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December 2022

Environmental Management Program (EMPr)

PROPOSED SHOPPING CENTRE AND ASSOCIATED SERVICES ON THE REMAINDER AND ERF 1, 2, 3, 4, 5, AND 6 OF PORTION 22; AND PORTION 26 OF THE FARM EKANGALA 610 JR WITHIN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY

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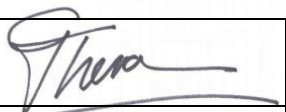
Document ID	Environmental Management Program					
File Path	*U:\Main data\PROJECTS\E\Ekangala\LEAP Submission\Final BAR\2022.12.12 Annexure H - EMPr gt edit.docx*					
Client	Litshaba Investments (Pty) Ltd		**Client Contact**		Mr Lampies Lamprecht	
Revision	**Date**	**Revision details/Status**	**Prepared by**	**Author**	**Verifier**	**Approved by**
0	December 2022		Mqondisi Mehlomakhulu		Dr G Theron	
1						
Current Revision						
APPROVAL						
Signature						
Name	Dr Gwen Theron					
Title	Environmental Practitioner EAPASA 2019/1421					

Table of Contents

TABLES

EKANGALA SHOPPING CENTRE – EMPR

Undertaking to Implement the EMPr

Undertaking by the Developer

I, ……, acting on behalf of ……. (the Developer), for:

PROPOSED SHOPPING CENTRE AND ASSOCIATED SERVICES ON THE REMAINDER AND ERF 1, 2, 3, 4, 5, AND 6 OF PORTION 22; AND PORTION 26 OF THE FARM EKANGALA 610 JR WITHIN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY

hereby indicate that I have read through the Environmental Management Program and understand the measures required to be implemented in terms of the EMPr. I hereby undertake to implement these measures and carry out my duties as specified herein.

Signed on at …… on ……..……..(date)

Signature ……

Witness……..

Witness…….

EKANGALA SHOPPING CENTRE – EMPR

Undertaking to Implement the EMPr

Undertaking by the Contractor

I, ……, acting on behalf of ……. (the Contractor), for

PROPOSED SHOPPING CENTRE AND ASSOCIATED SERVICES ON THE REMAINDER AND ERF 1, 2, 3, 4, 5, AND 6 OF PORTION 22; AND PORTION 26 OF THE FARM EKANGALA 610 JR WITHIN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY

hereby indicate that I have read through the Environmental Management Program and understand the measures required to be implemented in terms of the EMPr. I hereby undertake to implement these measures and carry out my duties as specified herein.

Signed on at …… on ……. (date)

Contractor's Environmental Representative Signature ……

Witness……

Witness……

EKANGALA SHOPPING CENTRE – EMPR

Undertaking to Implement the EMPr

Undertaking by the Environmental Control Officer

I, ……., the Environmental Control Officer appointed by

……., for:

PROPOSED SHOPPING CENTRE AND ASSOCIATED SERVICES ON THE REMAINDER AND ERF 1, 2, 3, 4, 5, AND 6 OF PORTION 22; AND PORTION 26 OF THE FARM EKANGALA 610 JR WITHIN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY

hereby indicate that I have read through the Environmental Management Program, and understand the measures required to be implemented in terms of the EMP and hereby undertake to fulfil my duties as specified herein.

Signed on at …… on …….. (date)

Environmental Control Officer Signature ……

Witness……

Witness……

EKANGALA SHOPPING CENTRE – EMPR

1.0 INTRODUCTION

The purpose of an Environmental Management Program (EMPr) is to guide the planning and design, construction and operational phases of the construction of **Proposed Shopping Centre and Associated Services on the Remainder and Erf 1, 2, 3, 4, 5, and 6 of Portion 22; and Portion 26 of the Farm Ekangala 610 J.R. within the City of Tshwane Metropolitan Municipality**.

The EMPr should be developed in parallel with the planning and design phase, which enables environmental guidelines and criteria to be incorporated into the detailed design. This is done to eliminate or mitigate the various possible risks to the environment and its surrounding inhabitants during the planning and pre-construction phase. And it will subsequently ensure that minimal damage will occur to these areas during the construction and operational phases of a project.

2.0 PHASES, ROLES & RESPONSIBILITIES

2.1 Phases of the Project

The Point of departure for any EMPr is to take a pro-active route by addressing and minimising any potentially significant problem before it occurs. This EMPr deals with the following phases:

2.1.1 Planning or Design Phase

It is essential that possible problematic situations be eliminated or mitigated during the planning phase, to ensure that contingency plans are prepared for any possible accidental situation that may arise during the construction phase. By having these contingency plans in order before construction starts it will limit any further potentially detrimental impacts to the environment and its surrounding inhabitants.

2.1.2 Construction Phase

Most possible impacts on a site would occur during the construction phase, and most of them will have immediate effect (e.g. dust pollution, fuel spillage). It is therefore vital that the site is monitored on a continual basis during this phase, as it would be possible to identify and correct these impacts as they occur, thus minimising their possible impact.

2.1.3 Operational Phase

By being pro-active during the design and construction phases, potentially harmful impacts originating in the operational phase will be minimised or eliminated. For the Proposed Shopping Centre within the City of Tshwane Municipality the following aspect are important during operations and is more thoroughly addressed under Items as indicated

- Waste management – 11.3.2
- Deliveries – 11.13
- Storm water management -11.1 and 11.2.2 and 11.12
- Maintenance of the wetlands – 11.14
- Noise – 11.6
- Traffic – 11.13
- Safety and security – 11.1 and 11.7

2.1.4 Decommissioning Phase

Thoughtful design, thorough monitoring and strict adherence to the EMPr during the construction and operational phases will ensure that the decommissioning phase (if and when applicable) will be done efficiently and with minimal damage to the bio-physical and social environments.

2.2 Roles and Responsibilities

Various role players have a range of responsibilities to perform during the different phases of a project:

2.2.1 Project Manager (PM) (Developer Representative)

- The PM will be responsible for overseeing the contract from initiation to completion of construction on the site
- The PM will appoint a team of contractors, which will be responsible for the construction of the entire project
- The PM will be responsible for ensuring that the development is implemented according to the requirements as set out in the EMPr
- The PM should ensure that sufficient resources are available to the other role players to efficiently perform their tasks in terms of the EMPr
- The PM must appoint an independent ECO to ensure strict adherence to the EMPr
- The PM must ensure that all designs comply with the EMPr

2.2.2 Resident Architects (RA)

Only architects approved by the PM will be allowed to work on the project and will oversee the individual contracts between the owners of the entire site or portions thereof and the contractors.

2.2.3 Resident Engineer (RE)

A resident engineer act as a direct, on-site resource for all technical aspects related to the development. He is available on the construction site at all times, overseeing all phases of the construction activities.

2.2.4 Consulting Engineer (CE)

The engineer consulted during the construction period. They are not available on site at all times but were part of the specialist team during the design of the proposed development.

2.2.5 Environmental Control Officer (ECO)

The ECO will be appointed at the start of the construction phase and is mandated to do the following:

- Ensure that all contractors/subcontractors/employees are fully aware of their environmental responsibilities. This will take the form of an initial environmental awareness-training program in which requirements of this document will be explained
- Any damage to the environment must be repaired as soon as possible after consultation between the ECO, Consulting Engineer and Contractor
- The ECO shall monitor their actions to ensure that the developer staff and/or contractor are adhering to all stipulations of the EMPr

- The ECO shall be responsible for monitoring the construction activities throughout the project by means of site visits and meetings. This should be documented as part of the site meeting minutes
- The ECO must sign off that the PM certify that they shall ensure that all clean-up and rehabilitation or any remedial action required, are completed prior to transfer of properties
- A post construction environmental audit is to be conducted to ensure that all conditions in the EMPr have been adhered to.

2.2.6 Contractor

The Contractor is appointed at the start of the construction phase and is responsible to do the following:

- Ensure that all subcontractors/employees are fully aware of their environmental responsibilities. This will take the form of an initial environmental awareness-training program by the ECO in which requirements of this document will be explained
- Further toolbox talks with an environmental theme must be conducted at least every 14 days to ensure that the subcontractors/employees rare consistently reminded that of the contents of the EMPr
- Any damage to the environment must be repaired within 14 day maximum after the Contractor has been made aware of the non-compliances.
- The Contractor shall assign an appropriately knowledgeable representative who shall accompany the ECO during site visits to monitor the construction for compliance during site visits. The results of the site visit must be documented as part of the site meeting minutes for immediate action.
- The Contractors shall give feedback within 14 days to the PM, Engineer and ECO to demonstrate the remedial measures to rectify the noncompliance observed on site.
- The Contractor must sign off the undertaking to comply with the EMP and EA that they shall ensure that all clean-up and rehabilitation or do any remedial action required as instructed by the Engineer, ECO or PM.
- A post construction environmental audit will be conducted to ensure that all conditions in the EA and EMPr have been adhered to and that the site is in a condition that satisfies these requirements. If found not to be complement, the Contractor will be responsible to complete all work requires to the satisfaction of the ECO prior to the site being taken over by the Client.

2.2.7 Community Liaison Officer (CLO)

Where necessary / required a representative of the community, as nominated by the community, will be the CLO and has the role of representing the community and managing all communication between the ECO, the Contractor and the community (I&APs). (The details of the CLO are to be forwarded to the Ward Municipality or for the area.)

3.0 IMPLEMENTATION AND MONITORING

3.1.1 Auditing/Inspections

- The appointed ECO on a two-weekly schedule, and also ad hoc basis will inspect the site where necessary
- The PM as well as the contractor's representative will accompany the ECO, onsite inspections
- The contractor will use the formats presented in this EMPr to report to the PM as to the compliance to this document

When, in the opinion of the ECO, a construction activity will result in environmental damage, the ECO will issue instructions to the PM, who will in turn order the Contractor to halt the activity. Spot fines or penalties may be levied for non-compliance.

3.1.2 Actions required prior to construction commencing.

Requirement	Comply	Date requested
1. Compile Environmental File to be kept on site at all time, according to the Table of Contents provided herewith.		
2. Complete the site establishment requirements		
3. Survey ALL sensitive areas as per the site plan attached.		
4. Install clear demarcation markers to identify the wetland, 32 buffer or any other sensitive areas as indicated on the site plan attached. 5. Varying from the site plan for the demarcation method, must be approved by ECO.		
6. Install toilets		
7. Submit site camp layout.		
8. Provide route plan for roads on site.		
9. Install measures to prevent hydrocarbon spills.		
10. Provide waste management plan.		
11. Demarcate CLEARLY waste management areas		
12. Provide eating and washing facilities at Site Camp		
13. Provide eating and washing facilities at construction camp		
14. Provide method statements for erosion control		
15. Provide method statements o prevent siltation on roads and into water courses.		
16. Provide method statements for rehabilitation to be implemented throughout the project timeframe.		

3.1.3 Methods Statements

Methods statements from the contractor will be required for specific sensitive actions on request of the authorities or ECO. All method statements will form part of the EMPr documentation and are subject to all terms and conditions contained within the EMPr document. For each instance where in it is requested that the contractor submit a method statement to the satisfaction of ECO, the format should clearly indicate the following:

- What – a brief description of the work to be undertaken
- How – a detailed description of the process of work, methods and materials
- Where – a description / sketch map of the locality of work
- When – the sequencing (phases) of actions with commencement date and completion date estimates

The contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ECO.

3.1.4 Record Keeping

All records related to the implementation of this management plan (e.g. site instruction book, ECO diary, methods statements etc.) must be kept together in an office where it is safe. Records should be kept for two years and at any time be available for scrutiny by any relevant authority.

3.1.5 Feedback

- The Contractors shall give feedback within 14 days to the PM, Engineer and ECO to demonstrate the remedial measures to rectify the noncompliance observed on site.

4.0 STANDARDS

- The ECO will keep written and photographic records of the site and it's surrounding before, after and during construction on the site
- The Contractor will keep records of construction activities, instructions received from the ECO and PM concerning environmental matters
- The ECO will keep records of cases of non-compliance and remedial actions taken
- Where no quantitative standards are applicable, visual standards will apply
- The contractor will rehabilitate the site to a condition acceptable to the ECO, and respond timeously to any complaints and instructions regarding construction activities

5.0 EMPR OBJECTIVES

This EMPr must be used during the pre-construction, construction, and operational phases of the proposed project. The objectives of this plan are to:

- Ensure all environmental safeguards are carried out correctly
- Manage site activities effectively and coordinate with other trades
- Minimise adverse impacts on the environment
- Ensure that environmental mitigation measures are in place from the start of the project
- Minimise disruption to fauna and flora
- Monitor the project

6.0 EMP CONTEXT AND ENVIRONMENTAL AUTHORISATION CONDITIONS

This EMPr fits into the overall planning process of the project and should be implemented by the developer as soon as the authorities have approved it. A copy of the EMPr should always be available on site. All contractors and sub-contractors are to be familiar with the EMPr and its contents.
Specific conditions of the ROD pertaining to the project will be included in the ROD **(Appendix C)**
The layout as approved in the ROD are attached as **Appendix D**

7.0 LEGISLATION

- The EMPr is compiled in order to comply with the following legislative documents:
- National Monuments Act, 1969 (Act 28 of 1969)
- National Parks Act, 1976 (Act 57 of 1976)
- Environmental Conservation Act, 1989 (Act 73 of 1989)
- National Environmental Management Act, 1998 (Act No. 107 of 1998)
- Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965)

- The National Water Act, 1998 (Act 36 of 1998)
- Mine Safety and Health Act, 1996 (Act 29 of 1996)
- The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
- Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
- Animal Protection Act, 1962 (Act 71 of 1962)
- Local Municipality By-Laws
- Municipal Systems Act, 2000 (Act 32 of 2000)
- Municipal Structures Act, 1998 (Act 117 o 1998)

8.0 PROJECT OVERVIEW

The proposed Shopping Centre and associated services is situated on the Remainder and Erf 1 1, 2, 3, 4, 5 and 6 of Portion 22, and Portion 26 of the Farm Ekangala 610 J.R., within the City of Tshwane Metropolitan Municipality, located at the corner of the R460 and the R568. The site is currently vacant and is not being put to any productive use. There is evidence of pedestrian walking routes across the site and above ground electrical cables along with natural veld grass and isolated clumps of trees.

The site is approximately 5.64 hectares in extent and the sewer line is 1.6km.

The owner of the property is Litshaba Investments (Pty) Ltd.

Figure 1: Location Map of the proposed Ekangala Shopping Centre and associated services

Proposed Development

It is the intention of Litshaba Investments (Pty) Ltd (the Applicant) to develop and operate a new community Shopping Centre, which will include associated services on the Remainder and Erf 1, 2, 3, 4, 5 and 6 of Portion 22 and Portion 26 Farm Ekangala 610 J.R., within the City of Tshwane Metropolitan Municipality. The Shopping Centre will sponsor anchor tenants and several line stores of which large percentage will be national franchise-type business concerns.

The proposed Shopping Centre will ultimately extend to a total maximum of approximately 13 764m^2 gross floor area, which will be implemented in phases. The present application is to follow for a maximum gross floor area of 14 112m^2 to be developed.

The development controls contained in the zoning certificate are indicated in the table below:

Density	Not applicable
Height	10 metres (2 storeys)
Floor Area Ratio (FAR)	Not applicable
Coverage	50%
Building-lines	
Streets	10 meters
Other	5 meters along rear and side boundaries as well as ground floor along southern boundary, for double volume or storeys above ground level along south boundary.

In order to connect to the existing sewerage system in Ekangala A, north-east of the proposed Shopping Centre, a sewerage line will be constructed as part of the Shopping Centre development.

9.0 TIMEFRAMES

The expected construction period will be phased with an estimated timeframe of approximately 10 years.

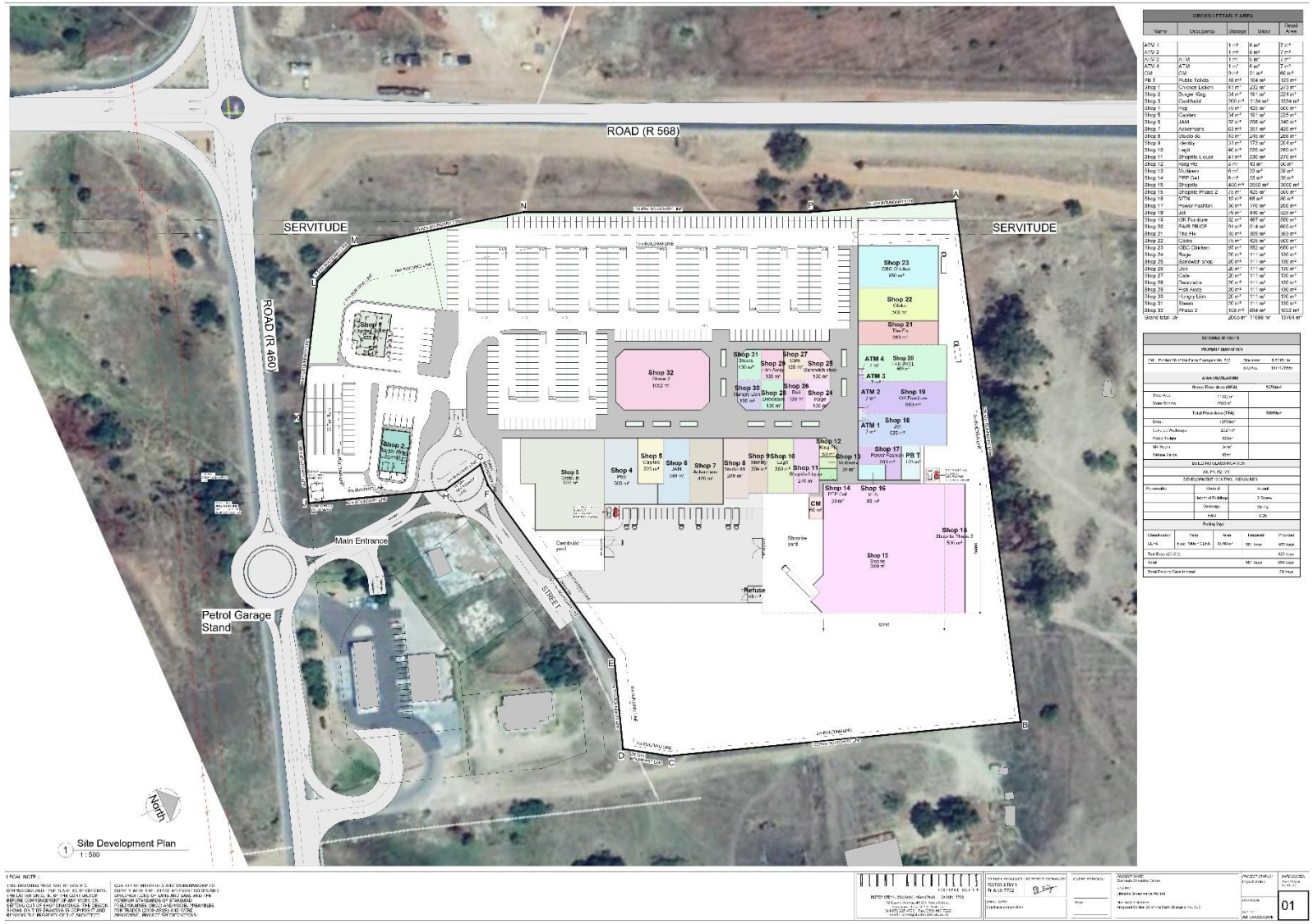


Figure 1: Site development plan

10.0 RECEIVING ENVIRONMENT

The results of the specialist investigations include the following:

10.1. Geology

10.1.1 General topography and drainage

The site slopes at an average of 5% towards the west. Surface water drains by means of sheet wash towards the west. A drainage feature striking west to east is situated on the central part of the site.

10.1.2 Method of investigation

Ten test pits were dug at predetermined positions and the soils were described according to the standard method proposed by Jennings, B rink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soil's laboratory for foundation indicator tests. Due to the variation in consistency and composition no undisturbed samples were taken.

10.1.3 Geology and soil profile

According to the 1:250 000 scale geological, the site is underlain by sandstone of the Waterberg Group and by transported materials; the regional geology is shown in **Figure 3**. The geology was confirmed during the investigation; sandstone was encountered in all the test pits. The following materials were encountered on the site:

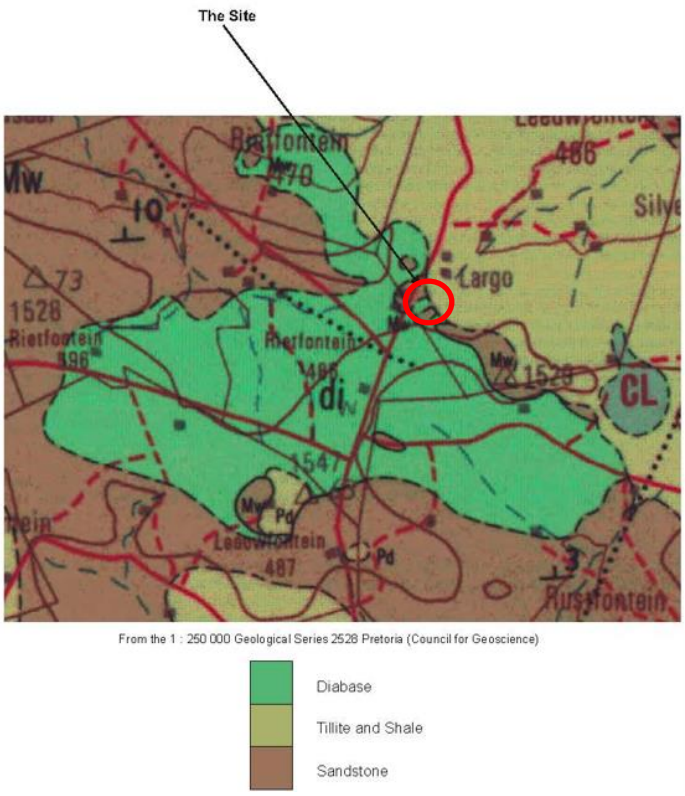


Figure 2: Regional Geology Map

10.1.4 Colluvium

Slightly moist, brown occasionally mottled black towards the base, medium dense, intact and slightly pinholes, silty sand with trace amounts of roots and highly weathered gravels of mixed origin with nodular ferricrete towards the base was encountered in all the test pits from surface up to an average depth of 1.0 meters.

10.1.5 Sandstone

10.1.5.1 Residual sandstone

Two types of residual sandstone were identified on the site:

- **A top layer of greyish brown residual sandstone:** Moist, greyish brown occasionally mottled black, orange brown and reddish brown, medium dense, slightly pinholed sandy silt with trace amounts of highly weathered sandstone gravels and ferricrete nodules was encountered in all the test pits from an average depth of 1,0 meters up to an average depth of 2.1 meters.
- **A bottom layer of orange brown residual sandstone:** Moist, orange brown ocassionally patchy greyish brown mottled black, orange brown and reddish brown, medium dense to dense, slightly pinholed gravelly silty sand occasionally slightly ferrugnised with trace amounts of highly weathered sandstone gravels was encountered in five test pits from an average depth of 1.6 meteres up to an average depth of 2.2 meters.

10.1.6 Sandstone bedrock

Sandstone bedrock was encountered in test pit 9 at a depth of 2.4 meters.

10.1.7 Geohydrology

Ground water seepage was encountered in test pits 4 and 5 at an average depth of 1.3 meters below surface. The presence of pedogenic material (ferricrete) furthermore confirms that a seasonal, perched water table could be present during and after periods of high rainfall.

10.1.8 Laboratory test results

10.1.8.1 Indicator test results

The laboratory test results have been summarised in the following table:

Material	TP	Depth (m)	PI	%Clay	%Silt	%Sand	%Gravel
Colluvium	4	1.1	SP	2	16	81	
Greyish brown residual sandstone	2	1.6	16	29	15	53	3
Greyish brown residual sandstone	4	1.6	14	14	15	68	3
Greyish brown residual sandstone	10	1.6	15	17	12	64	7
Greyish brown residual sandstone	1	1.5	14	13	12	48	27

The difference between the colluvium and the residual sandstone is shown by higher sand and lower clay content of the colluvium and the difference between the greyish brown residual sandstone and the orange residual andesite is reflected by the lower sand and higher gravel content of the orange residual andesite. The laboratory tests furthermore clearly reflect the variation in the composition of the materials.

10.1.9 Potential expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van de Merwe (1964). The following material characteristics are considered when applying this method:

- Plasticity index
- Clay fraction (<0.002mm)
- Thickness of expansive material
- Thickness of non-expansive material

Assuming the laboratory test results typify the material encountered on the site, the application of the method of Van der Merwe shows that colluvium and orange residual sandstone classify as “Low” and are therefore considered non-expansive. The greyish brown residual sandstone classifies as “Low” and “Medium”, it is recommended that a conservative approach be adopted and a classification of “Medium” rather than “Low” be assigned to the greyish brown residual sandstone. With this approach the calculated heave for the test pit is between 7,5mm and 15mm.

10.1.10 Collapse potential

Due to the variation in consistency and composition no undisturbed samples were taken.

10.1.11 Engineering geological zoning

Due to the relatively uniform soil profile the site is not divided into different engineering geological zones.

10.1.12 Geotechnical considerations

The following geotechnical considerations, which could influence the proposed development were identified:

10.1.13 Founding of structures:

- The composition and consistency of the colluvium varies; therefore, it is not considered suitable founding material. If unadapted structures are founded on this material and the moisture content should change, unacceptable differential, vertical movements could occur, with resultant cracking of structures.
- The greyish brown residual sandstone is potentially expansive, and classifies as “Medium”. Therefore, it is not considered suitable founding material. If unadapted structures are founded on this material, and the moisture condition of the in situ material should vary, unacceptable differential movements, with resultant cracking may occur in structures.
- The calculated heave us between 7,5mm and 15mm.
- The composition and consistency of the orange residual sandstone varies; therefore, it is not considered suitable founding material. If unadapted structures are founded on this material and the moisture content should change, unacceptable differential vertical movements could occur, with resultant cracking of structures.

10.1.14 Excavatability

Gradual refusal occurred at an average depth of 2.5 meters below surface. In test pit 9 the back actor refused at an average depth of 2.5 meters.

10.1.15 Construction material

The colluvium and residual sandstone classified as A-2-4 and A-2-6. The Plasticity Index and Grading Modulus were used to assess the suitability as construction material.

10.1.16 Groundwater

A seasonal perched water table, which could cause the flooding excavations, could be present during or after periods of high rainfall. This is confirmed by the groundwater seepage in test pits 4 and 5 and the presence of pedogenic material.

10.1.17 Stability of excavations

Limited instability occurred in the sidewalls of the test pits.

10.1.18 Geotechnical Classification

The site was classified according to the Geotechnical Classification for Urban Development (after Patridge, Wood and Brink 1993). The criteria for classification are shown in the following table:

	Constraint	Most Favourable (1)	Intermediate (2)	Least Favourable (3)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750mm in thickness	Any collapsible horizon or consecutive horizons totalling a depth of more than 750mm in thickness	A least favouravble situation for this constraint does not occur.
B	Seepage	Permanent or perched water table more than 1,5 metres below surface	Permanent or perched water table less than 1,5 meters below surface.	Swamps or marshes.
C	Active Soil	Low soil heave predicted	Moderate soil heave predicted	High soil heave predicted
D	Highly compressible soil	Low soil compressibility expected	Moderate soil heave predicted	High soil heave predicted
E	Erodibility of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of total volume
G	Undermined ground	Undermining at a depth greater than 100m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 100m below surface where step closure has ceased	Mining within less than 100m of surface or where total extraction mining has taken place
H	Instability in areas of soluble	Possibly unstable	Probably unstable	Known sinkholes and dolines
I	Steep slopes	Between 2 and 6 degrees	Slopes between 6 and 18 degrees and less 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less 2 degrees (all other regions)	More than 18 degrees (Natal and western Cape) More than 12 degrees (all other regions)

J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100cm/s^2 within 50 years	Mining induced seismic activity more than 100cm/s^2	Natural seismic activity more than 100cm/s^2
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

Based on the above, the site is classified as 2A, 2B, 2C, 2D, 2E, 1/2F, 1I.

10.1.19 NHBRC CLASSIFICATION

The residual sandstone is potentially expansive and the calculated heave is between 7,5mm and 15mm, therefore the site is zoned as H1/H2. The colluvium and orange residual sandstone is expected to be potentially collapsible/compressible. Due to the consistency and composition the collapsed/settlement could not be quantified. The average thickness of this material exceeds one meter, therefore a zoning of C2-S2 is added. Groundwater seepage occurred at an average depth of 1,3 meters in two test pits therefore a zoning of P (Perched water table is added).

10.1.19.1 The entire site is zoned as NHBRC Zone P (Perched water table) – C2-S2-H1/H2

It is important to note that the zoning is based on the profiling of test pits and the interpolation of information between test pits; therefore it is possible that variations from the expected conditions can occur.

10.1.20 Conclusions and Recommendations

It is important to note that the recommendations are based on the profiling of test pits and the interpolation of information. It is therefore possible that variations from the expected conditions can occur.

10.1.21 Foundations for light structures

The average thickness of the alluvium, which is considered to be potentially collapsible / compressible, is 1,0 meters. It is assumed that most of this layer will be removed during construction.
The residual sandstone is potentially expansive and the calculated heave is between 7,5mm and 15mm. the colluvium and orange residual sandstone is expected to be potentially collapsible / compressible. Due to the consistency and composition the collapse / settlement could be quantified. Therefore, this material is considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion, foundation improvement and imparting flexibility in the brickwork are clearly required. The alternatives are recommended:

- **Stiffened or cellular raft:** Found structures on a stiffened or cellular raft. Structures should be provided articulation joints and lightly reinforced masonry.
- **Soil raft:** Remove all or necessary parts of the expansive horizon to 1.0 meters beyond the perimeter of the structures. The loose material in the bottom of the excavations should be compacted, and the excavations backfilled with inert material, compacted to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal, lightly reinforced strip footings on the backfill and should be provided with light reinforcement in the masonry if the residual movements are <7.5mm, or the construction type should be appropriate to residual movements.

- **Piled construction:** Piled foundations with suspended floor slabs, with or without ground berms.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. It is furthermore recommended that the trenches for the services be profiled and that a construction report be compiled for the development. The purposed of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.

10.1.22 Foundations for large structures

Detailed foundation investigations should be done on the footprints of large structures.

10.1.23 Excavatability

The Excavatability of the materials encountered on site was evaluated according to the South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches). The excavatability is considered to classify as “soft to intermediate” up to an average depth of two meters below surface. It is important to note the evaluation is based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.

10.1.24 Geohydrology

All excavations should be provided with adequate drainage. Structures should be provided with damp proofing and provision should be made to prevent the ingress of water into and below foundations.

10.1.25 Construction material

Based on the laboratory test results and guidelines given in the THR14, the colluvium and residual sandstone could, depending on the composition, be suitable as fill. It is recommended that the suitability of material that is to be used, be confirmed by detailed laboratory testing.

10.1.26 Services

Due to the expected corrosivity, it is recommended that all services be protected in accordance with SANS 1200G.

10.1.27 Stability of excavations

It is recommended that all excavations be cut back or shored.

10.1.28 General recommendations

Water has significant influence on the behaviour of the in-situ material. To reduce differential movements of structures it is necessary to maintain moisture equilibrium under the structures. Therefore, it is recommended that the following measures be implemented:

- No accumulation of surface water must be allowed around the perimeter of the structures and the entire development must be properly drained.
- Down pipes should discharge into a lined or precast furrow. This furrow should discharge the water 1,5 meters away from the foundation onto a paved or grassed surface sloping away from the building.

- Preferably, if no gutters or paving is to be provided around structures, a 1,5-meter-wide sealed concrete apron should be cast along the perimeter of the structures the water must be channeled away from the foundation.
- Leaks in water bearing services should be attended to without undue delay.
- No large shrubs or tress should be planted closed to structures that the distances provided in the following table:

Description	Mature Height of Tree		
	Up to 8m	8m to 15m	Over 15m
Buildings other than single storey buildings of lightweight construction.	-	0,5	1.2
Single Storey buildings of lightweight construction (e.g., timber framed)	-	0,7	1,5
Free standing masonry walls	-	1,0 0,5	2,0 1,0
Drains and underground services • Less than 1 meter deep • More than 1 meter deep	 0,5 -	 1,5 1,0	 3,0 2,0

10.2 Geohydrology Assessment

10.2.1 Hydro census

Information on five boreholes could be found during the hydro census study in the region of the proposed sewer line. Four of these boreholes are located at the Ekangala Waste Water Treatment Plant which is located on the southern side of the Grootspruit. These boreholes serve as groundwater monitoring facilities for the Waste Water Treatment Plant. The fifth borehole was found just north of the planned sewer line and shopping centre site at the Zivuseni Primary School. The borehole at the school is currently not used.

The village receive Municipal piped bulk water supply and does not use groundwater production boreholes as a water resource.

The water table could be measured in the four groundwater monitoring boreholes located at the Ekangala waste water treatment plant as well as the borehole located at the Zivuseni Primary School. The water level depths at the Waste Water Treatment Plant range between 1.60 and 2.89 metres below ground level. The water level depth at the school located close to the proposed sewer line and shopping centre site is 16.32mbgl

BH	Coordinates		Altitude	BH	WL	WL	Remarks
	Latitude	Longitude	(mamsl)	Depth	Depth	Altitude	
HCBH 1	25.67690°	28.72441°	1473	-	16.32	1457	Borehole at Zivuseni Primary School.
MBH EA01	25.66676°	28.76066°	1425	30	2.89	1422	0 to 12 solid casing. 12 to 30 m perf casing.
MBH EA02	25.66492°	28.76044°	1421	22	2.21	1419	0 to 10 solid casing. 10 to 22 m perf casing.
MBH EA03	25.66554°	28.75953°	1422	22	1.69	1420	0 to 10 solid casing. 10 to 22 m perf casing.

MBH EA04	25.66615°	28.75916°	1423	22	1.60	1421	0 to 10 solid casing. 10 to 22 m perf casing.
River 1	25.676735°	28.73299°	-	-	-	-	River sample position 1
River 2	25.673172°	28.742219°	-	-	-	-	River sample position 2
Surface water 3	25.68513°	28.71876°	-	-	-	-	River sample position 2

10.2.2 Test pits and percolation tests

One new test pit was prepared, on surface on the sewer line profile. The pit was prepared for a double ring inflow meter test. The infiltration rate of the test pit can be found described in Table below.

Test pit 01 The test was done on surface. The hydraulic conductivity rate measured at this pit is 3.666 x 10-5cm/s or 0.0348 m/d, which relates to a very slow hydraulic conductivity rate

Co-ordinates	Elapsed Time	Time Period	Total Quantity of water (ml)	Infiltration rate (cm/s)	Infiltration rate (cm/h)	Infiltration rate (m/d)
Pit 1 S -25.67988° E -28.72797°	15	15	100	1.4666×10^{-4}	0.530	0.139
	30	15	100	1.4666×10^{-4}	0.530	0.139
	45	15	100	1.4666×10^{-4}	0.530	0.139
	60	15	50	7.333×10^{-5}	0.265	0.0696
	90	30	50	3.666×10^{-5}	0.132	0.0348
	120	30	50	3.666×10^{-5}	0.132	0.0348
	150	30	50	3.666×10^{-5}	0.132	0.0348
	180	30	50	3.666×10^{-5}	0.132	0.0348

10.2.3 Hydrochemical Analysis

Four groundwater monitoring boreholes could be found located around the existing waste water treatment plant which is located on the southern side of the Grootspruit. The waste water treatment plant is located 1km east of the Ekangala Village and downstream of the village. These four boreholes are located topographically around and below the waste water treatment site. For all practical reasons these four boreholes will be the first monitoring facilities to receive contaminated water from the waste water treatment plant and can therefore not be used as monitoring facilities for the village or the planned new sewerage pipe lines.

It was therefore decided to take water samples from the surface water bodies upstream and downstream of the village near the position of the planned sewer line, to be used as baseline water quality information.

The chemical water quality analyses of the two river water samples show that none of the chemical parameters analysed for are above the standards limits. The chemical analyses of the water show good water quality with determinants below the standard limits for domestic water use.

The E.Coli and Total coliform bacteria count for the water from both sampling points are above the Standard limits if compared to drinking standards. The E.Coli and Total coliform bacteria count for the river water sample River 1 show healthy (un-contaminated) surface water conditions (for a natural open water system) in the dam (not according drinking water standards). As the water moves down the healthy (read un-contaminated) river system the water is aerated with the result that the E.Coli and Total coliform bacteria count even lowers to levels below 100CFU/100mℓ. These phenomena show that the river system is healthy and is not contaminated by the current sewerage systems installed in the area.

A natural healthy river system may have E.Coli and Total coliform bacteria count of a 100CFU/100mℓ to 200CFU/100mℓ. This is not safe for domestic purposes but is natural for an open water river system. Counts of 1000CFU/100mℓ and above for E.Coli and Total coliform bacteria may indicate to contaminated water.

10.2.4 Groundwater Flow Direction

The north western side of the Ekqangala village is located on a topographical water divide. The surface area in the village is fairly unpaved with limited formal storm water management. Storm water is managed by sheet wash which enhance groundwater infiltration. The fact that groundwater is not abstracted in the area will limit groundwater movement in the aquifer to base flow.

It is expected in a fractured and weathered aquifer that the groundwater contours to a large degree will follow the surface contours. It can therefore also be expected that in general the groundwater flow will mimic the surface water flow. The surface contours can be used as indicator in which direction groundwater flow will be.

The groundwater and surface water flow directions will in general be from the topographic high areas in the village site towards the topographical low areas in the east and north east, towards the Grootspruit drainage system which drains towards the north east.

Figure 3: Groundwater flow direction

10.2.5 Parsons Rating System

Aquifer Classification

The aquifer at the Ekangala Village can be classed as a minor aquifer in a minor aquifer region and can be described as a low to moderately yielding aquifer system of variable water quality.

Aquifer vulnerability

A moderate tendency or likelihood does exist for contamination to reach a specific position in the groundwater system after introduction at some location above the uppermost aquifer.

Aquifer susceptibility

The aquifer is rated to have a medium susceptibility. Susceptibility is a qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification.

Groundwater Quality Management Classification

The GQM index of this option is rated at 4, with a medium protection level needed

Aquifer vulnerability due to hydrological conditions

According to Groundwater Protocol document, Version 2, dated March 2003, the vulnerability of the Groundwater Aquifer due to the Hydrogeological Conditions at the Planned Ekangala Sewer line can be rated as **medium to high** risk. The distance from the surface to the aquifer is in the region of 2 to 10 metres according the hydrocensus information gathered during the study

For surface sanitation spills at the Ekangala sewer line position, the travel distance vertically will be an estimated 2 to 10 metres to the water table. The permeability rate measured on site is very slow at a rate of 0.0348m/d

Vulnerability Class	Measurement	Definition
Extreme (Usually highly fractured rock and/or high groundwater table)	High risk and short distance(<2m) to water table	Vulnerable to most pollutants with relatively rapid impact from most contamination disposed of at or close to the surface
High (usually gravely or fractured rock, and/or high water table)	High risk and short distance(<2m) to water table	Vulnerable to many pollutants except those highly absorbed, filtered and/or readily transformed
Medium (usually fine sand, deep loam soils with semi-solid rock and average water table > 10m)	Low risk and medium to long distance to water table	Vulnerable to inorganic pollutants but with negligible risk of organic or microbiological contaminants
Low (usually clay or loam soils with semi-solid rock and deep water table >20m)	Minimal and low risk and long to very long distance to water table	Only vulnerable to the most persistent pollutants in the very long term
Negligible (usually dense clay and/or solid impervious rock with deep water table)	Minimal risk with confining layers	Confined beds present with no significant infiltration from surface areas above aquifer.

10.2.6 Assessment of the reduction of contaminants in the unsaturated zone

The surface material layer that is found on site have a medium capacity to absorb contaminants and a high capacity to create an effective barrier to contaminants. A high reduction of bacteria and viruses will be evident in the unsaturated aquifer if a spill does happen. Nitrates and phosphates will be reduced to some extent. Chlorides will be minimally reduced. Little reduction of chemical contaminants is expected. The top layer is a good barrier

Unsaturated Zone Conditions	Factor Effecting Reduction			Contamination Reduction			Comments
	Rate of flow in unsaturated zone	Capacity of the media to absorb contaminants	Capacity to create an effective barrier to contaminants	Bacteria and Viruses	Nitrates and Phosphates	Chlorides	
Clay	Very slow <10mm/d	High	High	Very High Reduction	High Reduction	High Reduction	Very Good barrier to movement of contaminants. May have

							problems with water retention in pit
Silt	Slow 10-100mm/d	Medium	High	High Reduction	Some Reduction	Minimal Reduction	Good barrier to movement of biological contaminants, but little reduction in chemical contaminants.
Sandy loam	Slow 10-100mm/d	Medium	High	High Reduction	Some Reduction	Minimal Reduction	Good barrier to movement of biological contaminants, but little reduction in chemical contaminants.
Fractured or weathered sandstone	Medium 0.1 - 10m/d	Medium	Medium	High Reduction	Minimal Reduction	Minimal Reduction	Fair barrier to movement of biological contaminants, but little reduction in chemical contaminants.
Fine sand	Medium 0.1 - 10m/d	Minimal	High	High Reduction	Minimal Reduction	Minimal Reduction	Good barrier to movement of biological contaminants, but little reduction in chemical contaminants.

10.2.7 Geohydrological risk from an on-surface source

As far as the geohydrological risk from the planned sewerage pipeline is concerned, the assessment is based on the level of risk of the source. Risk levels are based on three factors: 1) attenuation ability in unconsolidated materials; 2) risk load and travel time of degradable pollutants, in aquifer systems and 3) vulnerability of the aquifer and behavior of interstitial water regimes. Soil or unconsolidated material may provide a very effective attenuation buffer for certain contaminants and may have a very low attenuation on other risks. The nature of the soil materials and the thickness of this zone, are key issues in determining attenuation capacity. The sand layer on surface and the un-weathered status of the Dwyka Formation host rock may sufficiently protect the aquifer below from on surface spills.

10.2.8 Position in respect of domestic water sources

The location of a possible risk source, in relation to water sources utilised for human consumption, is of primary concern. The Ekangala Village used piped water for domestic use. No water production boreholes other than the un-used borehole at the Zivuseni Primary School is used for domestic purposes. There are no groundwater production boreholes at risk in the area

10.2.9 Position in respect of drainage features

The Grootspruit drains the area at the Ekangala Village. This river system will be at risk if a sanitation leak does happen at the position of the newly planned sewerage line

10.2.10 Conclusion and Recommendations

During the construction phase the potential impacts without mitigation measures are rated as “Negligible” to “Low”. With mitigation measures the significance of the impact is rated as “Negligible”.

- Construction should preferably take place in the dry season, as surface water runoff is
- minimal. Especially when crossing the Grootspruit and the wet areas. Surface water may create difficult working conditions especially during backfilling of trenches. Water levels in the aquifer may be at its lowest point during dry periods
- All vehicles shall be properly maintained and serviced so that no oil leaks occur on site.
- Any stockpiled soil and rock should have storm water management measures implemented.
- Spill trays must be provided for refuelling of plant vehicles

During the operational phase the significance of the impacts without mitigation measures are rated as “Moderate”. With mitigation measures the significance of the impact is rated as “Low”

- Storm water originating in the village must be kept away from the sanitation lines, especially the inspection pits.
- Erosion of the trenches after the construction phase must be stopped and mitigated at an early stage.
- Manhole lids must be tamper proof and must be inspected on a regular basis.

10.3 Floral Assessment

10.3.1 Vegetation Types

The proposed development site is located in the Grassland Biome and within the Mesic Highveld Grassland Bioregion and in the Rand Highveld Grassland vegetation type within this Bioregion. This vegetation type borders on the Central Sandy Bushveld to the north of Ekangala.

The Rand Highveld Grassland stretches across Gauteng, North-West, Free State and Mpumalanga Provinces. Grasses and herbs (forbs) form the main taxa in these grasslands. The conservation status of this vegetation type is given as Endangered as only % of this grassland is conserved in small Nature Reserves. Almost half of this grassland has been transformed by land uses such as cultivation, plantations, urbanisation or dam-building, while cultivation and invasive trees have affected large portions of the other half.

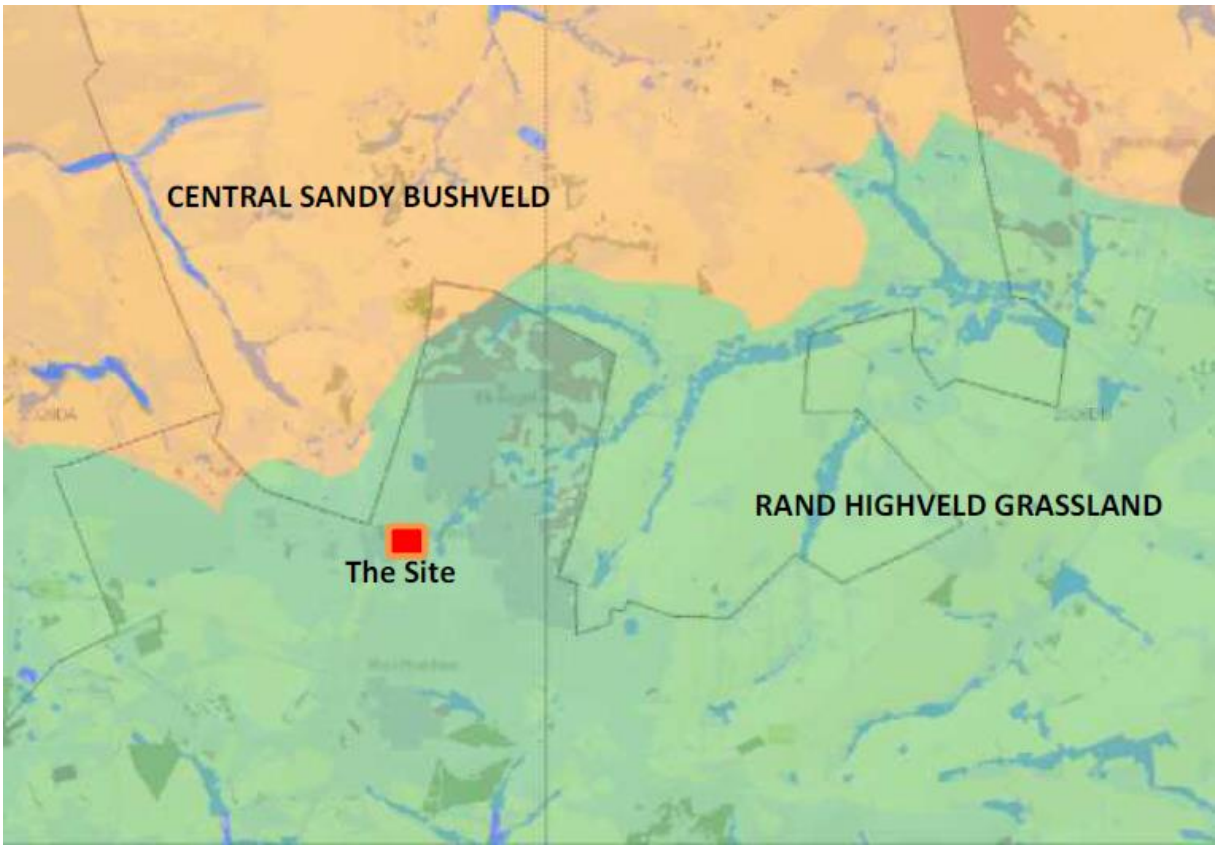


Figure 4: Vegetation map

10.3.2 Threatened Ecosystems

In Notice GN in section 52 National Environmental Management Biodiversity Act (No 10 of 2004), all the ecosystems that are listed are nationally threatened and in need of protection. Rand Highveld Grassland is considered to be Endangered Criteria A1 Threatened Ecosystem. This implies that there has been an irreversible loss of natural habitat where the remaining natural habitats are less than the biodiversity target +15%.

10.3.3 DFFE Comments and Protocols

The desktop study conducted by evaluating the DFFE Screening Tool and considering the NEMA Minimum Requirements (Protocols) of the Terrestrial Biodiversity Theme and the Plant Species Theme, indicated the following sensitivities for the site:

Theme	Status and comments
Terrestrial Biodiversity Theme	Very High Critical Biodiversity Area 2 Focus Areas for land-based protected areas expansion Vulnerable ecosystem
Plant Species Theme	Medium Sensitivity Four species of concern listed for the area

10.3.4 Protected Areas

The site does not affect any formally protected areas.

10.3.5 Historical status

The google images indicate that the grasslands on site were already negatively affected by anthropogenic disturbances in 2004. Footpaths and exotic trees were present on the site for several years. It can be expected that veld fires have been a yearly occurrence due to lack of conservation planning such as the implementation of fire breaks. All these factors have had an influence on the vegetation that is present on site today.

10.3.6 Ecological Units – Shopping Centre study area

Three Vegetation units were identified within and around the study area:

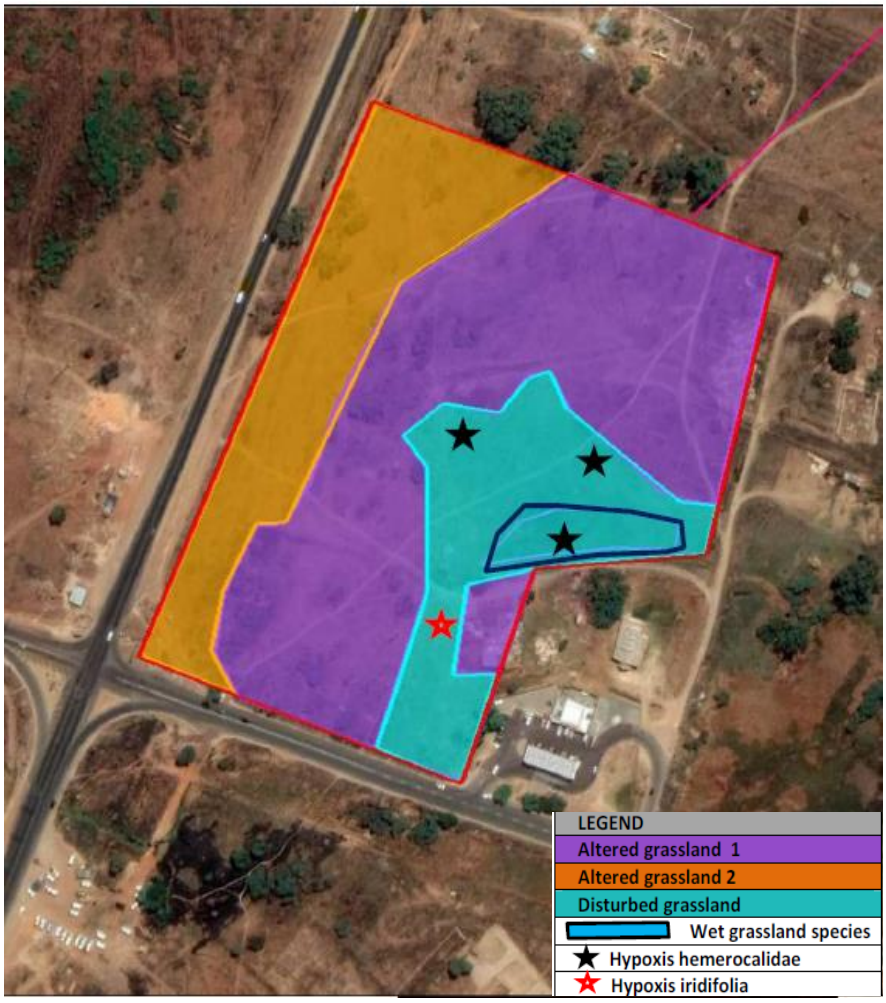


Figure 5: Vegetation unit map

10.3.6.1 Disturbed grassland: This grassland was observed towards the centre and south of the site. Mostly natural grassland species were found in the 1.3-hectare piece of grassland but with a moderate to low species richness. The vegetation cover was further found to be low, which has left the soil exposed to raindrop impact and erosion. The dominance of Stoebe vulgaris further indicated that the vegetation has been disturbed

in the past. This is a hardy, indigenous dwarf-shrub thriving in nutrient deficient soils with a history of poor veld management.

Within this area, some elements that are conservation worthy were observed. On the southern edge, a small wet grassland area has developed due to a leaking water pipe. A population of *Hypoxis hemerocallidae* and *Hypoxis iridifolia* occurred there as well as uncommon species such as *Drimia elata* (jeukbol) and orchid *Disa woodii.*

The conservation status of the Disturbed grassland was considered to Moderate.

10.3.6.2 Altered grassland 1: This section of grassland was located towards the centre of the site. The area is supported natural forb and grass species where the vegetation has recovered over time. Most of this area was however found to be poor in species richness. The exact nature of the past disturbances is unknown, but may have included activities that disturbed the natural soil structure, hence the original set of species typical of this grassland, was not present.

Within this grassland, single trees and bush clumps were recorded including exotic species such as *Accacia mearnsii* and *Eucalyptus grandis* bluegums as well as indigenous species such as *Dichrostachys cinerea, Grewia flava* and *Acacia karoo*.

The conservation status of the vegetation is considered to be Poor due to Low species richness and presence of exotic species.

10.3.6.3 Altered grassland 1: This grassland zone was located along the north-south bound road R568. The vegetation was found to be sparse and poor in species richness. Google images as far back as 2004 indicate that this section was disturbed many years ago, and has not recovered since then. Tree species included mostly exotic species typical of previously disadvantaged disturbed/ploughed grassland.

The conservation status is considered to be Poor.

10.3.7 Ecological Units – Sewer line study area

10.3.7.1 Altered grassland: The grassland along the proposed sewer line was historically ploughed. Presently it is also grazed by sheep and goats. The vegetation has not recovered from these disturbances. Subsequently the species richness was found to be poor and did not resemble the original natural vegetation of Rand Highveld Grassland.

Grass species included the sub-climax and climax such *Hyparrgenia hirta* and *Setaria spacelata*. *Hyparrgenia hirta* is typical of disturbed places such as old cultivated lands and road reserves. Trees in the vicinity of the sewer line study area included bluegum, black wattle and indigenous sweet thorn (*Acacia karroo*).

Along the route, a small wet area was observed where *Berkheya radula* and the grass species *Imperata cylindrica* were observed. The species typically grow in wetter soils. The wet area was not sensitive from a vegetation point of view due to the low species richness observed and small area that was affected.

The conservation status of the vegetation along the pipeline is subsequently considered to be poor due to historic and significant disturbances to the vegetation.

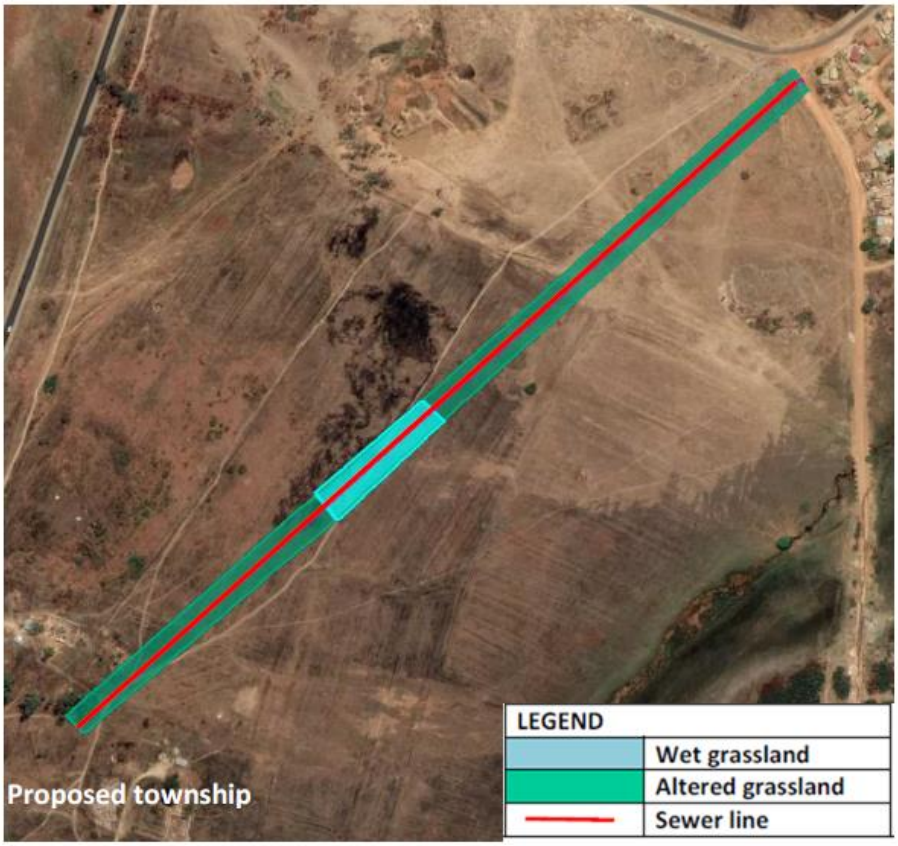


Figure 6: Vegetation unit map

10.3.8 NENMBA: Red Data Flora

According to GDARD records, no Red Data species were recorded on the site or in the vicinity of the site or within 5 kilometres.

Ten species were however recorded in the quarter degree grid of the site. in addition, DFFE lists four more species for the area. These fourteen species were assessed in terms of presence of suitable habitat in site.

For most of the species, no suitable habitat was observed on site. suitable habitat was observed for two declining species for which suitable habitat was recorded. One of the species, *Hypoxis hemerocallidae* was observed on site. Suitable habitat could further potentially be available for one orchid species listed by authorities. The assessment of the site however indicated that most of the vegetation on the site has been affected by the past disturbances, which makes it unlikely that this orchid species will occur on site.

10.3.9 Surrounding land use

A 200-meter perimeter area around the site was assessed for sensitivities. The surrounding land comprised a mosaic of natural, disturbed and altered grassland.

The northern areas were historically ploughed, but some woodland elements have appeared in these areas over time. The areas south of the site were characterised by formal and informal business. A wetland occurs east of the site, and some small patches of natural grassland were still present in the landscape.

The site is a continuation of these land uses, with most of its vegetation being historically altered by anthropological disturbances and the lack of conservation efforts to protect natural habitats.

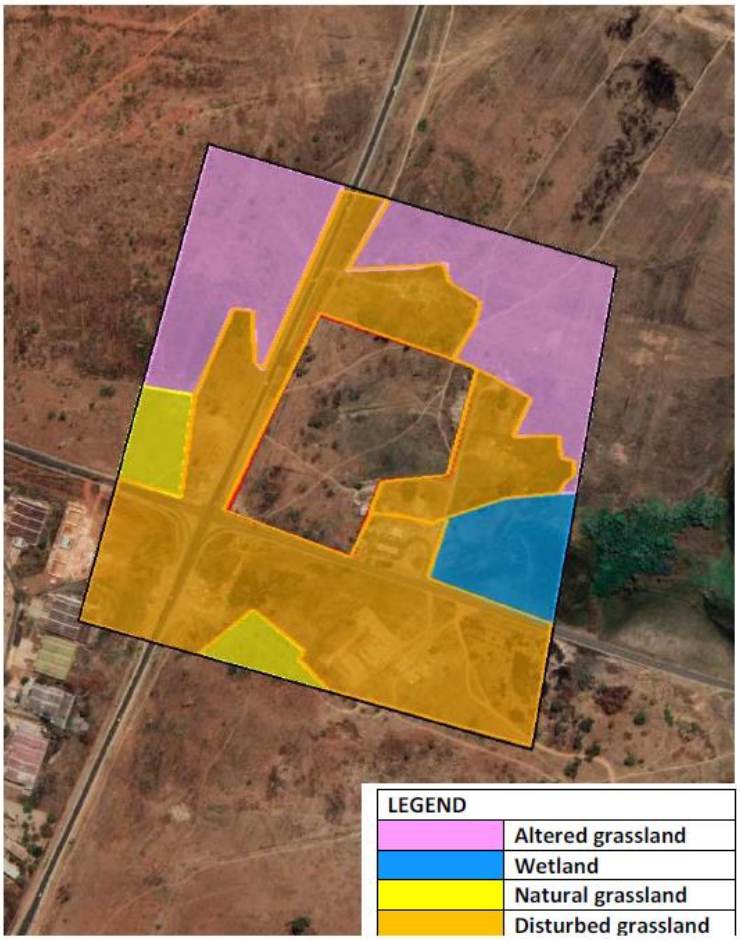


Figure 7: 200-meter radius around the site

10.3.10 Discussion

Although, the proposed development site could positively as a support for the local ecology since such support is not dependent on a pristine environment or undisturbed vegetation, there are however aspects of the site that would affect the ecological support of the site.

The site is located in close proximity to an intersection where a garage, taxi rank and old industrial park is located. It is further located between the suburbs of Ekangala and this intersection. This aspect limits the sites potential to act as an ecological support area, as there will always be some pressure for development on this

intersection. A development land use would be more suitable for such an area, as it can then assist in removing risks with ad hoc fires, the spread or invasion of alien invasive plants and the indiscriminate use of the site that may permit pollution, plant harvesting and other anthropomorphic impacts.

Other aspects that undermine the ecological role of the site, is that it was found to not be an important area for Red listed bird species as indicated in the faunal assessment and the vegetation was found to be in Moderate but mostly Poor condition.

10.3.11 Terrestrial Biodiversity

Considering all aspects assessed the areas within the site boundaries as well as along the sewer line is classified as having a Low ecological sensitivity.

This based on the fact that the vegetation structure and composition is not natural and therefore does not qualify as primary vegetation. No species of conservation concern have been recorded on the site and not such species were observed during the field survey.

The site also does not lie adjacent or in close proximity to a protected area or similar of conservation concern (i.e. ridge or natural habitat). The site does however lie just upslope of a water course,

Figure 8: Sensitivity map

10.3.12 Conclusion and Recommendations

The vegetation ecology and plant biodiversity that could possibly be affected by the development of the township and associated sewer link is rated to have a low sensitivity. Historical anthropomorphic activities have altered much of the vegetation structure and composition which resulted in a very poor reflection of species that would normally be representative of the Rand Highveld Vegetation type.

The intersection close to the site supports a taxi rank, an old industrial park, a Total Energies filling station and a few small informal businesses. The intersection is further located in close proximity to Ekangala towns located one kilometre north-east of the site.

Taking into account the disturbed vegetation on site, the site is not considered a suitable area for conservation effort as no aspects of the vegetation was found to necessitate the creation of an open space or similar land use.

The conservation of small patches of level grassland is not suitable in the long run, as urbanization soon overruns such areas with other informal uses that alters the natural grassland. This is typically an artefact of the disruption of normal ecological processes that include infrequent fire, regular cultivation of the grass sward, the absence of exotic plants and the limited disturbance of the soil surface.

The current presence of urbanisation activities close to the site mean that the feasibility of the site contributing meaningfully to a protected area is negligible. The potential occurrence of any species of conservation concern occurring on the site or re-occurring on the site is considered low to none without a significant restoration effort that will land up being costly.

The site does however include a number of specimens *of Hypoxis Hemerocallidea*, an orange listed plant species. An appropriate plan needs to be developed to ensure that this plant is not impacted upon during the construction phase of the development.

There is no reason found in the assessment why development can not be supported on the proposed site should the proposed mitigation measures be implemented.

10.4 Vertebrate Habitat Assessment

10.4.1 Mammal Habitat Assessment

Local occurrences of mammals are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

Two of the four major habitat types are present on the study site, i.e., terrestrial and wetlands.

10.4.1.1 Observed and Expected Mammal Species Richness

Large mammals (such as buffalo, blue wildebeest, white rhino, zebra, lion, cheetah and others) have long since been extirpated for sport and later for grazing. Most medium-sized mammal species like warthog, common duiker, steenbok, Cape porcupine, black jackal, caracal and African wild cate were also driven from the site.

The species richness is poor due to the disturbed nature and small size of the study site. it is estimated that 53 species of mammal may occur on or nearby the study site. The occurrence of only two mammal species (Rough-haired golden mole and Highveld Gerbil) was confirmed on the site.

Exotic feral and domesticated mammal species are expected to occur on the study site (e.g. cattle, sheep, goats, house mice, house rats, cats and dogs) since these species are normally associated with humans.

The species assemblage is typical of what can be expected of an area that is severely disturbed and does not have sufficient habitat to sustain populations. Most of the species of the resident diversity are fairly common and widespread, such as yellow mongoose, Africa mole rat, Multimammate mouse and Highveld gerbil. These species are likewise robust and capable of persisting in ecologically disturbed conditions. The two genet species and slender mongooses all have wide habitat tolerances, and that coupled with their catholic diets and reticent habitats render them persistent carnivores.

The study site offers no caves or suitable structures answering to the exacting roosting requirements of cave-dwelling bats, but it is likely that they have roosts elsewhere and during summer sunsets commute to the site to hawk for invertebrates rising over the waterbodies and wetlands. It can be expected that the water is an excellent source of insects that rise in swarms at summer sunsets and act as feeding patches for hawking vespar bats.

The present-day species richness is low to fair because of the size of the site and the fact that mainly two habitat types occur on the study site. The site is mostly disturbed, and connectivity is poor, except along the drainage line. The overall quality of conservation is largely ranked as poor.

10.4.1.2 Red Listed Mammal Species Identified

A total of eight mammal species with Red Data status could possibly occur on the site.

The study site falls outside the natural range of the Juliana's golden mole. This species should not occur on the study site.

Due to the absence of rupicolous habitat on the site, certain Red Data mammals should be absent from the site, which include mountain reedbuck and grey rhebok. The white-tailed mouse is often found in rocky areas with good grass cover, which are not present on the study site. Therefore, this species should not occur on the site.

The site has also been so transformed by anthropogenic influences that the oribi should not occur on or near the site.

Due to their ability to fly and to cover large distances, the distribution information on some bat species is insufficient. This has resulted in Red Data species such as the Blasius's (Peak saddle) horseshoe bat and short-eared trident bat being included as a precautionary measure.

Due to the presence of especially wetland-associated vegetation cover, the possibility of Red listed mammal species occurring increases dramatically. Protecting these habitat types would automatically protect many Red Data status species. The swamp shrew and Cape clawless otter species could occur on or near the site.

The Southern African hedgehog occurs in a wide variety of habitat types, but must have sufficient vegetation. The possibility exists that some individuals occur on the study site.

Due to severely disturbed nature of the site, very few prey items and poor connectivity, predators like the serval, leopard, brown hyena and Africa striped weasel should not occur on site.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

10.4.1.2.1 Roberts Marsh Rat (*Dasymus robertsii*)

Marsh Rats are dependent on intact wetland ecosystems, as they have not been found in artificial or degraded wetlands and are thus patchily distributed in their distribution range. Marsh rats are opportunistic carnivores and good swimmers, adapted to living in very marshy habitats where they build runways and nests in dense ground cover.

During the site visit such habitat was found on the site and there is a small possibility that the Robert's marsh rat could occur on the site.

10.4.1.2.2 Spotted-necked Otter (*Hydrictis maculicollis)*

Although the water of the drainage line, east of the site, is polluted and contains litter, many common rivers frog tadpoles were observed in the drainage line, which could provide food for a few water-dependent mammal species. This drainage line can still serve as a distribution corridor for the spotted-necked otter, especially north to a large manmade dam which is in the 500 meter buffer areas. The spotted-necked could occur on or near the study site from time to time.

10.4.1.2.3 Maquassie Musk Shrew (*Crocidura maquassiensis*)

Very few localities exist where this species has been collected. The species was collected in the not-too distant Roodeplaat dam area in the Gauteng Province. However, most specimens were collected under rocks or rocky areas. Such habitat does not occur in the study site. the Maquassie musk shrew should not occur in such a anthropogenically altered habitat.

10.4.1.2.4 Rough-haired Golde Mole (*Chrysospalax villosus)*

Rough-haired golden moles do not make subsurface runs like other golden moles, but excavate burrows, the entrances to which are characterised by loose piles of soils at the sides and back and which are left open when they leave the burrows to forage. The rough-haired golden mole prefers dry, sandy ground grassland. They are often found on the fringes of marshes or vleis. Such habitat occurs along the drainage line. During the survey, which was done in optimum conditions, one burrow was found near the study site which had typical rough-haired golden mole burrow characteristics.

10.4.2 Bird Habitat Assessment

The principal habitat types detected on the site that are most relevant to bird ecology and community structure are:

- Disturbed grasslands
- Wetlands

The habitats adjacent to the study site vary and consist mostly of degraded grassland, residential developments and busy provincial roads.

10.4.2.1 Expected and Observed Bird Species Richness

Most of the expected species are typical generalists that might occupy the fabricated habitats available, especially the various transformed lands and other man-induced alterations such as buildings, while others are aerial feeders that mainly use the airspace above the habitats. Species typically inhabiting aquatic habitats would be likely to occur in significant numbers due to the presence of this habitat.

The natural grasslands are in poor to fair condition and not sufficient to support species dependent on this habitat.

The disturbed nature of the habitat, and the location which includes busy tar roads and a filling station, collectively mean that avian diversity is lower than normal. During the survey, 65 bird species were observed.

10.4.2.2 Threatened and Red Listed Bird Species

A total of 28 threatened or near threatened species were recorded in the area of the site. however, only two were actually recorded for the study site, namely the Maccoa duck and Lanner falcon. The possibility exists that species such as the secretarybird may occur on the site from time to time. However, for most Red Data species the nature of the site is such that their occurrence is extremely unlikely. Due to the limited extent and quality of the habitats, half the species are expected to be at best erratic visitors and the other half are only expected as infrequent vagrants, their inclusion being primarily due to the Precautionary Principle. The odd Verreaux's eagle and Cape vulture may fly over the site, but the area is unlikely to an important hunting or scavenging habitat.

10.4.2.2.1 African Grass Owl (*Tyto capensis*)

In the past the African grass owl should have occurred on the site. But regular heavy grazing pressure and too frequent burning prevent the development of rank grassland habitat required by the African grass owl to breed.

The African grass owl does not occur on the site as a breeding species.

10.4.3 Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal, rupicolous and wetland-associated vegetation cover. From a herpetological habitat perspective, it was established that two of the four major habitat types are present on the study site, i.e., terrestrial and wetland-associated vegetation cover.

The site visit was conducted during summer. The natural grasslands were first transformed for agricultural purposed and later by the anthropogenic influences such as a filling station, fences, invasive plants, gravel roads, littering, powerlines, footpaths, diggings, a maize field, buildings, a recycling area, dumping, overgrazing and cattle and goats. The study site is thus ecologically disturbed in many parts. To the north of the site a few moribund termitaria were recorded on the study site. these structures are generally good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the herpetofauna population density for the study site is somewhat higher. At the time of the site visit, the basal cover was poor in some places and would not provide adequate nourishment and cover for small terrestrial herpetofauna.

Important wetland-associated vegetation cover occurs along the drainage line just east of the study site and a large manmade dam near the site in the 500-metre buffer. The water of the drainage line is polluted and contains litter, but many common river frog tadpoles were observed in the drainage line which indicates that this habitat is still suitable for water dependent herpetofauna species. This drainage line is even more important as a corridor for herpetofauna movement. In some areas along the drainage line, wetland vegetation provides for many vertebrate species.

Connectivity with areas around the study site is poor due to the busy R460 Road south of the site and the R568 Road west of the site. Residential properties occur to the north and east of the site. Real opportunities for migration exist along the drainage line.

10.4.3.1 Expected and Observed Herpetofauna Species Richness

Of the 50 reptile species that may occur on the study site, one was confirmed during the site visit and of 17 amphibian species that may possibly occur on the study site, one was confirmed during the site visit.

The American red-eared terrapin (*Trachemys scipta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus)* are the only feral reptile or amphibian species known to occur in South Africa, but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity are fairly common and

widespread (i.e., the common house snake, Cape skink, speckled rock skink, variable skink, yellow-throated plated lizard, savanna lizard, Transvaal gecko, guttural toad, common river frog, striped stream frog and Boettger's caco).

The species richness is poor to fair due to the small size and disturbed nature of the study site.

Threatened and Red listed Reptile and Amphibian Species
The study site falls outside the natural range of the Nile crocodile and the Southern African python and these species should not occur on the site.

10.5 Wetland Assessment

10.5.1 Biophysical Attributes

10.5.1.1 Climate

The climate for the study area has been derived from the recorded data (en.climate-data.org and worldweatheronline.com) for Bronkhorstspruit. The area receives seasonal summer rainfall and has very dry winter. Long term average rainfall ranges from 620 – 700mm, with long term average between around 660mm. most rains fall between November and March, peaking between December and February. Summer day temperatures, in July, fluctuate daily on average between 15˚C and 27˚C in January, but may go above 33˚C. the coldest winter temperatures, in July, fluctuate daily on average between 2˚C and 10˚C. Incidence of frost is frequent, which restricts the growth of high shrubs and trees under natural conditions, enabling grasslands to persist.

10.5.1.2 Associated Aquatic Ecosystems

The study area is located within the Olifants Water Management and the Upper Olifants Sub Water Management, forming part of the quaternary catchment B20H. The watercourse within the study area drains into the Grootspruit River which subsequently drain into the Wige River several kilometres downstream.

10.5.1.3 Associated Wetlands / Riparian Areas

10.5.1.3.1 Wetland soils

Soil profiles, were highly disturbed throughout the study area as result of historic impacts, such as agriculture, infrastructure developments (including commercial, road, sewage, potable water) as well as subsistence farming practices that is still continuing at present. The traversed catenas within the footprint of the proposed shopping centre as well as the associated catchment west and south from the development resembled a plinthic topo-sequence.

The Katspruit and Champagne soil forms are permanent wet soils which historically dominated the valley bottom position approximately 100m to 500m east from the study area (erosion processes have likely removed considerably quantities of organicrich horizons).

10.5.1.3.2 Wetland vegetation

The majority of the study area had been disturbed through various historic and current anthropogenic

practices. The most profound impact with the largest extent in the study area was considered to be past and present heavy grazing regimes, historic agriculture, changes in hydropedological catchment process and linear infrastructure developments which have led to vegetative successional changes and reduced basal cover. The majority of wetland habitats within the immediate proximity of study area and sewage connection line were considered to be temporary in nature, which for the most part was also considered the benchmark wetland zonation state according to augered soil profiles.

The disturbed conditions in and around the study area as a result of anthropogenic impacts made vegetation a poor wetland indicator, particularly for temporary zoned wetland habitats.

10.5.1.3.3 Delineated Wetland and Riparian Areas

No wetlands were delineated within the footprint of the proposed shopping centre. However, within 500m from the proposed development and within the vicinity of the proposed sewer line, two HGM types, a hillslope seepage connected to a watercourse and valley bottom wetland (historically likely unchanneled), were delineated and classified into two hydro-geomorphic (HGM) units, HGM 1 and HGM 2.

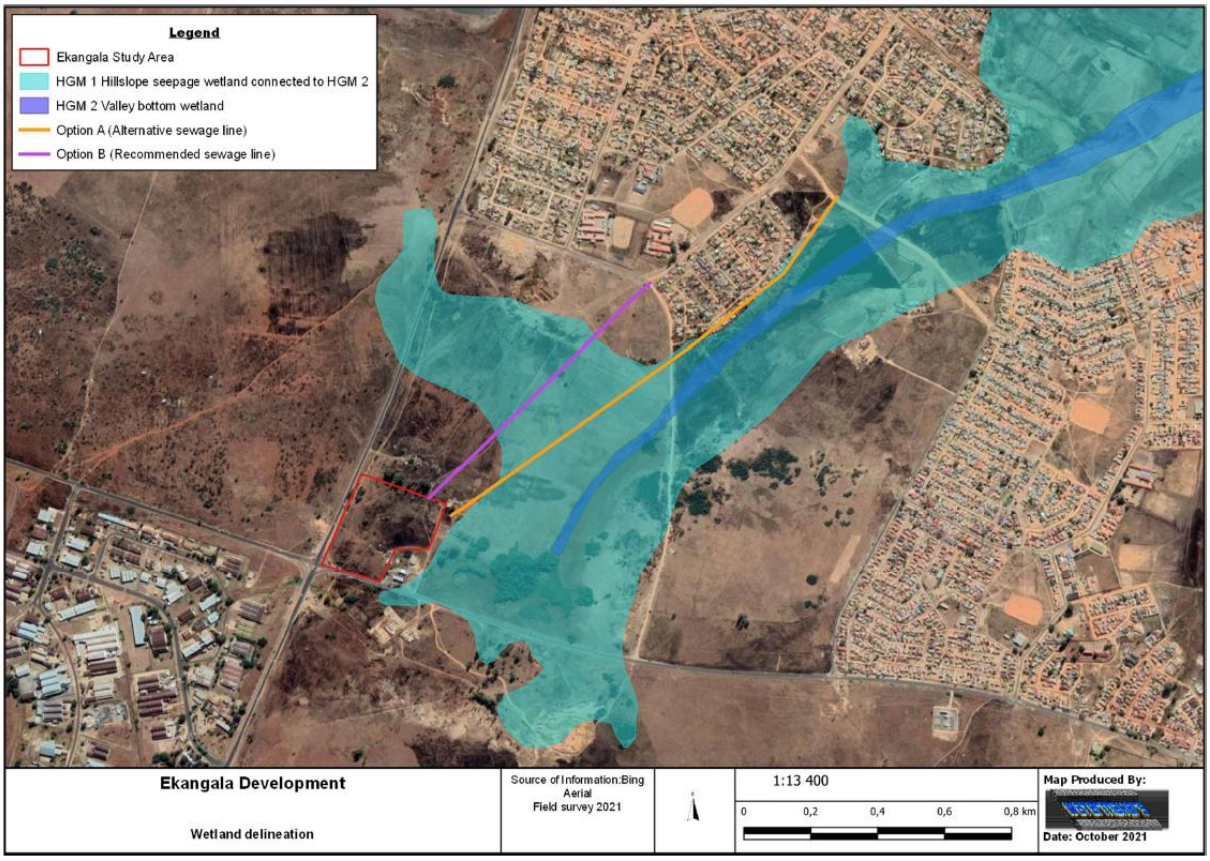


Figure 9: Wetland delineation map

A few small artificial wetlands were noted within the study area, one is caused by a leak of the water pipeline running behind the garage, which has been formerly directed towards the wetland downstream via an open channel. Two other historic excavations on the property contained wetland plants as a result of subsurface lateral flow paths (albic horizon) that has been exposed. None of these wetlands were considered natural and therefore does not have a legal status pertaining to them.

10.5.1.3.4 Present Ecological Status (PES)

The Present Ecological Class for **HGM 1** (seepage wetland) is a **category D** (largely modified with a large loss of natural habitats and basic ecosystem functions that has occurred). Distribution and retention patterns of water within the wetland has been negatively affected through agriculture, historic imagery reveals intensive agriculture production taking place in the previous century including drainage channels as well as ploughing against the contour to increase run off from fields.

HGM 2 (valley bottom wetland) is also has a **category D** PES. This is due to historic and current impacts on the wetland in combination with land use changes in the surrounding catchment resulted in geomorphological, hydrological and vegetation changes within the valley bottom wetland.

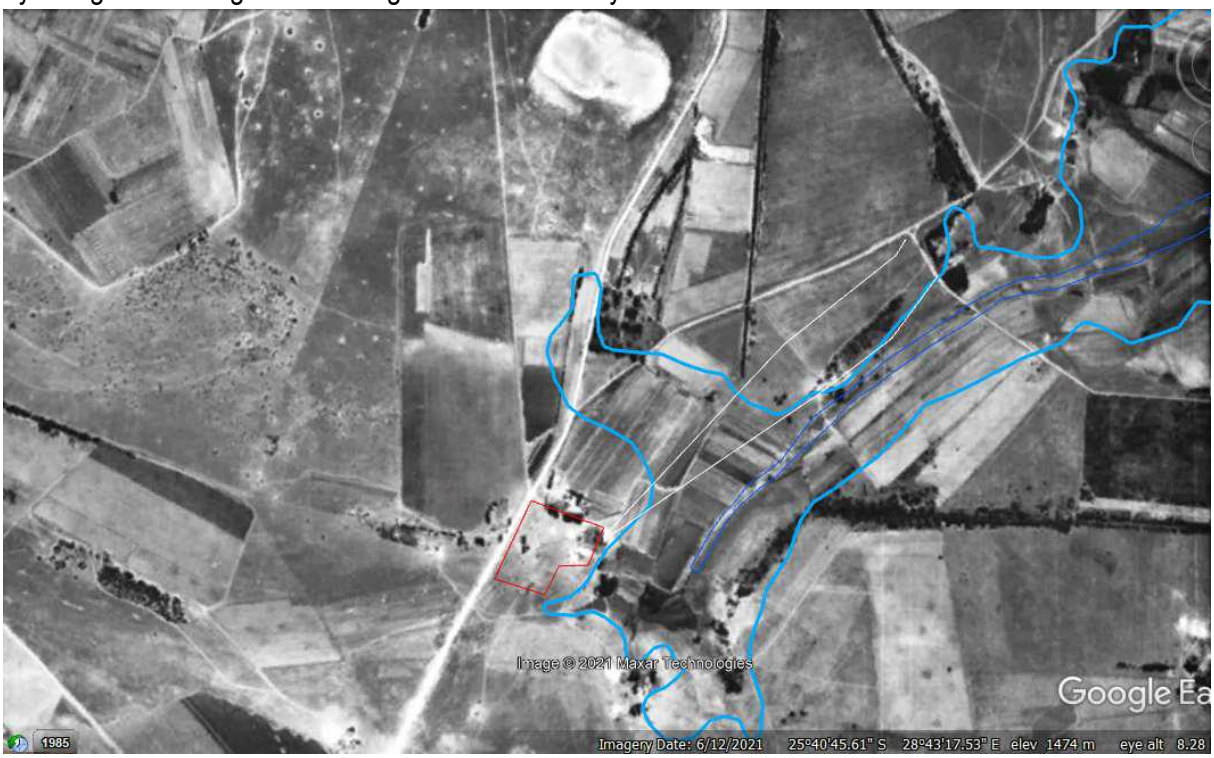


Figure 10: Historic image taken in 1962 overlaid in Google Earth shows the extent of agriculture within HGM 1

Ecological Importance and Sensitivity

The hillslope seepage wetlands were assigned a high Ecological Importance and Sensitivity, mostly as a result of the Freshwater Ecosystem Priority Areas (FEPA) designation. Further, the hillslope seepage wetlands were regarded as having a moderate.

Hydrological and Functional Importance due to the potential ecosystem services they provide, especially in terms of water flow regulation, phosphate trapping and nitrate removal. Direct human benefits were regarded as low within HGM 1 and HGM 2 which included utilization for grazing (higher moisture regimes associated with wetland areas result in wetland areas being utilised for longer periods, especially during winter) as well as some ad hoc hunting taking place by members of the surrounding communities.

10.5.1.3.5 Conclusion and Recommendations

Determination of preliminary buffer requirements for the identified wetland features present were determined to be 30m from the edge of the delineated wetland areas, based on development densities, slope, annual precipitation, rainfall intensity, channel width, catchment to wetland ratio, etc.

The impact assessment identified sedimentation of watercourse, increased erosion and increased run-off received by water courses, introduction and spread of invasive vegetation, impacts on ground and surface water quality as well as soils as well as an altered hydrological regime as the major potential impacts during the construction and operational phase. Several general and specific mitigation measures were proposed in order to reduce negative impacts and incorporate some potentially positive impacts from the proposed development following the application of the mitigation hierarchy. Some of the most pertinent recommendations include maintenance of the hydrological drivers supporting wetland downstream. Typical catena's within the study area indicated lateral subsurface hydrological pathways which could potentially be disrupted by foundations that are placed too deep. This will not only potentially cut off some of the hydrological drivers feeding wetland downstream, but also cause potential long term water damage to buildings and associated infrastructure. In general, soils are deeper in the western half o the development site, compared to the eastern half of the study area. Areas should therefore be filled in where it is necessary to create level ground, rather than cut into soil horizons, which could disrupt subsurface lateral hydrological drivers.

The same type of subsurface lateral flow impact could occur through the installation of the sewage pipeline connection. In order to avoid intercepting return flows from the adjacent hillslope, sewage line Option B should be chosen (as it also avoids more sensitive, wetter wetland habitat that contain subsurface flows). A hydropedological technician or hydropedologist should perform TLB test profiles along the planned sewage line Option B to ensure that there are no major lateral subsurface flow paths potentially intercepted (the area is dominated by vertic clays, therefore overland flow is expected). Where subsurface lateral flows are detected, appropriate mitigation measures such as changing the route alignment and or include design facilitation of lateral flows through permeable layering and installation of clay plugs to prevent preferential flows along the pipeline. The same investigation can then also determine the maximum depth of foundations of the mall development and associated infrastructure in order to avoid interception off subsurface lateral flow paths. Once the TLB test profiles have been completed, findings must be formalised in a wetland management and monitoring plan that will include soil handling procedures as well as rehabilitation methodology to be implemented.

Further, the proposed sewage line will have to traverse through smectic clays situated towards the northeast. These vertic soils (vertisols) have high swelling and shrinking properties known to impact on developments. The pipeline installation design must therefore cater for these soil properties in order to avoid potential leakages. A monitoring program and system should be designed for especially the sewage network to detect any leaks timeously. Further, a wetland monitoring program must be initiated shortly prior to the advent of the construction phase in order to confirm baseline conditions. Monitoring frequencies must be high during the construction phase (e.g. monthly) and remain high if significant wetland impact occur. If there are no wetland associated issues identified at completion of the construction phase, monitoring can be

reduced to annual visits for 4 years.

Following the proposed mitigation measures and approaches, the risk of the development impacting on watercourses is expected to be low.

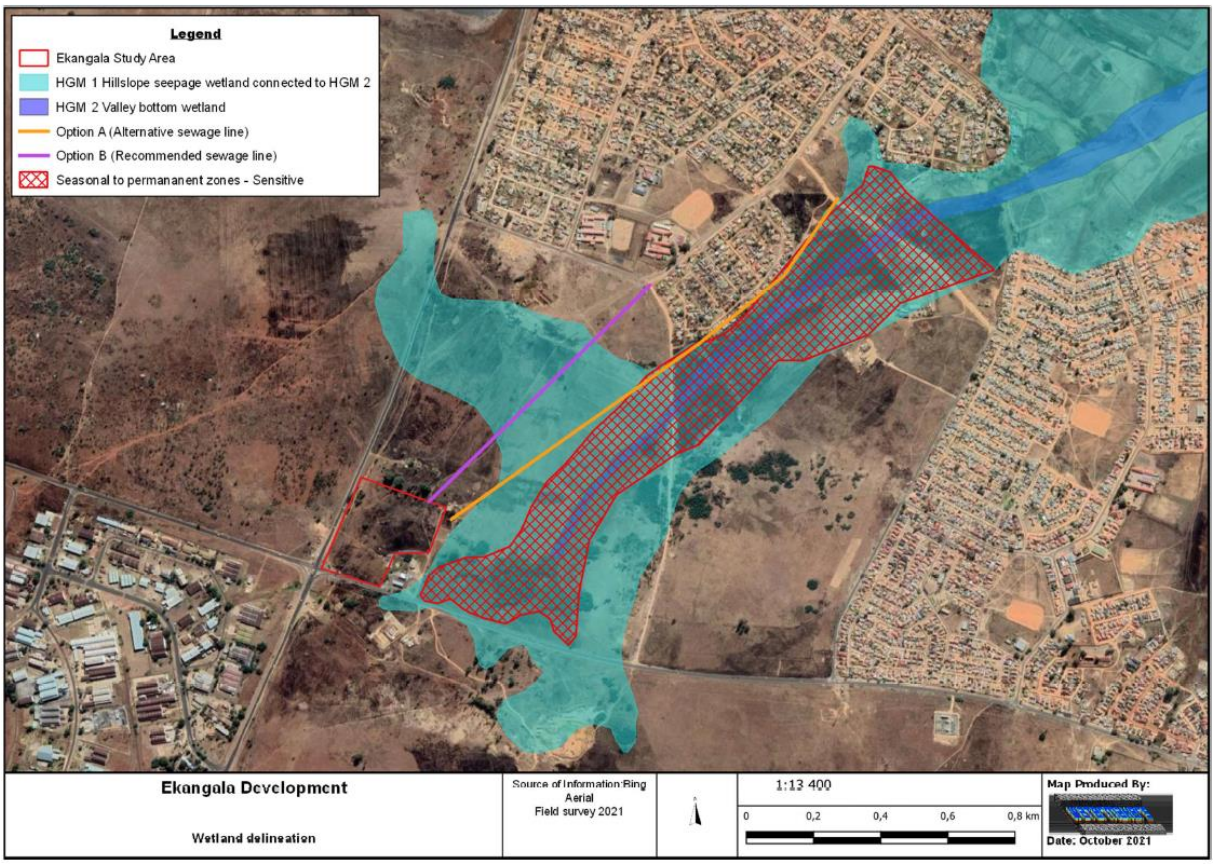


Figure 11: Wetland delineation map (Red hashed area indicating seasonal and permanent zoned wetland habitat and thus more sensitive to linear development)

10.6 Heritage Impact Assessment

10.6.1 General Desktop Study

A detailed archaeological and historical overview of the study area and surroundings were undertaken. This work was augmented by an assessment of reports and data contained on the South African. Heritage Resources Information System (SAHRIS). Additionally, an assessment was made of the available historic topographic maps. All these desktop study components were undertaken to support the fieldwork. The study revealed that the surroundings of the study area is characterised by a long and significant history.

10.6.2 Fieldwork Findings

The fieldwork was undertaken by way of intensive walkthroughs of the study area. These intensive walkthroughs were undertaken by two archaeologists on the 17th August 2021.

Throughout the fieldwork, hand-held GPS devices were used to record the tracklogs showing the routes followed by the team. The identified archaeological and heritage sites were numbered from ES-01 to ES-12. The recorded tracklogs and heritage sites in relation to the proposed development footprint areas are depicted in **Figure 11**.

Figure 12: Google Earth image depicting the tracklogs that were recorded in the field (yellow line) and the identified heritage sites.

10.6.3 Heritage sites identified within the proposed Shopping Complex

A total of 10 heritage sites were identified within this area. These are primarily comprised of poorly preserved structural remains associated with the two nearby farmsteads. In the interest of better interpreting these sites, it was deemed crucial to make an assessment of the depictions of this area and its structures on available old aerial photographs. Aerial photographs taken in 1939, 1964 and 1980 were assessed. Only structural remains from each site that are visible on these images will be indicated and briefly discussed.

Figure 12 below depicts a section of the 1939 aerial photograph. A cluster of livestock enclosures appear to be directly associated with the structural remains identified at sites ES-1 and ES-2. A structure is depicted at sites ES-04. The structure appears to be associated with a long furrow-like feature. One possibility is that this furrow-like feature was used as a cattle dip. A stonewall with planted trees is depicted at site ES-7. At ES-12, a farmstead comprising a farm dwelling and at least two associated structures are depicted.

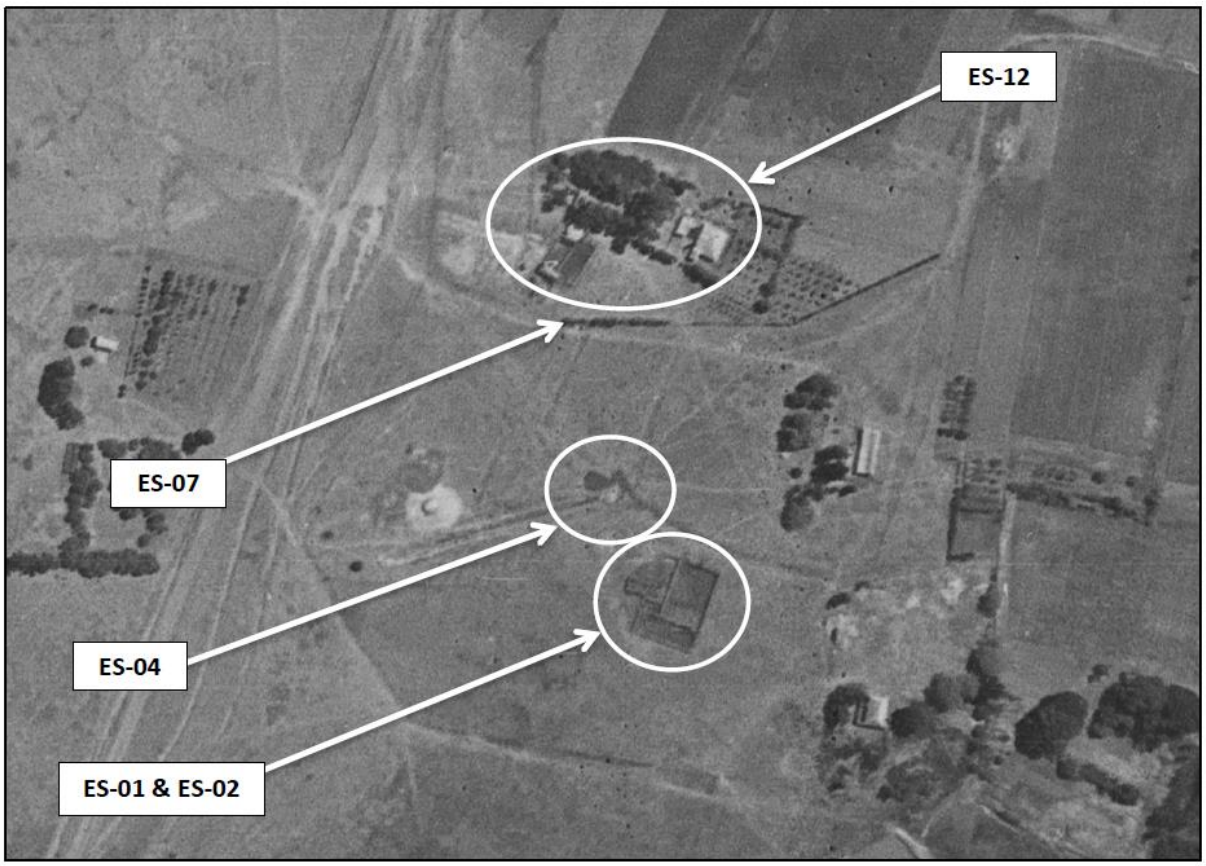


Figure 13: Depiction of the proposed shopping complex footprint area and surroundings on the 1939 aerial photographs.

Figure 13 depicts a section of the 1964 aerial photograph. A cluster of livestock enclosures appear to appear to be directly associated with the structural remains identified at ES-01 and ES-02. A shed with associated livestock enclosure is depicted at site ES-03. A structure is depicted at ES-04. The structure appears to be associated with a long furrow-like feature. One possibility is that this furrow-like feature was used as a cattle dip. What appears to be a low stone-wall or fence is depicted at site ES-06. A stonewall with planted trees is depicted at sites ES-07. At ES-12, a farmstead comprising a farm dwelling and several associated structures is depicted. These structures also include sheds and livestock enclosures.

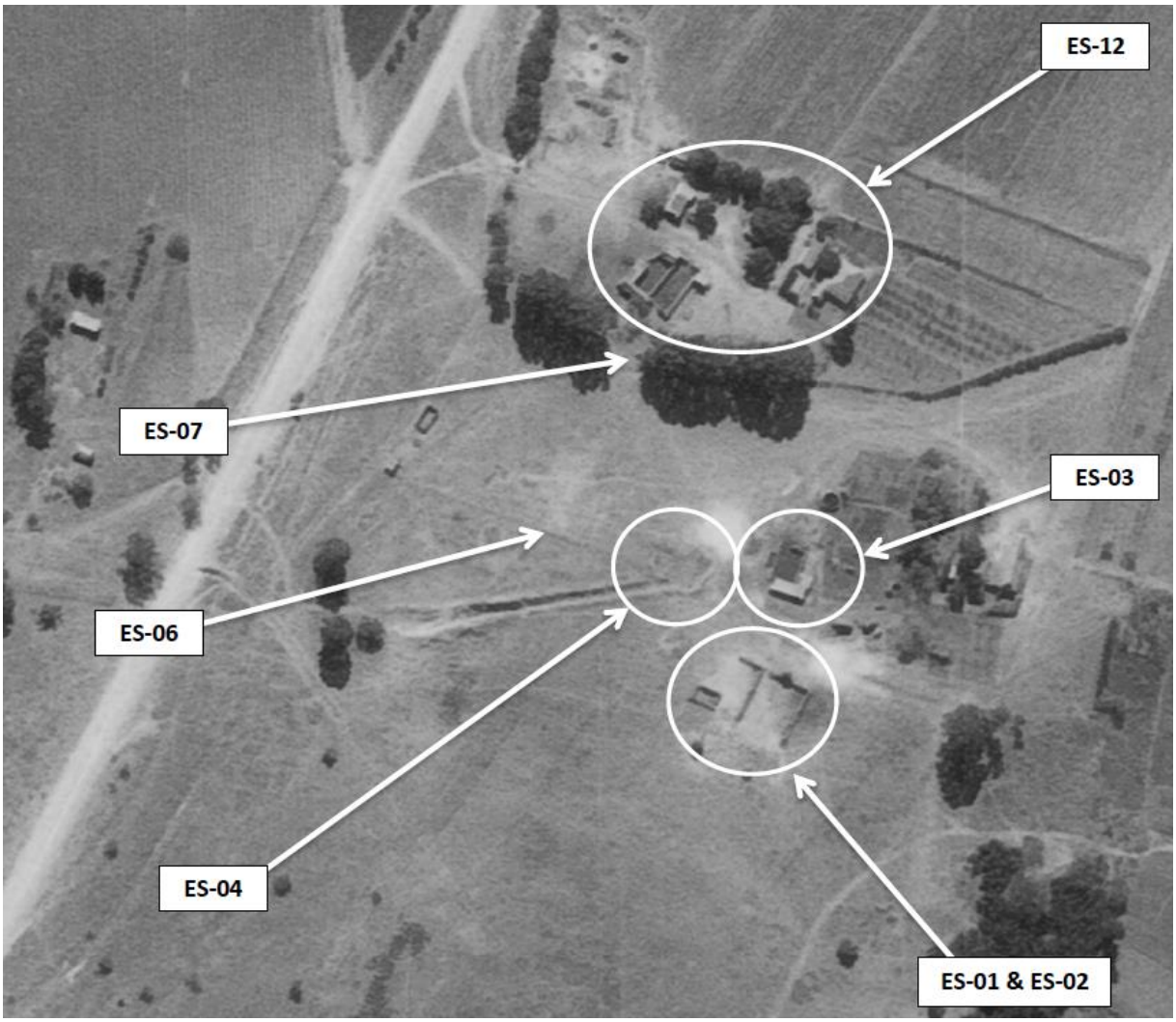


Figure 14: Depiction of the proposed shopping complex footprint and surroundings on the 1964 aerial photograph

Figure 14 depicts a section of the 1980 aerial photograph. A cluster of livestock enclosures appear to be directly associated with structural remains identified at sites ES-01 and ES-02. A shed with associated livestock enclosure is depicted at site ES-03. A structure is depicted at site ES. The structure appears to be associated with a long-like feature. One possibility is that this furrow-like feature was used as a cattle dip. What appears to be low stone-walls or fences are depicted at sites ES-05 and ES-06. A stonewall with planted trees is depicted at sites ES-07. At ES-12, a farmstead comprising a farm dwelling and numerous associated structures is depicted.

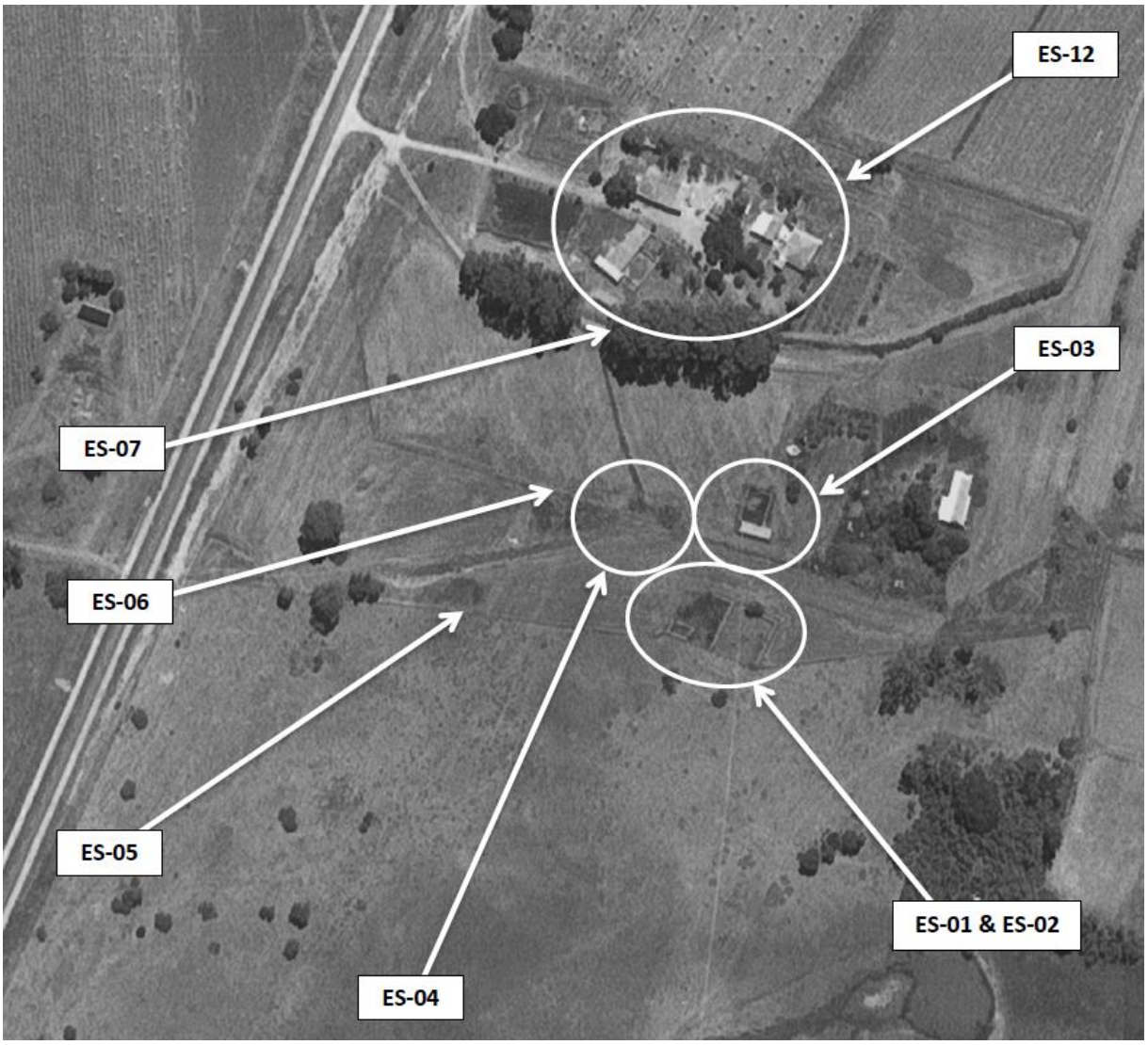


Figure 15: Depiction of the proposed shopping complex footprint area and surroundings on the 1980 aerial photograph

10.6.4 Heritage sites identified within the Proposed Shopping Complex

10.6.4.1 ES-01 and ES-02

Type: Remains of a stone structure and associated livestock enclosure

Description: the site consists of a square stone-walled structure (ES-01) with an associated stone-kraal (ES-02). During the fieldwork, two sites were identified here. However, the assessment of the old aerial photographs (**Figure12** to **14**) indicated that a single, attached structure is located here.

The structural remains of the enclosure and stone kraal are poorly preserved, with only the lower foundations and walls still visible. No cultural material could be observed on the surface of the site.

Both sites are already depicted on the 1939 aerial photograph. This means that these structures are at least 82 years old. However, all the structures from the site are in a poor state of preservation.

Site extent: The site is approximately 35m x 35m in extent.

Significance: Although the structural remains from the site are at least 82 years old, they are poorly preserved and not unique. As result, sites ES-01 and ES-02 are deemed to be Generally Protected C (GP.C) or Low significance.

10.6.4.2 *ES*-03

Type: Remains of a shed with associated livestock enclosure.

Description: The site consists of the remains of a demolished structure. From the various building materials scattered on site, it appears as if the structure consisted of an older stone section and a more contemporary brick addition.

The structural remains of the site are depicted for the first time on the 1964 aerial photograph. This means that the site is at least 57 years old, and may be older than 60 years. However, all the structures from the site are in a poor state of preservation.

Site extent: The site is approximately 40m x 30m in extent.

Significance: Although the structural remains from the site are at least 57 years old, and possibly even older than 60 years, they are poorly preserved and not unique. As a result, site ES-03 is deemed to be Generally Protected C(GP.C) or Low Significance.

10.6.4.3 ES-04, ES-05, ES-06

Type: Remains of a stone structure and walling

Description: Sites ES-04 consists of poorly preserved remains of what appears to have been a rectangular stone enclosure, possibly used as a livestock enclosure. The walls have collapsed almost entirely and only small sections are left. No other cultural material was observed. Single-row stone lines, possibly the remains of jackal-proof fences, were identified at sites ES-05 and ES-06.

The structural remains from site ES-04 are already depicted on the 1939 aerial photograph. This means that is is at least 82 years old. However, all the structures from the site are in a poor state of preservation.

Site Extent: The structural remains at the site ES-04 are approximately 10m x10m in extent.

Significance: Although the structural remains from ES-04 are at least 82 years old, they ate poorly preserved and not unique. Additionally, the stone lines from site ES-05 and ES-06 are simply the remains of fences. These three sites are of Generally Protects C (GP.C) or Low Significance.

10.6.4.4 ES-07

Type: Stone Wall

Description: The site consists of a stone wall that is located approximately 7m north of the development footprint area for the proposed shopping complex. The wall is located under a lane of trees that was most likely planted here as a windbreak for the old farmstead located north of the site.

The structural remains from site ES-07 are already depicted on the 1939 aerial photograph. This means that the site is at least 82 years old. However, all the structures from the site are in a poor state of preservation.

Site Extent: The wall is approximately 130m long.

Significance: Although the structural remains from ES-07 are least 82 years old, they are poorly preserved and not unique. The site is of Generally Protected C (GP.C) or Low Significance.

10.6.4.5 ES-08

Type: Remains of walling

Description: The site consists of single-row stone line or wall. It seems possible for the structural remains of the site to the remains of jackal-proof fences. These fences were built with stones packed all along the base of the fences. Once the fencing is removed, all the remains are the single rows of stones where fencing used to be.

Site Extent: The wall is approximately 5m long.

Significance: The site is not believed to be very old is also not unique. As a result, the site is deemed to be of Generally Protected C (GP.C) or Low Significance.

10.6.4.6 ES-09

Type: Concrete foundation

Description: The site consists of a concrete foundation. The concrete has cracked in a few places and is overgrown with grassy vegetation. The site is located behind a Total garage. No other cultural material was found.

Site Extent: The site is 15m x 15m in extent.

Significance: The site is not believed to be very old and poorly preserved. It is deemed to be of Generally Protected (GP.C) or Low Significance.

10.6.4.7 ES-10

Type: Remains of an old farmstead.

Description: The site consists of the remains of an old farmstead. The farmstead comprises a number of poorly preserved structures, including an old farmhouse. The walls of the farmhouse have collapsed, and sections have been demolished. A Google Earth image dated to 2004, shows the remains of the structures, suggesting that by 2004 the site was unoccupied and left in a dilapidated state.

No other cultural material was observed. The site is located approximately 66m north of the development footprint area of the proposed shopping complex and approximately 23m from the nearest point along the proposed sewer line.

The farmstead at the site ES-09 is already depicted on the 1939 aerial photograph. This means that the site at least 82 years old. However, all the structures from the site are in a poor state of preservation.

Site Extent: The site is approximately 120m x 80m in extent.

Significance: The site represents the remains of an old farmstead. However, the site is in a poor state of preservation. The site is deemed to be of Generally Protected C (GP.C) or Low Significance.

10.6.5 Heritage Sites Identified within the Sewer Line footprint

A total of 2 heritage sites were identified within this area.

10.6.5.1 ES-11

Type: Dam wall

Description: The site consists of the poorly preserved remains of a dam wall. It is depicted the first time on the aerial photograph taken in 1964. As a result, the dam wall is at least 57 years old. However, it is poorly preserved.

Site Extent: The site is approximately 40m x 30m in extent.

Significance: Although the structural remains of the site may be older than 60 years, it is poorly preserved. As a result, the site is deemed to be of Generally Protected C (GP.C) or Low Significance.

10.6.5.2 ES-12

Type: Remains of a structure.

Description: The site consists of the remains of a square stone structure that is located at the edge of a wetland. The site is in a poor state of preservation. No other cultural material was observed. The exact origin or function of the structure is not presently known.

The available aerial photographs (1939, 1964 and 1980) were assessed to established whether any structures or buildings are depicted at the site position. No evidence could be found on the 1939 and 1964 aerial photographs of any structures at the site and its immediate surroundings. The 1980 aerial photograph depicts black homesteads north-west and north-east of the site, but none of these are located in any proximity to the structure.

Site Extent: The site is 5m x 5m in extent.

Significance: The site is deemed to be Generally Protected B (GP.C) or Low Significance.

10.6.6 Palaeontology

According to the PalaeoMap on the SAHRIS database, the Palaeontological Sensitivity of the site is considered to be Moderate. As such, it is recommended that a palaeontological desktop study be undertaken.

Figure 16: Palaeontological Sensitivity map

10.7 Recommendations by Specialists

Impact	Recommendation
Recommendations for Flora Specialist	
Clearing of vegetation on site	• Topsoil must be removed and stored sustainably and re-used after the construction phase;
Loss of large trees (Exotic and indigenous)	• Should trees be planted in the development for landscaping purposes, such trees should be indigenous tree species local to the area such as *Searsia lancea, Combretum erythrophyllum, Searsia*

	pyroides, Gymnosporia buxifola, Celtis africana, Acacia karroo and *Olea europaea*
Litter and waste	• During the construction phase, the construction camp and work areas need to be clearly demarcated to prevent activities spilling over onto other pieces of land. • Waste and litter management strategies must be in place to contain waste and litter to the development site.
Exotic plant infestation	• Invasive plant species must be controlled during the construction and operational phases of the development • Edge effects must be minimized to prevent the spread of alien exotic plants. This is best accomplished by encouraging the planting of indigenous species local to the area; • Where-ever possible, natural landscaped areas should be encouraged to allow species to migrate through and across; • Herbicides and pesticides must be used with care and caution and where possible, eliminated as a management practice; • Rehabilitation of disturbed areas should be done with an indigenous mix of grass species
Movement of vehicles, noise, exotic vegetation, increased and polluted stormwater runoff.	• Drip trays must be available on site to prevent soil pollution from leaking trucks. • During the construction phase, the construction camp and work areas need to be clearly demarcated to prevent activities spilling over onto other pieces of land. •
Contamination of soil by fuels and oils	• Drip trays must be available on site to prevent soil pollution from leaking trucks
Species rescue programme	• A species rescue programme should be initiated to rescue allocated species from the site before construction starts. Several Hypoxis iridifolia plants occur on the site. These are not protected plants, but could add value in landscaping and rehabilitation efforts elsewhere; • A rescue program should be done in spring or in autumn and/or when the plants are not flowering; • The ecologist should be contacted for rescue donation sites where primary succession has occurred and

	where such sites would be enhanced by the addition of forb species; • A permit may be required for such plant rescue efforts.
Recommendations from Fauna Specialist	
Every effort should be made to retain the linear integrity, flow dynamics and water quality of the non-perennial stream and man-made dam.	• If the Southern African Hedgehog or any other mammal species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. • If the Giant Bullfrog, South African hedgehog or any herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. • Education of the construction staff about the value of wildlife and environmental sensitivity is imperative. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. • Alien and invasive plants must be removed. • During the construction phase there will be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate some of the environmental impact. • Measures will have to be taken to stop water pollution during construction and operational phases of the project. The polluted water run-off from the sewage works must not contaminate the non-perennial stream. • If any holes or trenches are dug for construction, they should be completed quickly; otherwise these excavations may act as a death trap for small mammals and herpetofauna. • The removal of invasive plants will increase the quality of habitat for most of the vertebrates • All new development must be located inside of the area classified as the footprint area and adhere to buffers as set out by the wetland report • Construct clean water outlets for people and their livestock • Restrict access to the suitable and sensitive habitats of faunal species • The residents/contractor/contractors must ensure that no animals 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 • Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering. Ensure there is a method statement in place to remedy any accidental spillages immediately. • No open fires may be lit for cooking or any other purposes, unless in specifically designated and secured areas
Recommendations by Wetland Specialist	
Increased erosion and increased run-off received by water courses.	• Maintenance of the hydrological drivers supporting wetland downstream • An ecologically-sound stormwater management plan must be implemented at the onset of the construction phase • Erosion must not be allowed to develop on a large scale before effecting repairs; • Make use of existing roads and tracks where feasible, rather than creating new routes through vegetated areas • Vegetation and soil must be retained in position for as long as possible, and removed immediately ahead of construction / earthworks in that area • All areas susceptible to erosion must be protected and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas • Natural trees, shrubbery and grass species must be retained wherever possible • Areas exposed to erosion due to construction should be vegetated with species naturally occurring in the area • Surface water or storm water must not be allowed to concentrate, or flow down cut or fill slopes without erosion protection measures being in place • The incorporation of Sustainable Drainage Systems (SuDS) as well as Water Sensitive Urban Design (WSUD) (e.g. permeable pavements, alignment/orientation of roads, etc.) within the layout planning • and design is required to reduce runoff from the site

The proposed sewage line will have to traverse through smectic clays situated towards the northeast. These vertic soils (vertisols) have high swelling and shrinking properties known to impact on developments.	• The pipeline installation design must therefore cater for these soil properties in order to avoid potential leakages. A monitoring program and system should be designed for especially the sewage network to detect any leaks timeously. • A wetland monitoring program must be initiated shortly prior to the advent of the construction phase in order to confirm baseline conditions. • Monitoring frequencies must be high during the construction phase (e.g. monthly) and remain high if significant wetland impact occur. • If there are no wetland associated issues identified at completion of the construction phase, monitoring can be reduced to annual visits for 4 years.
Sedimentation of watercourse	• Topsoil stripping must be done in a phased approach, only strip what is needed immediately prior to construction; • Silt fences are to be installed along the Restriction of Access Zone in order to capture sediment that may run off from the site during construction. These silt fences are to be inspected on a weekly basis, and after rainfall events; • All stockpiles must be protected from erosion, stored for the minimum amount of time necessary and on flat areas where run-off will be minimized, and be surrounded by bunds; • If possible, re-position the topsoil stockpile (where relevant) upslope of any infrastructure within the surface infrastructure footprint so as to prevent contaminated surface water coming into contact with topsoil • An effective Restriction of Access Zone must be established prior to any construction activities taking place which include wetland habitat, freshwater ecosystem buffers and open space areas. No person or vehicle must be allowed within the Buffer Zone
Water quality deterioration	• Storage of potentially hazardous materials should take place far away from preferential flow paths and or stormwater infrastructure. These materials include fuel, oil, cement, bitumen etc • Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils

	• Stormwater shall not be allowed to flow through the batching area. Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the Consulting Engineer; • All construction materials liable to spillage are to be stored in appropriate structures with impermeable flooring; • Portable septic toilets are to be provided and maintained for construction crews, and are to be located at least 100m from designated buffer zones. Maintenance must include their removal without sewage spillage; • No uncontrolled discharges from the construction crew camps to any surface water resources shall be permitted. Any discharge points need to be approved by the relevant authority; • In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water and Sanitation must be informed immediately;
Alien invasive vegetation	• Surrounding natural vegetation should not be disturbed to minimize chances of invasion by alien vegetation • All alien seedlings and saplings must be removed as they become evident for the duration of construction and operational phase • An alien invasive eradication and monitoring plan must be compiled and implemented whereby all emergent invasive species are removed during construction. The monitoring plan must also ensure that the re-emergence of invasive species is monitored continuously during the operational and decommissioning phases and that monitoring and eradication continues post decommissioning
Recommendations from Geohydrology Specialist	
Aquifer vulnerability and groundwater quality deterioration	• Construction should preferably take place in the dry season, as surface water runoff is • minimal. Especially when crossing the Grootspruit and the wet areas. Surface water may create difficult working conditions especially during backfilling of trenches. Water levels in the aquifer may be at its lowest point during dry periods • All vehicles shall be properly maintained and serviced so that no oil leaks occur on site. • Any stockpiled soil and rock should have storm water management measures

	• implemented. • Spill trays must be provided for refuelling of plant vehicles • Storm water originating in the village must be kept away from the sanitation lines, • especially the inspection pits. • Erosion of the trenches after the construction phase must be stopped and mitigated at an early stage. • Manhole lids must be tamper proof and must be inspected on a regular basis
Recommendations from Heritage Specialist	
Although 12 heritage sites were identified within or close proximity to the proposed development, footprint areas, these sites are poorly preserved and deemed to be of Generally Protected C (GP.C) or Low Significance.	The following general recommendations must be implemented: • An archaeological watching brief is required throughout the construction activities. • According to the palaeontological sensitivity map of SAHRIS, a palaeontological desktop assessment is required. This must be undertaken as soon as possible, and long before construction commences.

11.0 GENERAL ENVIRONMENTAL MANAGEMENT PROGRAM

Table 3: Environmental Management Program

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.1 Planning									
a) Appointment and duties of ECO	The Developer must appoint an independent ECO who must monitor the contractor's compliance to the EMP. The developer must provide all contractors with a copy of the EMP. The priority of the ECO is to maintain the integrity of the development conditions as outlined in the EMP. The ECO must form part of the project management team and attend all relevant project meetings.	√	√			DEVELOPER, ECO, CONTRACTOR	Continuous		
b) EMP	This EMP must be made binding to the Contractor, as well as sub-contractors and should be included in the tender documentation for the construction contract. The EMP is also binding to the owner during the operations of the facilities.	√	√			DEVELOPER, PROJECT MANAGER, CONTRACTOR	Once-off		
c) Environmental incidents	The Contractor and Owner must take corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves.		√			CONTRACTOR , ECO	Continuous		
d)Flooding, erosion and sedimentation	Storm water must not be allowed to flow directly into the wetland or stream situated on site. It must be directed to the road to be accepted into the municipal system. Where upgrading of systems is required according to the stormwater management plan and the municipal guidelines must be implemented.	√		√		DEVELOPER, PROJECT MANAGER			
e) Service systems	Care must be taken not to damage existing services infrastructure situated on the site.	√	√	√		PROJECT MANAGER,			

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	Should any services infrastructure be damaged it must be repaired immediately					ENGINEER, CONTRACTOR			
f) Geology	Geological monitoring should commence during the Construction Phase by the Geotechnical engineer Site specific investigations must be conducted on all erven planned for major structures prior to design finalization and construction.	√				ENGINEER, GEOLOGIST			
g) Structures	Road Infrastructure must be maintained in good standing at all times	√		√		DEVELOPER, ARCHITECT OWNER			
g) Landscape	The natural features of the site such as the wetland and stream including the 32m buffer zones situated on the site should be managed in a holistic manner. Sections where vegetation has been removed as part of the construction activities or unnecessarily, must immediately, upon instruction from the ECO, be re-vegetated with indigenous vegetation.	√				DEVELOPER, LANDSCAPE ARCHITECT, ECO			
h) Crime, safety and security	The Developer must determine which security system should be utilised for the site. Entrance points of the construction site for the road must be secured. A 24-hour guard service must operate in the area and must conduct regular patrols. The intention is that the guards are visible on the streets and not only inside the facility. Workers must not be allowed to wonder through the neighbourhood before, during or after working hours. Loitering must be avoided by clearly indicated signs showing **NO JOBS** placed around the outside of the site	√	√	√		DEVELOPER, CONTRACTOR			

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.2 Soil									
11.2.1 Compaction									
a) Designated Routes	Designated routes shall be determined for the construction vehicles and designated areas for storage of equipment. These areas shall preferably be already disturbed. The construction camp must be situated on an already disturbed area and approved by the relevant municipal department.	√	√			PROJECT MANAGER, ECO, CONTRACTOR	Once-off		
b) Compacted areas	All areas that are compacted by machinery shall be ripped prior to them being rehabilitated with topsoil and grass seed. The compaction of the soil will be avoided by primarily using areas where existing disturbances exist at a level that precludes vegetation.		√			CONTRACTOR	Continuous		
c) Access points & routes	Clearly mark the site access point and routes on site to be used by construction vehicles and pedestrians. Provide an access map to all contractors whom in turn must provide copies to the construction workers. Instruct all drivers to use access point and determined route.	√	√			PROJECT MANAGER, ECO, CONTRACTOR	Once-off		
d) Vehicular fences	Fence off areas which are off limits to vehicles. Failure to adhere will result in spot-fines and all damage will immediately be rehabilitated at the Contractor's expense.	√	√			ECO, CONTRACTOR	Once-off		
e) Excavated areas	Mark out the areas to be excavated to ensure that only necessary areas are excavated.	√	√			ECO, CONTRACTOR	Once-off		
11.2.2 Erosion									
a) Erosion prevention	All surface run-offs shall be managed in such a way so as to ensure erosion of soil does not occur. All surfaces that are susceptible to erosion shall be covered with a suitable vegetative cover as soon as construction is completed. Or where erosion may potentially occur, dissipaters such as gravel beds or straw bales must be installed to prevent erosion.	√	√			ENGINEER, ECO, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Surface cladding	Surfaces that are susceptible to erosion, shall be protected either by cladding with biodegradable material or with the top layer of soil being seeded with indigenous grass seed/planted with a suitable groundcover.	√	√			ECO, CONTRACTOR	Once-off		
c) Wet areas	No vehicles whatsoever are allowed to move across any wet areas (especially the wetland and stream on the site as well as wet soils areas after rainfall events), other than those specifically designated as access, which could cause erosion scouring and compaction.		√			CONTRACTOR	Continuous		
d) Swales	Erosion caused by construction methods or unusually heavy rainstorms must be prevented and managed by building retention swales and cut-off swales to direct the water to shallow slow flowing slope.		√			CONTRACTOR	Continuous		
e) Downhill areas	Straw bales should be placed and adequately secured on all downhill locations where erosion may occur to prevent washouts and to retain siltation and topsoil from the site. A supply of straw bales must be kept on site for this purpose.		√			CONTRACTOR	Continuous		
f) Clearing of large areas	Where it is necessary to clear large areas, the clearing activities must immediately be followed by the planting of grass indigenous to the area or covering of the surface within 2 weeks.		√			CONTRACTOR	Once-off		
g) Clearing on slopes	If clearing occurs during the rainy season, an earth berm must be created along the up-slope side of the construction area, at the edge of the cleared area and should be constructed of stones from within the cleared area and covered with soil being removed within the area being cleared. For areas close to the wetland and stream on the site, it is also recommended that berms be created on the down-slope side of the cleared area to reduce the sediment load in the storm water run-off.		√			CONTRACTOR , ECO	Once-off		
h) Clearing footprints	The area being cleared of vegetation for the construction activities must be limited to a minimum. Only the footprint of the structure may be cleared. Areas should only be cleared a maximum of two weeks before construction begins.		√			CONTRACTOR , ECO	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.2.3 Topsoil									
a) Stripping of topsoil	The top (200-300mm) layer (as applicable) of all areas to be excavated for the purposes of construction shall be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material shall be used for the rehabilitation of the site. Weeds appearing on the stockpiled topsoil shall be removed by hand before seeding.	√	√			CONTRACTOR	Once-off		
b) Storing	In order to minimize erosion and siltation and disturbance to existing vegetation, it is recommended that stockpiling be done/ equipment be stored in already disturbed/exposed areas.	√	√			ECO, CONTRACTOR	Continuous		
c) Mowing of vegetation	Only areas directly affected by construction may be grubbed and stripped of topsoil. The vegetation on the remainder of the construction areas, where possible, may only be mowed short and shall not be removed.		√			CONTRACTOR	Once-off		
d) Grass component	When the stripping of topsoil takes place, the grass component shall be included in the stripped topsoil. Weeds must be removed by hand. The soil will contain a natural grass seed mixture that may assist in the re-growth of grass once the soil is used for back filling and rehabilitation.		√			CONTRACTOR	Once-off		
e) Infrastructure	During the construction of road and services infrastructure, topsoil shall be kept aside to cover the disturbed areas immediately after such activities are completed. Measures should be taken to ensure that no rocks or any other materials are placed on the top layer of soil.		√			CONTRACTOR	Continuous		
f) Designated areas	Stockpiling will only be done in designated places where it will not interfere with the natural drainage paths of the environment.	√	√			ENGINEER, ECO, CONTRACTOR	Continuous		
g) Flood line areas	No stockpiling shall be allowed within the wetland and stream including the 32m buffer areas or within the transitional zones.	√	√			ECO, CONTRACTOR	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
h) Stockpile covering	Cover stockpiles and surround downhill sides with a sediment fence or straw bales to stop materials washing away.		√			CONTRACTOR	Continuous		
i) Runoff prevention	Care must be taken to prevent the runoff of silt from open soil and stockpiles into the sensitive areas.		√			CONTRACTOR	Continuous		
j) Removal areas	Remove vegetation only in areas designated during the planning stage.	√	√			CONTRACTOR	Once-off		
k) Stockpile footprint	Strip topsoil at start of works and store in stockpiles no more than 2m high in a designated materials storage area.		√			CONTRACTOR	Continuous		
l) Traversing topsoil	No vehicles are allowed to traverse the stockpiled topsoil areas.		√			CONTRACTOR	Continuous		
11.3 Waste Management									
11.3.1 Construction waste									
a) Planning	Plan the site before starting – for access, deliveries, construction areas, washout area, waste, stockpiles, and chemicals storage. Plan routes for trucks and also vehicles with limited turning ability. Indicate this on site and on maps prior to the event.	√				PROJECT MANAGER, ECO, CONTRACTOR	Once-off		
b) Storage	Temporary waste storage points on site shall be determined. These storage points shall be accessible by waste removal trucks and these points should not be located in areas highly visible from the properties of the surrounding landowners/tenants/in areas. These areas should also be already disturbed. The storage of solid waste on site, until such time that it may be disposed of, must be in the manner acceptable to the relevant Authority.	√	√			PROJECT MANAGER, ECO, CONTRACTOR	Once-off		
c) Waste Plan	The Civil engineer must prepare a Waste Management Plan. Coordinate with other trades on site and nearby businesses for potential reuse or 'waste exchange'. Coordinate with other trades working on site regarding site management, timing of works and waste management (recycling and reuse potential).	√				CONSULTANT, ECO, CONTRACTOR	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
d) Disposal	Solid waste shall be disposed of in a manner approved by the Gauteng Department of Agriculture and Rural Development. All solid waste must be removed and transported to a recognised waste disposal site on a weekly basis.	√	√			CONTRACTOR	Continuous		
e) Record keeping	Keep records of waste reuse, recycling and disposal for future reference. Provide information to ECO.		√			CONTRACTOR	Continuous		
f) Cleaning/clearing	Avoid the cleaning of the site camp or paved surfaces with soap. All roads should be cleared of any obstruction and should be swept clean with a broom, as to avoid the waste from entering the storm water systems.		√	√		CONTRACTOR	Continuous		
g) Waste removal	On completion of works, the contractor shall clear away and remove from the site all construction paint, surplus material, foundations, plumbing and other fixtures of every kind. Areas thus cleared shall be graded and scarified to restore the ground as near as possible to its original profile.			√		CONTRACTOR	Once-off		
11.3.2 Household waste									
a) Storage	Temporary waste storage points on the site should be determined. These storage points should be accessible by waste removal trucks and these points should not be located in ecological sensitive areas /areas highly visible from the properties of the surrounding landowners/ in areas where the wind direction will carry bad odours across the properties of adjacent landowners.	√	√	√		PROJECT MANAGER, CONTRACTOR	Once-off		
b) Disposal	No waste materials shall at any stage be disposed of in public areas or adjacent properties, or where the wind direction will carry bad odours across the properties of adjacent tenants or landowners. The piling of any material that could rot and release unpleasant smells into the air will not be permitted. Burning of waste is not permitted. Spot fines of up to		√	√		ECO, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	R100 may be administered if the employees are found to be polluting the area in any way.								
c)Recycling	Several waste bins must be provided and clearly marked, or colour coded according to industry standards to allow for recycling of waste into • Paper • Biodegradable • Glass • Plastics • General			√					
d) Waste Bins	Waste bins with lids shall be provided on site at convenient locations. These shall also be supplied in close proximity to the area where the workers eat.		√	√		CONTRACTOR	Continuous		
e) Removal	The waste bins shall be cleared by municipal services on a weekly basis. During municipal strikes special arrangements must be made to have the waste removed via private waste removal services.		√	√		CONTRACTOR	Continuous		
11.3.3 Chemical waste									
a) Design	Design the site in such a manner that chemical wastes (such as paint, thinners, etc. are not located in close proximity to any fire. These areas shall be predetermined and located in areas that are already disturbed. These areas shall not be within 100 m from the wetland or stream situated on the site. This area should be on a concrete base to avoid any possible seepage into the soil.	√		√		PROJECT MANAGER, CONTRACTOR	Once-off		
b) Contamination	Cover any wastes that are likely to wash away or contaminate storm water. Build a bund around waste storage area to stop overflow into storm water		√	√		CONTRACTOR	Continuous		
c) Containers	All hazardous waste (fuel, lubricants, chemicals, diesel, etc) shall be placed in specifically designed containers and properly sealed. Should		√	√		CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	any fuel storage tank be required on site, the Contractor shall ensure that he has complied with the necessary legal requirements for the erection of such tanks.								
d) Collection	All containers shall be collected on a weekly basis by certified chemical removal companies (such as OILKOL or WASTETECH).		√	√		CONTRACTOR	Continuous		
e) Disposal	All chemical waste shall be disposed of at a certified waste disposal site and proof of this disposal shall be sent to the contractor and ECO.		√	√		CONTRACTOR	Continuous		
11.4 Fuel, Fuelling and Maintenance									
11.4.1 Fuel storage									
a) Storage	Fuel storage shall be within the construction camp, and within a bunded area with at least 110% of the volume of the amount of fuel stored, as per agreement and approval of the ECO. No storage of any fuel will be allowed on site, other than what is approved by the applicable provincial government departments.	√	√			ENGINEER, CONTRACTOR	Once-off		
11.4.2 Fuelling									
a) Re-fuelling	Refuelling will take place in an area such designated, with sufficient surface sealing such as a plastic liner to prevent spillage and soil contamination. Where not approved by a provincial government department – refuelling will be done off-site.	√	√			ENGINEER, CONTRACTOR	Continuous		
b) Drip trays and spill kits	Drip trays (min 10cm deep) are to be placed under all vehicles if they stand for more than 3 hours. The drip tray must be able to contain 110% of the total amount/ volume of oil in the vehicle. Spill kits must be available in all vehicles that transport hydrocarbons for dispensing to other vehicles on the site. The dispensing devices (pump heads) must be compatible with the vehicles to which they are dispensing. In addition, the dispensing devices must be fitted with the necessary valves/		√			ECO, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	apparatus that will ensure that the nozzles do not drip fuel after pumping has stopped.								
c) Decontamination	In the event of spills from vehicles, the area should be cleaned immediately using a bioremediation product, such as *Petro-Clean ™* The absorbent and soil must be placed in a bin and removed from the site by a certified company and disposed of as a hazardous waste at a licensed commercial facility. No Hydrocarbons may escape into the environment. A spill recovery kit must be on site, along with trained personnel.		√			CONTRACTOR	Continuous		
d) Notification	Applicable provincial and local government departments, local municipalities and adjacent landowners must be notified within 24 hours of a spillage or leak.		√	√		ENGINEER, CONTRACTOR			
11.4.3 Maintenance									
a) Design	The maintenance yard and secured storage area will be established as far as is practicable, outside 32m buffer areas of the wetland and stream situated on the site as determined by the wetland delineation. The maintenance yard should be indicated on the layout plan of the site.	√		√		PROJECT MANAGER, CONTRACTOR OWNER	Once-off		
b) Maintenance area	The maintenance of vehicles and equipment used for any purpose during the development will take place only in the maintenance yard. Any breakdown in the field requires the presence of a spill treatment team and equipment. This team must prevent and mitigate any spills that occur in this situation.		√			ENGINEER, ECO, CONTRACTOR	Continuous		
c) Equipment	Equipment used in the development process must be adequately maintained so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid.		√			ENGINEER, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
d) Machinery	Machinery or equipment used on the site must not constitute a pollution hazard in respect of the above substances. The main contractor or ECO shall order such equipment to be repaired or withdrawn from use if he or she considers the equipment or machinery to be polluting and irreparable.		√			ENGINEER, CONTRACTOR	Continuous		
e) Buildings and facilities	Buildings, yards, paving areas, gardens, outside fencing or walls, etc. must be maintained in good standing at all times. Maintenance must be carried out expeditiously and with care to maintain the residential character of the area at all times.	√	√	√		CONTRACTOR OWNER			
11.5 Air Pollution									
11.5.1 Dust control									
a) Water dampening	The liberation of dust into the surrounding environment shall be effectively controlled by the use of, *inter alia*, water spraying and/or other dust-allaying agents, such as dust nets. Regular and effective damping down of working areas (especially during the dry and windy periods) must be carried out to avoid dust pollution that will have a negative impact on the surrounding environment. When necessary, these working areas should be damped down every 3 - 4 hours.		√	√		CONTRACTOR	Continuous		
b) Speed of trucks	The speed of haul trucks and other vehicles must be strictly controlled to avoid dangerous conditions and excessive dust. Preferably trucks should not exceed a speed of 20km/hr on any dirt roads or temporary construction roads.		√			CONTRACTOR	Continuous		
c) Fires	No burning of refuse or vegetation is permitted.		√			CONTRACTOR	Continuous		
d) Clearance of vegetation	Should construction in areas that have been stripped not be commencing within a short period of time the exposed areas shall be re-vegetated or stabilised. Soil stabilising measures could include rotovating in straw bales		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	(at a rate of 1 bale/20 m²), applying mulching or brush packing, or creating windbreaks using brush or bales.								
11.5.2 Fire									
a) Fires on site	A designated area shall be assigned for fire making by the construction workers, so as to ensure that run-away veld fires do not occur. This will reduce air pollution by excessive smoke.	√	√			CONTRACTOR	Once-off		
11.5.3 Machinery									
a) Exhaust fumes	Machinery or equipment used on the site must not constitute a pollution hazard in respect of air pollution via excessive exhaust fumes. This shall be inspected regularly by the contractor and rectified immediately.		√			CONTRACTOR	Continuous		
b) Transporting materials	All vehicles transporting material that can be blown off (e.g. soil, rubble, etc.) must be covered with a tarpaulin, and speed limits of 20km/h must be adhered to.		√			CONTRACTOR	Continuous		
11.6 Noise Pollution									
11.6.1 Working hours									
a) Construction working hours	Construction should be limited to National Buildings Regulated working hours,. No work should be allowed on Sundays and Public Holidays, except in extreme emergencies and with the prior approval of the Project Manager and ECO and with notification to the direct surrounding landowners.	√	√			PROJECT MANAGER, ECO, CONTRACTOR	Continuous		
11.6.2 Staying on site									
a) Construction workers	Except for 24-hour security guards (max 2), no workforce for any of the contractors, nor their family and friends, are allowed to stay on the site.		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Accommodation	Alternative accommodation shall be arranged for construction workers by the contractors, should they be too far from their permanent residence, and need accommodation closer to the site.	√	√			CONTRACTOR	Continuous		
11.6.3 Noise on site									
a) Noise Regulations	Site workers must comply with the Provincial noise requirements as outlined in Provincial Notice No. 5479 of 1999: Noise Control Regulations. The contractor is required by contract to adhere to SABS 1200 and ISO 9000 safety measures during construction on the entire site. And to fit silencers to frilling and other machinery as required.		√	√		CONTRACTOR	Continuous		
11.7 Safety and Security									
11.7.1 Safety									
a) Site and crew	The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act (85 of 1993) and the National Building Regulations.		√	√		CONTRACTOR	Continuous		
b) Informal settlement	No informal settlement will be allowed on the premises or in the adjacent roads leading to the construction site.		√	√		CONTRACTOR	Continuous		
c) Informal trading	No informal trading will be allowed at the entrances to the property, or the adjacent roads. It is the responsibility of the contractor to remove any informal traders and discourage the workers from using these informal traders.		√	√		CONTRACTOR	Continuous		
d) Dangerous areas	All dangerous areas and deep excavations should be barrier taped to ensure visibility of these areas in compliance with the Occupational Health and Safety Act (85 of 1993). In the case where demolition of buildings can pose a threat to workers or visitors to the site, emergency officers must be summoned.		√			CONTRACTOR	Continuous		
e) Equipment and materials	The Contractor should ensure that the handling of equipment and materials is supervised and adequately instructed.		√			CONTRACTOR OWNER	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
f) Sign boards	Clear sign boards should be erected at the entrance to the site to indicate that a construction site is being entered and that OHSA safety precautions should be followed		√			CONTRACTOR OWNER	Continuous		
g) Fire extinguisher	A fire extinguisher should be accessible, and the personnel should receive training in the use of a fire extinguisher. Furthermore, a fire extinguisher must at all times be available wherever welding or similar activities take place and be present on all construction vehicles. A full-time fire prevention team and the associated equipment must be available on site.	√	√	√		CONTRACTOR OWNER	Continuous		
h) Emergency numbers	A list with all the relevant emergency telephone numbers shall be pasted up in the site office (hospital, fire department, police, ambulance, etc.) for easy access in the event of an accident	√	√	√		CONTRACTOR OWNER	Continuous		
i) Speed limits	Within the construction site a maximum speed limit of 20km/h must be enforced for all construction vehicles and 40km/h for light vehicles. Speed limit signs must be installed at the site entrance.		√			CONTRACTOR	Continuous		
j) Traffic impact	Vehicular movement beyond the property boundaries should be limited during peak hours. Access to the site must follow current and established routes. Speed limits must be adhered to at all times.		√	√		CONTRACTOR OWNER	Continuous		
11.7.2 Security									
a) Security guards	Due to the requirement for security, the construction teams will not be housed on site, and will have to travel to/from site, however security officers (max 2) will remain on site for the purpose of guarding the equipment.	√	√			CONTRACTOR	Continuous		
b) Access control	A system must be implemented where all staff will carry ID. Access control will be enforced, the site could be swept, and a search could be	√	√	√		CONTRACTOR OWNER	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	done each night for construction workers. The provincial government departments will be allowed access to site at any time of the day								
c) Fencing	Fencing is required during the construction phase of the project to demarcate the boundaries of the construction site and work camp. Erection of the fence must occur with minimal impact on the natural environment. The fence will ensure that access to and from the site will be restricted to staff only.		√			CONTRACTOR	Once-off		
d) Casual access	No casual access to the work camp and the construction site will be allowed.		√			CONTRACTOR	Continuous		
e) Fence rehabilitation	All negative effects caused by the erection of any temporary fences must be rehabilitated after construction is complete.			√		CONTRACTOR	Once-off		
11.8 Health									
11.8.1 Chemical Toilets									
a) Number of toilets	Chemical toilet must be established on site as per the SHEQ requirements, (not all in the contractor's camp, but within reasonable walking distance from where the workers are working).	√	√			CONTRACTOR	Continuous		
b) Location	Chemical toilets shall not be in close proximity to any natural drainage channels or wetlands. Chemical toilets shall not be within 100 m of the wetland and stream. It is important, however, that toilets be placed in areas where the largest number of workers is located on a daily basis.	√	√			ECO, CONTRACTOR	Continuous		
c) French drains	No French drain systems may be installed due to potential ground water pollution.	√				ENGINEER, CONTRACTOR	Continuous		
d) Usage	No person is allowed to use any other area than chemical toilets.		√			CONTRACTOR	Continuous		
e) Inspections	Regular inspections shall be carried out to ensure that toilets are kept in a hygienic state.		√			CONTRACTOR	Continuous		
f) Toilet paper	Toilet paper shall be supplied to all toilets.		√			CONTRACTOR	Continuous		
g) Cleaning	Toilets shall be cleaned by a certified company on a weekly basis.		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
h) Locking	Toilets must be secured to the ground so that they cannot be overturned and have a sufficient locking mechanism operational at all times.		√			CONTRACTOR	Continuous		
11.9 Blasting on Site – It is not anticipated that blasting is required, however should blasting be required the following measures must be implemented									
a) Authorisation	In cases where blasting is required, an authorisation must be obtained from the Department of Minerals and the Department of Energy.	√	√			PROJECT MANAGER, ENGINEER, CONTRACTOR			
a) Magazine area	The ECO, Contractor and Safety Officer will earmark a suitable area on site for a temporary magazine for the duration of the construction. This magazine however will only be used to store the daily stock and not for stock to be stored for a long period.	√	√			ECO, SAFETY OFFICER, CONTRACTOR	Once-off		
b) Blasting times	Blasting will only take place after confirmation between the ECO and Contractor.		√			ECO, CONTRACTOR	Continuous		
c) Notification	Blasting shall be limited to specific, pre-agreed periods of the day so as to minimize disturbance and shall be agreed upon with the ECO. The ECO shall be notified in writing 3 days in advance with a two weekly daily schedule of when blasting operations will take place and where so that he can notify surrounding residents of each blasting event in writing, 24 hours in advance before blasting events will take place.		√			ECO, CONTRACTOR	Continuous		
d) Safety precautions	If blasting is required, it will be covered blasting with the necessary Safety precautions of Red flags, Siren and Safety signs. Where blasting will be near a road the Metro Police must be notified to arrange traffic for duration of blasting operation.		√			ECO, CONTRACTOR	Continuous		
11.10 Fauna									
a) Regulations	All activities on site must comply with the regulations of the Animal Protection Act, 1962 and NEMPAA 2003.		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Sensitive areas	No construction worker activity whatsoever will be allowed outside of the specific construction area.	√	√			CONTRACTOR	Continuous		
c) Snaring / hunting	Snaring and hunting of fauna by construction workers on or adjacent to the site are strictly prohibited and the Local Municipality shall prosecute offenders. It should also be a condition of employment that any employees/ workers caught poaching will be dismissed.		√			CONTRACTOR	Continuous		
d) Training	Workers must be trained on how to deal with fauna species as intentional killing will not be tolerated. Awareness campaigns and regulations must be implemented and maintained among residents so that the corridors and buffers can double as recreational parks and public open space.		√			ECO, CONTRACTOR	Continuous		
e) Lighting	During the construction phase, artificial lighting must be restricted to areas under construction only. Where lighting is required for safety or security reasons, this should be targeted at the areas requiring attention. Yellow sodium lights or Compressed Flourescent Bulbs (CFL"s) should be prescribed as they do not attract as many invertebrates (insects) at night and will not disturb the existing wildlife. Sodium lamps require a third less energy than conventional light bulbs.		√			ECO, CONTRACTOR	Continuous		
f) Fencing	Ideally fences should not restrict the natural migratory movements of certain animals. The site offers limited suitable migratory habitat. Electric fences have a negative impact on certain animal species including Bushbabies, geckoes, chameleons, bullfrogs and tortoises. Palisade fencing with adequate gaps is recommended for the conserved public open spaces.		√			ECO, CONTRACTOR	Continuous		
11.11 Flora – No Red Data floral species were found on site during the vegetation assessment									
a) Site inspection	Before any vegetation is removed, a suitably qualified person (i.e. on ECO request of a vegetation specialist) shall inspect the study area for	√	√	√		FLORA SPECIALIST,	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	any plant/ grass/ tree species that could be transplanted to other similar/ suitable areas. This includes all Red Data or Protected, or rare plants that may be found during the flora site assessment or during construction operations.					ECO, CONTRACTOR			
b) Sensitive flora	Any other medicinal/ protected/ Red Data flora found on the site will have to be removed shall be removed by a suitably qualified specialist and relocated. The applicable responsible person at the provincial department must be notified in the event of such plants being identified, who will then advise the ECO regarding what steps need to be taken and who will be responsible for the relocation and transplantation processes.	√		√		FLORA SPECIALIST, ECO	Once-off		
c) Site access and circulation	Strictly no unauthorised access, land clearing, construction activities, vehicular traffic of any kind, pedestrian traffic or fires will be permitted external of specific construction areas or in sensitive vegetation areas.	√	√	√		ECO, CONTRACTOR	Continuous		
d) Drainage lines	No clearing of vegetation will be allowed within the wetland or the Stream except for the sections where the road crossings are constructed, these areas must be rehabilitated with indigenous vegetation as soon as the crossings has been constructed.	√	√			ECO, CONTRACTOR	Continuous		
e) Exotic / invader species	All invader or exotic plant species **must** be removed from the site and disposed of at a landfill site. The National Department of Agriculture, Forestry and Fisheries (NDAFF) will be consulted during this process. Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used During the operational phase an annual assessment should be undertaken to check that no disturbance is occurring to the river and that alien plant species are being adequately controlled in the area, especially in the more sensitive areas.		√	√		FLORA SPECIALIST, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
f) Landscaping	The use of indigenous vegetation should be optimised during the landscaping of the development.	√	√	√		FLORA SPECIALIST, LANDSCAPE ARCHITECT, LANDSCAPE CONTRACTOR	Once-off		
g) Wood harvesting	Wood harvesting of any trees or shrubs on the study area or adjacent areas for firewood shall be prohibited and subject to a fine.		√	√		CONTRACTOR	Continuous		
h) Retaining flora	On site floral assets and tree clumps shall be identified and retained where possible. Floral assets intended to be retained shall be clearly marked on site and be fenced off until they have been removed.	√	√	√		FLORA SPECIALIST, ECO, CONTRACTOR	Continuous		
i) Street trees	No street trees planted by the Local Municipality may be removed without prior approval by Urban Forestry / the relevant department.	√	√	√		FLORA SPECIALIST, CONTRACTOR	Continuous		
j) Removing flora	No indigenous trees or floral assets may be removed without permission from the specialist or in some cases a flora removal permit may be required.		√	√		FLORA SPECIALIST, CONTRACTOR	Continuous		
j) Vegetation along services	No trees, hedges or other large vegetation types may be planted along or over service pipelines/ areas, due to the risk of damage and for ease of maintenance purposes.	√	√	√		LANDSCAPE ARCHITECT, LANDSCAPE CONTRACTOR , CONTRACTOR	Continuous		
11.12 Storm water									
a) Covering of wastes	Cover any wastes that are likely to wash away or contaminate storm water		√	√		CONTRACTOR OWNER	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Bunded area	Build a bund around waste storage area to stop overflow into storm water		√	√		CONTRACTOR OWNER	Once-off		
c) Natural flow	Natural storm water must flow freely, either as sheet flow or where necessary in open grass swales, to allow for infiltration and retention. Natural veld grass must be left undisturbed as far as possible, to allow natural drainage.		√	√		ENGINEER, CONTRACTOR	Continuous		
d) Piping of flow	Natural storm water must not be piped other than in areas where it runs perpendicularly cross the roadway.		√	√		ENGINEER, CONTRACTOR	Continuous		
e) Drainage channels	Drainage channels must be constructed along the road every 50m to divert runoff during construction period.	√	√	√		ENGINEER, CONTRACTOR	Continuous		
f) Energy dissipaters	Energy dissipaters (gabions/strawbales etc.) must be installed at all potential large flow volume areas, especially during the construction phase where large areas will be open soil.		√	√		ENGINEER, CONTRACTOR	Once-off		
g) Engineering report	The stormwater management plan completed by the Engineers specifically address storm water to the satisfaction of the Local Municipality. This report will be set submitted to the Municipality once the development has been approved. This storm water design (as per civil engineers) for all hard surfaces will ensure the proper management and precautionary measures are taken into account.	√		√		ENGINEER	Once-off		
h) Vegetated swales	Where feasible the use of vegetated swales should be used to accommodate surface runoff during construction, in order to increase infiltration into the soil. The swales should be vegetated with indigenous, wetland vegetation in order to provide habitat for bird life and other aquatic and semi-aquatic species. Where feasible, the swales should be provided adjacent to the property boundaries along the natural gradient.	√	√	√		ENGINEER, ECO, CONTRACTOR	Continuous		
i) Retention ponds	Retention ponds should be constructed. Retention ponds manage storm water runoff to prevent flooding and downstream erosion, and to improve water quality in adjacent water bodies.	√		√		ENGINEER	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
j) Alkaline soils	Where alkaline soils occur and the design of the development permits, swales should be used to infiltrate surface runoff, as this promotes the removal of metals from runoff. Especially runoff from parking areas should by filtered in this fashion before passing into the underground storm water sewer system.	√	√	√		ENGINEER, CONTRACTOR	Continuous		
k) Design of swales	The cross-section of the swale should be parabolic or trapezoidal in shape with side slopes no steeper than 1:3, to maximise the wetted channel perimeter. It is recommended that the longitudinal slope not exceed 2% where possible and that a maximum slope of 4% be used. Where a 4% slope must be exceeded, check dams should be provided at a minimum interval of 17m. As a rule of thumb, the total surface area of the swale must be 1% of the area that drains into the swale. The surface of the swale must be carefully constructed, to avoid compaction, which will inhibit dense vegetation growth and effective runoff infiltration. The installation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.	√		√		ENGINEER	Once-off		
l) Maintenance of swale	Maintenance of the swale should include periodic mowing of the grass (never shorter than the design flow depth of the channel). Bare areas should be re-seeded, and debris and blockages regularly removed. Sediment depositions should be regularly removed from the swale, to prevent pollution of the runoff from contaminants contained therein.		√	√		CONTRACTOR	Continuous		
m) Hydrological Engineer	Please note that the recommendations for the design of the swales are guidelines only and that the designs of the swales, sedimentation ponds and check dams must be done by a hydrological engineer.	√		√		CONTRACTOR	Once-off		
n) Wetland	Storm water outflows will not enter directly into the wetland or stream.	√		√		ENGINEER	Continuous		
o) DWS approval	Both storm water and excess effluent intended for irrigation must be purified according to DWS standards. Approval must be obtained from DWS for the abstraction of groundwater.	√		√		ENGINEER	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.13 Traffic Impact									
a) Departmental requirements	All requirements from the provincial roads and traffic departments and the Local Municipality must be adhered to and precautionary measures taken to provide safe and effective traffic management.	√		√		ENGINEER OWNER	Once-off		
b) Delivery trucks	Deliveries by large vehicles may only take place during weekdays and pre-warning of at least one day prior to delivery must be given to the facility manager to ensure adequate space and manoeuvrability inside the facility and in the adjacent roads. Large delivery trucks should not be scheduled at the same time as events.		√	√		CONTRACTOR OWNER	Continuous		
c) Site access	The access of large trucks will be investigated by the PM to provide a suitable access route that does not become a nuisance to surrounding residents. Only a specified number of trucks at any one time will be allowed onto the property as agreed to between the PM and the ECO based on the capacity of the site to carry the number of trucks.		√			ENGINEER, CONTRACTOR	Continuous		
d) Wheel wash	Establish an all-weather site access and wheel wash or shake down to prevent soil and materials from being tracked onto the road.		√			CONTRACTOR	Continuous		
e) Peak traffic hours	Construction vehicles and activities must aim to avoid peak hour traffic times (weekdays 7-8am and 5-6pm)		√	√		CONTRACTOR OWNER	Continuous		
f) Legislation	Access roads and traffic planning will adhere to Gautrans and the Local Municipality requirements.	√				ENGINEER	Once-off		
g) Established tracks	Access and travelling on site must follow current and established tracks only.		√			CONTRACTOR	Continuous		
h) Road construction	Where roads cross open areas the traffic calming features will have a 300mm pipe sleeve under it for potentially occurring amphibians and mammals to cross under the road in safety.	√	√			ENGINEER, CONTRACTOR	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.14 Sensitive Areas									
11.14.1 Wetland and stream situated on the site									
a) Flood line and wetland buffer areas	No activities may be allowed within the 32m buffer zones surrounding the Wetland and Stream	√	√	√		CONTRACTOR OWNER	Continuous		
b) Fencing of the Wetland	During construction the wetland and stream affected by the construction of proposed development must be fenced off. The fence must be erected on a conservation line determined by the ECO. No construction worker or vehicular access shall be allowed within this area, unless authorised by the ECO.	√	√	√		CONTRACTOR OWNER	Once-off		
c) No dumping	No dumping will be allowed within any drainage areas, the wetland and stream. No bins shall be located within 50m of these areas.		√			CONTRACTOR	Continuous		
d) No toilets	No chemical toilets shall be situated within 100m from the natural drainage areas or the wetland		√			CONTRACTOR	Continuous		
e) Surface runoff	Surface runoff must be directed away from the Wetland and the stream and must be filtered or put into a municipal system prior to being released. All surface runoff shall be managed in such a way as to ensure that erosion of soil does not occur.	√	√	√		ENGINEER, CONTRACTOR OWNER	Continuous		
f) Vehicle access	No vehicles whatsoever are allowed to move across or within the 32 meter buffer zones of the wetland and stream		√			CONTRACTOR	Continuous		
g) No stockpiling	No topsoil stockpiling, or stockpiling of any other material, shall be allowed within the 32 metre buffer zones surrounding the wetland and stream		√			CONTRACTOR	Continuous		
h) Siltation ponds	Where natural drainage channels join up with man-made channels, siltation ponds/ stilling basins shall be implemented in order to allow for	√	√	√		ENGINEER, CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	the sediments to settle before the water is dispersed into the natural system.								
i) Longitudinal connectivity	No activity is allowed that will impede the longitudinal connectivity of drainage areas, as this will hamper efficiency and flow.	√	√			WETLAND SPECIALIST, CONTRACTOR	Continuous		
j) No bathing	No bathing will be allowed in any of the water bodies (wetland and stream) on or adjacent to the site.		√			CONTRACTOR	Continuous		
k) No washing	No washing of clothes will be allowed in any water bodies (the wetland and stream) on or adjacent to the site.		√			CONTRACTOR	Continuous		
l) No taking of water	No taking of water from water bodies (the wetland and stream) for drinking or cooking purposes will be allowed, as potable water should be available on site.		√			CONTRACTOR	Continuous		
m) No urinating	No urinating will be allowed anywhere on site, as this will result in an immediate fine.		√			CONTRACTOR	Continuous		
n) Sensitive zones rehabilitation	Considerable attention must be given to avoid any unnecessary vegetation disturbance within any natural drainage habitat zones, or the wetland and stream. All potential disturbances within these areas shall immediately be reported to the ECO and rehabilitated with appropriate vegetation (a specialist must be consulted in this regard).		√			WETLAND SPECIALIST, CONTRACTOR	Continuous		
11.14.2 Heritage / Cultural / Archaeological Sites									
a) Discovery of artefacts	Should any other Cultural / Archaeological artefacts be discovered during construction activities, construction shall immediately cease and the National, Cultural and History Museum shall be contacted for investigation. The area must be barrier taped immediately until the ECO can communicate appropriate methods of protection to the contactor.		√			CONTRACTOR , HERITAGE SPECIALIST, ECO	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Fencing	Any archaeological sites present on site shall be fenced and at least 5 metres around it should be safeguarded from construction and development.	√	√			CONTRACTOR	Once-off		
c) Structures older than 60 years	No buildings / structures older than 60 years shall be damaged / demolished, or archaeological artefacts removed, without written authorisation from SAHRA.	√	√			CONTRACTOR	Continuous		
d) Burial grounds	Any burial ground or grave found on site will be reported immediately to the Contractor, ECO and Project Manager. An undertaker must also be contacted who will place advertisements in the newspapers. This should be investigated by a specialist and recommendations made.		√			PROJECT MANAGER, CONTRACTOR , ECO	Continuous		
e) Suspicious artefacts	The ECO will be notified of any suspicious artefacts prior to it being moved or removed.		√			CONTRACTOR	Continuous		
11.15 Services									
11.15.1 Disruption in services									
a) Informing ECO	If any disruption in services (electricity, water, sewage) are foreseen during the construction of proposed development, the contractor must inform the ECO at least 4 days prior to these activities, to enable the ECO to inform the surrounding land owners of such possible disruptions.		√			CONTRACTOR	Continuous		
b) Existing storm water channels and other services	Existing storm water channels and services are not to be impacted upon in any way during the course of construction of proposed development except when part of the construction scope of works. Any damage repairs shall be for the Contractor's account. No littering or dumping of rubble shall be permitted in the storm water channel and all potential blockages shall be removed immediately. Where necessary these areas should be clearly fenced off with white poles at 5m centres, with blue wire and orange barrier netting.		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
11.16 Contractor's Site Camp									
a) Establishment of site camp	A work site will be established and maintained for storing construction equipment on a non-sensitive area to be agreed upon by the ECO and contractor. The contractor shall furnish the Engineer on site with a site plan indicating the layout of site offices, facilities, such as chemical toilets, areas for stockpiling of materials and provision of containers, prior to commencement of construction.		√			CONTRACTOR, ECO	Once-off		
b) Fencing	The site camp shall be fenced and all materials shall be stored within this camp. All hazardous materials i.e. fuel, polyethylene liners, etc. shall be stored in an appointed area that is fenced off and has restricted access.		√			CONTRACTOR	Continuous		
c) Camp location	The site camp shall not be situated within a natural drainage line or within 50m from the wetland and stream. It should also be situated in an area that is already disturbed.		√			CONTRACTOR	Once-off		
d) Rehabilitation of camp	The area where the camp was established must after the construction period be rehabilitated to guidelines in this document or as otherwise directed by the ECO.		√			CONTRACTOR, VEGETATION SPECIALIST, ECO	Once-off		
11.17 Environmental Awareness Training									
a) Training program	An environmental awareness-training program must be organized as part of the EMPr to ensure that each employee knows his/her responsibilities regarding the EMPr and the environment in general. Attendance certificates must be issued. Additional training as required, i.e. encounters with Red Data or other fauna should be arranged and provided.	√	√			CONTRACTOR, ECO	Once-off		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
b) Appropriate activities	The employees, construction workers and maintenance crews will receive instruction in the appropriate activities that could take place among the natural resources of the area.		√			ECO	Once-off		
11.18 Rehabilitation & Landscaping									
a) Master Plan	A Landscape Master Plan will be prepared that stipulates that the existing indigenous vegetation must be retained on site. This plan should be strictly adhered to. A landscaping programme is to be submitted to the applicable Provincial and Local Government department together with the construction programme.	√				LANDSCAPE ARCHITECT	Once-off		
b) Landscaping	The use of indigenous vegetation should be optimised during the landscaping of the development. Landscaping should enhance the aesthetic appeal of the development/ mitigate the visual impact as far as possible.	√				LANDSCAPE ARCHITECT	Once-off		
c) Compacted areas	All compacted areas (including backfilled trenches) should be ripped prior to them being rehabilitated.		√			CONTRACTOR	Continuous		
d) Reseeding	Stored topsoil and reseeding must be used to rehabilitate all open soil areas following construction activities. Any proclaimed weed or alien invader plant shall be cleared by hand before seeding. All rehabilitated areas must be maintained and irrigated as required to ensure sufficient vegetation coverage. Re-seeding may be required if sufficient coverage has not been achieved after 6 months and shall be at the Contractor's expense.		√			LANDSCAPE ARCHITECT, CONTRACTOR	Once-off		
e) Timeframe	Rehabilitation/ landscaping is to be done immediately after the involved works are completed.		√			CONTRACTOR	Once-off		
f) Rehabilitation by Sub-contractors	The Contractor is responsible for the actions and works of the sub-contractors and is required to complete the rehabilitation work if the sub-contractor fails to do so. Payment may be withheld from the sub-		√			CONTRACTOR	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	contractor in the event that the work must be completed by the main contractor.								
g) Completion of work	On completion of works, the contractor shall clear away and remove from the site all construction paint, surplus materials, foundations, plumbing and other fixtures, rubbish and temporary works of every kind. Areas thus cleared shall be graded and scarified to restore the ground to its original profile as near as practicable before topsoil placement.		√			CONTRACTOR	Once-off		
h) Cement mixing	Cement mixing shall be done only at specifically selected sites. After construction activities ended the cement shall be crushed and removed from the site. This mixing area shall then be ripped and rehabilitated.		√			CONTRACTOR	Continuous		
i) Natural features	The natural features of the site should be managed in a holistic manner.	√				LANDSCAPE ARCHITECT	Continuous		
11.19 Advertising									
a) Design	A graphic design of the advertisement will be subject to the approval of the Directorate of Integrated Environmental Management, Directorate of Marketing, Directorate of Local Economic Development and Directorate of Public Safety.	√				ARCHITECT, CONTRACTOR	Once-off		
b) Requirements	Advertisements will not obstruct traffic view, movement of pedestrians, cause visual pollution or appear to be unsightly. It will be tastefully low key, as will be defined by the Local Municipality and will not unrightfully interfere with other existing advertising rights.	√		√		ARCHITECT, CONTRACTOR	Continuous		
c) Lease	The lease of the advertising space will be valid for a period of 12 months after which the applicant can request for renewal.	√		√		PROJECT MANAGER	Continuous		
11.20 Penalties									
a) Payment of penalties	Any person who contravenes any of the provisions of the laws and by-laws will be guilty of an offence and on conviction liable to a fine not	√	√	√		DEVELOPER,	Continuous		

POSSIBLE IMPACT	MITIGATION MEASURES	APPLICABLE PHASES				RESPONSIBLE PERSON	FREQ	COMPLIANT	
		DS	CO	OP	DE			YES	NO
	exceeding R20 000 (Twenty-thousand Rand) or in default of payment, to imprisonment for a period of not exceeding 6 months.					ENGINEER, CONTRACTOR, ARCHITECT, ECO			

ABBREVIATIONS AND DEFINITIONS

ARCH	Architect
CE	Consulting Engineer
CO	Construction
DE	Demolition
DS	Design
DWS	The Department of Water and Sanitation – both national office and their various regional offices, which are divided across the country on the basis of water catchment areas.
ECA	Environment Conservation Act (Act 73 of 1989)
ECO	Environmental Control Officer
EIA	An Environmental Impact Assessment as contemplated in the national Environmental Management Act (Act 107 of 1998)
EMI	Environmental Monitoring Inspector – from Provincial Government (E.g. GDARD)
EMPr	Environmental Management Program
FAUNA	All living biological creatures, usually capable of motion, including insects and predominantly of protein-based consistency.
FENCE	A physical barrier in the form of posts and barbed wire or any other concrete construction, ("palisade"- type fencing included), constructed with the purpose of keeping humans and animals within or out of defined boundaries.
FLOOD LINE	The line or mark to which a flood could rise, every 50 (1:50 year flood line), or 100 (1:100 year flood line) years
FLORA	All living plants, grasses, shrubs, trees, etc., usually incapable of easy natural motion and capable of photosynthesis.
GDARD	Gauteng Department of Agriculture and Rural Development
IEM	Integrated Environmental Management
MPRDA	The Mineral and Petroleum Resources Development (Act 28 of 2002)
NEMA	National Environmental Management Act (Act 107 of 1998)
NHRA	National Heritage Resources Act (Act 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
OP	Operational
PENALTY	A fine against the contractor by the PM as per request from the ECO. This could also be used for the benefit of the labourers (such as a camp braai).
PM	Project Manager
RA	Resident Architect
ROD	Record of Decision (approval or dismissal of project) as issued by GDACE
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resource Agency
SAMOAC	South African Manual for Outdoor Advertising Control
SPOTFINE	A fine against a labourer by the PM as per request from the ECO. This fine should be used for the labourers' benefit.

SWALE A depression between slopes that provides for drainage

TLB Tractor, Load & Backhoe

TOPSOIL The layer of soil covering the earth which-

(a) provides a suitable environment for the germination of seed;

(b) allows the penetration of water;

(c) is a source of micro-organisms, plant nutrients and in some cases seed; and

(d) is not of a depth of more than 0,5 metres or such depth as the Minister may prescribe for a specific prospecting or exploration area or mining area.

VEGETATION Any and all forms of plants, see also Fauna

WETLAND A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998).

APPENDIX A

Table of Contents for On site Environmental File

No	Document	Check	Comments
1	Environmental Authorisation	☐	
2	Environmental Authorisation Amendments (If applicable)	☐	
3	Water Use Licence	☐	
4	EMPr	☐	
5	Site Induction proof	☐	
6	Environmental Education / Awareness Training / Toolbox Talks	☐	
7	Site Planning and Layout	☐	
8	Method Statements and Site Instructions	☐	
	a. Site Clearing Programme	☐	
	b. Topsoil Stripping and Stockpiling	☐	
	c. Access Routes / Haul Roads	☐	
	d. Exposed Surfaces	☐	
	e. Prevention of Soil Erosion	☐	
	f. Stockpile Management	☐	
	g. Stormwater Management		
	h. Refueling	☐	
	i. Emergency Repairs to Machinery / Vehicles	☐	
	j. Ready Mix, Concrete, Mortar, Plastering		
	k. Painting	☐	
9	Hazardous Substances and Materials		
	a. MSDS	☐	
	b. Storage Requirements	☐	
10	Waste Management		
	a. Services Provider Contract	☐	
	b. Storage Requirements	☐	
	c. Quantity and Proof of Responsible Disposal	☐	
11	Public Complaints Procedure		
	a. Procedure	☐	
	b. Register	☐	
12	Audits	☐	

APPENDIX B

EMP Checklist

EMP Checklist Results DATE

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
		only 1 or 0			
1	Environmental Management System	18	18	R 0.00	R 18,000.00
1.1	Latest revision of signed Environmental policy is on display in office and on notice boards	1	1		R 1,000.00
1.2	Declaration of understanding has been signed	1	1		R 1,000.00
1.3	A site specific Aspects and Impacts Register has been compiled	1	1		R 1,000.00
1.4	Site Specific Objectives and Targets completed. Action plan in place	1	1		R 1,000.00
1.5	An Environmental Officer has been appointed	1	1		R 1,000.00
1.6	All employees, subcontractors and management has completed the Environmental Induction within the last 12 months	1	1		R 1,000.00
1.7	The complaints register is available and up to date	1	1		R 1,000.00
1.8	Relevant Environmental Method Statements have been completed and signed off by the project manager	1	1		R 1,000.00
1.9	The Incident register is available and up to date	1	1		R 1,000.00
1.10	The Start-up and Monthly Checklist is up to date and has been signed off by the project manager	1	1		R 1,000.00
1.11	The Facilities Checklist is up to date and has been signed off by the project manager	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
1.12	Waste Management Checklist has been completed	1	1		R 1,000.00
1.13	Borrow pit and spoil Checklist has been completed	1	1		R 1,000.00
1.14	All NCR's have been closed and addressed	1	1		R 1,000.00
1.15	The NCR's register is available and up to date	1	1		R 1,000.00
1.16	Internal Audit report action plan has been completed and signed off by the project manager	1	1		R 1,000.00
1.17	Internal Environmental Inspection report has been communicated, actioned and signed off by the project manager	1	1		R 1,000.00
1.18	Environmental Monthly report has been submitted to head office	1	1		R 1,000.00
2	Legal Documentation	7	6	**R 0.00**	**R 7,000.00**
2.1	Is a copy of the EMP and ROD stored on the site for easy reference?	1	1		R 1,000.00
2.2	DWA permits obtained for river, stream or wetland crossing?	1			R 1,000.00
2.3	DWA permits obtained for the removal of protected species of plants?	1	1		R 1,000.00
2.4	DWA permits obtained for abstraction of construction water from rivers, dams or boreholes	1	1		R 1,000.00
2.5	DMR permits obtained for the use of borrow pits, spoil areas, sand mines and materials used for batching and ready mix	1	1		R 1,000.00
2.6	Environmental file on site, transmittal note signed off	1	1		R 1,000.00
2.7	Have audits and incident records being made available to the authorities?	1	1		R 1,000.00
3	Environmental Awareness Training	4	4	**R 0.00**	**R 4,000.00**

EKANGALA SHOPPING CENTRE – EMPR

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
3.1	Employees have general understanding of EMP/ROD trough toolbox talks and additional environmental awareness is on display on notice boards	1	1		R 1,000.00
3.2	Records of training kept up to date	1	1		R 1,000.00
3.3	Specific training on awareness	1	1		R 1,000.00
3.4	Specific training on legal liability	1	1		R 1,000.00
4	Site Establishment and Demarcation	4	3	**R 0.00**	**R 32,000.00**
4.1	Site configuration/ method statement corresponds with approved plan	1	1		R 1,000.00
4.2	Site fencing and demarcation of facilities remain intact	1			**R 10,000.00**
4.3	Sewage and effluent infrastructure intact				**R 10,000.00**
4.4	Work areas properly and safe guarded/ barricading	1	1		**R 10,000.00**
4.5	Designated smoking areas with designated bin – no paper	1	1		R 1,000.00
5	Access and Traffic	9	7	**R 0.00**	**R 87,000.00**
5.1	Construction routes clearly defined and contractor is making use of existing roads as far as possible	1	1		**R 5,000.00**
5.2	Entry and exit points strategically placed to ensure as little impact on traffic as possible	1	1		**R 5,000.00**
5.3	Entry and exit points controlled by security	1			**R 5,000.00**
5.4	All construction vehicles must be clearly marked (yellow light)	1	1		R 1,000.00
5.5	Access points clearly indicated by signage	1	1		**R 5,000.00**

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
5.6	40km/h speed limit on access roads	1	1		R 1,000.00
5.7	Nobody allowed driving in the veld, causing damage to vegetation or creating new access road within written permission	1			**R 50,000.00**
5.8	All deliveries and construction traffic within construction hours	1	1		**R 5,000.00**
5.9	No parking of any type of vehicles outside the de-markated construction & site camps' areas	1	1		**R 10,000.00**
6	Borrow Pit and Spoil Areas	6	3	**R 0.00**	**R 14,000.00**
6.1	Topsoil, Overburden and Primary STOCKPILE CLEARLY DEMARCATED ON SITE DRAWING, FENCED OFF AND SECURE	1			**R 5,000.00**
6.2	Designated spoil areas separate and identified by means of site drawing	1			R 1,000.00
6.3	Top soil berms not exceed 2m in height and area indicated onsite drawing	1			R 1,000.00
6.4	Topsoil not compacted or driven over	1	1		R 1,000.00
6.5	Dust suppression in place	1	1		**R 5,000.00**
6.6	Documentation as per checklist is on file	1	1		R 1,000.00
7	Waste Management	10	8	**R 0.00**	**R 27,000.00**
7.1	No littering on site allowed	1	1		R 1,000.00
7.2	Enough bins available to manage waste	1	1		**R 5,000.00**
7.3	Waste and scrap areas clearly demarcated	1			R 1,000.00
7.4	Waste and scrap areas have adequate capacity	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
7.5	Waste equipment (bins, skips) in good condition	1	1		R 1,000.00
7.6	Loose waste material covered or tied down (skip nets)	1	1		R 1,000.00
7.7	Excess concrete to be dumped in designated area and truck to wash out at area.	1			**R 5,000.00**
7.8	Waste regularly disposed of	1	1		**R 10,000.00**
7.9	Documentation as per checklist is on file	1	1		R 1,000.00
7.10	Training on waste recycling and disposal through toolbox talks	1	1		R 1,000.00
8	Hydrocarbons	22	22	**R 0.00**	**R 12,000.00**
8.1	Oils, fuels and greases inventory list and bund capacity on display	1	1		R 1,000.00
8.2	Relevant MSDS available in MDSDS register	1	1		R 1,000.00
8.3	Property stored in impermeable bunded areas with roof	1	1		R 1,000.00
8.4	Bunded area able to contain 110% in case of spill	1	1		R 1,000.00
8.5	Proper decanting equipment used to prevent spills (hand pump, funnels)	1	1		R 1,000.00
8.6	Spill response material/ equipment on site with adequate absorbents. No natural material used to absorb spills	1	1		R 1,000.00
8.7	Spills recorded on Incident report reported and properly cleaned up	1	1		R 1,000.00
8.8	Spilled material stored properly and disposed of at approved disposal site	1	1		R 1,000.00
8.9	Documentation as per Checklist is on file	1	1		R 1,000.00
8.10	Spill response plan available and display	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
8.11	Training on spill management – toolbox talk	1	1		R 1,000.00
8.12	Regular cleaning of oil separators and disposal of old oil, oil filters and rags	1	1		R 1,000.00
8.13	Capacity fuel within legal limits in bunded area as per SANS specs	1	1		**R 5,000.00**
8.14	Refuelling conducted by appointed staff in dedicated area	1	1		**R 5,000.00**
8.15	Soil protected from contamination by concrete slab or drip tray	1	1		**R 5,000.00**
8.16	Spill response equipment on hand with adequate absorbents, no material used to absorb spills	1	1		**R 5,000.00**
8.17	Spill recorded on incident report reported and properly cleaned up	1	1		**R 5,000.00**
8.18	Fire fighting equipment at hand	1	1		**R 5,000.00**
8.19	Soil protected from contamination by concrete slab or drip tray	1	1		**R 5,000.00**
8.2	Spill response equipment on hand with adequate absorbents, no material used to absorb spills	1	1		**R 5,000.00**
8.21	Spill recorded on incident report reported and properly cleaned up	1	1		**R 5,000.00**
8.22	Fire fighting equipment at hand	1	1		**R 5,000.00**
9	Vehicle and Plant maintenance	5	5	**R 0.00**	**R 9,000.00**
9.1	Conducted by trained staff in dedicated workshop areas	1	1		R 1,000.00
9.2	Soil protected from contamination by concrete slab or drip trays	1	1		**R 5,000.00**
9.3	Spill response equipment on hand with adequate absorbents, , no material used to absorb spills	1	1		R 1,000.00
9.4	Spill recorded on incident report reported and properly cleaned up	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
9.5	Service truck crew to be specifically trained for maintenance on site	1	1		R 1,000.00
10	Wash Bays	9	9	**R 0.00**	**R 18,000.00**
10.1	Impermeable sloping concrete basis	1	1		R 1,000.00
10.2	Bunded walls in tact and efficient	1	1		R 1,000.00
10.3	Proper constructed silt trap	1	1		R 1,000.00
10.4	3 Stage oil separator, installed correctly	1	1		R 1,000.00
10.5	Unblocked drains to oil separator	1	1		R 1,000.00
10.6	Water use monitored – no wastage	1	1		R 1,000.00
10.7	All wheeled plant to be washed in the constructed wash bay	1	1		R 1,000.00
10.8	All tracked plant to be washed on site with cold water after excess oil and grease have been removed	1	1		R 1,000.00
10.9	Proper temporary storm water control	1	1		**R 10,000.00**
11	Batching Plants/ Mixing Areas	10	10	**R 0.00**	**R 31,000.00**
11.1	Impermeable concrete basis or surface	1	1		R 1,000.00
11.2	Filters / socks on silo's in working order	1	1		R 1,000.00
11.3	Bunded curing compound area	1	1		R 1,000.00
11.4	Sedimentation / containment ponds for wash water	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
11.5	Designated spoil area for excess concrete	1	1		R 1,000.00
11.6	Bunded wash bay for mixer trucks	1	1		**R 5,000.00**
11.7	Wash water is disposed into sewer or removed by an approved contractor and correctly disposed	1	1		**R 5,000.00**
11.8	Unblocked drains	1	1		R 1,000.00
11.9	Drip trays for parked plant	1	1		**R 5,000.00**
11.10	Proper temporary storm water control	1	1		**R 10,000.00**
12	Sewage and Sanitation	11	9	**R 0.00**	**R 36,000.00**
12.1	Enough toilets provided (1 per 30 persons)	1			**R 5,000.00**
12.2	Safety and conveniently accessible (within 100m)	1			**R 5,000.00**
12.3	Ablutions not placed within 50 m of river, stream, storm water channel or wetland	1	1		**R 10,000.00**
12.4	Ablution facilities in tact and working – not leaking	1	1		**R 5,000.00**
12.5	Separate screened / facilities toilets for men and woman	1	1		R 1,000.00
12.6	Seats and doors intact and working	1	1		R 1,000.00
12.7	Toilet paper available	1	1		R 1,000.00
12.8	Chemical toilets are placed level and secured to prevent spillage	1	1		**R 5,000.00**
12.9	Facilities are regularly emptied and cleaned	1	1		R 1,000.00
12.10	Documentation per checklist is on file	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
12.11	Facilities to be used at all times – no urination and / or deification on site	1	1		R 1,000.00
13	Supply of water for Human Consumption	4	4	R 0.00	R 5,000.00
13.1	Proof of water is fit for human consumption				R 1,000.00
13.2	Water taken from approved points	1	1		R 1,000.00
13.3	Water supply to working area on site	1	1		R 1,000.00
13.4	Water use monitored – no wastage	1	1		R 1,000.00
13.5	Contamination of water points reported, recorded, addressed	1	1		R 1,000.00
14	Staff Areas	17	17	R 0.00	R 5,000.00
14.1	Demarcated undercover seating	1	1		R 1,000.00
14.2	Dust free well illuminated and clean	1	1		R 1,000.00
14.3	Refuse bins available with secured lids	1	1		R 1,000.00
14.4	No accumulation of food scraps outside bins	1	1		R 1,000.00
14.5	No open fires for food preparation	1	1		R 1,000.00
14.6	Sufficient space provided for bags and clothes	1	1		R 1,000.00
14.7	Sufficient lighting and ventilation	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
14.8	Sufficient privacy from outside	1	1		R 1,000.00
14.9	Area clean and disinfected	1	1		R 1,000.00
14.1	All sub-contractors have space available for a change area	1	1		R 1,000.00
14.11	Refuse bins available with secured lids	1	1		R 1,000.00
14.12	Sufficient privacy from outside	1	1		R 1,000.00
14.13	Area kept clean and hygienic	1	1		R 1,000.00
14.14	Hot and cold water available	1	1		R 1,000.00
14.15	Containment tank for shower / wash water	1	1		R 1,000.00
14.16	Regular emptied and cleaning of tank	1	1		R 1,000.00
14.17	Prevention of stagnant water	1	1		R 1,000.00
15	Storm Water Management	6	4	**R 0.00**	**R 42,000.00**
15.1	Temporary drainage infrastructure in place and should include sediment filtration measures	1			**R 10,000.00**
15.2	Sedimentation traps / filtration infrastructure is being maintained	1			**R 10,000.00**
15.3	Erosion gullies are repaired after rainfall events	1	1		**R 10,000.00**
15.4	Stagnant water to be cleared out where possible	1	1		R 1,000.00
15.5	Storm water contamination to be reported and recorded	1	1		R 1,000.00
15.6	Municipal storm water inlets to be protected by biddim	1	1		**R 10,000.00**

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
16	Air Pollution Management	7	7	R 0.00	R 31,000.00
16.1	Dust suppression equipment working & available	1	1		R 5,000.00
16.2	Vehicle speed adjusted to condition of unpaved roads	1	1		R 5,000.00
16.3	Water for dust suppression taken from approved points	1	1		R 5,000.00
16.4	No excessive smoke from vehicles and plant	1	1		R 5,000.00
16.5	No excessive cement dust from filling silo's	1	1		R 5,000.00
16.6	No excessive dust from moving aggregate to batch plant and loads to be covered to minimise dust	1	1		R 5,000.00
16.7	Dust reported, recorded and corrective action taken	1	1		R 1,000.00
17	Noise Management	5	5	R 0.00	R 13,000.00
17.1	Noise generating equipment list available on site and is on display	1	1		R 1,000.00
17.2	Noise generating equipment in good working order	1	1		R 5,000.00
17.3	After hours work has been authorised	1	1		R 5,000.00
17.4	Noise levels recorded to ensure compliance	1	1		R 1,000.00
17.5	Noise incidents reported, recorded and addressed	1	1		R 1,000.00
18	Fire Prevention	6	6	R 0.00	R 6,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
18.1	Fire prevention equipment in good order – serviced	1	1		R 1,000.00
18.2	Fire breaks in place where needed	1	1		R 1,000.00
18.3	No fire allowed on site unless in a designated area and permission has been obtained	1	1		R 1,000.00
18.4	Fire emergency contact numbers available on site	1	1		R 1,000.00
18.5	Fire incidents reported, documented and addressed	1	1		R 1,000.00
18.6	Fire awareness training through toolbox talks	1	1		R 1,000.00
19	Sensitive Areas	4	2	**R 0.00**	**R 57,000.00**
19.1	Sensitive areas demarcated and fenced off	1			**R 50,000.00**
19.2	Relevant signage posted	1			**R 5,000.00**
19.3	Environmental awareness training on sensitive areas through induction and toolbox talks	1	1		R 1,000.00
19.4	Encroachment on sensitive areas reported	1	1		R 1,000.00
20	Fauna	4	4	**R 0.00**	**R 4,000.00**
20.1	Rules communicated to employees through induction and toolbox talks	1	1		R 1,000.00
20.2	Incident reported and recoded	1	1		R 1,000.00
20.3	Follow – up training to be given after incident	1	1		R 1,000.00
20.4	Disciplinary procedures in place for offenders	1	1		R 1,000.00

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
20.5					
21	Flora	5	5	R 0.00	R 9,000.00
21.1	Construction footprint kept to the minimal regarding clearing of vegetation	1	1		R 5,000.00
21.2	Rules communicated to employees through induction and toolbox talks	1	1		R 1,000.00
21.3	Incident reported and recoded	1	1		R 1,000.00
21.4	Follow – up training to be given after incident	1	1		R 1,000.00
21.5	Disciplinary procedures in place for offenders	1	1		R 1,000.00
22	Protection of Heritage Resources	4	4	R 0.00	R 4,000.00
22.1	Before work commences in specific area, final check for heritage resources to be done	1	1		R 1,000.00
22.2	Procedure to report finds in place	1	1		R 1,000.00
22.3	Work stopped and area secured	1	1		R 1,000.00
22.4	Relevant parties informed of finds	1	1		R 1,000.00
23	Rehabilitation	4	4	R 0.00	R 4,000.00
23.1	Rehabilitation method statements in place	1	1		R 1,000.00
23.2	Rehabilitation conducted according to MS and EMP	1	1		R 1,000.00
23.3	Rehabilitated area monitored as construction continue	1	1		R 1,000.00

EKANGALA SHOPPING CENTRE – EMPR

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
23.4	Encroachment and access on rehabilitated area restricted	1	1		R 1,000.00

	RESULTS SUMMARY	Target	Achieved	Fine this ECO report	Potential fine
1	Environmental Management System	18	18	R 0.00	R 18,000.00
2	Legal Documentation	7	6	R 0.00	R 7,000.00
3	Environmental Awareness	4	4	R 0.00	R 4,000.00
4	Site Establishment and Demarcation	4	3	R 0.00	R 32,000.00
5	Access and Traffic	9	7	R 0.00	R 87,000.00
6	Borrow Pits and Spoil Areas	6	3	R 0.00	R 14,000.00
7	Waste Management	10	8	R 0.00	R 27,000.00
8	Hydrocarbons	22	22	R 0.00	R 12,000.00
9	Vehicle and Plant Maintenance	5	5	R 0.00	R 9,000.00
10	Wash bays	9	9	R 0.00	R 18,000.00
11	Batch Plant / Mixing Areas	10	10	R 0.00	R 31,000.00
12	Sewage and Sanitation	11	9	R 0.00	R 36,000.00
13	Supply of Water for Human Consumption	4	4	R 0.00	R 5,000.00

EKANGALA SHOPPING CENTRE – EMPR

No	ASPECTS/IMPACT	Score	Achieved this ECO inspection	Fine for this ECO report	Potential Fine Imposed for noncompliance
14	Staff Areas	17	17	R 0.00	R 5,000.00
15	Storm Water Management	6	4	R 0.00	R 42,000.00
16	Air Pollution Management	7	7	R 0.00	R 31,000.00
17	Noise Management	5	5	R 0.00	R 13,000.00
18	Fire Prevention	6	6	R 0.00	R 6,000.00
19	Sensitive Areas	4	2	R 0.00	R 57,000.00
20	Fauna	4	4	R 0.00	R 4,000.00
21	Flora	5	5	R 0.00	R 9,000.00
22	Flora	4	4	R 0.00	R 4,000.00
23	Rehabilitation	4	4	R 0.00	R 4,000.00
	Compliance sum	181	166	R 0.00	R 475,000.00
	Compliance percentage		92%		
	Previous percentage		100%		

Procedures Against Transgression of EMP Guidelines and Checklists

APPENDIX C

Record of Decision

APPENDIX D

Layout