stork (*Ciconia nigra*)

No particular reference was made for the occurrence any Red Data avifaunal species on or surrounding the study site.

5. RESULTS

Avifaunal Habitat Assessment:

Two major avifaunal habitat systems were identified on the study site which is small remainders of natural woodland, with garden habitat that surrounds the buildings on the study site. In general the entire habitat has been disturbed by past and present human activities and the study site is entirely surrounded urbanisation. Avifaunal species that are likely to occur within the natural woodland are also expected to occur within the garden habitat and vice versa and thus the species diversity will not differ significantly from these two habitat systems. For the purposes of this report the two habitat systems are grouped together as mixed exotic (including alien vegetation) and indigenous vegetation. A short description of this habitat system is as follows (refer to figure 2):

Figure 2 illustrates the major habitat systems identified as likely to be used by bird species expected to occur on the study site.

A short description of each habitat type follows, ranked from most to least important (refer to Figure 2):

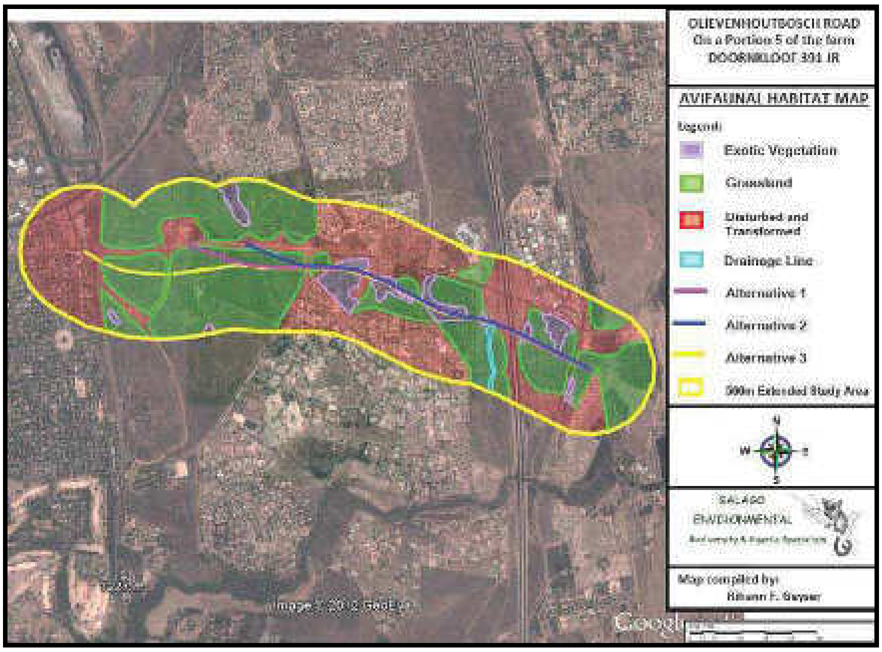

Figure 2: **Bird habitat systems identified from the study site.**

Open grassland:

The largest portion of the study site consists of a mixture of disturbed and undisturbed grassland with scattered trees and rocky outcrops (Figure 3) with hardy woody vegetation.

Figure 3: Open grassland with scattered trees and rocky outcrops

Open grassland is the most important habitat type for South Africa's threatened bird species in the region with a proportional importance of 27%. The highest diversity of threatened bird species occurs within this grassland habitat, many of which are under the highest categories of threat (Barnes 2000).

The presence and abundance of bird species in this habitat will vary from season to season - lush and green in summer after summer rains and dry, brown, frosted or burnt during winter. The habitat favours ground-living bird species, such as lapwings, francolins, pipits, longclaws, larks and chats. These birds hunt for insects and/or breed on the ground, in burrows in the ground, or between the grasses. Weavers and widowbirds make use of such habitat for feeding on ripe seeds during late summer and early winter when the grass is not burnt, and widowbirds and cisticolas will also breed in the tall grass during summer. Species such as weavers and bishops that breed in the wetland habitat during summer will also make use of the open grassland habitat for feeding during winter after the grasses have seeded. Aerial feeding birds such as martins, swifts and swallows will also hunt for insects over the grasslands.

This habitat system includes vegetation growing on the rocky outcrops that give the typical impression of rocky highveld grassland, and they also protect some low woody plants from fire. The habitat will favour birds associated with rocky habitats, such as chats, wheatears, rock-thrushes and cisticolas, which favour the rocky nature of the area for breeding and to perch on to hunt for insects and detect predators. The trees and shrubs growing between these rocks will also provide food in the form of seeds and fruits to various bird species, and shelter and nesting sites for many birds, especially passerines.

Sections of the proposed route have already been graded and the natural vegetation has already been destroyed by these activities (Figure 4). In addition another road in which the various alternatives run into has already been constructed but looks abandoned and left uncompleted (Figure 5). These are also areas that have been disturbed by an open quarry (Figure 6).

Figure 4: Road already graded east of Nellmapius Road

Figure 5: Road in construction

Figure 6: Quarry area

The drainage lines on the study site consist of Palustrine wetlands consisting of dry drainage lines with vegetation that does not differ significantly from the surrounding grassland. The avifaunal species diversity will not differ significantly from the surrounding grassland since there are no places where water can accumulate to form wetlands with standing water due the fast down flow of rain water during the rain season except for a small impoundment that was built within the drainage line that mainly remain dry and where aquatic vegetation are absent. For purposes of this report the drainage line habitat is grouped together with the grassland habitat system.

Exotic vegetation

Exotic alien tree species has taken over an area with open natural grassland vegetation. These alien tree species largely consists of *Eucalyptus* sp. trees (Figure 7) and exotic wattle tree species (Figure 8).

Figure 7: An area with alien *Eucalyptus* trees on the study route

Figure 8: An area with wattle trees on the study route

This exotic and alien vegetation usually does not offer a large variation in plant communities and these trees are mostly unpalatable in their live stage for insect and game species. As a result, few insect-eating bird species will occur within these plantations. A number of nectar feeding species, such as white-eyes and sunbirds, will feed on the nectar produced by the flowers of these trees, and some birds also make nests in these trees.

A few species of bird of prey, which require tall trees for nest building have adapted to these trees and have increased their ranges due to the presence of these trees. These include species such as Black and Ovambo Sparrowhawks.

No or little grass growth takes place on the ground where these trees grow and seed-eating bird species are few. The roots of these trees are known to extract large volumes of water daily and the surrounding ground is normally hard and dry.

The growth of exotic and alien *Acacia* sp. (wattle) on site varies from single standing trees to large clumps. In general, wattle trees create a sterile environment and are not utilised by many bird species. Some of the most common species have however adapted to wattle plantations, such as Cape White-eye, White-bellied Sunbird, Southern Boubou, Neddicky, Black-crowned Tchagra and Cape Robin. These birds either make use of the flowers for nectar-feeding or the trees for nest building or shelter.

Other habitat systems outside the boundaries of the study site but within the 500m extended study area are mainly disturbed by past and present human activities consists of the following:

Observed and Expected Species Richness
Of the 359 bird species recorded for the 2528CC q.d.g.c., 140 (39 %) are likely to occur on the study site and 48 (34.3 %) of these bird species were actually observed on site.

The avifaunal biodiversity index (ABI) indicates that the largest bird species diversity is likely to occur within the open grassland vegetation habitat system on and within 500m surrounding the study site, with a avifauna biodiversity index (ABI) of 465, followed by the exotic vegetation and (ABI 259).

The avifaunal species listed in Table 1 are in the species order according to *Roberts - Birds of Southern Africa* VIIth edition (Hockey *et al*, 2005). These comprise the 140 species actually observed on (**in bold**) or that are likely to occur within the specific habitat systems on and within 500m surrounding the study site. This does not include overflying birds or rare vagrants. The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas (Harrison *et al.* 1997) and is represented by colour codes as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium and Red = High. Our habitat preference scores for each species are shown under the recognised habitat types on site: **OG = Open Grassland** and **EX = Exotic Vegetation** with their possibility of occurrence in these specific habitats rated as 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = Very low and 0 = Not likely to occur.

Table 1: Bird species observed and that are likely to occur on the study site.

SCIENTIFIC NAMES	COMMON NAMES	Reporting rate (%)*		Habitat preference	
		2528CC	2528CD	OG	EX
Peliperdix coqui	Coqui Francolin	4	6	4	2
Pternistis swainsonii	**Swainson's Spurfowl**	21	19	5	2
Coturnix coturnix	Common Quail	1	<1	2	0
Numida meleagris	Helmeted Guineafowl	53	52	4	4
Indicator indicator	Greater Honeyguide	1	4	0	4
Indicator minor	Lesser Honeyguide	4	8	0	4
Prodotiscus regulus	Brown-backed Honeybird	1	1	3	2

SCIENTIFIC NAMES	COMMON NAMES	Reporting rate (%)*		Habitat preference	
		2528CC	2528CD	OG	EX
Jynx ruficollis	Red-throated Wryneck	**20**	**32**	4	4
Campethera abingoni	Golden-tailed Woodpecker	**11**	**9**	1	1
Dendropicos fuscescens	Cardinal Woodpecker	**9**	**18**	2	1
Tricholaema leucomelas	Acacia Pied Barbet	**5**	**20**	2	1
Lybius torquatus	Black-collared Barbet	**55**	**74**	2	2
Trachyphonus vaillantii	**Crested Barbet**	**79**	**91**	5	2
Tockus nasutus	African Grey Hornbill	**3**	**4**	3	2
Upupa africana	African Hoopoe	**76**	**80**	3	1
Phoeniculus purpureus	**Green Wood-Hoopoe**	**48**	**62**	2	3
Halcyon albiventris	Brown-hooded Kingfisher	**6**	**22**	3	3
Merops bullockoides	White-fronted Bee-eater	**4**	**12**	3	2
Merops apiaster	**European Bee-eater**	**12**	**18**	5	3
Colius striatus	**Speckled Mousebird**	**72**	**79**	5	2
Urocolius indicus	**Red-faced Mousebird**	**38**	**38**	5	3
Cuculus solitarius	Red-chested Cuckoo	**15**	**25**	3	4
Cuculus clamosus	Black Cuckoo	**3**	**9**	1	1
Chrysococcyx klaas	Klaas's Cuckoo	**1**	**6**	1	1
Chrysococcyx caprius	**Diderick Cuckoo**	**26**	**33**	5	3
Cypsiurus parvus	**African Palm-Swift**	**23**	**22**	5	2
Apus barbatus	African Black Swift	**1**	**3**	2	0
Apus affinis	**Little Swift**	**39**	**33**	5	0
Apus caffer	**White-rumped Swift**	**19**	**24**	5	0
Corythaixoides concolor	Grey Go-away-bird	**44**	**55**	4	2
Tyto alba	Barn Owl	**6**	**7**	4	4
Bubo africanus	Spotted Eagle-Owl	**4**	**12**	4	3
Caprimulgus rufigena	Rufous-cheeked Nightjar	**<1**	**<1**	2	0
Columba livia	Rock Dove	**27**	**31**	2	1
Columba guinea	Speckled Pigeon	**42**	**57**	3	1
Streptopelia senegalensis	**Laughing Dove**	**94**	**96**	4	4
Streptopelia capicola	**Cape Turtle-Dove**	**81**	**81**	4	4
Streptopelia semitorquata	**Red-eyed Dove**	**32**	**22**	4	4
Burhinus capensis	Spotted Thick-knee	**36**	**40**	4	3
Vanellus armatus	Blacksmith Lapwing	**39**	**39**	2	0
Vanellus senegallus	**African Wattled Lapwing**	**16**	**15**	5	0
Vanellus coronatus	**Crowned Lapwing**	**74**	**80**	5	2
Cursorius temminckii	Temminck's Courser	**<1**	**<1**	2	0
Elanus caeruleus	Black-shouldered Kite	**47**	**48**	4	3
Milvus migrans	Black Kite	**4**	**14**	2	1
Accipiter minullus	Little Sparrowhawk	**1**	**1**	1	4
Accipiter ovampensis	Ovambo Sparrowhawk	**2**	**2**	0	4
Accipiter melanoleucus	Black Sparrowhawk	**2**	**1**	0	2
Buteo vulpinus	Steppe Buzzard	**5**	**4**	2	3
Falco naumanni	Lesser Kestrel (**VU**)	**1**	**1**	1	0
Falco rupicoloides	Greater Kestrel	**5**	**3**	2	0
Falco amurensis	Amur Falcon	**1**	**1**	2	1
Ardea melanocephala	Black-headed Heron	**40**	**33**	4	0
Bubulcus ibis	Cattle Egret	**71**	**75**	4	2
Bostrychia hagedash	**Hadeda Ibis**	**86**	**91**	2	4

SCIENTIFIC NAMES	COMMON NAMES	Reporting rate (%)*		Habitat preference	
		2528CC	2528CD	OG	EX
Oriolus larvatus	Black-headed Oriole	**12**	**20**	4	3
Dicrurus adsimilis	Fork-tailed Drongo	**13**	**35**	2	3
Terpsiphone viridis	African Paradise-Flycatcher	**16**	**18**	2	1
Dryoscopus cubla	Black-backed Puffback	**14**	**18**	3	1
Tchagra senegalus	**Black-crowned Tchagra**	**3**	**25**	5	1
Laniarius ferrugineus	**Southern Boubou**	**28**	**36**	5	1
Laniarius atrococcineus	Crimson-breasted Shrike	**5**	**8**	2	2
Telophorus zeylonus	**Bokmakierie**	**64**	**68**	5	2
Batis molitor	Chinspot Batis	**3**	**23**	2	0
Corvus albus	**Pied Crow**	**64**	**56**	5	4
Lanius collurio	Red-backed Shrike	**1**	**2**	4	2
Lanius minor	Lesser Grey Shrike	**1**	**1**	3	1
Lanius collaris	**Common Fiscal**	**90**	**93**	5	4
Riparia paludicola	Brown-throated Martin	**3**	**7**	2	0
Riparia cincta	Banded Martin	**1**	**4**	3	0
Hirundo rustica	**Barn Swallow**	**28**	**23**	5	4
Hirundo albigularis	White-throated Swallow	**22**	**24**	4	1
Hirundo dimidiata	Pearl-breasted Swallow	**1**	**2**	2	1
Hirundo cucullata	**Greater Striped Swallow**	**34**	**41**	5	2
Hirundo abyssinica	Lesser Striped Swallow	**20**	**33**	4	2
Hirundo spilodera	South African Cliff-Swallow	**10**	**10**	3	0
Hirundo fuligula	Rock Martin	**18**	**13**	4	2
Delichon urbicum	Common House-Martin	**5**	**4**	3	2
Pycnonotus tricolor	**Dark-capped Bulbul**	**89**	**94**	5	4
Stenostira scita	Fairy Flycatcher	**2**	**5**	3	0
Sylvietta rufescens	Long-billed Crombec	**2**	**13**	2	0
Phylloscopus trochilus	Willow Warbler	**6**	**9**	4	4
Turdoides jardineii	Arrow-marked Babbler	**8**	**18**	2	1
Parisoma subcaeruleum	Chestnut-vented Tit-Babbler	**8**	**24**	1	0
Zosterops virens	**Cape White-eye**	**69**	**78**	5	4
Cisticola aberrans	Lazy Cisticola	**1**	**4**	3	0
Cisticola chiniana	Rattling Cisticola	**2**	**7**	3	0
Cisticola lais	**Wailing Cisticola**	**<1**	**2**	5	0
Cisticola tinniens	Levaillant's Cisticola	**10**	**12**	2	0
Cisticola fulvicapilla	Neddicky	**16**	**28**	4	4
Cisticola juncidis	**Zitting Cisticola**	**11**	**12**	5	0
Cisticola aridulus	Desert Cisticola	**3**	**4**	3	0
Cisticola textrix	Cloud Cisticola	**3**	**2**	3	0
Prinia subflava	**Tawny-flanked Prinia**	**22**	**32**	4	4
Prinia flavicans	**Black-chested Prinia**	**22**	**37**	5	3
Mirafra africana	**Rufous-naped Lark**	**21**	**16**	5	0
Chersomanes albofasciata	Spike-heeled Lark	**2**	**1**	3	0
Psophocichla litsitsirupa	Groundscraper Thrush	**2**	**8**	2	0
Turdus libonyanus	Kurrichane Thrush	**7**	**14**	2	3
Turdus smithi	Karoo Thrush	**76**	**84**	3	3
Sigelus silens	Fiscal Flycatcher	**39**	**46**	2	2
Muscicapa striata	**Spotted Flycatcher**	**2**	**7**	5	4
Cossypha caffra	**Cape Robin-Chat**	**66**	**78**	5	4

SCIENTIFIC NAMES	COMMON NAMES	Reporting rate (%)*		Habitat preference	
		2528CC	2528CD	OG	EX
Saxicola torquatus	African Stonechat	**15**	**20**	4	0
Oenanthe monticola	Mountain Wheatear	**7**	**24**	3	0
Oenanthe pileata	Capped Wheatear	**3**	**1**	2	0
Cercomela familiaris	Familiar Chat	**2**	**5**	3	1
Onychognathus morio	Red-winged Starling	**23**	**10**	2	1
Lamprotornis nitens	**Cape Glossy Starling**	**46**	**33**	5	4
Spreo bicolor	Pied Starling	**9**	**8**	3	1
Creatophora cinerea	Wattled Starling	**1**	**<1**	2	1
Acridotheres tristis	**Common Myna (INT)**	**46**	**7**	5	5
Chalcomitra amethystina	**Amethyst Sunbird**	**32**	**51**	5	5
Cinnyris talatala	White-bellied Sunbird	**37**	**59**	4	3
Ploceus capensis	Cape Weaver	**22**	**33**	3	1
Ploceus velatus	**Southern Masked-Weaver**	**73**	**84**	5	4
Quelea quelea	Red-billed Quelea	**5**	**4**	3	3
Euplectes afer	Yellow-crowned Bishop	**5**	**3**	3	0
Euplectes orix	**Southern Red Bishop**	**38**	**44**	5	3
Euplectes albonotatus	**White-winged Widowbird**	**10**	**27**	4	2
Euplectes ardens	**Red-collared Widowbird**	**9**	**28**	4	0
Euplectes progne	**Long-tailed Widowbird**	**25**	**18**	5	0
Sporaeginthus subflavus	**Orange-breasted Waxbill**	**4**	**7**	5	0
Ortygospiza atricollis	**African Quailfinch**	**1**	**4**	5	0
Amadina erythrocephala	Red-headed Finch	**3**	**1**	4	2
Estrilda astrild	Common Waxbill	**10**	**20**	4	2
Uraeginthus angolensis	Blue Waxbill	**3**	**4**	2	1
Lagonosticta rhodopareia	**Jameson's Firefinch**	**3**	**3**	2	5
Spermestes cucullatus	Bronze Mannikin	**9**	**30**	4	3
Vidua macroura	**Pin-tailed Whydah**	**18**	**24**	4	3
Passer melanurus	Cape Sparrow	**91**	**93**	4	4
Passer diffusus	**Southern Grey-headed Sparrow**	**24**	**28**	4	5
Motacilla capensis	Cape Wagtail	**70**	**70**	3	0
Macronyx capensis	Cape Longclaw	**19**	**20**	4	0
Anthus cinnamomeus	African Pipit	**14**	**8**	4	0
Crithagra mozambicus	Yellow-fronted Canary	**7**	**15**	2	1
Crithagra atrogularis	**Black-throated Canary**	**28**	**30**	5	4
Crithagra gularis	**Streaky-headed Seedeater**	**13**	**23**	5	4
Emberiza tahapisi	Cinnamon-breasted Bunting	**3**	**7**	3	1
	Avifaunal diversity index:			465	259

*The reporting rate is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell. **INT** = Introduced or alien birds species to Southern Africa.

Red Data Species Categories for the birds (Barnes, 2000)
RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened.

The biodiversity index gives an indication of which habitat will hold the richest bird diversity on site. The colour codes for each species are represented as follows: The colour codes for each species are represented as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium and Red = High. The likelihood of occurrence of each species in the specific habitat systems on the study site are as follow: 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = very low, and 0 = Not likely to occur.

Threatened and Red Listed Bird Species

The following Red Data avifaunal species were recorded for the 2528CC and 2528CD q.d.g.c during SABAP1 (Harrison *et al.* 1997) and prior to the SABAP1 project (Tarboton *et al.* 1987) (Table 2).

Table 2: Red Data bird species recorded for the 2528CC & 2528CD q.d.g.c. with SABAP1 data

SCIENTIFIC NAME	ENGLISH NAME	REPORTING RATE (%)* 2528CC Centurion	REPORTING RATE (%)* 2528CD Rietvlei
Nettapus auritus	African Pygmy-Goose (**NT**)	**(T)**	
Alcedo semitorquata	Half-collared Kingfisher (**NT**)	**1(T)**	**<1(T)**
Tyto capensis	African Grass-Owl (**VU**)	**2(Tb)**	**1(Tb)**
Neotis denhami	Denham's Bustard (**VU**)	**(T)**	**(T)**
Eupodotis caerulescens	Blue Korhaan (**NT**)	**(Tb)**	**<1(T)**
Eupodotis senegalensis	White-bellied Korhaan (**VU**)	**<1(T)**	**<1(T)**
Anthropoides paradiseus	Blue Crane (**VU**)	**3(Tb)**	**3(Tb)**
Podica senegalensis	African Finfoot (**VU**)	**<1(T)**	**(T)**
Crex crex	Corn Crake (**VU**)	**(T)**	**<1**
Rostratula benghalensis	Greater Painted-snipe (**NT**)	**(T)**	**<1**
Glareola nordmanni	Black-winged Pratincole (**NT**)	**(T)**	**<1(T)**
Sterna caspia	Caspian Tern (**NT**)		**<1**
Gyps coprotheres	Cape Vulture (**VU**)	**<1(T)**	**(T)**
Aegypius tracheliotus	Lappet-faced Vulture (**VU**)	**(T)**	**(T)**
Terathopius ecaudatus	Bateleur (**VU**)		**(T)**
Circus ranivorus	African Marsh-Harrier (**VU**)	**<1(Tb)**	**(T)**
Aquila rapax	Tawny Eagle (**VU**)		**<1**
Aquila ayresii	Ayres's Hawk-Eagle (**NT**)	**<1(T)**	**<1**
Polemaetus bellicosus	Martial Eagle (**VU**)	**<1(T)**	**(Tb)**
Sagittarius serpentarius	Secretarybird (**NT**)	**(Tb)**	**2(T)**
Falco naumanni	Lesser Kestrel (**VU**)	**1(T)**	**1(T)**
Falco biarmicus	Lanner Falcon (**NT**)	**1(Tb)**	**1(Tb)**
Falco peregrinus	Peregrine Falcon (**NT**)		**<1**
Phoenicopterus ruber	Greater Flamingo (**NT**)		**<1(T)**
Mycteria ibis	Yellow-billed Stork (**NT**)	**<1(T)**	**(T)**
Ciconia nigra	Black Stork (**NT**)	**<1(T)**	**<1**
Mirafra cheniana	Melodious Lark (**NT**)	**<1(T)**	**(Tb)**
	SABAP1 Very Low :	**12**	**15**
	SABAP1 Low :	**2**	**2**
	SABAP1 Medium :	**0**	**0**
	SABAP1 High :	**0**	**0**
	SABAP1 TOTAL :	**14**	**17**
	Tarboton *et al* (1987) :	**20**	**14**
	Tarboton *et al* (1987) breeding:	**6**	**5**
	TOTAL :	**26**	**19**

*The reporting rate is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell. T = Bird species recorded as present (light blue) and Tb = bird species recording as breeding (dark blue) for the q.d.g.c. according to Tarboton (1987). Bird species with both reporting rates and T or Tb were recorded for the q.d.g.c. according to both Harrison *et al.* (1997) and Tarboton *et al.* (1987). The colour codes for each species are represented as follows: yellow = very low, light orange = low, dark orange = medium and red = high with reference to the specific habitat systems found on site.

Red Data Species Categories for the birds (Barnes, 2000)
RE = Regionally extinct, **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened.

The following avifaunal species were recorded for 2528CC and 2528CD q.d.g.c. and for the 2550_2810 and 2550_2815 pentad respectively according to the current SABAP2 project.

Table 3: Red Data bird species recorded for the 2528CC & 2528CD q.d.g.c. with SABAP2 data

SCIENTIFIC NAMES	ENGLISH NAMES	2528CC		2528CD	
		SABAP2	Pentad	SABAP2	Pentad
Nettapus auritus	African Pygmy-Goose (**NT**)	0	0	0	0
Alcedo semitorquata	Half-collared Kingfisher (**NT**)	**1.7**	**0.4**	**1.1**	**0.3**
Tyto capensis	African Grass-Owl (**VU**)	**0.3**	**0.4**	**0.8**	**0.9**
Neotis denhami	Denham's Bustard (**VU**)	0	0	0	0
Eupodotis caerulescens	Blue Korhaan (**NT**)	0	0	0	0
Eupodotis senegalensis	White-bellied Korhaan (**VU**)	0	0	**0.8**	**2.0**
Anthropoides paradiseus	Blue Crane (**VU**)	0	0	**Inst**	**0**
Podica senegalensis	African Finfoot (**VU**)	**0.1**	0	0	0
Crex crex	Corn Crake (**VU**)	0	0	0	0
Rostratula benghalensis	Greater Painted-snipe (**NT**)	0	0	0	**0.9**
Glareola nordmanni	Black-winged Pratincole (**NT**)	0	0	0	0
Gyps coprotheres	Cape Vulture (**VU**)	0	0	0	0
Aegypius tracheliotus	Lappet-faced Vulture (**VU**)	0	0	0	0
Circus ranivorus	African Marsh-Harrier (**VU**)	0	0	**0.2**	**0.3**
Circus macrourus	Pallid Harrier (**NT**)	0	0	0	0
Aquila ayresii	Ayres's Hawk-Eagle (**NT**)	0	0	**0.1**	0
Polemaetus bellicosus	Martial Eagle (**VU**)	0	0	0	0
Sagittarius serpentarius	Secretarybird (**NT**)	**0.1**	0	**3.5**	**8.6**
Falco naumanni	Lesser Kestrel (**VU**)	**0.3**	0	**0.6**	**0.9**
Falco biarmicus	Lanner Falcon (**NT**)	**0.9**	**0.4**	**1.9**	**4.0**
Falco peregrinus	Perigrine Falcon (**NT**)	**0.3**	**0.4**	**0.6**	**1.1**
Phoenicopterus ruber	Greater Flamingo (**NT**)	0	0	**0.7**	**0.3**
Mycteria ibis	Yellow-billed Stork (**NT**)	0	**0.4**	**0.1**	**0.3**
Ciconia nigra	Black Stork (**NT**)	0	0	0	0
Mirafra cheniana	Melodious Lark (**NT**)	**4.5**	**0.8**	**1.1**	**1.4**
	TOTAL:	**8**	**6**	**13**	**12**

A total of 27 Red Data bird species have been recorded within the 2528CC & 2528CD q.d.g.c. (Table 2) according to Harrison *et al.* (1997) and Tarboton *et al.* (1987). Four of these species appear to have disappeared from the area or were not subsequently recorded for this quarter degree grid cell during the time of the southern African Bird Atlas project (SABAP1). It is unlikely that they will ever recur in this region again except maybe on rare occasions or in protected areas. None of the species that have subsequently disappeared from the region used to breed within the said q.d.g.c. (Tarboton, 1987). None of the species have a high or medium reporting rate and all indicate a low (3 species) to very low (21 species) reporting rate. The 2528CC q.d.g.c. indicates a drastic decline in the number of Red Data bird species (12) from 26 species to 14 species. This is probably as a result of the high level of development that has taken place and the lack of conservation areas within the 2528CC q.d.g.c. The 2528CD q.d.g.c. on the other hand indicates a decline of only 2 species. The low drop in Red Data bird species could be due to a large conservation area, the Rietvlei Nature Reserve, to the east of the study site where suitable habitat can be found for most of the Red Data bird species mentioned above.

According to the latest SABAP2 data, eight of the twenty-six Red Data avifaunal species were recorded for the entire 2528CC q.d.g.c. but only six were recorded for the 2550_2810 pentad and thirteen of the nineteen Red Data avifaunal species were recorded for the entire 2528CD q.d.g.c. and 12 were recorded for the 2550_2815 pentad. These records for the 2528CD q.d.g.c. are all mainly from the Rietvlei Nature Reserve east of the study site.

Summary of the Red Data bird species

Table 3 provides a list of the Red Data bird species recorded for the 2528CC and 2528CD q.d.g.c. according to Harrison *et al.* (1997) and an indication of their likelihood of occurrence on the study site based on habitat and food availability.

Table 4: Red Data bird species assessment for the 2528CC and 2528CD q.d.g.c.

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
*Alcedo semitorquata** (Half-collared Kingfisher) (**NT**)	None on site: Requires fast-flowing streams, rivers and estuaries, usually with dense marginal vegetation (Maclean, 1993), especially perennial streams and smaller rivers with overhanging riparian vegetation on their banks. Nests in sand/earth banks (Tarboton *et al.* 1987) and requires riverbanks in which to excavate nest tunnels (Harrison *et al.* 1997a). Most typically occurs along fast-flowing streams with clear water and well-wooded riparian growth, often near rapids. It most frequently favours broken escarpment terrain and requires at least 1 km up and down stream of undisturbed river and riparian vegetation while breeding. It occurs from sea-level to 2000 m.a.s.l. in southern Africa. Usually perches low down on the banks of rivers and streams, often on exposed roots, as well as exposed rock and low overhanging tree branches.	Likely Due to a lack of suitable habitat.
*Tyto capensis** (African Grass-Owl) (**VU**)	None on site: Occurs predominately in rank grass, typically but not always at fairly high altitudes. Breeds mainly in permanent and seasonal vleis, which it vacates while hunting or during post-breeding although it will sometimes breed in any area of long grass, sedges or even weeds (Van Rooyen, pers comm.) and not necessarily associated with wetlands (Tarboton *et al.* 1987) although this is more the exception than the rule. Foraging mainly confined to tall grassland next to their wetland vegetation and rarely hunts in short grassland, wetlands or croplands nearby (Barnes, 2000). Mainly restricted to wet areas (marshes and vleis) where tall dense grass and/or sedges occur. Prefers permanent or seasonal vleis and vacates the	Highly unlikely No suitable breeding, roosting and foraging habitat were identified on and surrounding the study site

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
	latter when these dried up or are burnt. Roosts and breeds in vleis but often hunt elsewhere e.g. old lands and disturbed grassland although this is suboptimal habitat conditions (Tarboton *et al*. 1987). May rarely occur in sparse *Acacia* woodland where patches of dense grass cover are present (Harrison *et al*. 1997a).	
Eupodotis caerulescens (Blue Korhaan) (**VU**)	None on site: Occurs in flat undulating terrain in grassland and Nama Karoo, where rainfall 300-1 000 mm /a. Often on damp ground; sometimes attracted to burnt areas. Favours short vegetation; 61 % of 141 groups where vegetation ≤ belly height. At Wakkerstroom, Mpumalanga, abundance positively correlated with altitude, flat topography and burnt grassland. In Nama Karoo, 96% of 88 groups in natural vegetation, 2% in fallow fields, 1% in cultivated grass and pastures and 1% in lucerne pastures. At De Aar, Nothern Cape, near western edge of range, only found close to large lucern fields. Remains < 1 km from water (Hockey *et al*., 2005).	Highly unlikely Due to unsuitable habitat, high human presence on site and disturbance surrounding the study site. Localised in SE Gauteng were common. Occasional visitor to most other areas in Gauteng. (Marais & Peacock, 2008)
*Anthropoides paradiseus** (Blue Crane) (**VU**)	None on site: Midlands and highland grassland, edge of karoo, cultivated land and edges of vleis (Maclean, 1993). Nests in both moist situations in vleis which have short grass cover and in dry sites far from water, usually exposed places such as on hillsides; forages in grassland and cultivated and fallow lands; roosts communally in the shallow water of pans and dams (Tarboton *et al*. 1987). Short dry grassland, being more abundant and evenly disturbed in the eastern "sour" grassland, where natural grazing of livestock is the predominant land use. Prefers to nest in areas of open grassland (Barnes, 2000) In the fynbos biome it inhabit cereal croplands and cultivated pastures and avoids natural vegetation. By contrast, it is found in natural vegetation in the Karoo and grassland biomes, but it also feeds in crop fields (Harrison *et al*. 1997a).	Highly unlikely Due to the small extent of the grassland, disturbance surrounding the study site and high human presence on the study site. Localised but common in the south-eastern Gauteng (Marais & Peacock, 2008)
*Podica senegalensis** (African Finfoot) (**VU**)	None on site: Occurs mostly along quiet, wooded streams and rivers flanked by thick riparian vegetation and overhanging trees. Also dam verges, especially where there is sufficient overhanging vegetation and reed cover. Avoids both stagnant and very fast-flowing watercourses, with a preference for clear, rather than silted water (Hockey *et al*., 2005).	Highly unlikely Due to high human presence on site and disturbance surrounding the study site. Scarce in Gauteng and secretive resident; widespread (Marais & Peacock, 2008)
Crex crex (Corn Crake) (**VU**)	None on site: Rank grassland and savanna, dry grassland bordering marshes and streams, including long grass areas of seasonally flooded grassland and, occasionally, wet clay patches and soft mud fringing ponds. In Acacia savanna, occurs mostly where trees are small and scattered, and grass dense often tussocky, 0.7 – 1.5 m tall (Hockey *et al*. 2005).	Highly unlikely Due to a lack of suitable habitat. Rare summer visitor. Widespread but elusive (Marais & Peacock, 2008).

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
Rostratula benghalensis (Greater Painted-snipe) (**NT**)	None on site: Dams, pans and marshy river flood plains. Favours waterside habitat with substantial cover and receding water levels with exposed mud among vegetation, departing when water recedes beyond the fringes of vegetation. Rare in seasonally flooded grassland and palm savanna (Hockey *et al.* 2005).	<u>Highly unlikely</u> Due to a lack of suitable habitat Uncommon visitor and resident (Marais & Peacock, 2008)
Glareola nordmanni (Black-winged Pratincole) (**NT**)	None on site: A non-breeding overland migrant to southern Africa. In southern Africa winter quarters, prefers open grassland, edges of pans and cultivated fields, but most common in seasonally wet grasslands and pan systems. Attracted to damp ground after rains, also tp agricultural activities, including mowing and ploughing, and to newly flooded grassland (Hockey *et al.* 2005).	<u>Highly unlikely</u> Might only pass through the area on rare occasions. Erratic summer migrant sometimes in large flocks (Marais & Peacock, 2008)
Sterna caspia (Caspian Tern) (**NT**)	None on site: Occurs along coast, mostly in sheltered bays and estuaries. Inland, at large water bodies, both natural and man-made, with preference for saline pans and large impoundments. Coastal breeding habitat primarily offshore islands, but with increasing use of sandy beaches and islands in saltworks, where protection is offered. Inland, breeds on small, low islets in pans and dams (Hockey *et al.* 2005).	<u>Highly unlikely</u> Due to a lack of suitable foraging and breeding habitat. Non-breeding winter visitor to large water bodies in Gauteng (Marais & Peacock, 2008)
*Gyps coprotheres** (Cape Vulture) (**VU**)	They mostly occur in mountainous country, or open county with inselbergs and escarpments; less commonly as visitors to savannah or desert (Maclean, 1993). Forage over open grassland, woodland and agricultural areas; usually roosts on cliffs, but will also roost on trees and pylons (Barnes, 2000). It is reliant on tall cliffs for breeding but it wanders widely away from these when foraging. It occurs and breeds from sea level to 3 100 m.a.s.l. Current distribution is closely associated with subsistence communal grazing areas characterised by high stock losses and low use of poisons and, to a lesser extent, with protected areas (Harrison *et al.* 1997a), but their presence is ultimately dependent on the availability of food.	<u>Highly unlikely</u> Due to a lack of suitable foraging and breeding habitat. Breeds in Magaliesberg; uncommon wanderer elsewhere; mostly SW & NW Gauteng (Marais & Peacock, 2008)
*Circus ranivorus** (African Marsh-Harrier) (**VU**)	None on site: Almost exclusively inland and coastal wetlands (Hockey *et al.* 2005). Wetland and surrounding grasslands. Most highveld wetlands > 100 ha support a breeding pair (Tarboton & Allan 1984). Nests in extensive reed beds often nigh above water. Forages over reeds, lake margins, floodplains and occasionally even woodland. Almost entirely absent from areas below 300 mm of rainfall (Harrison et al., 1997a). Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna (Maclean, 1993). Dependant on wetlands, particularly permanent wetlands for breeding, roosting and feeding. May utilise small wetlands 1-2 ha in extent for foraging, but larger wetlands are required for breeding (Barnes, 2000).	<u>Highly unlikely</u> There are no suitable foraging, breeding or roosting habitat for this species on the study site. Declining resident of large vleis, occurs mainly in south-eastern Gauteng (Marais & Peacock, 2008)

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
Aquila rapax (Tawney Eagle) (**VU**)	None on site: Occurs in lightly wooded savanna; absent from dense forests and highlands. Able to colonise Nama Karoo and treeless grasslands by breeding on pylons and alien trees (Hockey *et al.* 2005).	Highly unlikely There are no suitable foraging, breeding or roosting habitat for this species on the study site. Uncommon. NW & NE Gauteng (Marais & Peacock, 2008)
Aquila ayresii (Ayres's Hawk-Eagle) (**NT**)	None on site: Non-breeding summer visitor to South Africa, favouring dense woodland and forest edge, often in hilly country. Regular in larger northern cities and towns (Johannesburg, Pretoria, Mokopane/Pietersburg), where it often roosts in *Eucalyptus* stands or other tall trees withn its prime distribution range (Hockey *et al.* 2005) .	Highly unlikely There is no suitable habitat for this species on the study site. Rare in Gauteng (Marais & Peacock, 2008)
*Polemaetus bellicosus** (Martial Eagle) (**VU**)	None on site: Tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo, agricultural lands and woodland, It relies on large trees (or electricity pylons) to provide nest sites (Barnes, 2000) as well as windmills and even cliffs in treeless areas . It occurs mainly in flat country and is rarer in mountains, and it also avoids extreme desert, and densely wooded and forested areas (Harrison *et al.* 1997a & Barnes, 2000).	Highly unlikely Due to a lack of suitable habitat and disturbance cause by the large scale development surrounding the study site. Uncommon local resident (Marais & Peacock, 2008)
*Sagittarius serpentarius** (Secretarybird) (**NT**)	None on site: Open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savanna (Hockey *et al.* 2005). Restricted to large conservation areas in the region. Avoids densely wooded areas, rocky hills and mountainous areas (Hockey *et al.* 2005 & Barnes, 2000). Requires small to medium-sized trees with a flat crown for nesting, and often roosts in similar locations. Nesting density only about 150 km^2/pair (n = 4, Kemp, 1995).	Highly unlikely Due to the small extent of the study site and the disturbance surrounding it. Uncommon in open areas within Gauteng (Marais & Peacock, 2008)
*Falco naumanni** (Lesser Kestrel) (**VU**)	None on site: Non-breeding Palaearctic migrant. Forages preferentially in pristine open grassland but also hunts in converted grassland such as small scale pastures provided the conversion is not as total as in plantation forestry or in areas of consolidated agricultural monoculture (Barnes, 2000; Hockey *et al.* 2005) such as maize, sorghum, peanuts, wheat, beans and other crops (Tarboton & Allan 1984) where they hunt for large insects and small rodents, but avoid wooded areas except on migration. They roost communally in tall trees, mainly *Eucalyptus*, in urban areas (Barnes, 2000), often in towns or villages, but also in farm lands (pers. obs). Favour a warm, dry, open or lightly wooded environment, and are concentrated in the grassy Karoo, western fringes of the grassland biome and southeast Kalahari. Generally avoids foraging in transformed habitats but occurs in some agricultural areas, including croplands, in fynbos and	Unlikely Only on rare occasions Localised summer migrant (Marais & Peacock, 2008)

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
	renosterveld of the Western Cape (Hockey *et al.* 2005). Large numbers congregate in sweet and mixed grasslands of the highveld regions.	
*Falco biarmicus** (Lanner Falcon) (**NT**)	None on site: Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs generally favour habitats where cliffs are available as nest and roost sites, but will use alternative sites such as trees, electricity pylons and building ledges if cliffs are absent (Hockey *et al.* 2005). Mountains or open country, from semi desert to woodland and agricultural land, also cities (Maclean, 1993), even on forest-grassland ecotones. Generally a cliff nesting species and its wider distribution is closely associated with mountains with suitable cliffs. Able to breed on lower rock faces than Peregrine Falcon *Falco peregrinus* and also utilises the disused nests of other species, such as crows, other raptors and storks, on cliffs, in trees and on power pylons, and also quarry walls (Tarboton *et al.* 1987). Generally prefers open habitats e.g. alpine grassland and the Kalahari, but exploits a wide range of habitats – grassland, open savanna, agricultural lands, suburban and urban areas, rural settlements – in both flat and hilly or mountainous country. Also breeds in wooded and forested areas where cliffs occur (Harrison *et al.* 1997a).	<u>Highly unlikely</u> Due to a lack of suitable breeding habitat. Uncommon resident in open areas in Gauteng (Marais & Peacock, 2008)
Falco peregrinus (Peregrine Falcon) (**NT**)	None on site: Resident *F. p. minor* mostly restricted to mountainous riparian or coastal habitats, where high cliffs provides breeding and roosting sites. Breeding pairs prefer habitats that favour specialised, high speed, aerial hunting, e.g. high cliffs overhanging vegetation with raised and/or discontinuous canopy (eg forest, fynbos, woodland), or expanses of open water. Also uses quarries and dam walls, and frequents city centres, e.g. Cape Town, where tall buildings substitute for rock faces. Migrant *F. p. calidus* in more open country, often coastal, even roosting on ground on almost unvegetated salt flats.	<u>Highly unlikely</u> Due to a lack of suitable breeding habitat. Could move through the area or rare occasions. Uncommon resident and summer migrant in Gauteng (Marais & Peacock, 2008)
*Phoenicopterus ruber** (Greater Flamingo) (**NT**)	None on site: Breeds at recently flooded, large, eutrophic wetlands (favoured foraging habitat), shallow salt pans; at other times, at coastal mudflats, inland dams, sewage treatments works, small ephemeral pans and river mouths (Hockey *et al.* 2005). Usually breeds colonially on mudflats in large pans (Harrison *et al.* 1997a). Shallow pans, especially saline pans when they have water; also occasionally on other bodies of shallow water such as dams and vleis (Tarboton *et al.* 1987). Large bodies of shallow water, both inland and coastal; prefers saline and brackish water (Maclean 1993). Occasionally forages along sandy coasts.	<u>Highly unlikely</u> Due to a lack of suitable foraging and breeding habitat. Mainly restricted to the south-eastern Gauteng (Marais & Peacock, 2008)
Mycteria ibis (Yellow-billed Stork) (**NT**)	None on site: Utilises diverse wetlands and permanent and seasonal habitats, including alkaline and freshwater lakes, river, dams, pans, flood plains, large marshes, swamps, estuaries, margins of lakes or rivers, flooded grassland and small pools or streams where there are areas of shallow water free of emergent vegetation (Tarboton *et al.*, 1987); less	<u>Highly unlikely</u> Due to a lack of suitable habitat Common at large wetlands within Gauteng; erratic elsewhere (Marais &

SCIENTIFIC NAME	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
	often marine mudflats and estuaries (Hockey *et al.*, 2005). Nests colonially on large trees adjacent to productive wetlands, but only locally and erratically during ideal conditions.	Peacock, 2008)
*Ciconia nigra** (Black Stork) (**NT**)	None on site: Dams, pans, flood plains, shallows of rivers, pools in dry riverbeds, estuaries and sometimes on marshland and flooded grassland; uncommon at seasonal pans lacking fish. Associated with mountainous regions (Hockey *et al.*, 2005) where they nest (Maclean, 1993) on cliffs (Harrison *et al.* 1997a). Feeds in shallow water, but occasionally on dry land, in streams and rivers, marshes, floodplains, coastal estuaries and large and small dams; it is typically seen at pools in large rivers.	<u>Highly unlikely</u> Due to a lack of suitable breeding and foraging habitat
Mirafra cheniana (Melodious Lark) (**NT**)	None on site: Occurs in grassland dominated by *Themeda triandra* grass in South Africa. Occasionally in planted pastures of *Eragrostis curvula* and *E. tef.* Avoids wet lowlands, favouring fairly short grassland (< 0.5 m), with open spaces between tussocks, at 550 – 1 750 m.a.s.l. with annual rainfall of between 400 – 800 mm p/a (Hockey *et al.*, 2005).	<u>Unlikely</u> Due to a lack of suitable habitat Localised resident in Gauteng (Marais & Peacock, 2008) where suitable habitat occur

*Priority Red Data bird species according to GDACE.

6. FINDINGS AND POTENTIAL IMPLICATIONS

6.1 <u>Red Data avifaunal species confirmed from the study site including the 500m extended study area for which suitable foraging, breeding and roosting habitat was confirmed</u>:

None

6.2 <u>Red Data avifaunal species confirmed within the 500m extended study site for which suitable foraging, breeding and roosting habitat was confirmed</u>:

None

6.4 <u>Red Data avifaunal species for which suitable breeding, foraging and/or roosting habitat was confirmed from the study site and within the 500m extended study site</u>:

Lesser Kestrel (*Falco naumanni*):

<u>Criteria for IUCN threatened category:</u> A1a,c,e. Status: Vulnerable.
<u>Habitat:</u> Lesser Kestrels frequents open grassland areas of the Highveld. The area on which the development is to take place might favour this species but falls outside its core distribution range of this species within southern Africa.
<u>Threat:</u> The Lesser Kestrel is sensitive to dense human populations and disturbance and will more than likely not use the area despite the presence of suitable hunting habitat found on site. Future development of adjacent undisturbed grassland will result in fragmentation of its preferred open grassland habitat, which is one of the main threats to

this species (Barnes 2000) as well as the human disturbance that comes with development. The primary threat to this species is however based in the Palaearctic breeding grounds and will most likely find suitable habitat for foraging purposes elsewhere within its southern African core distribution range.
<u>On site conclusion:</u> Lesser Kestrel might on rare occasion move through the area during migration and might use the area for hunting purposes.

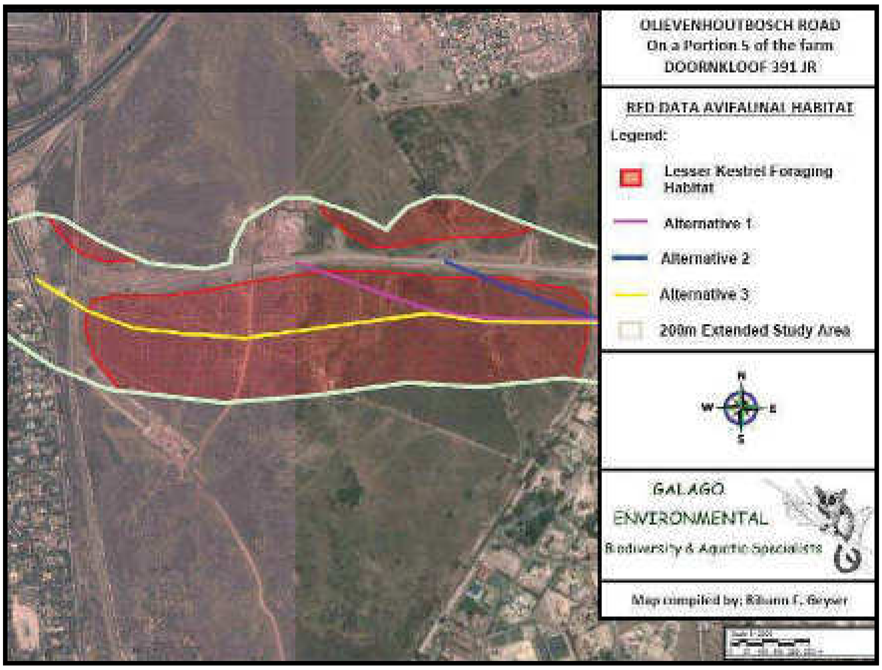

Figure 9: Habitat map for the Lesser Kestrels

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The Galago Environmental team has appropriate training and registration, as well as extensive practical experience and access to wide-ranging data bases to consider the derived species lists with high limits of accuracy. In this instance the biodiversity of all Alignments has to a greater or lesser extent been jeopardized, which renders the need for field surveys unnecessary. In instances where uncertainty exists regarding the presence of a species it is listed as a potential occupant, which renders the suggested mitigation measures and conclusions more robust.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

The general assessment of species rests mainly on the 1987 atlas for birds of the then-Transvaal (Tarboton *et al*. 1987) and comparison with the 1997 SABAP atlas (Harrison et al. 1997), so any limitations in either of those studies will by implication also affect this survey and conclusions.

8. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialist:

- The Alternative 2 route is recommended since this will have the least impact on the natural vegetation and the avifaunal species recorded on or that are likely to occur on the study site.
- Where possible, **work should be restricted to one area at a time**, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- **No vehicles should be allowed to move in or across the wet areas or drainage lines and possibly get stuck.** This leaves visible scars and destroys habitat, and it is important to conserve areas where there are tall reeds or grass, or areas were there is short grass and mud.
- The contractor must ensure that no fauna is disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- During the construction phase, noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.
- Alien and invasive plants must be removed.

9. CONCLUSIONS

Although the natural open grassland area offers habitat for Red Data avifaunal species (Lesser Kestrels), they are only likely to move through the area on rare occasions. This is attributed to disturbance of the area on and surrounding the study site due to human presence and human related activities and also development surrounding the study site and the fragmented state of the natural grassland. This alternative is recommended since this will have a minimum impact on the natural vegetation on the study site and the avifaunal species recorded on or that are likely to occur on the study site.

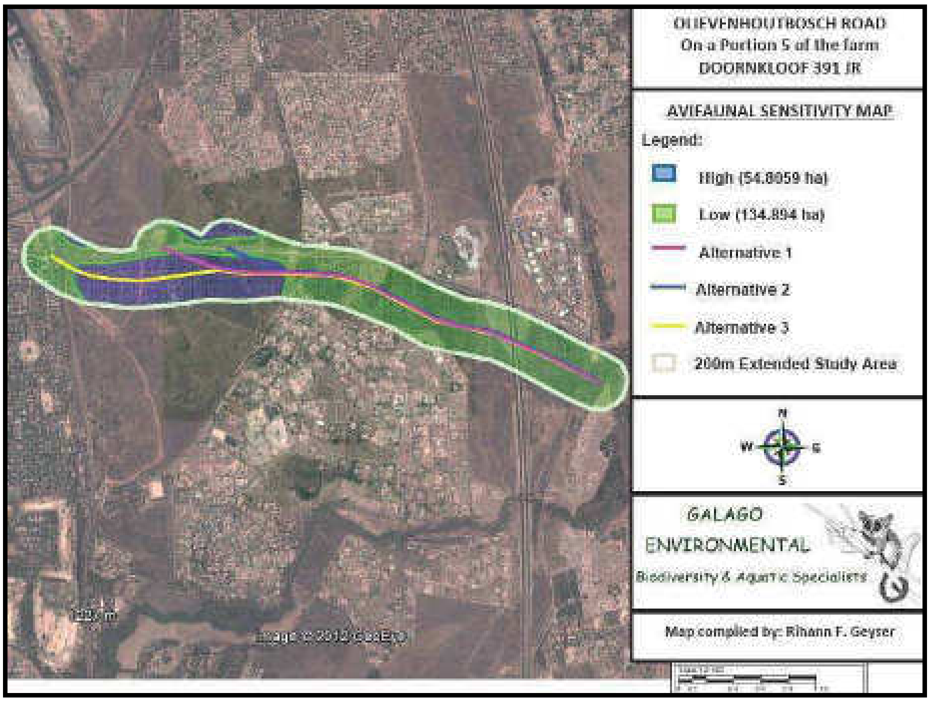

Figure 10: Avifaunal sensitivity map

10. LITERATURE SOURCES

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Herpetofauna
Habitat Assessment
of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

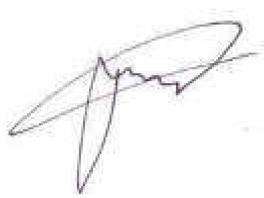
May 2012

Report author: Mr. J.C.P van Wyk (Pri. Sci. Nat: M.Sc)

DECLARATION OF INDEPENDENCE:

I, Jacobus, Casparus Petrus van Wyk (6808045041084) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to the Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2006
- Our intellectual property in this report will only be transferred to the client (the party/ company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent of the client will be required for release of any part of this report to third parties.



J.C.P. van Wyk

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1. INTRODUCTION

Galago Environmental CC. was appointed to undertake a Herpetofauna habitat Assessment of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR, scheduled for construction.

This report focuses on the reigning status of threatened and sensitive reptiles and amphibians (herpetofauna) likely to occur on the proposed development site. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the development that is suggested. The secondary objective of the investigation was to gauge which herpetofauna might still reside on the site and compile a complete list of herpetofauna diversity of the study area.

This assignment is in accordance with the 2010 EIA Regulations (No. R. 543-546, Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

2. SCOPE AND OBJECTIVES OF THE STUDY

This report:

- Is a survey of reptile and amphibian habitats, with comments on preferred habitats;
- Comments on ecologically sensitive areas;
- Evaluates the conservation importance and significance of the site with special emphasis on the current status of resident threatened species;
- Offers recommendations to reduce or minimise impacts, should the proposed development be approved

3. STUDY AREA

This study routes lies in the quarter degree grid cells 2528 CC & 2528CD, mostly south of the M31 Road (Nellmapius Drive), in Centurion, Gauteng Province. The study site crosses the M57 on the eastern border of the study site, the R21 road and the M31 Road towards the western side of the study site. The Cornwall Hill Estate is situated near the southern border of part of the study site. Presently the three alternative routes traverse the mostly undeveloped area west of the M31 Road.

A manmade dam was constructed just to the west of the R21 off-ramp between the new proposed road and the M31. This manmade dam forms an artificial wetland. Between this manmade dam and the Sesmyl Spruit there is an overflow of water during the rainy season. The new proposed road crosses this overflow area.

During the site visit it appeared that ecological damage has been caused by regular fires, casual damage and land abuse. However, the dense and high stand of grass provides ample refuge and nourishment for small herpetofauna. The topography of the terrain is undulating grassy plains typical of the Highveld grassland biome. For most of the routes the substrate consists of reddish soil imbedded with gravel and even rocks in some places. West of the R21 there are a few very small exposed natural ridges.

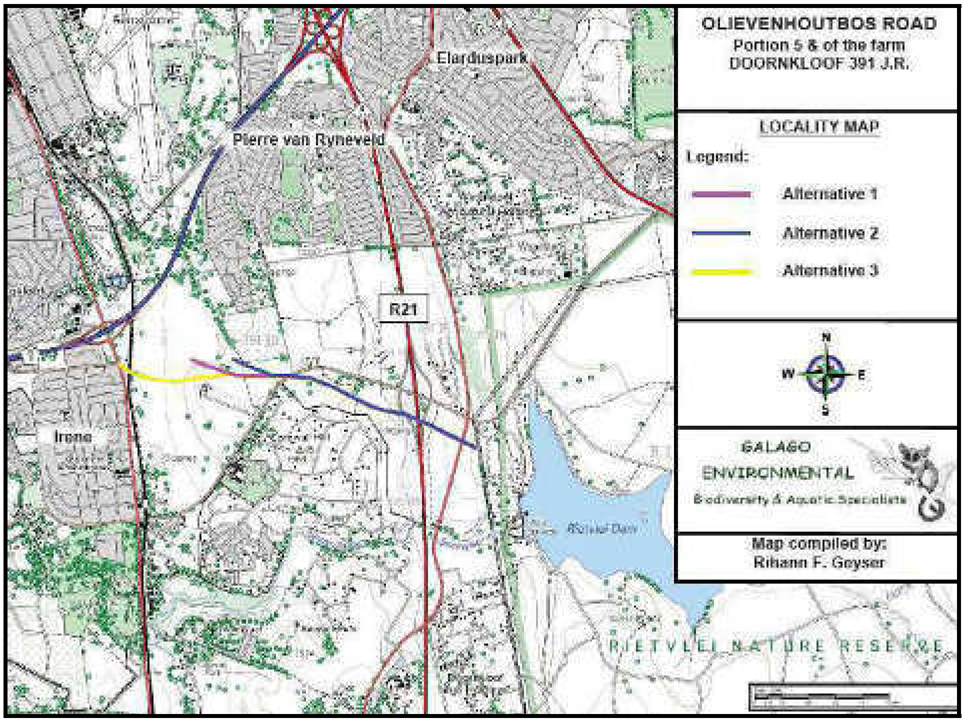

Figure 1: Locality map of the study area

4. METHOD

A site visit was conducted on 9 April 2012. During this visit the observed and derived presence of reptiles and amphibians associated with the recognised habitat types of the study site were recorded. This was done with due regard to the well-recorded global distributions of Southern African herpetofauna, coupled with the qualitative and quantitative nature of recognised habitats.

The 500 metres of adjoining properties were scanned for important fauna habitats.

4.1 Field Surveys

During the site visits, reptiles and amphibians were identified by visual sightings through random transect walks. Amphibian diversity was also established by means of acoustic identification. No trapping was conducted, as the terms of reference did not require such intensive work**.**

4.2 Desktop Surveys

As the majority of reptiles and amphibians are secretive, nocturnal and/or poikilothermic or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The probability of the occurrence of **reptile and amphibian** species was based on their respective geographical distributional ranges and the suitability of on-site habitats. In other words, *high* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common to the area, i.e. normally occurring at high population densities.

Medium probability pertains to a herpetofaunal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is taken into consideration. Species categorised as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.

A *low* probability of occurrence would imply that the species' distributional range is peripheral to the study site <u>and</u> habitat is sub-optimal. Furthermore, some reptiles and amphibians categorised as *low* are generally deemed to be rare.

Based on the impressions gathered during the site visit, as well as publications, such as FitzSimons' Snakes of Southern Africa (Broadley, 1990), Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998), A Guide to the Reptiles of Southern Africa (Alexander and Marais, 2007), Amphibians of Central and Southern Africa (Channing 2001), Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter, *et al*, 2004) and A Complete Guide to the Frogs of Southern Africa (Du Preez & Carruthers, 2009), a list of species which may occur on the site was compiled. The latest taxonomic nomenclature was used. The vegetation type was defined according to the standard handbook by Mucina and Rutherford (eds) (2006).

4.3 Specific Requirements

During the visit the site was surveyed and assessed for the potential occurrence of Red Data species such as:

- Giant Bullfrogs (*Pyxicephalus adspersus*);
- The Striped Harlequin Snake (*Homoroselaps dorsalis*); and
- The Southern African Python (*Python natalensis*).

5. RESULTS

The three alternative routes fall within the Carleton Dolomite Grassland & Rand Highveld Grassland vegetation units as defined by Mucina and Rutherford (2006).

5.1. Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges.

From a herpetological habitat perspective, it was established that one of the four major habitats is naturally present on the study site, namely terrestrial. The three other habitat types are present on a very small scale on parts of the study site.

Terrestrial habitat dominates along the combined and individual alternative routes. Most of the grassland has been transformed and is thus ecologically disturbed. The grassland has been severely altered, mostly by annual fires and secondarily by previous agricultural activities. The natural vegetation of the study site is currently not utilised as grazing and during the end of summer at the time of the site visit the basal cover was lush and would provide adequate cover for small terrestrial herpetofauna.

Figure 2: Near where the combined three alternative routes end/originate on the M57 Road.

Note the transformed vegetation in the foreground and exotic trees in the distance.

Termitaria, especially dead termitaria, which normally provide ideal retreats for small reptiles and amphibians, are present in reasonable numbers. There are also small stands of indigenous trees. A few dead logs of mainly exotic tree species occur on the study site, which provide habitat for small herpetofauna. Exotic trees predominate, whereas indigenous trees are solitary and geographically too isolated to allow for the occurrence of arboreal reptiles. There are a few small rocky outcrops on the study site, west of the R21.

Figure 3*:* Some of the rupiculous habitat in the foreground, which the new intended Road will cross. Note the R21 in the background.

On the north-western side of the study site, near the M31, there is one very large and quite a few small areas covered in building rubble. Building rubble provides excellent habitat for rupiculous reptiles. Part of the study site was used as a dumping ground in the past.

Figure 4: The combined route in an undeveloped area west of the R21 and south of Nellmapius road. Note the wattle trees and rubble in the foreground.

A manmade dam wall was constructed just to the west of the R21 off-ramp. This manmade dam forms an artificial wetland. Between this manmade dam and the Sesmyl Spruit there is an overflow of water during the rainy season, but the few small pools are too shallow and do not contain enough water to make successful breeding possible even for the most explosive breeders of amphibian species. But these temporary water pools and drainage line to the south of the man-made dam and the Sesmyl Spruit can support some moisture-reliant herpetofauna during the rainy season and is an important dispersal corridor between these two water bodies.

Figure 5: The temporary man-made dam which is a potential breeding place for giant bullfrogs and other temporary water breeding amphibians.

The few natural areas of the 500 metres of adjoining properties mirror the ecological conditions described for the study site.

Figure 6: The area north-west of Nellmapius Road where the three routes split.

Formidable barriers such as the R21 Road and M57 to the east, the M31 Road and the solid fence along part of the south, make migration almost impossible. Presently, connectivity as a whole is fair and the only real opportunities for migration exist between the man-made dam and the Sesmyl Spruit and areas to the west of the study site. In the foreseeable future, the general area will be subjected to fragmentation caused by more roads and urban development, which will curb connectivity even more.

It is clear that migration is only suitable for mostly common herpetofauna with the capacity to capitalize on fluctuating environmental conditions of suboptimal quality.

5.2. Observed and Expected Herpetofauna Species Richness

Of the 43 reptile species which may occur on the study site (Table 1), one was confirmed during the site visit (Table 2) and of the possible 15 amphibian species which may occur on the study site (Table 1); none was confirmed during the site visit (Table 2).

The 58 herpetofaunal species are recorded as potential occupants along the various routes and within the 500 metres zones which include the rupiculous habitat of the koppie near Alternative 3, the few small rocky outcrops on the study site west of the R21 and the drainage line to the south of the man-made dam. Most of these herpetofaunal species are robust generalists with the ability to capitalize on disturbed environments. Many of these species are often found in suburban gardens.

The American red-eared terrapin (*Trachemys scripta elegans*) is the only feral reptile or amphibian that has been known to occur in South Africa (De Moor and Bruton, 1988), but with only a few populations and no open water on the study site, it is not expected to occur on this particular site.

The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 1) are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, rinkhals, eastern striped skink, guttural toad, raucous toad and red toad, common river frog and Boettger's caco).

The relatively high species richness is due to the size of the study site, habitat diversity and the fairly large manmade temporary pond/wetland with its drainage line.

5.3 Red Data Listed Reptiles

The study site falls outside the natural range of the Southern African python.

The striped harlequin snake has not been recorded on this quarter degree cell (Ditsong Museum of Natural History or TVL Museum Records), although a few moribund termitaria, where this species are most likely to be found, are present on the study site. It is very difficult to confirm whether this cryptic snake is present on the study site, but it is quite unlikely.

5.4 Red Data Listed Amphibians

The findings concerning giant bullfrog habitat are based on the presence of a potential breeding site (25°52'06''S; 28°15'13''E) on the north-eastern side of the study site near the R21 Road. A temporary manmade dam with its surrounding wetland has been created by run-off water where the R21 and M31 roads meet.

This temporary dam is ideal breeding area for giant bullfrogs. Bullfrogs prefer these temporary pans in order to avoid predation from fish and for tadpoles to swim in schools and stay in the warm, shallow water during the day for rapid development (Van Wyk *et al*., 1992).

Although some of the terrain around this wetland includes rocky outcrops, other areas appear to be fairly suitable as a dispersal area, which combines feeding and aestivation. It is essential that the soil must be suitable for burrowing on a daily basis during the short activity period at the beginning of the rainy season and for deeper retreats during the resting periods.

This potential breeding site on the study site currently has three barriers, which might hinder giant bullfrog movement. Very close to the eastern side there is the very busy R21 Road, which would result in many road mortalities during the breeding season. Just to the north of the study site, there is the M31 Road and to the west is the solid wall of the Cornwall Hill Estate, which would obstruct the movement of giant bullfrogs. There is a good chance that bullfrogs may occur on the study site as observed by this specialist near the M57 (Goede Hoop Avenue). People have also donated bullfrogs from the Pierre van Ryneveld suburb, which is less than two kilometres north of the potential breeding site.

It is important to note that in the latest literature (Measey (ed.) 2011 and Carruthers & Du Preez, 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter *et al*, 2004) to Least Concern in South Africa.

Table 1: **Reptile and Amphibian diversity.**
The species observed on or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Alexander and Marais (2007), Minter, *et.al* (2004) & Du Preez and Carruthers (2009).

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	**REPTILES**
	Order: TESTUDINES	**TORTOISES & TERRAPINS**
	Family: Pelomedusidae	**Side-necked Terrapins**
*	*Pelomedusa subrufa*	Marsh or Helmeted Terrapin
	Order: Squamata	**SCALE-BEARING REPTILES**
	Suborder:Lacertilia	**LIZARDS**
	Family: Gekkonidae	Geckos
√	*Lygodactylus capensis*	Cape Dwarf Gecko
√	*Pachydactylus affinis*	Transvaal Thick-toed or Transvaal Gecko
*	*Pachydactylus capensis*	Cape Thick-toed of Cape Gecko
	Family: Agamidae	Agamas
*	*Agama aculeate*	Ground Agama
?	*Agama atra*	Southern Rock Agama
	Family: Scincidae	**Skinks**
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis punctatissima*	Montane Speckled Skink
√	*Trachylepis varia*	Variable Skink
?	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink
	Family:Lacertidae	**Old World Lizards or Lacertids**
?	*Pedioplanis lineoocellata*	Spotted Sand Lizard
?	*Ichnotropis squamulosa*	Common Rough-scaled Lizard
	Family: Gerrhosauridae	**Plated Lizards**
?	*Gerhosaurus flavigularis*	Yellow-throated Plated lizard
	Family: Cordyidae	
?	*Chamaesaura aenea*	Coppery Grass Lizard

	SCIENTIFIC NAME	ENGLISH NAME
?	*Cordylus vittifer*	Transvaal Girdled Lizard
	Family: Varanidae	**Monitors**
?	*Varanus albigularis*	Rock Monitor
*	*Varanus niloticus*	Water Monitor
	Family: Chamaeleonidae	**Chameleons**
?	*Chamaeleo dilepis*	Flap-neck Chameleon
	Suborder: SERPENTES	**SNAKES**
	Family: Typhlopidae	**Blind Snakes**
?	*Typhlops bibronii*	Bibron's Blind Snake
?	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake
	Family: Leptotyphlopidae	**Thread Snakes**
*	*Leptotyphlops conjunctus*	Cape Thread or Worm Snakes
*	*Leptotyphlops scutifrons*	Peter's Thread or Worm Snake
	Family: Atractaspididae	**African burrowing Snakes**
?	*Aparallactus capensis*	Cape or Black-headed Centipede Eater
	Family: Colubridae	**Typical Snakes**
*	*Lycodonomorphus rufulus*	Common Brown Water Snake
√	*Boaedon capensis*	Brown House Snake
*	*Lamprophis inornatus*	Olive House Snake
?	*Lamprophis aurora*	Aurora House Snake
√	*Lycophidion capense*	Cape or Common Wolf Snake
?	*Duberria lutrix*	Common Slug Eater
√	*Pseudaspis cana*	Mole Snake
?	*Prosymna sundevallii*	Sundevall's Shovel-snout
*	*Psammophylax rhombeatus*	Spotted Skaapsteker
?	*Psammophylax tritaeniatus*	Striped Skaapsteker
√	*Psammophis brevirostris*	Short-snouted Grass or Sand Snake
?	*Psammophis mossambicus*	Olive Grass Snake
√	*Psammophis crucifer*	Crossed Whip Snake
?	*Philothamnus hoplogaster*	Green water snake
√	*Dasypeltis scabra*	Common or Rhombic Egg Eater
*	*Crotaphopeltis hotamboeia*	Herald Snake
	Family: Elapidae	**Cobras, Mambas and Others**
?	*Elapsoidea sunderwallii*	Sundevall's Garter Snake
√	*Hemachatus haemachatus*	Rinkhals
	Family: Viperidae	**Adders**
√	*Causus rhombeatus*	Rhombic Night Adder
√	*Brits arietans*	Puff Adder
	Class: AMPHIBIA	**AMPHIBIANS**
	Order: ANURA	**FROGS**
	Family: Pipidae	**Clawed Frogs**
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	**Toads**
?	*Amietaophrynus garmani*	Eastern Olive Toad
√	*Amietaophrynus gutturalis*	Guttural Toad
√	*Amietaophrynus rangeri*	Raucous Toad
√	*Schismaderma carens*	Red Toad

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Hyperoliidae	**Reed frogs**
√	*Kassina senegalesis*	Bubbling Kassina
?	*Semnodactylus weali*	Rattling Frog
	Family: Phrynobatrachidae	**Puddle Frogs**
*	*Phrynobatrachus natalenis*	Snoring Puddle Frog
	Family: Pyxicephalidae	
√	*Cocosternum boettgeri*	Boettger's Caco or Common Caco
*	*Amietia angolensis*	Common River Frog
?	*Amietia fuscigula*	Cape River Frog
NT?	*Pyxicephalus adspersus*	Giant Bullfrog
?	*Strongylopus fasciatus*	Stripe Stream Frog
√	*Tomopterna cryptotis*	Tremolo Sand Frog
√	*Tomopterna natalensis*	Natal Sand Frog

√ Definitely there or have a *high* probability of occurring;
***** *Medium* probability of occurring based on ecological and distributional parameters;
? *Low* probability of occurring based on ecological and distributional parameters.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103..In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 2: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Trachylepis punctatissima	Montane Speckled Skink	Sight record	Man-made rupiculous habitat

The Montane Speckled Skink listed in Table 2 should be very common on the study site and elsewhere in its range.

7. FINDINGS AND POTENTIAL IMPLICATIONS

Generally the proposed new tarred access road will not result in a loss of ecologically sensitive habitat (given application of the mitigation measures suggested below), but it will result in a loss of an important habitat unit with ecosystem function and the loss of critical faunal habitat. For the final section of the road, there are three alternative routes through the undeveloped terrain.

However, maintaining (and even improving) the conservation integrity of the south-flowing seasonal drainage line, which the new road crosses near the R21, is imperative. The drainage line flows into the Sesmyl Spruit. These water sources should be regarded as sensitive (see suggested mitigation measures cited below), as such providing indispensable habitat for Red Listed and sensitive species as well as serving as a dispersal corridor in places. The previously Red-Data-listed giant bullfrog has a chance of occurring on the study site.

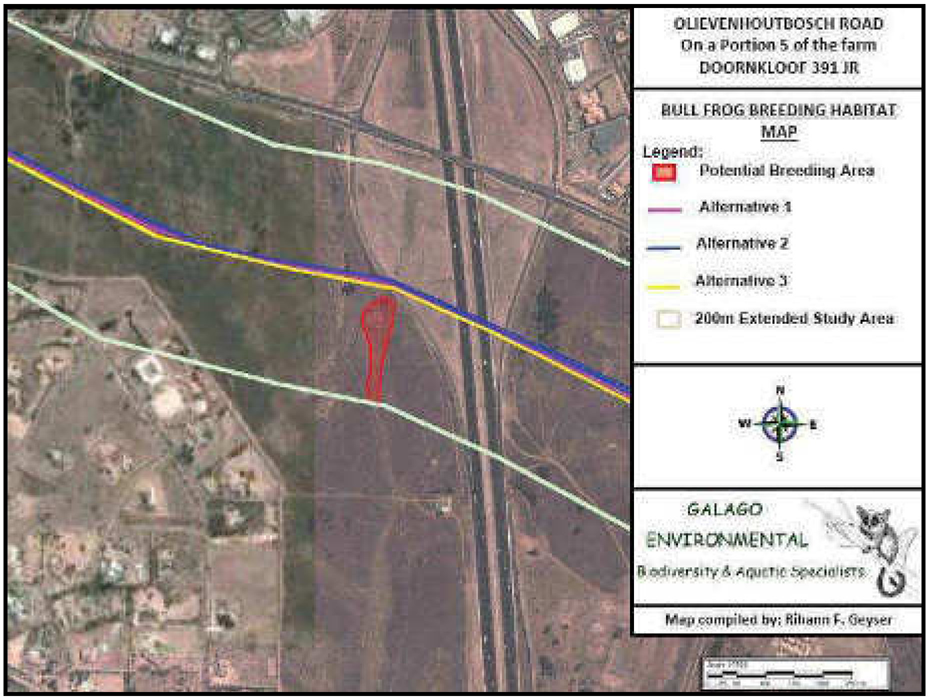

Figure 7: Herpetofaunal sensitivity map

An important indirect effect of the proposed development would be the likely impact that the proposed development might have on the surface water runoff and water quality of the catchment area. This could have a negative impact on the herpetofauna but the effects could be ameliorated by the construction of retention ponds, which would retard discharge into the manmade dam and adjacent wetland and improve the water quality of the discharge.

The loss/displacement of some fauna is a foregone conclusion, particularly that of terrestrial species, but considering the small scale of the proposed road construction, it will be minimal in the overall picture of the affected species.

It is recommended that Alternative 2 is selected since it is shorter (and thus more cost-effective) and since it will not affect the isolated koppie.

8. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The Galago Environmental specialists are amply qualified and experienced to gauge absences or presences of species on a location such as this. The team has access to ample data bases and information resources, and has earlier conducted numerous intensive field surveys allowing the extrapolation of habitat diversity and quality into species occurrences. In this instance an intensive survey will be lucrative for the specialists, but it is deemed an expensive and fruitless experience with no or little chance of altering the opinion presented here.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. To some extent, discussions and proposed mitigations are made on reasonable and informed assumptions base on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. Galago Environmental Fauna and Flora Specialists can therefore not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

9. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialist.

- Should Bullfrogs or any herpetological species be encountered during the construction phase of the proposed development, these should be relocated to natural grassland areas in the vicinity or the Rietvlei Nature Reserve nearby.
- The contractor must ensure that no herpetofaunal species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed.
- All storm water structures should be designed so as to block amphibian and reptile access to the road surface.
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the road development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.
- Where the roads traverse the drainage line, an underpass should provide for the movement of aquatic as well as terrestrial species.
- A barrier (either prefab concrete wall or galvanized sheeting that extends as a continuous sheet above ground for at least 40cm and below ground for at least 30cm) that will physically block animals from accessing the road surface should be constructed for a distance of 200m on either side of all aquatic and terrestrial underpasses. Holes under barriers should be routinely filled in and areas directly adjacent to the barrier should be kept free of vegetation.

10. CONCLUSION

The proposed development routes are relatively small, but there is a chance that at least one of the three Red Data herpetofaunal species of the Gauteng Province may occur on the site.

The man-made dam/wetland adjacent to the study site is a potential breeding site for the giant bullfrog and there is a good possibility that giant bullfrogs may use the study site as a dispersal area, which combines feeding and aestivation.

If the proposed development should go ahead, an important indirect effect would be the likely impact that the proposed development might have on the surface water runoff and water quality of the catchment area. This could have a negative impact on the herpetofauna. This is especially true for the drainage line which flows into the Sesmyl Spruit. The effects could be ameliorated by the construction of retention ponds, which would retard discharge into the catchment area and improve the water quality of the discharge.

Figure 8: Herpetological sensitivity map

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Ecological conditions of the ridge

of

A section of the proposed Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR

May 2012

Report author: Reinier Terblanche (M.Sc, Pr.Sci.Nat)

Declaration of Independence:

I, Reinier F. Terblanche (670409 5201 084) declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them

- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions

- act as an independent specialist consultant in the field of Ecology

- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Olievenhoutbosch Road from Main Road to K54 described in this report

- have no financial interest in the proposed development other than remuneration for work performed

- have or will not have any vested or conflicting interests in the proposed development

- undertake to disclose to the Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2006.

Reinier F. Terblanche

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1. INTRODUCTION

A survey of the ecological conditions was required for the ridges along the proposed route for the Olievenhoutbosch Road from Main Road to K54 on Portion 5 of the farm Doornkloof 391-JR, scheduled for construction. The survey focused on ecological conditions of the ridge that should be taken into account in the impact study.

1.1 Objectives of the habitat study

The objectives of the habitat study on ecological conditions are to provide:

- An outline of the habitats that are present;
- An outline of vegetation assemblages (communities) present with an estimate of the dominant species that are present at rocky ridges;
- An estimate of the degradation;
- An outline of compositional aspects of exotic species, indigenous pioneer species and indigenous plant species of higher ecological status based on broad subjective observations and quantitative surveys;
- Estimates of degradation and impacts of disturbances on the vegetation; and
- Functional aspects of ecosystems at the site.

1.2 Scope of study

- A survey consisting of a visit of key elements of habitats on the site and surveys of vegetation composition.
- Integration of literature and field observations to evaluate the ecological conditions on the ridge.

2. STUDY AREA

The study site is situated in the Grassland Biome (Mucina & Rutherford 2006). Grassland Biome is represented by Carletonville Dolomite Grassland and Rand Highveld Grassland vegetation types (Mucina & Rutherford, 2006). The site is part of the summer-rainfall region with dry winters. Frost is frequent in the winter (Mucina & Rutherford, 2006). Mean annual precipitation varies from 540 mm to 730mm a year. The alternatives of the proposed road cross Class 3 rocky ridges at three places with the exception of Alternative 2 that only crosses rocky ridges at two places. An eastern rocky ridge section, a central rocky ridge section and a western rocky ridge section could be distinguished. The eastern rocky ridge section consists of the rocky ridge slope adjacent residential developments between the M57 and the Rietvlei Nature Reserve and crosses all three alternatives. The central rocky ridge section is between Cornwall Hill and Nellmapius Road and crosses all three alternatives as well. The western rocky ridge section consists of a rocky quartzite hill with a reservoir on top and lower dolomitic slopes of the rocky hill. The quartzite hill and lower dolomitic slopes cross alternative 3 whilst lower slopes cross alternative 1.

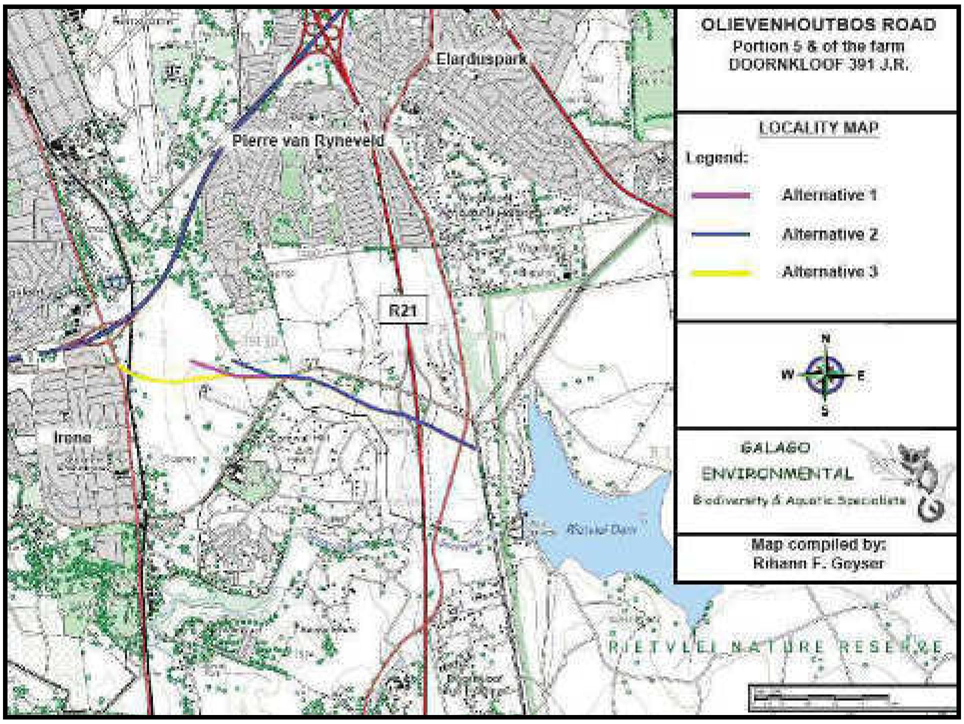

Figure 1: Locality map of the study area

3. METHODS

Surveys were conducted on 1 April 2012.

3.1 Habitat characteristics

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/ physiognomy).

3.2 Vegetation assemblages (communities)

Relatively homogenous vegetation assemblages (communities) were identified based on overall appearance (mainly physiognomy) and composition (conspicuous dominant species). Transects consisting of 30 points each, at each consecutive metre along a 30m steel measuring tape, was applied in apparent representative parts of the relatively homogenous vegetation assemblages to establish dominant plant species in the grassland.

Identification of plant species during the species composition surveys were based on various literature resources, or where deemed necessary, by experts on certain taxonomic groups. Field guides such as those by Manning (2003), Smit (2008), Van Oudtshoorn (1999), Van Wyk and Malan (1998), Van Wyk and Van Wyk (1997), Van Wyk and Smith (2003), Germishuizen (2003) and Pooley (1998) were used to identify plant species and find additional information about plant species. Retief and Herman (1997) were consulted to find information about diagnostic characteristics and the broad distribution of species. Main sources to obtain information about the status, origin and identification of problem plants and alien invasive plant species were Bromilow (2001) and Henderson (2001). Pfab (2002) as well as Pfab and Victor (2002) were used as the guideline for threatened, data deficient and near threatened plant species of the Gauteng Province. Updated information from GDARD was also consulted. For the most recent treatise of scientific names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) were followed to compile the lists of species.

3.3 Ecological conditions

At the time of the present survey, the terms of reference for ecological conditions are not available in as much detail as the requirements for biodiversity studies. Here an approach has been followed to describe ecological conditions that are relevant to potential development or to note possible exclusion of any development.

The veld condition is often an important aspect of overall ecological conditions at a chosen site. The veld condition can be determined in various ways. Two techniques that are commonly used are the ecological index, which yields a veld condition index, and the occurrence or absence of key grass species (Bothma, 2002; Van Rooyen, 2002). Different veld condition assessment methods that have an ecological base have been proposed by various researchers in South Africa including Dyksterhuis (1949), Foran, Tainton & Booysen (1978), Hardy & Hurt (1989), Mentis (1983), Tainton (1988), Tainton, Edwards & Mentis (1980). These methods use key grass species or grass species with allocated ecological status to determine veld condition. Degradation models (Bosch & Gauch, 1991) can also be used to assess veld condition. Directly or indirectly, these methods are based more on responses of grass species to mega-herbivores and in addition at the higher rainfall areas also based on responses of grass species to fire. A good veld condition is therefore close to a good rangeland condition, which is not necessarily ideal for the conservation of smaller fauna and flora, especially at ridges where soils are naturally poor in nutrients. For the purposes of this study the application of these methods are doubtful to apply for three main reasons.

Firstly, natural grassland on rocky ridges may contain a low frequency or abundance of grass species that are of high ecological status in terms of grazing by megaherbivores, even though a patch may be ideal for rare flora and smaller fauna. For example a *Melinis nerviglumis – Aristida transvaalensis* community, which is inhabited by a number of grass species of lower ecological status, was found to include the ideal habitats of the rare and red-listed Heidelberg Copper butterfly, *Chrysoritis aureus* (Terblanche, Morgenthal & Cilliers, 2003). Threatened insect species often require habitats that are to some extent disturbed, for example the Brenton Blue Butterfly, *Orachrysops niobe* (Edge, Cilliers & Terblanche, 2008). Secondly, the diversity of indigenous forb species, and not necessarily grass species, is often of paramount importance for smaller fauna and flora. Thirdly, especially within and on the fringes of urban areas, pioneer forbs, shrubs and trees may be more important to indicate degradation of ecosystems than low ecological status grass species. Patches opened up by excavations do not necessarily follow the same succession pattern as patches that are opened up by overgrazing or fire.

Though not suitable for assessing ecological conditions in open grassland/savanna or rocky ridges the Riparian Vegetation Index method (Kemper, 2001) provided useful information that could be incorporated as guidance for ecosystems that are not wetlands as well. Vegetation adjacent to the rocky ridges has also been studied though the main focus remains the rocky ridges.

3.4. Limitations

It should be emphasized that the survey can by no means represent a full account of all the species and their abundances on the site. Full analyses, such as complete randomised sampling or detailed stratified random sampling, followed by detailed ordination analyses are not practical within the time constraint and objectives of the study. Survey methods and analyses were adapted to fulfil the objectives of the study within its practical limitations. The site was visited during April 2012 which comprises an optimal time of the year to document ecological conditions.

4. RESULTS AND DISCUSSION

Table 1 gives an outline of the main vegetation assemblages (communities) at the site with emphasis on the ridge vegetation. Only one community associated with the ridges at the site, has been identified.

Table 2 lists the species with a high fidelity to the vegetation assemblages locally at the site. Fidelity classes from preferential, selective to exclusive (Kent & Coker, 1992) are used here to indicate habitat specificity locally at the site. Some of the species with a high fidelity are widespread in Gauteng but can be locally indicative of unique ecosystems. In the case of this study some plant species with a high fidelity at certain rocky habitats also stands out as being particularly habitat specific in the regional and international context.

Table 3 gives a summary of the ecological conditions of the main vegetation assemblage at the rocky ridge.

Figure 1 illustrates of the main vegetation assemblage identified for the interpretation of ecological conditions at the ridge at the site.

A discussion of the results in tables 1, 2 and 3 as well as Figure 1 then follows.

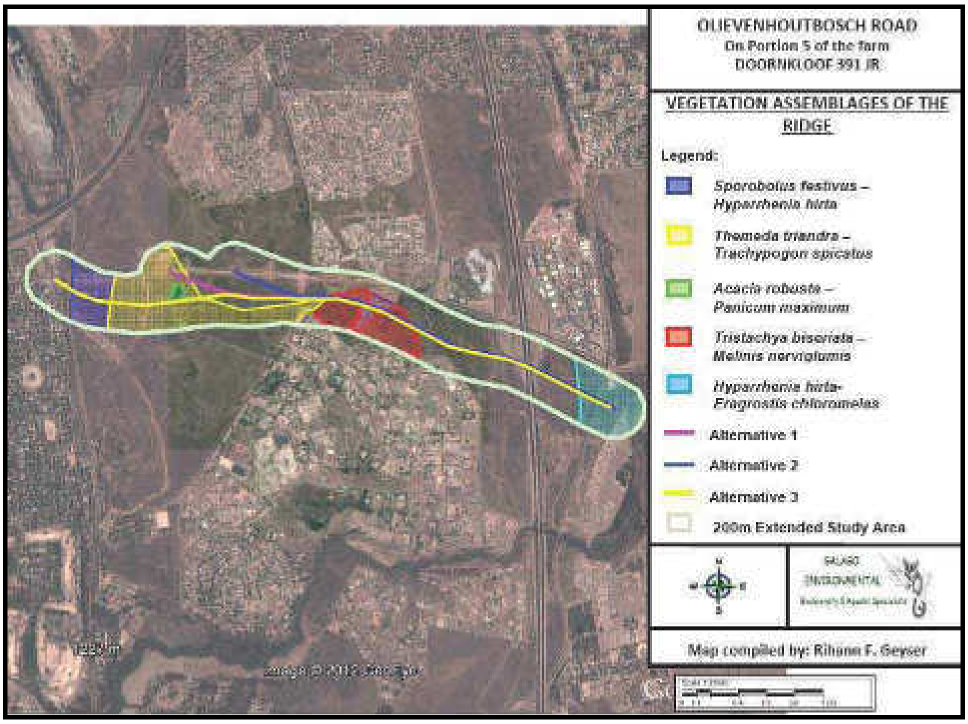

Figure 2: Vegetation assemblages (communities) at the ridge in terms of ecological conditions

Table 1: List of ridge vegetation assemblages at the site and a summary of the most dominant plant species recorded from each assemblage with 30m transect surveys (note: basal frequency). Most dominant species are listed as well as the relative frequency of other species combined.

Plant assemblage	Location in study area	General vegetation structure	Number of 30m transects used	Species	Relative frequency: percentage
Hyparrhenia hirta* – *Eragrostis chloromelas assemblage	Eastern section between M57 and Rietvlei NR	Grassland with very few trees	4	*Hyparrhenia hirta* *Eragrostis chloromelas* *Themeda triandra* Other species	47 20 14 19
Tristachya biseriata* – *Melinis nerviglumis *assemblage*	Central section between Cornwall Hill and Nellmapius road	Trees and shrubs with sparse grass cover	3	*Tristachya biseriata* *Melinis nerviglumis* *Themeda triandra* Other species	30 27 14 29
Themeda triandra* – *Trachypogon spicatus *assemblage*	Quartzite hill with reservoir on top	Grassland with sparse tree cover	4	*Themeda triandra* *Hyparrhenia hirta* *Trachypogon spicatus* Other species	29 25 14 32
Acacia robusta* – *Panicum maximum *assemblage*	Northern slope of quartzite hill	Dense woodland patch	2	*Panicum maximum* *Setaria sphacelata* *Themeda triandra* Other species	56 16 15 13
Sporobolus festivus* – *Hyparrhenia hirta *assemblage*	Lower dolomitic slopes north and west of quartzite hill	Mosaic of tall and short grassland (shorter grass at shallow dolomitic rock patches)	4	*Hyparrhenia hirta* *Themeda triandra* *Sporobolus festivus* Other species	41 26 15 18

Table 2: Summary of characteristic species of the main vegetation assemblages of the site. Characteristic species are here indicated to be those plant species that are rare or absent elsewhere at the site i.e. with a high degree of fidelity to certain vegetation communities at the site.

Description of plant assemblage*	Characteristic species with high degree of fidelity, including species that appear to be locally exclusive, selective or preferential in the study area		
	Species/ groups	Growth form	Fidelity
Hyparrhenia hirta – Eragrostis chloromelas assemblage	Most species have low fidelity, few species locally unique to this vegetation unit		
Tristachya biseriata – Melinis nerviglumis *assemblage*	*Melinis nerviglumis*	Grass	Preferential
	Monocymbium ceresiiforme	Grass	Selective
	Tristachya biseriata	Grass	Preferential
Themeda triandra – Trachypogon spicatus *assemblage*	*Trachypogon spicatus*	Grass	Selective
	Helichrysum setosum	Herb	Selective
Acacia robusta – Panicum maximum *assemblage*	*Panicum maximum*	Grass	Selective
	Acacia robusta	Tree	Selective
	Combretum molle	Tree	Selective
	Scolopia zeyheri	Tree	Exclusive
	Pavetta gardenifolia	Tree	Exclusive
Sporobolus festivus – Hyparrhenia hirta *assemblage*	*Sporobolus festivus*	Grass	Exclusive
	Melolobium subspicatum	Herb	Exclusive
	Lotononis laxa	Herb	Preferential

Table 3: Summary of the ecological conditions of the main vegetation assemblages at the site. Categories: Very low, Low, Moderate, High, Very high, Confirmed.

Community	***Hyparrhenia hirta – Eragrostis chloromelas*** assemblage	***Tristachya biseriata - Melinis nerviglumis*** *assemblage*	***Themeda triandra - Trachypogon spicatus*** *assemblage*	***Acacia robusta - Panicum maximum*** *assemblage*	***Sporobolus festivus – Hyparrhenia hirta*** *assemblage*
Probability of unique habitat of threatened plant species	**Low**	**Low**	**Low**	**Low**	**Confirmed (nearby < 200m)** *Melolobium subspicatum* (Vulnerable)
Unique habitat for plant species which are not threatened but of conservation concern	**Confirmed (nearby strip)** *Boophone disticha, Hypoxis hemerocallidea* (Declining)	**Low**	**Confirmed (nearby strip)** *Boophone disticha, Hypoxis hemerocallidea* (Declining)	**Low**	**Low**
Diversity of indigenous plant species	**Moderate**	**Moderate**	**High**	**High**	**High**
Unique habitat for threatened fauna	**Low**	**Low**	**Low**	**Low**	**High** *Ichnestoma stobbiai*
Frequency of total indigenous plant species	**Moderate** (disturbed patches)	**Moderate** (disturbed patches)	**Moderate** (disturbed patches)	**High**	**Moderate (disturbed patches)**
Grazing importance	**Low**	**Low**	**Moderate**	**Low**	**Low**
Connectivity, intactness	**Low (isolated)**	**Low (isolated)**	**Moderate (increasingly isolated)**	**Moderate**	**Moderate**
***Ecologically negative edge effects from surrounding areas**	**High**	**High**	**High**	**High**	**High**
***Ecologically negative edge effects to surrounding areas**	**Moderate**	**Low**	**Very low**	**Very low**	**Low**

- Ecologically negative edge effects are those edge effects that compromise the overall ecological function and integrity of an area.

Outline of plant assemblages at the ridge on the study site

Vegetation at the rocky ridges that cross the proposed development could be divided in five assemblages/ communities/ vegetation units. An outline of the vegetation assemblages that have been identified, follows:

Hyparrhenia hirta – Eragrostis chloromelas community (assemblage):

Disturbed grassland between the M57 and residential developments adjacent the Rietvlei Nature Reserve. Grass species such as *Hyparrhenia hirta, Eragrostis chloromelas* are dominant. Most plant species in this vegetation unit is common and widespread in the region but also locally.

Structurally the *Hyparrhenia hirta – Eragrostis chloromelas* assemblage consist of tall grass with very few trees. Open patches dominated by weeds are also common.

Apart from the widespread and declining *Boophone disticha* and *Hypoxis hemerocallidea* no plant species of particular conservation concern appears to occur close or at the crossing of the ridge with the proposed development.

Tristachya biseriata – Melinis nerviglumis community (assemblage):

The *Tristachya biseriata – Melinis nerviglumis* assemblage is present south of the Nellmapius road and some distance north of the Cornwall hill. Grass species such as *Tristachya biseriata, Melinis nerviglumis* and *Monocymbium ceresiiforme* are conspicuous in this assemblage. Some areas have been cleared or being disturbed where the shrub *Lippia javanica* and the grass *Melinis repens* can be abundant.

Structurally the *Tristachya biseriata – Melinis nerviglumis* assemblage consists of a variety of grass species with a mixture of shrubs and herbaceous plant species. However, where disturbances have been severe the vegetation is transformed to tall exotic weeds, shrubs and a high frequency of annual grass species.

Plant species of particular conservation concern do not appear to be present at the *Tristachya biseriata – Melinis nerviglumis* assemblage at this part of the ridge nearby the strip proposed for the development.

Themeda triandra – Trachypogon spicatus community (assemblage):

Slopes of the quartzite ridge where a reservior is present are favoured by the *Themeda triandra – Trachypogon spicatus* assemblage. Conspicuous grass species are *Themeda triandra, Trachypogon spicatus* and *Hyparrhenia hirta*.

Structurally the *Themeda triandra – Trachypogon spicatus* assemblage consists of a well-developed grass layer with scattered trees and shrubs.

Plant species of particular conservation concern at the *Themeda triandra – Trachypogon spicatus* assemblage nearby the strip proposed for the development are the declining *Boophone disticha* and *Hypoxis hemerocallidea*.

Acacia robusta – Panicum maximum community (assemblage):

The *Acacia robusta – Panicum maximum* assemblage comprises a patch of trees at the northern slope of the quartzite koppie. Crown cover of a dense patch of trees is dominated by *Acacia robusta* (ankle thorn) and *Combretum molle* (velvet bushwillow). Basal cover is dominated by the grass species *Panicum maximum* that favours the shade of trees.

Structurally the *Acacia robusta – Panicum maximum* assemblage consists of a well-developed tree stratum and a well-developed grass layer.

Plant species of particular conservation concern at the *Acacia robusta – Panicum maximum* assemblage nearby the strip proposed for the development are the widespread but declining *Boophone disticha* and *Hypoxis hemerocallidea*.

Sporobolus festivus* – *Hyparrhenia hirta community (assemblage):

The *Sporobolus festivus* – *Hyparrhenie hirta* assemblage occur at the lower and more gentle slopes of the rocky ridge where dolomite surface at small patches across this vegetation unit. Patches with tall grass, most abundant *Hyparrhenia hirta*, are interrupted by open patches where shorter grass species such as *Sporobolus festivus* are found around dolomitic rock on the surface.

A plant species of particular conservation concern at the *Sporobolus festivus – Hyparrhenia hirta* assemblage is the Threatened *Melolobium subspicatum* (Vulnerable) which became very scarce in the local area. Very few specimens seem to be left within 200m of the present proposed development.

General remarks

High frequencies of alien invasive plant species at excavations or disturbed places at the ridges in the area reflect urban edge effects.

The grazing importance of the area appears to be moderate to high. Palatable grass species such as *Themeda triandra* has overall a high frequency. See Bosch & Kellner (1991), Tainton (1999) for more information on degradation models and veld assessment. The site is too small and isolated to be of particular relevance to mega-herbivores. Smaller animals may benefit from the conservation of the indigenous vegetation at the rocky ridges.

A burning programme could be applied on the remaining natural veld, but would not be without practical difficulties in such a fragmented area with fair concentration of residences and other developed areas.

Rocky outcrops at the site should be regarded as stepping stone corridors with rocky ridges elsewhere in the local area. Rocky ridges is important for a number of ecological processes, including its function as a controller of water inputs into wetlands, fire-protection for some species and different microclimates for certain fauna and flora (Samways, 1994; Lowrey and Wright, 1987; Pfab 2001).

5. CONCLUSION

- Transformation of vegetation owing to present excavations, scraping or other disturbances are clear at the site. Exotic weeds and annual pioneer grass species invade such disturbed patches.
- Overall Alternative 2 appears to be ecologically the least sensitive strip.
- Alternative 3 is not preferred. This proposed alternative 3 passes the quartzite ridge and the lower dolomitic slopes near areas where a Threatened plant species, *Melolobium subspicatum* are present. Furthermore alternative 3 crosses sensitive ecosystems notably the *Acacia robusta – Panicum maximum* as well as the *Sporobolus festivus – Hyparrhenia hirta* assemblages. The slopes of the quartzite koppie as well as the intersection between the dolomite and chert approaches a habitat which may be suitable for the rare and threatened fruit chafer beetle, *Ichnestoma stobbiai*.
- *Ichnestoma stobbiai* is an endangered fruit chafer (Scarabaeidae: Cetoniinae) that occurs in small habitat fragments of South Africa (Kryger & Scholtz, 2008). The adults of this species are short-lived and the females are flightless. Thus, the vagility of these beetles is extremely low (Kryger & Scholtz, 2008). The species *I. stobbiai* (Holm, 1992) is thought to occur in a very restricted area in and around Gauteng Province and all habitat patches should be protected (Kryger & Scholtz, 2008; Deschodt, Scholtz & Kryger, 2009). Unlike most cetoniine larvae, the larvae of this species usually occur in dolomitic to cherty, well-drained soils (Deschodt, Scholtz & Kryger, 2009).

- A Class 3 rocky ridge is present at all the intersections of rocky ridges with the proposed strip allocated for the development.
- Fire and frost probably play an important role in maintaining the grassland at the ridge and therefore a burning programme is desirable.
- In an increasingly urbanised area, the possible conservation importance value of rocky ridges is underlined at the site both in terms of remarkable diversity and as refuge for threatened species.
- Though a class 3 rocky ridge is present it is believed that near pristine patches of rocky ridge may still be conserved at the site.
- Proper ecological planning and actions are urgent and include:
  - The eradication of invasive exotic plant species at the site.
  - Development of conservation infrastructure that would avoid the continuous trampling, excavations and informal dumping which are present in the area.
  - The zoning of habitats where threatened species occur as a no-go area for *any* developments.

It appears that Alternative 3 will have an undesirable impact on an ecosystem of high conservation priority and that Alternative 2 in terms of biodiversity and ecosystem functioning is the preferable option.

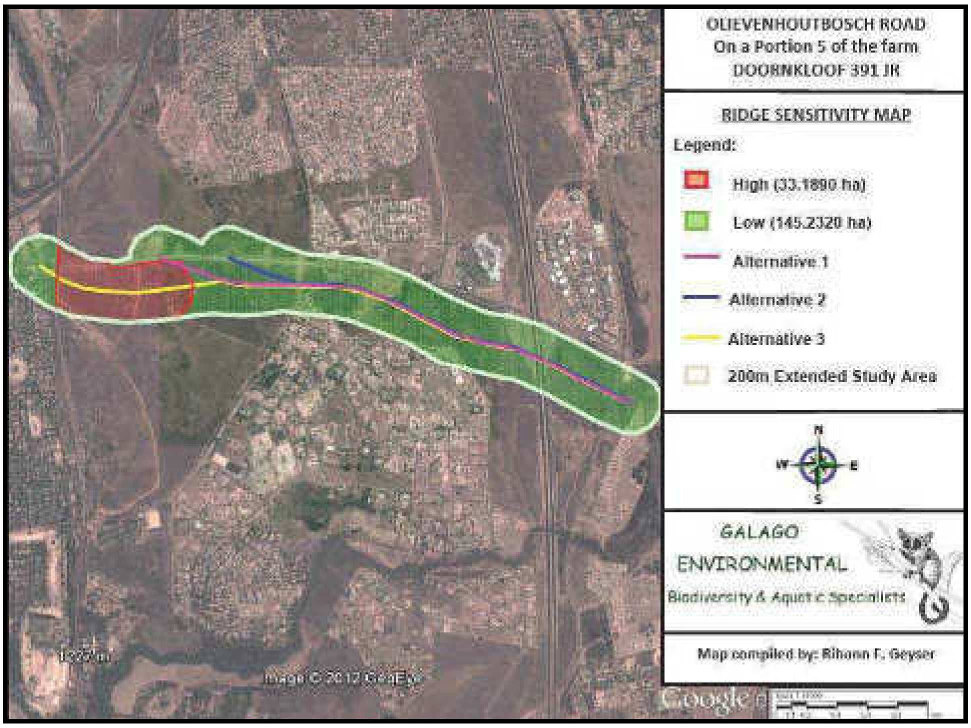

Figure 3: Sensitivity map of the ridges on site

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