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LIST OF ABBREVIATIONS

BP Report: Basic Planning Report

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

GDACE: 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

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.

C-Plan: The GDACE'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.

Agricultural Hub: An area identified for agricultural use by GDACE.

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.

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 encompassing 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.

1. INTRODUCTION, BACKGROUND AND WAY FORWARD

1.1 Introduction

The application is made for authorization of the **Preliminary Design, Detail Design and Construction for route K220 between K109 and R21 Albertina Sisulu Freeway (Road 157-1), including the intersections**. The proposed road only represents a section of the K220 route that runs between the **N1-21 (Ben Schoeman Highway)** and **Road P36-1**, crossing Road P157-1 (R21 Albertina Sisulu Freeway). The involved section of K220 between **K109 (km 11,20)** and **R21 Albertina Sisulu Freeway (km 19,642)** is approximately **8,44 km** in length (refer to Figure 1, Locality Map and Figure 2, Aerial Map).

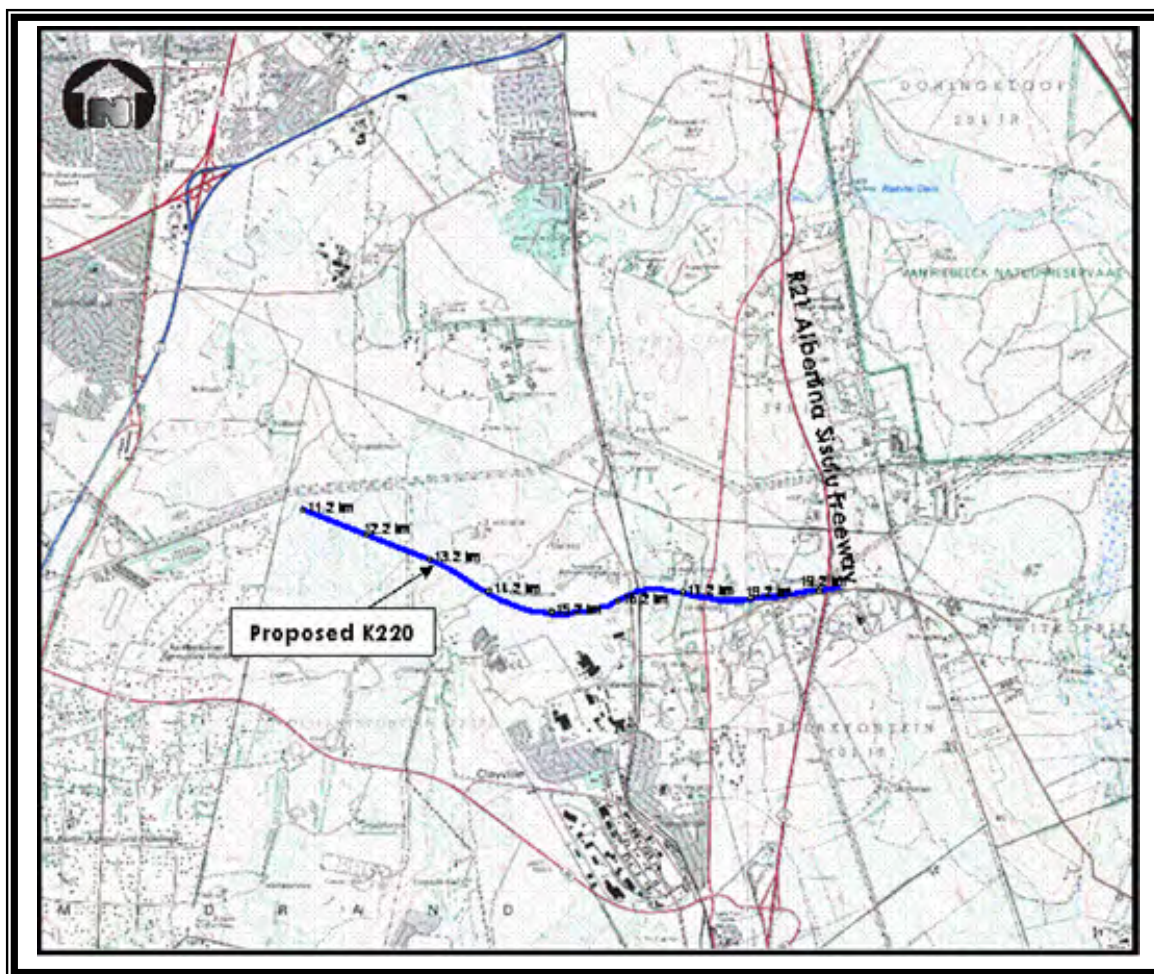
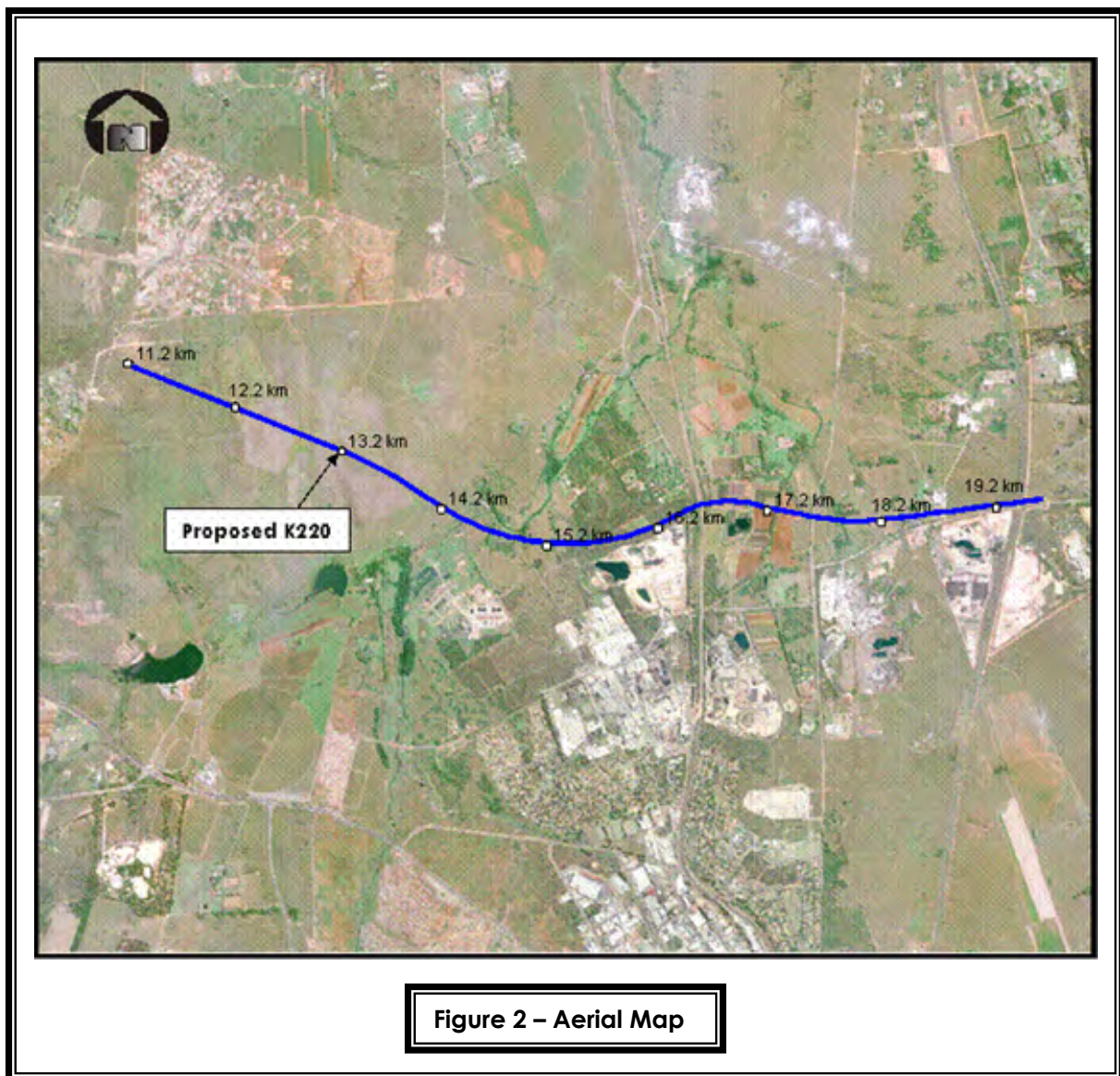


Figure 1 – Locality Map



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

Route K220 is a planned east-west provincial major arterial road, located south of Centurion, and is intended to form a west-east link connecting the developing southern suburbs of Centurion with the future planned Waterberg Road in the west (planned by Tshwane Metropolitan Municipality immediately to the west of the N1-21, (Ben Schoeman freeway) and Road P157-1 (R21, Albertina Sisulu Freeway) in the east. It also facilitates access to various other north-south routes such as K101, K111, K105 and K109.

Dabra Design Services and **UWP Engineers** were appointed to undertake the preliminary design of the section of route K220 from the K101 (the Old Johannesburg Road) to route K109 (east of P157-1). The preliminary design for the section of route K220 from km 8,40 up to km 13,430 (between K101 and K111) was done by UWP Engineers while the preliminary design from km 13,430 to km 22,430 (between Route K111 and Route K 109 (east)) was done by Dabra Design Services.

ITS Engineers have been appointed for the Detail Design of the section of route K220 from K109 to R21 Albertina Sisulu Freeway.

1.2 Background

The Environmental Impact Management Guideline document published by the Department of Environmental Affairs and Tourism, in April 1998 identified the activity of the planning and construction of a provincial road numbered and administered by a provincial authority as a potentially detrimental activity that needs to be investigated. In Regulation 1182, Schedule 1 (c) and (d) of the former EIA Regulations and in Part 4 of the National Environmental Management Act (Act 107 of 1998), the construction and upgrading of transportation routes were identified as specific listed activities, which required that the EIA process be followed. However, the fact that road planning consist of various planning phases (network planning phase, route determination phase, preliminary design phase and the detail design phase) made it difficult for authorities, applicants and environmental consultants to determine the specific EIA process (scoping/ EIA) required for each planning phase. As a consequence, Gautrans and the Department of Agriculture, Conservation Environment and Land Affairs (GDACE) agreed (in a Memorandum of Understanding (MOU)¹) that an Environmental Scan be conducted for the Route Determination Stage, that a Scoping Report be conducted for the Preliminary Design Stage and that an EIA Report be compiled for the Detail Design Stage of each provincial road. Although the Scoping and EIA reports were a requirement of the

¹ According to one of the Officials at GDACE the original MOU as referred to above has been amended. We were not yet able to obtain a copy of such document. We would therefore appreciate it if GDACE could supply us with a copy of the revised MOU or with the contact details of the person/ department that could supply us with a copy of the document.

former EIA Regulations, the environmental scan report required for the route determination phase of a road was not a requirement of the EIA process.

The environmental scan was however added to the road planning process to assist with the determination and identification of the most significant environmental issues and "fatal flaws" before entering into the costly preliminary and detailed design stages of roads. The MOU also required that a Road History Report, which supplies the history and background of the road applied for, be included as part of the specific road report submitted to the authorities for evaluation. The purpose of the road history report was to supply the planning history of a specific road to GDACE, because the network planning for the Gauteng Roads already commenced more than 30 years ago and all the roads on the network plan are at different planning stages and different levels of engineering² and environmental³ reports have been compiled for the various roads.

The MOU as discussed above was however compiled when the former EIA Regulations were still in place and there appears to be some confusion regarding the applicability of the MOU amongst the EIA consultants and the GDACE officials. According to some of the officials the MOU is still applicable and according to other officials, the validity of the MOU expired when the former ECA EIA Regulations were replaced by the New NEMA Regulations. We already tried to arrange several meetings with GDACE to get clarity regarding the applicability of the MOU and the level of detail required for the Scoping, EIA and Basic Assessment Reports to be compiled in line with the New NEMA Regulations (as described in item 1 above), but unfortunately this effort was unsuccessful.

1.3 Way Forward – MOU Versus The NEMA Requirements

Due to time constraints, it is not possible to wait until the above mentioned process discrepancies have been resolved. It was therefore decided to take the requirements of the New NEMA Regulations as well as the above mentioned MOU into consideration and

² i.e. Route Determination reports/Basic Planning Reports/Detail Design Reports

³ i.e. Environmental Evaluation Reports (prior to the EIA Process)/Environmental Scans/Scoping Reports/ EIA Reports

to combine the historical and new information regarding the road into one report that will supply GDACE with enough information to make an informed decision at the end of the EIA process.

Ms. L. Gregory of Bokamoso has more than 15 years experience in road planning in Gauteng. She assisted the former PWV Consortium with the compilation of the MOU between GDACE and Gautrans and she compiled Road History Reports and Environmental Scans for many of the Provincial Roads in Gauteng. These reports were compiled in line with the report requirements of the MOU.

Although the proposed road will be a provincial road, Gautrans gave Mr. Francois van Rensburg (Traffic Engineer of M & T Development) the authority to apply for the involved section of the road on behalf of the **Gautrans. Bokamoso Landscape Architects and Environmental Consultants** were therefore appointed by **M & T Development** as independent consultants (on behalf of **Gautrans**) to prepare the applicable environmental reports for the **Preliminary Design, Detail Design and Construction for route K220 between K109 and R21 Albertina Sisulu Freeway (Road 157-1), including the intersections**. This EIAR has been prepared to comply with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).

The Gauteng Department of Agriculture, Conservation and Environment (GDACE) 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 1 February 2008. GDACE requested that the following information requirements be addressed in the EIAR:

- a) Wetland assessment along the 8.44 km route must be conducted following procedures outlined below:
- A delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas and is part of the wetland that remains flooded or saturated close

to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.

- Locating the outer edge of the temporary zone must make use of four specific indicators including the terrain unit indicator, the soil form indicator, the soil wetness indicator and the vegetative indicator.
- The wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. The edge of the wetland must be clearly demarcated in the field with poles, sticks, or any solid structure that will last for the duration of the development, colour-coded as follows:
 - **Red** – Indicating the edge of the wetlands, or parts thereof; and no vehicles or building materials are allowed in this zone. (These should be put along the entire length of the property/site).
 - **Orange** – Indicating the edge of the buffer zone (50m outside the urban edge). However, allowance must be made for sensitive species that require larger areas, e.g. Grass Owl, Giant Bullfrog, etc.
 - **Green** – Indication where the first structures will be built (e.g. stands/plots building, paving, wall fencing, etc).

- Refer to Section 7.1.3, page 91 and Annexure J for the Wetland Delineation Report.

- The buffer zone and edge of the wetland are indicated on the **Sensitivity Map** (refer to Figure 23).

- The demarcation of the wetland edge had been incorporated into the EMP (refer to Annexure U).

- All wetland habitat must be surveyed for the following mammal species: *Aonyx capensis*, *Atilax paludinis*, *Chrysospalax villosus*, *Dasymys incomtus*, *Lutra maculicollis*, *Otomys angoniensis* and *Otomys irroratus*. The applicant must obtain minimum requirements for the mammal studies by e-mailing EIAADMIN@gauteng.gov.za or downloading the appropriate document form the www.gdace.gpg.gov.za website.

Refer to Section 7.2.3, page 138 and Annexure M.

b) A vegetation survey must be undertaken by a suitably qualified specialist taking into consideration the conditions not limited to the following:

- Survey must take place during the summer season.
- The location and extent of all plant communities on site must be mapped and their ecological sensitivities indicated. All good condition natural vegetation must be designated as ecologically sensitive.
- A general Red Data plant survey must be undertaken. Lists of potential species can be obtained from Lorraine Mills (Lorraine.Mills@gauteng.gov.za)
- A plant species list must be provided for each plant community with medicinal and invasive/exotic species indicated.
- The condition of any grassland on site must be assessed and the location and extent of primary grassland mapped. All primary grassland must be designated as ecologically sensitive.
- Those plant species located by the specialist during surveys, the entire extent of the population must be accurately mapped out, augmenting with data already collected by the Directorate of Nature Conservation.
- If the site is smaller than 12 ha, then at least a 12 ha area, centered on the proposed development site, must be assessed for the presence of primary grassland.
- Results must be incorporated into a sensitivity map.

Refer to Section 7.2, page 106, Annexures K and L and Figure 23.

c) Furnish the Department with the River Assessment Study which include the following:

- An ecological study, with specific emphases on ecological processes & connectivity at the landscape level.
- Assessment of the current ecological state of the river or stream, based on the River Health Programme biomonitoring protocol (FAII, SASS5, IHI & RVI) & classification.
- Delineation of the 1:100 year & 1:50 year flood lines.

- Delineation of the riparian zone according to "DWAF, 2003: A Practical Guideline Procedure for the Identification & Delineation of Wetlands and Riparian Zones".
- Delineation of a 100m buffer zone from the edge of the riparian zone for rivers/streams outside the urban edge and a 32m buffer zone from the edge of the riparian zone for rivers/streams within the urban edge.
- Impact assessment of the proposed development on the hydrological regime and the change thereof, including the effect of that change on the downstream habitat and integrity of the system.
- Flood lines, riparian zones and buffer zones must be designated as sensitive in a sensitivity map.
- The edge of the watercourse must be clearly demarcated in the field with poles, sticks or any solid structure that will last the duration of the development, colour-coded as follows:
 - **Red** – Indicating the 1:100 and 1:50 year flood lines. (These should be placed along the entire length of the property/site).
 - **Orange** – Indicating the edge of the buffer zone (32m for areas within the urban edge & 100m outside the urban edge), and
 - **Green** – Should indicate where the first structure(s) will be built (e.g. stands/plots, building, paving, wall fencing, etc).

Refer to Section 7.2.3, page 138 and Annexure M.

d) A bird survey in terms of the procedure outline below:

- i. The report must include the following information:
 - A map showing the location of the proposed development site and the area that was covered by the survey.
 - The date and hours spent on the site as part of the methodology section of the report.
 - An assessment of the availability of suitable bird habitat (breeding, foraging, roosting etc) on site and within a minimum of 500m of the site. A larger area may be appropriate for wide-ranging species and the specialist must use his/her discretion to determine this.

- A sensitivity map demarcating areas of suitable bird habitat (differentiating between breeding, foraging, roosting etc), for each Red List species, together with appropriate buffers and corridors. All sensitive habitats (e.g. wetlands) must be clearly demarcated using appropriate techniques, even where the probability of Red List species utilizing them is considered small.
 - GPS coordinates [decimal degrees (WGS)] for all confirmed sightings of Red List species.
 - The size and location of buffers must be motivated in terms of the latest research and publications. All references must be listed at the end of the report.
 - Where mitigation measures are appropriate, these must be detailed together with the relevant problem statement.
 - A comprehensive, site-specific ecological management plan for all proposed open spaces, buffers and corridors that are relevant to the species and/or habitats under investigation.
- ii. Specialist assessment must encompass the site and all relevant adjacent properties (minimum of 500m radius). Where suitable foraging and roosting habitat occurs on site, the nearest suitable breeding habitat must be identified for those species that breed in Gauteng.
- iii. Surveys for terrestrial birds must be conducted in summer, but only once the vegetation layer has recovered sufficiently from winter fires to allow for assessment of available habitat.
- iv. Surveys for aquatic birds must be conducted in summer. For species associated with river, the assessment must coincide with average flow conditions (i.e. not dry and not in flood) and preferably within the breeding season. For species associated with wetlands the assessment must follow good summer rains (i.e. once standing water is present and vegetation has recovered sufficiently from winter fires to allow for the assessment of available habitat).

Refer to Section 7.2.2, page 117 and Annexure K.

e) The impact assessment process must consist of the following:

- A description of the methodology used to identify possible impacts.
- A thorough process of identification of impacts.
- A description of the criteria used to rate the impacts for significance.
- An assessment of each impact according to nature, extent, duration, intensity and probability.
- Rating of the impacts according to significance.
- Interpretation of the results of the above.
- Cumulative impacts of the proposed road construction project.

Refer to Section 10, page 231.

f) A detailed Stormwater Management Plan must form part of the study and it must consider the following:

- The containment of stormwater during the construction phase, a period when there is a potential to cause the most amount of damage to natural drainage systems.
- The management of stormwater. It must be noted that no stormwater must be allowed to enter any of the natural drainage systems directly. This stormwater must be diverted through forms of stormwater retention facilities for containing and releasing flood water in a way that simulate natural flow into the natural drainage systems to assuage associated erosion and siltation problems that may arise.

Refer to Section 5.5 and Annexures E and F.

g) Service (water, electricity, sewerage and stormwater and traffic management) provision during construction phase must also be addressed.

Refer to Section 8.4.4 and EMP attached as Annexure U.

h) The Environmental Management Plan (EMP) complying with regulation 34 of Environmental Impact Regulations, 2006 must also be submitted with the Environmental Impact Assessment Report (EIAR).

Refer to Annexure U.

Comprehensive Public Participation Process must be conducted in terms of regulation 56 of Environmental Impact Regulations, 2006. Comments from South African Heritage Resource Agency (SAHRA) on historical sites where the proposed road is being proposed must be submitted as part of the EIAR. ***Refer to Section 8.1, Page 152 and Annexures N and O.***

- i) Also as part of public participation process, relevant affected parties must be identified and comment on the following:

- Crossing of railway line and road
- Crossing of servitudes
- High power cables
- Rand water pipeline

Refer to Section 8.4.6, page 205 and Annexure T.

- j) Comments from Department of Water Affairs and Forestry (DWAF) especially on the impact of the proposed road construction activities on the river and riparian vegetation must be attached to the EIAR.

The comments received from DWAF stated that their department is in agreement that all issues and impacts pertinent to the mandate of DWAF have been identified and that tasks to address these have been included in the Plan of Study for EIA. It should be ensured that further reports and water use authorisation applications are submitted to the relevant Regional Office of DWAF for consideration and processing. ***Refer to Annexure B for comments received from DWAF.***

The relevant Section 21 Water Use License applications have already been submitted to DWAF (***refer to Annexure C for proof.***).

- k) A detailed Geo-technical report conducted by the qualified specialist must be forwarded to this Department as an EIAR attachment.

Refer to Section 7.1.1, page 55 and Annexure G.

In addition, GDACE is of the opinion that impacts on agricultural potential areas of the proposed road should be determined and be submitted as part of the EIAR.

Refer to Section 8.2, page 156 and Annexure P.

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 Scoping Report. In this regard, attached as **Annexure D**, is a copy of the CV of the EAP for this project, Ms. Lizelle Gregory from Bokamoso Landscape Architects and Environmental Consultants. 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 15 years experience in the following fields:
 - Environmental Planning and Management;
 - Compilation of Environmental Impact Assessments;
 - Landscape Architecture; and
 - Landscape Contracting

Me. 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. Activities Applied for in Terms of NEMA

Notice No. R 386 and R 387 of the New Regulations list activities that require that the EIA process be followed. The Activities listed in Notice No. R 386 requires that a Basic Assessment process be followed and the Activities listed in Notice No. R 387 requires that the Scoping and EIA process be followed. However, the draft guideline document supplied by DEA&T states that if an activity being applied for is made up of more than one listed activity and the scoping and EIA process is required for one or more of these activities, the scoping and EIA process must be followed for the entire application. The applicant is applying for the following listed activities:

Table 1: Listed activities in terms of Notice No. R 386

No. R. 386 of 21 April 2006	Activity 15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.
No. R. 386 of 21 April 2006	Activity 1 (m)	The construction of facilities or infrastructure, including associated structures or infrastructure, for - Any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including- (i) canals; (ii) channels; (iii) bridges; (iv) dams; and (v) weirs.
No. R. 386 of 21 April 2006	Activity 4	The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.

Table 2: Listed activities in terms of Notice No. R 387.

R. 387, 21 April 2006	5(b)	The route determination of road and design of associated physical infrastructure, including roads that have not yet been built for which routes has been determined before the publication of this notice and which has been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government notice No. R. 385 of 2006, where – (b) it is a road administered by a provincial authority.
R. 387, 21 April 2006	5(c)	The route determination of road and design of associated physical infrastructure, including roads that have not yet been built for which routes has been determined before the publication of this notice and which has been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government notice No. R. 385 of 2006, where – (c) the road reserve is wider than 30 metres.

Please note that the presence of wetlands was confirmed during the EIA phase and as a result Activity 4, R. 386 of 21 April 2006, was added to the list of listed activities. The additional activity was included in the public participation process of the EIA Phase (refer to Section 8.4.6)

4 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, Conservation and Environment (GDACE). 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 development on the surrounding environment (including the interested and affected parties).

This document represents the EIA for the proposed development. 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)).

5. DESCRIPTION OF THE PROPOSED ACTIVITY

5.1. Name of activity

The preliminary design, detail design and construction of route K220 between the K 109 and R21 Albertina Sisulu Freeway (Road P157-1) including the intersections. Route K220 is proposed to link with the K101 on the western side and R21 Albertina Sisulu Freeway on the eastern side by means of an interchange. The involved section of the K220 is approximately **8,44 km** in extent.

5.2 Delineation of the study area

The section of the K220 investigated only represents a section of the K220 route that runs from the N1-21 (Ben Schoeman Highway), crosses P157-1 (R21 Albertina Sisulu Freeway) and originally terminated where it linked up with road K109 (east), however the route was extended to continue up to P36-1). The involved section of K220 stretches from **K109 (km 11,20) to R21 Albertina Sisulu Freeway (km 19,642)** and is approximately **8,44 km** in length.

Refer to figure 3.

Although the Gauteng New 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 route.

There were cases in the past where GDACE 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

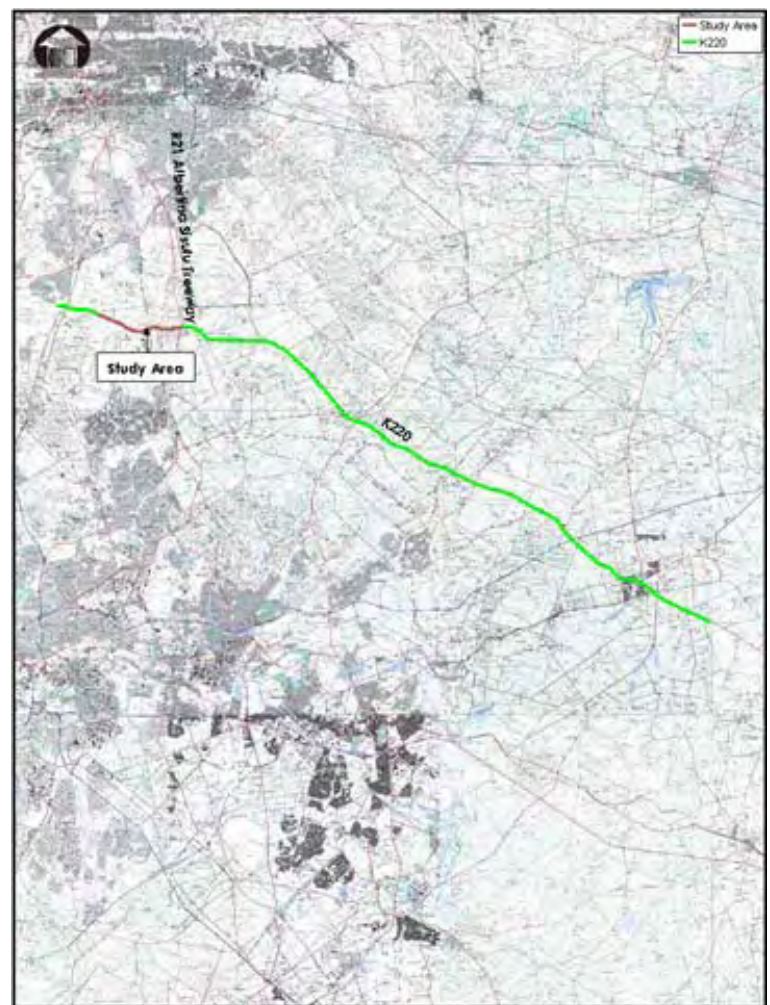
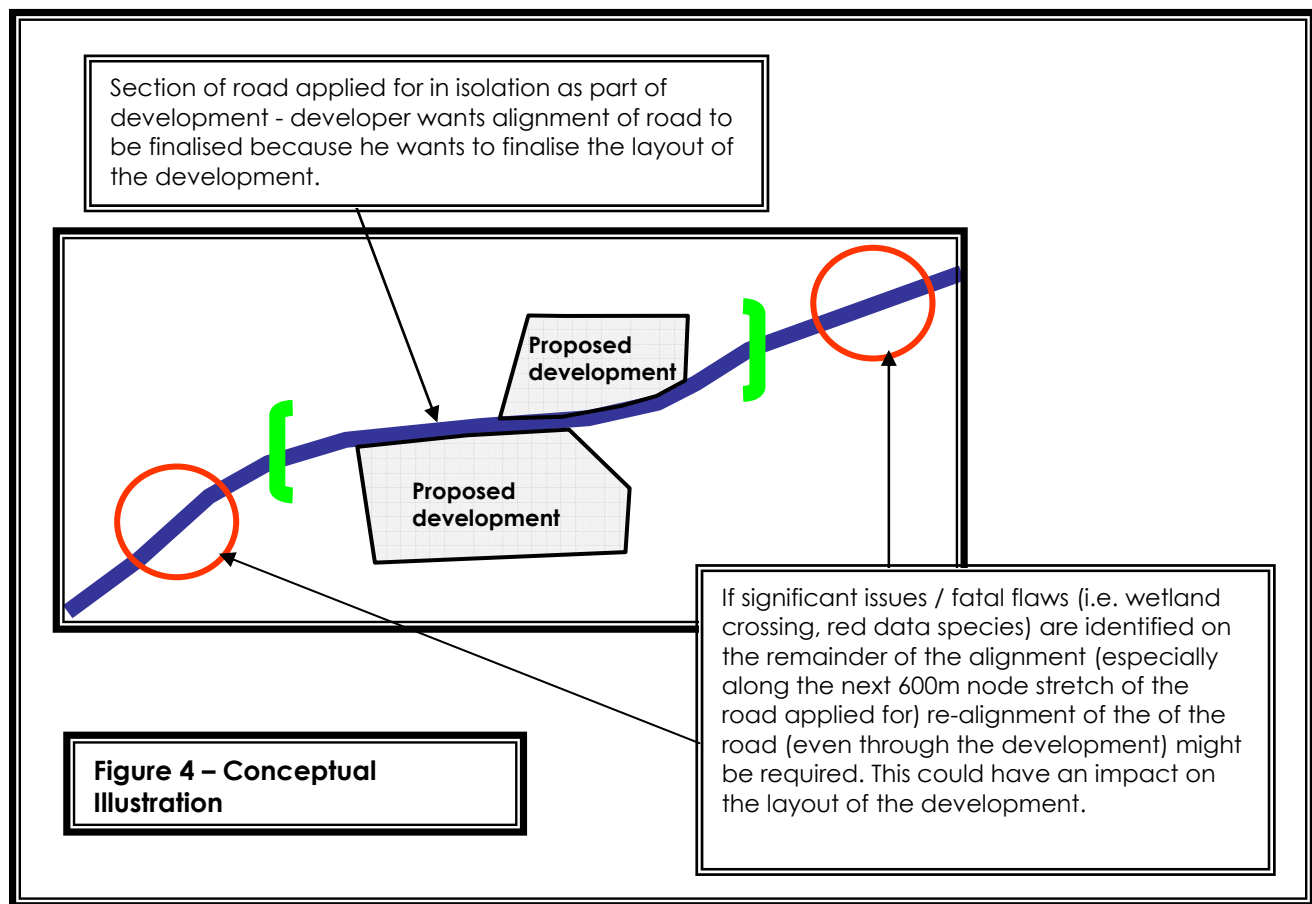
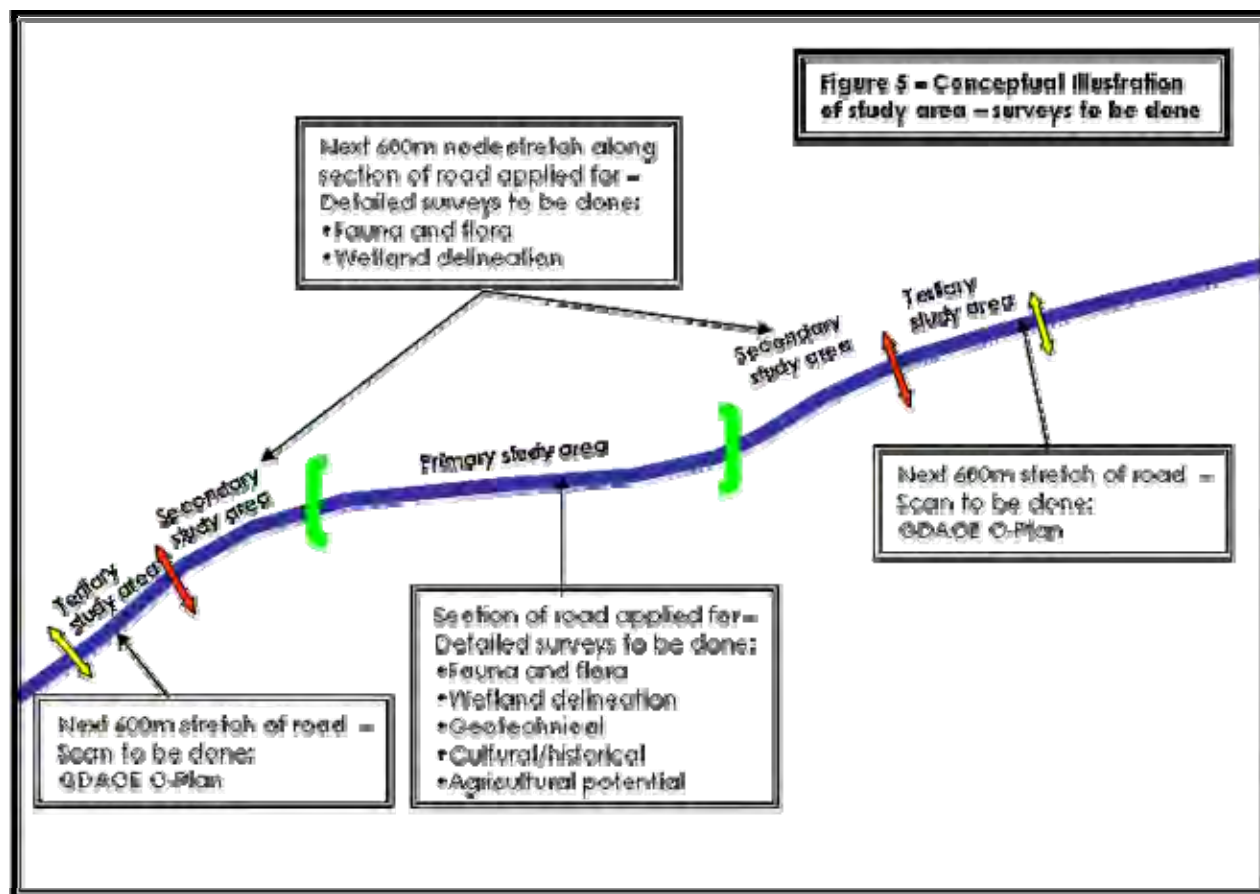


Figure 3 – Delineation of study Area

environmental issues / “fatal flaws” were identified along other sections of the road not applied for as part of a specific development. Refer to *Figure 4* below for a **conceptual illustration**.

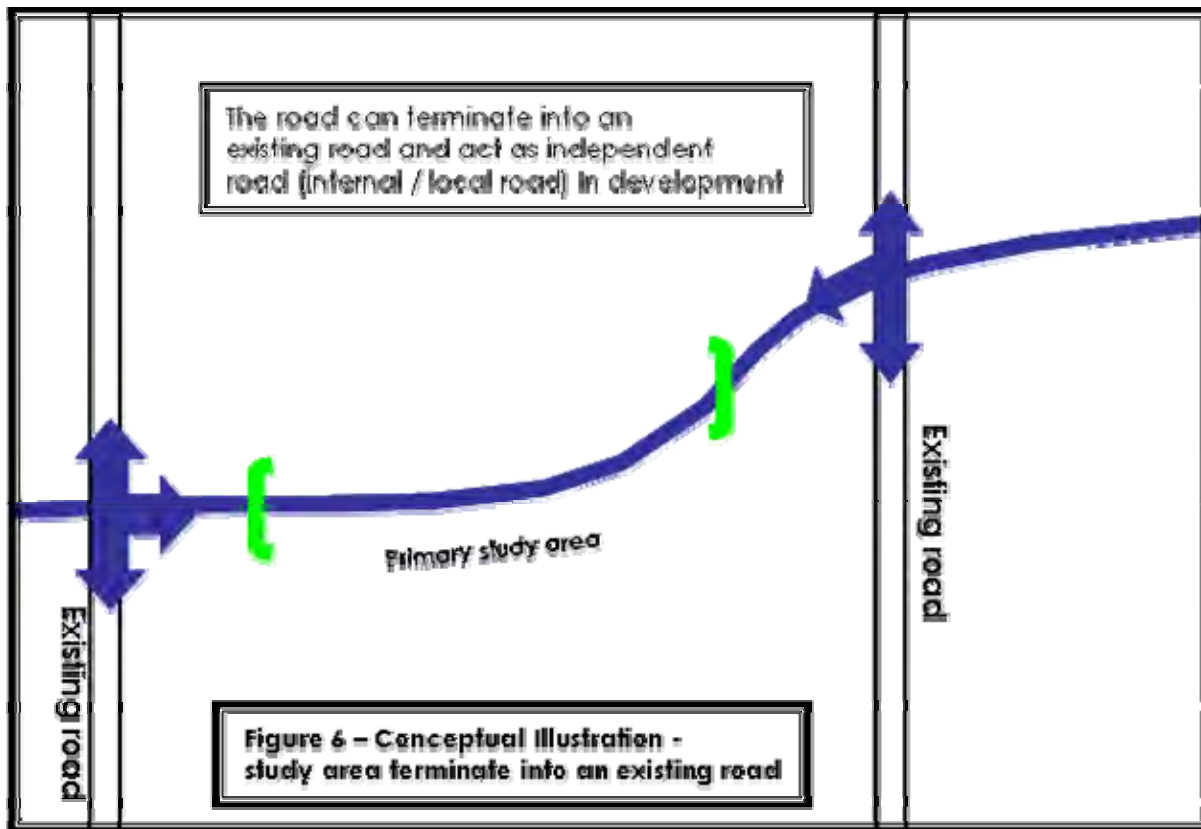


In order to prevent such cases, GDACE now requires that EAPs not limit their environmental assessments to the portion of a road applied for, but that they also extend their investigations to incorporate a longer section of the road (to both sides of the involved portion of the road). This will allow for two options: (i) amendments in the alignment or (ii) to investigate a portion of road that can easily terminate at existing roads and act as an independent internal / local road if “fatal flaws” prevent the remainder of the route from happening. Refer to *Figure 5 and 6* for conceptual illustrations.



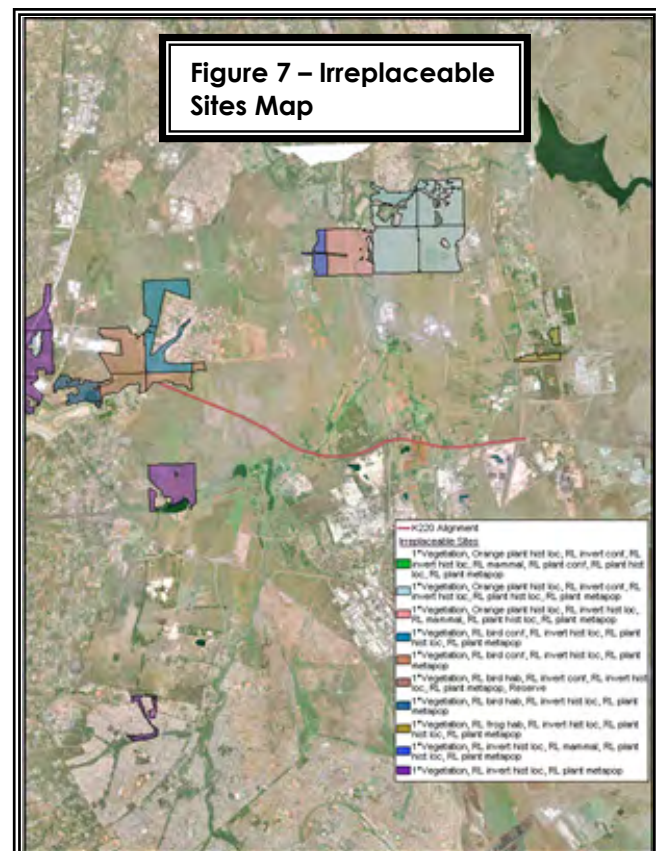
Gautrans considers an acceptable minimum distance which would allow for an amendment in the alignment to be 600m from a node (distance from one intersection to the next potential intersection)⁴. It is therefore recommended that detailed surveys also be done for the adjacent 600 m past the end points of the section of road applied for and that a scan (GDACE C-plan) be done for a further 600m extension of the road.

⁴ Provincial / national roads are divided into 600m nodes which allows for intersections or termination of a road.



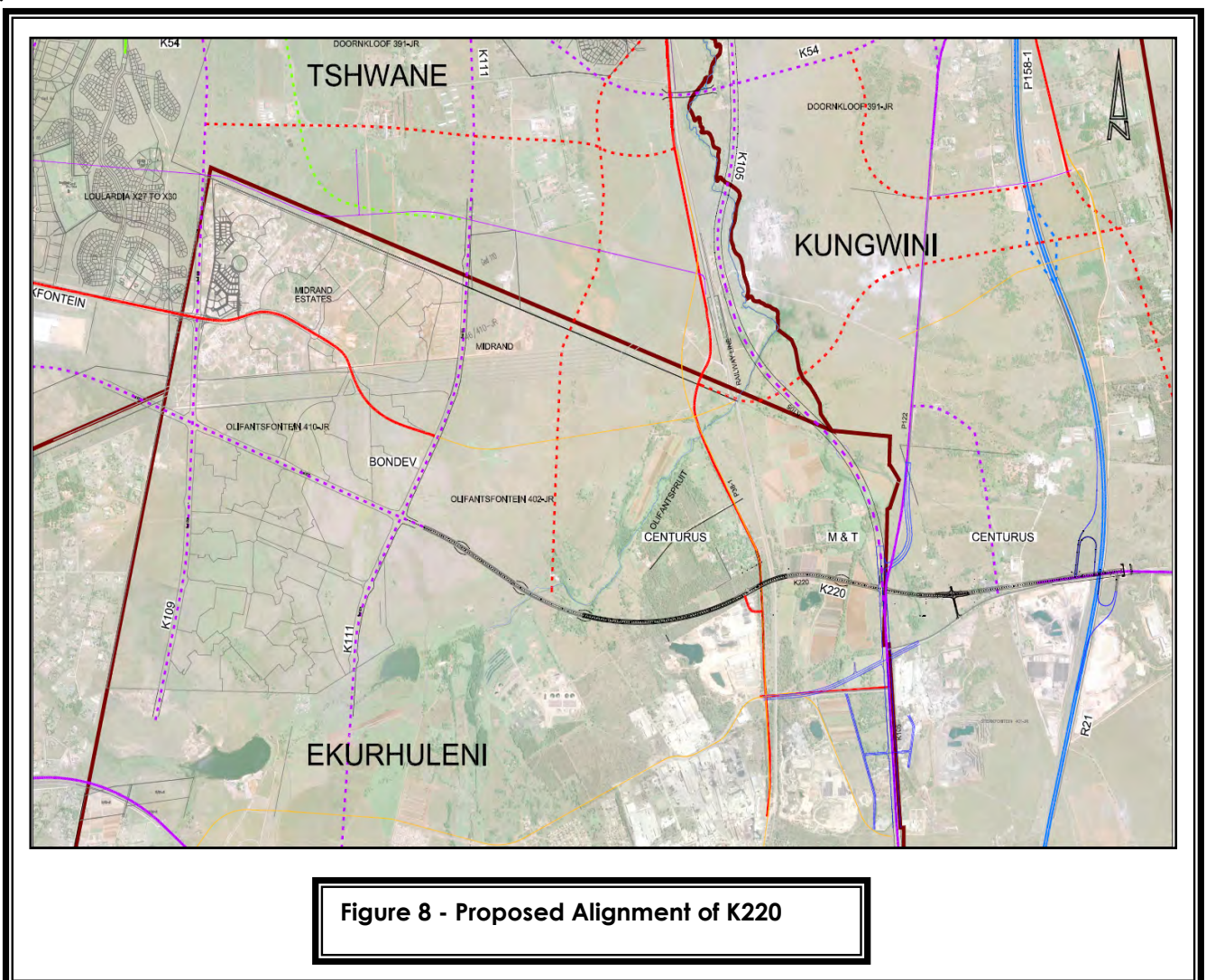
In the case of this application the EAPs investigated the 600m node extensions of the involved section of the K220 and identified possible issues along the western extension due to the presence of irreplaceable sites (RL bird habitat, RL invertebrates and RL plants), as indicated in *Figure 7*.

The fauna and flora survey included a 500m buffer around the study area and found no possible issues that could result in a “fatal flaw” (*refer to Annexures K and L and Section 7.2 for a detailed discussion*).



5.3 Background

Jointly, Bondev, Centurus and M&T Development own more than 95% of the property affected by the involved section of Route K220. Bondev is currently developing the area known as Midstream Estate, which only has network access to the west to the N1 Freeway and the R101 via Brakfontein Road. M&T Development is planning the development of the Strawberry Farm area which may gain access off the Provincial roads P122-1 and D781. Centurus is planning the development of the Gilliamead area and the area between Provincial road P38-1 and the Bondev property. ***Refer to Figure 8, proposed Alignment of K220.*** The planned route K220 is expected to open up the respective development areas for development and facilitate regional east-west connectivity and access to both the N1-Freeway in the west and the R21-Freeway in the east.



The Gauteng Provincial Government, Ekurhuleni Metropolitan Municipality and Kungwini Local Authority do not regard the construction of the K220 as a priority project. The construction of K220 is estimated at more than R100 million and therefore can not be borne by one developer only. The three developers therefore decided to work together to develop a business plan for the construction of the road. To expedite the finalisation of the route alignment and acceptance of the route it was agreed between the developers that the Environmental Impact Assessment must proceed to obtain a Record of Decision from the Gauteng Department of Agriculture Conservation and the Environment. It was agreed between the three developers, i.e. Bondev, Centurus and M&T Development, that Bokamoso Environmental Consultants will be appointed by M & T Development for the EIA application process.

5.4 Particulars of applicant

Applicants Name: Mr. Francois van Rensburg
On behalf of M&T Development (Pty) Ltd

Physical Address: Block 5
Boardwalk Office Park
Haymeadow Crescent
Faerie Glen
Pretoria

Postal Address: P.O. Box 39727
Faerie Glen
0043

Tel: (012) 991 9700
Fax: (011) 991 3038

Contact Person: Mr. Francois van Rensburg

5.5. Particulars of Activity

Nature of Activity

During the mid-seventies, Gautrans compiled a gridlike road network covering the traditional PWV area. The grid network concept was based on a road hierarchy system comprising a range of mobility and access routes. The design of the Gauteng Provincial Road Network hence is based on a grid pattern covering the whole province comprising freeways (PWV routes) and supporting dual carriageway roads (K-routes).

Based on overseas experiences and a reasonable expectation of land use densification, it was decided to space freeways approximately 12 km apart, with a minimum spacing of 5km. A total of 22 new freeways were identified for the whole Gauteng/ PWV area. A secondary road system of K-routes was planned to make maximum use of existing roads, with a spacing of between 2 and 3 km, based on similar considerations as the freeways. The K-route network is a supporting route network to freeways and amongst others serves the function of linking the freeway network to the local road networks of Gauteng. In many instances, the access function of a K-route unlocks the development potential of an area.

According to the PWV Consortium none of these routes (neither freeways nor K-routes) can be eliminated from the network or its function replaced by the adjacent route as it would unbalance the network. Each route also serves specifically the strip of land adjacent to it. By eliminating one route from the network, the remainder of the routes will carry the additional traffic load, which consequently leads to congestion and poor traffic conditions.

As already mentioned the proposed activity is the Preliminary Design, Detail Design and Construction of Route K220 between K109 and the R21 Albertina Sisulu Freeway, including the intersections.

- **Location of Activity – (In line with Section 32 (c))**

Refer to Figure 1, Locality Map, Figure 2, Aerial Map and Figure 9, Alternative alignments

Two final alignments, **Alternative A** and **Alternative E** were identified by Gautrans after consulting with the stakeholders and Interested and Affected Parties and will be discussed in this EIAR. **Alternative A was ultimately identified as the preferred alternative (refer to Section 9, page 206 for a detailed comparison of these alternatives).**

As already mentioned the proposed alignment of the involved section of the K220 is located to the south of Centurion and runs in a **west-east** direction between the **K109 and the R21 Albertina Sisulu Freeway**.

Both **Alternative A** and **Alternative E** start and end at the same point but follow different routes in between.

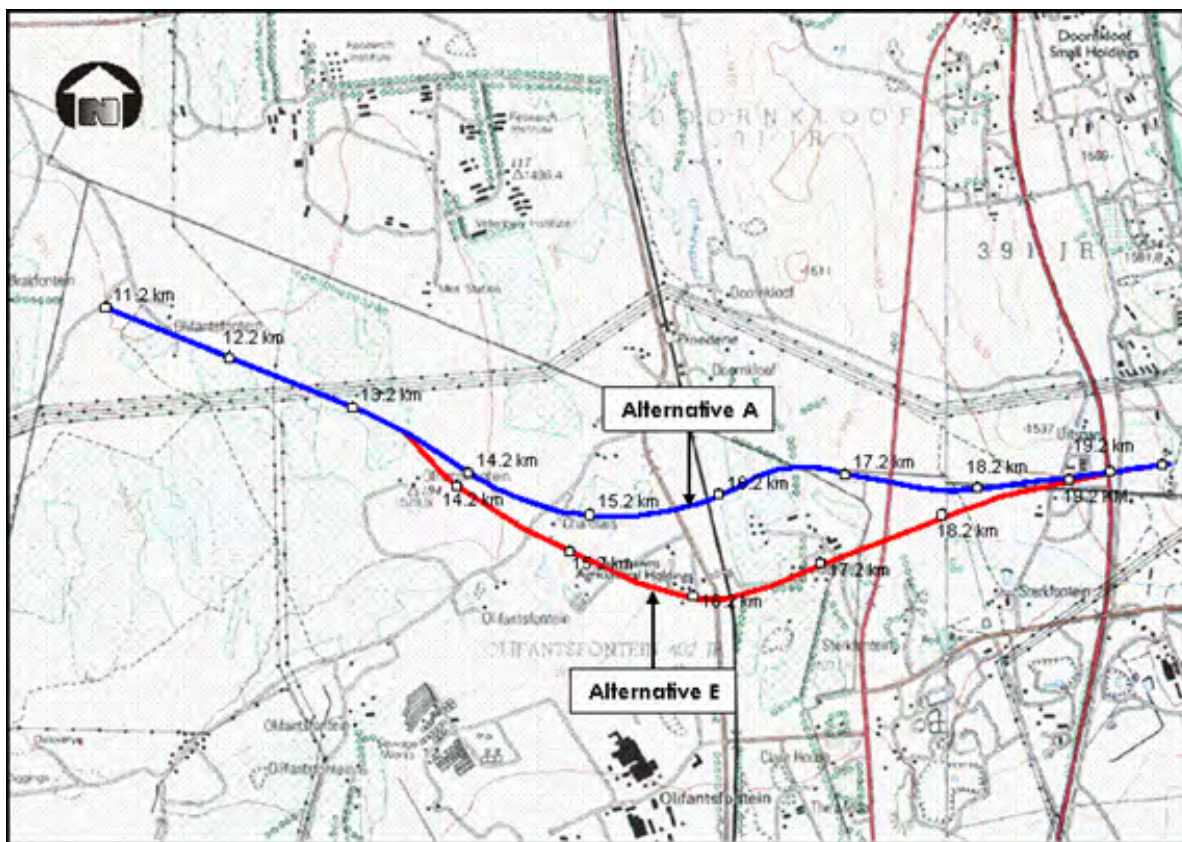


Figure 9 – Alignment Alternatives

- *The role of route K220 in the Gauteng Road Network and the importance of the proposed road for the Kungwini Local Municipality and Ekurhuleni Metropolitan Municipality.*

Refer to Figure 10 for locality of the proposed K220 within the larger Gauteng Road Network System

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

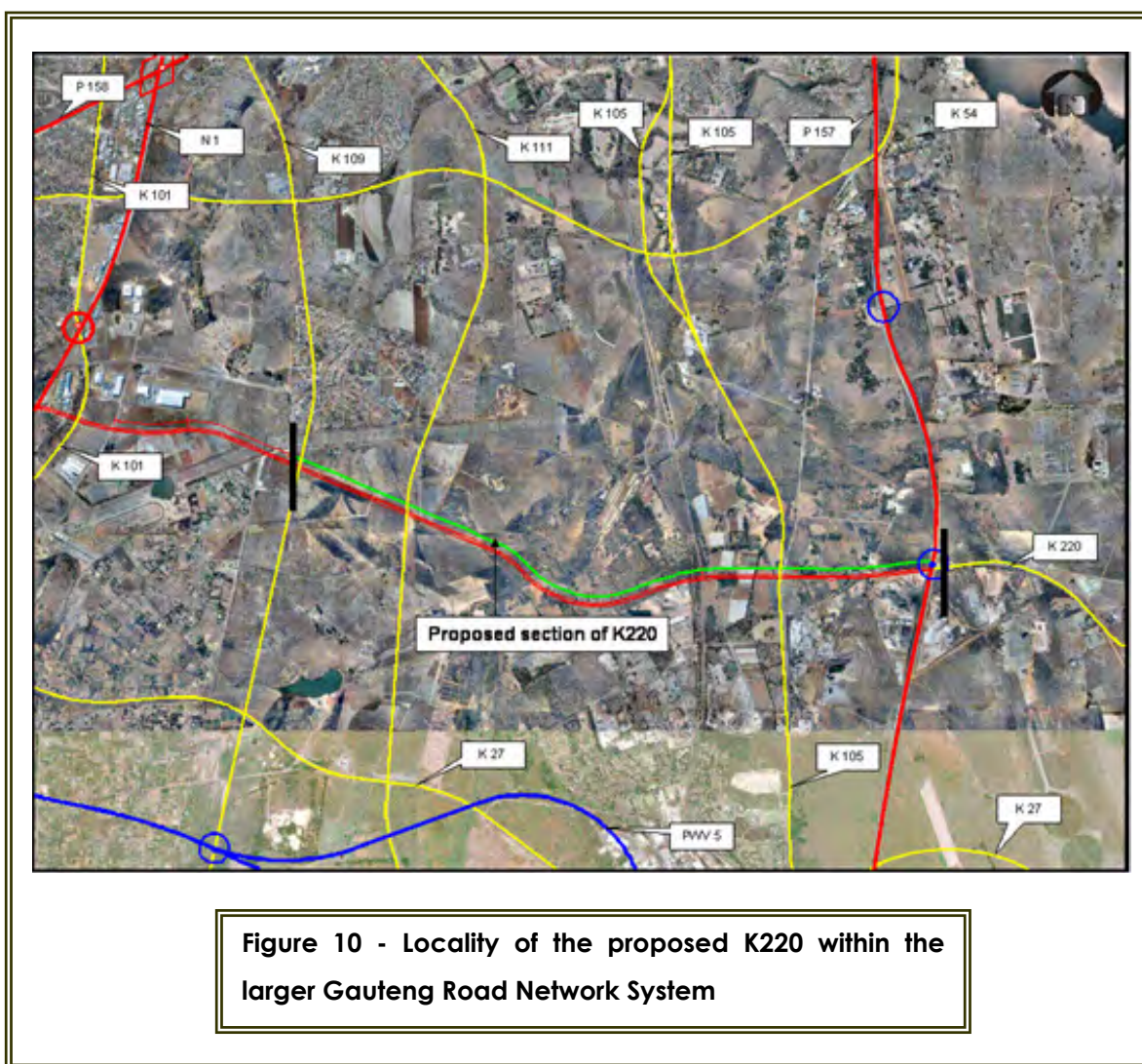
- The economic growth of the province which currently stand at almost double the national growth rate;
- Increased urbanization towards the major cities; and
- Increased job opportunities resulting in more people engaging in economic activity thereby increasing their personal wealth including property 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 Provincial Government has also announced its UniCity Vision for the three major Metros in Gauteng in which development in Tshwane, Johannesburg and Ekurhuleni must be encouraged to fill in the areas between the cities rather than encouraging urban sprawl.

It is envisaged that the planning and the subsequent construction of the Route K220 between the N1 Freeway and the R21 Albertina Sisulu Freeway will support the infill of development between the mentioned metropolitan areas, while also alleviate

congestion on the existing road network system. It will furthermore link the segregated areas between the west (N1 / Midrand areas) and east (Irene / Tembisa / Olifantsfontein / Clayville / Pretoria East). The proposed road network link will divert traffic from existing road network links and thereby alleviate congestion on the existing road network system. It also facilitates access to the various north-south roads and freeways (both existing and planned).



This road link will establish another element to facilitate a more balanced road network and is also part of the Local Authority and Provincial Government's road network planning for the larger areas.

In order to ensure an efficient hierarchy of roads, primary distributors are spaced between regional distributors (freeways), in a grid approximately 3km apart. In addition to the K220, the other east-west primary distributors in the area are the K54, approximately 3km to the north, and the K27 approximately 3km to the south.

When this area is developed to its full potential, all three these roads will be required to effectively distribute the east-west traffic in the area. The only east-west freeway in this area is the proposed PWV 5, approximately 10 km south of the proposed K220.

The north-south primary distributors that will distribute traffic between the N1 freeway in the north and the PWV 5 in the south, is K111 West, K111 East, K105, K109 and K101.

Due to capacity constraints on the N1 Freeway, and the fact that it will not be possible to provide additional interchanges on the N1 Freeway between the Brakfontein interchange and PWV 5, the K220 will be of paramount importance to provide mobility in the area.

- ***The Need For Route K220***

Refer to Figure 11 for Surrounding Development Map

A reassessment of the major road network in the area and its development potential has indicated the need to strengthen the regional network. The Gauteng Provincial Government has identified the corridor linking the OR Tambo International Airport and Tshwane as well as the corridor linking Johannesburg and Tshwane as areas of economic opportunity in the region. The K220 will serve an important east-west traffic distribution function in the area linking these two corridors.

The area is largely vacant with residential developments to the north, warehousing and light industrial developments to the west as well as Olifantsfontein industrial and Tembisa residential areas to the south-east. The area has a high potential for development and job creation (*refer to Figure 11, Surrounding land use map*).

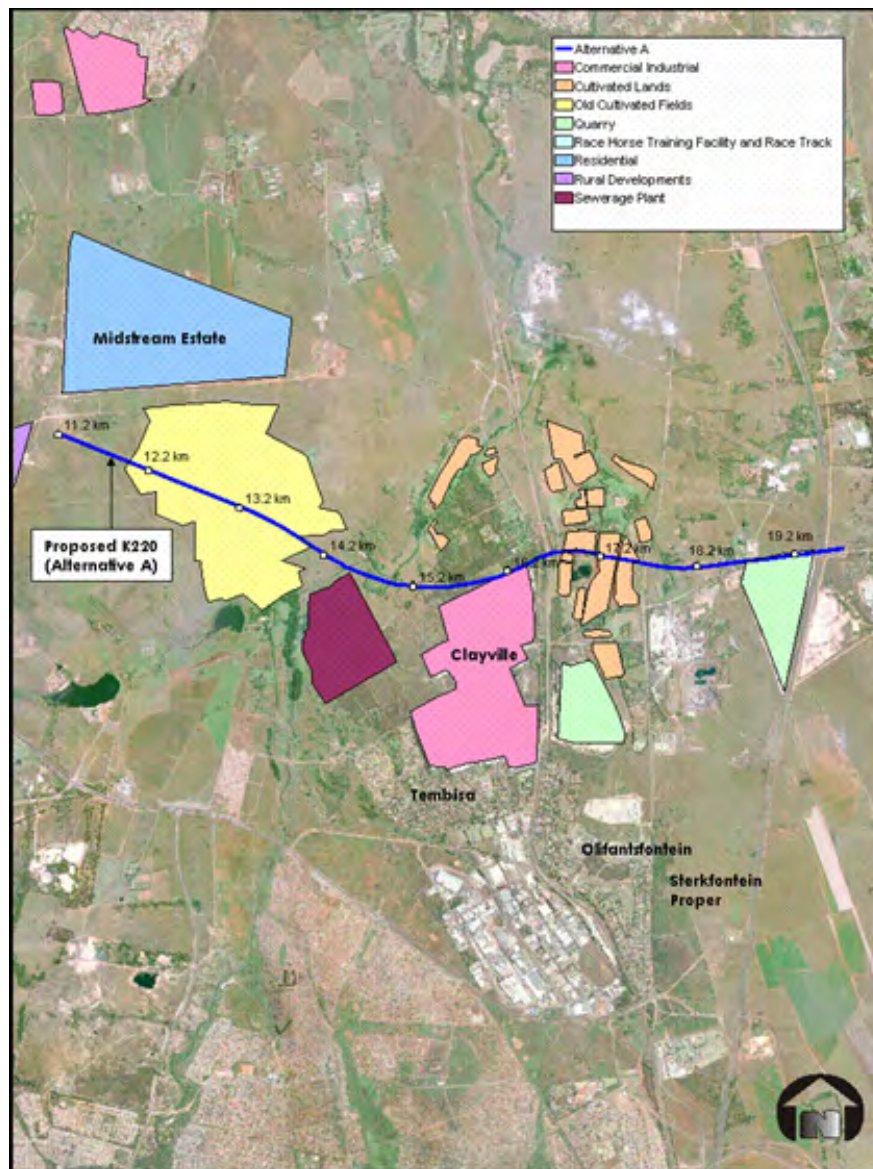


Figure 11 – Surrounding Land Uses

The area has no high order access routes at present and the proposed K220 will open up the area for development and will provide a vital link between Tshwane and the N1 Freeway in the west and Ekurhuleni, Kungwini and the R21 Albertina Sisulu Freeway in the east.

The road will provide much needed accessibility to large areas of vacant land and will provide a critical link across the barriers formed by the north-south railway line and the Oilfantspruit in the north-western quadrant of Ekurhuleni.

From a road network planning and capacity point of view the K220 can not be omitted from the network as the remaining roads will not have sufficient capacity to support the provincial development vision for the area.

- ***Existing roads***

Except for a short section close to the crossing with road P157-1 (R21 Albertina Sisulu freeway) where route K220 replaces a section of road D781 (Apollo Road), the proposed route for K220 does not follow an existing road nor does it replace any road or is it close to any parallel existing road.

- ***End Points And Length***

The section of the K220 to be constructed is proposed to be from the **K109 (km 11,20)** in the west to the **R21 Albertina Sisulu Freeway (km 19,642)** in the east.

The proposed section has a total length of approximately **8.44 km**.

- ***Geometrical Standards Of The Proposed Route***

For preliminary design purposes a four lane stage was applied using the two outer lanes.

According to the involved engineers the terrain allows for the achievement of a high standard of vertical and horizontal alignment with relative ease.

Horizontal alignment details

This section of the K220 follows the horizontal alignment as proposed in the Basic Planning (BP) Report for Route K220 between route K111 and Route K109 (East) at km 20,0 in the district Ekurhuleni by the Gauteng Department of Transport and Public Works⁵.

Alternative A (proposal)

From **km 11,20 to km 13,430** both alternatives follow the same route. Between **km 13,50** and **km 18,719** **Alternative A** follows a different route from **Alternative E**. From km 13,430 **Alternative A** runs south-easterly up to km 13,50 from where it continues around a right turn 2000 m curve to run more southerly up to km 14,33 where it turns left in a 2000 m radius curve to continue north-easterly up to the crossing of the existing Road P38-1 and the electrified double railway line. At km 16,55 the route swings right again around an 850m radius curve to run south-easterly again but at km 17,71 **Alternative A** then turns left through a 2000m radius curve to run parallel to the existing Road 781 in an easterly direction up to the limit of planning at km 19,760, crossing P122-1 (K105) at km 17,66 and the R21 Albertina Sisulu Freeway at km 19,53.

Alternative E

Between **km 13,500** and **km 18,719** **Alternative E** deviates from **Alternative A**. From km 11,2 to km 13,430 both alternatives follows the same route. From km 13,430 **Alternative E** runs south-easterly up to km 13,51 where it turns slightly right in a 3000 m radius curve to continue south-easterly up to km 16,01 where the route swings left around a 850 m radius curve to run north-easterly, crossing the existing Road P38-1 and the electrified double railway line. At km 18,01 this alternative then turns right through a 3000 m radius curve to run parallel to the existing Road 781 in an easterly direction up to the limit of planning at 19,996, crossing P122-1 (K105) at km 17,86 and the R21 Albertina Sisulu Freeway at km 19,77. *Refer to Figure 9, Alternative alignments.*

⁵ The BP Report is available on request

Vertical alignment

The only high fill ($\pm 4\text{m}$) is at the stream crossing at km 10.8 (not situated within the involved section of the K220) and the only deep cutting required is at **km 11,3 ($\pm 3\text{m}$)**. The remainder of K220 and the intersections are all in shallow fill between 0.5 and 1.5 in depth.

The design standards achieved between km 8.400 and km 13.430 are shown in **Table 3**

Table 3: Design Standards

Item	Specification	Actual	
		Alternative A	Alternative E
Design speed – km/h	100	100	100
Absolute minimum radius – m	850	850	850
Desirable minimum radius – m	1000	2000	3000
Maximum curve length – m	2000	2117,323(1)	923,63(3)
Design speed for super elevation – km/h	80	80	80
Maximum super-elevation - %	6	0-6-0	0-6-0
Minimum road reserve width – m	48,4	48,4	48,4
Maximum gradient - %	6	3,15	3,30
Minimum gradient	0,5	0,64	1,05
Minimum curve length – m	180	180	180
Minimum K-values: Crest sight distance	96	101,5	110,9
Minimum K-values: Crest	62	101,5	68,5
Minimum K-values: Sag	37	43,9	38,7

- ***Design speed***

The involved section of Route K220 has a design speed of **100km/h** as specified in the Design Manual of the Gauteng Department of Public Transport, Roads and Works.

- ***Intersecting roads and accesses***

All the intersections have been planned as at grade intersections except at the crossing of P38-1 and P157-1. Road P38-1 runs close to and parallel to a railway line and as a result of this close proximity to the railway line, an at grade intersection with K220 is impossible, and a quarter link is provided between these two roads.

An existing road-over-road bridge is situated at the crossing of the R21 Albertina Sisulu Freeway and Road D781. The route for K220 was positioned in such a way that the east bound right hand carriageway falls exactly on D781, utilizing the bridge to its full extent in the provision of the new interchange at this point.

Road 38-1 from K220 via K 105 (P122-1) and Road D781

It was initially suggested that no direct link be provided from K220 to P38-1 and that access to and from K220 to P38-1 be obtained via K105 (P122-1) and road D781. However, this was not an acceptable option due to the longer travelling distance and costs associated with the required upgrading of the sub-way bridge at the crossing of the D781 with the railway line. As a result it was recommended that a quarter link be provided to connect Road P38-1 with K220.

A quarter link can be provided for **Alternative A** to connect P38-1 with K220, but a section of P38-1 will have to be rebuilt over a distance of approximately 600m. More properties in the Sunlawns Agricultural Holdings are affected, resulting in higher expropriation costs.

However, no quarter link can be provided for **Alternative E** due to a lack of sufficient space. Access from K220 to P38-1 via K105 and Road 781 can perform as a link for smaller vehicles with a travel distance of approximately 1,6 km. Bigger and commercial vehicles will have to follow the indirect link road from the access at km 15,300 on K220 and then via Keramiek Street and Porcelain Road to link up with P38-1 with a travel distance of approximately 2,5 km.

- ***Future Intersections and Accesses***

Future intersections / access positions have been allowed for at a minimum spacing of 600m to provide points of possible access from adjacent properties should it be required at some stage in future.

These positions have been indicated in broken lines on the layout plans and any future development adjacent to K220 will have to adhere to these proposed points of access.

R21 Albertina Sisulu Freeway Interchange

Projected traffic volumes on K220 were obtained from the Gauteng Transportation Model for the year 2010 by including the following roads: K54, K105, K111 and K220.

The modelled average traffic flow during the morning peak hour is 2077 vph. The highest traffic volumes at the proposed R21 Albertina Sisulu freeway/K220 access interchange are 732 vph and 744 vph in the northbound on-ramp and the southbound off-ramp respectively.

During the planning stage, several alternative layouts were considered but the layout finally accepted (**Alternative A**) was derived after considering the following factors:

- The position of the new road D2382;
- Utilise the existing bridge number 2738;
- Minimize the effect of the interchange on the existing overhead power line pylons in the interchange area;
- According to the current design standards the clearances at the existing structure becomes critical with any road widening on the R21 Albertina Sisulu freeway to allow for on/off-ramp tapers. The existing bridge cannot accommodate any road widening on the R21 Albertina Sisulu Freeway to allow for possible on/off-ramp tapers on Parclo interchange configurations;

- The vertical clearance on the existing bridge – no widening of the existing bridge on its southern side is possible due to lack of sufficient vertical clearance;
- The existence of current mining activities – mining is very active in the south-western quadrant with deep excavation and mountains of materials present;
- The existence of worked out mines and associated deep excavations.

Road K220 was therefore aligned in such a way that the existing bridge will form the southern (right-hand looking east) portion of the new structure with all future widening taking place on the northern (left hand) side. At the same time, since the existing bridge cannot accommodate any road widening on the R21 Albertina Sisulu Freeway, the on/off-ramp tapers were designed to start past the critical clearance point.

- ***Other transport services***

Both alternatives must cross over an existing double railway line which is in slight fill. The railway line is a major link between Pretoria and Johannesburg and carries a significant amount of traffic. It is not possible for the road to pass under the railway line because the free and natural drainage of water is not possible. According to the involved engineers the construction of such a structure will also be immensely difficult.

- **Major Structures**

Major structures (i.e. bridges) are envisaged at the following km readings:

- Km 14,515 – Olifantspruit
- Km 16,580 – K220 over P38-1
- Km 16,707 – K220 over Railway line
- Km 19,520 – K220 over R21 Albertina Sisulu Freeway

Section 21 Water Use License applications for the river and drainage line crossings had been submitted to DWAF (refer to Annexure C).

- **Storm Water Drainage**

The preliminary design for Route K220 includes all aspects associated with road drainage such as bridges, culverts, side and median drains, kerb and grid inlets, chutes, catch water banks and subsoil drainage. Details of the road drainage systems are shown on the plans for both Alternative A and E (*refer to Annexure E*).

Culverts

As stated in the BP Report, apart from established waterways that are encountered along the proposed route for K220, drainage structures are provided for overland flow. Box culverts have been used in fill areas to facilitate a lower grade line with a corresponding saving in cost. Pipe culverts have been placed in positions where enough fill height is available and also in median drains. The proposed position, number and size of all drainage structures are shown on the layout plans and longitudinal sections (*refer to Annexures E*).

Runoff volumes have been calculated using the rationale method and have been based on a mean annual precipitation (MAP) of 750 mm. Runoff factors ranging from 0,2 to 0,4 have been used. A HW/D ratio of 1,2 was adopted as far as possible to determine the capacity of the drainage structures and a minimum free board of 100mm below shoulder break point was used throughout.

At km 18,20 culverts are proposed for the crossing of the drainage line and associated wetland (*refer to Annexure F for details of culverts*).

Culverts have been designed for a return period of 1 in 25 years.

Bridges

According to the involved engineers a return period of 1 in 50 years is used in determining the bridge opening over the Olifantspruit and the flood plain immediately up-and down-

stream of the bridge site. The proposed bridge will be 40 m wide to prevent impacts on the floodplain upstream and downstream of the bridge.

Side drains and Median drains

Side and median drains have been designed for a maximum flow velocity of 1 m/s and a maximum flow depth of 200 mm for all unpaved sections. A rain fall intensity of 225 mm/h has been adopted for the design of all side drains, medians and kerb inlets. Adequate side drain and median drain inlets have been provided to distribute the surface run-off evenly to prevent the concentration thereof. The grid inlets have been designed in accordance with the maximum allowable back water height and maximum capacity. The orifice- formula was used to determine the capacity of the grid inlets.

Subsoil drainage

Subsoil drainage systems have been provided in all cuttings where problems with subsurface water are expected. The need for these subsurface drains will have to be investigated prior to the construction of the road.

- ***Time Frame***

The developer is planning to commence with the construction phase as soon as the EIA had been approved (only if GDACE decides to grant authorisation for the road after the EIA was submitted and considered).

The construction timeframe for the proposed road will be between 6 – 12 months.

5.6 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 was planned initially on a 1: 50 000 scale and pro-actively managed ever since by Gautrans. 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.**

Broad network planning was followed by route determination. 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 aspects; 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 accurately and to conduct a cost framework. This phase includes also details regarding bridge structures,

culverts and road cuts and fillings. The commencement of this phase is normally dependant on either or 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.

- **Detail Design And Construction.**

During this phase all physical, environmental and socio-economic issues are integrated with the road planning and land will be expropriated. 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 the K220 is currently at the detail design stage.

6. ALTERNATIVES IDENTIFIED - (In line with Section 32 (f) and (h))

6.1 The “No-Go” Alternative

The proposed route K220 traverses an area with high development potential and Gautrans has identified the necessity to establish the road infrastructure to direct and facilitate development. Route K220 forms an important west-east link connecting the rapidly growing areas south of Centurion with the future planned Waterberg Road in the west and Road P157-1 (R21-Albertina Sisulu freeway). It also facilitates access to the various north-south roads and freeways (both existing and planned) and for future property developments now commencing in this area.

The establishment and protection of the road reserve form a very important part of controlled development and the road reserve needs to be established as soon as possible. Once the road reserve has been established the planning for access to properties and future developments can be controlled.

If the “No-Go” alternative is followed future development will be restrained, and if not managed properly, the road reserve may not be protected and expropriation costs in future will increase to high levels. The “No-Go” alternative is therefore not considered as a viable alternative from a transport and economic point of view.

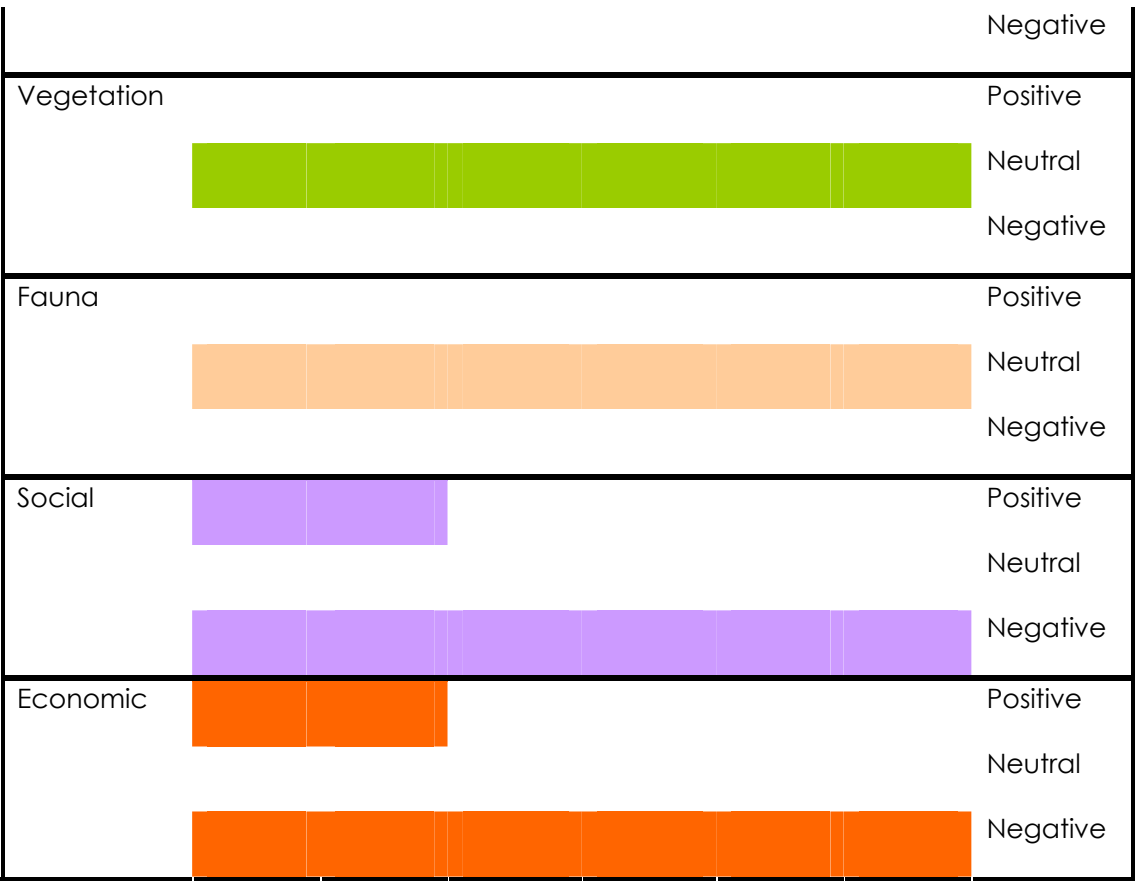
The following environmental issues were identified on the study area affected by the proposed alignment of the K220:

- According to the GDACE C-plan the proposed route does **not** traverse any irreplaceable sites;
- The proposed route crosses the Olifantspruit and an unnamed drainage line with associated wetlands;
- A section of the route is underlain by dolomite;
- Expropriation of properties; and
- Impact on agricultural and mining activities (i.e. Corobrik).

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

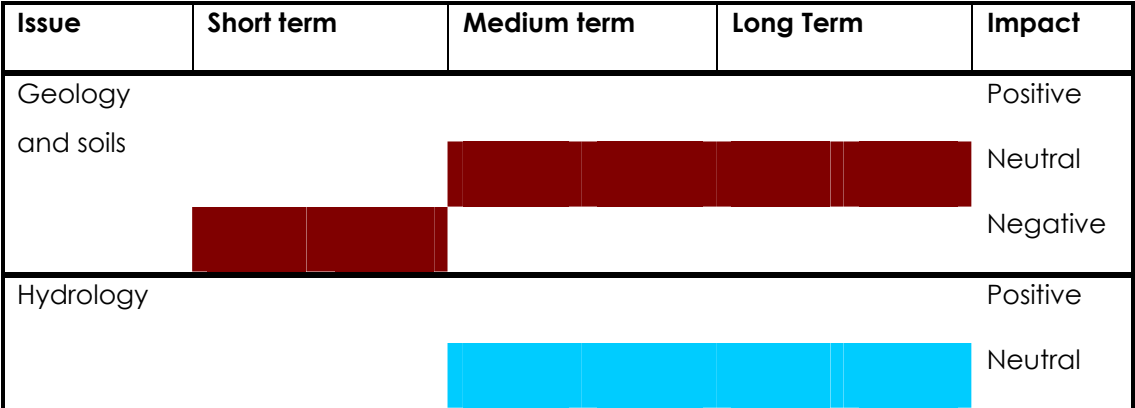
Diagram 1: Environmental issues - “No-Go” Option

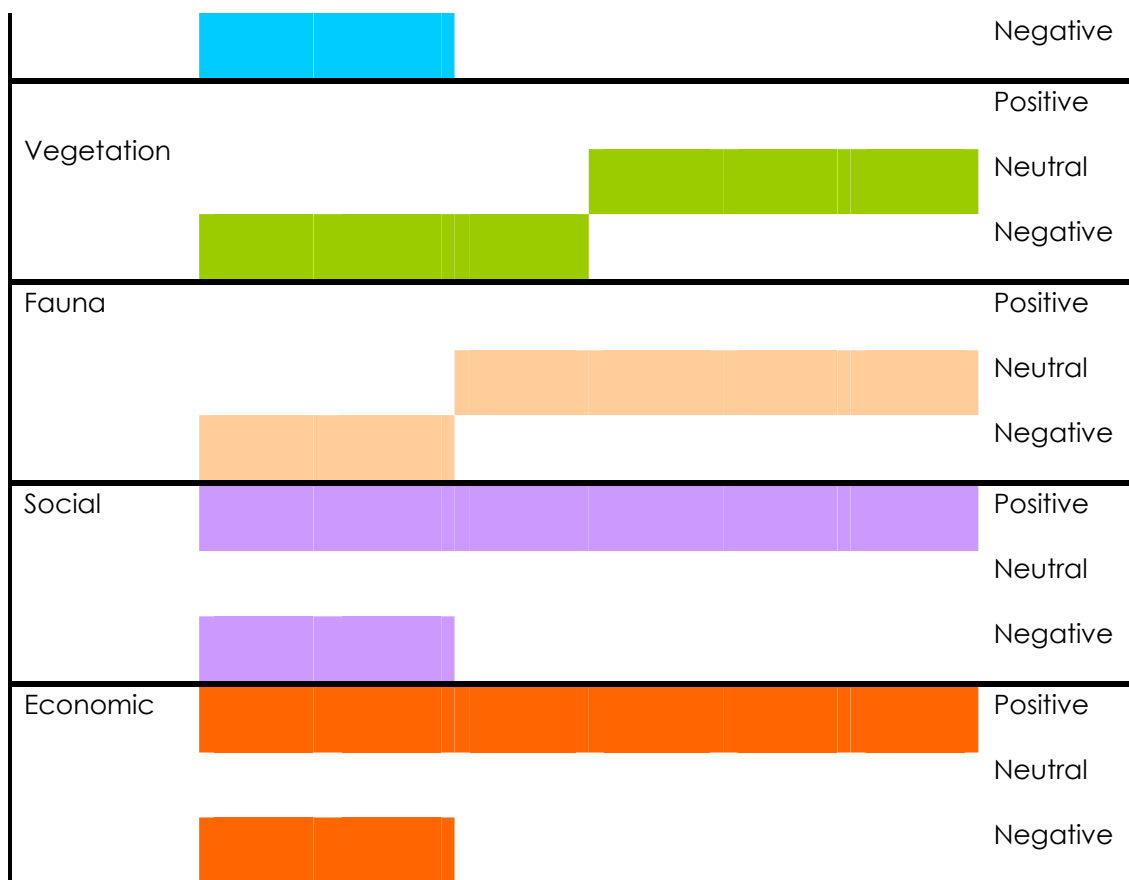
Issue	Short term	Medium term	Long Term	Impact
Geology and soils				Positive
				Neutral
				Negative
Hydrology				Positive
				Neutral



Note: The “no-go” option is predominantly neutral in the short and medium term, and turns negative in the long term. Due to the expropriation of properties and impact on agricultural and mining activities the socio-economical issues are also positive in the short term.

Diagram 2: Environmental issues if the proposed section of the K220 is constructed





Note: It is anticipated that the construction of the proposed section of the K220 is predominantly negative in the short term, but turns neutral in the medium term and long term. The Social and Economic issues will be positive from the short term to the long term, however due to the expropriation of properties and impact on mining activities (i.e. Corobrik) the socio-economic issues could also be negative in the short term.

6.2 Alignment Alternatives

Refer to Figure 9, Alternative Alignments

Several alignment alternatives for Route K220 were investigated by Gautrans during the preliminary design phase. The following aspects were considered during the investigation of the alternative alignments:

- The “Midstream Estate” development which is situated between Route K 109 and Route K111. Bondev requested that the alignment be moved as far as possible to the south of their southern property boundary in order to accommodate the “Midstream Estate” development.
- Areas for which mining rights have been granted for the extraction of clay deposits which are used for the manufacturing of high quality bricks i.e. Corobrik Pty (Ltd) situated on Portion 113 Olifantsfontein 402 JR.
- Agricultural land i.e. the Remainder of Portion 14 Olifantsfontein 402 JR and Portion 4 Olifantsfontein 410 JR as well as Sunlawns Agricultural Holdings.

The K220 is a planned provincial arterial (primary distributor) with an alignment that is protected by the Gauteng Transport Infrastructure Act. The Gauteng Department of Public Transport Roads and Works, has provisionally planned the route alignment of the K220 as well as various major distributors in the area.

Major urban distributors, being the second-tier in the five-tier road system, generally have access interchanges on freeways. Network considerations and the location where it is technically feasible to provide an interchange on the R21 Albertina Sisulu Freeway, dictate the position where the K220 and other K-routes intersect with the freeways on either side of this section of the K220.

According to the involved traffic engineers the criteria used to determine the optimum horizontal and vertical alignment of K220 in between the two freeways includes road safety, cost and environmental considerations. The road safety considerations affected the design, including slope, horizontal radii and sight distance. In terms of cost considerations, an optimum had to be found between the capital cost of the road and operational cost of the road users. This was done by limiting expensive cuts and fills, while at the same time reducing gradients.

The cross section and road reserves adhere to Gauteng Department of Public Transport Roads and Works standards for major arterials.

The environmental impacts of the proposed alignment were also taken into consideration during the investigation of the alternative alignments.

As already mentioned two final alignment alternatives, **Alternative A** and **Alternative E**, were identified by Gautrans. **From a road planning point of view Alternative A was ultimately identified as the preferred alternative. Refer to Figure 24, Sensitive issues Map and Figure 25, Sensitivity Map and Section 9, page 214 for a detailed comparison between these alternatives.**

Alternative A (proposal)

From **km 11,20 to km 13,430** both alternatives follow the same route. Between **km 13,50** and **km 18,719** *Alternative A* follows a different route from *Alternative E*. *Alternative A* is 236 m shorter than *Alternative E*.

From km 13,430 *Alternative A* runs south-easterly up to km 13,50 from where it continues around a right turn 2000m curve to run more southerly up to km 14,33 where it turns left in a 2000 m radius curve to continue north-easterly up to the crossing of the existing Road P38-1 and the electrified double railway line. At km 16,55 the route swings right again around an 850 m radius curve to run south-easterly again but at km 17,71 *Alternative A* then turns left through a 2000 m radius curve to run parallel to the existing Road 781 in an easterly direction up to the limit of planning at 19,760 km, crossing P122-1 (and K105) at km 17,66 and the R21 Albertina Sisulu Freeway at km 19,53.

Alternative E

Between **km 13,500** and **km 18,719** *Alternative E* follows a different route from *Alternative A*. *Alternative E* is 236m longer than *Alternative A*.

From km 11,2 to km 13,430 both alternatives follows the same route. From km 13,430 *Alternative E* runs south-easterly up to km 13,51 where it turns slightly right in a 3000m

radius curve to continue south-easterly up to km 16,01 where the route swings left around a 850 m radius curve to run north-easterly, crossing the existing Road P38-1 and the electrified double railway line. At km 18,01 this alternative then turns right through a 3000 m radius curve to run parallel to the existing Road 781 in an easterly direction up to the limit of planning at 19,996, crossing P122-1 (and K105) at km 17,86 and the R21 Albertina Sisulu Freeway at km 19,77.

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

7.1. THE BIOPHYSICAL ENVIRONMENT

This section briefly describes the biophysical environment of the study area.

7.1.1. Geology and Soils

A dolomite stability and engineering geological investigation for the preliminary planning phase of route K220 between the N1 and P157-1 was done by *BKS (Pty) Ltd in May 2002 (Refer to Annexure G).*

Geology

According to the new 1: 50 000 geology map 2528 Lyttleton, the route transects the following geological formations from west to east: the Halfway House Granite Suite, the Black Reef Quartzite Formation dolomite from the Malmani Subgroup (i.e. Oaktree, Monte Christo, Lyttleton and Eccles Formations). According to the involved geological engineers various Pilanesberg age syenite intrusions are present especially in the black Reef Formation and the lower part of the dolomite formations. Karoo age mudrocks and tillite are also present as remnants of older blocks while alluvial deposits of mostly clayey material are present along the Olifantspruit.

Table 4: Geology along the proposed Route K220

Kilometre Distance	Stratigraphy	Material/Description
8,40 – 12,20	Halfway House Granite	Granite
12,20 – 12,40	Black Reef Formation	Thin layer of quartzite and mudrock, mainly intruded by syenite in this area
12,40 – 13,80	Oaktree Formation	Generally chert poor dolomite with abundant syenite sills intruded in this area
13,80 – 14,40 15,15 – 15,25 15,60 – 15,85	Monté Chrtisto Formation	Chert rich dolomite and possible large bodies of syenite sills intruded into this geological formation
17,00 – 15,35	Lyttleton Formation	Chert poor dolomite
17,55 – 17,85	Eccles Formation	Chert rich dolomite
	Chert boulders	Probably Eccles or Rooihoogte Formation (Chert breccia).
15,25 – 15,50 17,85 – 17,00 17,86 – 19,10	Ecca Group	Mudrock of Karoo age which weathers to silt/clay. Dwyka Tillite. Weathering product is clayey and prone to heave.
Possibly at various locations	Pilanesberg Syenite	The syenite is present as dykes and sills and forms very irregular bodies which are very difficult to identify and map.
14,4 – 15,05	Alluvium	The alluvium is mostly clayey material which is deposited in and on the banks of the drainage courses.

Soils

The geological investigation showed that the soils found on the surface along the route reflect the underlying geology.

On the chert-poor dolomite formations (i.e. Oaktree and Lyttleton Formations), the soil cover is expected to be thin and generally outcrops can be expected with a soil cover thickness of between 0 m and 3 m. A thicker soil cover is expected on the chert-rich formations (the Monte Christo and Eccles Formations). Most of the dolomite is typically overlain by red –brown gravelly soils.

The syenite has no surface expression and is blanketed by chert gravel and breccia and the weathered syenite is usually present as silty material.

The soils developed due to the weathering of the Karoo mud rock and tillite in this area is generally a clayey material which is mined by the brick making industry. Clayey alluvial deposits are present along the banks of the Olifantspruit and its tributaries.

Geological engineering properties

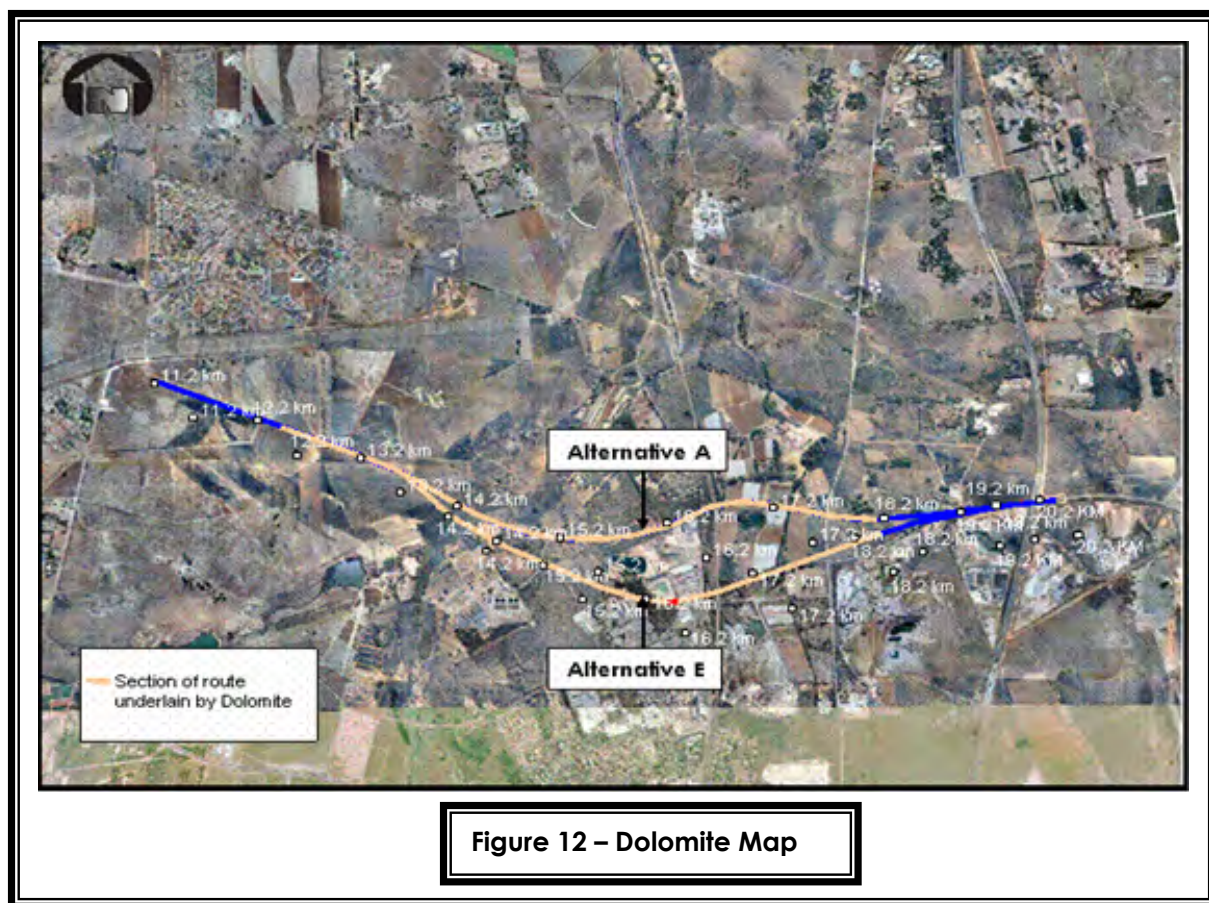
According to the involved geotechnical engineers there are geological engineering problems related to the different geological materials, i.e. collapsible sands, expansive clays, excavatability etc.

Dolomite

Refer to Figure 12, Dolomite Map.

Dolomite is present over a large portion of the route from approximately **km 12,40 up to approximately km 17,85**. The formation of sinkholes and dolines are associated with dolomitic areas and generally develops due to leaking of wet services and/or the accumulation of stormwater.

No sinkhole or doline features were identified during the investigation along the proposed route of K220 but the entire area should be investigated in detail conducting a gravity survey and drilling percussion boreholes. The percussion boreholes will be required on the gravimetric anomalies.



Oaktree Formation

Historically, limited sinkhole developments have been recorded on this formation. However, investigations showed that poor conditions such as low-density zones between dolomite pinnacles are present. The involved geotechnical engineers stated that this low density material must be compacted with a vibrating or impact roller and in extreme poor conditions the material must be excavated and backfilled with granular material. Small (<2 m in diameter) to possible medium (2-5 m in diameter) sinkholes are likely to develop due to presence of the shallow bedrock and weathered slots expected in this area. Differential movement is also possible due to the presence of hard rock dolomite directly along side the low density wad rich material. **The shallow bedrock will require blasting in road cuttings.**

The presence of syenite intruded extensively into this formation, which occurs to the north of the proposed route, greatly reduces the risk for dolomitic instabilities.

Monte Christo

This formation is a chert-rich formation and bedrock is generally expected to be deeper than on the Oaktree Formation. Medium (2-5 m in diameter) to large (5-15 m in diameter) sinkholes can develop due to the deeper dolomite bedrock. In general, however, sinkholes are less than 10 m in diameter.

Towards the north of the proposed route K220 a large syenite sill has intruded the Monte Christo Formation. This sill overlies the dolomite, however it is uncertain whether the intrusion extends onto the route. If so, similar conditions are expected along the route which will lower the risk for sinkhole and doline development considerably.

Lyttleton Formation

The Lyttleton Formation is also a chert-poor formation and bedrock is generally shallow with numerous pinnacle outcrops. Small to medium sized sinkholes can develop and differential movement due to the presence of hard rock dolomite adjacent to unconsolidated low density material is possible.

Numerous sinkholes have developed on this geological formation and detailed stability investigations will be required.

Shallow dolomite pinnacles will require blasting in any excavations.

Eccles Formation

The Eccles Formation is a chert-rich dolomite which is the Formation with the highest risk of presenting dolomite stability problems. **Numerous sinkholes and dolines have developed in this geological formation and naturally occurring sinkholes have developed mainly**

due to the inherent poor conditions present in the formation on an area approximately 1km north of the proposed route.

Chert hillocks are often present in this area. The large chert boulders can generally be removed with a large tracked excavator. **Some blasting may however be required for deep excavations.**

Collapsible Sands

Colluvium and residual material on the dolomitic areas may be collapsible and will have to be pre-collapsed, possibly by impact rolling if the collapse potential is too high. The weathering product of granite often shows a collapse potential, an inherent property of the material. It can be tested by doing a collapse potential test and also by determining the bulk density. If the bulk density of the material is $< 1600 \text{ kg/m}^3$ then it is likely to be collapsible.

Expansive Clay

The material is generally not expansive although the weathered syenite may be slightly expansive. Along the gulley heads on the granite some active clayey material can also be expected.

Excavatability

Excavations up to a depth of 3m on the granite should not be problematic except where outcrops are present. Shallow dolomite pinnacles are present on the Oaktree Formation and Lyttleton Formations and will require blasting.

It is recommended that allowance be made in the quantities and specifications for the excavation of wad (or other soft material) during construction due to the fact that the soft wad can cause settlement. Allowance should also be made for over-blasting of cutting floors and pinnacles since blasting in dolomitic causes uneven surfaces and it

may require the compaction of rockfill in the cutting floors. Hard rock pinnacles may also be encountered in excavations for culverts and drains in the dolomitic areas.

Conclusions and recommendations made by the involved geotechnical engineers

- Dolomite is present over a large portion of the route (from approximately **km 12,40 up to approximately km 17,850**) and sinkholes and dolomites are likely to develop if poor water management takes place;
- According to the geotechnical engineer there are certain geotechnical constraints that must be taken into consideration during the planning and designing of the road, i.e. collapsible sands, expansive clays, excavatability etc;
- The expected conditions are such that the road can be constructed without serious problems provided that the necessary precautionary measures are implemented;
- **The dolomite stability along the entire route should be investigated in detail by conducting a gravity survey and percussion boreholes;**
- Potential damage to metallic elements placed underground due to corrosive soils in dolomitic areas;
- Some blasting exercises may be required where deep cuttings are required and some dolomite pinnacles may have to be removed by blasting;
- **More detailed stability and foundation investigations will be required for structures such as bridges and culverts;**
- **A detailed investigation will be required where the Route K220 crosses the Olifantspruit;** and
- During the wet season a perched water table can develop on the granite and slight seepage may also be present on the syenite.

Table 5: 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	-	☹

7.1.1.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

A large portion of the route, from approximately **km 12,40 up to approximately km 17,850**, 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 6: 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	M - To be included in EMP

	<p>precautionary measures for development in dolomitic areas must be implemented</p> <p>P, C & O – Stormwater management is extremely important and must be designed to prevent the concentrated ingress and ponding of water.</p> <p>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> <p>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.</p> <p>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.</p>	<p>H - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p>
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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

Expansive material is expected along the Olifantspruit and its tributaries and also in the gulley heads on the granite and possibly weathered syenite. Differential movement is also possible due to the presence of hard rock dolomite directly alongside low-density wad rich material within the Oaktree Formation.

Table 7: 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 Planning phase, Construction and/ or Operational 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>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> <p>P & C – The granite is covered by collapsible material and will have to be pre-collapsed, possibly by impact rolling if the collapse potential is too high.</p> <p>P & C – The low-density material encountered within the Oaktree Formation must be compacted with a vibrating or impact roller. In extremely poor conditions the material must be excavated and backfilled with granular material.</p> <p>P & C – Embankments will only be required where structures such as bridges and culverts are constructed;</p> <p>P & C – The dolomite stability along the entire route should be investigated in detail by conducting a gravity survey and percussion boreholes;</p> <p>P & C – More detailed foundation investigations should be conducted for structures such as bridges and culverts.</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p>

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

Some blasting exercises may be required where deep cuttings are required and some dolomite pinnacles may have to be removed by blasting.

Serious excavatability problems are foreseen on the granite while blasting will probably be required on the chert poor dolomite;

Table 8: 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 9: 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 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 soils erosion on the site. If construction takes place during the rainy season, sufficient storm water management will be required to manage water runoff.

Table 10: 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>P & C – A storm water management plan must be compiled for the construction and operational phases of the proposed road.</p> <p>P & C – Cut-off drains should be excavated up- and down-hill of denuded areas to reduce run-off across these areas.</p> <p>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.</p> <p>P & C - Rehabilitate exposed areas immediately after construction in these areas is completed (not at the end of the project).</p> <p>P & C – Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.</p> <p>P – Specifications for topsoil storage and replacement to ensure sufficient soil coverage as soon as possible after construction must be implemented.</p> <p>P & C – All embankments must</p>	<p>H - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>L - To be included in EMP</p> <p>L - To be included in EMP</p> <p>L - To be included in EMP</p>

	<p>be adequately compacted and planted with grass to stop any excessive soils erosion and scouring of the landscape.</p> <p>C – Storm water diversion measures are recommended to control peak flows during thunder storms.</p> <p>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.</p>	<p>L - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p>
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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 11: 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 🟡	<p>C - Remove vegetation only in designated areas for construction.</p> <p>C - Rehabilitation works must be done immediately after the involved works are completed</p> <p>C -All compacted areas should be ripped prior to them being rehabilitated/landscaped;</p> <p>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 material should be used for the rehabilitation of the site and for landscaping purposes</p> <p>C - Strip topsoil at beginning of works and store in stockpiles no more than 1,5 m high in designated materials storage area.</p> <p>C – Stockpiles should be covered correctly</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M- To be included in EMP</p> <p>M- To be included in EMP</p> <p>M- To be included in EMP</p>

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

7.1.2 Hydrology

(Refer To Figure 13: Hydrology Map).

7.1.2.1 Surface Hydrology

The area is drained northwards by a tributary of the Sesmylspruit as well as by the Olifantspruit. The tributary of the Sesmylspruit originates just north of the proposed the proposed route, but the Olifantspruit would need to be crossed by means of a bridge/culvert (*refer to Annexure F for details of the bridge structures*). An unnamed drainage line in the eastern section of the road would also need to be crossed by means of a bridge/culvert. *Refer to Annexure F for details of the culvert structures*). According to the wetland specialist this drainage line seems to originate from seepage from the **Sterkfontein spring** and as such the system can be considered to be at least partially fed by this source (*refer to Figure 13, Hydrology map*).

The tributary of the Sesmylspruit is non-perennial while the Olifantspruit is more perennial in nature and dams for recreation and agricultural purposes have been constructed along the river course. None of the dams are affected by the proposed river crossing.

The Olifantspruit forms part of the A21B quaternary catchment and the systems being crossed form part of the headwaters of the Olifantspruit, a tributary of the Sesmylspruit. The Sesmylspruit forms the Hennops River which confluences with the Crocodile River. This catchment therefore forms part of the Crocodile Marico (west) secondary catchment and, ultimately, the Limpopo primary catchment.

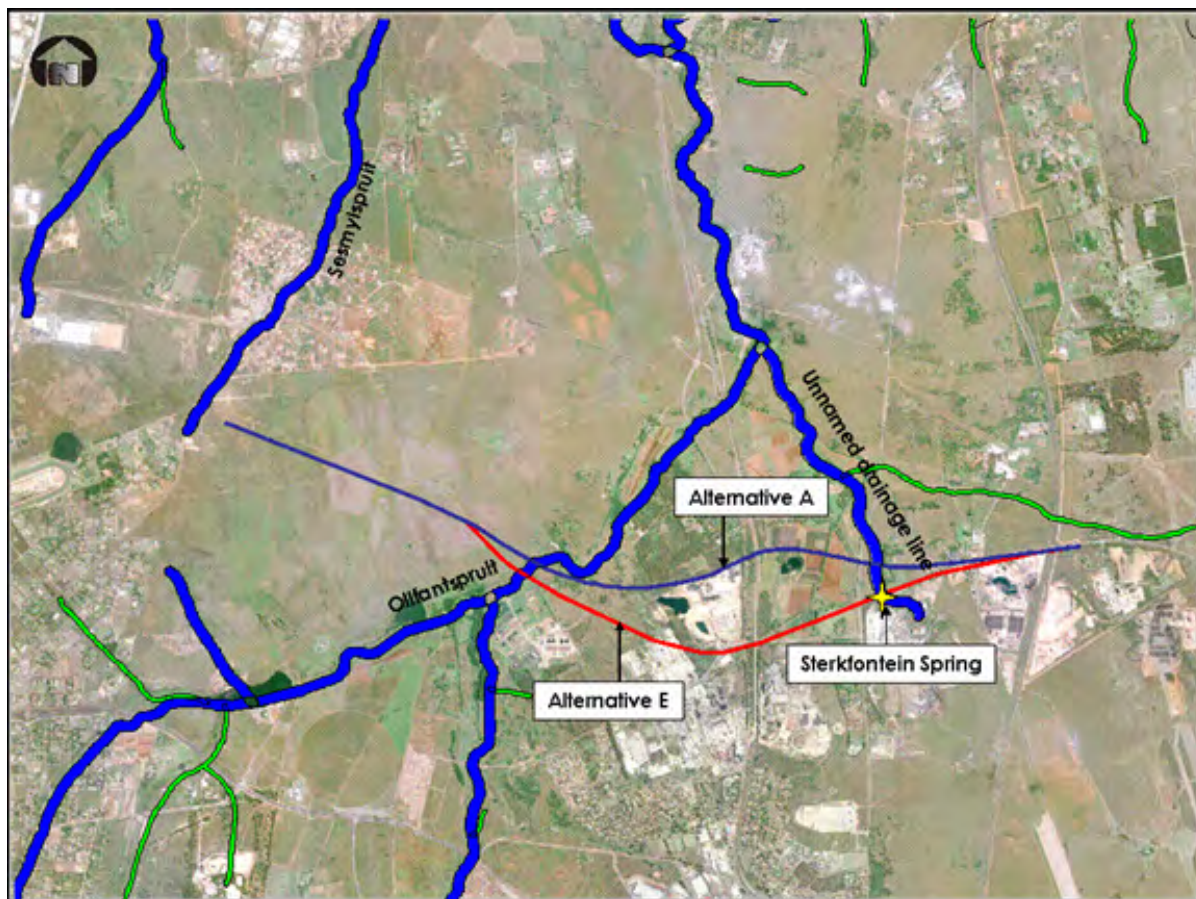


Figure 13 –
Hydrology Map

Section 21 Water Use License applications for the river crossings have been submitted to DWAF (refer to Annexure C for proof).

Floodlines

Both alignment alternatives of the involved section of K220 cross the Olifantspruit and a drainage line and are therefore influenced by 1:100 year floodlines. *Refer to Annexure V.*

7.1.2.2 Sub-Surface Hydrology

A large section of 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.

According to results of the geological investigation by BKS a perched water table could develop on the granite along gulley heads during the wet season. In some instances slight seepage may also be present on the syenite.

As already mentioned the **Sterkfontein spring** is situated to the south of the proposed alignment of route K220. The flow of the spring is collected into a pipeline that transports spring water into the Rietvlei purification plant for municipal water use (*refer to Section 7.1.2.2.a* for a detailed discussion of the Sterkfontein spring).

7.1.2.2.a Pollution Potential of the Tshwane Dolomitic Water Resources

Refer to Annexure H for Report compiled by Mothopong Consulting (Pty) Ltd

Mothopong Consulting (Pty) Ltd compiled a report on the Pollution Potential of the Tshwane Dolomitic Water Resources in June 2005. *Mothopong Consulting* stated that the CTMM obtain a significant portion of their water supply from boreholes and springs, which is blended with Rand Water and water from Rietvlei Dam within the bulk distribution system. The boreholes and springs are located in dolomites of the Chuniespoort Group,

which is divided into isolated or semi-isolated compartments and sub-compartments by a series of E-W, N-S and NW-SE trending dykes. Two dolomite windows exist of which one extends south from the Rietvlei Nature Reserve and Moreleta Park south to Bapsfontein and the other one extends from the Fountains Valley to Kempton Park and underlies Centurion, Erasmia and the Clayville-Sterkfontein area.

According to *Mothopong Consulting* previous investigations regarding pollution potential of the dolomitic aquifers in the CTMM area indicated that they are strategic but extremely vulnerable water sources and it is suggested that pollution could be a real threat.

As a result, three studies were commissioned by the CoT to investigate the pollution potential of these water sources, to identify protection zones, and identify proposals to secure these water sources against possible pollution. These three studies covered the Sterkfontein spring, the Grootfontein spring and the Rietvlei boreholes, and the Fountain valley springs and Centurion boreholes.

Only the Sterkfontein spring, which is situated to the south of the proposed alignments of the involved section of the K220, will be discussed in detail in this EIA report.

The Sterkfontein spring issuing from the dolomite aquifer system northeast of the Olifantsfontein/Clayville area is used to supply water of good quality for the Tshwane Metropolitan area. The long-term average flow is 75 l/s however due to existing industrial and other land-use exposure there are concerns related to long-term quality and sustainability of the spring.

Location

The area under consideration is within broad environs of Clayville/Olifantsfontein and lies immediately to the south of the Centurion study area. The southernmost extent is uncertain, but for practical purposes was taken at 26° South.

Land Use

Two dominant land uses are apparent – residential and industrial development in the western section and almost solely agricultural use in the east. Due to presence of Karoo deposits there are a number of brickworks and quarry facilities (e.g. Rosema Bricks, Victoria Bricks, Concor Bricks, Metex, etc.). Immediately south of the spring there are several brickworks, a quarry and, most importantly, the Clayville waste disposal site, which are about 500 m to the south-west. The immediate eastern side is again dominated by brickworks and quarry facilities.

The area further south is also used for commercial agriculture (arable farming). North of the Sterkfontein dyke the prevailing use is arable farming. Some portions of the same area are under threat of illegal squatting, which is the problem that can grow rapidly in future.

Hydrogeology

Groundwater Movement

The general groundwater flow is from south to north and according to *Mothopong Consulting* the spring issues on the Sterkfontein Dyke, which is the boundary with the Centurion study area and which runs in East-North –East and West-South-West direction.

Water balance

Refer to Table 4, Annexure H for the groundwater budget that quantifies the regional flow. *Mothopong Consulting* stated that the simulated lateral and vertical recharge of 640 l/s is significantly greater than the DWAF estimate of 430 l/s. Most of the water discharges into the Sterkfontein Spring and surface streams and canals (almost 70%). Contrary to DWAF (1988), there is a sizeable outflow across the Sterkfontein Dyke.

Sterkfontein Spring

The spring issues in the vicinity of the perceived intersection of the Pretoria and Sterkfontein Dykes. The spring was added into the Pretoria distribution network in 1934 and its flow is collected into a pipeline that transports spring water into the Rietvlei

purification plant. The long-term average flow is 75 l/s (DWAF, 1989), although the record for July 1986 – January 2001 is somewhat lower (63 l/s). The flow has increased and stabilized recently to about 90 l/s and responds to long-term trends in rainfall (WREM, 1997).

Abstraction

Groundwater abstraction is only 38 l/s in total.

Recharge

According to equal volume method applied on dolomite springs, the calculated recharge from this source is between 111 and 196 mm per annum. This represents 7.5 % and 13 % for dry and wet periods, respectively.

Water Quality

While water quality parameters hardly exceed SABs, DWAF or RWB guidelines a few boreholes indicate signs of pollution. Ammonium (as N) is the only constituent that exceeds the guideline values, but more importantly, it clearly documents the pollution process in place. The presence of ammonium indicates surface water pollution and/or improper sanitation or agricultural practices. The results of the Pollution Potential Survey indicated that **pollution is encountered upstream from the Sterkfontein Spring, not within its catchment zone**. According to Mothopong Consulting it is quite possible that the informal settlement just north of the spring (noted during the time of the survey) contributes to the ammonium enrichment of groundwater. On the western side of the Pretoria dyke, ammonium indicates either agricultural impacts or the waste disposal site (Wastetech). Ammonium concentrations in groundwater are usually associated with sewage (e.g. leaking pipes or improper sanitation) or certain fertilizers (both organic and chemical).

Impact on Groundwater Abstraction

Refer to Figure 14 a-c for the calculated capture zones for 100 days, 1 year and 5 years, respectively. **The 100-day capture zone covers the immediate vicinity of the**

spring and 500-700 m radius south of the spring. The quarrying and brick-making facilities (Concor Bricks and Sterkfontein Bricks) fall within the 100-day capture zone and are theoretically the most vulnerable part of the aquifer with respect to the Sterkfontein spring. According to Mothopong Consulting the existence of the Karoo sediments (which are quarried to provide material for bricks and tiles) provides a partial cover of the dolomite aquifer offering some protection, which is probably why the impact of these facilities is not being felt.



Figure 14a: 100 days capture zone of Sterkfontein Spring

The **1-year capture zone (Figure 14b)** covers about a kilometre radius from the spring, partially covering Sterkfontein Bricks, the farmland area just south of brick operators (including the whole property of Concor Bricks) and large parts of Agricultural Holdings in Olifantsfontein. It does not extend to the Wastetech disposal site.



Figure 14b: 1-year capture zone of Sterkfontein Spring

According to *Mothopong Consulting* the **5-year capture zone (Figure 14c)** can be thought to cover the significant parts of the spring catchment area. It extends in the eastern section of the

modeled domain, covering large tracts of farmlands east of Olifantsfontein / Clayville as well as parts of Clayville (mainly residential areas about 500 m west of the Pretoria-Olifantsfontein Road, M18). The potential source of pollution, Wastetech site, is not included within the 5-year capture zone. From the flow vector map as well as from hydrochemical trends it appears that groundwater flowing below the Wastetech site drains towards north and it does not impact on the spring in a significant way. It is also apparent that the Pretoria Dyke does not function as a full barrier allowing some flow between dolomite compartments.



Figure 14c: 5 year capture zone of Sterkfontein Spring

Aquifer Protection

Protection against microbial contamination

It is recommended that the 100 day capture zones be used as the basis for preventing activities that could result in contamination of the aquifer. These activities include dense on-site sanitation or low density wet on-site sanitation, cemeteries, feedlots, the use of pesticides and herbicides, local disposal of household wastes and oils, industrial activity etc. High load untreated point sources, such as sewage pipelines, should be kept outside the 1 year capture zone.

Aquifer protection based on capture zones

It is recommended that the 5 year capture zones be utilised as the basis for controlling activities that could generate persistent contaminants. These activities include: waste disposal sites, industrial sites, mining.

Contamination Sources for Sterkfontein Spring

- The existing road just south of the spring (Apollo road) represents a risk should a collision occur on this road involving toxic materials and/or liquid fuels;
- Another potential threat is the settlement of squatters in the capture zone of the spring;
- The existing quarry operations and brickwork facilities do not appear to affect groundwater negatively. This is however based on very few boreholes and once-off measurements. *Mothopong Consulting* advised that a monitoring system be set up and water monitored on a quarterly basis.

Conclusions and Recommendations made by *Mothopong Consulting*

- Sampling results confirmed limited groundwater pollution processes taking place west and southwest of the spring. The impact of these processes on the spring is however very limited. The main pathline of the pollution plume is directed towards the north into the compartment north of the Sterkfontein Dyke.
- The leakage through the N-S running Pretoria Dyke was considered and modelled in the numerical model. Although there is water influx through the dyke towards the spring its contribution is rather limited. The closed Clayville Waste Disposal site is not considered to contribute to the pollution load towards the spring.

It is recommended that:

- Boreholes in the area should be monitored at least on a quarterly basis (water level and water quality). The monitoring design should be applied within the 100 day capture zone with the view to monitor the groundwater situation within facilities that are usually not recommended within this zone, such as Concor Bricks.
- Squatting has to be prevented from the immediate vicinity of the spring and cannot be allowed within the 100 day capture zone as the sanitation practices could be harmful to spring water quality.

7.1.2.2.b Intermediate Groundwater Reserve Determination for Quaternary Catchments A21A and A21B

Refer to Annexure I for Report compiled by Hobb Consulting and Khulani Groundwater Consultants (Pty) Ltd on behalf of DWAF, August 2004.

Recognising that the rapid rate of urban, industrial and agricultural development in the quaternary catchments A21A and A21B represents increasing pressure on the surface water and groundwater environments in these catchments, the Department of Water Affairs and Forestry (DWAF) identified the need to define Resource Directed Measures (RDM) for these quaternary catchments of the Crocodile (West) and Marico Water Management Area (WMA). As already mentioned the Olifantspruit forms part of the A21B quaternary catchment and the systems being crossed form part of the headwaters of the Olifantspruit, a tributary of the Sesmylspruit. The Sesmylspruit forms the Hennops River which confluences with the Crocodile River and this catchment therefore forms part of the Crocodile Marico (west) secondary catchment.

The conjunction of water resources in these two quaternary catchment areas relates to both quantity and quality considerations. According to the involved groundwater consultants the manifestation of a quantity-based relationship between surface water and groundwater resources in this area is represented by the numerous dolomitic springs. These would typically provide flow in their natural receiving surface drainages, with the magnitude and consistency of their discharges lending permanency to these drainages. However, three of the most productive springs in the area, viz. the Pretoria Fountains, the Grootfontein and the Sterkfontein springs, have been secured for bulk (municipal) water supply purposes. This has entailed diverting the flow into pipelines, thereby curtailing their contribution to the original receiving surface drainages and, in essence, permanently "resetting" the reference conditions in regard to the surface water environments downstream of these features.

According to the involved groundwater consultants surface water in these catchment areas demonstrates a poorer macro-inorganic quality than "reference" dolomitic groundwater. This has also been confirmed in the groundwater produced by a number of

boreholes in the area. It is evident therefore that poorer quality surface water has infiltrated the groundwater regime and compromised the quality of the dolomitic groundwater adjoining the “culprit” surface water drainages.

The results of the groundwater reserves indicated that the current depth to the groundwater rest level is generally shallower than in the mid-1980'. It is also observed that the rate of hydrostatic change is greater in the upper reaches of the dolomitic compartments than in the lower reaches which suggests that excessive groundwater utilisation in the upper reaches of a dolomitic groundwater catchment has a greater negative impact than if it occurred in the lower reaches. These circumstances might also explain the development of sinkholes in the vicinity of Bapsfontein in catchment A21A.

These two catchment areas were divided into eleven groundwater management units (GMU) and a RDM framework was compiled for each GMU (*refer to Figure 49, Annexure I for the GMU's*).

Sterkfontein Spring

The Sterkfontein Spring, located south of the proposed alignment of the K220, falls within the East Sterkfontein dolomitic compartment and within GMU2d.

Groundwater Quality

According to the involved groundwater consultants this source has recently produced groundwater with a salinity of between 30 and 40mS/m and reasonably constant major ion concentrations. Magnesium and bicarbonate consistently represent the dominant cation and anion respectively. Chloride and sulphate concentrations remain below 20mg/l. Although the two latest salinity values are higher than in the recent past, no rising trends are discernable in any of the major ion concentrations. The value of the $(\text{SO}_4 + \text{Cl})/\text{HCO}_3$ ratio is relatively constant in the range of 10 % to 20 % (*refer to Figure 45, Annexure I*).

GMU2d (East Sterkfontein dolomitic compartment)

This compartment exhibits a poor hydraulic connection with the adjoining West Sterkfontein compartment, and “overflows” to the north at the Sterkfontein spring. The Sterkfontein spring is utilised by Tshwane Metro as an augmentative municipal water supply source in the average amount of 82 l/s (2.59Mm³/a). This area also supports agricultural activity and a substantial brickmaking industry based on the refractory clay that occurs in the region.

The involved groundwater consultants recommend that this compartment be managed as a distinctive GMU due to the combination of these factors.

GMU2c/d/e:

These GMU collectively form the Sterkfontein compartment (*refer to Figures 35 and 49, Annexure I*). They share a present status **category rating of D**, and a **groundwater resource class of “Fair”** (*refer to Figure 52, Annexure I*). The ambient groundwater quality reported for this GMU grouping is the average of 16 analyses recorded for the **Sterkfontein spring** in the past two years.

Monitoring

Surface Water

The drainages in this area receive surface water runoff from the highly urbanised Kempton Park, Tembisa and Olifantsfontein areas and as a result the Kaalspruit and Olifantspruit water quality is very poor (*refer to section 6.2, Annexure I*). The City of Tshwane performs monthly water quality sampling at 14 localities in Catchment A21B (Lottering, 2004). The 14 localities in A21B extend from the downstream (northern) end of Tembisa on the Kaalspruit, the Olifantspruit and the Sesmylspruit, with the last station being located on the Hennops River at the western boundary of the Zwartkop Nature Reserve. Two of these stations are located on the Sesmylspruit between Rietvlei Dam and the confluence with the Olifantspruit.

The DWAF Gauteng Region also conducts 2 weekly surface water quality monitoring at eight localities in catchment A21B (Hlabolwa, 2004). *Refer to Table 29, Annexure I for a Comparison of City of Tshwane and DWAF surface water quality monitoring suites.*

Groundwater

Groundwater quality monitoring by the City of Tshwane is addressed on the basis of water samples collected from boreholes to assess the quality of groundwater used for bulk municipal water supply purposes. Similar monitoring by the DWAF, however, is very sparse in this area.

Conceptual Groundwater Resource Management Plan

A conceptual Groundwater Resource Management Plan was compiled by the involved groundwater consultants (*refer to Section 10, Annexure I*).

Table 12: 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 Sesmyspruit, Olifantspruit and systems lower down in the catchment area if a stormwater management plan is not implemented.	-	😊
8)	Groundwater pollution and contamination of the Olifantspruit and Sesmyspruit.	-	😊
9)	Pollution and contamination of the Sterkfontein Spring	-	😊

10)	Perched water conditions	-	☹️
11)	Increased storm water runoff from road into surrounding natural areas	-	😊

7.1.2.2.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, Olifantspruit and systems lower down in the catchment area 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 13: 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 Planning phase, Construction and/ or Operational 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	M - To be included in EMP

	<p>road must be designed to:</p> <ul style="list-style-type: none"> - 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. - 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. 	
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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 Olifantspruit and 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 14: Significance of Issue 8 (Ground water pollution and contamination of Olifantspruit and Sesmylspruit) 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>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> <p>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> <p>P/C – Containment of run-off from construction areas should be implemented and the streams closed off from access by construction workers.</p> <p>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> <p>P/C/O – All spillages must be cleaned up and contaminated soil removed as hazardous waste.</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p>

	P/C/O – Affected soil must be treated with DRIZIT or similar product.	M - To be included in EMP
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Result: Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

9) Pollution and contamination of the Sterkfontein Spring

Alternative E traverses the Sterkfontein spring and could therefore have a significant impact on the water quality of the spring. The proposed alignment (**Alternative A**) is situated to the **north** of the Sterkfontein spring and does not fall within the capture zone of the spring, which is situated to the south (*refer to Figures 14 a-c*). **Alternative A** would therefore not have a pollution impact on the water quality of the spring (i.e. accidents involving toxic materials and/or liquid fuels) during the operational phase. **Alternative A** however crosses the drainage line flowing from the spring and could have a pollution impact on this waterbody during the construction and operational phase.

Table 15: Significance of Issue 9 (Pollution and contamination of the Sterkfontein Spring) 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 - Compilation of a storm water management plan that will address storm water management during the construction and operational	M - To be included in EMP

	<p>phases of the project</p> <p>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> <p>P/C – Containment of run-off from construction areas should be implemented and the streams closed off from access by construction workers.</p> <p>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> <p>P/C/O – All spillages must be cleaned up and contaminated soil removed as hazardous waste.</p> <p>P/C/O – Affected soil must be treated with DRIZIT or similar product.</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>H - To be included in EMP</p> <p>H - To be included in EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

10) Perched water

During the wet season a perched water table could develop on the granite and slight seepage may also be present on the syenite.

Table 16: Significance of Issue 10 (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 areas with shallow ground water, especially for areas underlain by granite and syenite. 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*

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

At present the study area is covered with vegetation and surface drainage is taking place.

The proposed road will add a large amount of hard surfaces and will also lead to the compaction of soils. The soils 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 17: Significance of Issue 11 (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: <ul style="list-style-type: none"> • 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 - To be included in EMP and conditions of approval 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*

7.1.3 Wetland Delineation

Scientific Aquatic Services was appointed to delineate the wetlands in the vicinity of the stream crossings which will be required for the proposed construction of the K220 road (*refer to Annexure J*).

The purpose of the study was to determine the boundary of the wetlands and to determine the position of the 32 metre buffers, or other suitable buffer, around the wetland areas on the site, since building within this area will require more careful planning in order to protect the riparian wetland and riparian habitats which are generally considered as sensitive habitat.

The western crossing is located on a furrow forming a tributary of the Olifantspruit. According to Mr. van Staden, Scientific Aquatic Services, this system is recharged significantly by treated sewage effluent being discharged into the system which leads to increased volumes of water in the system and therefore an increased degree of wetland development.

The eastern crossing forms the headwater of an unnamed drainage line. This drainage feature seems to originate from seepage from a pump station (Sterkfontein spring) and as such the system can be considered to be at least partially fed by this source. The feature does however show a significant degree of wetland development

Mr. Stephen van Staden stated that wetland delineation took place according to the method presented in the final draft of "A practical field procedure for identification and delineation of wetlands and riparian areas" published by the Department of Water Affairs and Forestry in February 2003. The foundation of the method is based on the fact that wetlands have several distinguishing factors including the following:

- The presence of water at or near the ground surface
- Distinctive hydromorphic soils
- Vegetation adapted to saturated soils
- The presence of alluvial soils in stream systems

By observing the evidence of these features, in the form of indicators, wetlands can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF 2003).

General observations and conclusions made by Mr. van Staden

The western feature

- The wetland areas are fairly expansive at this point with a fairly expansive temporary zone occurring on either side of the active channel of the system;
- Due to the past disturbances of the area the wetland area has been altered with terrestrial and alien vegetation elements occurring in areas which should naturally be dominated by wetland vegetation types; and
- There is increased flow in the system due to water released from the sewage treatment facility nearby. As such the degree of wetland development is increased.

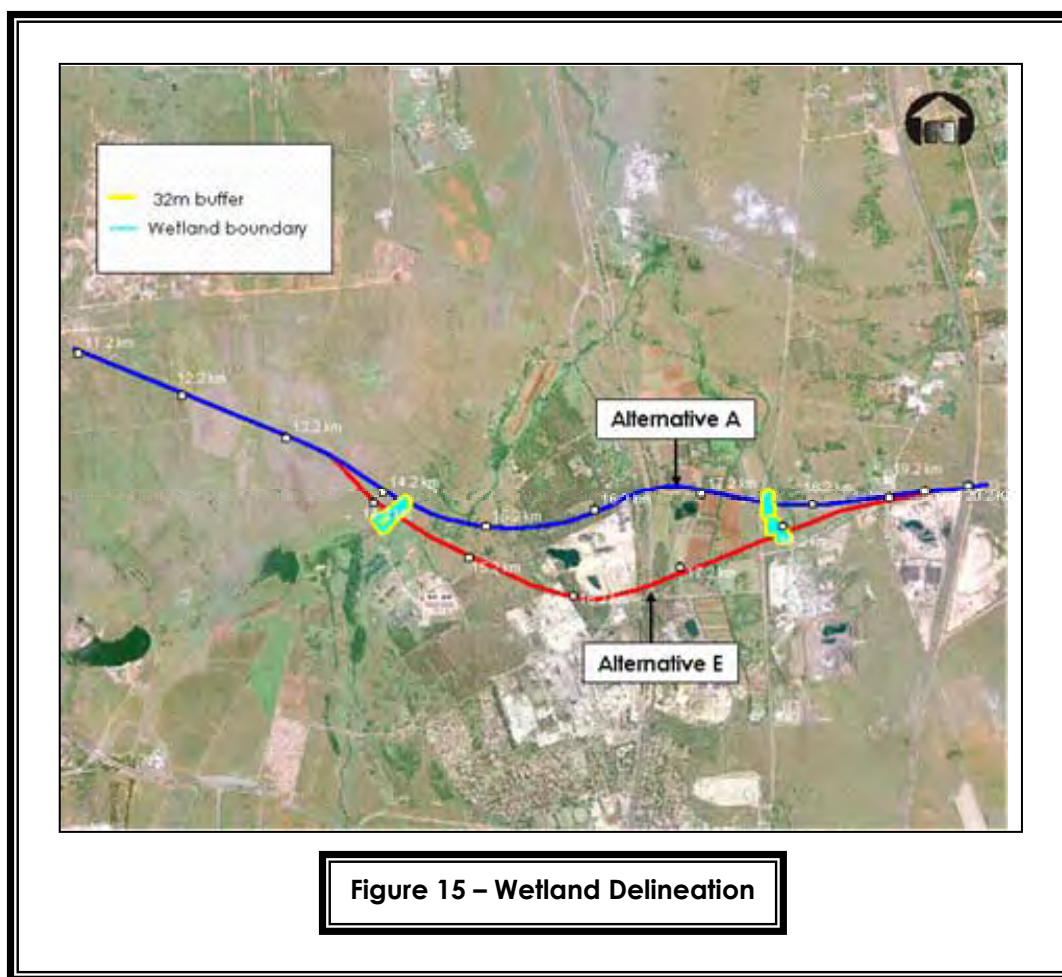
The eastern feature

- A true wetland vegetation landscape has developed downstream of the pump station;
- No well defined active channel is evident at this point;
- Due to the limited availability of water the degree of wetland development is limited; and
- The wetland areas are under threat of alien invasion. The areas affected by invasion were considered as wetland areas but were not considered as wetlands as the area

has been severely transformed by alien encroachment and some disturbance of soils.

Wetland delineation

Refer to **Figure 15** for the location of the wetlands boundaries as well as the **32 metre** buffer zone.



Mitigation measures supplied by Mr. van Staden

The points below serve to summarise the measures deemed necessary in order to ensure protection of the riparian and aquatic resources and to ensure the safe design of the proposed road.

- Since **Alternative A** falls to the north of the spring construction of this option will not affect water quality and will not affect the drinking water abstracted from the spring, this is the preferred route from a wetland conservation point of view.
- **Alternative E** is not supported as this option will have a direct impact on the spring and the drinking water abstracted from the spring.
- Due to the degree of disturbance in the area of the crossing and due to the presence of adjacent activities within the wetland areas it is deemed adequate that the river crossing be designed so as to ensure that the roadway does not encroach on the 1:100 year floodline. It is deemed unnecessary that the bridge traverse the outer areas of the natural temporary wetland zone.
- A **32m buffer zone** along the wetlands is recommended.
- The wetland crossings should take place at 90 degree angles to the drainage line to minimise the length of the crossing within the wetland areas.
- Adequate stormwater management must be implemented for the proposed road in order to prevent bank and riparian zone erosion.
- The bridge over the area within the floodline needs to be constructed in such a way so as to minimise the change in flow patterns in the area so that the areas of the wetland which are influenced by the presence of a fluctuating water level are minimally affected.
- The crossing support structure needs to be designed in such a way so as to ensure that there is limited creation of turbulent flow within the wetland areas. In this regard the following points should be born in mind:
 - Bridge support structures should be streamlined with narrow profiles facing the stream flow direction.
 - The bridge support structures should be kept out of the permanent wetland zone.
- Upon completion of the construction in the area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made:
 - All areas of disturbed and compacted soils need to be compacted and reprofiled.
 - Ongoing removal of alien vegetation from the area must take place after the

completion of the structure to prevent the uncontrollable recruitment of these species.

Table 18: Issues and Impacts – Wetland

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact/ Neutral - Not Necessary To Mitigate 🌟
12)	Impact on wetlands in the vicinity of the stream crossings	-	🟡

7.1.3.a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation - Wetland

The construction and operational phases of the proposed K220 could have a detrimental impact on the wetlands if not properly planned and managed. Bridge and culvert structures must be designed to reduce the impact on the wetlands (*refer to Annexure F for details on these structures*).

The proposed culvert structures over the eastern crossing were discussed with Ms. Madeleine Oosthuizen from City of Tshwane Environmental Planning Section and the wetland specialist, Mr. Stephen van Staden, and are supported by both parties.

Table 19: Significance of Issue 12 (Impact on wetlands in vicinity of stream crossings) 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>P - River crossings should be designed so as to ensure that the roadway does not encroach on the 1:100 year floodline. It is deemed unnecessary that the bridge traverse the outer areas of the natural temporary wetland zone.</p> <p>P/C – The wetland crossings should take place at 90 degree angles to the drainage line to minimise the length of the crossing within the wetland areas.</p> <p>P/C - Adequate stormwater management must be implemented for the proposed Road in order to prevent bank and riparian zone erosion.</p> <p>C – Throughout the construction phase compacted earth berms should be constructed at suitable intervals to reduce the volume and speed of runoff from construction areas into the stormwater and wetland systems for the duration of the construction phase of the road. The following guidelines</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p>

	<p>should be used:</p> <ul style="list-style-type: none"> - Where the area has a slope of less than 2%, berms every 50m should be installed. - Where the area slopes between 2% and 10%, berms every 25m should be installed. - Where the area slopes between 10%-15%, berms every 20m should be installed. - Where the area has a slope greater than-15%, berms every 10m should be installed. <p>P/C - The bridge/culverts over the areas within the floodline need to be constructed in such a way so as to minimise the change in flow patterns in the area so that the areas of the wetland which are influenced by the presence of a fluctuating water level are minimally affected.</p> <p>P/C - The crossing support structure needs to be designed in such a way so as to ensure that there is limited creation of turbulent flow within the wetland areas. In this regard the following points should be born in mind:</p> <ul style="list-style-type: none"> ➤ Bridge support structures should be streamlined with narrow profiles facing the stream flow direction. ➤ The bridge support structures should be kept out of the permanent wetland zone. <p>P/C/O – Reduce runoff from surface areas as far as possible. The storm water should be introduced into the system at a shallow angle to prevent erosion of the opposite bank of the system.</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP and conditions of approval</p> <p>M - To be included in EMP</p>
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	<p>C - No vehicles should be allowed to indiscriminately drive through the wetland areas. A fence should be erected along the 30m wetland buffer zone to prevent entry into the wetland areas and drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the wetland/drainage line.</p>	<p>M - To be included in EMP</p>
	<p>C/O - All areas affected by construction should be rehabilitated upon completion of the construction phase of the road. Areas should be reseeded with indigenous grasses as required.</p>	<p>M - To be included in EMP</p>
	<p>C/O - Upon completion of the construction in the area, the area should be rehabilitated to a level that will ensure that wetland vegetation can become re-established. In this regard special mention of the following is made: ·</p> <ul style="list-style-type: none"> ➤ All areas of disturbed and compacted soils need to be compacted and reprofiled. ➤ Ongoing removal of alien vegetation from the area must take place after the completion of the structure to prevent the uncontrollable recruitment of these species. 	<p>M - To be included in EMP</p>
	<p>C - Care must be taken to ensure that construction activities remain within the boundary of the planned road reserve.</p>	<p>M - To be included in EMP</p>
	<p>P/C - Site offices, parking</p>	<p>M - To be included in EMP</p>

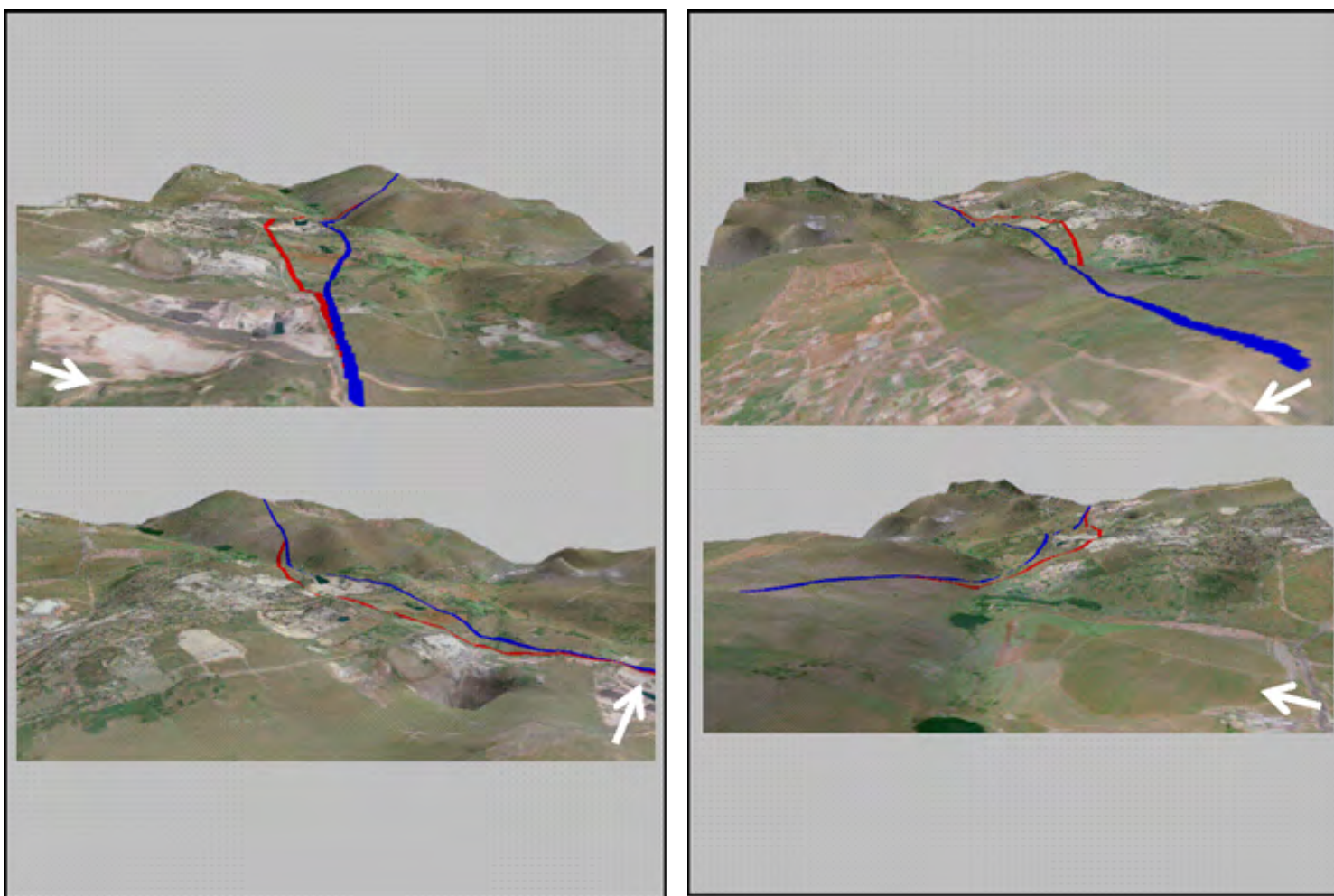
	<p>areas for construction vehicles, etc. should be confined to non-sensitive areas.</p> <p>C - Limited access to the water of the Olifantspruit should be given to construction vehicles by fencing off all access points to the water, except at the predetermined water-intake point.</p> <p>C/O - No plants 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> <p>C/O - All Category 1 Declared Weeds and other alien species must be removed from the vicinity of the proposed route.</p> <p>C/O – P/C/O – All spillages must be cleaned up and contaminated soil removed as hazardous waste.</p> <p>P/C/O – Affected soil must be treated with DRIZIT or similar product.</p>	<p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>M - To be included in EMP</p> <p>H - To be included in EMP</p> <p>H - To be included in EMP</p>
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Result:

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

7.1.4 Topography

The study area is gently undulating, with the natural slope not exceeding 10%, however the valleys formed by the streams are more pronounced. Where dolomite, chert and quartzite occur the landscape is more rugged while the occurrence of rocky outcrops and low ridges are typical of topography overlaying chert. *Refer to Figure 16 for a 3 Dimensional illustration of the study area.*



**Figure 16 – 3 D Illustration
of Study Area**

The average height is 1480 metres above sea level.

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 visible from the Randjesfontein residential area and Midstream Estate.

It is important to note that the proposed road is aligned through an area earmarked for urban development and many provincial, major collector roads and local roads will eventually be established in the study area and its surroundings.

The proposed K220 will be in line with the development planning for the area.

Table 20: Issues and Impacts – Topography

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 😊 Low 🟡 Positive Impact - Not Necessary To Mitigate 🌟
13)	Due to the topography only sections of the proposed road will be visible from surrounding view-sheds. It will be visible from the Randjesfontein residential area and Midstream Estate.	-/+ Depending on the architectural style and finishes	😊

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

- 13) 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.

Refer to Figure 20 for the Visual Assessment.

Table 21: Significance of Issue 13 (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*

7.1.5 Climate

The climate is typical of the Transvaal Highveld. The summers are mild to hot and the winters 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 Weinert N value is approximately 2.4, which indicates that chemical decomposition is the predominant form of weathering of rock.

The climatological data for the site was taken from the weather station 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 22: Issues and Impacts – Climate

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 😊 Medium 😊 Low ☹️ Positive Impact - Not Necessary To Mitigate ☀️
14)	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.	-	😊
15)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem.	-	😊

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

14) 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 wetlands, Olifantspruit and Sesmylspruit, 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. The involved engineers indicated that the normal flow of the Olifantspruit during winter is less than 0,3m³/s, mainly fed from the outlet from

15) 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 Olifantsfontein and the R21 Albertina Sisulu freeway and during the winter months dust could be carried over the properties to the north of the study area.

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 24: Significance of Issue 15 (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 - To 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*

7.2 The Biological Environment

Galago Environmental CC was appointed to conduct a flora and bird survey (refer to Annexure K for the report) as well as a habitat survey of invertebrates (refer to Annexure L for the report) for the involved section of the K220.

7.2.1 Vegetation

The proposed route lies in the quarter degree grid squares 2528CC (Centurion) and 2528CD (Rietvlei Dam) and passes through two vegetation units that Mucina & Rutherford (2006) classified as Carltonville Dolomite Grassland and Egoli Granite Grassland.

The Carltonville Dolomite Grassland is a species-rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges. This grassland falls within a warm-temperate summer-rainfall region with high summer temperatures and severe frequent winter frosts.

The Carltonville Dolomite Grassland is considered vulnerable and its conservation target is 24%. Small parts of this unit are conserved in statutory reserves and a few private conservation areas.

Egoli Granite Grassland is a vegetation unit associated with the archaean granite and gneiss of Halfway House Granite at the core of the Johannesburg Dome and the weathered leached, shallow, coarsely grained, sandy soil poor in nutrients. This grassland falls within a strongly seasonal summer-rainfall region with very dry winters and frequent frosts.

The Egoli Granite Grassland is considered endangered and its conservation target is 24%. Only about 3% of this vegetation unit is conserved in statutory reserves and a few private conservation areas. More than two-thirds of the unit has already undergone transformation, mostly by urbanization and cultivation. Current rates of transformation threaten most of the remaining unconserved areas.

Five plant communities were identified during the vegetation survey (*refer to Figure 17*):

- Natural grassland
- Riparian vegetation
- Alien vegetation and cultivated lands
- Mining; and
- Sewage works.

Refer to Tables 3 and 5, Annexure K for a list of the trees, shrubs, suffrutices, geophytes, herbs and grasses actually found on each of the surveyed areas in the vicinity of the proposed route.

Medicinal plants

Of the 168 plant species recorded in the vicinity of the proposed route, 32 species with medicinal properties were found. Their distribution in the various vegetation communities is as follows:

Table 25: Number of medicinal species in various vegetation communities

Vegetation community	Total no of species in vegetation community	No of medicinal species / vegetation community (%)
Natural grassland	98	24 (24%)
Riparian vegetation	62	17 (27%)
Alien vegetation and cultivated lands	73	10 (14%)
Mining	-	-
Sewage works	-	-

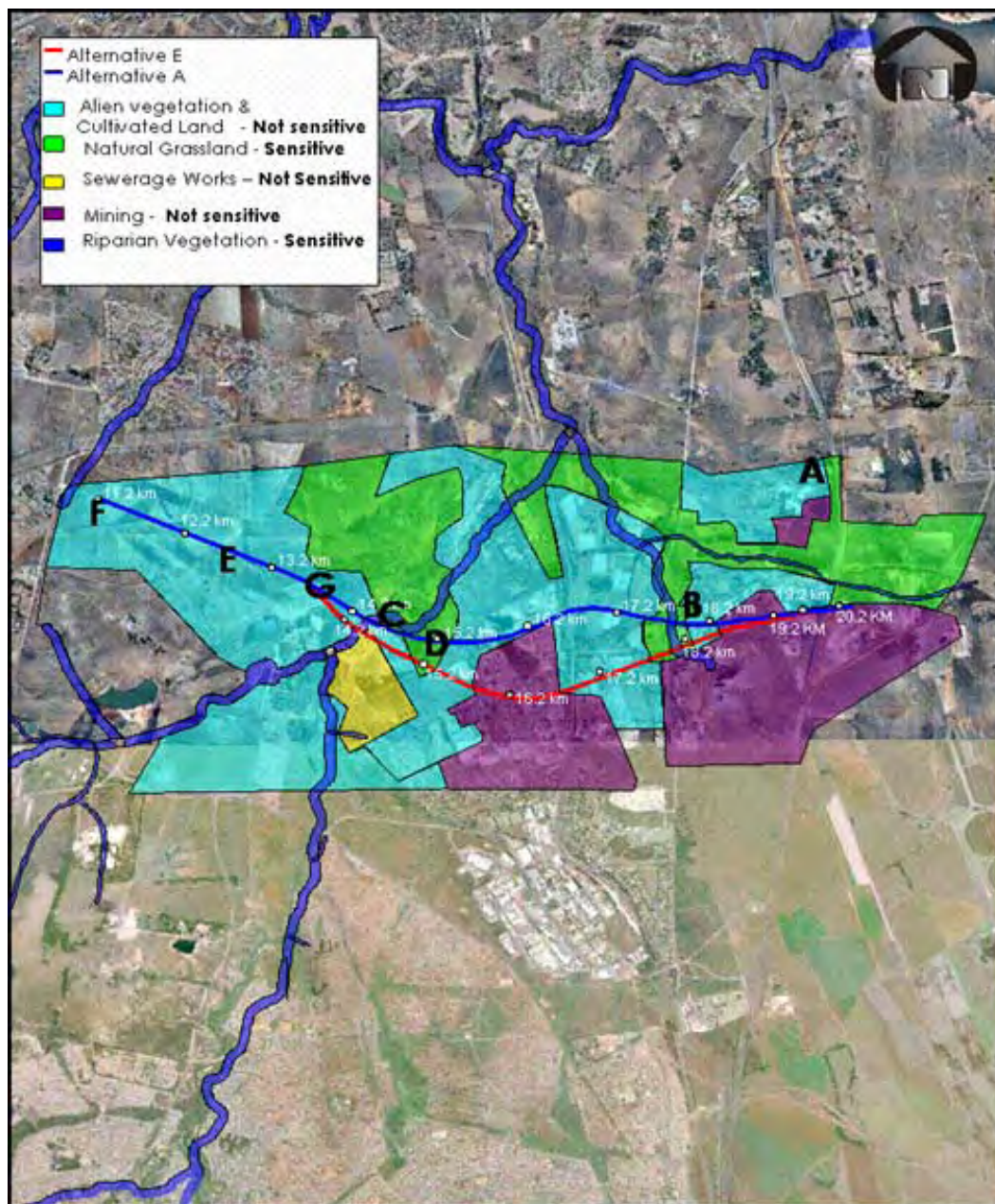


Figure 17 – Vegetation Map

Alien plants

Forty-two alien plant species, of which nine species were Category 1 Declared weeds, eight were Category 2 Declared invaders and five were Category 3 Declared invaders, were recorded in the vicinity of the proposed route. *Refer to Table 26, for the number of alien species in each vegetation community.*

Table 26: Number of alien species in each vegetation community

Vegetation community	No. of alien species	Cat 1	Cat 2	Cat 3	Not declared
Natural grassland	1	1		0	0
Riparian vegetation	25	1		4	14
Alien vegetation and cultivated lands	30		7	3	16
Mining	-				
Sewage works	-				

The removal of Category 1 Declared Weeds is *compulsory* in terms of the regulations formulated under “*The Conservation of Agricultural Resources Act*” (*Act No. 43 of 1983*), *as amended*. Category 2 Declared invaders should likewise be controlled.

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. In such cases, a land user must take all reasonable steps to curtail the spreading of propagating material of Category 3 plants.

Orange listed species

The habitat was suitable for three of the five Orange-listed plant species known to occur in the 2528CC and 2528CD quarter degree grid squares. Two of these species were found: *Hypoxis hemerocallidea* (African potato) was sparsely scattered in the Natural grassland. A few plants of the Transvaal stone plant *Lithops lesliei* subsp. *lesliei* were found at position A just west of the M57 road.

Red listed species

The habitat of the Natural grassland was suitable for **three of the Red-listed** species known to occur in the two quarter-degree grid squares, but none was found. The survey was

conducted during the flowering time of the Red-listed legume and it can be stated with certainty that this species does not occur within 200 metres of the proposed route. The two orchids, however, only flower in late summer and early autumn and their presence in the Natural grassland within 200 meters of the proposed route can only be assumed.

Natural grassland

Functional aspects

This vegetation community comprised natural primary grassland with high species diversity. The proposed route runs twice through narrow tongues of the Natural grassland (*see D and a small area west of B in Figure 17*) without impacting much on this vegetation community.

Red – and orange-listed species

The habitat of the Natural grassland was suitable for three of the Red-listed species, one legume species and two orchids, known to occur in the two quarter-degree grid squares, but none was found. The habitat was suitable for three of the Orange-listed plant species known to occur in the two quarter-degree grid squares. Two of these species were found: *Hypoxis hemerocallidea* (African potato) was sparsely scattered in the vegetation community, but *Lithops lesliei* subsp. *lesliei* (Transvaal stone plant) was found only at *position A*, west of the M57.

Medicinal and alien species

Twenty four of the 32 medicinal species recorded in the vicinity of the proposed route were found in this vegetation community, but only one alien species was recorded, *Campuloclinium macrocephalum* (Pom pom weed), a Category 1 Declared weed that infiltrates pristine grassland.

Connectivity and Sensitivity

Connectivity with natural grassland existed only to the north. **This vegetation community was considered sensitive.**



Photo 1: Natural primary grassland at D with drainage line in the background



Photo 2: Natural primary grassland showing *Microchloa caffra* on shallow dolomite

Refer to Table 3, Annexure K for a list of the plants recorded in the natural grassland.

Riparian vegetation

Functional aspects

The Riparian vegetation was badly infested with alien species. The indigenous species, although comprising 60% of the species, were far outnumbered by the aliens in quantity.

Red – and orange-listed species

The habitat of this vegetation community was not suitable for any of the Red-listed or Orange-listed species known to occur in the quarter degree grid square.

Medicinal and alien species

Seventeen of the 32 medicinal species recorded in the vicinity of the proposed route were found in this vegetation community, and 25 alien species were recorded, of which one was a Category 1 Declared weed, six were Category 2 Declared invaders and four were Category 3 Declared invaders.

Connectivity and Sensitivity

Connectivity existed both upstream and downstream of the drainage line. Notwithstanding the alien infestation, drainage lines form corridors for the movement of species, which include pollinators of plant species, and **the drainage lines were therefore regarded as sensitive.**



Photo 3: Drainage line with riparian vegetation photographed at position B:



Photo 4: Riparian vegetation of the Olifantspruit photographed at position C.

Refer to Table 4, Annexure K for a list of the plants recorded in the riparian vegetation

Alien vegetation and cultivated lands

The Alien vegetation and cultivated lands plant community covered the largest surface area along the proposed K220 route and its adjacent land. Cultivated fields, both old and new, were included in this vegetation community. Most of the area along the proposed route was classified as Carltonville Dolomite Grassland, but the vegetation along the western part of the route was classified as Egoli Granite grassland (*see E and F in Figure 17*). Both vegetation units within this vegetation community were very disturbed.

The species diversity was high with the alien component 41% of the recorded species. Of the 30 alien species recorded, seven were Category 1 Declared weeds, four were Category 2 Declared invaders and three were Category 3 Declared invaders.

Ten of the 32 medicinal species recorded in the vicinity of the proposed route were found in this vegetation community. The habitat was not suitable for any of the Red-listed or Orange-listed species known to occur in the two quarter-degree grid squares. **This vegetation community was not considered sensitive.**



Photo 5: *Eucalyptus sp*,
Arundo donax and
Kikuyu grass (Pennisetum clandestinum)



Photo 6: An old strawberry field photographed at position H with *Eucalyptus sp* in the background



Photo 7: Old cultivated lands in position E, looking south-east towards the sewage works



Photo 8: The proposed route at the junction with K109, looking south-eastwards. The route is fenced north and south by enclosures of new Midstream developments

Refer to Table 5, Annexure K for a list of plants recorded in the Alien vegetation and cultivated lands

Mining

The vegetation of the mining areas was very degraded, with alien species such as *Eucalyptus* sp and Green wattle (*Acacia decurrens*) most evident in places that were not excavated. In addition to the quarries, large surfaces were used for manufacture and storage of the products (bricks and tiles).

The habitat was not suitable for any of the Red-listed or Orange-listed species known to occur in the two quarter-degree grid squares. **This vegetation community was not considered sensitive.**

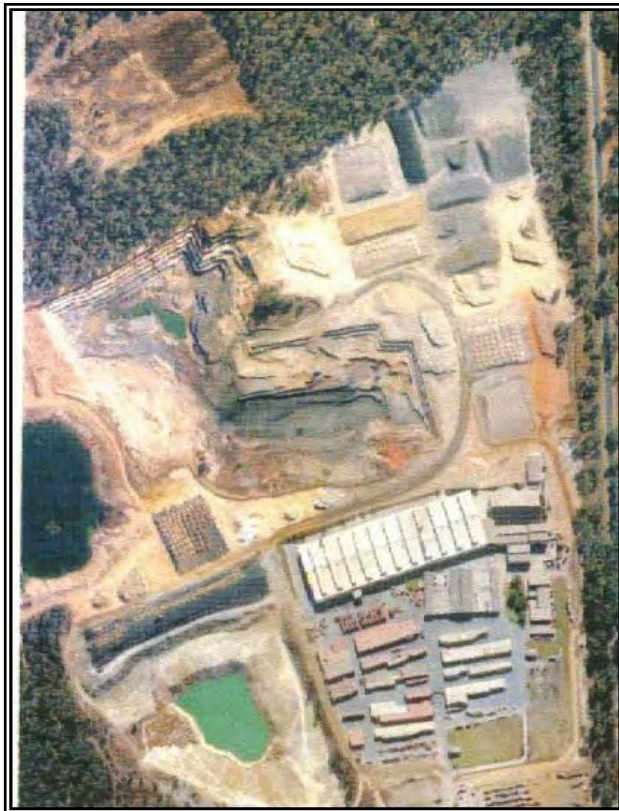


Photo 9: Aerial photo of Corobrik



Photo 10: Aerial photo of Sterkfontein Bricks

Sewage works

The vegetation of the sewage works was degraded with alien species such as *Eucalyptus* sp most evident, but with grassy patches between the structures of the sewage works. Most of the surface area was taken up by retention ponds, water recirculation facilities and other related structures.

The habitat was **not** suitable for any of the Red-listed or Orange-listed species known to occur in the two quarter-degree grid squares. **This vegetation community was not considered sensitive.**

Findings by Galago Environmental and Potential Implications

- Both alignment alternatives run twice through narrow tongues of the southernmost distribution of Natural grassland areas (*see Figure 17*) and as connectivity with natural grassland existed only to the north, the proposed route was not expected to impact much on this vegetation community.
- The habitat of the Natural grassland was suitable for three of the Red-listed and three of the Orange-listed species known to occur in the two quarter-degree grid squares, but only two Orange-listed species were found.
- The proposed route runs close to the elbow formed by the Olifantspruit and care should be taken that the drainage line and its riparian vegetation are not damaged, except for removal of alien species.
- **The Natural grassland and the Riparian vegetation were deemed sensitive** (*refer to Figure 25, Sensitivity Map*).

7.2.2 Fauna

Bird survey

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).

Within this vegetation type two distinct bird habitat systems were identified that will be directly affected by the construction of the road. A short description of each habitat type is as follows ranked from most to least important:

Open grassland and rocky ridges:

Only very small and fragmented pockets of open grassland can be found on the route where the K220 will be constructed. The open grassland areas are mainly disturbed by past and present human activities. 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 and brown or burnt during winter. The area will favour ground-living bird species such as lap-wings, francolins, pipits, long claws, larks and chats that either hunt for insects or breed on the ground, in barrows in the ground or in the grass. Weavers and widow-birds will make use of this area for feeding (seeds) during late summer and early winter when the grass is not burnt. 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.

Disturbed or transformed areas

The rest of the area consists mainly of disturbed areas or areas transformed by past and present human activities. The areas are as follows:

Exotic plantations:

The proposed K220 road will cross areas where Eucalyptus trees grow. Exotic plantations usually do not offer a large variation in plant communities and these trees are mostly unpalatable in their growing and live stage for insect and other fauna 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. Some birds also nest in these trees. A few bird of prey species, which require 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 bird species are few. These trees are known to extract large volumes of water daily and the surrounding ground is normally hard and dry.

Agricultural lands, pastures and other disturbed areas

Sections of the proposed K220 road cross areas where natural, mainly grassland vegetation, has been disturbed or transformed by human related activities such as industries, agriculture, removal of soil, dumping etc. The largest being land transformed for agricultural purposes. Agriculture and other forms of land use is a major environmental problem for threatened bird species as well as species that depend on grassland for

survival. The tilling of soil for agricultural land is one of the most drastic and irrevocable alterations wrought on natural systems. It destroys the structure and species composition of the natural vegetation (Barnes 1998). This disturbance is mainly permanent and thereby has a massive impact on the taxa that are dependent on that vegetation. It especially affects the grassland areas in the region.

Bird species that are able to exploit monoculture and cultivated crops, or a by-product of cultivation such as bare ground, or bird species that are able to adapt to a human changed environment, may benefit temporarily. Seed and fruit eating bird species, such as queleas, doves, bishops, barbets and mousebirds largely benefit from maize, wheat or other crops as it supplies food in large quantities to them. Many of these species flock in large numbers to these fields and become pests to the farmers. The birds least likely to be effected by this transformation of grassland to agricultural field, or another land use, are the smaller species. They are able to subsist in small, fragmented remnants of undisturbed habitat. Species most likely to show disrupted patterns of distribution are the larger species with larger home ranges.

Of the 358 bird species recorded for the 2528CC & 2528CD q.d.g.c., 121 (33.79%) are likely to occur on site and 47 (38.84%) of these bird species were actually observed on the study site. The largest species diversity was recorded in and around the wetland area (*Refer to Table 6, Annexure K*). The largest bird diversity can be expected within the disturbed and transformed habitat system on the study site, with a biodiversity index of 385 followed by the open grassland (271).

Findings by Galago Environmental and Potential Implications

Twenty-seven Red Data bird species have been recorded within the 2528CC & 2528CD q.d.g.c (*Refer to Table 7, Annexure K*). Four of these species have disappeared from the area or were not recorded for this quarter degree grid cell during the time of the southern African Bird Atlas project and it is unlikely that they will ever be seen in this region again except maybe on rare occasions or in protected areas. None of the species that have disappeared from the region used to breed within the said q.d.g.c's (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 for the 2528CD q.d.g.c. 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.

On site habitat assessment:

According to Galago Environmental the construction of the K220 route will not have a negative effect on the Red Data bird species recorded for the 2528CC & 2528CD q.d.g.c. due to a lack of sufficient breeding and foraging habitat.

Refer to Table 8, Annexure K for a list of the Red Data bird species recorded for the 2528CC and CD q.d.g.c according to Harrison *et al.* (1997) and an indication of the likelihood of occurring on the study site based on habitat and food availability on site.

Limitations, Assumptions and gaps in knowledge

The Galago Environmental team is aptly qualified and experienced to derive reasonably accurate species lists based on a site visit.

According to Galago Environmental sufficient information was received and sufficient rain had fallen to accomplish the survey that was done during optimum growing conditions. The two orchids expected to occur in the Natural grassland only flower in late summer and no verdict about their presence within 200 meters of the proposed route can be given in their report.

Invertebrate survey

Refer to Annexure L

A habitat survey of invertebrates, of known high conservation priority, was required for a proposed road development K220 to determine which species may reside on the site. According to Galago Environmental the survey focused on the possibility that red listed invertebrate species known to occur in Gauteng, are likely to occur within the proposed development site and immediate surrounding areas or not. Species of high conservation priority that do not appear on red lists also received attention in the survey.

Habitat characteristics and vegetation

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/physiognomy) as well as floristic composition. Voucher specimens of plant species were only taken where the taxonomy was in doubt and where the plant specimens were of significant relevance for invertebrate conservation. Field guides such as those by Van Oudtshoorn (1999), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997) were used to confirm the taxonomy of the species. In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification.

Butterflies

Butterflies were noted as sight records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt.

Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival. Known food plants of butterflies were therefore also recorded. After the visits to the site and the identification of the butterflies found there, a

list was also compiled of butterflies that will most probably be found in the area in all the other seasons because of suitable habitat. The emphasis is on a habitat survey.

Fruit chafer beetles

Different habitat types in the areas were explored for any sensitive or special fruit chafer species. Selection of methods to find fruit chafers depends on the different types of habitat present and the species that may be present. Fruit bait traps would probably not be successful for capturing *Ichneustoma* species in a grassland patch (Holm & Marais 1992). Possible chafer beetles of high conservation priority were noted as sight records accompanied by the collecting of voucher specimens with grass nets or containers. Voucher specimens were taken since the relevant species belongs to taxa that warrant collecting due to taxonomic difficulties or possible confusion of identity in the veldt.

Mygalomorph spiders and rock scorpions

Relatively homogenous habitat / vegetation areas were identified and explored to identify any sensitive or special species. Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. The area was searched for possible signs of trap door spiders or other mygalomorph spiders (for example traces of wafer-lids, cork-lids or silk-lined burrows). Investigations by brushing the soil surface with a small broom/paint brush, scraping or digging into the soil with a spade, were made. All the above actions were accompanied by the least disturbance possible.

Limitations

It should be emphasized that the survey is by no means an exhaustive list of the butterflies and other invertebrates present on the site, because of the time constraint. The on site butterfly and invertebrate survey was conducted during November 2007 after ample rains, which is an optimal time of the year to find sensitive butterflies as well as other

invertebrates of high conservation priority. Weather conditions during the visits were favourable for recording butterflies and invertebrates.

Butterflies

Refer to Table 4.2, Annexure L, for a list of Butterfly species in Gauteng that appear in the present revised red data book of butterfly species in South Africa (Henning, Terblanche & Ball in press).

Refer to Table 4.3, Annexure L for a list of Butterfly species of high conservation priority in the Gauteng Province due to localized distribution and habitat specificities

Fruit chafers

Refer to Table 4.4, Annexure L for a list of Fruit chafer species (Coleoptera: Scarabaeidae: Cetoniinae) in Gauteng that are known to be of high conservation priority.

Baboon spiders

Refer to Table 4.5, Annexure L for a list of Baboon spiders species (Araneae: Teraphosidae) species that are of known high conservation priority in the Gauteng Province.

Trapdoor spiders

Refer to Table 4.6, Annexure L for a list of Front-eyed or spurred trapdoor spiders species (Araneae: Idiopidae) species that are of known high conservation priority in the Gauteng Province.

Rock scorpions

Refer to Table 4.7, Annexure L for a list of Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province.

Butterfly biodiversity in general

Refer to Table 4.8, Annexure L for a list of the butterflies that were actually recorded on site as well as butterflies that will most probably be found there. It does include a few butterflies that may only be visitors (migratory species).

Refer to Table 4.9, Annexure L for a list of the known larval host plants of some butterflies that were found on site. Note that though in most cases these host plants will be used on the site by the different butterfly larvae, exceptions may occur. The only proof for a natural larval host-plant in any area is finding larvae feeding on the particular plant on site.

Status of threatened butterfly species at the site

The red list of butterflies is under revision at present (*Refer to Table 4.3, Annexure L*). Six species of butterfly in Gauteng are listed in the revised red list and Red Data Book (G.A. Henning, Terblanche & Ball 2007 *in prep.*) and regional list (G.A. Henning, Roos, Ball & Terblanche *in prep.*).

Research revealed that the Heidelberg Copper, *Chrysorits aureus* (RED DATA: RARE), has very specific habitat requirements - for more detail refer to Terblanche, Morgenthal & Cilliers (2003). The host plant of the Heidelberg Copper, the lightning bush, *Clutia pulchella* does not occur on the site. The Heidelberg Copper will not occur at the study site - there is clearly no suitable habitat for this butterfly there, also none of its host plants occur.

It also appears that the site is not an ideal habitat for the RED DATA *Aloeides dentatis* subsp. *dentatis*. See Deutschländer and Bredenkamp (1999) for the description of the vegetation and habitat characteristics of one locality of *Aloeides dentatis* subsp. *dentatis* at Ruimsig, Roodepoort, Gauteng Province.

Lepidochrysops praeterita is a butterfly that occurs in only in selected rocky areas where plants species of the genus *Ocimum* is present. There appears to be no suitable habitat for *Lepidochrysops praeterita* at the site.

No ideal habitats of *Metisella meninx* (the marsh sylph butterfly), a wetland species favouring treeless marshy areas where *Leersia hexandra* (rice grass) is abundant, were found. No *Metisella meninx* was found or is likely to be found. The streambed that crosses the proposed development appears to contain no suitable habitat for *Metisella meninx* on its banks, based on the vegetation that include the exotic kikuyu grass (*Pennisetum clandestinum*) and *Typha capensis* (bull-rush).

Platylesches dolomitica is a rare butterfly of which the habitat is still poorly known. *P. dolomitica* was not found on the site.

No *Orachrysops* species were recorded on the site and it is unlikely that any *Orachrysops* will be present.

To conclude there appears to be no threat to any red listed butterfly species if the study site is to be developed.

Status of invertebrates of special conservation significance

Table 4.3, Annexure L lists the butterfly species (Lepidoptera: Hesperidae, Papilionidae, Pieridae, Nymphalidae and Lycaenidae) that are of known high conservation priority in the Gauteng Province. None of the above butterfly species were found on the site, or are likely to be resident at the site. There appears to be no threat to the butterfly species of high conservation significance if the site was to be developed.

Table 4.4, Annexure L lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoninae) that are of known high conservation priority in the Gauteng Province. No beetle species of high conservation priority are likely to be resident at the site.

Table 4.5, Annexure L lists the baboon spider species (Araneae: Teraphosidae) that are of known high conservation priority in the Gauteng Province. None of the above baboon spider species were found on the site, or are likely to be resident at the site. There appears to be no threat to the baboon spider species of high conservation significance if the study site was to be developed.

Table 4.6, Annexure L lists the trapdoor spider species (Araneae: Teraphosidae) that are of known high conservation priority in the Gauteng Province. Most trapdoor spider species in general are regarded as being sensitive to environmental changes. None of the trapdoor spider species listed in Table 4.6 were found on the site despite efforts to find them. There appears to be no threat to the trapdoor spider species of high conservation significance if the study site was to be developed.

Table 4.7, Annexure L lists the rock scorpion species (Scorpiones: Ischnuridae) that are of known high conservation priority in the Gauteng Province. No *Hadogenes gunningi* individuals are found or are likely to be found on the site. There will be no threat to rock scorpions of high conservation priority, if the site is to be developed.

Butterfly biodiversity in general

Estimated on the basis of experience in other habitats, a low number of butterfly species will probably occur at the site.

According to Galago Environmental the general biodiversity of invertebrates appears to be low at this impacted site. There appears to be no threat to red listed invertebrate species or invertebrate species of high conservation priority in the Gauteng Province if the site is to be developed.

Recommended mitigation measures from Galago Environmental

- A fence should be erected between the Riparian vegetation at the elbow in the Olifantspruit (*approximately position C in Figure 15*) and the planned road reserve.

This will prevent entry into the drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the drainage line.

- Care must be taken to ensure that construction activities remain within the boundary of the planned road reserve.
- Site offices, parking areas for construction vehicles, etc. should be confined to non-sensitive areas.
- Limited access to the water of the Olifantspruit should be given to construction vehicles by fencing off all access points to the water, except at the predetermined water-intake point.
- 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.
- All Category 1 Declared Weeds and other alien species must be removed from the vicinity of the proposed route.
- Where possible work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- 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.
- 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.
- It would be beneficial for invertebrate conservation if as much as possible exotic plant species, especially *Eucalyptus* (bloekom), *Acacia mearnsii* (black wattle), *Melia azedarach* (syringa) and *Solanum mauritianum* (bugweed) individuals in the area can be removed.
- The construction of the road should be accompanied by the eradication of exotic plant species and should be confined as much as possible to the strip that is to be developed.

- As many as possible of the mature indigenous trees that occur naturally in the vicinity of the proposed route should be retained. These vegetation communities should be connected to natural vegetation on neighbouring properties to facilitate connectivity. This area must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity

Table 27: Issues and Impacts – Flora and Fauna

	Issue/ Impact	Positive/ Negative / Neutral ±	Mitigation Possibilities High 🟢 Medium 😊 Low 🟡 Positive Impact - Not Necessary To Mitigate 🌟
16)	Impact on natural grassland areas	-	😊
17)	Impact on riparian vegetation	-	😊
18)	Loss of Orange listed and medicinal plant species	-	😊
19)	The eradication of weeds and exotic invaders	+	🌟
20)	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.	-	😊
21)	Noise of construction machinery could have a negative impact on the fauna species during the construction phase.	-	😊
22)	During the construction phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.	-	🟢
23)	Loss of habitat can lead to the decrease of fauna numbers and species.	-	🟡

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

16) Impact on natural grassland areas

Both alternatives proposed for the route run twice through narrow tongues of the natural grassland without impacting much on this vegetation community.

Table 28: Significance of Issue 16 (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>P/C/O – As many as possible of the mature indigenous trees that occur naturally in the vicinity of the proposed route should be retained. These vegetation communities should be connected to natural vegetation on neighbouring properties to facilitate connectivity. This area must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics to ensure biodiversity.</p> <p>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</p>	<p>M -To be included in EMP</p> <p>M -To be included in EMP</p>

	will drastically interfere with the nature of the area. P/C/O – All Category 1 Declared Weeds and other alien species must be removed from the vicinity of the proposed route.	M -To be included in EMP
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

17) Impact on riparian vegetation

The proposed route crosses an unnamed drainage line and the Olifantspruit and will have an impact on the riparian vegetation in these areas. The riparian vegetation was badly infested with alien species, However, drainage lines form movement corridors and were therefore regarded as sensitive.

Table 29: Significance of Issue 17 (Impact on riparian vegetation) 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 – A fence should be erected between the Riparian vegetation at the elbow in the Olifant Spruit (<i>refer to Figure 23,</i>	M -To be included in EMP

	<p><i>sensitivity map</i>) and the planned road reserve. This will prevent entry into the drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the drainage line.</p> <p>P/C - Care must be taken to ensure that construction activities remain within the boundary of the planned road reserve.</p> <p>P/C - Site offices, parking areas for construction vehicles, etc. should be confined to non-sensitive areas.</p> <p>P/C - Limited access to the water of the Olifantspruit should be given to construction vehicles by fencing off all access points to the water, except at the predetermined water-intake point.</p> <p>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> <p>P/C/O – All Category 1 Declared Weeds and other alien species must be removed from the vicinity of the proposed route.</p>	<p>M -To be included in EMP</p> <p>M -To be included in EMP</p> <p>M -To be included in EMP</p> <p>H -To be included in EMP</p> <p>H -To be included in EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

18) Loss of Orange listed and medicinal plant species

Two Orange-listed plant species were found (*Hypoxis hemerocallidea* (African potato) and the Transvaal stone plant *Lithops lesliei* subsp. *Leslie*) while 32 species with medicinal properties were found in the vegetation communities in the vicinity of the road alignment.

**Table 30: Significance of Issue 18 (Loss of Orange listed and medicinal plant 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
Medium 🟡	P – As much as possible of the <i>Hypoxis hemerocallidea</i> , <i>Lithops lesliei</i> subsp. <i>Leslie</i> and medicinal plant species impacted by the alignment of the road should be removed prior to construction and be transplanted in a suitable area by a vegetation specialist.	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

19) 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 31: Significance of Issue 19 (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 -To be included in EMP L -To be included in EMP

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

- 20) 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 32: Significance of Issue 20 (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

21) 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 33: Significance of Issue 21 (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 -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*

	penalty clauses for non-compliance.	
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

23) 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 35: Significance of Issue 23(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	M - In terms of local fauna population L - In terms of the global conservation status of fauna

	order to maintain and possibly increase numbers and species of indigenous fauna.	
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

7.2.3 Aquatic Ecological Assessment

Scientific Aquatic Services (SAS) was requested to assess and characterise the aquatic and riparian areas where the proposed development of the K220 route cross riverine features (*refer to Annexure M, Aquatic Ecological Assessment Report*).

The purpose of the report was to provide a summary of the aquatic ecological status of the Olifantspruit and an unnamed tributary of the Olifantspruit prior to the proposed development of the involved section of the K220. *Refer to Figure 13, Hydrology map.*

The western crossing (**referred to as C1 in the report**) is located on a furrow forming a tributary of the Olifantspruit. This system is recharged significantly by treated sewage effluent being discharged into the system. This leads to increased volumes of water in the system, increased flow and improved habitat conditions in the system. The introduction of treated sewage into the system does, however, have a negative impact on water quality and some aspects of habitat suitability.

The eastern crossing (**referred to as C2 in the report**) forms the headwater of an unnamed drainage line which seems to originate from a spring located immediately to the south of the proposed crossing. According to Mr. van Staden, Scientific Aquatic Services, the feature has limited surface water present with limited flow which will limit the diversity of the aquatic community at this point; however, a significant degree of wetland development is evident.

As already mentioned the Olifantspruit forms part of the A21B quaternary catchment. The systems being crossed form part of the headwaters of the Olifantspruit, a tributary of the Sesmylspruit. The Sesmylspruit forms the Hennops River which confluences with the Crocodile River. This catchment therefore forms part of the Crocodile Marico (west) secondary catchment and, ultimately, the Limpopo primary catchment.

Methodology

The instream and aquatic ecology of the two systems which are to be crossed was Assessed and a general overview of the site was also undertaken to observe any anomalies which may occur in the system in the area.

The following were included in the aquatic assessment:

- Visual assessment
- Biota specific water quality
- Habitat integrity
- Aquatic macro-invertebrates
- Fish community integrity
- Riparian vegetation

Results

Visual Assessment

The site was investigated in order to identify visible impacts on the site with specific reference to impacts from surrounding activities. Both natural constraints placed on ecosystem structure and function as well as anthropogenic alterations to the system was assessed by observing conditions and relating them to professional experience. Photographs of each site were taken to provide visual indications of the conditions at the time of assessment:



Photograph 11: Downstream view showing rapids and riffles on the Olifantspruit



Photograph 12: A pool on the Olifantspruit providing slower and deeper water for aquatic life



Photograph 13: General view of the C2 site showing the absence of a well defined drainage channel



Photograph 14: Surface water at the C2 site

Table 36: Visual description of the Olifantspruit in the vicinity of the involved section of the K220

ASPECT	C1	C2
Surrounding features	The stream forms the headwaters of the Olifantspruit. The area is surrounded by industrial areas as well as the Thembisa residential areas. Immediately upstream of the site is a sewerage purification plant which releases treated effluent into the system.	The stream forms the headwaters of the Olifantspruit. The area is surrounded by industrial areas, quarrying activities and roadways.
Significance of the point	The site serves to indicate the aquatic ecological integrity of the Olifantspruit prior to the proposed development taking place.	The site serves to indicate the aquatic ecological integrity of the unnamed tributary Olifantspruit prior to the proposed development taking place.
Riparian zone characteristics	The riparian zone is narrow due to the incised nature of the active-channel. The riparian zone has seen significant invasion by alien vegetation.	Due to the shallow bottom of the valley at this point wetland features are fairly expansive in relation to the stream flow and channel width.
Depth and flow characteristics	The stream has a diversity of depth and flow types at this point giving rise to a wide variety of habitats and the potential to support a diverse aquatic community.	The active channel at this point is ill defined with few areas of open channel. There is limited flow in the system and limited variation in depth flow and substrate types.
Water clarity	Water at this point is discoloured due to upstream impacts on the system.	Water in the system is clear at this point.
Signs of pollution	The site shows evidence of impact by sewage with an odour present. Significant amounts of litter have been distributed by the stream along the banks of the stream.	The site seems fairly clear of pollution at this point although fires do impact the system.

Biota Specific Water Quality

- Dissolved salt concentrations can be considered to be fair in the Olifantspruit while in the unnamed tributary values can be considered to be good. Some addition of salts to the Olifantspruit from the upstream sewerage treatment facility as well as the surrounding industrial and residential activities is deemed likely.
- pH is fairly high; however, no significant impairment of the aquatic community, due to elevated pH levels is deemed likely.
- The organic compounds introduced through **sewage outfall** will most likely significantly impair the aquatic community in this system.
- Some impact on dissolved oxygen levels is evident, especially in the Olifantspruit as a result of the introduction of sewage effluent and urban runoff into the system further up in the catchment. This is likely to affect all but the more tolerant aquatic community members.

- Temperature can be regarded as normal for the time of year and time of day during which the assessment took place.

Habitat integrity

- General habitat conditions can be considered to be moderately modified (Class C) in the Olifantspruit while in the unnamed tributary conditions can be considered to be largely natural.
- The largest instream impacts in the Olifantspruit include flow, channel, bed and water quality modifications as well as a smaller impact from solid waste disposal. In the unnamed tributary there were only small impacts from channel modification and solid waste disposal.
- The riparian zone is more severely modified on the Olifantspruit with channel modification, indigenous vegetation removal, alien vegetation encroachment and bank erosion. Other relatively large impacts on the riparian zone include impacts from flow and channel modification.
- The unnamed tributary has only been affected by limited natural vegetation removal and some encroachment by alien vegetation.
- Due to the incised nature of the stream the riparian vegetation structure has been severely impaired.
- The stream is fairly incised as a result of past erosion, most likely caused by upstream introduction of stormwater.
- The stream bankfull height, bankfull depth, bank angle and bank soil particle composition all indicate that the stream banks in the Olifantspruit have a low level of stability and are prone to **erosion and incision**.
- The channel form of the Olifantspruit can be considered to be somewhat modified with a reduction in the sinuosity of the channel, due to erosion of the system.
- Limited impacts on the unnamed tributary channel forms are evident.

Habitat for fish, Aquatic Macro-invertebrates and riparian life forms

- Vegetation habitats, including bankside vegetation and undercut root wads, are

present in low abundances in the Olifantspruit while in the unnamed tributary it provides the only available cover for fish and the main cover for macro-invertebrates.

- Good rocky riffle and rapid habitat is present interspersed with deeper pools providing excellent diversity in habitat and cover in the area on the Olifantspruit while in the unnamed tributary no rocky substrate and flowing water is present.
- Habitat structure and diversity is suitable for supporting a diverse aquatic macroinvertebrate and fish community on the Olifantspruit while in the unnamed tributary insufficient habitat to support a diverse aquatic macro-invertebrate community is present and habitat conditions are unlikely to allow a fish community to occur on a permanent basis at this point in the stream. Some migratory activity may, however, take place.
- Both the fish community and aquatic macro-invertebrate community indicated a substantial decrease in community integrity in relation to the expected conditions for the site.
- **The largest impact on the aquatic community at this point is likely to be reduced water quality; however, erosion and the associated loss of bankside habitats and cover are likely to also play a role in the lower than expected aquatic community integrity (diversity and sensitivity) observed.**
- **The aquatic community of the Olifantspruit can be considered to be Critically modified (Class F) due to impacts on water quality and due to treated sewage effluent disposal.**
- The invertebrate community of the unnamed tributary can be classified as being largely modified (Class D).
- **The fish community of the Olifantspruit can be considered to be Critically modified (Class F) while a fish community was not expected at the C2 site on the unnamed tributary.**
- Other impacts on the fish community are most likely related to a loss of suitable spawning habitat and migrational barriers, both upstream and downstream of the site.
- The riparian zone is significantly impacted and provides fairly poor habitat for birds associated with riparian areas due to impacts of fire, vegetation removal, bank

erosion and alien vegetation encroachment. The system does, however, provide a role in supporting a bird community. Herpetofauna and reptilian species such as *Viranus niloticus* and mammals such as water mongoose (*Atilax paludinosus*) are also likely to inhabit the riparian area of the proposed development site.

Riparian vegetation

The **RVI (Riparian Vegetation Index)** for this site was 12.8 (out of a possible 20) on the Olifantspruit while a value of 12.6 was obtained on the unnamed tributary. These values fall on the boundary of a class C (moderately modified) to D (largely modified). The reason for this site receiving this value is largely attributed to the abundant presence of **exotic species**, which has resulted in the displacement of indigenous flora. It must be noted that certain aspects of the assessment were hampered by a fire that had passed through the area prior to the site visit, making such aspects as determining the degree of indigenous species recruitment difficult. If this assessment was repeated in the following summer season a different RVI may be obtained, which may place the stream more definitively in a particular class.

Wetland Mammals

The wetland habitat was surveyed for the mammal species with special reference to *Aonyx capensis*, *Atilax paludinosus*, *Chrysospalax villosus*, *Dasymys incomtus*, *Lutra maculicollis*, *Otomys angoniensis* and *Otomys irroratus*.

During the survey only one mammal i.e. a Multimammate Mouse (listed as least concern) was found at K220A. According to Scientific Aquatic Services this is a common species and is likely to be abundant at both sites. The habitat and food available indicates that both sites have the potential to support more resilient species, particularly rodents.

With regards to the habitat at both sites, disturbances such as dominance by exotic species, construction, sewerage, recreational activities, high human traffic through have

degraded the wetland habitat. The habitat and food requirements for only the Water Rat, Vlei Rat and Angoni Vlei Rats' were partially met, indicating that there is a **low-medium** possibility of them occurring at both sites.

Table 37: The habitat and food requirements of wetland mammals as well as whether or not they these requirements were met at the different field sites

Species	Habitat requirements	Habitat available on site	Food requirements	Food available on site	Overall
<i>Aonyx capensis</i> [African (Cape) clawless otter]	Fresh, unpolluted water, preferably flowing; Cover of dense vegetation; Require holes and rocks	The combination of fresh, flowing, unpolluted water was not observed at either site.	In freshwater: 50-70 % crabs; 10-20 % frogs; 15% dragonfly larvae, and 3-23 % fish	Low	Sites not suitable for species.
<i>Atilax paludinosus</i> [Water (Marsh) mongoose]	Dense vegetation near water; Foragers from footpaths and muddy banks	Some suitable habitat found at K220B. However, the high human traffic through the site makes it unlikely that the species would reside here.	Frogs, crabs, mice, fish, insects and bird eggs. Mainly frogs and crabs	Moderate	Remote possibility of species being found at either site.
<i>Chrysopalax villosus</i> (Rough haired golden mole)	Grassland with dry sandy soils near marshes and streams	Some suitable habitat found at K220B	Invertebrates, especially giant earthworms and millipedes	Moderate	Remote possibility of species being found at either site
<i>Dasymys incomtus</i> (Water rat)	Swamps and wet areas along rivers and streams	Some suitable habitat found at both sites.	Stems and ripening seeds of grass; Reeds and other plants; Insects	Moderate	Moderate possibility of being found at both sites.
<i>Lutra maculicollis</i> (Spotter Neck)	Fresh water only, generally	The combination of fresh, flowing,	Primarily fish eater. 40% fish; 40 %	Low	Site not suitable for species

Otter)	prefers deeper water that does not necessarily have to flow ; Must have dense vegetation and holes available	unpolluted water was not observed at either site.	crab and 20% frog		
<i>Itomys angoniensis</i> / <i>Otomys angoniensis</i> (Angoni Vlei Rat)	Wet vleis/ swampy areas; Grassland and bushveld next to rivers; Requires dense cover for protection from prey	Suitable habitat found at both sites.	Stems and rhizomes of grass and fine seeds; Own faeces	Moderate	Moderate possibility of being found at both sites.
<i>Otomys irroratus</i> (Vlei rat)	Vleis and swampy areas; Grassland next to wet areas; Found in wetter areas than <i>Otomys angoniensis</i> ; Wet soil and standing water	Suitable habitat found at both sites	Stems and leaves of grasses and reeds; Forbs and seeds; Bark from pine trees;	Moderate	Moderate possibility of being found at both sites.

Mitigation measures and management recommendations from Scientific Aquatic Services

- Any stormwater produced from the proposed development will need to be carefully introduced to the system should the stormwater need to be disposed into the aquatic systems in order to prevent erosion of the banks of the stream. In this regard special mention of the following is made:
 - Reduce runoff from surface areas as far as possible.
 - The storm water should be introduced into the system at a shallow angle to prevent erosion of the opposite bank of the system.

- Ongoing removal of alien vegetation stands which show signs of dominance or active recruitment should take place throughout the construction and operational phase of the development.
- Throughout the construction phase of the proposed development, construction of compacted earth berms at suitable intervals to reduce the volume and speed of runoff from construction areas into the stormwater and wetland systems for the duration of the construction phase of the development. The following guidelines should be used:
 - Where the area has a slope of less than 2%, berms every 50m should be installed.
 - Where the area slopes between 2% and 10%, berms every 25m should be installed.
 - Where the area slopes between 10%-15%, berms every 20m should be installed.
 - Where the area has a slope greater than-15%, berms every 10m should be installed.
- All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Areas should be reseeded with indigenous grasses as required.
- During the construction phase no vehicles should be allowed to indiscriminately drive through the wetland areas.

Table 38: Issues and Impacts – Aquatic systems

	Issue/ Impact	Positive/ Negative / Neutral ±	Mitigation Possibilities High 🟢 Medium 😊 Low 🟡 Positive Impact - Not Necessary To Mitigate 🌟
24)	Erosion of Olifantspruit and unnamed drainage line	-	😊

8)	Pollution of Olifantspruit and wetland systems - <i>refer to section 7.1.2.2.c, page 84</i>	-	☹
25)	Impact on aquatic habitat	-	☹
17)	Impact on riparian vegetation - <i>refer to section 7.2.2.a, page 73</i>	-	☹
12)	Impact on wetland system – <i>refer to section 7.1.3.a, page 95</i>	-	☹

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

24) Erosion of Olifantspruit, unnamed drainage line and wetland systems

The results of the Aquatic Ecological survey indicated that the banks in the Olifantspruit have a low level of stability and are prone to erosion and incision. Any stormwater produced from the proposed road will need to be carefully introduced to the system should the stormwater need to be disposed into the aquatic systems in order to prevent erosion of the banks of the streams.

Table 39: Significance of Issue 24 (Erosion of Olifantspruit and unnamed drainage line) 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

<p>Medium 😊</p>	<p>P/C/O – Reduce runoff from surface areas as far as possible. The storm water should be introduced into the system at a shallow angle to prevent erosion of the opposite bank of the system.</p> <p>C – Throughout the construction phase of the proposed road, compacted earth berms should be constructed at suitable intervals to reduce the volume and speed of runoff from construction areas into the stormwater and wetland systems for the duration of the construction phase of the road. The following guidelines should be used:</p> <ul style="list-style-type: none"> - Where the area has a slope of less than 2%, berms every 50m should be installed. - Where the area slopes between 2% and 10%, berms every 25m should be installed. - Where the area slopes between 10%-15%, berms every 20m should be installed. - Where the area has a slope greater than-15%, berms every 10m should be installed. <p>C - During the construction phase no vehicles should be allowed to indiscriminately drive through the wetland areas.</p> <p>C/O - All areas affected by construction should be rehabilitated upon completion of the construction phase of the road. Areas should be reseeded with indigenous grasses as required.</p>	<p>M -To be included in EMP</p> <p>M -To be included in EMP</p> <p>M -To be included in EMP</p> <p>M -To be included in EMP</p>
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Result: Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

25) Impact on aquatic habitat

The wetland habitat had been degraded by disturbances such as dominance by exotic species, construction, sewerage, recreational activities and high human traffic.

The largest impact on the aquatic community is likely to be reduced water quality; however, erosion and the associated loss of bankside habitats and cover are likely to also play a role in the lower than expected aquatic community integrity (diversity and sensitivity) observed.

Table 40: Significance of Issue 25 (Loss of aquatic habitat) 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 – Reduce runoff from surface areas as far as possible. The storm water should be introduced into the system at a shallow angle to prevent erosion of the opposite bank of the system. C – Throughout the	M -To be included in EMP M -To be included in EMP

	<p>construction phase of the proposed road, compacted earth berms should be constructed at suitable intervals to reduce the volume and speed of runoff from construction areas into the stormwater and wetland systems for the duration of the construction phase of the road. The following guidelines should be used:</p> <ul style="list-style-type: none"> - Where the area has a slope of less than 2%, berms every 50m should be installed. - Where the area slopes between 2% and 10%, berms every 25m should be installed. - Where the area slopes between 10%-15%, berms every 20m should be installed. - Where the area has a slope greater than-15%, berms every 10m should be installed. <p>C/O – P/C/O – All spillages must be cleaned up and contaminated soil removed as hazardous waste.</p> <p>P/C/O – Affected soil must be treated with DRIZIT or similar product.</p> <p>P/C/O –Ongoing removal of alien vegetation stands which show signs of dominance or active recruitment should take place throughout the construction and operational phase of the development.</p> <p>C/O - All areas affected by construction should be rehabilitated upon completion of the construction phase of the road. Areas should be reseeded with indigenous grasses as required.</p>	<p>H -To be included in EMP</p> <p>H -To be included in EMP</p> <p>M -To be included in EMP</p> <p>M -To be included in EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

8 DESCRIPTION OF THE SOCIAL ENVIRONMENT [Regulation 29(c) (d)]

8.1 Cultural and Historical

Dr. Johnny van Schalkwyk, an independent heritage consultant was appointed by Bokamoso Landscape Architects to conduct a survey to locate, identify, evaluate and document sites, objects and structures of cultural importance found within the proposed alignment of the involved section of the K220. *Refer to Annexure N, Heritage Survey Report. We are still awaiting the comments from SAHRA on the Heritage survey Report (refer to Annexure O for proof of request for comments from SAHRA).*

Terms of Reference

The scope of work consisted of conducting a Phase 1 archaeological survey of the site in accordance with the requirements of Section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

This included:

- Conducting a desk-top investigation of the area
- A visit to the proposed development site

The objectives were to

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.

Regional overview

According to Dr. van Schalkwyk a number of sites of cultural heritage significance are known to exist in the region. The closest sites dating to the Stone Age are found in the Rietvlei Dam Nature Reserve, and far to the west in the Halfway House area.

Iron Age sites are known to the north and east of the Rietvlei Dam Nature Reserve.

A number of sites dating to the historic period are known to exist in the larger region. These range from Anglo Boer War sites to farmsteads and cemeteries.

Identified sites

Stone Age

No sites, features or objects of cultural heritage significance dating to the Stone Age were identified.

Iron Age

No such sites, objects or features of cultural heritage significance dating to the Iron Age were identified.

Historic period

No sites, objects or features of cultural heritage significance dating to historic times were identified.

The Cultural specialist found no obvious features, sites or artefacts of cultural significance that would be impacted on by the proposed development.

Legal requirements

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.

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.

Conclusions and Recommendations

- None of the sites dating to the historic period known to exist in the larger region are located close to the proposed alignment of the K220.
- No sites, features or objects of cultural significance were identified in the study area during the survey.
- Based on what was found and its evaluation, it is recommended that the construction of the involved section of the K220 can continue in the area, on condition of acceptance of the following recommendation:

If construction takes place and archaeological sites are exposed, 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.

8.1.a Issues & Impact Identification – Cultural and Historical

Table 41: Issues and Impacts – Cultural and Historical

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact - Not Necessary To Mitigate ✨
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26)	Structures of cultural and historical significance may be destroyed.	-	😊
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8.1.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

26) 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 the K220.

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 42: Significance of Issue 26 (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	L – To be included in the EMP

	<p>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> <p>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.</p>	<p>L – To be included in the EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

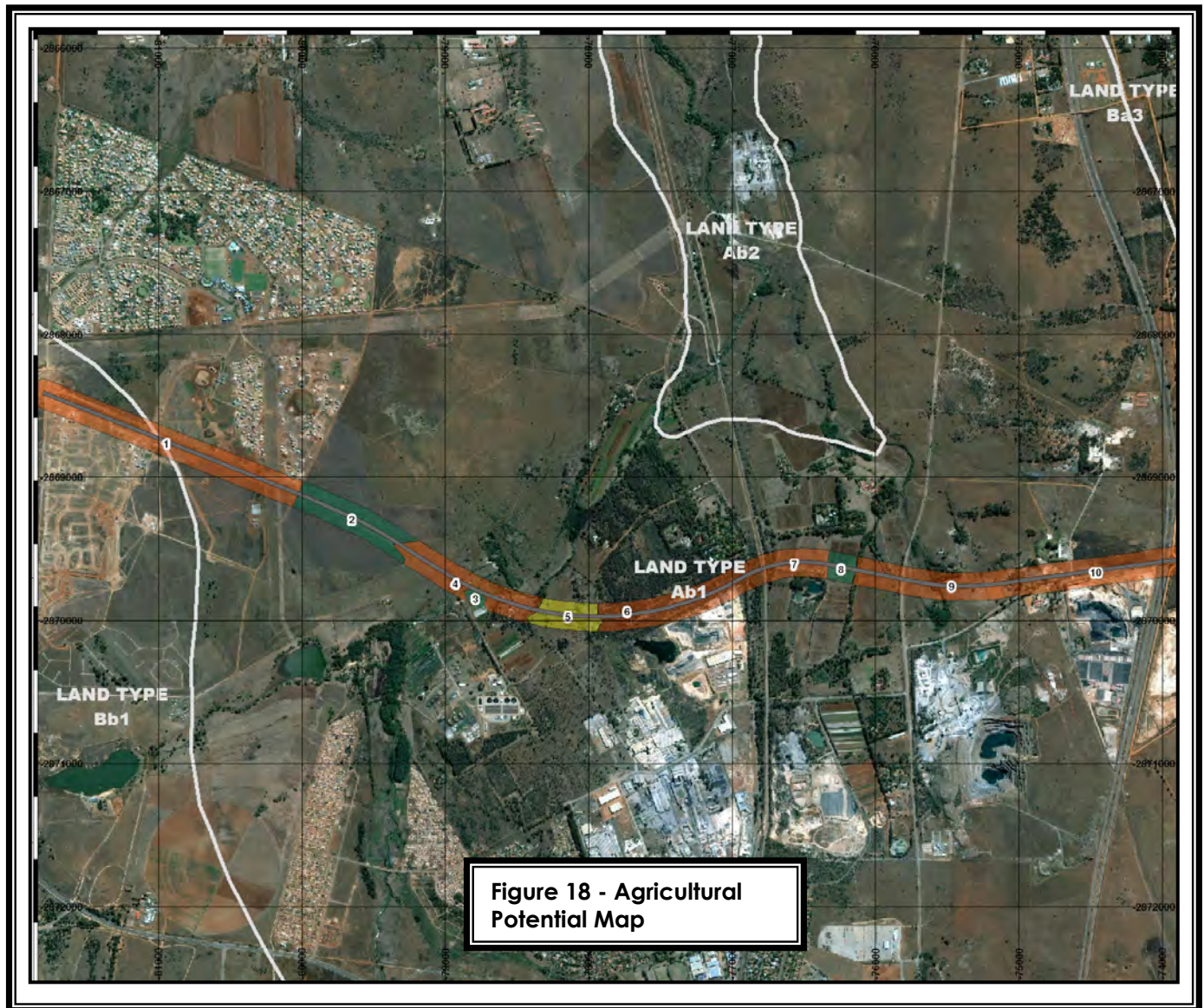
8.2 Agricultural Potential

Terrasoil Science was appointed to conduct an Agricultural Potential Survey along the proposed alignment of the involved section of the K220. ***Refer to Annexure P, Agricultural Potential Survey Report.*** Dr. van der Waals, Terrasoil Science, divided the proposed route into 10 distinct sections for the purposes of the report, as indicated on ***Figure 18, Agricultural Map.***

Section 1 – Low Potential

This section occupies 1 900 m (22.4 %) of the transect and is characterized by shallow and rocky soils (Mispah, Glenrosa and shallow Hutton forms) that range from sandy and light in colour in the west to red in the east. This section also lies between two boundary fences that is wide enough for the construction of a road but not wide enough for the practicing

of agriculture economically. The conclusion is that this section is of **low agricultural potential**.



Section 2 – High potential

This section occupies 780 m (9.2 %) of the transect and is characterized by moderately deep to deep red soils (Hutton forms) with varying degrees of rockiness. Due to adequate rooting depth and favourable soil physical conditions this area is considered to be of **high agricultural potential**.

According to Dr. Van der Waals there are a few restrictions:

- Relatively high Mn levels in the soil as exhibited by soil colour and copious amounts of Mn concretions. Although not a serious restriction the Mn levels could inhibit the growth of Mn sensitive crops or lead to inhibited growth of many crops if the soil is allowed to acidify.
- The underlying geological material is dolomite. The irrigation of soils on dolomite is discouraged due to the distinct danger of sinkhole formation following prolonged ingress of water into subsoil layers. Groundwater pollution due to the leaching of fertilizers and pesticides is also a distinct risk in these areas.

Section 3 – High Potential

This section occupies a very small section (70 m – 0.8 %) of the transect and is characterized by moderately deep to deep red soils (Hutton forms) with varying degrees of rockiness. Due to the presence of irrigation infrastructure this area is considered to be of **high agricultural potential**. According to Dr. van der Waals the same restrictions as for Section 2 applies with the difference that irrigation is already done.

Section 4 – Low Potential

This section occupies 1 010 m (11.9 %) of the transect and traverses the area on both sides of the Olifantspruit. This area is characterised by rock outcrops and rocky soils (Mispah and Glenrosa forms) on the edge of the stream and is therefore considered to be of **low agricultural potential**.

Section 5 – Medium Potential

This section occupies 440 m (5.2 %) of the transect and traverses a section with soils of variable depth and rockiness (Mispah, Glenrosa and Hutton forms). Due to the variable nature of the soils this area is considered to be **medium agricultural potential** at best. This

area has a few disturbances in the form of rubble and rocks occur on the surface at regular intervals leading to a restriction on tillage.

Section 6 – Low Potential

This section occupies 1200 m (14.1 %) of the transect and traverses a section that is characterised by shallow rocky soils (Mispah and Glenrosa forms) and is covered in Eucalyptus trees as well as numerous mounds of rubble. Due to soil and rubble restrictions this area is considered to be of **low agricultural potential**.

Section 7 – Low Potential

Section 7 occupies 480 m (5.7 %) of the transect and traverses a section that has been used for agricultural purposes in the past (specifically strawberry production). The soils in this area are very rocky and shallow and are therefore considered to be of **low agricultural potential**. This section (along with Section 8) forms the subject of a report (Strawberry Farm) that was submitted on November 13th, 2006, by Terrasoil Science. Even though this area is currently used for the production of strawberries Dr. van der Waals is of the opinion that it is not suitable for the production of other crops due to severe soil restrictions. The current production of strawberries entails the use of irrigation water – an aspect that is not supported by Dr. van der Waals as this practise could lead to geotechnical instability in the form of the formation of sinkholes. This practice will only be supported once a geotechnical assessment has indicated its safety, and then still, the soils will pose severe restrictions to agricultural production.

Section 8 – High Potential

This section occupies 190 m (2.2 %) of the transect and traverses a section of deep, well drained red soils of **high agricultural potential**. Even though these soils are of high potential they still suffer the same restrictions in terms of irrigation as discussed for Section 7.

Section 9 – Low Potential

Section 9 occupies 1070 m (12.6 %) of the transect and traverses a section that is characterised by shallow and rocky soils as well as a small drainage depression. Due to distinct soil restrictions this area is considered to be of **low agricultural potential**. This section includes a very limited occurrence of low yielding subsistence maize production as well as an informal soccer field.

Section 10 – Low Potential

This section occupies 1350 m (15.9 %) of the transect and traverses a section that runs very close to or over the existing Apollo road. As such the whole section has already been influenced radically and therefore constitutes **low agricultural potential**.

Soil Potential Linked to Current Land Use and Status

The current land use along the proposed route varies considerably with the bulk of the route having been influenced drastically by human activities. The low potential soils occupy 63.3 % of the route, medium potential 14.1 % and the high potential areas 22.6 %. Only Sections 3 and 8 (3 %) are currently being used for agricultural production. Section 2, even though of deeper soils, is currently not being used for agricultural production. This is a reflection of the fact that these soils, although of adequate depth, pose some restrictions to the production of maize. The restrictions emanate from the well drained nature of the soils and the fact that true high potential soils in similar climatic areas as the survey site often exhibit water holding characteristics in the form of a soft plinthic horizon or are highly suitable to irrigation practices (not advised for the site).

Possible Crop Types According to the Soil Type

A wide range of crops could be produced on the high potential areas but would require additional water in most years (as in Section 3) for sustained high yields. As mentioned

elsewhere this is a practice that is not supported in the specific geological setting. There are no crops suited to the low potential areas.

Cost-Benefit Analysis

The proposed route is a linear feature and as such has a limited influence on the decrease in geographical extent of the high potential soils. Dr. van der Waals stated that due to the limited area of influence, the potential economic implications of implementing the proposed route will far outweigh any potential benefit gained from keeping the land under cultivation.

Water Availability and Quantity

The availability of water and its quality is not known for the site. The Olifantspruit runs through the site and its water is currently used for the irrigation of crops in Section 3. The quality of this water is suspect though, as foam often occurs on the surface in the area due to the discharge of treated sewage water into the stream from the neighboring sewage works.

Access Routes and Condition Thereof

The area is adequately serviced by local roads and tracks, commensurate with agricultural use.

Economic Viability

Due to the linear nature of the proposed route the economic viability of the high potential soil will not be influenced markedly. As mentioned earlier, the economic implications of changing the proposed route will far outweigh any possible benefit from conserving the small areas of high potential soil that will be impacted.

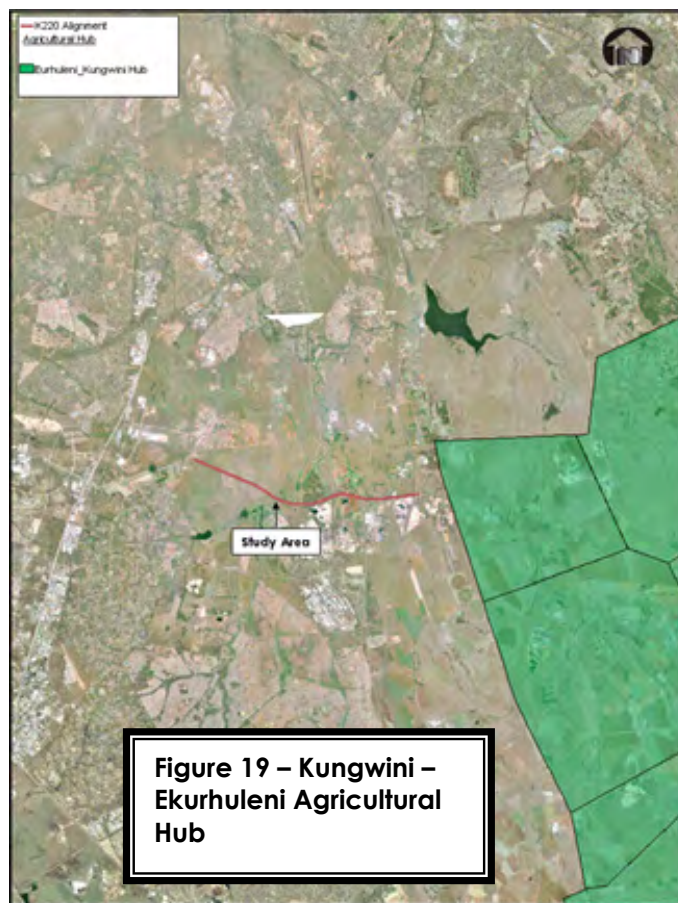
Surrounding Developments and Activities

The area surrounding the proposed route is increasingly being developed in terms of residential and industrial activities. The pressures these activities exert on agricultural activities will in all probability lead to the abandonment of agricultural activities in the future. Economic pressures on land use options tend to increase with increasing urban developments and as such it becomes impossible for agriculture to compete economically.

Conclusions made by Dr. van der Waals

- The soils along the proposed route range from **low to high potential**.
- The distribution of the high potential soils is restricted and as such the construction of a road through this area will have a very small impact on agricultural production. This is especially so due to the linear nature of a road.

The study area does not fall within the **Kungwini - Ekurhuleni Agricultural Hub**, an area identified for agricultural use by GDACE according to the **Draft Policy on the Protection of Agricultural Land (2006)**, as indicated in **Figure 189**



8.2.a Issues & Impact Identification – Agricultural Potential

Table 43: Issues and Impacts – Agricultural Potential

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴

			Positive Impact - Not Necessary To Mitigate ☀
27)	Loss of agricultural land	-	☐


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

27) Loss of agricultural land

The soils along the proposed alignment of the involved section of the K220 range from low to high agricultural potential. However, according to the agricultural specialist the distribution of the high potential soils is restricted and the construction of the road through this area will have a very small impact on agricultural production. The loss of agricultural land is therefore not regarded as significant. The study area also does not fall within an agricultural hub identified by GDACE.

Table 44: Significance of Issue 27 (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 p lanning phase, c onstruction and/ or o perational 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
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		flaw NP
Low 	P / C / O – The loss of agricultural land is not regarded as significant and no mitigation measures are deemed necessary.	L / E

Result: *Although no mitigation measures are deemed necessary, the significance of this impact still need to be determined/confirmed and assessed in the Significance Rating Table*

8.3 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 the K220 is part of the Local Authority and Provincial Government's road network planning for the larger areas.

8.3.1 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).

8.3.2 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 affected by water resources, flood lines and wetlands. Section 21 water use licences will be required for any development which may take place within and/or impact any water resource and or floodlines. The National Water Act also required that the 1:50 and 1:100 year flood line be indicated on all the development drawings that are being submitted for approval.

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 the K220 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).

The Cultural specialist found no obvious features, sites or artefacts of cultural significance that would be impacted on by the proposed development.

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 two wetlands and mitigation measures for the protection of these systems 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 two wetlands and mitigation measures for the protection of these systems 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 two wetlands and mitigation measures for the protection of these systems 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.

According to the involved agricultural specialist the proposed K220 will not have a significant impact on agricultural resources in the area.

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

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 the K220 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 the K220 must comply with the regulations of the Mine Health and Safety Act with regard to distance from mining operations.

8.3.3 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)

The Gauteng Spatial Development Framework (GSDF) identified a “**Core Economic Focus Area**” for Gauteng Province which broadly represents the triangular area between the CBD's of Pretoria, Johannesburg and the O.R. Tambo International Airport (ORTIA). This triangle corresponds with the **N1, R24 and R21 Albertina Sisulu Freeways**, and the GSDF proposed that economic development and associated investment be optimized in the area.

The primary philosophy of the **Economic Core Area** is to make optimal uses of the resources available in the area to promote economic development. In the case of the R21 Corridor the most important resources available include:

- the existing R21 Albertina Sisulu Freeway which links the City of Tshwane to the Johannesburg International Airport;
- the Johannesburg International Airport which is the major entrance point of foreign visitors to Southern Africa;
- large pockets of undeveloped land surrounding route R21 in the Ekurhuleni Metropolitan Area with relatively easy access to bulk services provision;

- the close proximity and accessibility of workers to serve the R21 corridor, and which also benefit from the development in terms of job opportunities and income; and
- current market/development trends around route R21 which shows a natural propensity towards development along its alignment.

UniCity Vision

The provincial government had announce its Unicity Vision for the three major Metros in Gauteng in which Tshwane, Johannesburg and Ekurhuleni must be encouraged to fill in the areas between the cities rather than encouraging urban sprawl.

It is envisaged that the planning and subsequent construction of the route K220 between the N1 and the R21 will support the infill of development between the mentioned metropolitan areas, while also alleviate congestion on the existing road network system. It will furthermore link the segregated areas between the west (N1/Midrand areas) and east (Irene/Tembisa/Olifantsfontein/Clayville/Pretoria East).

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

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.

GDACE C-Plan (GIDS)

The environmental data contained in the GDACE C-Plan (Version 2) and GIDS were taken into consideration during the compilation of the EIA report. According to the GDACE C-Plan and GIDS the proposed road does not cut across any irreplaceable sites.

GDACE Draft Red Data Species Policy, 2001

No red data species were identified during the EIA process.

GDACE Draft Ridges Policy, 2001

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

The proposed road cuts across an area with slopes that are less than 8,8% and therefore the Draft Ridges Policy is not regarded as applicable.

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

The proposed K220 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 GDACE in 2006. The Draft Policy on the Protection of Agricultural Land (2006) is therefore not applicable to the proposed road.

8.3.4 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 - 2000)

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

Ekurhuleni Spatial Development Framework

The Ekurhuleni Metropolitan Municipality commenced with the compilation of its Metropolitan Spatial Development Framework process during October 2002. Important

concepts that received attention were the concept of the R21 Corridor, as well as the alignment of the draft provincial Urban Edge in the Ekurhuleni Metropolitan area.

As far as the Urban Edge in the vicinity of the R21 Albertina Sisulu Freeway is concerned, the Ekurhuleni Spatial Development Framework document (p.50) states as follows:

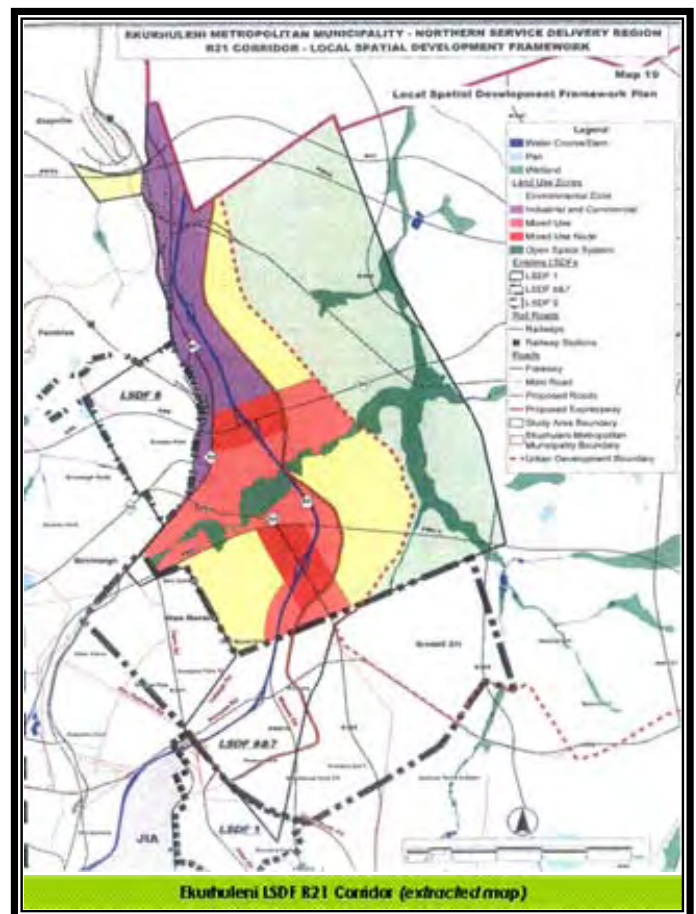
“The Urban Development Boundary in the vicinity of the R21 Albertina Sisulu Freeway represents and makes provision for development on both sides of the freeway. Subject to all environmental and other conditions, the Ekurhuleni Metropolitan Municipality will, as a principle, support development proposals in the vicinity of the R21 Albertina Sisulu Freeway both to the east and the west of the road and which can and will promote development of the R21 corridor concept as planned by the metropolitan Municipality.”

The Ekurhuleni Metropolitan Municipality adopted the Spatial Development Framework together with the IDP during March 2003 by means of which they also adopted the **amendments** proposed to the **Gauteng Urban Edge**.

With the above as background it is clear that route R21 should be promoted as a “development corridor”.

Ekurhuleni Local Spatial Development Framework R21 Corridor

The Ekurhuleni Metropolitan Municipality (EMM) recently compiled the R21 Local Spatial Development Corridor (LSDF) document in which various land uses have been defined for specific areas.



This was done through various workshops with relevant parties as well as the town planners of EMM. The R21 LSDF was compiled with the vision of optimizing the economic development potential of the area, improving the social conditions of the area, creating employment opportunities, and to protect and enhance the natural environment.

It is envisaged that the planning and subsequent construction of the route K220 between the N1 and the R21 will support the infill of development between the mentioned metropolitan areas. The proposed K220 will be in line with the SDF that has been compiled for the area.

The proposed construction of the K220 is in line with the future planning for the area.

8.3.a Issues & Impact Identification – Institutional

Table 45: Issues and Impacts – Institutional

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 😊 Low 🟡 Positive Impact - Not Necessary To Mitigate 🌞
28)	The proposed construction of the K220 will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	+	🌞

8.4 Qualitative Environment

8.4.1 Noise Impact

The proposed section of the K220 runs through a rural area where small scale agriculture is still practiced but which is changing to residential and commercial uses (proposed and approved). Clay manufacturing, quarrying and brick making activities, which form part of the Olifantsfontein and Clayville industrial areas are located to the eastern end of the of the proposed route. It also crosses a number of provincial routes (K109, K111, K105 and R21 Albertina Sisulu Freeway).

Pro-active planning in the area had already taken place around the K220 alignment. The K220 was taken into consideration during the layout designs of proposed new developments in the area.

8.4.1.a Issues & Impact Identification – Noise Impact

Table 46: Issues and Impacts – Noise Impact

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 😊 Low 🔴 Positive Impact - Not Necessary To Mitigate 🌟
29)	Noise impact	-	🔴

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

29) Noise Impact

Pro-active planning in the area had already taken place around the K220 alignment and the K220 was taken into consideration during the layout designs of proposed new developments in the area. If planned correctly, the proposed K220 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 K220.

Table 47: Significance of Issue 29 (Noise Impact) After Mitigation/ Addressing 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	Positive ✨ 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 K220 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*

8.4.2 Visual Environment

The following visual assessment criteria (*see Table 48*) 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:

Table 48: Visual Impact Criteria

CRITERIA	IMPACT		
	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	The ability of the landscape to easily accept visually a particular type of development because of its diverse landform, vegetation and texture

		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

Due to the gently undulating topography, the proposed route is not visible in its entirety, as indicated in *Figure 20*. It will be visible from the Randjesfontein residential area and the Midstream Estate development. The involved section of the K220 will have a medium to low visual impact on the surrounding environment however it should be planned and designed correctly, to minimise any impacts in the area.

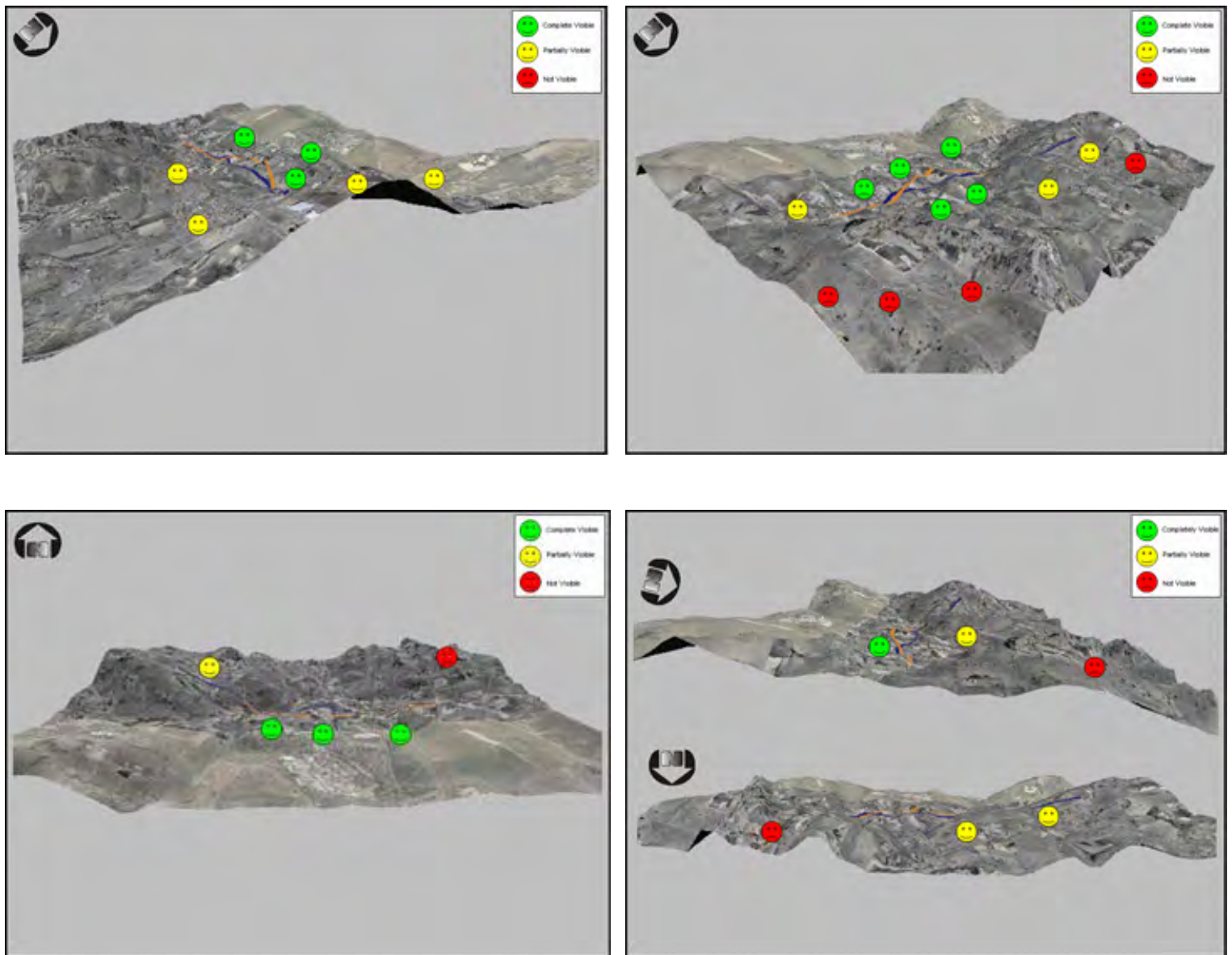
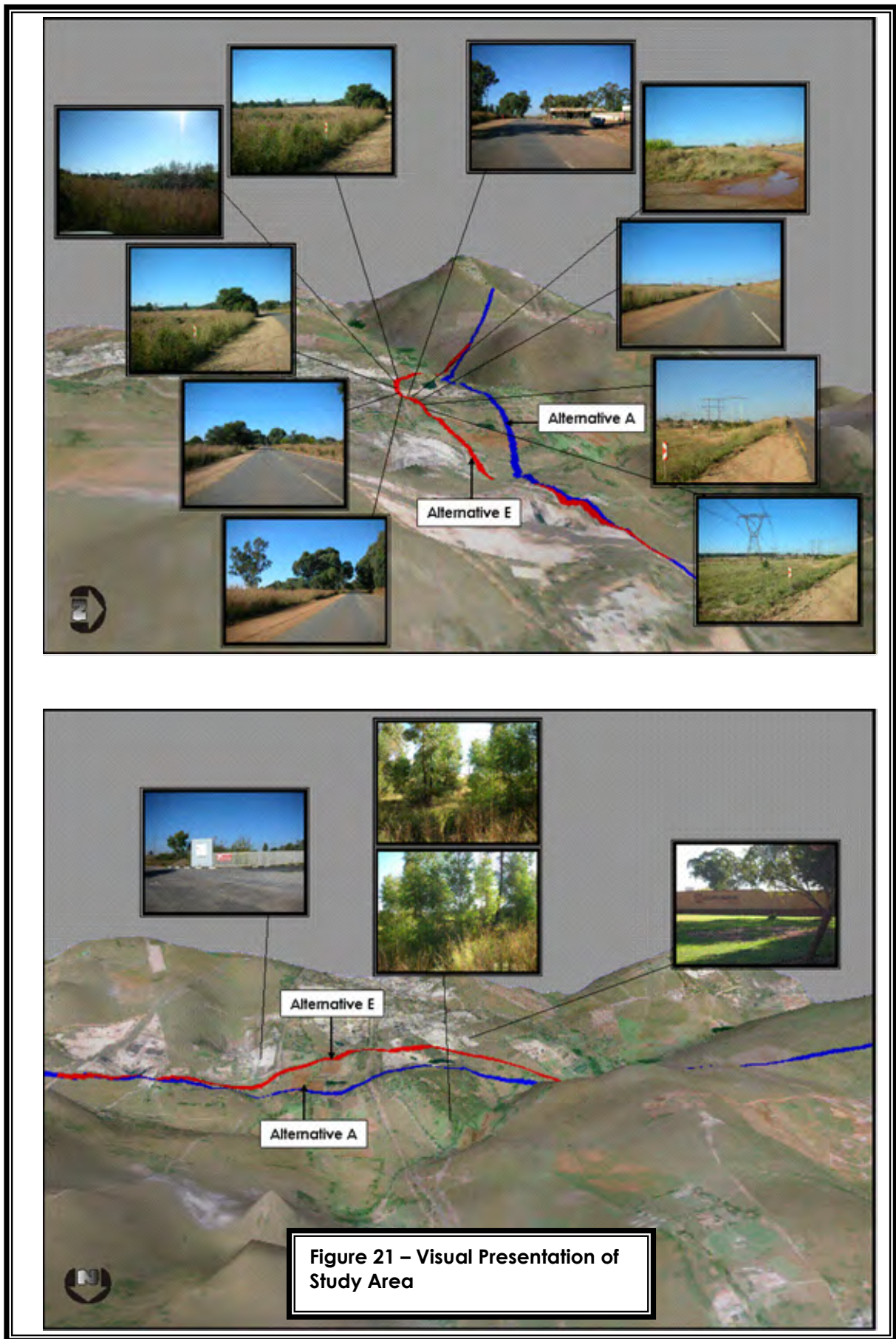
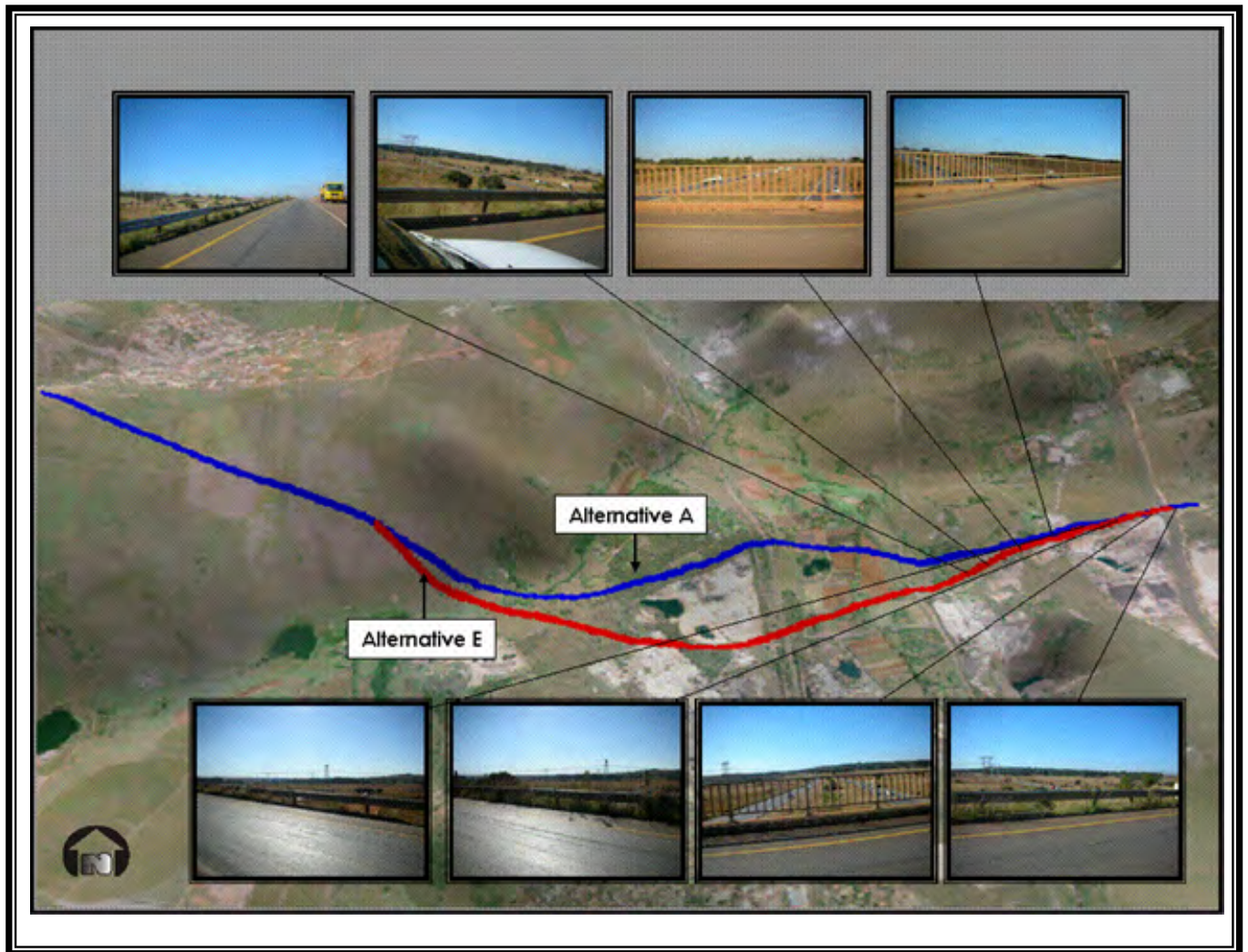


Figure 20 – Visual Assessment





8.4.2.a Issues & Impact Identification – Visual

Table 49: Issues and Impacts – Visual

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact - Not Necessary To Mitigate ✨

13)	Due to the topography only sections of the proposed road will be visible from surrounding view-sheds. It will be visible from the Randjesfontein residential area and Midstream Estate.	- / + Depending on the architectural style and finishes	😊
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8.4.3. "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 undulating landscape and Olifantspruit are the Sense of Place creators in the area. Mining activities (i.e. Corobrik, Sterkfontein Bricks) and the sewerage treatment works (ERWAT Olifantsfontein waste water treatment works) currently have a negative impact on the "Sense of Place" of the area.

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.

8.4.3.a Issues & Impact Identification – “Sense of Place”

Table 50: Issues and Impacts – “Sense of Place”

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact - Not Necessary To Mitigate 🌟
30)	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.	-	🟢

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

30) 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 51: Significance of Issue 30 (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 🔴	Mitigation Already achieved ✓	Significance of Issue after mitigation
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Positive Impact/ Neutral - Not Necessary To Mitigate ☼	Must be implemented during p ^l anning phase, c ^o nstruction and/ or o ^o perational 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/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*

8.4.4 Services and Infrastructure

Infrastructure

The involved section of the K220 crosses an existing railway line and the existing road P38-1 between Irene and Olifantsfontein at km 16,7 and 16,8 respectively.

The proposed route will also intersect with existing and proposed provincial roads (K109, K111, K105 and R21 Albertina Sisulu Freeway).

An irrigation channel crosses Portion 14 of the farm Olifantsfontein 402 JR and has also been taken into account in the route alignment.

Old and existing quarries

Both alignments of the involved section of route K220 cross quarries on Plots 15 and 16 Gilliamead A.H., a portion of Clayville X 14 and Portion 113 of the farm Olifantsfontein 402 JR. These quarries will be filled and proper layer works undertaken during construction to prevent damage to the road structure.

Servitudes

A large number of servitudes have been registered across the area to be traversed by the involved section of Road K220 and have been included in the engineering drawings.

Overhead Power Cables

Overhead high-voltage electrical cables in an existing Eskom servitude cross the involved section of the K220 near the western end of the road alignment. The point where the K220 is proposed to cross the servitude has been determined based on positions of pylons and road design standards.

Dabra Design Services sent copies of the plans to Eskom for their comments but no comments was received.

The Eskom servitude contains five power lines each in its own 47m wide servitude. Provision is made for two additional power lines, adding up to the total servitude width of 330m.

Rand Water Pipeline

A Rand Water pipeline of 710mm diameter and a second pipeline of 760mm diameter have been identified and taken into consideration in the planning of the route.

Dabra Design Services sent copies of the plans to the Rand Water Board for their comments. One set of comments was received from them indicating their services as well

as a set of rules and conditions to adhere to when detail design and construction begin.

Refer to Annexure Q

Sewage Treatment Plant

A sewage treatment facility, ERWAT Olifantsfontein Waste Water Treatment Works, is located on the Olifantspruit where the bridge crossing is proposed. The proposed route is planned between the sewage treatment facility and the road, and the detail design phase of the route alignment will determine the exact position of bridge columns and ensure no pipes or outlet structures are affected by the new road.

Shifting of Services

Amongst the services that area effected by the proposed routes for K220 are power lines, telephone lines, bulk water supply pipe lines and a weigh bridge (Alternative E).

The location and type of all services identified are shown on the layout plans and summarised in the shifting of services schedule in *Plan GRP 02/31/1Ps, Annexure R*, including the relocation and/or protection thereof.

According to the involved engineers the recommendations regarding the relocation and/or protection of services are only draft proposals and the final requirements must be determined, discussed, confirmed and approved with the relevant authorities at the detail design stage.

Dabra Design Services also sent copies of the plans to Telkom and Transnet for their comments but no comments was received.

8.4.4.a Issues and impacts identification - services and infrastructure

Table 52: Issues and Impacts – Services and Infrastructure

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact - Not Necessary To Mitigate ☀️
31)	Impact on existing infrastructure and services during the construction of the proposed road.	-	🟡
32)	The alignment of the route traverses old and existing quarries	-	🟡
33)	Impact on sewage treatment facility in the vicinity of the route	-	🟡
34)	The proposed K220 will improve regional accessibility in the area. It will furthermore link the segregated areas between the west (N1 / Midrand areas) and east (Irene / Tembisa / Olifantsfontein / Clayville / Pretoria East).	+	☀️
35)	The proposed K220 will divert traffic from existing road network links and thereby alleviate congestion on the existing road network system.	+	☀️
36)	The construction phase of the proposed road will supply a number of temporary job opportunities.	+	☀️
37)	The developer will deliver a large contribution to the infrastructure in the area	+	☀️

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

31) 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 53: Significance of Issue 31 (Impact on existing infrastructure and services during the construction of the proposed road) 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 – Servitudes must be indicated on Engineering drawings. 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.	M – To be included in the EMP M – To be included in the EMP M – To be included in the EMP

	<p>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.</p> <p>C – It is important to erect warning signs on existing roads when impacted on by the construction of the K220 (i.e. construction of intersections/bridges).</p> <p>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.</p>	<p>M – To be included in the EMP</p> <p>M – To be included in the EMP</p> <p>M – To be included in the EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

32) The alignment of the route traverses old and existing quarries

The alignment of the route traverse old and existing quarries which must be filled and proper layer works undertaken during construction to prevent damage to the road structure.

Table 54: Significance of Issue 32 (The alignment of the route traverses old and existing quarries) 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
Medium 🟡	P / C – The affected quarries must be filled and proper layerworks undertaken to prevent damage to the road structure.	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

33) Impact on sewage treatment facility in the vicinity of the route

The proposed route is planned between the sewage treatment facility and the road, and the detail design phase of the route alignment will determine the exact position of bridge columns and ensure no pipes or outlet structures are affected by the new road.

Table 55: Significance of Issue 33 (Impact on sewage treatment facility in the vicinity of the route) 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
Medium 🟡	P / C – No pipes or outlet structures of the sewage facility may be affected by the K220.	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*

8.4.5 Affected Properties

Alternative A does not pass through any existing city, town, suburb or informal settlement.

Alternative E does not pass through any informal settlement, however at km 16,0 it cuts the corner of one property in the industrial township Clayville Extension 12 and between km 16,3 and km 16,7 it runs over one property in the industrial township Clayville Extension 14, cutting it in two large portions.

Alternative E encroaches on the property of Corobrik, which is used for stockpiling manufactured bricks, and the owners of Corobrik claimed that this alternative would place a severe restriction of their factory activities.

Alternative A traverses two portions of land recently acquired by Corobrik, namely mineral areas 6 to 10 on Portion 7 of the farm Sterkfontein 410 JR and the Remaining extent of Portion 25 of the farm Olifantsfontein 402 JR. According to Mr. Ron de Gabriele the sterilization of these two portions of land would have huge financial implications for the factory and Corobrik Group and they therefore object to this alignment. **Refer to section 8.4.6, public participation.**

The properties that are directly affected by the involved section of the K220 are listed in Table 56.

Table 56: List of Properties affected by the proposed alignments of the K220

Ptn	Property	Owner	Alternative A km	Alternative B km
12	Olifantsfontein 410 JR	Bondev Ontwik P/L	14,6	-
39	Olifantsfontein 410 JR	Bondev Ontwik P/L	13,5	13,5
100	Olifantsfontein 410 JR	Bondev Ontwik P/L	14,3	14,5
117	Olifantsfontein 410 JR	Gilliemead P/L	14,5	14,5 -15,2
46	Olifantsfontein 410 JR	Mun Midrand	14,8	14,8
25	Olifantsfontein 410 JR	Cullinan Holdings Ltd	16,1	-
53	Olifantsfontein 410 JR	Cullinan Holdings Ltd	-	16,8
113	Olifantsfontein 410 JR	Corobrick P/L	15,7	15,9
Rem	Olifantsfontein 410 JR	Cullinan Holdings Ltd	16,6	16,7
1	Sunlawn LH	Estate Sunlawns	16,1	-
	Clayville X 16		-	15,5
981	Clayville X 12	Norcross SA P/L	-	15,9
1257	Clayville X 14	Corobrick P/L	-	16,3
1256	Clayville X 14	Corobrick P/L	-	16,6
R 14	Olifantsfontein 402 JR	Cullinan AJ	17	16,8
108	Olifantsfontein 402 JR	Gilliemead P/L	-	17,0

4	Olifantsfontein 410 JR	Cullinan AJ	17,5	17,5
4	Sterkfontein 401 JR	Cullinan AJ	-	18,0
R 6	Sterkfontein 401 JR	Cullinan AJ	17,7	17,7
	Gilliemead AH	Gilliemead P/L	18,1	18,5
R 6	Sterkfontein 401 JR	Sterkfontein AH	18,6	-
19	Sterkfontein 401 JR	Sterkfontein AH	19,1	19,1
16	Sterkfontein 401 JR	Sterkfontein Bricks P/L	19,1	19,1

It should be noted that the proposed alignment of the K220 (Alternative A) is protected under the Gauteng Transport Infrastructure act. **Debra Services submitted the current alignment to Gautrans (Report No. 1872) in February 2004, taking into account the objections of all landowners affected by the route.**

Preliminary Cost Estimate

The total preliminary expropriation cost estimates for both Alternative A and Alternative B for K220 between the beginning of planning at km 13,43 and the end of planning at km 19,90 have been compiled by the professional valuer, D Griffiths and are shown in *Table 57*.

Table 57: Preliminary Expropriation Cost Estimate

Description	Expropriation Cost
Alternative A	R 2 008 000
Alternative E	R 4 293 000

As indicated in **Table 57** the expropriation cost associated with *Alternative E* is significantly higher (more than double) than that of *Alternative A*.

8.4.5.a Issues and Impacts – Affected Properties

Table 58: Issues and Impacts – Affected Properties

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact/ Neutral - Not Necessary To Mitigate 🌟
38)	Expropriation of properties	-	🔴
39)	Impact on existing mining industries i.e. Corobrik	-	🔴
40)	Impact on agricultural land and agricultural holdings	-	🔴
41)	Impact on property values	-/+	🔴/🌟
42)	Access to local roads and properties	-	🟡

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

38) Expropriation of properties

The construction of the involved section of the K220 will require the expropriation of a large number of properties.

Table 59: Significance of Issue 38 (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*

39) Impact on existing mining industries i.e. Corobrik

Both alternatives would have an impact on Corobrik.

Alternative E encroaches on the property of Corobrik, which is used for stockpiling manufactured bricks, and the owners of Corobrik claimed that this alternative would place a severe restriction on their factory activities.

Alternative A traverses two portions of land recently acquired by Corobrik and would have huge financial implications for the factory and Corobrik Group. According to Mr. Sean Cullinan from Centurus, a lease agreement has been signed with Corobrik (Ptn 7 of the farm Sterkfontein 410 JR) and one of the agreements is that Corobrik mine the area which is affected by the K220 first (*refer to Annexure S for correspondence from Centurus regarding Corobrik*). According to Centurus they have been trying to assist Corobrik where possible in having this area mined as soon as possible. Corobrik indicated that they should be finished mining the affected portion within their first season. The mined area is to be rehabilitated according to an EMP.

The mineral area over Portion 25 Olifantsfontein 402 JR is also under discussion.

Table 60: Significance of Issue 39 (Impact on existing mining industries i.e. Corobrik) 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 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 / C – The construction of the section of the route that affects the mining activities of Corobrik should be planned to commence once the mining activities had finished. P / C – The mined areas must be rehabilitated according to an EMP prior	M - To be included in EMP M - To be included in EMP

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

40) Impact on agricultural land and agricultural holdings

Alternative A passes through the middle of agricultural land on the eastern side of the railway line, cutting it into two and on the western side of the railway line it cuts through Sunlawns Agricultural Holdings. However, these properties have been purchased by M & T Development for development purposes.

**Table 61: Significance of Issue 40 (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 Planning phase, Construction and/ or Operational 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

41) 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 K-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 a K-route are much sought after by developers and property owners are often supplied with very high offers for their land.

**Table 62: Significance of Issue 41 (Impact on property values) 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 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*

42) 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 the K220 must make provision for access to local roads and properties as well as future roads.

Apollo Road will be linked to the K220 in order to provide access to properties along Apollo Road i.e. Sterkfontein Bricks.

Table 63: Significance of Issue 42 (Access to local roads and properties) 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 P lanning phase, C onstruction and/ or O perational 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 – The design of the K220 must make provision for access to local roads and properties as well as future roads.	M - To be included in EMP

	<p>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.</p>	<p>M - To be included in EMP</p>
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

8.4.6 Public Participation

(Refer to Annexure T 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 ongoing 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&AP's) 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 through:

- 1) An advertisement was placed in 'Die Beeld' newspaper on Thursday 8 May 2008 and readvertised (to include activity, R 386 of 21 April 2006, Activity 4 subsequent to the identification of wetlands on the study area) on 17 November 2008 **(Annexure T (i))**.
- 2) Site notices were erected (at prominent points on and around the study area) on Friday 2 May 2008 and 17 November 2008 (to include activity, R 386 of 21 April 2006, Activity 4 subsequent to the identification of wetlands on the study area) **(refer to Annexure T (ii) and Photographs 15 & 16)**.
- 3) On Friday 2 May 2008 and 19 November 2008 (to include activity, R 386 of 21 April 2006, Activity 4 subsequent to the identification of wetlands on the study area) public notice/ flyers were distributed to the neighbouring properties and estates/ developments that may be affected by the proposed section of the K220 and all Interested and Affected parties (I & AP) registered during the public participation process for the Scoping Phase **(Annexure T (iii))**.
- 4) The following affected parties affected by the construction of the involved section of the K220 were also notified: SANRAL (crossing of railway line), ESKOM (crossing of high power cables), Rand Water (crossing of Rand Water pipeline) and Gautrans (crossing of roads) **(Annexure T (iv))**.
- 5) A Public Meeting was held on 3 August 2008 in the St George Hotel. Refer to **Annexure T (v)** for invitation notice and **Annexure T (vi)** for Minutes of the meeting.
- 6) The Scoping Report was available for review by I & AP for a period of 1 month. No comments were received. Refer to **Annexure T (vii)** for review register.
- 7) The draft EIA Report will be available for review by I & AP (including Ekurhuleni Metropolitan Municipality, Kungwini Local Municipality and DWAF) for a period of 1 month.

Photograph 15: Site Notice 1

Photograph 16: Site Notice 2

Table 64: List of Interested and Affected Parties

	Name	Address	Contact Details	Comments/Issues
1	James Mahlalela	P.O. Box 6376 Weltevreden Park 1715	Tel: 011 670 5708 Cell: 082 498 3139 Fax: 011 670 5208 e-mail: James.Mahlalela@holcim.com	
2	P.Ackerman on behalf of Afrisam	Apollo Road Olifantsfontein	Tel: 082 338 5328 E-mail: Piet.Ackerman@za.afrisam.com	1. Open cast mining area with blasting & crushing process 2. DME requirements 3. Minimum distance from blast area 4. Entrance at Apollo Road, heavy trucks
3	D. Widdicombe On behalf of Sterkfontein Bricks	Apollo Road Olifantsfontein	Tel: 011 206 8904 Cell: 082 569 6352 Fax: 011 206 8907	1. Time scale 2. How does it affect their access to Apollo Road presently? 3. How does the interchange affect their property - Sterkfontein Bricks? 4. How does the road reserve (new) requirements affect their property with regard to present relaxations on their perimeter.
4	Dr. Herman Joubert	P.O. Box 2731 Brooklyn Square 0075	Tel: 012 346 5336 Cell: 082 652 9550 Fax: 346 2509 E-Mail: hsj@tiq.co.za	Access to local streets and K105
5	Bob Dehning	42 Oribi Ave Clayville X 7 Olifantsfontein 1666	Tel: 011 316 1426 Cell: 082 651 1501 Fax: 086 510 7814 E-Mail: dehning@mweb.co.za	The Sterkfontein spring
6	C. Fouchee	Plot 126 Doornkloof	Tel: Cell: 082 682 2107 Fax: E-Mail: fouchee@hotmail.com	
7	D. Garner	P.O. Box 72927 Lynnwoodrif 0040	Tel: 012 481 3800 Cell: 083 303 7943 Fax: E-Mail: garnerd@velavke.co.za	
8	S. Cullinan	Centurus Irene Dairy farm	Tel: 012 667 5701 Cell: 083 458 8289 Fax: 012 667 5105	

			E-Mail: sean@centurus.co.za	
8	D.P. Colantoni	7 Apollo Road Witkoppies	Tel: 083 378 7733 Cell: 083 388 6565 Fax: 083 283 3826 E-Mail:	1. Concerned about the future east of the R21 and R21 Expressway – this have a big impact on their property 2. The traffic increase in the area does impact them
9	Pat Pretorius	Portion 159 Doornkloof	Tel: 011 357 7600 Cell: 083 655 7996 Fax: 011 357 7635 E-Mail: pat@salberg.co.za	
10	Geyers	Portion 37 Doornkloof	Tel: 072 203 5271 Cell: 082 611 1129 Fax: 086 689 4629 E-Mail: janett@yebo.co.za	Please keep them informed on all happenings
11	Eras Venter	P.O. Box 25045 Monumentpark 0105	Tel: 012 346 6901 Cell: 082 567 5278 Fax: 012 346 6858 E-Mail: b.j.v.@mweb.co.za	Will the R21 interchange give access to all directions (north and south)?
12	Mr. David Larsen on behalf of Doornkloof Owners Association	Private Bag X2352 Wingate Park 0153	Tel: 011 316 1393 Cell: 082 821 2202 Fax: 086 689 5220 E-Mail: salbu@email.com	
13	Cllr. Deon van Tonder		Tel: Cell: Fax: E-Mail: deon@belvedere.co.za	
14	Adv Bosch	Plot 708 (Part of Plot 39) Doornkloof	Tel: Cell: 082 458 6834 Fax: E-Mail:	
15	Bill and Lee-Anne Jones		Tel: Cell: Fax: E-Mail: enviroblasting .com	
16	Ellen Lomas	Urban Dynamics	Tel: ellen@urbandynamics.co.za Cell: Fax: E-Mail:	
17	Ronnie de Gabriele on behalf of Corobrik	Corobrik P.O. Box 201367 Durban North 4016	Tel: 031 560 3111 Cell: Fax: 031 565 1532 E-Mail: Ronnie.DeGabriele@corobrik.co.za	The sterilization of two portions of land recently acquired by Corobrik, namely mineral areas 6 to 10

				on Portion 7 of the farm Sterkfontein 410 JR and the Remaining extent of Portion 25 of the farm Olifantsfontein 402 JR would have huge financial implications for the factory and Corobrick Group and they therefore object to the proposed alignment of the K220
18	M. Pretorius on behalf of Irene Glen Home Owners Association		Tel: Cell: Fax: E-Mail: ireneglen@telkomsa.net	
19	Chris Buitendag on behalf of Gautrans		Tel: Cell: Fax: E-Mail: Chris.Buitendag@gauteng.gov.za	
20	Daan Visser on behalf of Gautrans		Tel: Cell: Fax: E-Mail: Daan.Visser@gauteng.gov.za	
21	Eddie Westpfahl		Tel: Cell: Fax: E-Mail: eddie@west-engineering.com	
22	Chris and Andriette Moolman		Tel: Cell: 082 441 6589 Fax: E-Mail: chris@mediaventures.co.za	
23	Rand Water		Tel: Cell: Fax: E-Mail: rkokke@randwater.co.za	
24	Sanral		Tel: Cell: Fax: E-Mail: info@i-traffic.co.za	
25	Eskom		Tel: Cell: Fax: E-Mail: Paia@eskom.co.za	
26	Madeleine Oosthuizen On behalf of Environmental		Tel: 012 358 8672 Cell: Fax: 012 358 8934 E-Mail:	

	Management Division, Open Space Management Section, City of Tshwane			
27	Fritz Eksteen	286 Schoongezicht St Erasmusrand Pretoria 0186	Tel: 012 347 7210 Cell: Fax: 086 519 3353 E-Mail: engineering1@ventura.co.za	
28	H van Rooy, Weavind & Weavind on behalf of Victoria Bricks.		Tel: 012 346 3098 Fax: 012 346 3479 gwenle@weavind.co.za	

Issues raised during the public meeting

1. Mr. Erras Venter

Will the R21 interchange give access to all directions (north and south)?

Response

The interchange will give access from the north as well as the south.

2. Mr. P. Ackerman, Apollo Road

- a. Open cast mining area with blasting & crushing process
- b. DME requirements
- c. Minimum distance from blast area
- d. Entrance at Apollo Road, heavy trucks

Response

a, b & c. According to the **Regulations of the Mine Health and Safety Act 1996, Act 29 of 1996:**

17(6)(a) The employer must ensure that no mining operations are carried out under or within a horizontal distance of 100 metres from buildings, roads, railways, reserves, mine boundaries, any structure whatsoever or any surface, which it may be necessary to protect, unless a shorter distance has been determined safe by risk assessment and all restrictions and conditions determined in terms of risk assessment are complied with.

17(7) No person may erect or construct any buildings, roads, railways, or any structure within a horizontal distance of 100 metres from the workings of a mine, or such lesser distance and at such positions and subject to such restrictions and conditions, determined by –

17(7)(a) risk assessment; or

17(7)(b) the Chief Inspector of Mines

The proposed alignment of the K220 in the vicinity of Sterkfontein Bricks is situated on the existing Apollo road (at the intersection with R21 Albertina Sisulu Freeway) or to the north of the existing Apollo road. Sterkfontein Bricks had to comply with these regulations with regard to Apollo road and therefore will comply with these regulations with regard to the K220.

During the construction of the K220 Apollo road will be linked to the K220 between road M57 and R21 Albertina Sisulu freeway **(refer to Figure 8, K220 Alignment)**.

Sterkfontein Bricks will therefore still gain access from Apollo Road and therefore the proposed K220 will not have an impact on heavy trucks at the entrance.

3. D. Widdicombe on behalf of Sterkfontein Bricks, Apollo Road

a. Time scale

b. How does it affect their access to Apollo Road presently?

c. How does the interchange affect their property - Sterkfontein Bricks?

d. How do the road reserve (new) requirements affect their property with regard to present relaxations on their perimeter.

Response

a. The developer is planning to commence with construction as soon as the EIA is approved (if approval is granted by GDACE). The construction time scale is approximately 6 months.

b & c. During the construction of the K220 Apollo road will be linked to the K220 between road M57 and R21 Albertina Sisulu freeway (**refer to Figure 8, K220 Alignment**). Sterkfontein Bricks will therefore still gain access from Apollo Road.

d. According to ITS Engineers a strip, up to 20m wide over a distance of approximately 500m, along the northern boundary of Sterkfontein Bricks will be affected by the K220 reserve. A section of Apollo Road east of the entrance to Sterkfontein Bricks will be removed by the construction of the K220 (*indicated in blue in Figures 22 & 23*).

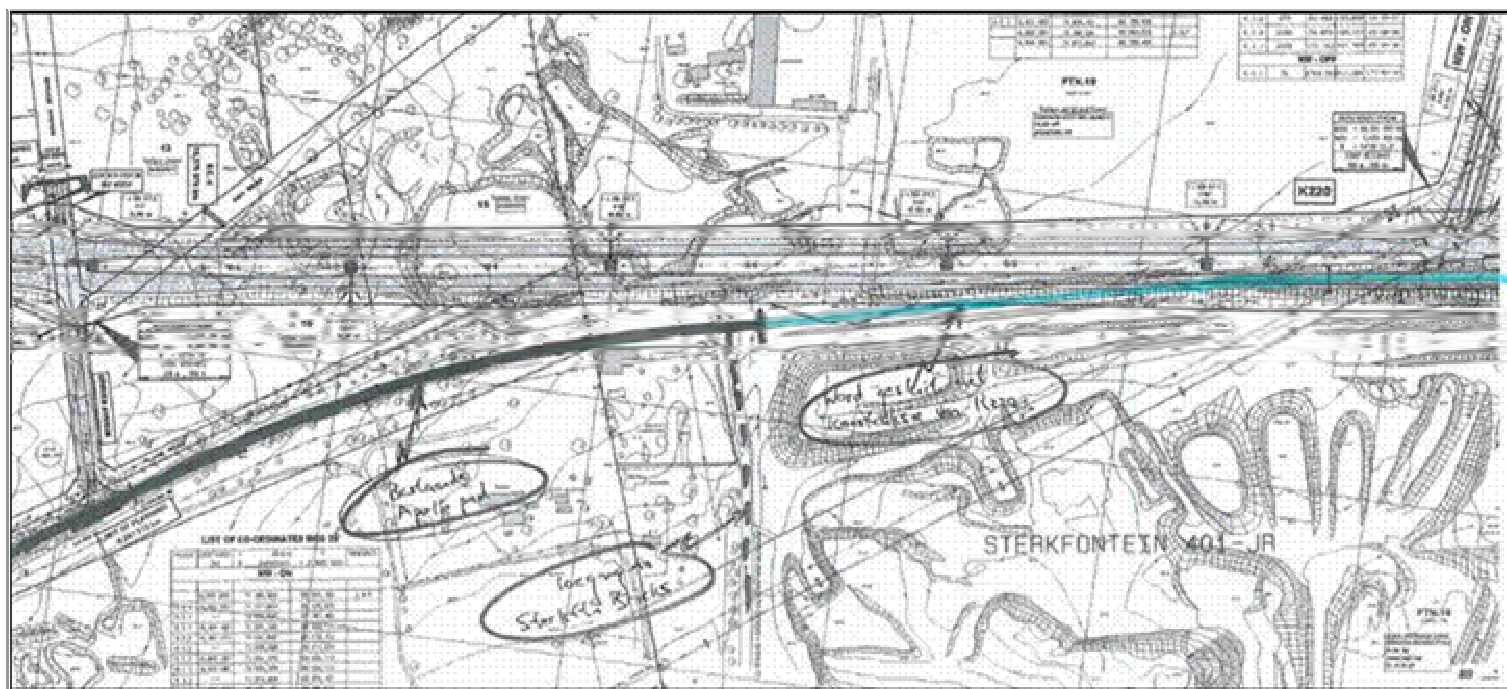


Figure 22 – K220 and Apollo Road in vicinity of Sterkfontein Bricks



Figure 23 – Apollo Road in vicinity of Sterkfontein Bricks

4. Dr. Herman Joubert

Access to local streets and K105.

Response

- Apollo road will be linked to the K220 between road M57 and R21 Albertina Sisulu freeway to provide access.
- A quarterlink has been provided to link road P38-1 with the K220.
- An interchange will link the K220 with the R21 Albertina Sisulu freeway.
- Future intersections / access positions have been allowed for at a minimum intersection spacing of 600 metres to provide points for possible access from adjacent properties should it be required at some stage in future.

5. Mr. D.P. Colantoni, 7 Apollo Road, Witkoppies

Concerned about the future east of the R21 and R21 Expressway – this have a big impact on their property.

The traffic increase in the area does impact them.

Response

An EIA application had been submitted for the section of the K220 east of the R21 Albertina Sisulu Freeway and these concerns will be addressed during the said EIA process.

6. Mr. Bob Dehning

The Sterkfontein spring must be discussed with Tshwane

It is recommended that a geohydrological study be done for the spring

Response

The Sterkfontein spring was discussed with Me. Madeleine Oosthuizen, Environmental Management Division, Open Space Management Section, City of Tshwane. She recommended that a geohydrological study be done in the vicinity of the spring and she requested details on the bridge/culvert structures at the wetland crossings.

Please refer to section 7.1.2.2.a & b for a detailed discussion on the impact of the K220 on the Sterkfontein spring.

Additional Issues raised during the Public Participation Process**7. Objection to the proposed alignment (Alternative A) from Mr. Ron de Gabriele on behalf of Corobrik.**

Alternative A traverses two portions of land recently acquired by Corobrik, namely mineral areas 6 to 10 on Portion 7 of the farm Sterkfontein 410 JR and the Remaining extent of Portion 25 of the farm Olifantsfontein 402 JR. According to Mr. Ron de Gabriele the sterilization of these two portions of land would have huge financial implications for the factory and Corobrik Group and they therefore object to this alignment. *Refer to Annexure T (viii) for correspondence from Corobrik).*

Response

According to Mr. Sean Cullinan from Centurus, a lease agreement has been signed with Corobrik (Ptn 7 of the farm Sterkfontein 410 JR) and one of the agreements is that Corobrik mine the area which is affected by the K220 first (*refer to Annexure S for correspondence from Centurus*). According to Centurus they have been trying to assist Corobrik where possible in having this area mined as soon as possible. Corobrik indicated that they should be finished mining the affected portion within their first season. The mined area is to be rehabilitated according to an EMP.

The mineral area over Portion 25 Olifantsfontein 402 JR is also under discussion.

8. Dr. Herman Joubert on behalf of the owners of portions of the farm Doornkloof to the north of K220, Praysa Trade 1162 (Pty) Ltd and Ostiprop 1168 (Pty) Ltd - Provision of access from adjoining properties (*refer to Annexure T (ix) for correspondence*).

According to Dr. Joubert the layout of the township to the north of the K220 between the R21 Albertina Sisulu freeway and provincial road P122-1 creates a barrier between the K220 and the properties to the north. He is of the opinion that the layout of the township does not comply with the requirements of the GTIA, neither is it considered to be acceptable transportation planning. The proposed layout will result in congestion at the intersection of K220 and P122-1 and will also result in additional travel cost, fuel consumption and air pollution.

Dr. Joubert insists that the planning of the K220 be undertaken to comply with the requirements of the GTIA and that no environmental authorization is given to the K220 unless provision is made for equitable and efficient access to all affected properties, including those indirectly affected as provided for in the GTIA.

Response from Mr. Dudley Garner, Vela VKE

A balanced road network for the so-called N1-R21 Precinct has been planned by the Provincial and the four local authorities concerned. Particulars can be obtained from Mr. Eric Coetzee at GDPTRW. K220 forms part of this network and the

preliminary design of the K220 should take this planning into consideration and there should be no reasons for Dr. Joubert's concerns.

Mr. Garner is concerned about the apparent lack of a unified LSDF for the area that gives status to the planning.

8.4.6.a Issues and Impacts – Affected Properties

Table 65: Issues and Impacts – Affected Properties

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High 🟢 Medium 🟡 Low 🔴 Positive Impact/ Neutral - Not Necessary To Mitigate 🌟
42)	Access to local roads and properties <i>Refer to section 8.4.5.a, page 200</i>	-	🟡
39)	Impact on existing mining industries i.e. Corobrik <i>Refer to section 8.4.5.a, page 197</i>	-	🔴
43)	Access to existing and proposed Provincial roads	-	🟡
44)	Impact on Sterkfontein Bricks	-	🟡
45)	Safety during construction	-	🟡

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

43. Access to existing and proposed Provincial roads

The construction of the involved section of the K220 will have an impact on existing and proposed provincial roads.

**Table 66: Significance of Issue 43 (Impact on existing and proposed Provincial roads)
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 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 – Provision must be made for links and access to local and provincial roads. C – Access to existing local roads must be provided or alternatively routes must be provided.	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*

44. Impact on Sterkfontein Bricks

During the construction of the K220 Apollo road will be linked to the K220 between road M57 and R21 Albertina Sisulu freeway. Sterkfontein Bricks will therefore still gain access from Apollo Road and therefore the proposed K220 will not have an impact on heavy trucks at the entrance.

The proposed K220 will not have a significant impact on mining activities at Sterkfontein Bricks.

Table 67: Significance of Issue 44 (Impact on Sterkfontein Bricks) 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 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 / O – Provision must be made for access to Sterkfontein Bricks.	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

45. Safety during construction

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

Table 68: Significance of Issue 45 (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 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) C - Construction vehicles and activities to avoid peak hour traffic times C - Presence of law enforcement officials at strategic places must be ensured	M - To be included in EMP

	<p>C – Surrounding residents must be informed of blasting exercises one week in advance.</p> <p>Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.</p>	
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Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table*

9 Comparative Assessment between Alternative A and Alternative E

9.1 Comparison between Alternative A and Alternative E

*Refer to Table 69 for a comparison between **Alternative A** and **Alternative E**.*

Table 69: Comparison between Alternative A and Alternative E

	Alternative A	Alternative E
Geology	A section of route is underlain by dolomite	A section of route is underlain by dolomite
Hydrology	<ul style="list-style-type: none"> - Crosses the Olifantspruit and an unnamed drainage line - Crosses 2 wetlands - Situated to the north of the Sterkfontein spring 	<ul style="list-style-type: none"> - Crosses the Olifantspruit and an unnamed drainage line - Crosses 2 wetlands - Runs across the Sterkfontein spring
Fauna and flora	<ul style="list-style-type: none"> -Does not run through any irreplaceable sites - Does not run through any areas with red data fauna and flora species -Cuts natural grassland areas, which are regarded as sensitive, twice. 	<ul style="list-style-type: none"> -Does not run through any irreplaceable sites -Does not run through any areas with red data fauna and flora species -Cuts natural grassland areas, which are regarded as sensitive, twice.
Agricultural Potential	Traverses through moderate to low agricultural potential soils.	Traverses through moderate to low agricultural potential soils.
Impact on agricultural land and activities	Cuts through the middle of agricultural land on the remainder of portion 14 of the farm Olifantsfontein 402 JR and	Cuts through the most southern boundary of agricultural land on the remainder of portion 14 of the farm Olifantsfontein 402

	portion 4 of the farm Olifantsfontein 410 JR. Cuts through Sunlawns A.H.	JR and portion 4 of the farm Olifantsfontein 410 JR.
Impact on mining activities i.e. Corobrik	Traverses two portions of land recently acquired by Corobrik and the sterilization of these two portions of land would have huge financial implications for the factory and Corobrik Group. However, an agreement had been reached.	Encroaches on Corobrik property used for stockpiling manufactured bricks and will result in a severe restriction in their factory activities.
Infrastructure	Crosses powerlines, bulk water supply lines, a railway line and 3 existing roads.	Crosses powerlines, bulk water supply lines, weigh bridge, a railway line and 3 existing roads.
Cost associated with shifting of services (estimated cost)	R 1 250 000.00	R 1 670 000.00
Existing townships	Does not cut through any existing city, town, suburb or informal settlement.	Cuts through industrial townships i.e. Clayville X 12 and 14.
Expropriation cost (preliminary estimates)	R 2 008 000	R 4 293 000
Construction cost (preliminary estimates)	R 96 241 000	R 98 669 000
Length	6,330 km	6,566 km
Design	Quarterlink can be provided to connect road P38-1 with K220	No quarterlink can be provided to link road P38-1 with K220

Tables 70 and 71 below are a **comparative assessments based on the issues identified in this report.**

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 71 below*) will, therefore, give a more accurate indication of the preferred alternative for the project.

9.2 Anticipated impacts, including cumulative impacts

The impacts/ aspects (beneficial and adverse) of the proposed section of the K220 (Alternative A: "Proposal" and Alternative E) on the receiving environment were identified. The above impacts, as well as the affected environmental characteristics, are indicated in *Tables 70 and 71* below.

Table 70: Comparative Assessment between impacts of Alternatives A and E for Road K220 before mitigation

Environmental Aspects <u>Key to impacts:</u> 😊 l– Lower positive 😊 m– Medium positive 😊 h– Higher positive 😞 l– Lower negative 😞 m–Medium negative 😞 h– Higher negative 😊 - Neutral	Physical				Biological		Socio-Economical								Institutional				Total of Impacts	
	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																				
Issues and Impacts																				
Alternative A “Proposal”	😞 h	😞 m	😊	😞 m	😞 m	😞 m	😊 m	😊	😊 h	😊	😞 h	😞 m	😊	😞 l	😊 h	😊 h	😊 h	😊 h	😊 x 4 😊 h x 5 😊 m x 1 😞 h x 2 😞 m x 6 😞 l x 1	
Alternative E	😞 h	😞 h	😊	😞 m	😞 m	😞 m	😊 m	😊	😊 h	😊	😞 h	😞 h	😊	😞 l	😊 h	😊 h	😊 h	😊 h	😊 x 4 😊 h x 5	

																				😊 m x 1 ☹ m x 4 ☹ h x 4 ☹ l x 1
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

OPERATIONAL PHASE																			
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 A "Proposal"	☹ h	☹ m	😊	☹ m	☹ m	☹ m	☹ m	😊 h	😊 h	😊 h	😊 h	☹ h	☹ m	😊	☹ l	😊 h	😊 h	😊 h	😊 h
																			😊 h x 8 😊 m x 0 😊 l x 0 😊 x 2 ☹ h x 2 ☹ m x 6 ☹ l x 1
Alternative E	☹ h	☹ h	😊	☹ m	☹ m	☹ m	☹ m	😊 h	😊 h	😊 h	😊 h	☹ h	☹ h	😊	☹ l	😊 h	😊 h	😊 h	😊 h
																			😊 h x 8 😊 m x 0 😊 l x 0

																			☺ x 2 ☹ h x 4 ☹ m x 4 ☹ l x 1
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Table 71: Comparative Assessment between impacts of Alternative A and E for Road K220 after Mitigation

Environmental Aspects <u>Key to impacts:</u> 😊 l– Lower positive 😊 m– Medium positive 😊 h– Higher positive 😞 l– Lower negative 😞 m–Medium negative 😞 h– Higher negative 😊 - Neutral	Physical				Biological		Socio-Economical								Institutional				Total of Impacts	
	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																				
Issues and Impacts																				
Alternative A “Proposal”	😞 l	😞 l	😊	😞 l	😞 m	😞 m	😞 l	😊 h	😊	😊 h	😊	😊	😞 m	😊	😊	😊 h	😊 h	😊 h	😊 h	😊 h x 6 😊 x 6 😞 l x 4 😞 m x 3

Alternative E	⊖ l	⊖ h	⊖	⊖ l	⊖ m	⊖ h	⊖ l	😊 m	😊	😊 h	😊	😊	⊖ m	😊	⊖ m	😊 h	😊 h	😊 h	😊 h	😊 h x 5 😊 m x 1 😊 x 5 ⊖ l x 3 ⊖ m x 3 ⊖ h x 2
OPERATIONAL PHASE 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 A "Proposal"	😊	😊	😊	⊖ l	⊖ l	⊖ m	⊖ l	😊 h	😊 h	😊 h	😊 h	😊 l	😊 m	😊	😊	😊 h	😊 h	😊 h	😊 h	😊 h x 8 😊 m x 1 😊 l x 1 ⊖ l x 3 ⊖ m x 1 😊 x 5
Alternative E	😊	⊖ h	😊	⊖ l	⊖ l	⊖ m	⊖ l	😊 h	😊 h	😊 h	😊 h	😊 l	😊 m	😊	⊖ l	😊 h	😊 h	😊 h	😊 h	😊 h x 8 😊 m x 1 😊 l x 1

																				☹ x 4 ☹ m x 1 ☹ h x 1 😊 x 3
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9.3 Comparative Assessment between Alternative A and Alternative E

The Tables above are the comparative assessments based on the issues identified in the EIAR.

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 71**) will therefore give a more accurate indication of the preferred alternative for the project.

Table 72: Comparative Assessment between Alternative A and Alternative E before Mitigation

Environmental Aspects	Physical	Biological	Socio-Economic	Institutional
Alternative A (Proposal)	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 0 😊 m x 1 😊 h x 5	😊 l x 0 😊 m x 0 😊 h x 8
	😞 l x 0 😞 m x 4 😞 h x 2	😞 l x 0 😞 m x 4 😞 h x 0	😞 l x 2 😞 m x 4 😞 h x 2	😞 l x 0 😞 m x 0 😞 h x 0
	😐 x 2	😐 x 0	😐 x 4	😐 x 0
Alternative E	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 0 😊 m x 1 😊 h x 5	😊 l x 0 😊 m x 0 😊 h x 8
	😞 l x 0 😞 m x 2 😞 h x 4	😞 l x 0 😞 m x 4 😞 h x 0	😞 l x 2 😞 m x 2 😞 h x 4	😞 l x 0 😞 m x 0 😞 h x 0

	☹ x 2	☹ x 0	☹ x 4	☹ x 0
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Table 73: Comparative Assessment between Alternative A and Alternative E after Mitigation

Aspects	Physical	Biological	Socio-Economic	Institutional
Alternative A "Proposal"	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 1 😊 m x 1 😊 h x 6	😊 l x 0 😊 m x 0 😊 h x 8
	☹ l x 4 ☹ m x 0 ☹ h x 0	☹ l x 1 ☹ m x 3 ☹ h x 0	☹ l x 2 ☹ m x 1 ☹ h x 0	☹ l x 0 ☹ m x 0 ☹ h x 0
	☹ x 4	☹ x 0	☹ x 7	☹ x 0
Alternative E	😊 l x 0 😊 m x 1 😊 h x 0	😊 l x 0 😊 m x 0 😊 h x 0	😊 l x 1 😊 m x 2 😊 h x 5	😊 l x 0 😊 m x 0 😊 h x 8
	☹ l x 3 ☹ m x 0 ☹ h x 2	☹ l x 1 ☹ m x 2 ☹ h x 1	☹ l x 1 ☹ m x 2 ☹ h x 0	☹ l x 0 ☹ m x 0 ☹ h x 0
	☹ x 3	☹ x 0	☹ x 5	☹ x 0

Summary

It can be concluded from the Tables above that **Alternative A** (the development proposal) is the preferred alternative.

From an ecological point of view **Alternative A** is regarded as the preferred alternative due to the locality to the north of the Sterkfontein spring. **Alternative E** runs across the Sterkfontein spring and will therefore have a significant impact on the spring.

From a road planning point of view **Alternative A** is regarded as the preferred alternative in terms of road safety and cost considerations. The road safety considerations affected the design, including slope, horizontal radii and sight distance. In terms of cost, the final alignment is the optimal route in terms of capital cost and future operational cost.

From a social point of view **Alternative A** will have a higher impact on agricultural land and activities in comparison with **Alternative E**. However, **Alternative E** will have a higher impact on mining activities at Corobrik.

Alternative A is therefore regarded as the preferred alternative from a socio-economic point of view.

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

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

10. SIGNIFICANCE ASSESSMENT

10.1 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:

- | | | | |
|--------------------------|-----------------|---|--|
| <input type="checkbox"/> | Improbable | - | Low possibility of impact to occur either because of design or historic experience.
Rating = 2 |
| <input type="checkbox"/> | Probable | - | Distinct possibility that impact will occur.
Rating = 3 |
| <input type="checkbox"/> | Highly probable | - | Most likely that impact will occur.
Rating = 4 |
| <input type="checkbox"/> | 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:

- | | | | |
|--------------------------|------------------|---|---|
| <input type="checkbox"/> | Low intensity | - | natural and man made functions not affected – Factor 1 |
| <input type="checkbox"/> | Medium intensity | - | environment affected but natural and man made functions and processes continue - Factor 2 |
| <input type="checkbox"/> | 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:

$$\begin{aligned}
 \text{The Severity factor} &= \text{Intensity factor} \times \text{Duration factor} \\
 &= 2 \times 3 \\
 &= 6
 \end{aligned}$$

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

TABLE 74: 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 GDACE 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 can not 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 Me. Lizelle Gregory, has extensive experience in the field of impact assessments.

10.2 Significance Assessment of Anticipated Impacts

Impacts indicated under each section of the environment were each assessed according to the above methodology. *Table 75* below contains the results of the significance assessment.

TABLE 75: 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						
17. The eradication of weeds and exotic invaders	5	4	3	12	4	20 High
36. 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 Sesmyspruit, Olifantspruit and systems lower down in the catchment area if a stormwater management plan is not implemented.	4	4	4	16	5	20 High
8. Groundwater pollution and	3	4	4	16	5	15 Medium

contamination of the Olifantspruit and Sesmylspruit.						
9. Pollution and contamination of the Sterkfontein Spring	2	4	4	16	5	10 Medium
10. Perched water conditions	4	2	4	8	3	12 Medium
11. Increased storm water runoff from road into surrounding natural areas	3	4	4	16	5	15 Medium
12. Impact on wetlands in the vicinity of the stream crossings	4	4	4	16	5	20 High
13. Due to the topography only sections of the proposed K220 will be visible from view sheds in the flatter areas around the study area.	4	2	4	8	3	12 Medium
14. 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
15. 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
16. Impact on natural grassland areas	3	4	4	16	5	15 Medium
17. Impact on riparian vegetation	3	4	4	16	5	15 Medium
18. Loss of Orange listed and medicinal plant species	3	4	4	16	5	15 Medium
20. 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	2	4	2	8	3	6 Low

zone close to their natural territories.						
21. Noise of construction machinery could have a negative impact on the fauna species during the construction phase.	2	4	2	8	3	6 Low
22. 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
23. Loss of habitat can lead to the decrease of fauna numbers and species.	3	4	4	16	5	15 Medium
24. Erosion of Olifantspruit and unnamed drainage line	4	4	4	16	5	20 High
25. Loss of aquatic habitat	3	4	4	16	5	15 Medium
26. Structures of cultural and historical significance may be destroyed.	2	4	4	16	4	8 Medium
27. Loss of agricultural land	3	2	4	8	3	9 Medium
31. 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. The alignment of the route traverses old and existing quarries	3	2	2	4	2	6 Low
33. Impact on sewage treatment facility in the vicinity of the route	3	2	2	4	2	6 Low
38. Expropriation of properties	5	4	4	16	5	25 High
39. Impact on existing mining industries i.e. Corobrik	4	4	4	16	5	20 High
40. Impact on agricultural land and agricultural holdings	4	4	4	16	5	20 High

44. Impact on Sterkfontein Bricks	3	4	4	16	5	15 Medium
45. Safety during construction	3	4	4	16	5	15 Medium
OPERATION PHASE						
Beneficial Impacts						
28. The proposed construction of the K220 will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	5	4	4	16	5	25 High
34. The proposed K220 will improve regional accessibility in the area. It will furthermore link the segregated areas between the west (N1 / Midrand areas) and east (Irene / Tembisa / Olifantsfontein / Clayville / Pretoria East).	5	4	4	16	5	25 High
35. The proposed K220 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
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
6. Siltation, erosion and water pollution could occur if a stormwater management plan is not implemented.	4	4	4	16	5	20 High
7. Risk of the lowering of groundwater	3	4	4	16	5	15 Medium
8. Possible ground water pollution.	3	4	4	16	5	15 Medium
11. Impact on wetland adjacent to the	4	4	4	16	5	20 High

study area						
13. Due to the topography only sections of the proposed K220 will be visible from view sheds in the flatter areas around the study area.	4	2	4	8	3	12 Medium
30. 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
38. Expropriation of properties	5	4	4	16	5	25 High
39. Impact on existing mining industries i.e. Corobrik	4	4	4	16	5	20 High
40. Impact on agricultural land and agricultural holdings	4	4	4	16	5	20 High
29. Noise impact	5	2	4	8	3	15 Medium
42. Access to local roads and properties	5	2	4	8	3	15 Medium
43. Access to existing and proposed Provincial roads	5	2	4	8	3	15 Medium
44. Impact on Sterkfontein Bricks	5	2	4	8	3	15 Medium

10.3 Discussion of Significance Assessment

Five beneficial impacts associated with the proposed road are anticipated, of which four has a high significance rating. The Environmental Management Plan (*Refer to Annexure U*) contains measures to achieve maximum gain from the above beneficial impacts. Four 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 forty five anticipated adverse impacts associated with the construction and operational phases of the proposed road eleven of the anticipated impacts have a high significance rating, twenty-seven impacts have a medium significance rating and seven 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 K220.

11 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 K220 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 A) be accepted as the alignment for the road.

The most significant environmental issues that were identified are the following (*refer to Figure 24, Sensitive Issues Map and Figure 25, Sensitivity Map*):

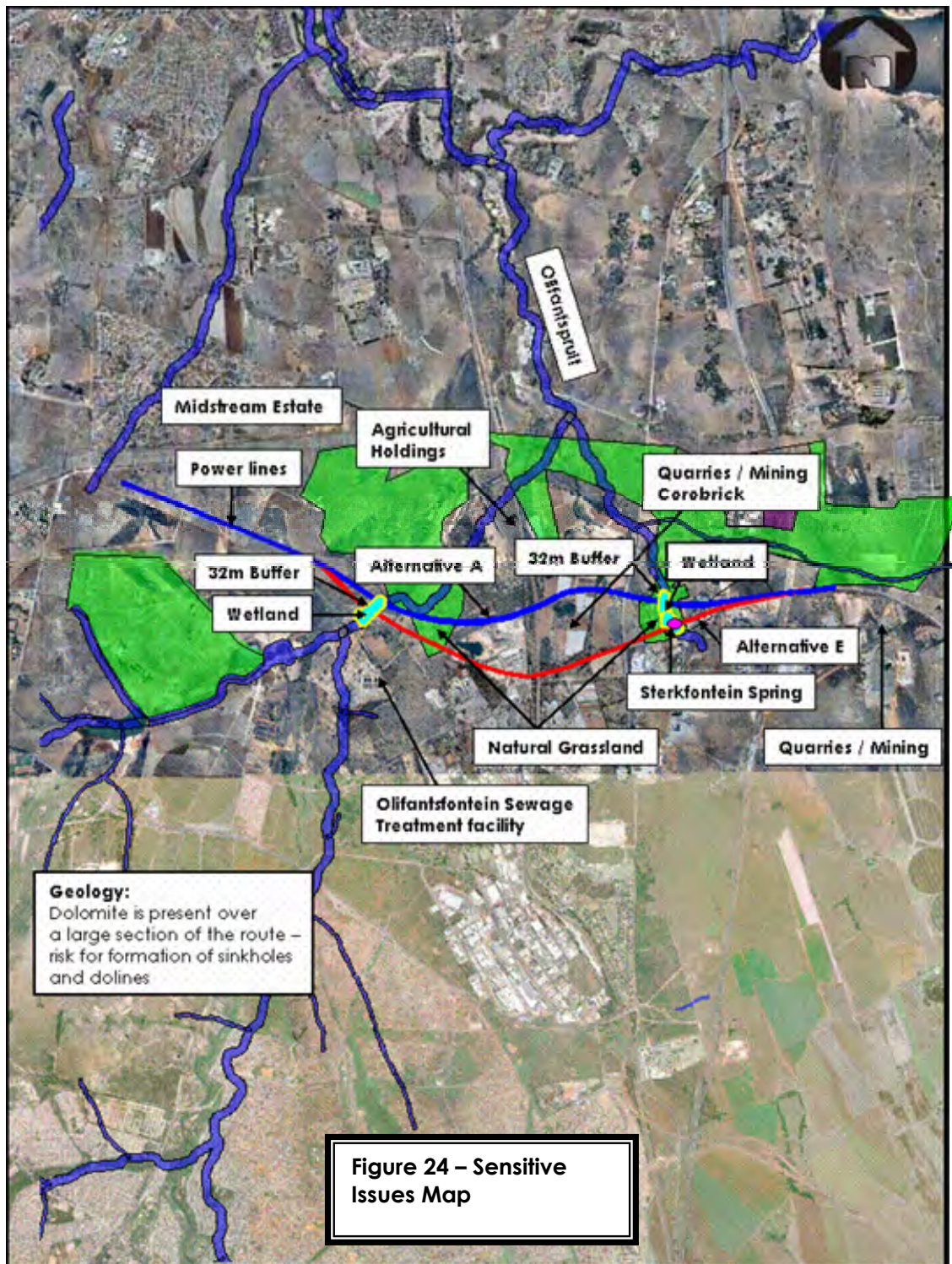
- **Geotechnical:** A large portion of the route, from approximately km 12.40 to km 17.85, is underlain by dolomite which poses the risk of formation of sinkholes and dolines. According to the geotechnical engineer there are certain geotechnical constraints that must be taken into consideration during the planning and designing of the road, i.e. collapsible sands, expansive clays, excavatability etc.
- **Fauna and flora:** No red data flora species was found but two **Orange listed flora** species were found in the natural grassland. No red data fauna (both vertebrate and invertebrate) species was found and the habitat is not suitable for red data bird species due to a lack of sufficient breeding and foraging habitat. The proposed alignments of this section of the K220 traverse Natural grassland areas which were deemed sensitive, however it does not traverse any irreplaceable sites.
- **Hydrology:** Both alignments cross the **Olifantspruit** and an unnamed tributary with associated **wetlands**. The construction and operational phase of the proposed K220 could cause erosion, siltation and pollution of these water bodies if mitigation measures are not implemented. The wetlands and riparian vegetation are regarded as sensitive.

Alternative A (proposal) is situated to the north of the **Sterkfontein spring** and does not fall within its catchment zone. The proposed alignment of the K220 would therefore not have an impact on the water quality of the spring.

Alternative E, however, runs in close proximity of the **Sterkfontein spring** and could have a significant impact on the water quality of the spring.
- **Impact on agricultural land and agricultural holdings:** Both alignments cut through agricultural land. The general agricultural potential of the soils traversed by the alignments of K220 are **moderate to low** and the study area does not fall within a GDACE Agricultural Hub.
- **Quarries/mines:** Both alignments cross quarries / brick manufacturing plants. Both alignments have an impact on **Corobrik**, however an agreement has been reached regarding **Alternative A** (proposal).

- **Crossing of railway line and road:** Both alternatives cross a railway line and a number of roads, including provincial roads.
- **Olifantsfontein Sewage Treatment Works:** The sewage treatment facility is located on the Olifantspruit where the bridge crossing for both alignments is proposed.
- **Expropriation of properties:** The involved section of route K220 will necessitate the expropriation of land from a number of properties.
- **Relocation of services:** The involved section of route K220 will require the relocation of services i.e. High tension power lines and Rand Water Pipelines.
- **Visual Impact:** Due to the topography only sections of the proposed road will be visible from surrounding view-sheds. It will be visible from the Randjesfontein residential area and Midstream Estate.
- **Noise Impact:** Pro-active planning in the area had already taken place around the K220 alignment and the K220 was taken into consideration during the layout designs of proposed new developments in the area. If planned correctly, the proposed K220 should therefore not have a significant noise impact on the surrounding environment (currently and in future).
- **Blasting:** Some blasting may be required during the construction of the road.
- **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.

- **Need and desirability:** The K220 will serve an important east-west traffic distribution function in the area linking the corridor linking the OR Tambo International Airport and Tshwane with the corridor linking Johannesburg and Tshwane.



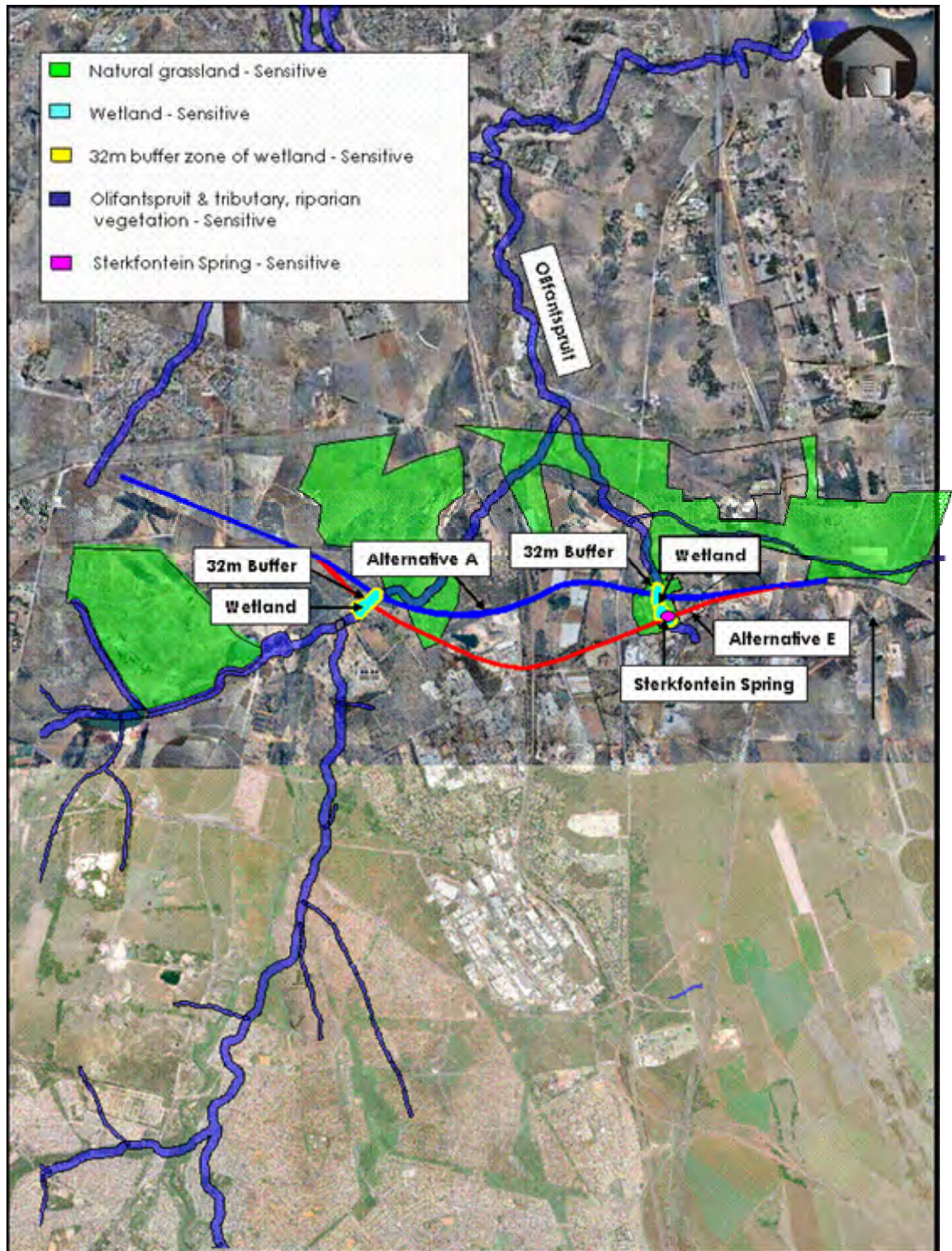


Figure 25 – Sensitivity Map

12. 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 proposed road be approved subject to:

- 1) The implementation of the mitigation measures contained in the Environmental Management Plan (*Annexure U*) to achieve maximum advantage from beneficial impacts, and sufficient mitigation of adverse impacts;
- 2) The implementation of the precautionary measures provided for construction on dolomite;
- 3) The implementation of a Dolomite Risk Management Plan; and
- 4) Obtaining Section 21 Water Use License applications for the river crossings.