

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

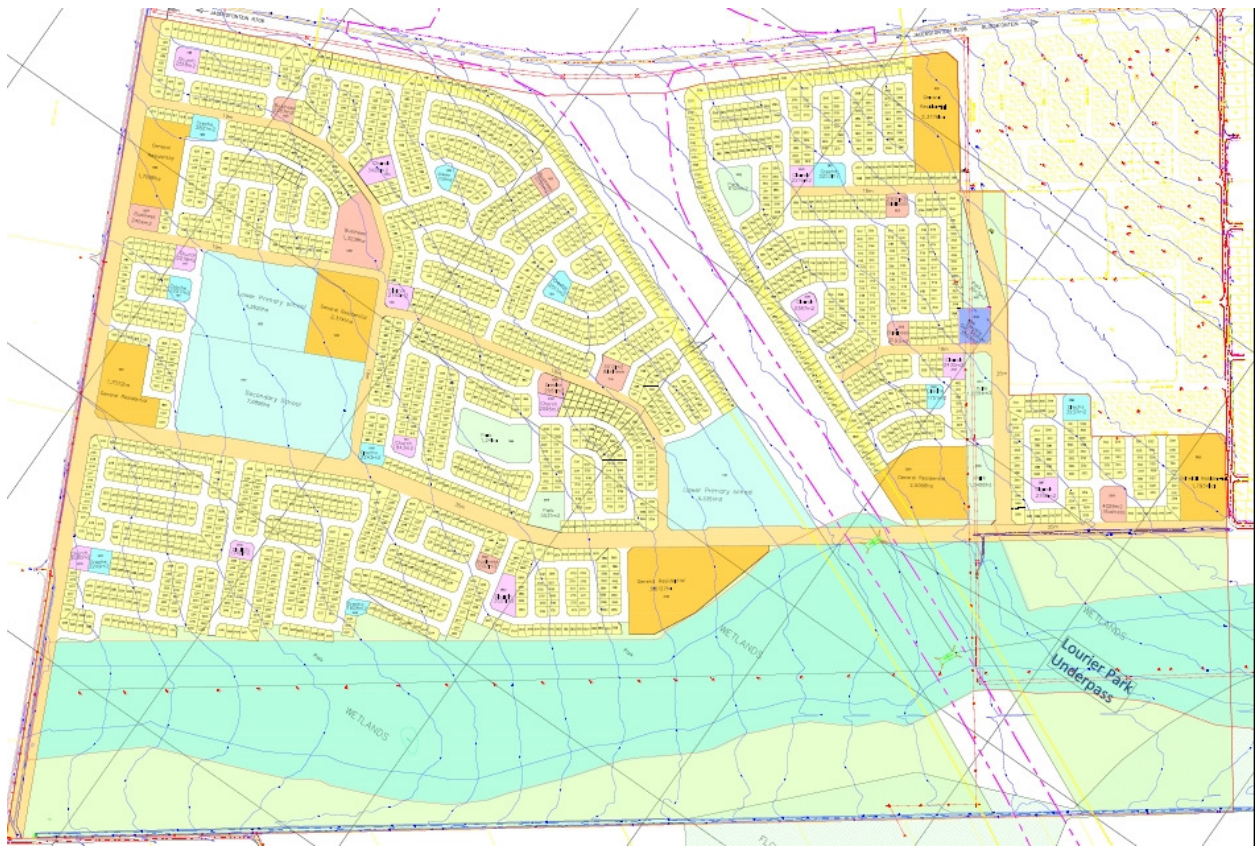
This EIR was done to comply with the requirements of the environmental regulations, R982 and R984, promulgated on 4 December 2014. These regulations are promulgated in terms of Section 24(5) of the National Environmental Management Act, Act 107 of 1998. The proposed project is listed under Item 2 of Listing Notice 2.

Administrative Information

Location description	:	The Proposed Development is located on Portion 1 of the Farm Brandkop 702 on the southern side of Bloemfontein just south of the Jagersfontein Road and is an extension of the existing Lourierpark suburb.
Project Description	:	Proposed Lourierpark Township Establishment on Portion 1 of the Farm Brandkop 702, Bloemfontein that includes Infrastructure and Roads.

19 September 2017

on behalf of: **MANGAUNG METRO MUNICIPALITY**



Compiled By:



MvW Environmental Services
Stock Crescent 9
Bloemfontein
9301

**PROPOSED LOURIERPARK TOWNSHIP
ESTABLISHMENT ON PORTION 1 OF THE FARM
BRANDKOP 702, BLOEMFONTEIN THAT INCLUDES
INFRASTRUCTURE AND ROADS.**

19 September 2017

Conducted on behalf of:

MANGAUNG METRO MUNICIPALITY

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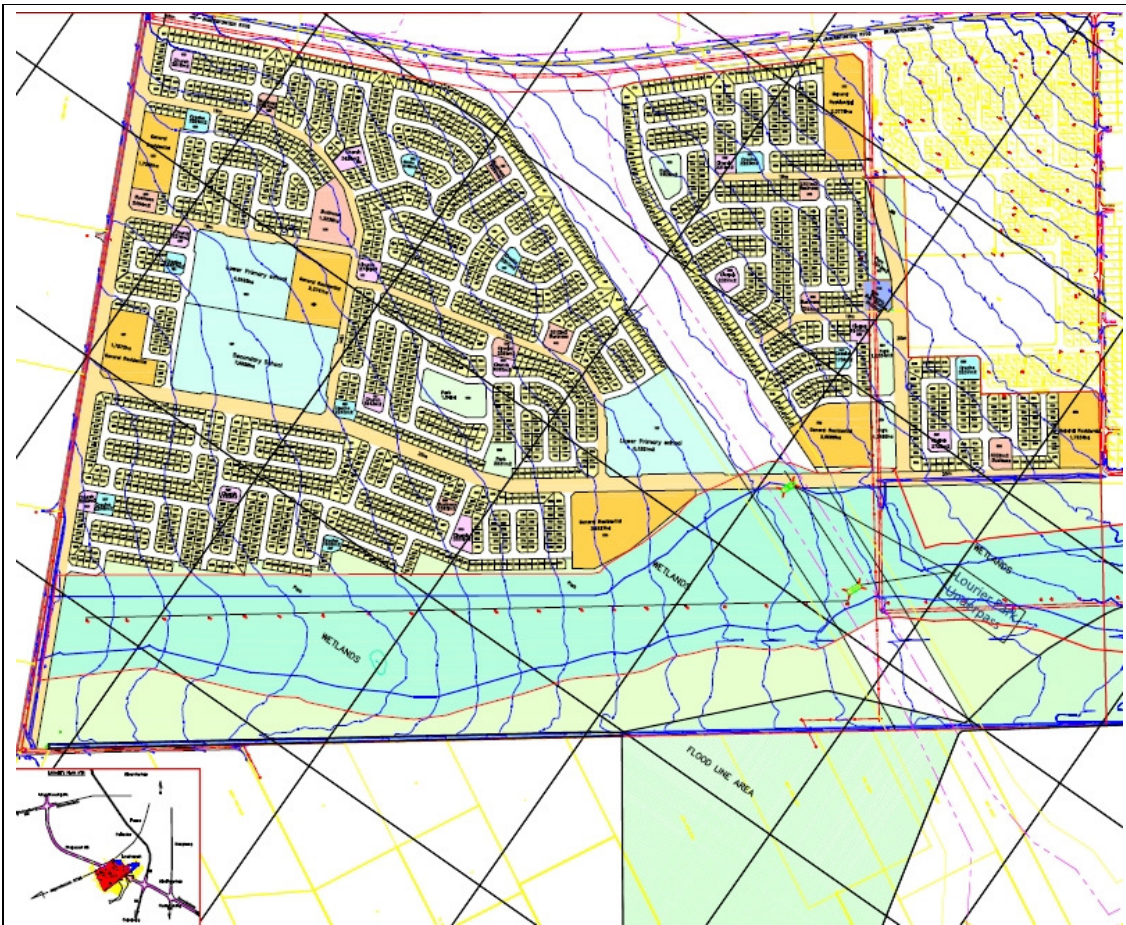
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EXECUTIVE SUMMARY

A. INTRODUCTION

MvW Environmental Services, as an independent Environmental Assessment Practitioner (EAP), has been appointed by Mangaung Metro Municipality to facilitate the EIA process for the proposed Township Establishment at Lourierpark, Bloemfontein in the Free State Province.

The land earmarked for the development is ±357Ha in extent and is owned by Mangaung Metro Municipality. The project will deliver temporary and permanent work opportunities during both the construction and operational phases. See the Proposed Township Establishment's Breakdown in the table below.



LAND USE	NUMBER OF ERVEN	AREA/HA	% OF DEVELOPMENT
Residential	2306	100.0278	28.05
General Residential (±483 units)	7	16.1304	4.53
Business	9	3.3838	0.95
Community Facility – Education	3	17.2838	4.85
Community Facility – Crèche	11	2.6017	0.73
Community Facility – Church	13	3.2027	0.89
CENTLEC	1	0.5103	0.14

Parks	6	128.9371	36.1
N8	0	31.2440	8.77
Streets	0	53.7908	15.09
TOTAL	2356	357.1124	100.00

The Environmental Impact Assessment (EIA) process followed is in compliance with the National Environmental Management Act: NEMA, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations of 4 December 2014 (Government Notice No's R982, 983 and 984 & 985 of 2014). The proposed development involves 'listed activities', as defined by the NEMA, 1998. Listed activities are activities, which may potentially have detrimental impacts on the environment and therefore require environmental authorisation from the relevant authorising body. The proposed development occurs inside the Free State Province and therefore are DESTEA the responsible decision making authority.

The proposed development will possibly involve the following listed activities as stipulated in the amended EIA Regulations of 4 December 2014:

As per Government Notice Number R. 983 of 2014, the following listed activities are included for the above application:

28. Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development:

- (i) Will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or
- (ii) Will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;

Excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.

The above activities are all Basic Assessment activities. However, we confirm that the application will remain a Scoping and EIA application, due to the following listed activities as per Government Notice Number 984 of 2014:

15. The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-

- (i) The undertaking of a linear activity; or
- (ii) Maintenance purposes undertaken in accordance with a maintenance management plan.

MvW Environmental Services has been appointed to act as independent environmental assessment practitioners responsible for:

- The public participation process for both the Scoping and EIA phases;
- The compilation of this Scoping Report and the EIR (and site specific EMP) and its submission to the relevant environmental authority.

B. GENERAL PROJECT DESCRIPTION

The study area for this investigation is located approximately 10 km directly south west of the City of Bloemfontein, within the central portion of the Free State Province, South Africa. Bloemfontein is the capital city of the Free State Province and, as the judicial capital of the nation, one of South Africa's three national capitals.

The Proposed Lourierpark Township Development is located on the farm Brandkop 702 on the southern side of Bloemfontein just south of the Jagersfontein Road and is an extension of the

existing Lourierpark suburb. The site is seen to have a proposed surface area of approximately 357 Ha, and is easily accessible via the R706.

The following farm portions are applicable:

- ✚ Portion 1 of the Farm Brandkop 702, Bloemfontein District.

The project site is situated on an undeveloped portion of the farm Brandkop 702. The project site is surrounded by residential developments on the north-eastern side, small holdings on its south-eastern and south-western sides and farms on its north-western sides. Large areas of the site have been ploughed and left fallow. At present communal cattle graze the area.

The responsible municipality in the proposed area is the Mangaung Metro Municipality.

C. ENVIRONMENTAL IMPACT ASSESSMENT AND PUBLIC PARTICIPATION

The principles of NEMA govern many aspects of EIA's, including consultation with interested and affected parties (I&AP's). These principles include the provision of sufficient and transparent information to I&AP's on an on-going basis, to allow them to comment, and ensuring the participation of historically disadvantaged individuals, including women, the disabled and the youth.

Company / Organization / Ward Notified of Proposed Lourierpark Township Development and Draft Reports	Contact Person
Mangaung Metro Municipality – Acting Municipal Manager	Adv Mea
Mangaung Metro Municipality - Environmental Section	Mpolokeng Kolobe
Mangaung Metro Municipality – Town Planning Section	Collin Dihemo
Mangaung Metro Municipality – SDF Section	George Masuabi
Mangaung Metro Municipality – Air Quality Section	Neo Shapu
Mangaung Metro Municipality – Environmental Health Section	Jaco Lambrecht
Mangaung Metro Municipality – Water and Sanitation	Mosiua Tsomela
Mangaung Metro Municipality – Roads and Stormwater	Jeff Letsi
Mangaung Metro Municipality – Infrastructure	Gerhard Fritz
Department of Water Affairs	Vernon Blair G Janse van Noordwyk
Ward councilor (Ward 25)	Clr Rossouw Botes
Department of Health	Dr. David Motau Mr Leshabanetl
SANRAL	Casper Landman
Free State Department: Police, Roads and Transport	HOD & Hannes Maree
Department of Economic, Small Business Development, Tourism and Environmental Affairs	Ms. Grace Mkhosana Nacelle Collins
Free State Department: Public Works	Mr. Maditse Wessels Seoke (HOD)
Free State Department: Social Development	Ms Mokone Nthongoa (HOD) HODsec@fssocdev.gov.za
Free State Department: Sport, Arts, Culture and Recreation	Mr Molapo (HOD)
Heritage Free State	Ntando PZ Mbatha (Heritage Coordinator)
SAHRA	A Solomon

Gentlec	Mamello Mpholo
Landowner	Mangaung Metro Municipality
Department of Agriculture	Ndumo Nosisa Jack Morton
Department of Education	Mr RS Malope
Telkom	Willem Voight

The surrounding landowners were informed of the project via maildrop and afforded the opportunity to comment on the project by means of an Interested and Affected Parties Comment Form: Please refer to the comments and response report attached as Annexure E for comments received and responses from the EAP.

Public Participation on Draft Scoping Report and Plan of Study if EIR:

The project and availability of the Draft Scoping Report was announced by means of the following:

- Publication of a media advertisement in the local/regional newspaper, The Express on the 26th April 2017.
- On-site notices advertising the EIA have been placed at the following public locations on 24th May 2017:
 - At the proposed site at the access road to Lourierpark;
 - Notices were placed at the Filling Station at Casino.
- Mail drop to all directly adjacent landowners;

All the issues raised on the proposed development as well as on the Draft Scoping Report and Plan of Study of EIR was captured in the Final Scoping Report and Plan of Study of EIR that was submitted to DESTEA for review. A period of 30 days was allowed for public comment on the Draft Scoping Report and Plan of Study of EIR.

The Draft Scoping Report and Plan of Study of EIR were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final Scoping Report was prepared after the end of the public review period, which started on 24/05/2017 and ended on 23/06/2017. The Draft report was updated with issues raised by I&AP's and new information generated as a result. The Final Scoping Report was submitted to DESTEA for review on 30 June 2017.

Public Participation on Draft Environmental Impact Report & EMP:

Public participation during this Impact Assessment Phase of the EIA revolves around a review of the findings of the EIR and inputs into the Environmental Management Plan (EMP). The findings are presented in this Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies.

All the issues raised on the proposed development as well as on the Final Scoping Report and Plan of Study of EIR was captured in this Draft EIR to be submitted to DESTEA for review. A period of 30 days will be available for public comment on the Draft EIR & EMP.

This Draft EIR & EMP were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final EIR and EMP will be prepared after the end of the public review period, which will started on 19/09/2017 and ended on 18/10/2017. The Draft Report will be updated with issues raised by I&AP's and new information generated as a result. The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017.

D. KEY IMPACTS

The key issues listed in the following section have been determined through the following avenues:

- Views of interested and affected parties;
- Legislation; and
- Professional understanding of environmental assessment practitioners and specialist consultants.

The potential impacts and key issues identified for the proposed development include:

- Geological formations;
- Soil erosion and pollution;
- Storm water management;
- Soil and water (surface and groundwater) contamination;
- Ecological functioning;
- Air quality and Noise;
- Heritage and culture;
- Safety and security;
- Infrastructure and services provision;
- Traffic;
- Socio economic; and
- Landscape character / visual character.

Further details associated with the construction and operation of the various activities as listed in the project description will be discussed in detail in this EIA Report. The EIA Report will assess the impacts of each of the activities as well as ascertain the cumulative impacts of the development in totality. The EIA Report will outline the necessary mitigation measures and delineate sensitive areas containing species of conservation importance and habitats integral to the maintenance of ecosystem function.

E. ALTERNATIVES

The identification of alternatives is an important component of the EIA process. Where possible, alternatives will be identified and investigated. The various alternatives were assessed in terms of both environmental acceptability as well as economic feasibility. The preferred option was highlighted and presented to the authorities through this EIR.

Some of the alternatives inter alia that were assessed include:

- Status Quo/No Go Alternative;
- Alternative Land Use;
- Alternative Site;
- Alternative Layouts;
- The Preferred Routes for Installation of the Services;
- Water Sources;
- Solid Waste Disposal;
- Roads Design and Access.

An indication of the applicants thinking/reasoning in deciding on their preferred alternative was determined, before the EIA process started. These indications have been given to the consultants during the life of the project, and are reported on in this EIR.

Input from I&AP's with regards the identification of alternatives, were encouraged during the public participation process, and accommodated in this EIR.

F. CONCLUSIONS AND RECOMMENDATIONS

Our recommendation, based on the assessment of the available information, is that application for the Proposed Lourierpark Development should be authorised provided that sensitive planning, design and good environmental management be carried out by the proponent during all phases of development. A variety of mitigation measures have been identified that will serve to mitigate the scale, intensity, duration or significance of the impacts identified. These include guidelines to be applied during the planning and design, construction and operational phases of the project.

Specialist studies assisted with the development assessment by helping to understand the system processes and the potential impacts of the proposed development on both the social and biophysical environments. The following specialist studies were undertaken as part of this environmental impact assessment:

1. Geological and Geo-technical Investigations;
2. Civil Services Reports;
3. Electrical Report;
4. Archaeological and Paleontological Impact Assessments;
5. Traffic Impact Assessment;
6. Ecological and Wetland Report;
7. Flood Line Report.

Anticipated environmental impacts, together with potential cumulative impacts were assessed during this impact assessment phase of the project in order to predict the nature and characteristics of the impacts and establish appropriate mitigation measures to reduce the identified impacts as far as possible.

The environmental impact statement clearly shows that the proposed development will not have any major negative impacts on the receiving environment. It's submitted that the proposed mitigatory measures, if implemented, will reduce the significance of the identified negative impacts to "low", and that the proposed project should proceed. The development will however have positive impacts on the socio and economic environments of the larger MMM area. They include:

- During Construction Phase:
 - Impact on Economy and Employment Creation (Moderate +);
 - Impact on the Economy of MMM (High +);
 - Removal/Management of Exotic and Invader Species Occurring on the Proposed Site (High +) - Declared weeds and invaders of Category 1 of the Alien and Invasive Species Regulations, 2014 are prohibited and must be controlled. These weeds and invaders will be eradicated during the construction phase and managed throughout the operational phase preventing further spread.

The only environmental impacts that will have a high negative impact (without mitigation measures) on the environment during the construction phase include:

- Exotic and Invader Species currently occurring on the site (High –).
- During Operational Phase:
 - Provision of Much Needed Residential Erven in the Area (High +);
 - Impact on Surrounding Property Values (Low + without and Moderate + with mitigation);
 - Impact on Economy and Employment Creation (High +);
 - Impact on the Economy of MMM (High +);
 - Impact on Social Structure, Dynamics and Relations (Moderate +).

The only environmental impacts that will have a high negative impact (without mitigation measures) on the environment during the operational phase include:

- Impact on the Environment Due to a Lack of Adequate Services and Maintenance to these Services (High – without mitigation and Low - with mitigation).

In the light of the findings in this EIR and attached Specialist Reports it is therefore our submission that a sustainable environment can be created containing indirect benefits to the larger MMM area that outweighs the potential limited and short-lived environmental disruption during construction. The development is financially feasible, physically possible and legally permissible – and therefore passes the three tests to determine implementation possibility, development, maintenance potential and sustainability.

The following should be included within the environmental authorization if issued by DESTEA:

- All recommendations and requirements made in this EIR and the above mentioned specialist studies must be adhered to at all times.
- Environmental Authorization will be required for the package treatment facility (Might be required until such time that the sewerage treatment works has been upgraded) for the proposed development. It does not form part of this study.
- The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998). This licence must be obtained from DWS before construction may commence.
- An ECO must be appointed on a full time basis to monitor the requirements of the EIR and EMP.
- The monthly Environmental Audit Reports for the construction of the development must be submitted to DESTEA. A Post Construction audit must also be completed directly after construction is completed.
- The EMP must include litter management along the boundary fences and access roads. Refuse collection should take place on a regular basis. A litter patrol around the construction area is to take place twice a week to collect any litter that may have been strewn around.
- At least one groundwater monitoring borehole must be established down gradient of the proposed site. The groundwater monitoring should include:
 - At least one groundwater sample before construction commences;
 - Quarterly groundwater sampling during construction;
 - Groundwater sampling on a quarterly basis for up to 1 year after construction.
- Waste is to be stored in access controlled enclosures during construction such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages must have a concrete floor.
- Waste must be sorted and recycled (glass, plastic, metal, paper and wet waste). No waste may be buried on site.
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately.
- No groundwater should be used for domestic use. Approval from DWS will be required if the proposed development will be making use of groundwater for other purposes like irrigation etc.
- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998).
- Cordoning off of proposed open space areas and sensitive areas to restrict the movement of construction vehicles and construction personnel.
- Prevent runoff to wetland areas.
- The 600mm diameter pipe in Jagersfontein Road has sufficient capacity to accommodate the development although the 220kpa reading is a concern for fire flow conditions. The

pressure reducing valve in the pipeline will have to be adjusted to accommodate the water demand from the Development.

- The 600mm diameter outflow pipe to the Welvaart Waste Water Treatment Works (WWTW) is adequate for the development, but the WWTW does not have sufficient capacity to accommodate runoff from the development. For the interim a package plant can be considered until such time the WWTW has been upgraded.
- Care must be taken to preserve the grassland areas in the wetland buffers and open areas.
- The EMP for construction must ensure that all site access is via the formal road network.
- According to the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014, all declared aliens must be effectively controlled. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories: Category 1: Prohibited and must be controlled. This includes the following species found on site: *Argemone ocoleuca*, *Datura ferox**, and *Solanum elaeagnifolium**
- All approvals to be obtained from SANRAL, MMM and Department of Roads and Public Works regarding the proposed access roads planned and the upgrade of the existing intersections.
- Access will be obtained from the R706 road. According to the attached Traffic Impact Assessment this intersection (Nr 1 on map in figure below) must be signalized.
- The proposed development must comply with the SANRAL Act regarding signage along a national road.
- All invasive alien plants must be eradicated and replaced with indigenous vegetation. Follow-up clearing must be maintained for the duration of the operational phase of the development.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens. Only indigenous trees should be planted along the roads. An eco-control officer should be appointed to monitor and help with the planting of indigenous trees and shrubs along the roads and open areas.
- The open trenches and construction areas must be demarcated using red tape to ensure safety of humans and other animals. A construction Safety Plan must be prepared in line with the Occupation Health and Safety Act. Provision must be made for a full time safety officer during construction. This must be included in the EMP and part of the contractor's terms of reference.
- Only sanitation systems that do not rely on seepage for the disposal of liquid wastes (i.e.: septic tanks that drain into "French Drain"-type soak-aways) must be utilized in the proposed development. In this light it is recommended that use be made of a closed sewerage reticulation system. Septic tanks and subsurface drainage systems which have a tendency to leak are not recommended, except if properly sealed.
- No on-site sanitation must be allowed closer than 100m from surface or groundwater resources. The sewage system (chemical toilets) must be inspected for leakages on a regular basis and any leakages must be attended immediately.
- Efficient surface drainage system must be installed along roads in order to prevent the ponding at the surface next to the road directly after heavy precipitation events.
- The terrain may have a vast amount of construction materials available for roads, etc. However, a more detailed study and testing of materials are required to locate these materials and to determine the suitability thereof for construction purposes. It must be noted that permits will be required for any burrow pits required to make use of this construction material.
- The fill material to be used must be obtained from a source approved by the Department of Mineral and Energy. Proof of provenance of this material must be available on site.
- Excess backfill material and larger rocks (spoil) must be disposed of at an appropriate spoil site.
- The proposed development must meet the requirements of sustainable development. It must also consider energy efficient technologies and water saving devices and technologies for the proposed development. This could include measures like recycling of waste, the use of low voltage or compact fluorescent light instead of incandescent globes, maximizing the use of solar heating, management of storm water, the capture and use of rainwater from gutter and roof and the use of locally indigenous vegetation during landscaping.

- Buildings and perimeter fencing etc. must be maintained in order to ensure that they do not deteriorate and result in an aesthetically unpleasing development.
- All external fittings for example satellite dishes and TV aerials should be positioned in such a way that will have the least visual impact.
- All outside lighting to shine directly down. No general spotlighted areas must be allowed, which could bother neighbours.
- To reduce the visual impact of power lines on the environment the power can be distributed from existing overhead power lines to the stands by means of underground low voltage cables.
- In the event that any human remains are found that these would have to be reported to SAHRA (South African Heritage Resources Agency) as they would be protected under the National Heritage Resources Act (No 25 of 1999).
- The development must comply with the recommendations as stipulated in the attached TIS.
- The development must comply with the recommendations as stipulated in the attached Floodline Report namely:
 - The culverts immediately downstream of Rooidam be enlarged to accommodate the flow (Figure 2-4 of attached Floodline Report).
 - Runoff from Catchment Areas B and D must be guided to only enter the canal at point 2.
 - If development takes place in Catchment Areas B and C, the capacity of the open concrete canal must be taken into consideration. Stormwater drainage from Catchment Areas B and C should be diverted as per The Masterplan of Mangaung Metro Municipality, September 2009, via main stormwater drainage systems alongside the Jagersfontein Road to the west at point 1 and only deposited downstream of the canal analysed in the Floodline Report. However, it is the recommendation that irrespective of these catchments' development, that stormwater be diverted to the west (point 1) as described above and not towards the Development.
 - Urgent maintenance and cleaning must be done on all the culverts as can be seen on the photos. This will enable the culverts to operate at their design capacity.
 - In view of the results of the floodline analysis, the following options can be considered:
 - Enlargement of the downstream culvert and open canal up to the third section. This is a costly option, but is still recommended.
 - A berm on both sides of the canal. This is not recommended due to aesthetical reasons, space availability on the southern side and stormwater not being able to enter the canal overland.
 - A wall built on top of the canal's edges. This option is not recommended due to the layout of the Development not being finalized and runoff from the Catchment Areas B + D should be able to enter the canal overland.
- The development must comply with the recommendations as stipulated in the attached Geotechnical Report regarding foundations etc.
- The development must comply with the recommendations as stipulated in the attached Archaeological and Paleontological Impact Assessments.
- Also important will be the training of staff and learners to implement good housekeeping techniques, to be aware of light pollution, air quality, water use, solid waste and storm water management.

It can be concluded that the proposed development will not conflict with the principles of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA] and should, therefore, be authorised. The Public Participation Process (PPP) has been duly undertaken as per the NEMA and the issues of I&AP's have been adequately addressed. It is therefore recommended that the proposed development should proceed subject to the implementation and enforcement of the recommendations and mitigation measures contained in this EIR, EMP and Specialist Reports.

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 Annexure F7: Declaration of Interest Signed by the Specialists
 Annexure G: Environmental Management Plan

LIST OF ABBREVIATIONS

CA	Competent Authority
CBD	Central Business District
DEAT	Department of Environmental Affairs and Tourism
DESTEA	Department of Economic, Small Business Development, Tourism and Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment as defined in the Environment Conservation Act, 1989 (Act 73 of 1989)
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity
ELO	Environmental Liaison Officer
EMP	Environmental Management Plan
FSPG	Free State Provincial Government
IDP	Integrated Development Plan
I&AP's	Interested and Affected Parties
IEM	Integrated Environmental Management
m	metres
m.a.m.s.l.	Metres above mean sea level
Max	Maximum
Min	Minimum
MMM	Mangaung Metro Municipality
mm	Millimetres
MOSS	Metropolitan Open Space System
N8	National Road number 8
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NGO	Non-Governmental Organization
NHRA	National Heritage Resources Agency
PES	Present Ecological State
POS	Plan of Study
POSA	Plants of South Africa
PPP	Public Participation Process
LOS	Level of Service
SAHRA	South African Heritage Resources Agency
SAMOAC	South African Manual For Outdoor Advertising Control
SANRAL	South African National Roads Agency
SATGRM	South African Trip Generation Manual
SDF	Spatial Development Framework
SR	Scoping Report
TIA	Traffic Impact Assessment
VAC	Visual Absorption Capacity
WM	With Mitigation
WOM	Without Mitigation
WWTW	Welvaart Waste Water Treatment Works

GLOSSARY OF TERMS

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

Alternative Route : Refers to a specific route with local re-alignment along the route to avoid sensitive sites.

Applicant: Any person who applies for an authorisation to undertake an activity or to cause such activity to be undertaken as contemplated in section 22 (1) of the Environment Conservation Act, 1989.

Arable Potential: Land with soil, slope and climate components where the production of cultivated crops is economical and practical.

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

Environment: All physical, chemical and biological factors and conditions that influence an object.

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

Environmental Management Plan: A working document on environmental and socio-economic mitigation measures that must be implemented by several responsible parties during all the phases of the project.

Interested and Affected Party: Any person or group of persons who may express interest in a project or be affected by the project, positively or negatively.

Key Stakeholder: Any person who acts as a spokesperson for his/her constituency and/or community/organization, has specialized knowledge about the project and/or area, is directly or indirectly affected by the project or who considers himself/herself a key stakeholder.

Soil Compaction: Soil becoming dense by blows, vehicle passage or other type of loading. Wet soils compact easier than moist or dry soils.

Stakeholder: Any person or group of persons whose live(s) may be affected by a project.

Study Area: Refers to the entire study area, encompassing all the alternative routes as indicated on the study area map.

Succession: The natural restoration process of vegetation after disturbance.

SECTION 1: BACKGROUND INFORMATION AND HISTORY

MvW Environmental Services was appointed by Mangaung Metro Municipality to conduct an Environmental Impact Assessment to obtain the necessary environmental authorisation for the proposed Township Development on Portion 1 of the farm Brandkop 702 in the Bloemfontein District.

The Scoping Report was done with the objective to supply the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs with the necessary environmental information to make a decision regarding the approval of the Scoping Report and the Plan of Study for EIR.

This Scoping Report was done to comply with the requirements of the environmental regulations, R983 and R984, promulgated on 4 December 2014 and amended in April 2017. These regulations are promulgated in terms of Section 24(5) of the National Environmental Management Act, Act 107 of 1998. The proposed project is listed under Item 15 of Listing Notice 2 namely:

15 - The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-

- (i) the undertaking of a linear activity; or*
- (ii) maintenance purposes undertaken in accordance with a maintenance management plan.*

See Section 1.6.1 for other regulations that will also be applicable.

The term “environment” is used in the broadest sense in an environmental impact assessment. It covers the physical, biological, social, economic, cultural, historical, institutional and political environments.

1.1 DETAILS OF THE PROJECT TEAM

1.1.1 The Applicant

Description	
Organisation	Mangaung Metro Municipality
Contact Person	ME Mohlahlo
Address	P O Box 3704, Bloemfontein, 9300
Telephone Number	051 – 405 8523
Email Address	attie.vanheerden@mangaung.co.za

1.1.2 The Landowner

Description	
Organisation	Mangaung Metro Municipality
Contact Person	ME Mohlahlo
Address	P O Box 3704, Bloemfontein, 9300
Telephone Number	051 – 405 8523
Email Address	attie.vanheerden@mangaung.co.za

1.1.3 The Project Manager

Description	
Company	Phethogo Consulting
Contact Person	Mr JH Viljoen
Address	122 Nelson Mandela Drive, Westdene, Bloemfontein, 9301. P O Box 43284, Heuwelsig, 9332
Telephone Number	051 – 448 6006
Email Address	rikus@phethogo.co.za

1.1.4 The Environmental Consultant

Description	
Company	MvW Environmental Services
Contact Person	Manie van Wyk
Address	Stock Crescent 9 Fichardtpark, Bloemfontein, 9301
Telephone Number	082 697 7073
Email Address	manievanwyk.ssi@gmail.com
Experience	18 years in the field of Environmental Management
Tertiary Education	B.Sc & M.Sc Environmental Management from University of the Free State

1.1.5 Specialists

i. Heritage Impact Assessment

Description	
Company	Paleo Field Services
Contact Person	Dr L Rossouw
Address	P O Box 38806, Langenhovenpark, 9330
Telephone Number	084 250 5992
Email Address	lloyd.rossouw@gmail.com

ii. Ecological Impact Assessment and Sensitive Areas Report

Description	
Company	Enviro-Niche Consulting
Contact Person	Dr P J du Preez
Address	9 Cape Willow Avenue, Hemel & Aarde Estate, Hermanus
Telephone Number	082 376 4404
Email Address	greensa@gmail.com

iii. Civil Services Report

Description	
Company	Phethogo Consulting
Contact Person	Mr JH Viljoen
Address	122 Nelson Mandela Drive, Westdene, Bloemfontein, 9301.

	P O Box 43284, Heuwelsig, 9332
Telephone Number	051 – 448 6006
Email Address	rikus@phethogo.co.za

iv. Electrical Services Report

Description	
Company	FCE Consulting Engineers
Contact Person	FCE van der Merwe
Address	39 Brebner Street, Westdene, Bloemfontein, 9301
Telephone Number	051 – 403 8596
Email Address	

v. Geotechnical Report

Description	
Company	CHR Development Consultants
Contact Person	Mr W Badenhorst
Address	P.O. Box 43585, Heuwelsig, 9332
Telephone Number	079 883 9083
Email Address	bfnplan@gmail.com

vi. Traffic Impact Assessment

Description	
Company	KMA Consulting Engineers
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Telephone Number	083 381 5884
Email Address	kma@telkomsa.net

vii. Town and Regional Planners

Description	
Company	Phethogo Consulting
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Telephone Number	082 415 6069
Email Address	pdebie@absamail.co.za

See the signed Declaration of Interest Forms by all Specialists involved in this Project attached in Annexure F7.

1.2 APPROACH TO THE EIA

An Environmental Impact Assessment (EIA) is an essential planning tool for any development. It identifies the environmental impacts of a proposed project and assists in ensuring that a project will be environmentally acceptable and integrated into the surrounding environment in a sustainable way.

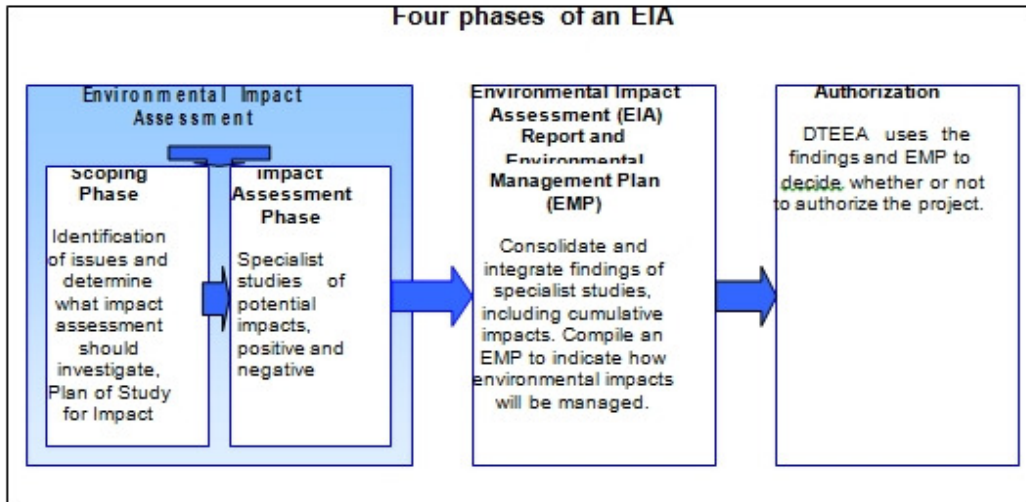
The EIA for this project complies with the NEMA Environmental Impact Assessment Regulations of the Department of Environmental Affairs and Tourism (DEAT). The guiding principles of the EIA are listed below.

1.3 GUIDING PRINCIPLES FOR AN EIA

An EIA typically has four phases, as illustrated in Figure 1 below.

- The EIA must take an open participatory approach throughout. This means that there should be no hidden agendas, no restrictions on the information collected during the process and an open-door policy by the proponent. Technical information must be communicated to stakeholders in a way that is understood by them and that enables them to meaningfully comment on the project.
- There should be on-going consultation with interested and affected parties representing all walks of life. Sufficient time for comment must be allowed. The opportunity for comment should be announced on an on-going basis.
- There should be opportunities for input by specialists and members of the public. Their contributions and issues should be considered when technical specialist studies are conducted and when decisions are made.

Figure 1: EIA Process – Four Phases



1.4 TERMS OF REFERENCE

MvW Environmental Services, as independent environmental managers/consultants, undertook to facilitate the implementation of the Integrated Environmental Management (IEM) process by adopting the following terms of reference:

1. Advertising, requesting that Interested and Affected Parties (I&AP's) register their concerns on the project as well as on the Draft Reports;
2. Identifying and contacting the possible I&AP's;
3. Assessing the issues, impacts and alternatives; and
4. Compiling a Scoping Report and Plan of Study for EIR as well as a full EIA & EMP report once the Scoping Report and Plan of Study for EIR is approved by DESTEA.

The Scoping Report is to include a description of the environment as well as the possible issues that may result from the proposed development. Consultation with I&AP's and the relevant authorities will be used to identify issues that are of particular concern. Furthermore, the experience MvW Environmental Services has gained through working on similar applications required that the following issues amongst others be assessed:

- Geological formations;
- Soil erosion and pollution;
- Storm water management;
- Soil and water (surface and groundwater) contamination;
- Ecological functioning;
- Air quality and Noise;
- Heritage and culture;
- Safety and security;
- Infrastructure and services provision;
- Traffic;
- Socio economic; and
- Landscape character/visual character.

1.5 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS TO BE FOLLOWED

The following section provides a summary of the technical process followed for this EIA (See Figure 2 for the flowchart indication the full EIA process to be followed). The Environmental Impact Assessment (full EIA) is a comprehensive assessment that comprises:

- a) A scoping phase (this report), where issues are identified, and includes a plan of study for EIR; and;
- b) An environmental impact assessment phase, which assesses issues identified in the scoping phase and includes an environmental management plan (EMP), which will address the impacts of the proposed activity.

The full EIA is required:

- For activities in listing notice 2 (R. 984 of 4 December 2014); this activity is listed under section 15 of this listing notice and therefore requires a full EIA to be carried out.

The full EIA is aimed at:

- Activities that due to nature and/or extent are likely to have significant impacts;
- Activities associated with high levels of pollution/ waste/environmental degradation;
- Activities where the impacts cannot easily be predicted; and/or;
- Higher risk activities.

The proposed activity is therefore identified as requiring a full EIA process. The full EIA Process comprises the following Steps to be undertaken by the independent environmental consultant.

STEP 1 – APPLICATION/PROJECT REGISTRATION AS WELL AS SCOPING PHASE

MvW Environmental Services conducted an important application meeting with DESTEA during January 2017. MvW Environmental Services informed DESTEA, about the proposed project and obtained specific requirements prior to drafting the Draft Scoping Report and making it available for public comment.

The urgency of the application was impressed on the authority, and an understanding of co-operative assistance to achieve the best time frames for the project, was discussed.

The following documentation was submitted to DESTEA, Free State Province on the 24th May 2017:

- Application form (See Annexure D for a Copy);
- Locality Map of the proposed site;
- Conceptual Layout Map of the proposed Lourierpark Township Establishment;
- List of adjacent Landowners that will be consulted;
- Declaration of the applicant;
- Declaration of interest of the consultant;
- Electronic Copy of the Draft Scoping Report and Plan of Study of EIR.

The scoping phase included:

- Public participation on the project as well as the Draft Scoping Report and Plan of Study of EIR;
- Identification of the issues relevant for consideration:
 - Potential impacts; and;
 - Alternatives (feasible and reasonable).

The Final Scoping Report was prepared after the end of the public review period, which started on 24/05/2017 and ended on 23/06/2017. The Draft Scoping Report was updated with issues raised by I&AP's and new information generated as a result. The Final Scoping Report was submitted to DESTEA for review on 30 June 2017 and approved by DESTEA on 7 July 2017.

This objective of the Scoping Process according to the EIA Regulations R982 of 4 December 2014 is the following:

The objective is to, through a consultative process-

- Identify the relevant policies and legislation relevant to the activity;
- Motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;
- Identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
- Identify the key issues to be addressed in the assessment phase;
- Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to Inform the location of the development footprint within the preferred site; and
- Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the Extent of the residual risks that need to be managed and monitored.

Content of the Scoping Report and Plan of Study of EIR according to the EIA Regulations R982 of 4 December 2014:

A Scoping Report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process, and must include:

- a. Details of:
 - i. The EAP who prepared the report; and
 - ii. The expertise of the EAP, including a curriculum vitae;
- b. The location of the activity, including:
 - i. The 21 digit Surveyor General code of each cadastral land parcel;
 - ii. Where available, the physical address and farm name;
 - iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;
- c. A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is:
 - i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or
 - ii. On land where the property has not been defined, the coordinates within which the activity is to be undertaken;
- d. A description of the scope of the proposed activity, including:
 - i. All listed and specified activities triggered;
 - ii. A description of the activities to be undertaken, including associated structures and infrastructure;
- e. A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;
- f. A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;
- g. A full description of the process followed to reach the proposed preferred activity, site and location within the site, including:
 - i. Details of all the alternatives considered;
 - ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;
 - iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;
 - iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
 - v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts:
 - vi. Can be reversed;
 - vii. May cause irreplaceable loss of resources; and
 - viii. Can be avoided, managed or mitigated;

- ix. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;
 - x. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
 - xi. The possible mitigation measures that could be applied and level of residual risk;
 - xii. The outcome of the site selection matrix;
 - xiii. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and
 - xiv. A concluding statement indicating the preferred alternatives, including preferred location of the activity;
- h. A plan of study for undertaking the environmental impact assessment process to be undertaken, including:
- i. A description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity;
 - ii. A description of the aspects to be assessed as part of the environmental impact assessment process;
 - iii. Aspects to be assessed by specialists;
 - iv. A description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists;
 - v. A description of the proposed method of assessing duration and significance;
 - vi. An indication of the stages at which the competent authority will be consulted;
 - vii. Particulars of the public participation process that will be conducted during the environmental impact assessment process; and
 - viii. A description of the tasks that will be undertaken as part of the environmental impact assessment process;
 - ix. Identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.
- i. An undertaking under oath or affirmation by the EAP in relation to:
- i. The correctness of the information provided in the report;
 - ii. The inclusion of comments and inputs from stakeholders and interested and affected parties; and
 - iii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;
- j. An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;
- k. Where applicable, any specific information required by the competent authority; and
- l. Any other matter required in terms of section 24(4)(a) and (b) of the Act.

STEP 2 – I&AP AND RELEVANT AUTHORITIES REVIEW

Public Participation on Draft Scoping Report and Plan of Study if EIR:

The project and availability of the Draft Scoping Report was announced by means of the following:

- Publication of a media advertisement in the local/regional newspaper, The Express on the 26th April 2017.
- On-site notices advertising the EIA have been placed at the following public locations on 24th May 2017:
 - At the proposed site at the access road to Lourierpark;

- Notices were placed at the Filling Station at Casino.
- Mail drop to all directly adjacent landowners;

All the issues raised on the proposed development as well as on the Draft Scoping Report and Plan of Study of EIR was captured in the Final Scoping Report and Plan of Study of EIR that was submitted to DESTEA for review. A period of 30 days was allowed for public comment on the Draft Scoping Report and Plan of Study of EIR.

The Draft Scoping Report and Plan of Study of EIR were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final Scoping Report was prepared after the end of the public review period, which started on 24/05/2017 and ended on 23/06/2017. The Draft Report was updated with issues raised by I&AP's and new information generated as a result. The Final Scoping Report was submitted to DESTEA for review on 30 June 2017.

Public Participation on Draft Environmental Impact Report & EMP:

Public participation during this Impact Assessment Phase of the EIA revolves around a review of the findings of the EIR and inputs into the Environmental Management Plan (EMP). The findings are presented in this Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies.

The availability of the Draft EIR and EMP were announced by means of the following:

- Publication of a media advertisement in the local/regional newspaper, The Express on the 13th September 2017.

All the issues raised on the proposed development as well as on the Final Scoping Report and Plan of Study of EIR was captured in this Draft EIR to be submitted to DESTEA for review. A period of 30 days will be available for public comment on the Draft EIR & EMP.

This Draft EIR & EMP were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final EIR and EMP will be prepared after the end of the public review period, which will start on 19/09/2017 and ended on 18/10/2017. The Draft Report will be updated with issues raised by I&AP's and new information generated as a result. The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017.

STEP 3 – SUBMISSION OF FINAL SCOPING REPORT AND PLAN OF STUDY OF EIR (S&EIR) TO DESTEA

The Final S&EIR was prepared after the end of the public review period, which started on 24/05/2017 and ends on 23/06/2017. The Draft Report was updated with issues raised by I&AP's and new information generated as a result. The Final Scoping Report was then submitted to DESTEA for review on the 30 June 2017.

According to the EIA Regulations R 982 of 4 December 2014 the following:

- a. If S&EIR must be applied to an application, the applicant must, within 44 days of receipt of the application by the competent authority, submit to the competent authority a scoping report which has been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority.
- b. Subject to regulation 46, and if the findings of the Scoping Report is still valid and the environmental context has not changed, the submission of a Scoping Report as contemplated in sub regulation (1) need not be complied with:
 - i. In cases where a Scoping Report was accepted as part of a previous application for environmental authorisation and the application was refused because of insufficient information;
 - ii. On condition that regulation 16 is complied with and that such application is accompanied by proof that registered interested and affected parties, who participated in the public participation process conducted as part of the previous application, have been notified of this intended resubmission of the application prior to submission of such application;

STEP 4 – CONSIDERATION OF SCOPING REPORT AND PLAN OF STUDY OF EIR BY DESTEA

DESTEA will have 43 days from the receipt of the Scoping Report and Plan of Study of EIR to:

- a. Accept the Scoping Report, with or without conditions, and advise the applicant to proceed or continue with the tasks contemplated in the plan of study for environmental impact assessment; or
- b. Refuse environmental authorisation if the proposed activity is in conflict with a prohibition contained in legislation; or if the Scoping Report does not substantially comply with Appendix 2 of the EIA Regulations R982 and the applicant is unwilling or unable to ensure compliance with these requirements within the prescribed timeframe. If the report needs to be amended, the authority will have a further 30 (thirty) days after receipt of the amended document to make its written assessment of the report.

The Final Scoping Report was submitted to DESTEA for review on 30 June 2017 and approved by DESTEA on 7 July 2017.

STEP 5 – ENVIRONMENTAL IMPACT ASSESSMENT PHASE

Once the SR and PoS-EIR was accepted by DESTEA, drafting of the EIR started.

According to the EIA Regulations R 982 of 4 December 2014 the following:

- i. The environmental impact assessment process must be undertaken in line with the approved plan of study for environmental impact assessment.
- ii. The environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the environmental impact assessment report.

The objective of the Environmental Impact Report according to the EIA Regulations R982 of 4 December 2014 the following:

1. The objective of the environmental impact assessment process is to, through a consultative process:
 - i. Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
 - ii. Describe the need and desirability of the proposed activity, including the need and

- desirability of the activity in the context of the preferred location;
- iii. Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
 - iv. Determine the:
 - a. Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
 - b. Degree to which these impacts:
 - i. Can be reversed;
 - ii. May cause irreplaceable loss of resources, and
 - iii. Can be avoided, managed or mitigated;
 - v. Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
 - vi. Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
 - vii. Identify suitable measures to avoid, manage or mitigate identified impacts; and
 - viii. Identify residual risks that need to be managed and monitored.

The scope of assessment and content of Environmental Impact Report (EIR) will contain according to the detailed implementation of the EIA Regulations R982 of 4 December 2014 the following:

- a. Details of:
 - i. The EAP who prepared the report; and
 - ii. The expertise of the EAP, including a curriculum vitae;
- b. The location of the activity, including:
 - i. The 21 digit Surveyor General code of each cadastral land parcel;
 - ii. Where available, the physical address and farm name; and
 - iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;
- c. A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is:
 - i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;
 - ii. On land where the property has not been defined, the coordinates within which the activity is to be undertaken;
- d. A description of the scope of the proposed activity, including:
 - i. All listed and specified activities triggered and being applied for; and
 - ii. A description of the associated structures and infrastructure related to the development;

- e. A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;
- f. A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;
- g. A motivation for the preferred development footprint within the approved site;
- h. A full description of the process followed to reach the proposed development footprint within the approved site, including:
 - i. Details of the development footprint alternatives considered;
 - ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;
 - iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;
 - iv. The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
 - v. The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts:
 - a. Can be reversed;
 - b. May cause irreplaceable loss of resources; and
 - c. Can be avoided, managed or mitigated;
- i. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;
- ii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
- iii. The possible mitigation measures that could be applied and level of residual risk;
- iv. If no alternative development locations for the activity were investigated, the motivation for not considering such; and
- v. A concluding statement indicating the preferred alternative development location within the approved site;
- i. A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including:
 - a. A description of all environmental issues and risks that were identified during the environmental impact assessment process; and
 - b. An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;
- j. An assessment of each identified potentially significant impact and risk, including:
 - i. Cumulative impacts;
 - ii. The nature, significance and consequences of the impact and risk;
 - iii. The extent and duration of the impact and risk;
 - iv. The probability of the impact and risk occurring;
 - v. The degree to which the impact and risk can be reversed;

- vi. The degree to which the impact and risk may cause irreplaceable loss of resources; and
 - vii. The degree to which the impact and risk can be mitigated;
- k. Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;
- l. An environmental impact statement which contains:
- i. A summary of the key findings of the environmental impact assessment;
 - ii. A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and
 - iii. A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.
- m. Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;
- n. The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;
- o. Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;
- p. A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;
- q. A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;
- r. Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;
- s. An undertaking under oath or affirmation by the EAP in relation to:
- i. The correctness of the information provided in the reports;
 - ii. The inclusion of comments and inputs from stakeholders and I&APs;
 - iii. The inclusion of inputs and recommendations from the specialist reports where relevant; and
 - iv. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.
- t. Where applicable, details of any financial provisions for the rehabilitation, closure, and on-going post decommissioning management of negative environmental impacts;
- u. An indication of any deviation from the approved scoping report, including the plan of study, including:
- i. Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and
 - ii. A motivation for the deviation;
- v. Any specific information that may be required by the competent authority; and
- w. Any other matters required in terms of section 24(4)(a) and (b) of the Act.

The content of Environmental Management Programme (EMPr) will contain according to the EIA Regulations R982 of 4 December 2014 the following:

An EMPr must comply with section 24N of the Act and include:

- a. Details of:
 - i. The EAP who prepared the EMPr; and
 - ii. The expertise of that EAP to prepare an EMPr, including a curriculum vitae;
- b. A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;
- c. A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;
- d. A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including:
 - i. Planning and design;
 - ii. Pre-construction activities;
 - iii. Construction activities;
 - iv. Rehabilitation of the environment after construction and where applicable post closure; and
 - v. Where relevant, operation activities
- e. A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);
- f. A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to:
 - i. Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
 - ii. Comply with any prescribed environmental management standards or practices;
 - iii. Comply with any applicable provisions of the Act regarding closure, where applicable; and
 - iv. Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.
- g. The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
- h. The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
- i. A indication of the persons who will be responsible for the implementation of the impact management actions;
- j. The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
- k. The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
- l. A program for reporting on compliance, taking into account the requirements as prescribed

by the Regulations;

m. An environmental awareness plan describing the manner in which:

- i. The applicant intends to inform his or her employees of any environmental risk which may result from their work; and
- ii. Risks must be dealt with in order to avoid pollution or the degradation of the environment; and

n. Any specific information that may be required by the competent authority.

STEP 6 – REVIEW OF THE EIR BY I&AP'S

The Draft version of the EIR & EMP will be made available to the registered I&AP's for consideration for a period of 30 days from 19 September 2017. Comments received will be integrated into the Final EIR for submission to DESTEA.

The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017.

STEP 7 – SUBMISSION AND CONSIDERATION OF ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PLAN

a. The applicant must within 106 days of the acceptance of the Scoping Report submit to the competent authority:

- i. An environmental impact report inclusive of any specialist reports, and an EMPr, which must have been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority; or
- ii. A notification in writing that the environmental impact report inclusive of any specialist reports, and an EMPr, will be submitted within 156 days of acceptance of the scoping report by the competent authority, as significant changes have been made or significant new information has been added to the environmental impact report or EMPr, which changes or information was not contained in the reports consulted on during the initial public participation process contemplated in sub regulation (1)(a), and that the revised environmental impact report or EMPr will be subjected to another public participation process of at least 30 days.

b. In the event where sub regulation (1)(b) applies, the environmental impact report inclusive of specialist reports and EMPr, which reflects the incorporation of comments received, including any comments of the competent authority, must be submitted to the competent authority within 156 days of receipt of the application by the competent authority.

c. An environmental impact: report must contain all information set out in Appendix 3 to these Regulations and, where the application is for an environmental authorisation for prospecting, exploration, extraction and primary processing of a mineral or petroleum resource or activities directly related thereto, the environmental impact report must address the requirements as determined in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, mining or production operations, made in terms of the Act.

d. An EMPr must contain all information set out in Appendix 4 to these Regulations and, where the application is for an environmental authorisation is for prospecting, exploration, extraction and primary processing of a mineral or petroleum resource or activities directly related thereto, the EMPr must address the requirements as determined in the regulations, pertaining to the financial provision for the rehabilitation, closure and post closure of prospecting, mining or production operations, made in terms of the Act.

e. A specialist report must contain all information set out in Appendix 6 to these Regulations.

The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017.

STEP 8 – DECISION REACHED BY DESTEA ON S&EIR APPLICATION

- a. The competent authority must within 107 days of receipt of the environmental impact report and EMP, in writing:
 - i. Grant environmental authorisation in respect of all or part of the activity applied for; or
 - ii. Refuse environmental authorisation.
- b. To the extent that authorisation is granted for an alternative, such alternative must for the purposes of sub regulation (1) be regarded as having been applied for, consulted on and its impacts investigated.
- c. On having reached a decision, the competent authority must comply with regulation 4(1), after which an applicant must comply with regulation 4(2).
- d. The Minister responsible for Mineral Resources may only issue an authorization if the provisions of section 24P(1) of the Act have been complied with.

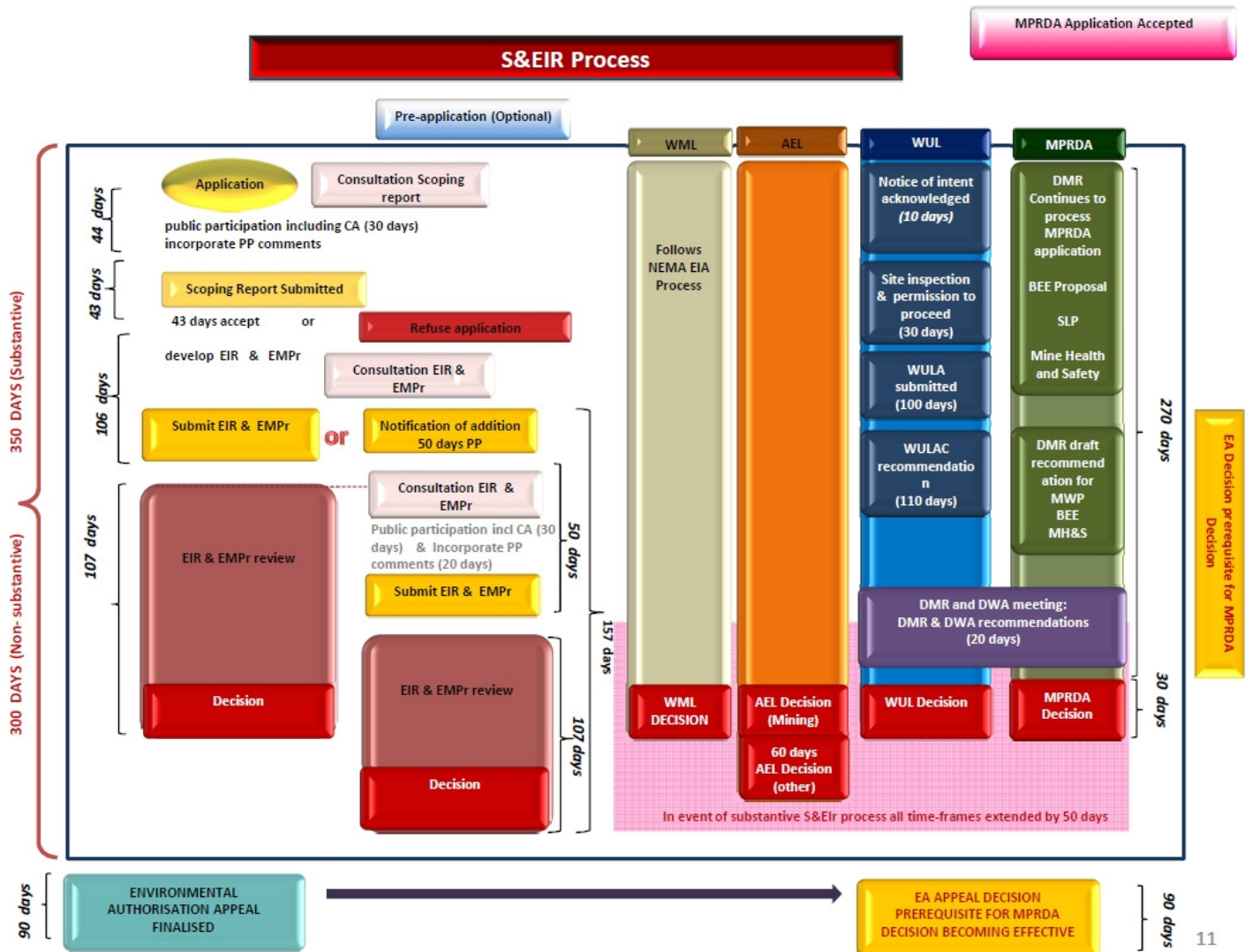
The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017. The 107 days for DESTEA to issue or refuse the EIR will lapse on 5 February 2018.

STEP 9 – NOTIFICATION OF REGISTERED I&AP'S ON THE DECISION (ENVIRONMENTAL AUTHORISATION) REACHED BY DESTEA

On receipt of the decision, MvW Environmental Services (EAP) will notify all I&AP's:

- Of the outcome of the application;
- Of the reasons for the decision; and;
- That an appeal may be lodged.

Figure 2: Full EIA Process According to the 2014 EIA Regulations



1.6 ASSUMPTIONS AND LIMITATIONS

1.6.1 Stage of Project

Adequate timing has been allowed for the EIA exercise. Particular note should, however, be taken of the fact that this EIA Report has been compiled during the conceptual stages of the Project.

1.6.2 Availability of Baseline Information

The majority of baseline information was readily available.

1.7 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

The aim of this component of the report is to provide a brief overview of the pertinent relevant policy, legal and administrative requirements which are applicable to the proposed project.

1.7.1 NEMA and Environmental Impact Assessment Regulations

The proposed development will possibly involve the following listed activities as stipulated in the amended EIA Regulations of 4 December 2014:

As per Government Notice Number R. 983 of 2014, the following listed activities are included for the above application:

28. Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming. Equestrian purposes or afforestation on or after 01 April 1998 and where such development:

- (i) Will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or
- (ii) Will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;

Excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.

The above activities are all Basic Assessment activities. However, we confirm that the application will remain a Scoping and EIA application, due to the following listed activities as per Government Notice Number 984 of 2014:

15. The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-

- (i) The undertaking of a linear activity; or
- (ii) Maintenance purposes undertaken in accordance with a maintenance management plan.

1.7.2 Constitution of South Africa (Act 108 of 1996)

In the simplest terms, the Regulations aim to meet the requirements of the Constitution (Act No. 108 of 1996), most specifically section 24, which indicate that all citizens of South Africa have the right:

- a) to an environment that is not harmful to their health or well-being; and;
- b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
 - i. prevent pollution and ecological degradation;
 - ii. promote conservation; and;

- iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”

1.7.3 Environmental Conservation Act (ECA), 1989 (Act 73 of 1989)

The Constitution as an over-arching law was bolstered by the previous Environment Conservation Act (Act No. 73 of 1989) and its related Environmental Impact Assessment (EIA) Regulations (Government Notice No. R. 1182 & 1183 of 5th September 1997; Amendment: GN No. R. 670 & 672 of 10th May 2002). The aim of the ECA was:

“To provide for the effective protection and controlled utilisation of the environment and for matters incidental thereto.”

The ECA and its related Regulations, therefore, provided specific measures by which the above aim of the ECA could be met, including provision of the so-called “listed activities” linked to an administrative process to ensure that development was controlled in a sustainable manner.

Note that with the commencement of the new NEMA Regulations the previous ECA Regulations have been repealed.

1.7.4 Integrated Environmental Management

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

1.7.5 National Water Act, 1998 (Act 36 of 1998)

The National Water Act aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation’s water resources are protected, used, developed, conserved, managed and controlled in ways, which take into account:

- Meeting the basic human needs of present and future generation;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources; and
- Meeting international obligations.

Section 19 of the National Water Act, Act 36 of 1998 requires that all reasonable measures be taken to prevent any water pollution from occurring, continuing or recurring. The Act further describes a number of water uses and requires that a water use License have to be obtained for the specified water uses.

The Rooi Dam is within the 500m zone which means that the project triggers a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998). This application do not form part if this EIR and must therefore be in place before the construction may commence.

1.7.6 Water Services Act (Act 108 of 1997)

No person may obtain water for industrial use from any source other than a water services provider nominated by the water services authority. Applicable to developments where the water required for the project will be obtained from a source other than from an established municipal supply system.

The water services provider must approve the manner of disposal of industrial effluent.

1.7.7 National Environmental Biodiversity Act (Act 10 of 2004)

The National Environmental Management Biodiversity Act (Act No. 10 of 2004), aims to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.

The diversity of ecological processes for the proposed site is to be determined through the specialist studies to be conducted. The outcome/recommendations of the specialist studies will determine the manner in which the biodiversity on site is to be managed, and whether the ecological elements on site need to form part of a greater environmental management framework for the region.

1.7.8 National Heritage Resources Act (NHRA) 1999 (Act 25 of 1999)

The National Heritage Resources Act legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Section 38 of the NHRA makes provision for developers to apply for a permit before any heritage resource may be damaged or destroyed. Permits are administered by the South African Heritage Resources Agency (SAHRA).

The Act defines cultural significance, archaeological and palaeontological sites and material (Section 35), historical sites and structures (Section 34), graves and burial sites (Section 36) that falls under its jurisdiction. Archaeological sites and material are generally those resources older than a hundred years, while Section 34 also protects structures and cultural landscapes older than 60 years, including gravestones. Procedures for managing grave and burial grounds are clearly set out in Section 36 of the NHRA. Graves older than 100 years are legislated as archaeological sites and must be dealt with accordingly.

The size of the application site warrants that a specialist Heritage Assessment be conducted. Mr Cobus Dreyer previously from the National Museum, has been appointed by MvW Environmental Services to conduct the Heritage Impact Assessment for the project. This report forms part of the EIA Report, and the findings of the specialist input will be reported upon in detail.

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

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

The diversity of ecological processes for the application sites is to be determined through the specialist studies to be conducted. The outcome/recommendations of the specialist studies will determine the manner in which the biodiversity on site is to be managed, and whether the ecological elements on site need to form part of a greater environmental management framework for the region.

1.7.10 Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965)

The purpose of this Act is to provide for the prevention of the pollution of the atmosphere, for the establishment of a National Air Pollution Advisory Committee, and for matters incidental thereto.

1.7.11 National Building Regulations and Building Standards Act 103 of 1997

Provides to the promotion of uniformity in the law relating to the erection of buildings in the areas of local authorities and prescribes building standards. Also provides that the owner of land on which any excavation work is in progress must take precautions to limit the amount of dust generated in the area. Also prohibits the generation of noise on certain days that would unreasonably disturb the neighbourhood.

1.7.12 Hazardous Substances Act 15 of 1973

The Hazardous Substances Act 15 of 1973 provides for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature or the generation of pressure thereby in certain circumstances, and for the control of certain electronic products; to provide for the division of such substances or products into groups in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products; and to provide for matters connected therewith (Henderson, 1996).

Where hazardous substances are used during construction and operation, the Hazardous Substances Act must be strictly applied. Incident management plans must include measures of limiting dangers of hazardous substances in the event of transport vehicle spillages along the route.

1.7.13 Conservation of Agricultural Resources Act (Act 43 of 1983)

This act provide for the control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants. The following impacts of developments are all subject to the control measures prescribed by the Minister in terms of the Act.

- Soil surface erosion and deterioration of soil quality and productivity;
- Flooding potential;
- Soil pollution;
- Subsidence, water logging and mass movements such as landslides and rock falls;
- Degradation, destruction or elimination of ecosystems;
- Introduction of elements that is uncharacteristic with the aesthetics and landscape character of the area.

With regard to the potential for the development to introduce new species to an area, or where developments take place on land where weeds and invasive plants occur, regulations relating to weeds and invasive plants may be applicable.

1.7.14 National Veld and Fires Act (Act 101 of 1998)

This act provides for the control of veld fires. The regulations in terms of this act set certain conditions for the owner of a property for emergency preparedness for the control of veld fires. It also describes the compulsory making of firebreaks to control veldt fires that originates on the owner's property as well as on adjacent properties.

1.7.15 Other Legislation which may also Apply Includes the Following:

- MMM Urban Open Space Policy and Framework Plan;
- MMM Spatial Development Framework;
- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);
- South African Manual for Outdoor advertising Control (SAMOAC);
- Local Government: Municipal Systems Act 32 of 2000;
- Common law principles form the basis of current neighbour law and the law of nuisance Delict, Nuisance & Neighbour Law;
- Mines, Health and Safety Act 29 of 1996;

- Explosives Act;
- Development Facilitation Act 67 of 1995;
- Basic Conditions of Employment Act 75 of 1997.

Apart from the above, cognisance must also be taken of Local and Provincial Government Ordinances, which may be applicable to the proposed development. For example:

1.7.16 Protected species – Provincial Ordinances

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the Provincial Departments of Environmental Affairs.

The ecological specialist studies to be conducted for the proposed site will determine the presence of protected or vulnerable species. If protected and/or vulnerable species are indeed located on site, these species will be managed as part of an ecological framework for the site, in order to ensure the viable genetic distribution and migration of the protected species from the application sites to connecting open spaces and riparian systems.

SECTION 2: DEFINITIONS

2.1 THE APPLICANT

Mangaung Metro Municipality hereinafter referred to as “the Applicant”.

2.2 THE INDEPENDENT ENVIRONMENTAL CONSULTANT

MvW Environmental Services hereinafter referred to as “the Independent Environmental Consultant”.

2.3 THE CONSULTING ENGINEER

Phethogo Consulting Engineers hereinafter referred to as “the Consulting Engineer”.

2.4 THE CONTRACTOR

The entity to be appointed by the Consulting Engineer or the Proponent, responsible for the conduct of all on-study area activities related to the construction and implementation of the Project, hereinafter referred to as “the Contractor.” Where more than one entity is appointed, all entities are jointly and severally liable for the conduct of the responsibilities of the Contractor as outlined in this EMP.

2.5 THE ENVIRONMENTAL CONTROL OFFICER

The entity to be appointed by the Applicant to audit compliance with the EMP to be compiled as part of the EIR, and hereinafter referred to as “the ECO” or “the Environmental Control Officer”.

2.6 THE ENVIRONMENTAL LIAISON OFFICER

The entity to be appointed by the Contractor to ensure compliance with the EMP, and hereinafter referred to as “the ELO” or “the Environmental Liaison Officer”.

2.7 THE SUB-CONTRACTOR

Any sub-contractor appointed by the Contractor to undertake any works related to the Project.

2.8 THE PROJECT

All activities related to the proposed development (Proposed Lourierpark Township Establishment), as described in Section 3: and hereinafter referred to as “the Project.”

2.9 THE STUDY AREA

The land upon which the Project will be undertaken (Portion 1 of the farm Brandkop 702), as described in section 3, delineated, for information purposes only, on Figure 3 & 4 and hereinafter referred to as “the Study area.”

Figure 3: Locality of the Proposed Site



2.10 THE ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan to form part of the EIR, and hereinafter referred to as the “Environmental Management Plan” or “the EMP”.

SECTION 3: PROJECT PROPOSAL

3.1 INTRODUCTION

MvW Environmental Services, as an independent Environmental Assessment Practitioner (EAP), has been appointed by Mangaung Metro Municipality to facilitate the EIA process for the proposed Township Establishment at Louierpark, Bloemfontein in the Free State Province.

The land earmarked for the development is ±357Ha in extent and is owned by Mangaung Metro Municipality. The project will deliver temporary and permanent work opportunities during both the construction and operational phases. See the Proposed Township Establishment's Breakdown in the table 1 below.

The study area for this investigation is located approximately 10 km directly south west of the City of Bloemfontein, within the central portion of the Free State Province, South Africa. Bloemfontein is the capital city of the Free State Province and, as the judicial capital of the nation, one of South Africa's three national capitals.

3.2 LOCATION

The proposed Development is located on the farm Brandkop 702 on the southern side of Bloemfontein just south of the Jagersfontein Road and is an extension of the existing Louierpark suburb. The site is seen to have a proposed surface area of approximately 357 Ha, and is easily accessible via the R706.

The following farm portions are applicable:

- Portion 1 of the Farm Brandkop 702, Bloemfontein District.

The project site falls within the quarter degree square 2926AA. Figure 4 is a Google Earth photo of the project site and Figure 5 is a proposed layout plan of the project site.

The following is the coordinates of the proposed development site:

- 29° 11' 32" S
26° 09' 50" E

See Annexure A for the locality map and Annexure C for photographs taken of the proposed site.

3.3 LOCAL AUTHORITY

The site falls into the area of jurisdiction of Mangaung Metro Municipality.

3.4 PROPERTY OWNERSHIP

The proposed site for the proposed Louierpark Township Establishment is owned by Mangaung Metro Municipality that is also the applicant.

3.5 EXISTING LAND USES

The project site is situated on an undeveloped portion of the farm Brandkop 702. The project site is surrounded by residential developments on the north-eastern side, small holdings on its south-eastern and south-western sides and farms on its north-western sides. Large areas of the site have been ploughed and left fallow. At present communal cattle graze the area.

3.6 DEVELOPMENT PLANNING

The proposed area falls within the Spatial Development Framework of the Mangaung Metro Municipality. The proposed site is shown as future residential area. The proposed development is therefore in line with the Spatial Development Framework plan for MMM.

3.7 PROJECT DESCRIPTION

The land earmarked for the development is ±357Ha in extent and is owned by Mangaung Metro Municipality. The project will deliver temporary and permanent work opportunities during both the construction and operational phases. See the proposed Lourierpark Township Development's Breakdown in table 1 below.

3.7.1 Layout

The layout plan makes provision for 2356 erven and streets that can be accommodated on these portions of vacant land. The Surveyor General will be requested to allocate erf numbers to this extension as well as the extension number.

Table 1: Land Use Table for the Proposed Lourierpark Township Development

LAND USE	NUMBER OF ERVEN	AREA/HA	% OF DEVELOPMENT
Residential	2306	100.0278	28.05
General Residential (±483 units)	7	16.1304	4.53
Business	9	3.3838	0.95
Community Facility – Education	3	17.2838	4.85
Community Facility – Crèche	11	2.6017	0.73
Community Facility – Church	13	3.2027	0.89
CENTLEC	1	0.5103	0.14
Parks	6	128.9371	36.1
N8	0	31.2440	8.77
Streets	0	53.7908	15.09
TOTAL	2356	357.1124	100.00

See Annexure B for the concept layout map for the proposed Lourierpark Township Development.

3.7.2 Residential Development

The proposed residential development is southwest of Lourierpark and Bloemfontein. This proposal takes up the portion of the area that is available on both sides of the proposed N8 in Lourierpark for township establishment purposes.

This area has been identified as an area for future residential development in the spatial development framework of the Mangaung IDP. The area which is situated southwest of Bloemfontein (Lourierpark) extension 148 is still inside the urban fringe.

The building line of 60m from the proposed N8 has a serious impact on the development of available land. An area of 40m wide is left open between the N8 boundary and erf boundaries while a 20m building line is applicable on the erven.

The 2306 residential erven are on average 350-400 m² in size while some larger erven were provided on block corners to make provision for building lines. Services can be provided to the erven from the adjacent extensions.

The gradient of the area is acceptable for residential development although certain areas will have to take storm water runoff and placement of houses into account when developing the erven. The Wetlands Report has identified a “wetland” in especially the southeaster area. Together with the required 50m buffer around the wetland and the proposed N8 a large area is not developable. It would however be possible to provide another 700-800 erven in the “wetlands” area if the storm water channel was diverted to the flood line area.

3.7.3 Streets

Access to the areas is from 2 points from the R706-Jagersfontein road and internal streets of the present Lourierpark. The 35m main streets from the R706 will link up with the 35m street in Lourierpark. The main streets of 35m and 19m will also function as the bus or taxi routes. They provide enough space for vehicles to stop and to drop off or pick up passengers. Special parking room has been provided next to the schools for vehicles, taxis and busses. The remaining streets are 16m wide. There is also an underpass link between the 2 portions of the township establishment in a position identified by SANRAL’s consultant.

The general gradient in the streets in the proposed development is on average between 1:100 and 1:300. The main streets will be provided with permanent paving in the future and the streets will also have the function to accommodate storm water as described in the next paragraph. The expected rainfall in this area will present no problems in this regard.

In the areas where the proposed N8 crosses the wetlands the design of the road will have to conform to standards specified by DESTEA. Its however important to note that the development of the proposed new N8 road is being handled by a separate Environmental Impact Assessment and does not form part of this study.

3.7.4 Parks and Municipal

Three large parks have been provided which are designated to be used as informal soccer fields. There are 3 parks provided which accommodate the power line servitudes. The largest parks accommodate the wetlands. A number of openings in the large park provide openings for storm water drainage. The total park area is more than 128ha which is much more than the required 15% of the total area.

3.7.5 Business

Nine business sites of between 1593 - 3324m² have been provided in the layout. The large site of 1,3815ha can accommodate a small shopping complex. The shops are situated next to the main and collector streets in the layout or at central points in the residential areas.

3.7.6 Education

11 crèche sites between 1399 and 3237m² have been provided. Some of the crèche sites are next to a church which allows a church related organisation to manage a crèche.

There are 2 lower primary schools and 1 secondary school site in the existing Lourierpark.

According to the standards or guidelines of the Department of Education 2 lower primary school sites as well as a secondary school site have to be provided. The school sites have been placed on the more level areas to reduce development costs.

3.7.7 Church

Based on normal planning standards and the request from the Municipality 13 church sites which range in size from 1740 - 3537m² have been provided. It is possible to use residential erven for church purposes through a consent use application.

3.8 PROJECT MOTIVATION

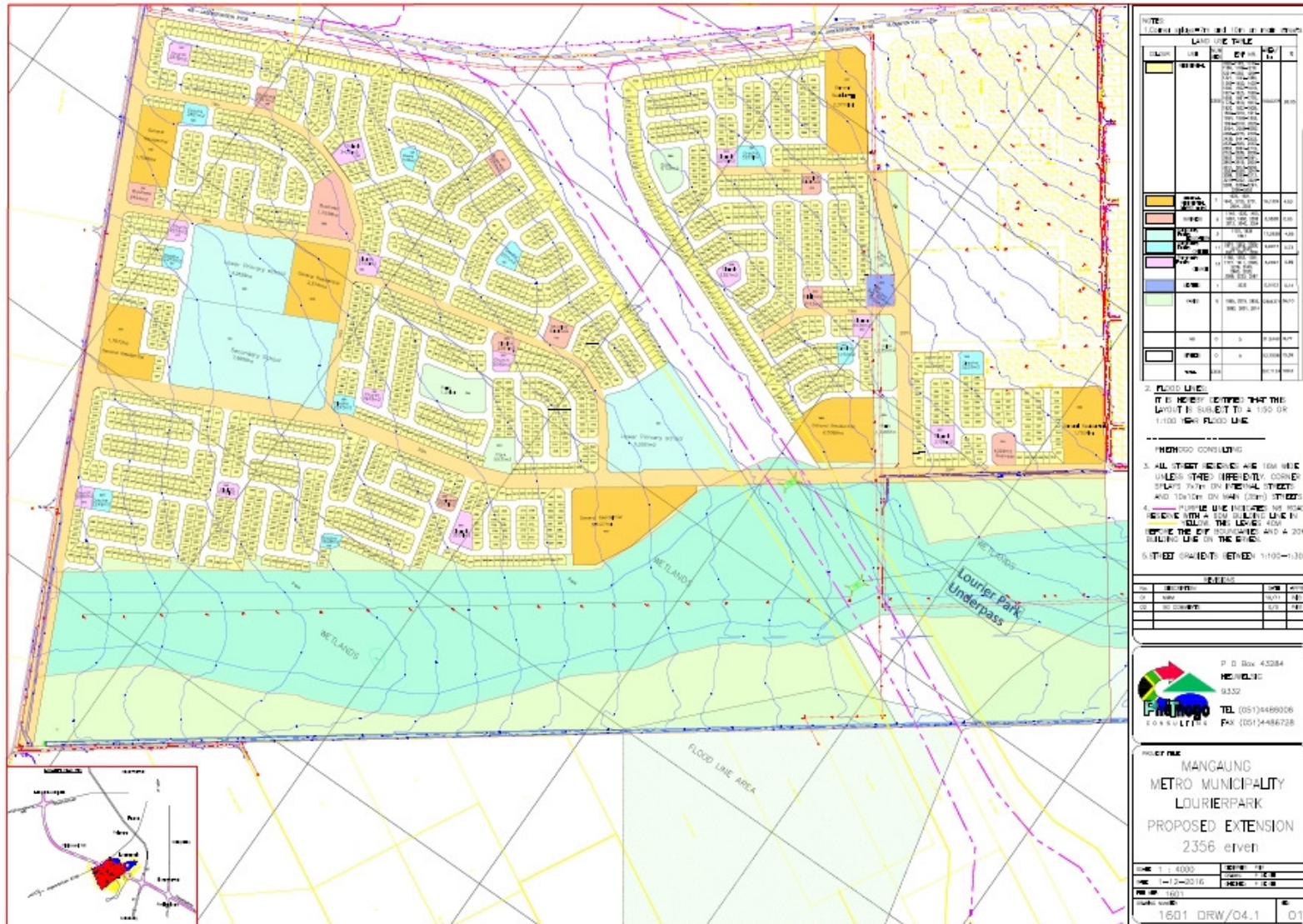
The Mangaung Metro Municipality is in need of residential erven in Bloemfontein, Lourierpark to be able to satisfy the waiting list for erven. According to the SDF and business plan there was a need of erven in Bloemfontein. This proposed layout is situated within the present and future residential areas on the SDF Map therefore in line with the SDF for Mangaung.

In order to get the urgently needed erven, the Municipality advertised for tenders and appointed Phethogo Consulting by letter dated 8 March 2016 to proceed with the planning and surveying of 2000 erven in Lourierpark, Bloemfontein. As is indicated in the Spatial Development Framework of Bloemfontein and Lourierpark, the identified portion of land has been earmarked for future extension and this area can also be serviced from the adjacent networks.

Figure 4: Aerial Photograph Showing the Proposed Site at Lourierpark



Figure 5: Proposed Layout Plan for Lourierpark



3.9 ENGINEERING SERVICES

The Local Authority will provide the erven with services. All services are available from the adjacent Lourierpark Township and the extension of the services to the new erven will not be a problem. A Services Report dated September 2016 by Phethogo Consulting is attached in Annexure F1 and confirms that the development can proceed. This report was prepared for 2000 erven but Phethogo Consulting has indicated that the larger number of erven won't create a problem.

A summary of the Services Report will be given below.

3.9.1 Water

Existing Services

The development area falls within the Brandkop water supply area which is supplied by the Welbedacht Bloemwater reservoir. The existing part of Lourierpark and a part of Pellisier are supplied with a 600 mm diameter pipeline from the Welbedacht Reservoir situated in Pellisier. This reservoir is owned and operated by Bloemwater, has a bottom elevation of 1486 m and a storage capacity of 136 ML.

In the Ferreira and Bonnievale Small Holdings area adjacent to the Development on the south-eastern side, the main water supply is from the Slypsteenberg Reservoir. The existing network is currently already under pressure for water demand.

The average demand on the Welbedacht Reservoir from existing developments is estimated as 4.02 ML/day. A pressure reducing valve was installed upstream of the Development for the Lourierpark suburb resulting in low pressure readings. Please refer to the Consultant's report attached as Annexure F1 of the Services Report for measured flows in the existing Lourierpark during the course of a day. The minimum pressure reading was 220 kPa at 11:00 in the morning.

Bulk Services

The 600 mm diameter pipe that is fed directly from the Welbedacht Reservoir is adequate for all the Development scenarios and will be able to supply the Development under peak flow conditions.

Possible connections could be to the 600 mm diameter pipe on the northern side of the Development and to the existing Lourierpark water network next to Jagersfontein Road. In order to obtain the required minimum pressure and fire flow conditions for the Development, the pressure reducing valve will have to be adjusted. The Bentley Hammer programme was used to analyse the system for the water demand of the reticulation.

The connection to the 600mm diameter pipeline is not the favourable option as the main objective of the Bloemwater (Welbedacht) reservoir is that of a terminal storage reservoir and not a supply reservoir. According to the Bloemfontein Bulk Civil Engineering Services Master plan, September 2009 the supply areas of the reservoir are already experiencing water supply problems when maintenance is required or repairs needs to be done on the supply line of Bloemwater. It would be preferable to obtain bulk water supply to the development area from an alternative source.

The following options exist:

- a) Bloemwater Welbedacht reservoir. This is not preferred, but is the easiest owing to the existing connection.
- b) Longridge reservoir. This would be the preferred option, once planned new storage reservoirs are constructed at Longridge.
- c) New reservoir at Slypsteenberg. This is the preferred option under the current conditions.
- d) A new reservoir that forms part of a new water supply zone (Bloemfontein Bulk Civil Engineering Services Master plan option). Apart from Highway Park, Cecilia North and South the reservoir will also supply the Brandkop and Fichardt Land developments. It is not the preferred option as it is not

known when these developments will take place. If the reservoir is constructed, it must make provision for the Lourierpark development.

Internal Reticulation

With the highest level of the Development being at 1416.5m it will be possible to supply the Development under gravity conditions. The existing pipe reticulation system was modelled for fire fighting draw-off. With the main supply from the 600 mm diameter pipe the internal network would consist of a ring mains distributing domestic and fire fighting water within the Development. The area can be classified as “Low Risk, Class 2” for fire fighting purposes. The pipe reticulation system will be designed to allow for sufficient draw-off volumes and pressure for fire fighting. Pipe sizes should range between 75 mm and 300 mm nominal diameters with double and single house connections to within the erf boundaries. Fire hydrants should be spaced 240 m apart throughout the Development. Materials and construction methods will be specified to comply with SANS Standards.

Please refer to a layout of the possible water connections attached as Annexure D of the Services Report attached.

Recommendation Regarding the Bulk Water Capacity

The 600mm diameter pipe in Jagersfontein Road has sufficient capacity to accommodate the development although the 220kpa reading is a concern for fire flow conditions. The pressure reducing valve in the pipeline will have to be adjusted to accommodate the water demand from the Development.

See the Services Report attached in Annexure F1

3.9.2 Sanitation

Existing Services

The existing sewage network of Lourierpark is draining towards a bulk main outfall line close to the southern side of the Development. The size of the pipe varies from 450 to 600 mm diameter where it runs through the Development and drains towards Welvaart Waste Water Treatment Works. This pipeline also serves Pellisier, part of Fichardt Park and Fauna.

According to Bloemfontein Bulk Civil Engineering Services Master plan, September 2009, the Welvaart Waste Water Treatment Works has a design treatment capacity of approximately 5.0 MI/d. Investigations revealed that the current achievable treatment capacity is approximately 3.8 MI/d, but will be increased to 5 MI/day within the next year with upgrades/refurbishment. The highest measured average discharge to the works is approximately 4.0 MI/d, leaving a remaining capacity of 1.0 MI/d. The 4.0 MI/day equals to 46 l/s if taken as an average over 24 hours.

The greatest runoff measured at the lowest point of the bulk outfall sewer pipeline of 600 mm diameter was 175 mm which equals 111 l/s and is 24 % of the 457 l/s capacity of the line.

Please refer to the Consultant’s report attached as Annexure C of the Services Report attached for the measured runoffs.

Bulk Services

With a remaining capacity of 1.0 MI/d in the Welvaart WWTW it can be seen that the works do not have the capacity to accommodate the inflow from the proposed Development. Although the 600mm diameter line with a capacity of 457 l/s can accommodate the peak flow of 34.07 l/s from the Development, the works will have to be upgraded by at least 0.28 MI/day to allow for the Development.

As a temporary alternative, the Development can be constructed in phases once the available 1 MI/day has been exceeded with an on-site treatment system, such as a package plant. It is

generally a requirement that the treated water from these systems be irrigated and not returned directly to a natural watercourse.

The use of these systems will require an Environmental Impact Assessment as well as approval from the Department of Water and Sanitation which could be a lengthy process.

Internal Reticulation

The minimum diameter sewer pipes should be 160 mm on the mains and 110 mm on the erf connections. The sewer mains should mainly run inside the road reserves and single house connections should run within the erf boundaries. Materials and construction methods will be specified to comply with SANS Standards.

Please refer to a layout of the possible sewer connection attached as Annexure E of the attached Services Report.

Recommendation Regarding the Bulk Sewer Capacity

The 600mm diameter outflow pipe to the Welvaart Waste Water Treatment Works (WWTW) is adequate for the development, but the WWTW does not have sufficient capacity to accommodate runoff from the development. For the interim a package plant can be considered.

See the Services Report attached in Annexure F1

3.9.3 Electricity

FCE Consulting Engineers has prepared the attached Electrical Report dated 2016 in which it is stated that “Electrical capacity is available for this development as described in detail” in their report.

a) Existing Electrical Services

The proposed area for this development as indicated on the layout plan is currently not serviced with an electrical infrastructure that could cater for high electrical load densities such as for urban areas.

b) Electrical Services to be Provided

- The developer shall appoint his own electrical consulting engineer that will be responsible for the internal reticulation of the development. The appointed electrical consulting engineers shall liaise with CENTLEC personnel with reference to the design and approval of the infrastructure, prior to the installation thereof.
- The developer shall make an adequate supply of electricity available to every erf according to its designated use.
- Before any construction takes place, CENTLEC shall be provided with a complete set of electrical drawings for reference purposes during the electrical construction.
- All electrical materials used shall be supplied and installed by the developer and be in accordance with the prescribed specifications and standards of CENTLEC.
- A Service Agreement Document shall be compiled by the developer for this development containing all aspects pertaining the electricity reticulation and supply conditions.
- The developer shall arrange for the surveying and the registration of the servitudes and/or plots for the various primary substations and miniature substations needed.
- The developer shall erect the primary substations at optimal positions in servitudes within the development. The primary substation should be as close to the load centre as possible.
- The developer shall supply and install miniature substations at optimal positions in servitudes within the development.
- The developer shall supply and install the necessary primary and secondary cables within the boundaries of the development, supplying the primary substation and miniature substations as required.

- The developer shall supply and install appropriate streetlights in all public roads around and within the development area.
- The developers/owners of each individual stand will be responsible for the meter point cost of each erf as and when needed.
- The developers/owners of each individual stand shall submit building plans for approval by GENTLEC and ensure that the following are adhered to:
 - Prove of subdivision and/or consolidation has been submitted.
 - When applicable, an application has been received and a quotation being provided for the provision of electricity to the development.
 - Detailed voltage drop calculations for the internal development accompany each building plan.

c) Conclusion and Recommendations Regarding Electricity Provision for Development

Enough electrical capacity is available for this development. The following general conditions will apply to the application for the provision of electricity to the proposed development:

- The developer will be required to appoint his own electrical consulting engineer that will be responsible for the internal reticulation of the developments. The appointed electrical consulting engineers shall liaise with CENTLEC personnel with reference to the design and approval of the infrastructure, prior to the installation thereof.
- A Service Agreement Document shall be compiled by the developer, in collaboration with GENTLEC which shall contain all aspects pertaining the electricity reticulation and supply conditions. After the approval and acceptance of the document all parties involved shall abide to this document.
- Before any construction takes place, GENTLEC shall be provided with a signed copy of the Service Agreement and a complete set of the Electrical Design Drawings of the development, which has been approved by GENTLEC and signed by the electrical consultant, for reference purposes during the electrical construction.
- According to the anticipated connection size requirements for the different stands, each stand will be supplied according to its designate use from the 400V three phase low- tension reticulation systems on the different stand boundaries on the sidewalk within the different road servitudes, provided that subdivision takes place into different stands as depicted on your proposed drawing.
- The developer will be required to contribute towards the cost of extending and strengthening CENTLEC's external electrical supply network on a "pro-rata" basis at the ruling rate per kVA, based on the calculated ADMD (after diversity maximum demand) for each development.
- Without prejudice to CENTLEC's rights, the developers will be required to use an average ADMD not less than 1.5kVA for low cost consumer classification, 3.5kVA for middle cost consumer classification and 5.5kVA for high cost consumer classification per single residential stand, and not less than 50kVA per commercial stand. However, written load calculations for each development must accompany every application.
- The developer shall ensure that all the electrical equipment installed or placed by his contractor, be installed at the prescribed height or depth with reference to the final natural ground levels. It is required that all meter boxes and miniature substations be at least 200mm above the average surrounding final ground level. Meter boxes and miniature substations placed on sloped ground shall be placed level and a brick barrier wall shall be build 500mm away, around the higher and lower side and all gaps between the foundation and ground be filled up with 6mm crusher gravel/rock. Substation building floors shall be at least 200mm above the outside natural ground level. Cables shall be installed at the following depths measured from the average final ground level: 11kV cables as well as 400V distribution cables at 800mm and low voltage connection cables as well as streetlight cables not less than 600mm deep.
- The developer shall supply and install miniature substations at optimal positions within the proposed area of development. The developer shall supply and install a copper earth grid underneath the substation. This earth grid shall be installed 100mm underneath the foundations and be in accordance with the GENTLEC requirements.

- The developer shall erect three-room primary substation building inside 14m long x 7m wide servitudes at an optimal position as close as possible to the load centre in line with the CENTLEC distribution philosophy. This building shall be placed longitudinal and parallel to the road reserve and be built according to CENTLEC standard drawing. The outside finishing of the substation building may be the same as the finishing of the development in order to blend in with the surroundings. The developer shall supply and install a copper earth grid underneath the substation. This earth grid shall be installed 100mm underneath the foundations and be in accordance with the CENTLEC standard drawing.
- The developer shall supply and install the miniature transformers that comply with CENTLEC standards and specification, and place it in servitudes at optimal positions within the development. The miniature substation servitudes measuring 6m long and 2.5m wide, as well as servitudes for extended miniature substations measuring 6m long and 2.5m wide, shall be placed along the inside of the erven, longitudinal parallel to the street boundaries .
- The developer shall register 14m x 7m servitudes for the future Primary Substations.
- Cables shall be installed and placed in the road reserve according to the CENTLEC standards. Underground 11kV cables shall be installed in bedded 1m deep trenches.
- It will be the responsibility of the developer to appoint a land surveyor for the identifying of substation erven and servitude pegs, and to register the servitudes in favour of the Local Electrical Distributor, currently CENTLEC (SOC) Ltd, at his/her cost. Legal proof of the registered erven and servitude is required from the Deeds Office before the supply will be energized.
- The developer shall supply and install appropriate streetlights that comply with the latest CENTLEC policy as well as with the latest SANS 10098-1 specifications for street lighting in all public roads within the development area.
- Within one month of completion of the works and installation of the electrical services, CENTLEC shall be provided with detailed record drawings on paper and in DXF file format for Micro station of the electrical services at no cost to CENTLEC. All electrical drawings and township layout plans with network details must be drawn on separate layers according to the current practices of CENTLEC in the CAD program so that separate sheets can be printed.
- Although the responsibility of CENTLEC stops at the metering points on the erf boundaries of developments when CENTLEC is not taking over the internal infrastructures, or on the erf boundaries of the individual stands when CENTLEC takes over the internal infrastructures, it is still required from CENTLEC to approve all building plans within the boundaries of the development with reference to electrical provision to each building.
- Building plans for individual developments within the boundaries of the development shall only be approved by CENTLEC when the following have been adhered to:
 - Prove of subdivision and/or consolidation has been submitted where applicable.
 - When applicable, an application has been received and a quotation being provided for the provision of an electrical metering point to the development or stand within the development.
 - Detailed voltage drop calculations for the internal reticulation of the different stands as well as the internal electrical supplies to the different buildings on a specific stand according to the building plans of that stand accompanies the building plans at the time of submission for approval of building plans.

3.9.4 Storm Water

Stormwater drainage towards the Development is mainly from cultivated lands on the northern side of the Jagersfontein Road through a series of 400 and 600 mm diameter culverts. The road acts as a retention facility in places, however, according to local residents a part of the road is flooded after a heavy rainstorm. No apparent erosion damage is visible on the site.

The main part of the Development drains towards culverts in Denne Lane as well as an open concrete stormwater canal on the southern side. Based on comments from the community the southern part of Denne Lane is flooded after heavy rainstorms. In order to prevent this situation a berm was constructed alongside Denne Lane inside the Development to divert the stormwater to a culvert at the most southern point.

Development of Lourierpark-Services Report 8 September 2016 Upstream of the main part of the Development a dam called Rooddam was constructed to act as a retention facility. The inflow to this dam is through three culverts with a catchment area starting from Pellisier. The outflow is over a U-shape weir into an open concrete canal on the southern side of the Development.

The stormwater drainage system should be designed for a 1: 5-year flood. Stormwater in the development should drain mostly via roadside channels and if required, subsurface concrete pipes. The minimum size should be 375 mm nominal diameter.

The stormwater drainage should be designed taking the inflow from the cultivated lands on the northern side of the Jagersfontein Road into consideration. As future development in these areas are planned, it is proposed that the stormwater design of the Development should only take the current scenario in consideration and that additional runoff from proposed northern developments be diverted alongside the Jagersfontein Road to the western side. This proposal forms part of the BLOEMFONTEIN BULK CIVIL ENGINEERING SERVICES MASTERPLAN.

Please refer to the services and Floodline Report attached as Annexure F1 for a more detailed analysis of the stormwater drainage.

3.9.5 Solid Waste

Mangaung Municipality is responsible for waste collection. Solid waste will be collected once a week.

3.9.6 Roads and Access

The development is situated to the south of the R706 (Jagersfontein Road) and to the west of the existing Lourierpark. Access will be obtained from the R706 road. According to the attached Traffic Impact Assessment this intersection (Nr 1 on map in figure below) must be signalized.

An important factor in this area is the future extension of the Outer Ring Road. SANRAL is planning to develop this portion of the ring road as part of what is known as the N8 Ring Road. Provision has been made for this route in the layout. This EIR however does not include the proposed N8 ring road. A separate study is currently being undertaken for the complete N8 Ring Road that is planned.

Figure 6: Proposed Access to the Development



3.10 ROADS & TRAFFIC

KMA Consulting engineers was also appointed as specialist consultants on the project, to investigate traffic issues in the area as well as compile a traffic impact study for the proposed new township development. See Annexure F3 for the Traffic Impact Report.

The proposed development was also discussed with Mr W Naude of the Provincial Roads Department. The proposed development is acceptable subject to certain conditions regarding access to the Jagersfontein Road R706 which have to be designed and approved by Metro Roads and the Provincial Roads Department.

The proposed layout plan was also submitted to SANRAL as their proposed N8 route is traversing this area. The “final” alignment of the N8 was obtained from SANRAL’s consultant Nyeleti Consulting. Nyeleti also provided the information and position regarding the underpass which links the 2 areas of the proposed township.

3.10.1 Conclusions and Recommendations of the Traffic Impact Assessment

The following conclusions can be made from the study:

- The development is expected to generate 3246 and 2539 peak hour trips as a maximum during the morning and afternoon peak hours.
- Most of the intersections in the study area will have to be upgraded and/or signalise with full development and if the area has low vehicle ownership. Actual trip generation might be lower than assumed, with the result that upgrading of intersections should only be implemented based on updated counts and capacity analyses as the development is implemented.
- Most of the identified improvements can easily be implemented with the exception of the widening of the P22/1 (Govan Mbeki Avenue) from the point where the road becomes a two lane road up to Pellisier Drive, which might require widening of the bridge over the N1.
- The layout plan is in principle acceptable.
- Based on the findings of the TIA the development can be approved from a traffic point of view.

3.11 SERVITUDES

There are power lines adjacent to and in the property with no known servitudes.

According to the Electrical Service Report the developer must also erect three-room primary substation building inside 14m long x 7m wide servitudes. The developer must also supply and install the miniature transformers that comply with CENTLEC standards and specification, and place it in servitudes at optimal positions within the development.

The layout was amended to make provision to accommodate the power lines and substation in park erven and to provide building lines to protect the power lines.

3.12 LEGAL DEVELOPMENT RIGHTS

A formal township establishment process is currently underway, in order to secure the required development rights for the planned development.

Town planning applications launched for the proposed development include:

- Section 20 of Ordinance 9 of 1969, for the subdivision of the remainder of portion 1 of the farm Brandkop no 702;
- Section 20 of Ordinance 9 of 1969, for the consolidation of a portion of the remainder of portion 1 of the farm Brandkop no 702 and erven 23129 and 23130 Lourierpark, Bloemfontein extension 148;
- Section 8 of Ordinance 9 of 1969, for the establishment of a township Lourierpark, Bloemfontein extension, consisting of 2356 erven and streets, as shown on layout plan 1601/DRW/04.1

As per Section 20 in the Mangaung Metropolitan Municipality By-Laws, "no person may establish a township except with the approval of the Municipal Planning Tribunal." Section 21 of the Mangaung Metropolitan Municipal By-laws apply.

It is expected, that the decision-making process is guided by the provincial Integrated Development Plan, the Spatial Development Framework and the merits of the application.

3.12.1 Development Controls MMM

In terms of the current development policies such as the Integrated Development Plan (IDP) and Spatial Development Framework (SDF) the development proposal appears to fall within the ambit of the authority's objectives for the area.

3.12.2 Title Deed Restrictions

The erven and portion of land are in the ownership of the Mangaung Metro Municipality. Title deed T2810/1971.

SECTION 4: DESCRIPTION OF THE AFFECTED ENVIRONMENT

The following section is provided as an overview of the prevailing biophysical/social settings of the site and its immediate surrounds. This is done to provide a baseline upon which the potential impacts of the proposed Lourierpark Township Development can be identified (Scoping Phase of the EIA) and evaluated (EIA Phase of the Environmental Process).

Figure 7: Typical View of the Proposed Site in a North-eastern Direction taken from Dennelaan towards Lourierpark.



Figure 8: Typical View of the Proposed Site Taken from R706 in a south eastern direction over proposed site.



See more photographs attached in Annexure C and also in the various specialist reports.

4.1 BIOPHYSICAL ENVIRONMENT

4.1.1 Site Geology and Groundwater Seepage

a) Regional Stratigraphic Setting

Typically the site is underlain by sandstone and mudstone as part of the Adelaide (Pa) Formation forming part of the Beaufort Group of the Karoo Supergroup. Dolerite (Jd) intrusions in plates and dykes are present on site and surrounding the study area. An extract of the regional geology obtained from the Council of Geoscience is attached below. (Sheet 2926: Bloemfontein – Scale 1 : 250 000).

Figure 9: Regional Geology



b) Mining History

According to the published geological map, significant sources of economically important minerals do not occur in the vicinity of the study area.

4.1.2 Geotechnical Investigation

This report outlines the method of the investigation and describes the geological conditions encountered. The results of the investigation are evaluated and conclusions drawn with regard to the objectives as set out in the attached report. See the Geotechnical Report in Annexure F2.

a) Heave

According to the Geotechnical Investigation the maximum estimated heave per test pit is calculated as 21.4mm in Test Pit 57 which according to the NHBRC's Home Building Guide Part 1 & 2 can be classified as H2.

The Lourierpark area is synonymous with expansive clays as is evident by several expansive cracks on the soil surface as well as expansive cracking on surrounding structures. Insofar feasible, it is recommended to cut the clayey materials encountered on site to spoil.

b) Bearing Capacity

California Bearing Ratio (CBR) Tests were conducted to determine the estimated ultimate bearing capacity of the saturated material. This serves as a relatively conservative estimation of the bearing capacity of the in-situ material under the worst expected conditions with the assumption that naturally consolidated materials, especially those with overburden in excess of 500mm, will have the same (or higher) degree of consolidation than a MOD AASHTO of 95%.

A paper by W.P.M Black titled “The Calculation of Laboratory and In-situ Values of California Bearing Ratio from Bearing Capacity Data” indicates that the CBR values of material are roughly 10% of the ultimate bearing capacity (qu) of the material. In the paper W.P.M Black suggests using a lower factor in order to obtain more conservative values.

Generally the bearing capacities expected on site is low (below 50kPa) with minor exceptions. It is recommended to take a foundation approach that accommodates low ultimate bearing capacities.

c) Excavation Classification

Excavatability is defined as the ease with which the ground can be dug to a depth of 1,5m. This is of importance for urban development as increased costs are associated with installing services or foundations in areas where difficulty is experienced during the investigation stage. Generally the excavations on site can be described as “ranges from soft to hard” with an average depth of 1,4m being reached with an eight ton TLB.

d) Engineering Properties of the In situ Material

Typically material classified as a G5, G6, G7 or G8 can be used for road construction and material classified as G5, G6 and G7 can be used as backfill material, depending on the engineering design and specifications supplied by the consulting engineer.

e) Collapse Potential

Based on the particle size distribution of the materials encountered on site and the presence of clays, the material on site is generally not considered to be collapsible. Some compressibility is expected with soft clays typically being compressible. A site classification of S1 is therefore adopted in conjunction with the H2 classification.

f) Erodibility

Some forms of piping were evident on site, but it is considered to be minor.

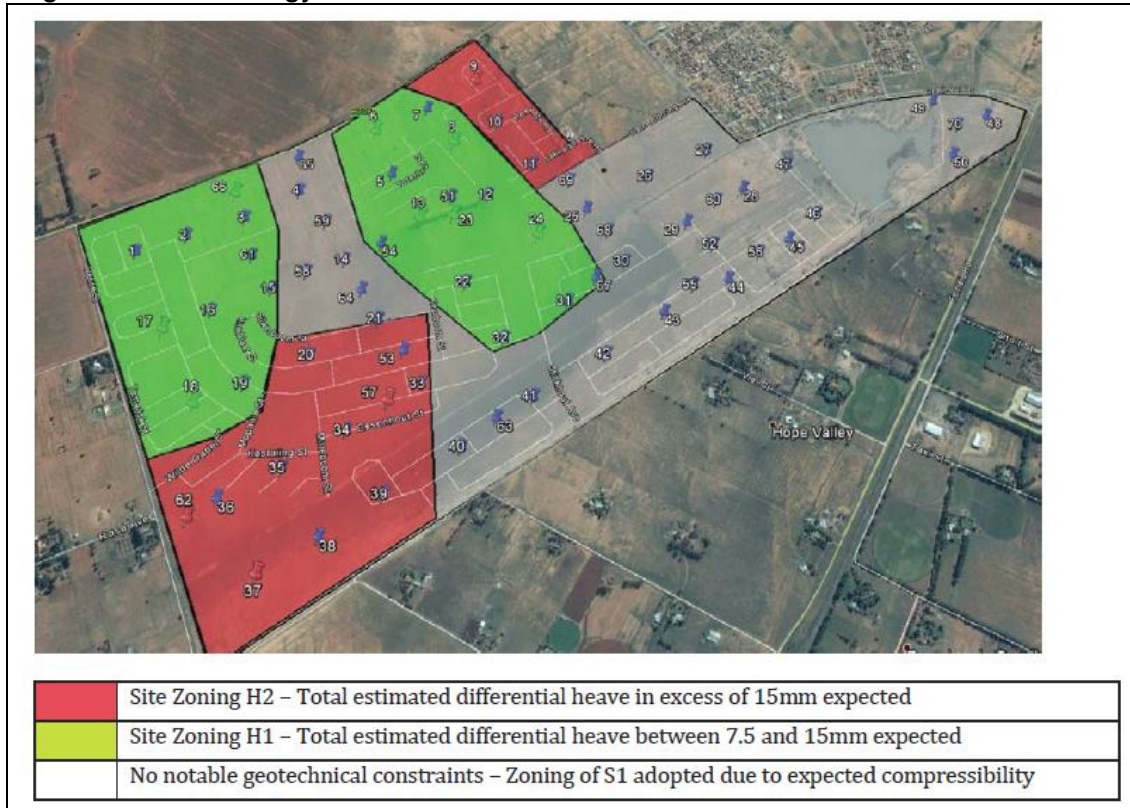
g) Ground Slope Stability

Generally the sidewalls of the excavations were stable and no unstable or steep slopes were encountered on site.

h) Engineering Geological Zones

The NHBRC engineering geological zoning of this site is as follows: H and S. The Site Classes are H2 (30%), H1 (35%) and S1 (35%).

Figure 10: Sites Geology Zones



i) Foundations

The tables on the following pages indicate the proposed foundations as recommended by the NHBRC Home Building Manual (Parts 1 and 2) based on the site zoning. It is relevant for single and double storey structures. The relevant options are highlighted below.

Table 2: Site Classification (Heave)

Site Class	Estimated Total Heave (mm)	Construction Type	Foundation design and building procedures (expected damage limited to category 1 of expected damage)
H	<7.5	Normal	<ul style="list-style-type: none"> • Normal construction (strip footing or slab-on-the-ground) foundation • Site drainage and service and plumbing precautions recommended
H1	7.5 – 15	Modified Normal	<ul style="list-style-type: none"> • Lightly reinforced strip footings • Articulation joints at all internal and external doors and openings • Light reinforcement in masonry • Site drainage and plumbing and service precautions
		Soil Raft	<ul style="list-style-type: none"> • Remove all or necessary parts of expansive horizon to 1.0meter beyond the perimeter of the building and replace with inert backfill (preferably G6 or better material) compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. • Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7.5mm, or construction type is appropriate to residual movements • Site drainage and plumbing and service precautions
H2	15 – 30	Stiffened or cellular raft	<ul style="list-style-type: none"> • Stiffened or cellular raft of articulated lightly reinforced masonry • Site drainage and plumbing and service precautions
		Piled construction	<ul style="list-style-type: none"> • Piled foundations with suspended floor slabs with or without ground beams • Site drainage and plumbing and service precautions
		Split construction	<ul style="list-style-type: none"> • Combination of reinforced masonry and full movement joints • Suspended floors or fabric reinforced ground slabs acting independently from the building • Site drainage and plumbing and service precautions
		Soil raft	<ul style="list-style-type: none"> • As for H1
H3	>30	Stiffened or cellular raft	<ul style="list-style-type: none"> • As for H2
		Piled construction	<ul style="list-style-type: none"> • As for H2
		Soil raft	<ul style="list-style-type: none"> • As for H1
NOTE 1: Differential heave equals 50% of total heave			
NOTE 2: The relaxation of some of these requirements, for example, the reduction or omission of reinforcement or articulation joints, might result in category 2 of expected damage.			
Table extracted and adapted the NHBRC Home Building Manual with alterations from SANS 10400			

Table 3: Site Classification (Collapse Potential)

Site Class	Estimated Total Settlement (mm)	Construction Type	Foundation design and building procedures (expected damage limited to category 1 of expected damage)
C	<5	Normal	<ul style="list-style-type: none"> • Normal construction (strip footing or slab-on-the-ground) foundation • Good site drainage
C1	5 – 10	Modified normal	<ul style="list-style-type: none"> • Reinforced strip footings • Articulation joints at some internal and all external doors • Light reinforcement in masonry • Site drainage and service and plumbing precautions • Foundation pressure not to exceed 50kPa
		Compaction of in-situ soils below individual footings	<ul style="list-style-type: none"> • Remove in-situ material below foundations to a depth of and width of 1.5 times the foundation width or to a suitable soil horizon and replace with material (preferably G6 or better) compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content • Normal construction with light reinforcement in masonry
		Deep strip footings	<ul style="list-style-type: none"> • Normal construction with drainage precautions • Founding on a suitable founding horizon below the horizons within which relatively large movements might take place
		Soil raft	<ul style="list-style-type: none"> • Remove in-situ material to 1 meter beyond the perimeter of the building to a depth of 1.5 times the widest foundation width or to a suitable soil horizon and replace with material (preferably G6 or better) compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content • Normal construction with light reinforced strip footings and light reinforcement in masonry
C2	>10	Stiffened strip footings, stiffened or cellular raft	<ul style="list-style-type: none"> • Stiffened strip footings or stiffened or cellular raft with lightly reinforced or articulated masonry • Bearing pressure not to exceed 50kPa • Fabric reinforcement in floor slabs • Site drainage and service and plumbing precautions
		Deep strip foundations compaction of in-situ soils below individual footings	<ul style="list-style-type: none"> • As for C1 but with fabric reinforcement in floor slabs
		Piled or pier foundations	<ul style="list-style-type: none"> • Reinforced concrete ground beams or solid slabs on piled pier foundations • Ground slabs with fabric reinforcement • Good site drainage • As for C1
		Soil raft	<ul style="list-style-type: none"> • As for C1
NOTE 1: Differential heave equals 75% of total settlement			
NOTE 2: The relaxation of some of these requirements, for example, the reduction or omission of reinforcement or articulation joints, might result in category 2 of expected damage.			
Table extracted and adapted the NHBRC Home Building Manual with alterations from SANS 10400			

Table 4: Site Classification (Compressive Soils)

Site Class	Estimated Total Settlement (mm)	Construction Type	Foundation design and building procedures (expected damage limited to category 1 of expected damage)
S	<10	Normal	<ul style="list-style-type: none"> • Normal construction (strip footing or slab-on-the-ground) foundation • Foundation bearing pressure not to exceed 50kPa • Good site drainage
S1	10 – 20	Modified normal	<ul style="list-style-type: none"> • Reinforced strip footings • Articulation joints at some internal and all external doors • Light reinforcement in masonry • Site drainage and service and plumbing precautions • Foundation pressure not to exceed 50kPa
		Compaction of in-situ soils below individual footings	<ul style="list-style-type: none"> • Remove in-situ material below foundations to a depth of and width of 1.5 times the foundation width or to a suitable soil horizon and replace with material (preferably G6 or better) compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content • Normal construction with light reinforcement in masonry
		Deep strip footings	<ul style="list-style-type: none"> • Normal construction with drainage precautions • Founding on a suitable founding horizon below the horizons within which relatively large movements might take place
		Soil raft	<ul style="list-style-type: none"> • Remove in-situ material to 1meter beyond the perimeter of the building to a depth of 1.5 times the widest foundation width or to a suitable soil horizon and replace with material (preferably G6 or better) compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content • Normal construction with light reinforced strip footings and light reinforcement in masonry
S2	>20	Stiffened strip footings, stiffened or cellular raft	<ul style="list-style-type: none"> • Stiffened strip footings or stiffened or cellular raft with lightly reinforced or articulated masonry • Bearing pressure not to exceed 50kPa • Mesh reinforcement in floor slabs • Site drainage and service and plumbing precautions
		Deep strip foundations compaction of in-situ soils below individual footings	<ul style="list-style-type: none"> • As for S1 but with mesh reinforcement in floor slabs
		Piled or pier foundations	<ul style="list-style-type: none"> • Reinforced concrete ground beams or solid slabs on piled or pier foundations • Ground slabs with fabric reinforcement • Good site drainage
		Soil raft	<ul style="list-style-type: none"> • As for S1
<p>NOTE 1: Differential heave equals 50% of total settlement</p> <p>NOTE 2: The relaxation of some of these requirements, for example, the reduction or omission of reinforcement or articulation joints, might result in category 2 of expected damage.</p> <p>NOTE3: Account should be taken of sloping sites where differential fill heights might lead to greater differential settlements.</p> <p>NOTE4: Settlements induced by loads imposed by deep filling beneath surface beds might necessitate the adoption of a construction type appropriate to a more severe site class.</p>			
Table extracted and adapted the NHBRC Home Building Manual with alterations from SANS 10400			

j) Roadwork's

It is not recommended to use the clayey in-situ materials for roadwork's (typically classified as <G9). Material classified as G6, G7 and to a lesser extent, G8, may be used as selected layers, but the consistency of the material is questionable. Proper control testing will be required on site to ensure that the materials used comply with the relevant specifications. It is highly advisable to avoid using the materials on site for engineering purposes.

k) Utility Services

The material is generally slightly acidic ($6 < \text{pH} < 7$) with electrical conductivity readings varying from 0.191 to 0.294 mS/cm. Based on the results and degree of acidity and degree of corrosion, the material on site is considered to be mildly corrosive, therefore metallic services may have to be reconsidered and either be covered with an epoxy paint or be replaced with plastic alternatives. Steel poles used for fencing should be treated to prevent rust up to 150mm above ground level. Steel used for reinforcement in concrete slabs or foundations need to be adequately covered.

l) General

As the area is characterized by a compressible profile with potentially expansive material, good control and drainage of storm water runoff must be ensured to minimize ponding and ingress of water in the foundation profile. Moisture is often the trigger mechanism for swell in heaving soils and ingress of water can lead to collapse and thus the following additional precautions should also be considered:

- a) Discharge of storm water/surface water in lined channels;
- b) Impermeable surround around structures.

- It is recommended that founding conditions be re-assessed once layout, floor levels and type of structures are finalized and where necessary additional geotechnical investigation be undertaken, especially if the material encountered on site varies from those described in this report.
- Please take note that although due care was taken to ensure an accurate and thorough report reflecting on the areas indicated by the design team the report is only applicable to the samples tested and the evaluations made by the on-site team.
- It should be noted that the surrounding area is associated with heaving clays, as is evident in the test results. Care should be taken with the in-situ materials. It is recommended that as much of the in-situ material as is economically feasible be removed from the site and backfilled with a G6 or equivalent material, according to the design engineers' specifications.

m) Conclusions of the Geotechnical Investigation

It is the author's opinion that the geotechnical conditions at this site are generally favourable for the proposed development, provided that cognisance is taken of the following:

- Moderate to high expansive settlement potential of foundations sub-grades;
- Potential differential settlement on sub-grade interfaces in terms of compressibility;
- Potential corrosive conditions on steel pipes and fittings.

It should be borne in mind that the conclusions reached and recommendations made in this report apply to the test pits excavated as part of this study.

SITE CLASSIFICATIONS – H2 (30%), H1 (35%) AND S1 (35%)

The dominant design mode should be H2.

The zoning is based on the estimated potential heave (Section 5.1 of the attached Geotechnical Report) and the estimated collapse potential (Section 5.5 of the attached Geotechnical Report).

Please review the table within section 7 for the NHBRC proposed design approach for foundations.

- Foundations – Review section 7 of the attached Geotechnical Report
- Excavatability – ranges from soft to hard based on the specifications set in SANS 1200D. Excavations up to 1.5meter can be considered soft to intermediate with excavations in excess of 1.5meter can be considered intermediate to hard.
- Geohydrology - Excavations are to be adequately drained should rain water fill trenches during construction or if the water tables rise.
- Construction Material – It is not recommended to use the clayey materials found on site for backfilling. It would be best if as much as possible of they clayey material be spoiled.
- Stability of Excavations – Generally the excavations on site were stable with some seepage near the water body on the eastern part of the study area. Unstable excavations may be encountered there.

4.1.3 Agricultural Potential

The entire project site has been subjected to severed disturbance. The causes of disturbance include amongst others dumping of domestic waste, quarrying, vehicle tracks, and grazing by cattle, sheep and goats. Some areas on the project site have been ploughed in the past. The crop field have been left fallow for quite some time and they are now sparsely covered by a few grass and forb species.

4.1.4 Hydrology

a) Surface Water and Drainage

There is one poorly developed wetland area downstream of the Rooidam area. The drainage is not well defined and in the past a trench has been dug to drain the overflow from the Rooi Dam. On the southern boundary is another canal which also drains the dam's overflow.

Rooidam has a catchment area of approximately 8.3 km². As no records of the design criteria for Rooidam could be obtained, certain assumptions were made in Floodline Report to calculate the floodlines for 1:50 year and 1:100 return periods with specific reference to the dam being full at the start of the simulation as well as the roughness factor. These assumptions were based on a worst case scenario. Calculations were done for the overtopping high water level based on survey data of the full water supply level.

At the time of the study, Rooidam was almost at a full water level, millimetres from overtopping the weir resulting in a surface area of 136 000 m². The inlet to the dam is through three culverts. They are silted up but in a seemingly good structural condition.

Apart from the main dam wall on the western side, berms were constructed around the edge of the dam.

The outlet of the dam through the overflow weir is approximately 120 meters long and shaped in a U-form. It is in a good condition based on visual assessment. However, the culverts downstream of the weir are silted up and covered with debris and waste in places.

Immediately downstream of the weir the stormwater passes through two culverts, approximately 90m in length after which it runs along a straight open concrete canal. The canal is in a good condition based on a visual assessment; however badly contaminated in places with waste material dumped from nearby residents. The canal widens at the point where the outflow of Catchment Areas B + D joins up with the outflow from the overflow weir (please refer to Item 2.4 for a description of the catchment areas in the attached Floodline Report in Annexure F1). The outflow of the open concrete canal is through culverts at Denne Lane where it joins stormwater drainage from the northern side adjacent to Denne Lane. Please refer to Annexure E of the Floodline Report for the profiles of the open canal.

At the lowest end of the canal at the most southern point of the development drainage is towards three culverts of sizes 3.0 x 1.8 m and 4.275 x 2 m. At the same point it joins up with the drainage from Denne Lane via a 3.6 x 1.5 m culvert.

Figure 11: Photograph of Rooidam Situated Just Outside (North East) Proposed Site



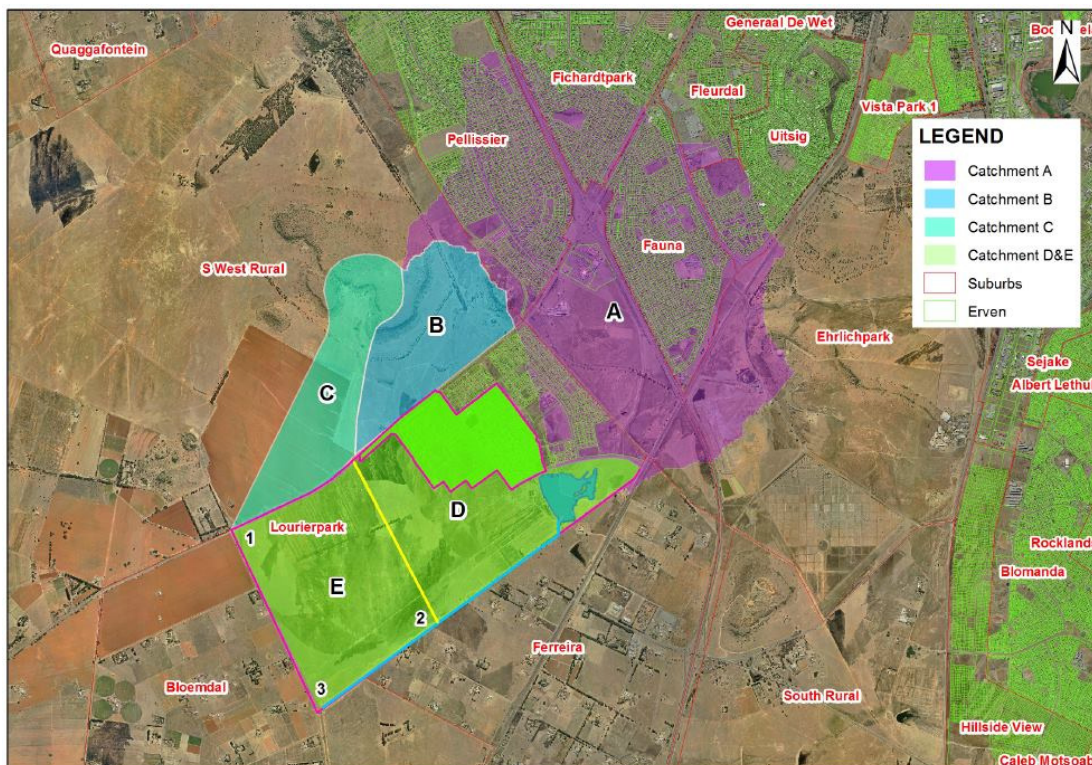
b) Catchment Area

The five catchment areas for the Lourierpark Development floodline analysis as described in attached Floodline Report:

- **Catchment Area A** is considered as the main inflow towards Rooidam and its overflow. The upper catchment area consists of a subsoil drainage system in Pellisier which drains towards the Windmill Casino. From the Casino an open concrete lined canal drains towards Rooidam through culverts leading directly into the inlet of Rooidam. The existing catchment properties consists of a part of Pellisier's, Fichardtpark's, Fauna's and Uitsig's urban development as well as an undeveloped area to the south of the Windmill Casino.
- **Catchment Area B** drains towards the existing and proposed new development of Lourierpark through a series of culverts (10 x 525 mm diameter and 1 x 600 mm diameter) on the Jagersfontein Road towards Catchment Area D. This stormwater drains towards the open concrete lined canal downstream of Rooidam at point 2 as indicated in the Annexures. The properties of this catchment are mainly cultivated farmlands.
- **Catchment Area C** is adjacent to Catchment Area B and also drains towards Catchment Area E of the proposed development through a number of culverts (5 x 525 mm diameter and 2 x 600 mm diameter) beneath the Jagersfontein Road and then to the open concrete lined canal and culvert in Denne Lane at point 3 as indicated in the Annexures of attached Floodline Report. The properties of this catchment are also mainly cultivated farmlands of typical small holdings.
- **Catchment Area D** is to the northern side of Rooidam receiving the main stormwater of Catchment Area B draining towards the open concrete canal downstream beneath Rooidam. This Catchment Area forms part of the proposed development as well as the existing Lourierpark part of the development. Through a system of existing and predesigned stormwater management systems it contributes towards the floodline analysis of the open concrete canal.
- **Catchment Area E** is adjacent and downstream of Catchment Area D and receives stormwater from Catchment Area C to the northern side of the Jagersfontein Road. This Catchment Area forms part of the proposed development and currently drains towards the open concrete canal as well as Denne Lane.

As runoff from Catchment Area B drains towards Catchment Area D, the combined result was calculated in the Floodline Report. The same principle applies to Catchment Areas C and E.

Figure 12: 1:100 Year Flood Line Renosterspruit



c) Conclusion & Recommendations of the Floodline Report

In conclusion, taking into consideration the 1:100-year flood discharge of approximately 60.824 m³/s, it was confirmed through calculation that the design of Rooidam can accommodate the inflow with the overflow depth over the weir at a safe depth.

The 1:100-year floodline directly behind the dam wall initially runs into the Proposed Development and downstream overtops the sides of the canal into the southern Ferreira Smallholdings. A small part of the Proposed Development will be affected by the floodline.

The downstream open concrete canal (section 2) will not be able to handle the discharge without overtopping its sides.

The third and last section of the canal appears to be able to handle the 1:100-year runoff. The capability of the infrastructure to accommodate the 1:100-year runoff is summarised in Table 3-1 of the attached Floodline Report.

The following Recommendations are made in the Floodline Report attached. They include:

- The culverts immediately downstream of Rooidam be enlarged to accommodate the flow (Figure 2-4 of attached Floodline Report).
- Runoff from Catchment Areas B and D must be guided to only enter the canal at point 2.
- If development takes place in Catchment Areas B and C, the capacity of the open concrete canal must be taken into consideration. Stormwater drainage from Catchment Areas B and C should be diverted as per The Masterplan of Mangaung Metro Municipality, September 2009, via main stormwater drainage systems alongside the Jagersfontein Road to the west at point 1 and only deposited downstream of the canal analysed in the Floodline Report. However, it is the recommendation that irrespective of these catchments' development, that stormwater be diverted to the west (point 1) as described above and not towards the Development.

- Urgent maintenance and cleaning must be done on all the culverts as can be seen on the photos. This will enable the culverts to operate at their design capacity.
- In view of the results of the floodline analysis, the following options can be considered:
 - Enlargement of the downstream culvert and open canal up to the third section. This is a costly option, but is still recommended.
 - A berm on both sides of the canal. This is not recommended due to aesthetical reasons, space availability on the southern side and stormwater not being able to enter the canal overland.
 - A wall built on top of the canal's edges. This option is not recommended due to the layout of the Development not being finalized and runoff from the Catchment Areas B + D should be able to enter the canal overland.

d) Ground Water

No recent information on the state of groundwater resources in the area is available. Significant quantities of groundwater are used in parts of the water management area mainly for agricultural activities. No groundwater seepage was encountered in the geotechnical test pits excavated across the site.

4.1.5 Climate

Bloemfontein Area has a mild Highveld climate with partly wet summers and dry winters. The average yearly temperature is 15,2 degrees Celsius with an average minimum of 7,4 degrees Celsius. Prevailing winds are generally northerly with a slight north-westerly predominance. The average rainfall varies around 550 mm per year.

Cycles of prolonged drought, lasting for several years, are a natural phenomenon. The area experiences thunderstorms, which usually occur in the late afternoons during the summer months.

4.1.6 Topography

The project site has an altitude of approximately 1 400m. The project site is on a gentle slope and the site is downstream of the Rooidam. The Rooidam is within the 500m zone which means that the project triggers a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998).

4.1.7 Ecology

EnviroNiche Consulting was appointed by Phethogo Consulting (Pty) Ltd to conduct an ecological impact assessment of the proposed project site as part of the EIA process to obtain environmental authorisation for the establishment of the proposed development. See Annexure F6 attached. The terms of reference were to undertake an ecological impact assessment to describe the fauna, flora, biodiversity and other ecological features of the project site as well as determine the impact of the establishment of the proposed development on the project site.

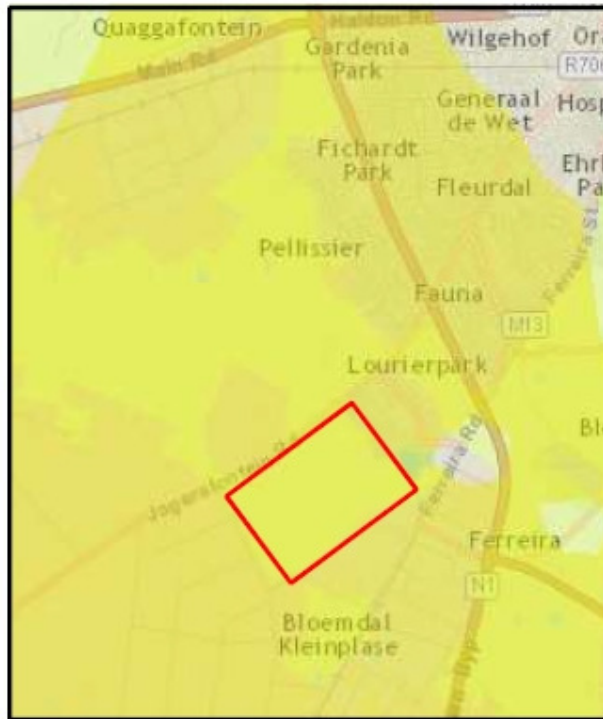
All components of the ecosystem (physical environment, vegetation, animals) of a site are interrelated and interdependent. Ideally an area should be developed in such a way that the quality of the resources does not decrease as this would inevitably lead to ecosystem degradation and lower productivity.

a) Vegetation, Biogeography and Conservation Vale

The most recent description of the broader study area's vegetation is the general description by Mucina & Rutherford (2006) relating to the vegetation which is considered to be the "Vegetation of South Africa, Lesotho and Swaziland" as well as its accompanying map of the country by (Mucina et al., 2005). This memoir contains species information and a comprehensive conservation assessment of all vegetation types.

The Bloemfontein Dry Grassland (Gh5) (Fig 4) dominates the vegetation of the project site, as well as the areas surrounding the site. According to Mucina & Rutherford (2006), the vegetation type has a conservation status of “endangered”. The vegetation of the project site is dry grassland and the important grasses include *Antheophora pubescens*, *Aristida congesta*, *Themeda triandra*, *Cymbopogon pospischillii*, *Eragrostis lehmanniana*, *E. trichophora*, *Enneapogon scoparius*, *Aristida adscensionis*, *Heteropogon contortus*. Dwarf shrubs such as *Felicia muricata*, *Hertia pallens*, *Berkheya onopordifolia*, *Lycium cinerium* also occur in the region.

Figure 13: Red Square Indicates Location of the Proposed Site West of Langenhoven Park. The Vegetation Type Present on Site (Yellow Area) is the Bloemfontein Dry Grassland (Gh5) which is a National Threatened Ecosystem.



b) Vegetation and Land Cover of the Study Area

Terrestrial Vegetation

The natural vegetation within the project site is severely degraded grassland. According to Mucina & Rutherford (2006) and BGIS (2016), the projects site is situated in the “vulnerable” Bloemfontein Dry Grassland (Gh5) which is also listed as a National Threatened Ecosystem.

The terrestrial vegetation of the project site can be classified into one community namely:

1) *Aristida congesta* – *Chloris virgata* grass community. As mentioned before this project site is in a severely degraded state due to numerous human impacts. This is reflected by the dominant vegetation which consist mainly of pioneer grasses and forbs. The dominant grass species present are *Eragrostis lehmanniana*, *E. superba*, *Aristida congesta*, *Chloris virgata*. The forbs and dwarf shrubs are *Felicia muricata*, *Chrysocoma ciliata*, *Salsola kali*, *Lycium pilifolium*, *Nenax microphylla* and *Sesamum triphyllum*. The species richness is quite low with about 10 species noted (See Annexure B of the attached Ecological Report).

Alien Trees and Weeds

The entire project site has been subjected to severed disturbance. The causes of disturbance include amongst others dumping of domestic waste, quarrying, vehicle tracks, and grazing by cattle, sheep and goats. Alien weeds flourish on these disturbed areas and several species were

noted: **Eucalyptus camuldulensis*, **Schinus molle*, *Xanthium spinosa*, *Xanthium strumarium*, **Conyza bonariensis*, **Argemone mexicana*, **Datura stramonium*, **Tagetes minuta*, **Bidens bipinnata* and **Conyza braziliensis* were noted.

Cultivation

Some areas on the project site have been ploughed in the past. The crop field have been left fallow for quite some time and they are now sparsely covered by a few grass and forb species.

Streams and Wetlands

There one poorly developed wetland area downstream of the Rooidam area. The drainage is not well defined and in the past a trench has been dug to drain the overflow from the Rooidam. On the southern boundary is another canal which also drain the dam's overflow.

A *Verbena bonariensis* wetland community dominate the wetland on the project site. The dominant plant species in these wetlands are **Cirsium vulgare*, **Verbena bonariensis*, and **Bromus catharticus*. The species richness of the wetland area is very low with about 6 species noted (See Annexure B of the attached Ecological Report).

Flora and Diversity of the Proposed Development Site

The plant species found during the survey are listed in Annexure B and provides a good indication of the species diversity and composition of the project site. The plants species found on the POSA list are listed in Annexure C of the attached Ecological Report.

c) Protected Systems and Species

The aim of this section in the Ecological Report was to list those ecosystems and/or plant species for which there is conservation concern that may be affected by the establishment of the proposed development. This includes threatened, rare, declining and protected plant species.

Protected Terrestrial Ecosystems

According to Mucina & Rutherford (2006) and BGIS (2016), the projects site is situated in the "vulnerable" Bloemfontein Dry Grassland (Gh5) which is also listed as a National Threatened Ecosystem. The site is however in such a degraded condition that almost none of the diagnostic species of the Bloemfontein Dry Grassland occur on site any more.

Streams and Wetlands

The identified wetland areas are no-go areas for development and the erven must be planned to accommodate these wetlands as well as their 50m buffer zones. scratched as part of the development. The overflow of the Rooidam drains along a flat area which has been canalled to contain the water. The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998).

Red List Plant Species

There are three basic rules of conservation that apply to populations of Red List Plant Species. Should any Red List plant species be recorded within the project site then these guidelines would apply. The guidelines are as follows:

1. All populations of Near Threatened and Threatened plant taxa must be conserved in situ.
2. All populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines as set out in the Policy.
3. An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red List Plant Species, and such Ecological Management Plans must conform to the Guidelines.

No Red Data plant species were noted on the site during the site assessment.

Protected Species in terms of the National Forests Act (Act 84 of 1998)

No protected species, in terms of the National Forests Act, were noted on the site during the site assessment.

Free State Nature Conservation Ordinance 8 of 1969

A number of protected species occur in the relevant quarter degree square as listed by POSA. Annexure B of the attached Ecological Report lists the species present at the project site. The protected species are marked by a yellow flag.

d) Animal Species Occurring on the Proposed Site

The presence of humans and construction activities had an impact on the grassland species as well as on the natural animal populations in the area of the study site. The site is surrounded by residential development and the site itself has been impacted by man. During the survey Ground Squirrel and Yellow Mongoose were noted on the project site. Annexure D list the potential animal species that could occur within the broader study area and the project site.

e) Identification of Sensitive Areas on or Near the Proposed Development Site.

The sensitivity assessment identifies those parts of the study area that will have a medium to high conservation value or that will be sensitive to disturbance. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have a low sensitivity. The habitat sensitivity assessment was done according to the rules provided in the “Sensitivity mapping rules for biodiversity assessments”

There are features within the project site that may be considered to have a medium conservation value, as follows:

Streams & wetlands (perennial and seasonal)

A number of man-made wetlands occur around the site of which four are listed as a NFEPA site.

Potential impacts: Pollutants from the construction and operation of the residential development might end up in these man-made dams.

Mitigation measures:

- Care must be taken to prevent runoff to the wetlands.

Sensitive vegetation

The plant community has been highly degraded and erosion damage may occur.

Potential impacts: The vegetation will be destroyed in the case that the entire project site will be developed.

Mitigation measures:

- Care must be taken to preserve the grassland areas in the wetland buffers and open areas.
- These areas must be demarcated and properly protected from accidental destruction.

Threatened and protected plant species

There could be protected and Red Data species present on the project site but the site is so degraded that it is highly unlikely.

Potential impacts: This proposed establishment of the residential development will have a negative impact on these species because of their destruction during the construction phase.

Mitigation measures:

- None.

Figure 14: The Yellow Lines Indicate the Sensitive Wetland Area and the Red Lines Indicate the 50m Buffer Zone to Protect the Wetland from Possible Impacts (Google Earth 2016).



Figure 15: A Close-up of the Wetland which Developed Around a Leaking Water Pipe. The Yellow Line Indicates the Sensitive Wetland (Google Earth 2016). Once the Leak has been Fixed the Wetland will Become Degraded.



Figure 16: A Close-up of the Drainage Area Downstream of Rooidam. The White Line (Arrows) is a Canal to Contain the Water. The Yellow Line Indicates the Sensitive Wetland Area and the Red Lines Indicate the 50m Buffer Zone to Protect the Wetland from Possible Impacts (Google Earth 2016).



f) Conclusions & Recommendations of the Ecological Report

The proposed establishment of a residential area on a vacant area of Lourierpark on the farm Brandkop 702 south-west of Bloemfontein triggers a number of listed activities as included in the Environmental Impact Assessment Regulations (08 December 2014), GN R 982 – 985, in accordance with the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended. Phethogo Consulting (Pty) Ltd, commissioned EnviroNiche Consulting, to undertake an ecological impact assessment to determine the impacts which may be triggered by the proposed development. The requirements of this assessment were to undertake a specialist study to assess the biodiversity and ecology of the project site as well as determine the significance of the impacts of the proposed development will have within the identified project site.

The project site is situated on a vacant property in Brandkop 702 south-west of the existing Lourierpark along the road to Jagersfontein. The project site and the surrounding area were assessed for any sensitive ecosystems including drainage lines and wetlands. It was found that there are wetlands but no drainage lines on the project site. The project site is situated in the Bloemfontein Dry Grassland (Gh5) vegetation type. According to Mucina & Rutherford (2006), this vegetation type has a conservation status of “vulnerable”. Although the site is classified as a Threatened Ecosystem the site has been transformed by agricultural activities (ploughing, overgrazing, alien vegetation). On a plant community level there are two plant communities namely a severely degraded *Aristida congesta* – *Chloris virgata* grass community as well as a poorly developed *Verbena bonariensis* wetland community. The PES and EIS scores of this wetland are an E and 0,5 respectively. On the project site is no listed NFEPA wetland or stream but just outside the borders of the proposed site area four small dams of which the Rooidam’s overflow runs through the project site.

From an environmental perspective the site is not that sensitive that the proposed development cannot take place.

It is recommended that:

General:

- An Environmental Control Officer (ECO) must be appointed to oversee that the aspects stipulated in the Environmental Permit be carried out properly;
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to;
- The areas to be cleared as well as the construction area should be clearly demarcated;
- All construction vehicles should adhere to clearly defined and demarcated roads;
- Dust suppression and erosion management should be an integrated component of the construction approach;

- No dumping of building waste or spoil material from the development should take place on areas other than a licenced landfill site;
- All hazardous materials should be stored appropriately to prevent contamination of the project site. Any accidental chemical, fuel and oil spills that occur at the project site should be cleaned up appropriately as related to the nature of the spill.

Flora:

- Weed control measures must be applied to eradicate the noxious weeds (category 1a & 1b species) on disturbed areas;

Fauna:

- Any fauna threatened by the construction and operation activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit (<30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them.
- Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

4.1.8 Air Quality and Noise

The most prominent noise sources are from the roads passing the proposed development on the western side of the site. During the construction and operational phases, noise and dust can be a factor. These impacts are addressed later in this EIA Report.

4.2 SOCIAL ENVIRONMENT

4.2.1 Visual Environment

The landscape of the study area is fairly flat. Due to the scale and nature of the proposed development, the visual impact of the development on surrounding communities can be significant. Large portions of the proposed site can be seen from all cardinal directions. Screening elements such as trees and berms, can soften the visual impact this development will have on the major roads. Internal landscaping and architectural design of the different components of the development, will positively contribute to the aesthetics of the area.

The increased light source from the developments will impact the study area at night. This aspect can however contribute to the deterrence of criminal activities. The establishment of a development of this nature, in the context of the surrounding land uses, is in line with the surrounding land uses. The establishment of a formal, well landscaped development will establish an improved aesthetic appeal to the area.

The visual environment will therefore definitely undergo certain changes. There is already a visual impact in terms of the various developments (smallholdings, townships & light industries) and lighting in the area. It is expected that the proposed new development will add to the visual impact in the area.

4.2.2 Archaeological and Paleontological Attributes

Phase 1 Archaeological and Paleontological Impact Assessments were carried out as part of a proposed township development on Portion 1 of the farm Brandkop 702 outside Bloemfontein, Free State Province. See Annexure F4 for the Archaeological and Annexure F5 for the Paleontological Impact Assessments.

A HIA is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25

of 1999. The region's unique and non-renewable archaeological and paleontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, Section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including archaeological and paleontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites.

The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development relevant to the Lourierpark development listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the NHR Act are as follows:

34. (1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

35 (4) No person may, without a permit issued by the responsible heritage resources authority—

- Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
- Destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite.

36 (3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority-

- a) Destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- b) Destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- c) Bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as-

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site

a) Exceeding 5000 m² in extent; or

b) Involving three or more existing erven or subdivisions thereof; or

c) Involving three or more subdivisions thereof which have been consolidated within the past five years;

- The rezoning of a site exceeding 10 000 m²; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

a) Impact Statement & Recommendations of the Archaeological Impact Assessment Conducted

It is unlikely that the proposed development will result in any significant archaeological impact at the site. Trees associated with historical settlements or farmsteads, that are older than 60 years old, are generally protected as heritage sites with cultural significance. However, the remnant grove appears to be younger than 60 years old and is not directly associated with a farmstead or historical structures. The proposed site is regarded as of low archaeological significance and is assigned the rating of Generally Protected C (GP.C).

b) Impact Statement & Recommendations of the Paleontological Impact Assessment Conducted

The development footprint is situated within the Beaufort Group (Karoo Supergroup), and is underlain by palaeontologically significant Adelaide Subgroup sedimentary rocks, that have been

widely intruded by Jurassic-age dolerites. It is considered unlikely that the proposed development will affect palaeontological heritage resources within the superficial component (Quaternary overburden) due to the disturbed condition of the substrate and the absence of a suitable alluvial context. The palaeontological significance of the Quaternary overburden within the boundaries of the proposed footprint is therefore considered to be very minor. This component is assigned a field rating of Generally Protected C (GP.C). The dolerite component is not palaeontologically vulnerable and is assigned a field rating of Generally Protected C (GP.C).

The proposed footprint is largely located on potentially intact sedimentary bedrock and thermally derived metasediments near dolerite intrusions, but the chances of impact on palaeontological material from fresh sedimentary bedrock strata is considered low because of the low topography terrain and the considerable Quaternary overburden that caps the study area.

However, since fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution), it is advised that if in situ fossil material is exposed as a result of excavations into fresh sedimentary bedrock, SAHRA and a professional palaeontologist are informed immediately. The sedimentary bedrock component is assigned a field rating of Generally Protected B (GP.B) with the recommendation that excavations into fresh sedimentary bedrock that exceeds a depth of >1m is monitored for potential palaeontological heritage during the construction phase of the development.

SECTION 5: PUBLIC PARTICIPATION

5.1 INTRODUCTION

The principles of NEMA govern many aspects of EIA's, including consultation with interested and affected parties (I&AP's). These principles include the provision of sufficient and transparent information to I&AP's on an on-going basis, to allow them to comment, and ensuring the participation of historically disadvantaged individuals, including women, the disabled and the youth.

Public participation therefore plays an important role in the compilation of an Environmental Impact Report as well as the planning, design and implementation of the project. Public participation is a process leading to informed decision-making, through joint effort by the:

- Proponent;
- Technical experts;
- Governmental authorities; and
- Interested and Affected Parties (I&AP's).

Public participation is a vehicle for public input, which achieves the following:

- Facilitates negotiated outcomes;
- Creates trust and partnership;
- Minimises negative effects;
- Maximises positive effects;
- Provides an indication of issues, which may
- Prevent the project continuing;
- Cause costly delays later; and
- Result in enhance and shared benefits.

MvW Environmental Services conducted the public participation process for the proposed Lourierpark Township Establishment.

5.2 PROCESS FOLLOWED

The following process was undertaken to facilitate the public participation for the proposed project, which commenced on 26th April 2017 (Refer to Annexure E).

5.3 PROJECT NOTIFICATION

5.3.1 Newspaper Advertisements

Advertisements, notifying the public of the proposed project and availability of the Draft Scoping Report and Plan of Study of EIR for comment as well as requesting I&AP's to register their comments with MvW Environmental Services, were placed in The Express newspaper on 26th April 2017.

5.3.2 Site Notices

In order to inform surrounding communities and adjacent landowners of the proposed development, site notices were placed at the proposed development site and at visible locations close to the site on the 24th May 2017 that included:

- At the proposed site at the access road to Lourierpark;
- Notices were placed at the filling station near Casio.

See Annexure C for photographs taken of these site notices.

5.3.3 Direct Notification of Identified I&AP's

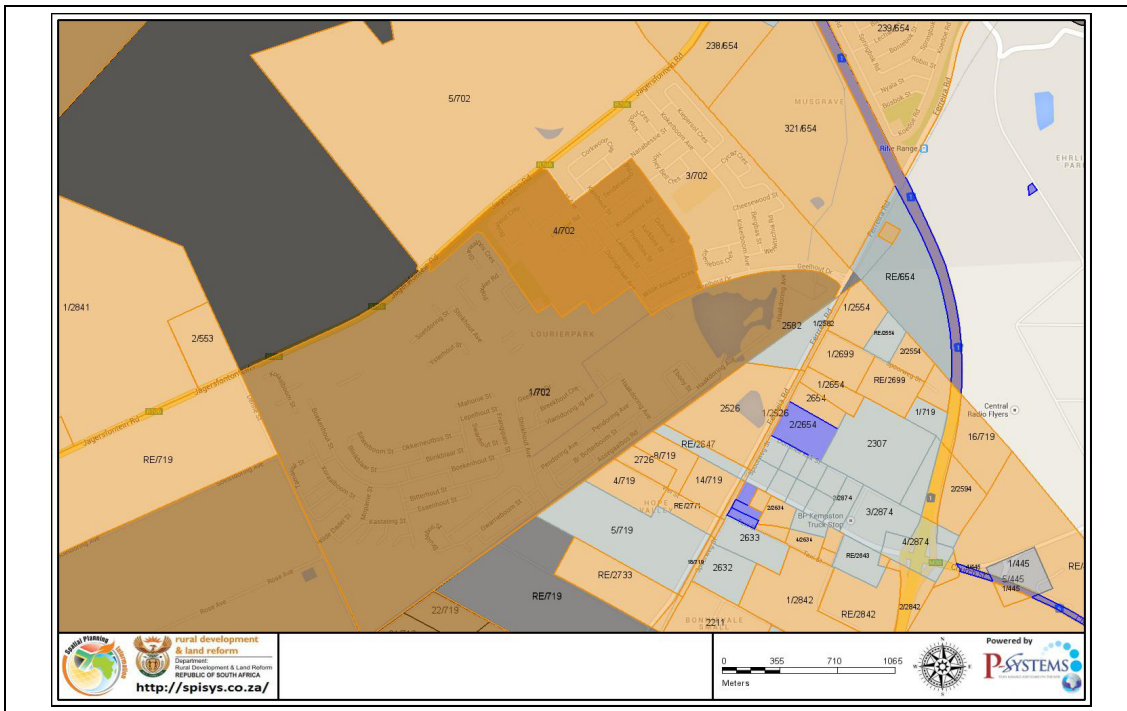
Key stakeholders, who included the following sectors, were directly informed of the proposed development by either registered letters; e-mail or fax. (Refer to Annexure E: For Identified and Registered I&AP's):

Table 5: Key Stakeholders Identified

Company / Organization / Ward to be Notified of Proposed Lourierpark Township Establishment and Reports for Comment	Contact Person
Mangaung Metro Municipality – Acting Municipal Manager	Adv Mea
Mangaung Metro Municipality - Environmental Section	Mpolokeng Kolobe
Mangaung Metro Municipality – Town Planning Section	Collin Dihemo
Mangaung Metro Municipality – SDF Section	George Masuabi
Mangaung Metro Municipality – Air Quality Section	Neo Shapu
Mangaung Metro Municipality – Environmental Health Section	Jaco Lambrecht
Mangaung Metro Municipality – Water and Sanitation	Mosiuoa Tsomela
Mangaung Metro Municipality – Roads and Stormwater	Jeff Letsi
Mangaung Metro Municipality – Infrastructure	Gerhard Fritz
Department of Water Affairs	Vernon Blair G Janse van Noordwyk
Ward councilor (Ward 25)	Clr Rossouw Botes
Department of Health	Dr. David Motau Mr Leshabanetl
SANRAL	Casper Landman
Free State Department: Police, Roads and Transport	HOD & Hannes Maree
Department of Economic, Small Business Development, Tourism and Environmental Affairs	Ms. Grace Mkhosana Nacelle Collins
Free State Department: Public Works	Mr. Maditse Wessels Seoke (HOD)
Free State Department: Social Development	Ms Mokone Nthongoa (HOD) HODsec@fssocdev.gov.za
Free State Department: Sport, Arts, Culture and Recreation	Mr Molapo (HOD)
Heritage Free State	Ntando PZ Mbatha (Heritage Coordinator)
SAHRA	A Solomon
Centlec	Mamello Mpholo
Mangaung Metro Municipality – Acting Municipal Manager	Adv Mea
Mangaung Metro Municipality - Environmental Section	Mpolokeng Kolobe

The map in Figure 17 below shows the farms portions surrounding the proposed site were maildrop was conducted.

Figure 17: Map Showing the Proposed Site and the Surrounding Properties.



Directly adjacent surrounding landowners were informed via maildrop of the project and afforded the opportunity to comment on the project by means of an Interested and Affected Parties Comment Form. Please refer to the comments and response report attached as Annexure E for comments received and responses from the EAP. Also see proof of maildrop that was conducted.

5.4 PUBLIC PARTICIPATION ON THE DRAFT REPORTS AS WELL AS COMMENTS AND CONCERNS RECEIVED

All the issues raised on the proposed development as well as on the Draft Scoping and Plan of Study of EIR were captured in this Draft EIR that was submitted to DESTEA for comment. A period of 30 days was available for public comment on both the Draft Scoping Report and Plan of Study of EIR as well as on this Draft EIR and EMP.

The Draft Reports were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

Table 6: Summary of Comments and Concerns Received During The Public Participation Conducted.

Registered I&AP	Comment on Concern Received	Feedback from Project Team
DESTEA – G Mkhosana	<ul style="list-style-type: none"> • Acknowledgement of receipt of the application form and Scoping Report. • Applications reference nr is: EMS/15,28(i)/17/07. • Official Handling the project is Ms d Mokoena. • The activity applied for may not commence prior to an EA being 	Noted. No feedback required.

	<p>granted by DESTEA.</p> <ul style="list-style-type: none"> In terms of Regulation 45 of 2014 EIA Regulations as amended, this application will lapse if the applicant or the EAP fails to meet any of the timeframes prescribed in term of these Regulations, and having submitted the application, unless the extension has been granted in terms of Regulation 3(7). 	
DESTEA – M Gunundu	<ul style="list-style-type: none"> Amend the Draft Scoping Report to include the following: <ul style="list-style-type: none"> Activity 27 is not triggered and should be removed. Correct proposed project description on table on page ii, iii and page 35. The comments and response report under Public Participation. 	Final Scoping Report was amended.
DESTEA – G Mkhosana	<ul style="list-style-type: none"> Approval of the Final Scoping Report and Plan of Study of EIR on the 7th July 2017. 	Noted
Department of Agriculture – Jack Morton & N Ndumo	<ul style="list-style-type: none"> Site is already included within the town planning scheme and therefore no comments from Department of Agriculture. 	Noted
MMM Councillor Ward 18 – David Mc Kay	<ul style="list-style-type: none"> Will be sending concerns on infrastructure capacity and the grazing area for the subsistence farmers across the road. In favour of the development, especially if it means employment and development progress for Lourierpark residents. 	Nothing received as yet. Noted
Adjacent Land Owner – Anette Smith	<ul style="list-style-type: none"> In the process of selling her property. With the planned development some of the real estate agents are not willing to list my property. The planned development has a negative impact on my financial position. It makes my property almost unsellable. 	Noted Cannot comment on this as we did not receive any comments from any real estate agents. The proposed site is situated within MMM Town planning Scheme and is already earmarked in the Spatial Development Framework as future Residential Area. This cannot be the case as the development has not even started. The reason for not being able to sell the property cannot be blamed solely on the proposed development. The site belongs to MMM and is within MMM Town planning Scheme and is already earmarked in the Spatial Development Framework as future Residential Area.
Adjacent Land	<ul style="list-style-type: none"> He requested high resolution 	Provided.

Owner – Wallies de Beer.	maps of the proposed development. No further correspondence received.	
Department of Police, Roads and Transport – Mr W Naude	<ul style="list-style-type: none"> No feedback received. 	
MMM Environmental Management – M Kolobe	<ul style="list-style-type: none"> No feedback received on the Draft Scoping Report. A copy of the Draft EIR was delivered to them for comment. 	
Department Water and Sanitation – G Janse van Noordwyk	<ul style="list-style-type: none"> No feedback received on the Draft Scoping Report. A copy of the Draft EIR was delivered to them for comment. 	
CENTLEC - Kobus Booyesen	<ul style="list-style-type: none"> No feedback received. 	
National Roads Agency – Casper Landman	<ul style="list-style-type: none"> No feedback received. 	
MMM Engineering Services – HOD LX Ntoyi	<ul style="list-style-type: none"> No feedback received. 	
MMM Planning Directorate.	<ul style="list-style-type: none"> No feedback received. 	<ul style="list-style-type: none"> Noted

5.5 PUBLIC PARTICIPATION ON THE DRAFT EIR AS WELL AS THE COMMENTS AND CONCERNS RECEIVED THERON

Public Participation on Draft Scoping Report and Plan of Study if EIR:

The project and availability of the Draft Scoping Report was announced by means of the following:

- Publication of a media advertisement in the local/regional newspaper, The Express on the 26th April 2017.
- On-site notices advertising the EIA have been placed at the following public locations on 24th May 2017:
 - At the proposed site at the access road to Lourierpark;
 - Notices were placed at the Filling Station at Casino.
- Mail drop to all directly adjacent landowners;

All the issues raised on the proposed development as well as on the Draft Scoping Report and Plan of Study of EIR was captured in the Final Scoping Report and Plan of Study of EIR that was submitted to DESTEA for review. A period of 30 days was allowed for public comment on the Draft Scoping Report and Plan of Study of EIR.

The Draft Scoping Report and Plan of Study of EIR were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final Scoping Report was prepared after the end of the public review period, which started on 24/05/2017 and ended on 23/06/2017. The Draft Report was updated with issues raised by I&AP's and new information generated as a result. The Final Scoping Report was submitted to DESTEA for review on 30 June 2017.

Public Participation on Draft Environmental Impact Report & EMP:

Public participation during this Impact Assessment Phase of the EIA revolves around a review of the findings of the EIR and inputs into the Environmental Management Plan (EMP). The findings are presented in this Draft Environmental Impact Assessment Report and EMP and the volume of specialist studies.

All the issues raised on the proposed development as well as on the Final Scoping Report and Plan of Study of EIR was captured in this Draft EIR to be submitted to DESTEA for review. A period of 30 days will be available for public comment on the Draft EIR & EMP.

This Draft EIR & EMP were distributed for comment as follows:

- Made available at the offices of MvW Environmental Services;
- Hand-delivered to the relevant authorities, i.e. DESTEA, Mangaung Metro Municipality and the Departments of Water Affairs and Forestry;
- E mailed to other identified authorities as well as I&AP's who requested copies thereof.

The Final EIR and EMP will be prepared after the end of the public review period, which will started on 19/09/2017 and ended on 18/10/2017. The Draft Report will be updated with issues raised by I&AP's and new information generated as a result. The Final EIR & EMP will be submitted to DESTEA for review on 20 October 2017.

Feedback received on the Draft EIR is summarised in Table 6 above.

5.6 CONCLUSION ON THE PUBLIC PARTICIPATION PROCESS FOLLOWED FOR THE EIA

It is the opinion of MvW Environmental Services that the public participation process followed was adequate. All comments and concerns received were resolved and mitigated to acceptable levels.

SECTION 6: ALTERNATIVE ANALYSIS

6.1 IDENTIFICATION OF ALTERNATIVES

The EIA (Environmental Impact Assessment) procedure stipulates that the environmental investigation needs to consider feasible alternatives for any proposed development. Therefore, DEAT requires that a number of possible proposals or alternatives be identified and considered in order to accomplishing the same objectives. It is noteworthy that DEAT considers the failure to consider alternatives adequately to be "... symptomatic of a biased process that is intent on defending a project proposal" (DEAT, 2004).

The following alternatives were assessed as part of the EIA:

- Scheduling Alternative
- Status Quo/No Go Alternative;
- Site Alternatives;
- Alternative Layouts;
- Alternative Land Use;
- The Preferred Routes for Installation of the Services;
- Energy Saving Alternatives;
- Water Sources;
- Solid Waste Disposal Alternatives;
- Sewerage Treatment Alternatives;
- Access/Road Design/Traffic;
- Process Alternatives.

6.2 SCHEDULING ALTERNATIVE

It is expected that development of the proposed development will start in 2018 after all required approvals have been received. No detailed information regarding the proposed time frame for the project is yet available, however, it is anticipated that construction starts as soon as possible once all the necessary approvals are obtained from the relevant authorities. Heavy construction will not take place during rainy/wet seasons and will be scheduled outside the summer months if at all possible.

6.3 NO-GO ALTERNATIVE

DEAT (2001) states that the no-go alternative should be considered in cases where the proposed development will have a significant impact, which cannot be effectively or satisfactorily mitigated.

One of the options to be considered on the proposed development is one of no development at all. This would entail leaving the site in its present deteriorating state. This would result in the site being unattended, uncontrolled and unmanaged which could subject the area to negative economic, social and environmental consequences.

The site is already part of the Bloemfontein Town Planning Scheme. The SDF for MMM shows the site as future residential development. The proposed project therefore complies with the Spatial Development Framework (SDF) and Development Facilitations Act (DFA).

Projects of this nature not only have potential to impact the environment negatively, they have proven to have significant detrimental effects both socially and economically. Thus all impacts identified in the Scoping phase have been assessed in this EIR Report, taking into consideration all the aspects of continual monitoring, mitigatory and management procedures.

Should this EIA find that the proposed development will have a significant impact on the receiving environment, which cannot be effectively or satisfactorily mitigated the no go option will be triggered.

6.4 SITE ALTERNATIVES

Alternative sites have not been considered for the proposed development due to the following reasons:

- The site is owned by MMM.
- The site is already part of the Bloemfontein Town Planning Scheme.
- The SDF for MMM shows the site as future residential development.
- The proposed project therefore complies with the Spatial Development Framework (SDF) and Development Facilitations Act (DFA).
- The proposed site can easily be serviced from adjacent existing Lourierpark Development.

6.5 LAYOUT ALTERNATIVES

An additional alternative to the currently proposed development is alternative layouts, while keeping the existing mix of land uses etc. The alternative layouts could include locating various components of the development in different locations and changes such as an increase or a reduction in the density of the development.

Two different layout options were evaluated as part of this EIA study namely Layout Option 1 (preferred) and Layout Option 2 in Figures 18 & 19 below respectively.

The layout as depicted in Figure 18 was used in the Scoping Report as the concept layout but has since undergone very small changes as required by the traffic engineer. The preferred layout identified as part of this EIA can be found in Annexure B and Figure 18 below.

It appears that representations have been made to the executive management at the Local Authority, and they have indicated their support of the preferred layout in Figure 18.

Following below is the advantages and disadvantages associated with the two different layout options.

Layout Option 1 (Preferred)

See Figure 18 as well as the pros and cons of Layout Option 1 below.

Figure 18: Layout Option 1 (Preferred) for the Proposed Lourierpark Development

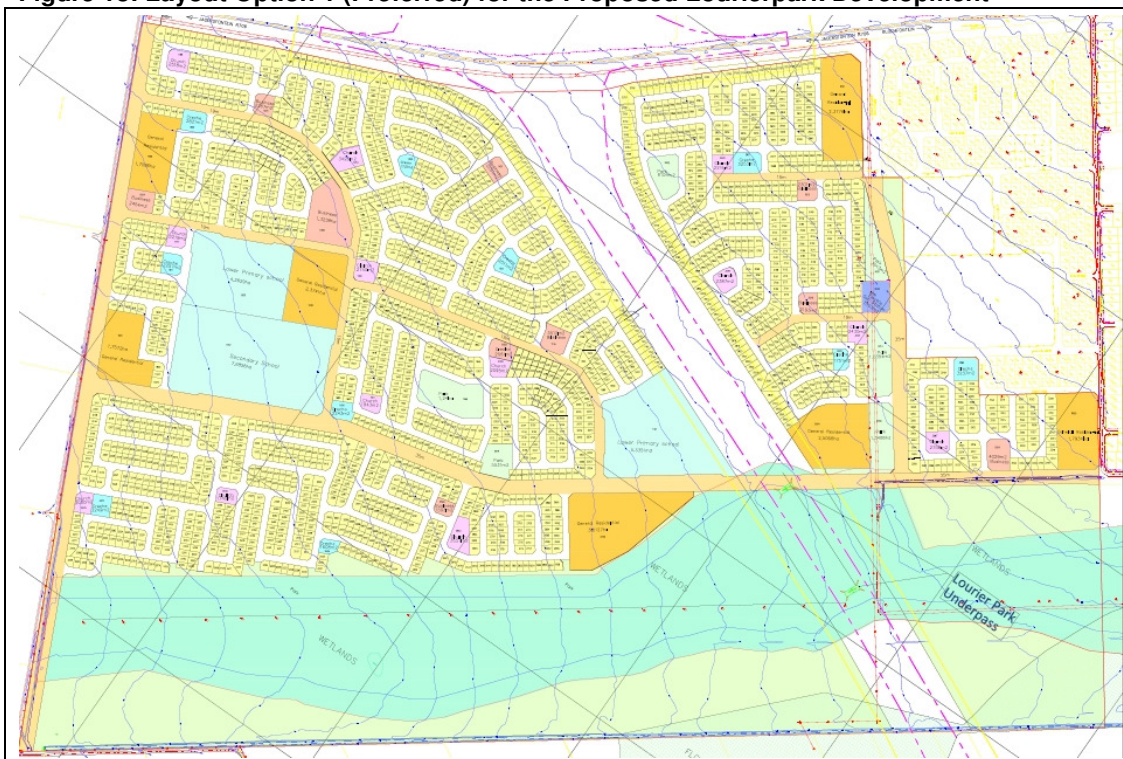


Table 7: Land Use and Statistics Option 1.

LAND USE	NUMBER OF ERVEN	AREA/HA	% OF DEVELOPMENT
Residential	2306	100.0278	28.05
General Residential (±483 units)	7	16.1304	4.53
Business	9	3.3838	0.95
Community Facility – Education	3	17.2838	4.85
Community Facility – Crèche	11	2.6017	0.73
Community Facility – Church	13	3.2027	0.89
CENTLEC	1	0.5103	0.14
Parks	6	128.9371	36.1
N8	0	31.2440	8.77
Streets	0	53.7908	15.09
TOTAL	2356	357.1124	100.00

Layout Option 1 Pros:

- 7 General residential sites are provided which increases the number of units by 145.
- The traffic issues have been cleared with the traffic engineer and Municipality.
- This layout requires less land for construction purposes, and more land becomes available for parks.
- The smaller development footprint of the development will require less intensive landscaping and thus less water and labour. Open space area is much larger than that of Layout Option 2.
- Less small parks erven will require less landscaping and maintenance by MMM. MMM requested less opens pace erven as they cannot maintain so many small parks erven.

- The identified wetland areas and their 50m buffer areas are excluded from the layout and incorporated as park erven.

Layout Option 1 Cons:

- Provision of only a few large parks is short-sighted but demanded by MMM. Parks are not evenly spaced through layout. Play areas for children and room for get together of elderly persons is not in close proximity to most erven in the development.
- The wetlands to the southeast are a serious hindrance to development especially as it can be amended easily, but funding seems a problem.

Layout Option 2 (Alternative)

See Figure 19 as well as the pros and cons of Layout Option 2 below.

Figure 19: Layout Option 2 (Alternative) for the Proposed Lourierpark Township Development.

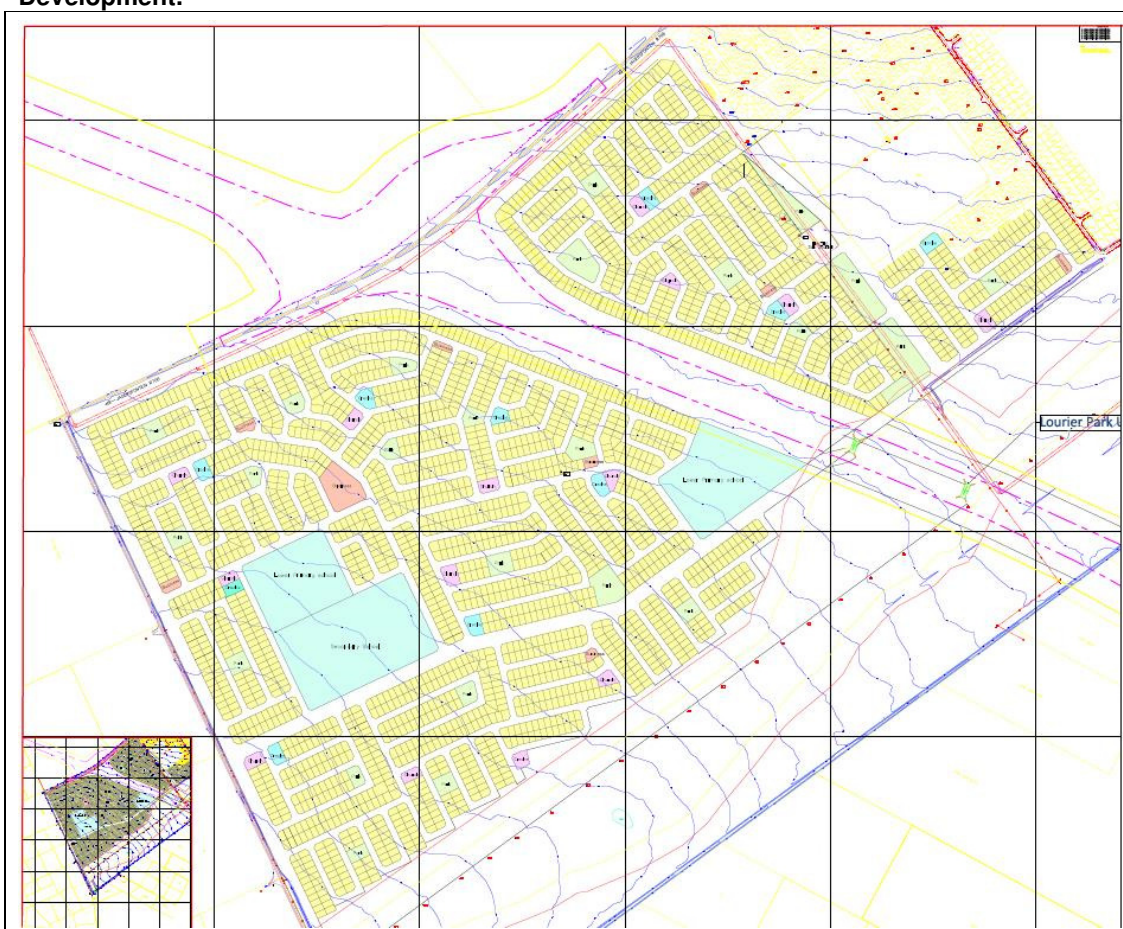


Table 8: Land Use and Statistics Option 2.

LAND USE	NUMBER OF ERVEN	AREA/HA	% OF DEVELOPMENT
Residential	2620	125.8162	35.23%
Business	9	3.2055	0.90%
Community Facility – Education	3	17.2838	4.84%
Community Facility – Crèche	10	2.5834	0.72%

Community Facility – Church	14	2.9185	0.82%
CENTLEC	1	0.5097	0.14%
Parks	24	118.5646	33.20%
N8	0	31.2440	8.75%
Streets	0	54.9867	15.40%
TOTAL	2356	357.1124	100.00

Layout Option 2 Pros:

- ±2620 single residential erven are provided
- Parks are provided evenly spaced through layout. Provides play areas for children and room for get together of elderly persons that is in close proximity to most erven in the development.
- Utilizes more of the land of the portion earmarked for development.

Layout Option 2 Cons:

- A number of traffic issues were identified by the traffic engineer.
- Municipality wants 2 big parks which can be used as soccer fields. There are no funds to develop or maintain smaller parks.
- A late request was also received from MMM to provide general residential erven which will increase number of units that can be accommodated. This is not included on this layout map.
- The wetlands to the southeast are a serious hindrance to development especially as it can be amended easily, but funding seems a problem.
- The larger number of parks erven will require more intensive landscaping and thus more water and labour. More paving will also be required. MMM indicated that they cannot maintain so many parks erven.

From the above mentioned evaluation it is clear that Layout Option 1 is the preferred option as it will provide more residential erven as requested by MMM; will be safer in terms of road layouts as per traffic engineer and it will also require less maintenance for MMM therefore being the more economical choice between Option 1 and Option 2.

6.6 LAND USE ALTERNATIVES

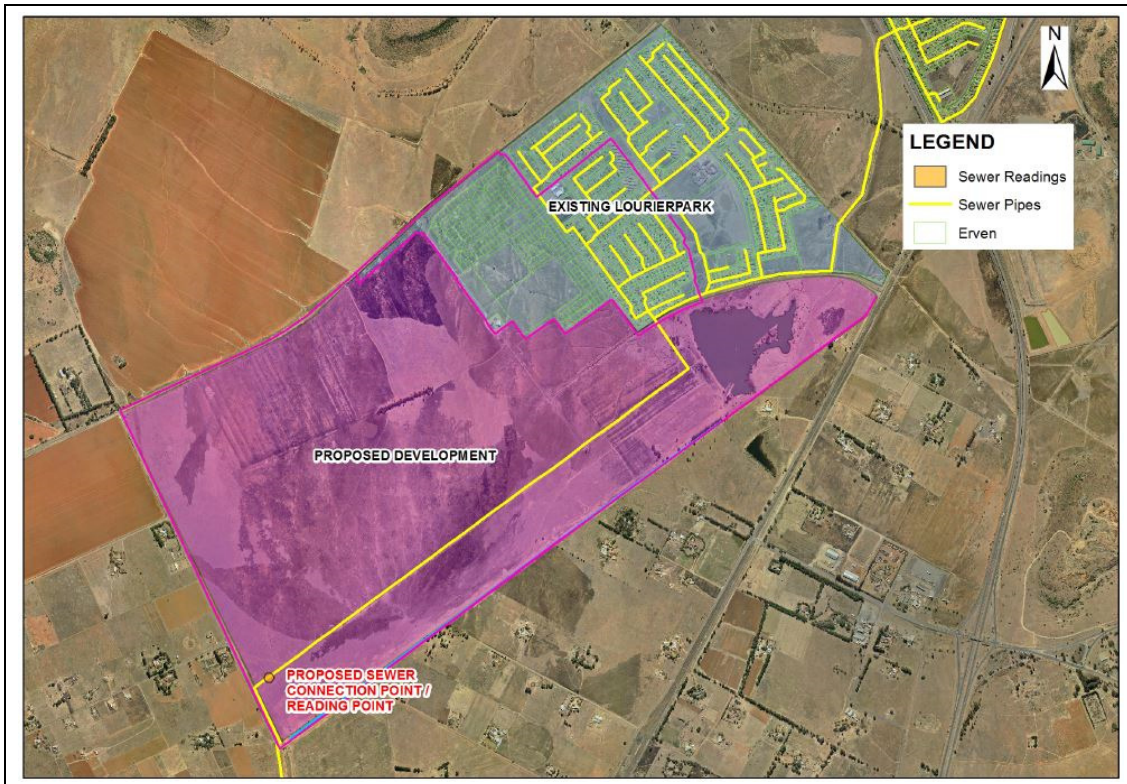
No land use alternatives were evaluated as part of this planned development.

6.7 PREFERRED ROUTES FOR INSTALLATION OF SERVICES

6.7.1 Sewer Line

The existing sewage network of Lourierpark is draining towards a bulk main outfall line close to the southern side of the Development. The size of the pipe varies from 450 to 600 mm diameter where it runs through the Development and drains towards Welvaart Waste Water Treatment Works. This pipeline also serves Pellisier, part of Fichardt Park and Fauna.

Figure 20: Map Showing the Existing Bulk Sewer Line Running Through the Proposed Site.



The 600mm diameter outflow pipe to the Welvaart Waste Water Treatment Works (WWTW) is adequate for the development, but the WWTW does not have sufficient capacity to accommodate runoff from the development. For the interim a package plant can be considered.

No alternative bulk outfall line was evaluated as the existing bulk outfall line already runs through the proposed site. The internal sewerage lines can therefore easily connect on the bulk sewerage line once the WWTW is upgraded, making it a much cheaper option than any other possible options.

6.7.2 Water Lines and Reservoirs

The development area falls within the Brandkop water supply area which is supplied by the Welbedacht Bloemwater reservoir. The existing part of Lourierpark and a part of Pellisier are supplied with a 600 mm diameter pipeline from the Welbedacht Reservoir situated in Pellisier. This reservoir is owned and operated by Bloemwater, has a bottom elevation of 1486 m and a storage capacity of 136 MI.

In the Ferreira and Bonnievale Small Holdings area adjacent to the Development on the south-eastern side, the main water supply is from the Slypsteenbergs Reservoir. The existing network is currently already under pressure for water demand.

The average demand on the Welbedacht Reservoir from existing developments is estimated as 4.02 MI/day. A pressure reducing valve was installed upstream of the Development for the Lourierpark suburb resulting in low pressure readings. Please refer to the Civil Services Report attached as Annexure F1 for measured flows in the existing Lourierpark during the course of a day. The minimum pressure reading was 220 kPa at 11:00 in the morning.

The 600 mm diameter pipe that is fed directly from the Welbedacht Reservoir is adequate for all the development scenarios and will be able to supply the Development under peak flow conditions. Possible connections could be to the 600 mm diameter pipe on the northern side of the

Development and to the existing Lourierpark water network next to Jagersfontein Road. In order to obtain the required minimum pressure and fireflow conditions for the Development, the pressure reducing valve will have to be adjusted. The Bentley Hammer programme was used to analyse the system for the water demand of the reticulation.

The connection to the 600mm diameter pipeline is not the favourable option as the main objective of the Bloemwater (Welbedacht) reservoir is that of a terminal storage reservoir and not a supply reservoir. According to the Bloemfontein Bulk Civil Engineering Services Masterplan, September 2009 the supply areas of the reservoir are already experiencing water supply problems when maintenance is required or repairs needs to be done on the supply line of Bloemwater. It would be preferable to obtain bulk water supply to the development area from an alternative source.

The following alternative options exist:

- a) Bloemwater Welbedacht reservoir. This is not preferred, but is the easiest owing to the existing connection.
- b) Longridge reservoir. This would be the preferred option, once planned new storage reservoirs are constructed at Longridge.
- c) New reservoir at Slypsteenbergh. This is the preferred option under the current conditions.
- d) A new reservoir that forms part of a new water supply zone (Bloemfontein Bulk Civil Engineering Services Masterplan option). Apart from Highway Park, Cecilia North and South the reservoir will also supply the Brandkop and Fichardt Land developments. It is not the preferred option as it is not known when these developments will take place. If the reservoir is constructed, it must make provision for the Lourierpark Development.

In all cases it is estimated that at least a 350 mm diameter bulk supply pipeline will be required.

Please refer to Figure 21 & 22 below for the proposed water connection and the positions of the reservoirs mentioned above respectively.

Figure 21: Map Showing the Existing Water Pipelines at Lourierpark and the Different Proposed Water Connection Points.

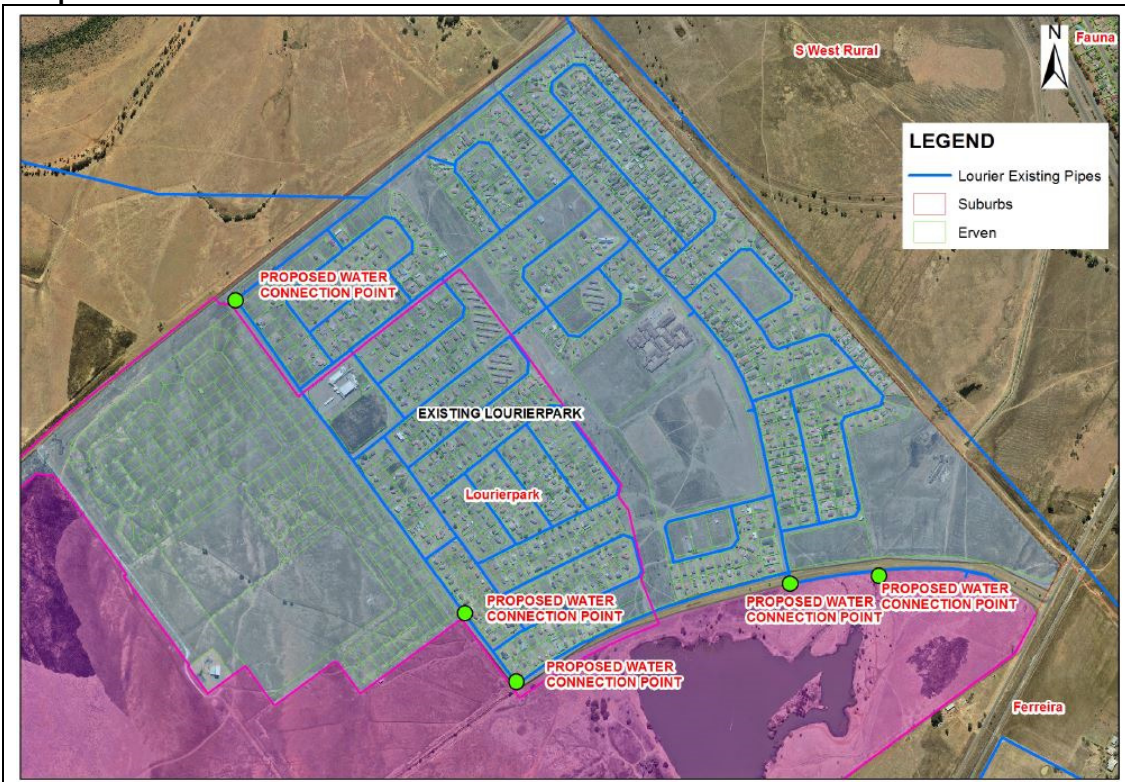
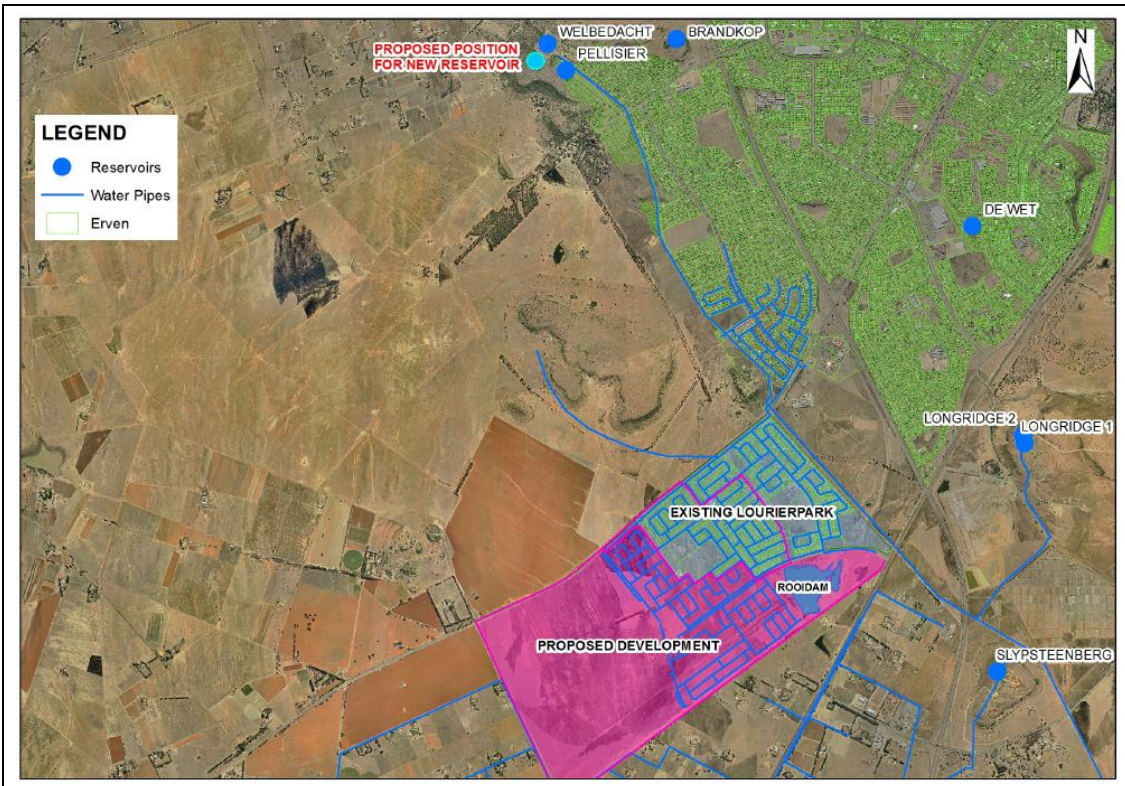


Figure 22: Map Showing the Alternative Water Reservoirs Available for Bulk Water Provision.



With the highest level of the Development being at 1416.5m it will be possible to supply the Development under gravity conditions. The existing pipe reticulation system was modelled for fire fighting draw-off. With the main supply from the 600 mm diameter pipe the internal network would consist of a ring mains distributing domestic and fire fighting water within the Development. The area can be classified as “Low Risk, Class 2” for fire fighting purposes. The pipe reticulation system will be designed to allow for sufficient draw-off volumes and pressure for fire fighting. Pipe sizes should range between 75 mm and 300 mm nominal diameters with double and single house connections to within the erf boundaries. Fire hydrants should be spaced 240 m apart throughout the Development. Materials and construction methods will be specified to comply with SANS Standards.

6.7.3 Electricity Line and Substations

The proposed area for this development as indicated on the layout plan is currently not serviced with an electrical infrastructure that could cater for high electrical load densities such as for urban areas.

The proposed development falls within the current supply area of Centlec and falls within the SDF for MMM.

The proposed development will have a load requirement of 6 MVA. This area will be supplied from the existing Flora Distribution Centre which has sufficient spare capacity to supply the proposed 6MVA. The developer will be required to provide three primary substation buildings within the development with a maximum of not more than 7 (seven) 500kVA miniature substation between primary substations.

No alternative investigated to the above mentioned as any other options will more expensive.

6.8 ENERGY EFFICIENCY

The planning and design of the electrical installations must comply with National Building Regulations in pursuit of energy efficient power consumption. Equipment and material must be selected and the installation designed for optimum energy efficiency. Conserving power will ultimately result in reduced carbon dioxide emissions.

To save electricity the following measures are proposed as alternatives to the norm, in order to save electricity in the proposed development.

- Making use of solar streetlights;
- Solar geysers;
- Solar cookers;
- Energy saving LED lights;
- Cut Your AC/Heating Needs;
- Unplug – Turn appliances off at the plug point. Appliances left on standby can still draw about 20% or more of normal electricity use!
- Turn down the heat – A geyser uses 39% of all household electricity. To save electricity, turn it off when during that day when it's not in use. You could also adjust the temperature setting to 60°C and you may see a 5% reduction on your electricity bill.
- Insulate your hot water geyser – Wrap up your geyser to prevent heat loss. A simple geyser blanket can reduce electricity consumption and help you save money by slashing as much as R500 a year off your electricity bill! We recommend eco-friendly thermal insulation made from recycled PET plastic bottles.
- Insulate the roof – The roof is a source of heat loss in winter so insulate it with thermal insulation. The good news is that it will also help reduce the heat in summer. According to the City of Cape Town roof insulation can save as much as 16% of the electricity required to heat or cool a home.

6.9 WATER SOURCES

Water is a scarce resource in South Africa without which life is not possible. At the present time Bloemfontein is subjected to water restrictions.

6.9.1 Water Supply Alternatives

The proposed development will require water for domestic supply as well as for irrigation of sports fields and landscaping areas. Two options are available:

- Option 1: MMM Water Reticulation;
- Option 2: Groundwater Resources.

The 600mm diameter pipe in Jagersfontein Road has sufficient capacity to accommodate the development although the 220kpa reading is a concern for fire flow conditions. The pressure reducing valve in the pipeline will have to be adjusted to accommodate the water demand from the Development.

Option 1 – MMM Water Reticulation:

Option 1 Pros:

- Preferred option for MMM and DWS;
- Enough bulk capacity is present for the flow expected from the proposed development;
- Less maintenance required;
- Does not require licencing from DWS.

Option 1 Cons:

- More expensive than water obtained from groundwater resources.

- Pipeline connecting the proposed development with existing Lourierpark reticulation will be required.
- Negative impact on the existing spare capacity of the bulk water supply capacity of the MMM for the area.

Option 2 – Groundwater Resources:

Option 2 Pros:

- No impact on the existing spare capacity of the bulk water supply capacity of the MMM for the area.
- Small footprint. No extra Lourierpark.
- Water will be much cheaper than that from MMM water reticulation.

Option 2 Cons:

- Not the preferred option for MMM and DWS;
- Require licence from DWS;
- Boreholes do not exist on the property. A new borehole will need to be drilled. It is very expensive to drill and equip a new borehole.
- The possibility always exists that the borehole might run dry leaving the proposed development without water.
- Much more maintenance than option 1.
- Groundwater resources might be affected or even depleted leaving the rural community and their farming operations without any water resources.

From the above mentioned it is clear that the best option for the proposed development's domestic water requirements will be to connect the proposed Lourierpark reticulation to the existing water reticulation of MMM next to the Jagersfontein road. The development must not be allowed to make use of groundwater as its domestic water supply. This might have a negative impact on the areas groundwater resources leaving many people and animals in the surrounding areas without any water supply.

It is however suggested that the client apply for a water use licence so that the developments sports fields and gardens can be irrigated.

6.9.2 Green Design of the Development.

South Africa is a semi-arid country that receives an average of 490 mm of rain every year. Currently, South Africa is experiencing a water shortage because there is only 1 000 m³ of water available per person per year. This figure will decrease as our population expands, pushing us into a greater water crisis. Municipal water use, which includes domestic water and water used in the garden, makes up an average of 27% of the total water used in the country. A major component of domestic water consumption is gardening, estimated at 31-50% of total household water use.

a) Storage Tanks

Storm water from roof coverings can be stored for later use in ground level rain water storage tanks. The rain water tanks will have to be aesthetically designed so as not degrade the overall architectural appearance of the buildings. In the most basic form the storm water can be stored in PVC/ HDPE tanks. The water can be utilised for watering of the gardens.

The following benefits will be derived from the implementation of the tanks:

- Reduction in demand on water for irrigation purposes.
- The flow hydrograph will flatten meaning that the peak flow will reduce burden on downstream storm water infrastructure.

Figure 23: Photograph Showing the Ground Level Rain Water Storage Tanks that can be Used in the Proposed Development.



Small inexpensive pumps may be required if the tanks are to be integrated into a sprinkler systems. The system can in the simplest form be operated using the “flood irrigation” method which means that a garden hose is simply left open to water lawns and beddings.

The following infrastructure will be required:

- Tanks complete with taps and garden hoses.
- Optional: Screen wall for protection of the tanks and to enhance appearance.
- Optional: Pump Installation if sprinkler irrigation is required.

b) Grey Water Management

Rand Water and UNISA research shows that the quality of grey water from sample homes in suburbs are all within the parameters of the South African water quality guidelines for irrigation. This means that grey water is safe to use for irrigation in your garden.

A grey water system can be very simple. For example, you can use a bucket to carry your bath water outside to water the garden. Or, you can install a state-of-the-art system that does everything for you. The goal is to find a system that makes maximum use of your grey water, while minimising costs for the purchase, installation and maintenance of your system.

Different systems include:

1. Bucket system: Use a bucket to transport the grey water, by hand, from the bathroom to garden. It is the cheapest system but may be slightly inconvenient.
2. DIY pipe system: Connect a pipe from the outlet of your bathroom to a hose-pipe. Lay the hose-pipe in the part of your garden that needs watering.
3. Commercial grey water system: The grey water system is connected directly to the outlet pipes of the bathroom and the grey water is collected in a closed storage tank. The grey water is filtered to remove hair and lint. From the storage tank, the grey water is pumped to irrigation pipes and distributed to the garden

Water from the following sources can be used for grey water irrigation. The following sources are ideal for such usage:

- Washing machine water.

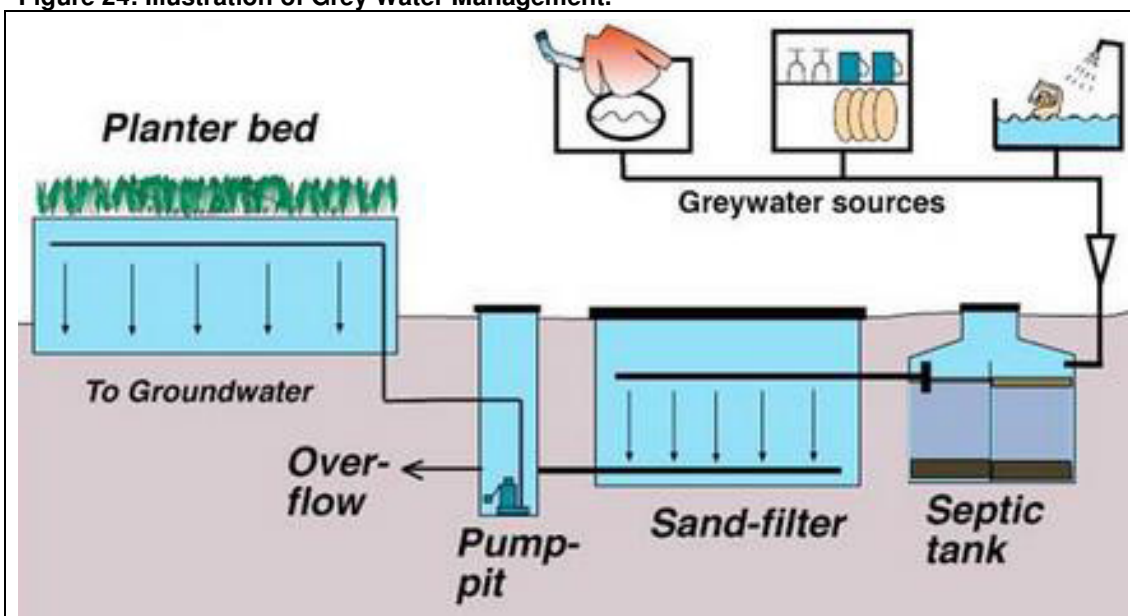
- Water from baths, hand wash basins and showers.

Septic tanks and water filtration systems may be implemented depending on the quality of water that is released back into the environment. The systems requires the installation and operation of pumps to either lift grey water to aboveground septic tanks or the lift water from below ground surface septic tanks. Septic tanks provide a facility where digestion can take place, but it also serve as a place to store water until it is needed.

The following infrastructure will be required:

- Flexible hoses to connect to 40 mm diameter waste water pipes.
- Optional: Septic Tank.
- Optional: Sand filter
- Optional: Pump installation
- Green landscape to take up the water.

Figure 24: Illustration of Grey Water Management.



There are many reasons why using grey water is beneficial. You will use less of our valuable potable water and save thousands of litres of drinking water. You will reduce the impact on natural water resources by reducing water consumption. Also, you will save money on your water bill.

Grey Water Tolerant Plants

In general, tough drought-tolerant plants will do best with grey water irrigation watering. Grey water is typically alkaline, so avoid using it on acid-loving plants. Plants watered with grey water will benefit from an occasional flushing of rainwater or tap water to remove any grey water residue on the plant leaves, especially if you’ve used the “sprayer” system. Pay attention to what your plants are telling you. Dry, wilted or curled leaves can be signs of lack of water, while wilted shoot tips or soft plant tissue can mean overwatering.

Using environmentally friendly soaps, detergents and cleaning products will positively improve the quality of your grey water and be an advantage to your garden. Also, don’t always irrigate in the same place with grey water. Constantly move the sprinkler watering system in the garden.’

Benefits of grey water to plants include:

- Grey water contains small amounts of nitrogen and phosphorus, which are potential sources of plant nutrients.
- The soapy nature of grey water can act as a pest repellent.

Important to Note:

- Don't let kids or pets play in or around grey water.
- Don't use grey water in a mist system (pathogens can be dispersed in the mist) or in a drip system (particles will clog the drip nozzles).
- Do not allow grey water to pool.
- Do not use grey water if it contains oil, faeces or urine.

c) Other Water Saving Measures to be Implemented.

The following measures must be utilised in the proposed development so as to lower the amount of water that will be consumed.

- Educate everybody involved in the development regarding the importance of conserving water resources.
- Implement the following water saving tips.
 - Reduce water consumption by:
 - Turn-off the tap while brushing teeth, shaving or soaping hands.
 - Take shorter showers and use less water if you bath.
 - Avoid buying bottled water.
 - Sweep outside areas instead of hosing with water.
 - Use eco-friendly soaps and cleaning products.
 - Fix leaks and report public water leaks to the Municipality.
 - Always use a plugged-sink or bowl instead of a running tap.
 - Insulate hot water pipes to reduce time waiting for water to heat up.
 - Install aerators and flow-reducing valves on your taps.
 - Install water saving devices on taps, toilets, showers & sprinklers.
 - Install a water meter and monitor your use.
 - Install an instant water heater at your taps for immediate hot water.
 - Car:
 - Wash your car with a bucket and sponge only.
 - Use a hosepipe with a self-closing nozzle to wash your car.
 - Use a commercial car wash that recycles water.
 - Bathroom:
 - Shower instead of bath.
 - Use less water in the bath.
 - Flush the toilet only when odours make it necessary. Unnecessary flushing of the toilet can waste lots of water per year.
 - Do not use the toilet as a garbage can. Tissues and other items are often flushed away instead of going into appropriate disposal containers.
 - Put a brick in your cistern to reduce.
 - Install a low-flow shower-head.
 - Install aerators and flow-reducing valves on your taps.
 - Install a dual flush mechanism on your toilet. Toilets use about 30% of the total water used in a household. An old style single flush toilet can use up to 13 litres of water in one flush. New, more water-efficient dual-flush toilets use only 8-9 litres for a full flush and 4-5 litres with a reduced flush. A family of four can save a swimming pool of water a year.
 - Install a geyser blanket for insulation.
 - Insulate the copper pipes around the geyser.
 - Laundry:
 - Cut back on washing your towels and linen.
 - Match the size of your laundry load with water volume.
 - Buy an eco-friendly wash ball.
 - Buy a water-efficient washing machine.
 - Kitchen:

- Only turn the dishwasher on when it's full.
- Use a plugged sink to wash dishes instead of a running tap.
- Use less dish-washing liquid to reduce the need for rinsing.
- Use a plugged sink to rinse vegetables instead of a running tap.
- Use the water you used to rinse fruit and veggies to water plants.
- Keep a bottle of tap water in the fridge to avoid running the tap until the water is cold.
- Don't use running water to defrost food.
- Install aerators and flow-reducing valves on your taps.
- Purchase water-efficient appliances and water-saving devices.
- Plants & Garden
 - Learn about water-wise gardening and implement.
 - The reuse of wastewater (grey water) and soil improvement process e.g. composting.
 - Mulch your garden. Mulch is a layer of material spread on top of the soil to conserve moisture, discourage the growth of weeds and even out soil temperature- it can keep up to 70% more water in the soil.
 - Use drip irrigation systems instead of sprinklers.
 - Beware of using green lawn clippings - they can pack down quite hard and become a barrier stopping water getting to the plants. Better to put them into the compost pile and let them break down
 - Do not overuse hoses or sprinklers in hot weather. A sprinkler can use as much water in an hour as a family of four will use in a day. Your lawn only really needs watering once a week and it is better to water in the morning when the temperature is lower and evaporation is less.
 - Group plants together that have the same water requirements.
 - Water plants with the water you used in the kitchen to rinse fruit and veggies.
 - Choose local indigenous water-wise plants for the gardens and landscaping.
 - Adjust sprinklers to water plants and not the pavement.
 - Put self-closing spray-nozzles on hosepipes.
 - Use natural and organic garden products.
 - Using collected rainwater for irrigation of gardens. Collecting rainwater allows you to be prepared for times of low rainfall, so you can still maintain your garden, especially if there are water restrictions in your area. It reduces the load on storm water systems because roof runoff is not flushed into the drains.
 - Using rainwater reduces the need to build more water storage dams, which may have to be situated in environmentally sensitive areas.
- Methods to check your home is leak free:
 - Use your water meter to check for hidden water leaks. Read the water meter before and after a two-hour period when no water has been used. If the water meter doesn't read exactly the same, then there is a leak.
 - To check for toilet tank leaks, add food colouring to the tank. If the toilet leaks, the toilet bowl will have changed colour within 30 minutes.
 - Repair dripping taps by replacing the washer. If a tap is dripping at a rate of 1 drop per second, you could be wasting up to 10,220 litres per year!
 - If your toilet handle constantly stays in a downward position this means that water is constantly running. Replace or fix the handle to avoid wasted water.
 - Insulate your water pipes. If you do, you'll get hot water faster, avoid wasting water while it is heating, and also saving money on electricity!

6.10 SEWERAGE TREATMENT ALTERNATIVES

According to the Services Report there are currently adequate bulk sewer connection points available for the proposed development. The 600mm diameter outflow pipe to the Welvaart Waste Water Treatment Works (WWTW) is adequate for the development, but the WWTW does not have sufficient capacity to accommodate runoff from the development. For the interim a package plant can be considered.

The following alternatives were considered with respect to treatment and disposal of wastewater. These include:

- Option 1 - Connection to MMM Urban Sewer Reticulation;
- Option 2 – Construction of Package Treatment plant on site.

Each of the options has certain advantages and disadvantages. Each potential option will be considered in turn, although only the practically feasible ones will be evaluated further in terms of costing.

Option 1 - Connection to MMM Urban Sewer Reticulation:

Option 1 Pros:

- Preferred option for MMM and DWS;
- Cheaper than option 2;
- Less Maintenance;
- Does not require licence from DWS.

Option 2 Cons:

- Enough bulk capacity is not available for the flow expected from the proposed development. WWTW needs to be upgraded.
- None

Option 2 – Construction of Package Treatment plant on site:

Option 2 Pros:

- Better control over standard of effluent;
- A small footprint;
- Utilisation of high quality effluent for irrigation purposes.

Option 2 Cons:

- Not the preferred option for MMM and DWS;
- Require licence from DWS;
- Effluent must comply with Department of Water Affairs standards and approvals;
- On-site purification is generally much more expensive per volume due to the negative economies of scale associated with small plants.
- It also places an operational burden on the beneficiaries of the development.
- Much more maintenance than option 1. The non-biodegradable sludge which accumulates inside process units will have to be removed on a regular basis, usually once per month. Some of the package plants also make use of enzyme dosing which is usually also a once a month requirement.
- These plants are generally constructed from alternative materials such as steel, glass reinforced plastics or pre-cast concrete elements, as these materials reduce the construction costs of a small works. As reinforced concrete is generally more durable than the alternative materials, the plants which contain alternative materials usually have a shorter design life.

From the above mentioned it can clearly be seen that the option 1 (connection to existing municipal reticulation) clearly outweigh option 2. The proposed development will therefore connect to the existing MMM sewer reticulation as soon as available capacity exists at WWTW.

In the interim the development must make use of a package treatment plant. Important to note that the package treatment plant will require its own EIA Authorization before it can be constructed. It therefore does not form part of this study.

6.11 SOLID WASTE DISPOSAL ALTERNATIVES

The Mangaung Local Municipality confirmed that they collect solid waste at Lourierpark and that they have sufficient capacity to remove solid waste generated at the proposed development. Local tariffs would apply for collection at the proposed development.

As an alternative to the above-mentioned, a private landfill site can be registered and constructed. With the waste removal services offered by the municipality, this option would not be viable and will not be discussed any further.

6.12 ACCESS/ROAD DESIGN/TRAFFIC

The development will make use of the access roads as indicated on the attached layout plan. No additional access roads were evaluated.

6.13 PROCESS ALTERNATIVES

Process alternatives relate to design configurations of service facilities. Alternatives relating to process include the routing of power and communication systems either above or below ground. In order to reduce the visual impact of the development, the below ground option was selected.

SECTION 7: ENVIRONMENTAL IMPACT DETERMINATION AND ASSESSMENT PROCEDURE/CRITERIA

7.1 INTRODUCTION

The potential impacts of the proposed development were initially identified through a desktop study and from the comments received during the public participation conducted. In the approved Scoping Report, the key issues/impacts were broadly identified and outlined to be investigated further. This EIR will assess the potential impacts, identifying the impacts that are potentially significant and recommending management and mitigation measures to reduce the impacts.

7.2 KEY ISSUES/IMPACTS AS IDENTIFIED IN THE SCOPING REPORT THAT WAS APPROVED IN THE SCOPING REPORT BY DESTEA

An environmental impact is defined as a change in the environment, be it the physical/chemical, biological, cultural and or socio-economic environment. Any impact can be related to certain aspects of human activities in this environment and this impact can be either positive or negative. It could also affect the environment directly or indirectly and the effect of it can be cumulative.

The key issues/impacts listed in the following section have been determined through an internal process based on similar developments, environmental impact assessment, public participation process as well as various site visits. The following potential impacts will be further investigated in this EIR by means of the Methodology described in section 7.3 below.

7.2.1 Geology

Due to construction, disturbance in surface geology may occur as result of foundations.

7.2.2 Topography

Erosion during the clearing and construction phases of the project may lead to an impact on the topography. Building material may also alter the topography of the area.

7.2.3 Top Soil and Land Use

During the construction phase of the project, soil recourses including essential top soil may be impacted on. Erosion of topsoil may occur as well as the compaction of soil.

7.2.4 Surface Water and Groundwater

Contamination of surface water may occur as a result of improper management of contaminants. Improper management of sanitation may result in the contamination of groundwater.

7.2.5 Fauna

Impact on Fauna may occur as a result of the distraction of habitats during the construction phase and clearing phase of the project.

7.2.6 Flora

A loss in vegetation may occur during vegetation removal prior to construction activities taking place.

7.2.7 Noise

During the construction phase of the project, noise will be generated by construction vehicles, construction machinery and contractors.

7.2.8 Air Quality

CO² Emissions from construction vehicles and machinery, as well as dust during the construction phase will have an impact on air quality.

7.2.9 Archaeology and Palaeontology

The possibility occur that the construction activity may lead to an impact on Archaeology and Palaeontology aspects.

7.2.10 Visual Impacts

The visual perspective of the property will be changed.

7.2.11 Traffic

The development will include the construction, expansion and lengthening of roads as mentioned in the report above. This will have an impact on traffic in the area.

7.2.12 Socio Economic

Socio Economic can be divided into the following two categories:

Positive Socio Economic Impacts:

- The proposed development will result in job creation during the construction and operational phase of the project.
- The proposed development will provide much needed services; educational facilities etc as well as economic injection within the municipality.

Negative Socio Economic Impacts:

- An increase in criminal activities in the local regions of the proposed activity.
- Safety impacts may occur as a result of improper safety management on site.

7.2.13 Cumulative Impacts

Cumulative Impacts include a potential change in surface and ground water source quality, impact on groundwater levels as well as increased flood events.

7.3 METHODOLOGY ADOPTED IN THE ASSESSMENT OF POTENTIAL IMPACTS

The identification and assessment of environmental impacts is a multi-faceted process, which combines quantitative and qualitative descriptions and evaluations. It involves the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of inter alia: the purpose and need for the project; views and concerns of interested and affected parties, general public interest; and environmental legislation and guidelines.

The generic criteria and systematic approach used to identify, describe and assess impacts are outlined below. The assessment of the impacts will be conducted according to a synthesis - of criteria required by the integrated environmental management procedure.

7.3.1 Phasing

Activities within the framework of the proposed project give rise to certain impacts. For the purposes of assessing these impacts, the project has been divided into four phases from which impacting activities can be identified, namely:

a) Planning and Design Phase

The management responses contained in the mitigation measures in this EIR, are measures prescribed to minimise the impacts associated with the project. The management responses contained in the mitigation measures in this EIR have been formulated with the holistic view to minimising any potential impacts to adjoining habitats and ecosystems linked to this site. These measures must be used on site during the planning and construction phases of the proposed Lourierpark township development and associated infrastructure.

The point of departure for these measures is to take a pro-active route by addressing potential problems before they occur. This should limit corrective measures required during the construction phase of the project. Additional mitigation will be included throughout the project's various phases, as required and if necessary. Although there are few impacts associated with the planning and design phase it's important that this EIA incorporate it. The following are considered mitigation measures prior to construction.

- Conduct the Public Participation Process as prescribed for the 2014 EIA Regulations.
- Construction may only commence once the Appeal Process on the EA issued by DESTEA had passed successfully.
- Construction may only commence once certain requirements as stipulated in the EA has been confirmed with.
- Obtain declaration of interest from all appointed specialists that will form part of the EIA.
- Obtain the required authorization from relevant landowners to conduct the EIA on their properties.
- The compilation of an Environmental Management Plan (EMP).
- Approval from DWS will be required if the development is planning to make use of groundwater.
- The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998).
- A Traffic Impact Assessment must be compiled.
- An Ecological Report must be compiled so as to identify any protected or red data plant and animal species that might be present on the site. Also to identify any potential sensitive areas on the devilmint site that must be conserved.
- Determination of the 1:100 year flood line that is a requirement of all township establishment applications.
- The stormwater drainage system should be designed for a 1: 5-year flood. Stormwater in the development should drain mostly via roadside channels and if required, subsurface concrete pipes. The minimum size should be 375 mm nominal diameter.
- The stormwater drainage should be designed taking the inflow from the cultivated lands on the northern side of the Jagersfontein Road into consideration. As future development in these areas are planned, it is proposed that the stormwater design of the Development should only take the current scenario in consideration and that additional runoff from proposed northern developments be diverted alongside the Jagersfontein Road to the western side. This proposal forms part of the BLOEMFONTEIN BULK CIVIL ENGINEERING SERVICES MASTERPLAN.
- Architectural and Town Planning Guidelines (e.g. coverage, height restrictions, building materials etc.) to help mitigate against potential visual impact on surrounding properties.
- Geotechnical Report must be conducted to determine the sub-surface features, to identify the soil and rock conditions.
- A Civil Services Report must be conducted to identify the availability of bulk services in the area as well their available capacity.
- An Electrical Report must be conducted to identify the possibility to connect to existing networks as well their available capacity.
- A First Phase Heritage Impact Assessment must be conducted.
- Studies must be done to determine whether or not the proposed site has a wetland on it or not.
- Identification of new access roads and the approval thereof at relevant authorities.
- Storm water runoff needs to be taken into account in the Civil Services Report.
- The EMP must be signed by the developer and the contractor stating that they understand the conditions and requirements of the EMP.
- The conditions in the environmental authorization must be complied with by the developer and the contractor.

- A photographic record of the site must be taken prior to construction and regularly updated during the construction phase.
- All records with respect to the construction (materials, suppliers) must be kept as well as compliance and non-compliance with the environmental authorization conditions, environmental incidents and complaints. These documents must be available to the department of environment on request.
- An environmental control officer (ECO) must be appointed before construction phase commences. The ECO must form part of the project management team and attend all relevant project meetings.
- Where possible skilled and unskilled labour should be sourced from the local community.
- An induction course of environmental awareness must be conducted for the contractor before commencement of the activity to ensure that they are fully aware of the EMP and their responsibilities. Training of staff working on the construction site with respect to environmental awareness and the EMP is essential and the responsibility of the developer and the contractor before construction commences.
- The proposed development must have obtained all required town planning authorizations from MMM.
- The developer must provide all contractors and sub-contractors with a copy of the EIR, EMP and EA as issued by DESTEA.
- The contractor must appoint an environmental liaison officer (ELO). This person will be required to monitor the development with a direct hands-on approach, and ensure compliance and co-operation of all personnel. He should preferably be fluent in the languages of the employees.

b) Construction Phase

All the construction and construction related activities on study area, until the contractor leaves the study area. The activities arising from the construction phase will be included in the impact tables to form part of this EIR. The assessment will identify activities, which will require certain environmental management actions to mitigate the associated negative impacts.

c) Operational Phase

All post-construction activities, including the operation and maintenance of the proposed development. The activities arising from operational phase were included in the impact tables to form part of this EIR. The assessment will identify activities, which will require certain environmental management actions to mitigate the associated negative impacts.

d) Decommissioning Phase

It is not envisaged that this project will be decommissioned. A Decommissioning EIA and EMP will be required before the developed site will be able to be decommissioned in future.

7.3.2 Assessment Criteria

The assessment of the impacts in this EIR was conducted according to a synthesis of criteria required by the Integrated Environmental Management (IEM) procedure.

Table 9: Impact Assessment Criteria

Impact Assessment Criteria	Description
Nature of Impact	This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. Its description should include receiving environment and how it is impacted. Is the impact destructive, or benign?
Extent	<p>The physical and spatial size of the impact, which is classified as:</p> <ul style="list-style-type: none"> • <u>Study Area/Site</u> - The impact could affect the whole, or a measurable portion of the proposed property. • <u>Local</u> – This include the site as well as the immediate areas surrounding the proposed site. • <u>Regional</u> - The impact could affect the area including the neighbouring farms/smallholdings, commercial properties the transport routes and adjoining towns. • <u>National</u> – The impact could have an impact on other provinces and therefore on National level. • <u>International</u> - The impact could have an impact on other countries and therefore on International level.
Duration	<p>The lifetime of the impact. This is measured in the context of the lifetime of the proposed development.</p> <ul style="list-style-type: none"> • Immediate – Impact expected immediately. • <u>Short-Term (0-5 years)</u> - The impact will either disappear with mitigation or will be mitigated through natural process in a span of 0 – 5 years normally during the construction phase. • <u>Medium Term (5 – 15 years)</u> - The impact will last up to the end of the phases, where after it will be entirely negated. • <u>Long Term (duration of operation)</u> - The impact will continue or last for the entire operational life of the Project, but will be mitigated by direct human action or by natural processes thereafter. • <u>Permanent</u> - The only non-transitory impact class. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Magnitude	<p>This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does it destroy the impacted environment, alter its functioning, or render it slightly altered? These are rated as:</p> <ul style="list-style-type: none"> • <u>Minor</u> – Impacts benign or no impacts. • <u>Low</u> - The impact alters the affected environment in such a way that the natural processes or functions are not affected.

Impact Assessment Criteria	Description
	<ul style="list-style-type: none"> • <u>Moderate</u> - The affected environment is altered, but function and process continue, albeit in a modified way. • <u>High</u> - Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability	<p>This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.</p> <ul style="list-style-type: none"> • <u>Improbable</u> - The possibility of the impact occurring is rated as very low, due to the circumstances, design or previous experience. • <u>Probable</u> - There is a possibility that the impact will occur, to the extent that provisions must be made therefore. • <u>Highly Probable</u> - It is most likely that the impacts will occur at some or other stage of the project. Plans must be drawn up before the undertaking of the activity. • <u>Definite</u> - The impact will take place regardless of any prevention plans, and mitigation actions or contingency plans must be relied on to contain the effect.

Impact Assessment Criteria	Description
<p>Environmental Significance</p> <p>SIGNIFICANCE POINTS (SP) = (MAGNITUDE + DURATION + EXTENT) X PROBABILITY (SEE SECTION BELOW)</p>	<p>Significance is determined through a synthesis of impact assessment criteria. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as “positive”.</p> <p><u>No significance:</u></p> <ul style="list-style-type: none"> ○ <u>Without mitigation:</u> The impact is not substantial and does not require any mitigation action. ○ <u>With mitigation:</u> The impact will be mitigated to the point where it is regarded to be insubstantial. <p><u>Low:</u></p> <ul style="list-style-type: none"> ○ <u>Without mitigation:</u> The impact is of little importance, but may require limited mitigation ○ <u>With mitigation:</u> The impact will be mitigated to the point where it is of limited importance. <p><u>Moderate:</u></p> <ul style="list-style-type: none"> ○ <u>Without mitigation:</u> The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels. ○ <u>With mitigation:</u> In spite of the successful implementation of the mitigation measures, the impact will remain of significance. However, within the overall context of the project, the persistent impact does not constitute a fatal flaw. <p><u>High-</u></p> <ul style="list-style-type: none"> ○ <u>Without mitigation:</u> The impact is of great importance. Failure to mitigate with the objective of reducing the impact to acceptable levels could render the entire project option or entire project proposal unacceptable. Mitigation is therefore essential. ○ <u>With mitigation:</u> Mitigation of the impact is not feasible. The impact continues to be of great importance, and, within the overall context of the project, is considered to be a fatal flaw in the project proposal.

The significance (quantification) of current and potential environmental impacts identified during the assessment was determined using a ranking scale, based on the following (terminology has been adopted from the guideline documentation on EIA Regulations of the Department of Environmental Affairs, April 1998):

Table 10: Impact Assessment Criteria Ranking Values

TERMINOLOGY	DEFINITION	RANKING
Duration (D)	In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment.	5 – Permanent. 4 - Long-term. 3 - Medium-term (5-15 years). 2 - Short-term (0-5 years). 1 – Immediate.
Magnitude (M)	A description must be given as to whether an impact is destructive, or benign. It determines whether the intensity of the impact on the natural environment or society is permanently, significantly changes its functionality, or slightly alters it.	5 - Very high. 4 – High. 3 – Moderate. 2 – Low. 1 – Minor.
Extent (E)	The extent of the impact refers to the spatial dimension to which an impact will be felt (i.e. site, study area, local, regional, or national scale).	5 – International. 4 – National. 3 – Regional. 2 – Local. 1 – Site only.
Probability (P)	The criteria used for rating the likelihood of impact occurrence	5 – Definite. 4 – Highly probable. 3 – Medium probability. 2 – Low probability. 1 – Improbable.

The environmental significance of each potential impact was assessed using the following formula:

$$\text{SIGNIFICANCE POINTS (SP)} = (\text{MAGNITUDE} + \text{DURATION} + \text{EXTENT}) \times \text{PROBABILITY}$$

The maximum value is 75 Significance Points (SP).

The rating of the environmental effects is done as follows:

- High (>50 SP),
- Moderate (25 - 50 SP) or
- Low (<25 SP) significance.

This is done with and without mitigation measures and for both occurrence and severity, on the following basis:

Table 11: Environmental Significance Impact Rating

SP >50	Indicates High environmental significance.	The impact could influence the decision regardless of any possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.
SP 25 - 50	Indicates Moderate environmental significance.	The impact could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SP <25	Indicates Low environmental significance.	The impact will not have an influence on the decision. Impacts will have little real effect and which should not have an influence on or require modification of the project design or alternative mitigation.

SECTION 8: ASSESSMENT OF THE ANTICIPATED IMPACTS FOR THE PROPOSED LOURIERPARK DEVELOPMENT AS WELL AS IDENTIFICATION OF MITIGATION MEASURES THEREFORE.

8.1 FOUNDATION STABILITY

Construction & Operational Phase:

The Geotechnical Report’s findings are that the geotechnical conditions at this site are generally favourable for the proposed development, provided that cognisance is taken of the following:

- Moderate to high expansive settlement potential of foundations sub-grades;
- Potential differential settlement on sub-grade interfaces in terms of compressibility;
- Potential corrosive conditions on steel pipes and fittings.

It should be borne in mind that the conclusions reached and recommendations made in the Geotechnical Report apply to the test pits excavated as part of this study.

SITE CLASSIFICATIONS – H2 (30%), H1 (35%) AND S1 (35%)

The dominant design mode should be H2 as classified in the Geotechnical Report.

The zoning is based on the estimated potential heave (Section 5.1 of the attached Geotechnical Report) and the estimated collapse potential (Section 5.5 of the attached Geotechnical Report).

Please review the table within section 7 for the NHBRC proposed design approach for foundations.

- Foundations – Review section 7 of the attached Geotechnical Report.
- Excavatability – ranges from soft to hard based on the specifications set in SANS 1200D. Excavations up to 1.5meter can be considered soft to intermediate with excavations in excess of 1.5meter can be considered intermediate to hard.
- Stability of Excavations – Generally the excavations on site were stable with some seepage near the water body on the eastern part of the study area. Unstable excavations may be encountered there.

Based on the field appraisal the likely geotechnical properties of the soils which occur on the site have been mapped, and are shown in the attached Geotechnical Report.

8.1.1 Impact on Foundation Stability – Construction & Operational Phase

Rating Criteria	Impact on Foundation Stability Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Site Ranking - 1	Site Ranking - 1
Duration	Permanent Ranking - 5	Permanent Ranking - 5
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (1+5+3) x 4 = 36	Low Significance (1+5+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Due to the potentially expansive properties of the soils encountered on the site. Soils and geological constraints are important considerations when undertaking development. Some soils may exhibit a very high collapse potential and could settle under certain loads. The choice of site and the nature of the proposed development should therefore consider all geological constraints. Any geotechnical impact that these activities may have on the present layout of the site must be taken account of, and the layout should be adjusted accordingly.

Nature/Description of the Impact:

- Damage to buildings and infrastructure due to the expansive properties of the soils encountered on the site.

Significance of the Impact:

The extent of the impact is site specific and over the long term and the impact is given a moderate intensity rating. The weighting factor attributed to this impact is therefore medium negative and significance of the impact with mitigation is therefore low negative.

Mitigation Measures:

- All development must be done in concurrence with the recommendations made in the attached geotechnical report.
- This Geotechnical Report is based on point data collected during the fieldwork phase of the investigation. Due to the limited testing locations, this development potential zonation could not be extrapolated across the entire study area. Site conditions may vary (for better or worse) from that present in the Geotechnical report. Foundation trenches and excavations should therefore be overseen by a competent engineering geologist or geotechnical engineer in order to identify and assess any variance in the geotechnical character exposed in these trenches.
- This geotechnical investigation was conducted mainly for planning purposes and for the Rezoning of the site, and will serve as a preceding phase to the subsequent detailed geotechnical survey (Phase 1 Geotechnical Investigation) which will have to be conducted to ascertain the geotechnical constraints for the site before the formal development commences.
- It is recommended that on-site sanitation systems that do not rely on seepage for the disposal of liquid wastes (i.e.: septic tanks that drain into “French Drain”-type soak-aways) be utilized in the proposed development, mainly due to:
 - The impaired functioning thereof due to the inferred low permeability of the clayey soil material covering the area.
 - The difficulty of excavating the soak-aways into the weathered bedrock in localized areas.
- In this light it is recommended that use be made of a closed sewerage reticulation system. Septic tanks and subsurface drainage systems which have a tendency to leak are not recommended, except if properly sealed.
- In the light of the very gentle slopes present across the entire site, specialised methods for the stabilisation of cuts into the natural slopes are not deemed necessary. The sidewalls of deep trenches must preferably be supported to prevent injury or loss of life through sidewall collapse.
- It is recommended that an efficient surface drainage system be installed along roads in order to:
 - Prevent the ponding at the surface next to the road directly after heavy precipitation events;
 - Prevent large-scale changes in soil moisture beneath the road on a seasonal basis;
 - Prevent the seasonal formation of perched water tables (i.e.: short-term groundwater seepage) within the soil material at shallow depth.
- The precautionary measures should ideally include:
 - The sealing of open ground surfaces by means of either of the following:
 - The cultivation of a natural soil cover (e.g.: grass);

- Compaction of the soil surface;
 - Bitumen or concrete paving.
 - The removal of storm water, by means of an efficient surface drainage system.
 - Wet services (i.e.: water supply pipes and sewers) must be designed and maintained to prevent leaks and blockages, and proper backfilling should be enforced to reduce storm water inflow.
 - Roads should preferably be constructed parallel to the natural surface elevation contours rather than perpendicular to it, in order to reduce run-off velocities.
- Please review the table within section 7 for the NHBRC proposed design approach for foundations. Review section 7 of the attached Geotechnical Report.
- It must be noted that permits will be required for any burrow pits required to make use of this construction material.
- All buildings must be regularly inspected and any structural failures must be reported and repaired by a competent person or company.

8.2 POTENTIAL FOR SOIL EROSION & POLLUTION

Construction Phase:

The site exhibits a very gentle slope with no steep slopes encountered. The presence of unstable natural slopes therefore presents no problem to the proposed development area. However, the very gentle slopes may pose a problem of surface water ponding. The topsoil is deemed to be potentially dispersive, and as such prone to surface erosion, although surface flow velocities will be low.

The removal of vegetation and the accidental spillage of hazardous materials such as fuels, oils, hydraulic fluids, paints and bitumen based products, as well as cement, are an unfortunate reality on small and large developments. Incorrect management and handling of the aforementioned substances can also result in unnecessary spillages. Fuel and oil leaks from poorly maintained plant and vehicles can also contribute to soil pollution.

During construction, it will be necessary to clear portions of vegetation, where the development will be undertaken. The individual construction sites will need to be levelled, which will alter the natural soil structure. The major impact of vegetation clearance is the exposure of soil to the agents of erosion, such as wind and water.

Contamination of soils as a result of accidental spillages will alter the chemical properties of the affected soils and negatively influence the future growth of vegetation on those soils. Surface water run-off over contaminated areas and bare soil (with no vegetation) can also transfer pollutants into the ground and water resources, thus contributing the potential contamination thereof and cause soil erosion.

8.2.1 Impacts as a Result of Soil Erosion and Pollution – Construction Phase

Rating Criteria	Impacts as a Result of Soil Erosion and Pollution Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Site Ranking - 1
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+2+4) x 4 = 32	Low Significance (1+2+2) x 2 = 10
Status	Negative	Negative

Source of the Impact:

- Vegetation clearing, site establishment, access road construction, movement of people and vehicles on site during construction phase.
- Operation of construction vehicles – oil & diesel spillages.
- Solid waste - Improper disposal of paints, cement bags and other building wastes during the construction phase, as well as inappropriate storage and handling of hazardous substances (including fuels and lubricants).
- Trenches for electric cables and water and sewerage pipes – loss of vegetation and topsoil - erosion.
- Storm water from roads and cleared areas - loss of topsoil – erosion.

Nature/Description of the Impact:

- As the study area is located within a slightly north-east sloping landscape, sloping towards the drainage system located to the east of the study area, there is a slight likelihood for some impacts such as an increase in surface runoff into the drainage system and the spread of erosion into the system. However, the possibility and extent of these impacts are still regarded as low and with the necessary monitoring and mitigation measures in place, these impacts on the ephemeral drainage line can be avoided.
- Nuisance (dust).
- Loss of topsoil due to erosion.
- Loss of vegetation due to loss of topsoil.

Receiving Environment:

- Soil resources on site and surroundings.

Significance of the Impact:

The extent of the impact is locally during the construction phase. The impact is given a high intensity rating due to the potential to contribute towards ground and surface water pollution. The duration would be over the short term, since the potential for soils erosion and pollution will persist throughout the construction period. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- Implementation of anti-erosion measures such as the construction of berms to reduce the water velocity.
- Only clear vegetated areas that are to be constructed and rehabilitate these areas as soon as possible, once construction is complete. By maintaining the maximum amount of vegetation, the extent of erosion and ecosystem loss can be contained.
- Storm water runoff shall be taken account of during design and its flow controlled on the construction site.
- It is recommended that all soil excavated during trenching be stockpiled in layers and protected by berms. It is also imperative that the topsoil layer be retained and used in facilitating the reinstatement of indigenous vegetation.
- Soil excavated during trenching should be stockpiled in layers and replaced in the same order when backfilling.
- No storage or stockpiling of any soils or construction materials should take place in areas where it may be washed into water courses.
- Excavation and installations should be carried out when the soil is at its driest.
- All access roads must be demarcated, and existing roads must be used as far as possible.
- Each construction site is to be clearly demarcated.
- In order to successfully avoid the major impacts caused by erosion, construction during the rainy season should be avoided.
- In the event of topsoil being stripped it shall be stockpiled on the site for later reuse. (Topsoil is considered to be a minimum of thickness of ± 300mm of the natural soil, including all vegetation and organic matter).

- Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil or overburden.
- All bulk fuel tanks kept on site should be appropriately and effectively banded to a capacity of 110% of that of the tanks themselves.
- All hazardous materials stored on site should also be stored in an appropriately banded and well-ventilated area.
- All contaminated soils should be immediately removed and placed within a hazardous waste skip located on site, for end disposal at an appropriately licensed hazardous waste disposal site by a reputable waste disposal contractor.
- All construction vehicles and plant operating on site should be regularly serviced in order to prevent the potential for oil and fuel leaks to occur.
- Drip trays should be placed under vehicles that stand within the contractor’s yard for extended periods of time.
- Vehicles should not be serviced out on terrain, but only in designated workshops established for that purpose that are equipped with oil water separators and sumps for the collection of contaminated materials.
- Solid waste must be kept in adequate containers and disposed of on a weekly basis at a licensed waste disposal landfill site.
- Any building rubble must be removed to a licensed disposal site after construction.
- Trenches for pipes or cables must where possible be dug next to roads where it will have the smallest impact. Trenches should be planned in such a way that no large trees should be removed.
- Any trenches that are dug for the supply of services to the stands must be filled up and compacted well and slightly higher than the areas around it. This would allow for settling of the soil without trench forming again. Next to the roads this trench areas can be packed with rocks to provide a slowdown area for running water and to prevent erosion due to storm water run down.

Operational Phase:

The potential spillage of oil and diesel from vehicles has the potential to pollute/degrade the soil. Solid waste can be a nuisance and has the potential to pollute the soil before disposal. The impact of soil erosion will become more pronounced if storm water management systems are not implemented and maintained.

8.2.2 Impacts as a Result of Soil Erosion and Pollution – Operational Phase

Rating Criteria	Impacts as a Result of Soil Erosion and Pollution Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Site Ranking - 1
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(2+4+4) \times 4 = 40$	Low Significance $(1+4+2) \times 2 = 14$
Status	Negative	Negative

Source of the Impact:

- The potential spillage of oil and diesel from vehicles has the potential to pollute/degrade the soil.
- Solid waste can be a nuisance and has the potential to pollute the soil before disposal.

- The impact of soil erosion will become more pronounced if storm water management systems are not implemented and maintained. This would result in an increased flow towards the drainage lines.
- Open areas that are not rehabilitated.

Nature/Description of the Impact:

- Soil pollution.
- Nuisance (dust).
- Loss of topsoil due to erosion.
- Loss of vegetation due to loss of topsoil.

Receiving Environment:

- Soil resources on site and surroundings.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a high intensity rating. The duration would be over the long term, since the potential for soils erosion and pollution will persist throughout the operational period. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- Storm water management systems must be well maintained.
- Effective rehabilitation of disturbed areas must be done.
- Measures to prevent erosion such as berms, gabions, and mats must also be installed where required.
- Where necessary, a suitable mixture of indigenous grass seed shall be used to reseed disturbed areas. All open space areas must be re-vegetated with indigenous and endemic species.
- Solid waste must be kept in adequate bins and disposed of weekly at a licensed waste disposal landfill site.
- There must be an active program to separate the metals, bottles and plastics in the solid waste and send it to a reputable recycling program. This has the effect of reducing soil pollution while at the same time promotes the preservation of valuable resources by recycling and/or reusing the materials.

8.3 AGRICULTURAL POTENTIAL

Construction & Operational Phase:

The site forms part of the Bloemfontein Town Planning Scheme. The MMM SDF also earmarks the area as future residential. Therefore agriculture cannot be considered feasible on the proposed site. The proposed site has not been used for any agricultural activities in the recent past except for grazing for the subsistence farmers across the road.

8.3.1 Impacts on the Agricultural Potential of the Area – Construction & Operational Phase

Rating Criteria	Agricultural Potential Construction and Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Site Ranking - 1	Site Ranking - 1
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Low Ranking - 2	Low Ranking - 2

Probability	Low Probability Ranking - 2	Low Probability Ranking - 2
Significance	Low Significance (1+4+2) x 2 = 14	Low Significance (1+4+2) x 2 = 14
Status	Negative	Negative

Source of the Impact:

- Development on areas with an agricultural potential.

Nature/Description of the Impact:

- Loss of areas with agricultural potential.

Receiving Environment:

- Agricultural land.

Significance of the Impact:

The extent of the impact is site specific and over the long term. The impact is given a low intensity rating as the current state of the proposed site is not agricultural orientated. The site forms part of the Bloemfontein Town Planning Scheme. The MMM SDF also earmarks the area as future residential. The weighting factor attributed to this impact is therefore low negative and significance of the impact with mitigation is also low negative.

Mitigation Measures:

- None required.

8.4 BOTANICAL IMPACTS**Construction Phase:**

The project site is situated on an undeveloped portion of the farm Brandkop 702. The project site is surrounded by residential developments on the north-eastern side, small holdings on its south-eastern and south-western sides and farms on its north-western sides. The entire project site has been subjected to severed disturbance. The causes of disturbance include amongst others dumping of domestic waste, quarrying, vehicle tracks, and grazing by cattle, sheep and goats. Some areas on the project site have been ploughed in the past. The crop field have been left fallow for quite some time and they are now sparsely covered by a few grass and forb species.

The Bloemfontein Dry Grassland (Gh5) dominates the vegetation of the project site, as well as the areas surrounding the site. According to Mucina & Rutherford (2006), the vegetation type has a conservation status of “endangered”. The vegetation of the project site is dry grassland and the important grasses include *Antheophora pubescens*, *Aristida congesta*, *Themeda triandra*, *Cymbopogon pospischillii*, *Eragrostis lehmanniana*, *E. trichophora*, *Enneapogon scoparius*, *Aristida adscensionis*, *Heteropogon contortus*. Dwarf shrubs such as *Felicia muricata*, *Hertia pallens*, *Berkheya onopordifolia*, *Lycium cinerium* also occur in the region.

Alien weeds flourish on disturbed areas and several species were noted: **Eucalyptus camuldulensis*, **Schinus molle*, *Xanthium spinosa*, *Xanthium strumarium*, **Conyza bonariensis*, **Argemone mexicana*, **Datura stramonium*, **Tagetes minuta*, **Bidens bipinnata* and **Conyza braziliensis* were noted.

There one poorly developed wetland area downstream of the Rooidam area. The drainage is not well defined and in the past a trench has been dug to drain the overflow from the Rooidam. On the southern boundary is another canal which also drains the dam’s overflow. A *Verbena bonariensis*

wetland community dominate the wetland on the project site. The dominant plant species in these wetlands are **Cirsium vulgare*, **Verbena bonariensis*, and **Bromus catharticus*. The species richness of the wetland area is very low with about 6 species noted (Annexure B).

The natural vegetation within the project site is severely degraded grassland. According to Mucina & Rutherford (2006) and BGIS (2016), the projects site is situated in the “vulnerable” Bloemfontein Dry Grassland (Gh5) which is also listed as a National Threatened Ecosystem. The terrestrial vegetation of the project site can be classified into one community namely:

Aristida congesta – *Chloris virgata* grass community. As mentioned before this project site is in a severely degraded state due to numerous human impacts. This is reflected by the dominant vegetation which consist mainly of pioneer grasses and forbs. The dominant grass species present are *Eragrostis lehmanniana*, *E. superba*, *Aristida congesta*, *Chloris virgata*. The forbs and dwarf shrubs are *Felicia muricata*, *Chrysocoma ciliata*, *Salsola kali*, *Lycium pilifolium*, *Nenax microphylla* and *Sesamum triphyllum*. The species richness is quite low with about 10 species noted according to the attached Ecological Specialist Report. The site is in such a degraded condition that almost none of the diagnostic species of the Bloemfontein Dry Grassland occur on site any more.

There could be protected and Red Data species present on the project site but the site is so degraded that it is highly unlikely. A number of protected species occur in the relevant quarter degree square as listed by POSA. Annexure B of attached Ecological Specialist Report lists the species present at the project site. The protected species are marked by a yellow flag.

8.4.1 Removal/Management of Exotic and Invader Species Occurring on the Proposed Site – Construction Phase

Rating Criteria	Removal/Management of Exotic and Invader Species Occurring on the Proposed Site Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Very High Ranking - 5	High Ranking - 4
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	High Significance (3+4+5) x 5 = 60	High Significance (3+4+4) x 5 = 55
Status	Negative	Positive

Source of the Impact:

Major factors contributing to invasion by alien invader plants include excessive disturbance to vegetation, creating a window of opportunity for the establishment of alien invasive species. The potential for alien invasive species to be present in and around the study area is regarded as high. A high number of alien invasive species have been recorded in the wider area according to the SANBI database. Alien weeds flourish on disturbed areas and several species were noted: **Eucalyptus camuldulensis*, **Schinus molle*, *Xanthium spinosa*, *Xanthium strumarium*, **Coryza bonariensis*, **Argemone mexicana*, **Datura stramonium*, **Tagetes minuta*, **Bidens bipinnata* and **Coryza braziliensis* were noted.

The construction of the proposed development will result in the loss of the vegetation communities in the building footprint. Vegetation in the footprint of the proposed development will be completely and permanently removed. Vegetation will be removed from all parts of the site apart from the natural open space areas. Removal of exotic/invader plant species on the site can be seen as a positive impact.

Nature/Description of the Impact:

- Removal of existing alien invasive plants;

Consequences of the establishment and spread of invasive plants include:

- Loss of indigenous vegetation;
- Change in vegetation structure leading to change in or loss of various habitat characteristics;
- Change in plant species composition;
- Change in flammability of vegetation, depending on alien species;
- Hydrological impacts due to increased transpiration and runoff.

Receiving Environment:

- Proposed Site

Significance of the Impact:

The extent of the impact is regional as the exotic weeds already found on the site can spread easily to surrounding areas. During the construction phase these exotic weeds will be removed. Spreading of the exotic weeds is given a very high intensity rating with a probability rating of definite. The significance attributed to this impact without mitigation is high negative and significance of the impact with mitigation is high positive on the existing situation of the site.

8.4.2 Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes - Construction Phase

Rating Criteria	Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Highly Probable Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+2+4) x 4 = 32	Low Significance (2+2+2) x 2 = 12
Status	Negative	Negative

Source of the Impact:

- Construction activities.
- Introduction of Exotic Species for Ornamental and Utilitarian Purposes.

Nature/Description of the Impact:

- Increased invasion by exotic plant species following vegetation disturbance and introduction of exotic species for ornamental and utilitarian purposes.

Receiving Environment:

- Vegetation and biodiversity on the proposed site.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a high intensity rating with a probability rating of highly probable. The duration of the impact will be short term until such time that exotic plant species are removed. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.4.3 Loss of Indigenous Plant Cover through Clearing for Construction - Construction Phase

Rating Criteria	Loss of Indigenous Plant Cover Through Clearing for Construction Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Site Ranking - 1
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Minor Ranking - 1
Probability	Definite Ranking - 5	Highly Probable Ranking - 4
Significance	Moderate Significance (2+4+3) x 5 = 45	Low Significance (1+4+1) x 4 = 24
Status	Negative	Negative

Source of the Impact:

- The construction of the proposed development will result in the loss of the vegetation communities/habitats in the building footprint. Vegetation in the footprint of the proposed development will be completely and permanently removed. Vegetation will be removed from all parts of the site apart from the natural open space areas. The vegetation specialist did not find any endangered plant in need of conservation to exist on the proposed site/footprint.

Nature/Description of the Impact:

Construction will result in transformation of the site, and lead to direct loss of vegetation. Consequences of clearing and loss of indigenous natural vegetation may include:

- Increased vulnerability of the remaining vegetation to future disturbance, including extreme climatic events;
- General loss of habitat for sensitive fauna and flora species;
- General reduction in biodiversity;
- Increased fragmentation (depending on the location of the impact) and associated reduced viability of species populations;
- Alteration of the habitats suitable for plant populations by altering the surface structure. This will change species composition and associated species interactions;
- Disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- A loss of ecosystem goods and services.

Receiving Environment:

- Vegetation and biodiversity on the proposed site and surroundings. No-Go areas include the areas identified as wetland areas as well as the 50m buffer areas surrounding them.

Significance of the Impact:

The area is generally heterogeneous in terms of plant communities and given the extensive amount of potentially intact vegetation in the area, there is likely to be little overall disruption to the broad-scale connectivity of the landscape. Given the large amount of building activity around the proposed site, an insignificant local impact is likely to occur, but it is expected that there would remain sufficient intact habitat in the broader area to retain the overall ecological functioning of the landscape. The impacts can be largely mitigated through avoidance of potential sensitive areas and listed species, by allowing a minimum clearance of vegetation (restricted to the absolute necessary areas) etc.

The extent of the impact is local during the construction phase and is given a moderate intensity rating with a probability rating of definite. The duration of the impact will be permanent. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is low negative.

8.4.4 Trampling and Disturbance of Indigenous Vegetation - Construction Phase

Rating Criteria	Trampling and Disturbance of Indigenous Vegetation Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Site Ranking - 1
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Highly Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(2+2+3) \times 4 = 28$	Low Significance $(1+2+2) \times 2 = 10$
Status	Negative	Negative

Source of the Impact:

- Construction related activities.
- Heavy motor vehicle usage over the site during construction and the necessity to construct infrastructure will disturb vegetation and expose soils on the site to erosion etc.

Nature/Description of the Impact:

- Trampling and disturbance of indigenous vegetation.

Receiving Environment:

- Vegetation on the proposed site.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a medium intensity rating with a probability rating of highly probable. The duration of the impact will be temporary during the construction phase. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.4.5 Disturbance or Loss of Threatened/Protected Plant Species on the Proposed Development Site - Construction Phase

Rating Criteria	Disturbance or Loss of Threatened/Protected Plant Species on the Site Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	High Ranking - 4	Low Ranking - 2
Significance	Moderate Significance (2+4+4) x 4 = 40	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Construction related activities.
- Vegetation clearance for buildings, roads and infrastructure.

Nature/Description of the Impact:

Some red-data plant species could potentially occur in the study area. Flora is affected by overall loss or alteration of habitat and due to its limited ability to extend or change its distribution range. In the case of threatened plant species, a loss of a population or individuals could lead to a direct change in the conservation status of the species and possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences of this may include:

- Fragmentation and decline of populations of the affected species;
- Reduction in the area of occupancy of affected species;
- Loss of genetic variation within the affected species;
- Alteration of the habitat suitable for plant associations through altering of the surface structure. This will change the species composition and associated species interactions and the species ability to persist;
- Future extinction debt of particular species of flora and fauna.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species.

Receiving Environment:

- Protected plant species and biodiversity on the site. There could be protected and Red Data species present on the project site but the site is so degraded that it is highly unlikely. A number of protected species occur in the relevant quarter degree square as listed by POSA. Annexure B of attached Ecological Specialist Report lists the species present at the project site. The protected species are marked by a yellow flag.
- No-Go areas include the areas identified as wetland areas as well as the 50m buffer areas surrounding them. Several red-data species have the potential to occur within the study area.

Significance of the Impact:

The extent of the local impact on protected and listed plants or tree species may be regarded as significant due to the nature of the development which will entail the clearance of the whole site, leading to a localised loss of habitat. The extent, nature and subsequently the significance of this

impact can be reduced with the implementation of mitigation measures, including a vegetation rehabilitation plan, a plan for search and rescue of protected and listed plants prior to construction, and avoidance where possible. Furthermore, due to the extent and availability of habitat surrounding the proposed site, this localised impact will most likely not have a significant impact on the greater area of occupancy of affected species as well as a loss of genetic variation. Therefore the significance regarding a potential change in status and/or the overall survival of the species can be regarded as low and unlikely.

The extent of the impact is on site during the construction phase and is given a moderate intensity rating as protected plants might occur on the proposed site but the site is so degraded that it is highly unlikely. The probability rating for the impact is therefore low. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is also low negative.

8.4.6 Increased Habitat Fragmentation due to Vegetation Disturbance and Destruction on Site - Construction Phase

Rating Criteria	Increased Habitat Fragmentation due to Vegetation Disturbance and Destruction on Site Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Highly Probable Ranking - 4	Medium Probability Ranking - 3
Significance	Moderate Significance (2+4+3) x 4 = 36	Low Significance (2+4+2) x 3 = 24
Status	Negative	Negative

Source of the Impact:

- Construction related activities.
- Vegetation clearance.
- Construction of buildings, boundary walls, roads etc.

Nature/Description of the Impact:

- Increased habitat fragmentation due to vegetation disturbance and destruction on site. Loss of available habitat normally equates to a loss of species that habituate the site as well as population numbers of those species.

Receiving Environment:

- Site and surrounding areas.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a medium intensity rating with a probability rating of highly probable. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.4.7 Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to the Soil Structure - Construction Phase

Rating Criteria	Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to the Soil Structure Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Very High Ranking - 4	Low Ranking - 2
Probability	Highly Probable Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(3+2+4) \times 4 = 36$	Low Significance $(3+2+2) \times 3 = 21$
Status	Negative	Negative

Source of the Impact:

- Construction related activities may lead to fires.
- Fires for cooking and warming by the construction workforce.

Nature/Description of the Impact:

- Uncontrolled fires on the property will result in destruction of indigenous vegetation/habitats and damage to the soil structure. It will also have an impact on the safety of people.

Receiving Environment:

- Vegetation on site and surroundings as well as surrounding landowners and their properties.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a high intensity rating with a probability rating of highly probable. The duration of the impact will be temporary during the construction phase. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is low negative.

8.4.8 Increased Risk of Soil Erosion Due to Vegetation Disturbance Associated with Construction Activities - Construction Phase

Rating Criteria	Increased Risk of Soil Erosion Due to Vegetation Disturbance Associated with Construction Activities - Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Highly Probable Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(2+2+4) \times 4 = 32$	Low Significance $(2+2+2) \times 2 = 12$
Status	Negative	Negative

Source of the Impact:

- Construction activities and clearance of vegetation.

Nature/Description of the Impact:

- Soil erosion due to vegetation disturbance.

Receiving Environment:

- Soil resources of the proposed site and direct surroundings.

Significance of the Impact:

The extent of the impact is local during the construction phase and is given a high intensity rating with a probability of highly probable. The duration of the impact will be temporary and for as long as construction activities will disturb the vegetation of the proposed site. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is low negative.

8.4.9 Destruction of Indigenous Plants by Collection for Ethnobotanical Use - Construction Phase

Rating Criteria	Destruction of Indigenous Plants by Collection for Ethnobotanical Use - Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Low Significance $(2+2+3) \times 3 = 21$	Low Significance $(2+2+2) \times 2 = 12$
Status	Negative	Negative

Source of the Impact:

- Collection of indigenous plants by construction workforce.

Nature/Description of the Impact:

- Destruction of indigenous plants by collection for ethnobotanical use.

Receiving Environment:

- Indigenous vegetation of the site and surroundings.

Significance of the Impact:

The extent of the impact is on site and surrounding areas and will only be temporary with a moderate intensity rating during the construction phase. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- All recommendations as made in the attached vegetation Specialist Report.
- The extent, nature and subsequently the significance of this impact can be reduced with the implementation of mitigation measures, including a vegetation rehabilitation plan, a plan for search and rescue of protected and listed plants prior to construction, and avoidance where possible.
- According to the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014, all declared aliens must be effectively controlled. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories: Category 1: Prohibited and must be controlled. This includes the following species found on site: *Argemone ocoleuca*, *Datura ferox**, and *Solanum elaeagnifolium**
- Wetland areas occurs on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- No collection of indigenous plants may be allowed on the property. Employees should undergo environmental awareness training and be sensitized to the need to avoid disturbance to the indigenous vegetation on the property.
- Entry points and access routes to the site must be clearly marked and traffic limited to those areas as far as possible.
- Indigenous trees and shrubs must be planted along the roads and in the open areas.
- The cleared vegetation should be composted where possible to preserve the nutrients in it and return it to the soil. This vegetation must not be burnt as it causes a loss of nutrients and organic material. It also causes air pollution and a fire hazard.
- Invasive exotic plants and weeds must be eradicated on the property. This must be accompanied by a long-term monitoring and follow-up clearing program.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens. Only local indigenous trees and shrubs should be planted in the open areas and along the roads. See below the list of indigenous trees and shrubs that should be planted.

<u>Genus & Species</u>	<u>Family</u>	<u>Common name</u>
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TREES

Acacia caffra	MIMOSACEAE	Common hook-thorn
Acacia erioloba	MIMOSACEAE	Camel thorn
Acacia hebeclada	MIMOSACEAE	Candle thorn
Acacia hereroensis	MIMOSACEAE	False hook-thorn
Acacia karroo	MIMOSACEAE	Sweet thorn
Acacia mellifera	MIMOSACEAE	Black thorn
Acacia robusta	MIMOSACEAE	Ankle thorn
Acacia tortilis	MIMOSACEAE	Umbrella thorn

Acacia galpinii	MIMOSACEAE	Monkey thorn
Acacia sieberiana	MIMOSACEAE	Paperbark thorn
Acacia xanthophloa	MIMOSACEAE	Fever tree
Apodytes dimidiata	ICACINACEAE	White pear
Boscia albitrunca	CAPPARACEAE	Shepherd's tree
Brachylaena rotundata	ASTERACEAE	Mountain silver oak
Calodendrum capense	RUTACEAE	Cape chestnut
Celtis africana	CELTIDACEAE	White stinkwood
Combretum erythrophyllum	COMBRETACEAE	River Bush-willow
Combretum kraussii	COMBRETACEAE	
Combretum molle	COMBRETACEAE	Velvet bushwillow
Cussonia paniculata	ARALIACEAE	Highveld cabbage tree
Cussonia spicata	ARALIACEAE	Common cabbage tree
Dais cotinifolia	THYMELAEACEAE	Pompom tree
Ficus cordata	MORACEAE	Namaqua fig
Ficus ingens	MORACEAE	Red-leaved fig
Heteropyxis natalensis	HETEROPIXIDAE	Lavender tree
Ilex mitis	AQUIFOLIACEAE	Cape holly
Kiggelaria africana	FLACOURTIACEAE	Wild peach
Maytenus peduncularis	CELASTRACEAE	Cape blackwood
Maytenus undata	CELASTRACEAE	Koko tree
Ochna pulchra	OCHNACEAE	Peeling plane
Olea europaea	OLEACEAE	Wild Olive
Olinia emarginata	OLINIACEAE	Mountain hard pear
Pappea capensis	SAPINDACEAE	Jacket-plum
Peltophorum africanum	CAESALPINACEAE	Weeping wattle
Pittosporum viridiflorum	PITTOSPORACEAE	Cheesewood
Podocarpus latifolius	PODOCARPACEAE	Real yellowwood
Podocarpus henkellii	PODOCARPACEAE	Henkel's yellowwood
Podocarpus falcatus	PODOCARPACEAE	Outeniqua yellowwood
Rhus lancea	ANACARDIACEAE	Common karee
Rhus leptodictya	ANACARDIACEAE	Mountain karee
Rhus pendulina	ANACARDIACEAE	White karee
Salix mucronata	SALICACEAE	Cape Willow
Schotia afra	FABACEAE	Karoo boer-bean
Scolopia mundii	FLACOURTIACEAE	Red pear
Scolopia zeyheri	FLACOURTIACEAE	Thorn pear
Strelitzia nicolai	STRELITZIACEAE	Natal Wild banana
Terminalia sericea	COMBRETACEAE	Silver cluster-leaf
Trimeria grandifolia	FLACOURTIACEAE	Wild mulberry
Widdringtonia nodiflora	CUPRESSACEAE	Mountain cypress
Ziziphus mucronata	RHAMNACEAE	Buffalo thorn

SHRUBS

Anisodonteia julii	MALVACEAE	
Aremisia afra	ASTERACEAE	Wormwood
Asparagus africanus	ASPARAGACEAE	Wild asparagus
Asparagus laricinus	ASPARAGACEAE	Cat-thorn asparagus
Asparagus virgatus	ASPARAGACEAE	
Bauhinia galpinii	CAESALPINACEAE	Pride-of-de Kaap
Bowkeria verticillata	SCROPHULARIACEAE	Natal shell-flower bush
Buddleja loricata	BUDDLEJACEAE	Mountain sage
Buddleja saligna	BUDDLEJACEAE	False Olive
Buddleja salviifolia	BUDDLEJACEAE	Sagewood
Buddleja glomerata	BUDDLEJACEAE	Karoo sage
Calpurnia capensis	FABACEAE	Wild laburnum
Calpurnia intrusa	FABACEAE	Wild laburnum
Calpurnia reflexus	FABACEAE	Wild laburnum
Calpurnia sericea	FABACEAE	Wild laburnum
Calpurnia villosa	FABACEAE	Wild laburnum

Canthium ciliatum	RUBIACEAE	Hairy turkey-berry
Canthium kuntzeanum	RUBIACEAE	
Canthium mundianum	RUBIACEAE	Rock alder
Carissa bispinosa	APOCYNACEAE	Num-Num
Cassinopsis ilicifolia	ICACINACEAE	Lemon thorn
Chrysanthemoides monilifera	ASTERACEAE	Bush-tick berry
Clausena anisata	RUTACEAE	Horsewood
Cliffortia ramosissima	ROSACEAE	
Clutia hirsuta	EUPHORBIACEAE	
Clutia monticola	EUPHORBIACEAE	Mountain lightning bush
Clutia natalensis	EUPHORBIACEAE	Natal lightning bush
Clutia pulchella	EUPHORBIACEAE	Common lightning bush
Coleonema pulchrum	RUTACEAE	
Croton gratissimus	EUPHORBIACEAE	Lavender fever-berry
Cryptocarya woodii	LAURACEAE	Cape quince
Dichrostachys cinerea	MIMOSACEAE	Sickle bush
Diospyros austro-africana	EBENACEAE	Small Jackal berry
Diospyros lycioides	EBENACEAE	Bluebush
Diospyros whyteana	EBENACEAE	Bladder-nut
Dodonaea angustifolia	SAPINDACEAE	Sand olive
Dovyalis caffra	FLACOURTIACEAE	Kei-apple
Ehretia rigida	BORAGINACEAE	Puzzle bush
Elephantorrhiza elephantina	MIMOSACEAE	Eland's bean
Erythrina humeana	FABACEAE	Dwarf coral tree
Euclea coriacea	EBENACEAE	
Euclea crispa	EBENACEAE	Blue quarri
Euclea undulata	EBENACEAE	Common quarri
Freylinia laceolata	SCROPHULARIACEAE	Honey-bell bush
Garuleum pinnatifidum	ASTERACEAE	
Gnidia burchellii	THYMELAEACEAE	
Gnidia caffra	THYMELAEACEAE	
Gnidia capitata	THYMELAEACEAE	
Gomphostigma virgatum	BUDDLEJACEAE	Otter bush
Grewia flava	TILIACEAE	Velvet raisin
Grewia hispida	TILIACEAE	Hairy-leaved raisin
Grewia occidentalis	TILIACEAE	Cross-berry
Grewia bicolor	TILIACEAE	White raisin
Greyia sutherlandii	GREYIACEAE	Natal bottlebrush
Gymnosporia buxifolia	CELASTRACEAE	Common spike-thorn
Gymnosporia tenuispina	CELASTRACEAE	Small-thorn spike-thorn
Helinus integrifolius	RHAMNACEAE	
Heteromorpha arborescens	APIACEAE	Parseley tree
Hypericum revolutum	CLUSIACEAE	Curry bush
Leucosidea sericea	ROSACEAE	Oldwood
Lycium arenicola	SOLANACEAE	
Lycium ferocissimum	SOLANACEAE	Red berry honey-thorn
Lycium hirsutum	SOLANACEAE	River honey-thorn
Maytenus acuminata	CELASTRACEAE	Silky bark
Melianthus comosus	MELIANTHACEAE	
Melianthus dregeanus	MELIANTHACEAE	
Melianthus villosus	MELIANTHACEAE	
Melianthus major	MELIANTHACEAE	Honey flower
Mentha longifolia	LAMIACEAE	
Metalasia densa	ASTERACEAE	White briste bush
Morella [Myrica] serrata	MYRICACEAE	Small-leaved waxberry
Mundulea sericea	FABACEAE	Cork bush
Myrsine africana	MYRSINACEAE	Cape Myrtle
Mystroxydon aethiopicum	CELASTRACEAE	Kooboo berry
Nuxia congesta	BUDDLEJACEAE	
Nuxia congesta	LOGANIACEAE	Common wild elder

Olinia emarginata	OLINIACEAE	Mountain hard pear
Osyris lanceolata	SANTALACEAE	
Ozoroa paniculosa	ANACARDIACEAE	Common resin tree
Passerina montana	THYMELAEACEAE	Mountain gonna
Pavetta zeyheri	RUBIACEAE	Small-leaved bride's bush
Pentzia cooperi	ASTERACEAE	
Phaeoptilum spinosum	NYCTAGINACEAE	
Phymaspermum acerosum	ASTERACEAE	
Phymaspermum aciculare	ASTERACEAE	
Phymaspermum athanasioides	ASTERACEAE	
Phymaspermum bolusii	ASTERACEAE	
Phymaspermum parvifolium	ASTERACEAE	
Plectranthus grallatus	LAMIACEAE	
Plectranthus madagascariensis	LAMIACEAE	
Plumbago auriculata	PLUMBAGINACEAE	
Plumbago zeylanica	PLUMBAGINACEAE	
Polygala virgata	POLYGALACEAE	
Polygala virgata	POLYGALACEAE	
Polygala myrtifolia	POLYGALACEAE	September bush
Portulacaria afra	PORTULACACEAE	Porkbush/spekboom
Protea caffra	PROTEACEAE	Common Sugarbush
Protea roupelliae	PROTEACEAE	Silver Sugarbush
Protea subvestita	PROTEACEAE	Lip-flower sugarbush
Prunus africana	ROSACEAE	
Rhamnus prinoides	RHAMNACEAE	Dogwood
Rhigozum obovatum	BIGNONIACEAE	Yellow pomegranate
Rhus bolusii	ANACARDIACEAE	
Rhus burchellii	ANACARDIACEAE	Karoo kuni-bush
Rhus dentata	ANACARDIACEAE	Nana-berry
Rhus discolor	ANACARDIACEAE	
Rhus divaricata	ANACARDIACEAE	
Rhus dracomontana	ANACARDIACEAE	
Rhus dregeana	ANACARDIACEAE	
Rhus erosa	ANACARDIACEAE	Besem karee
Rhus gerrardii	ANACARDIACEAE	
Rhus pallens	ANACARDIACEAE	
Rhus pendulina	ANACARDIACEAE	
Rhus pyroides	ANACARDIACEAE	Common Wild currant
Rhus rigida	ANACARDIACEAE	
Rhus bathophylla	ANACARDIACEAE	
Scutia myrtina	RHAMNACEAE	Cat-thorn
Smodingium argutum	ANACARDIACEAE	Rainbow leaf
Sparrmannia ricinocarpa	TILIACEAE	Stock-rose
Tapiphyllum parvifolium	RUBIACEAE	Mountain medlar
Tarchonanthus camphoratus	ASTERACEAE	Wild camphor bush
Tarchonanthus minor	ASTERACEAE	Vaalbos
Tecomaria capensis	BIGNONIACEAE	Cape honeysuckle
Vangueria infausta	RUBIACEAE	Wild medlar
Zanthoxylum capense	RUTACEAE	Small knobwood

CLIMBERS

Cynanchum virens	APOCYNACEAE	
Clematis brachiata	RANUNCULACEAE	
Clematis oweniae	RANUNCULACEAE	
Rhoicissus tridentata	VITACEAE	Bushman's grape

GEOPHYTES & BULBS

Agapanthus campanulatus	AGAPANTHACEAE	
Agapanthus africanus	AGAPANTHACEAE	
Ammocharis coranica	AMARYLLIDACEAE	

Aristea woodii	IRIDACEAE
Boophone disticha	AMARYLLIDACEAE
Bulbine abyssinica	ASPHODELACEAE
Bulbine frutescens	ASPHODELACEAE
Bulbine narcissifolia	ASPHODELACEAE
Clivia miniata	AMARYLLIDACEAE
Clivia gardenii	AMARYLLIDACEAE
Crinum bulbispermum	AMARYLLIDACEAE
Crinum macowanii	AMARYLLIDACEAE
Crocosmia paniculata	IRIDACEAE
Crocosmia pearsei	IRIDACEAE
Dierama cooperi	IRIDACEAE
Dierama dracomontanum	IRIDACEAE
Dierama pictum	IRIDACEAE
Dierama robustum	IRIDACEAE
Dietes bicolor	IRIDACEAE
Dietes grandiflora	IRIDACEAE
Eucomis autumnalis	HYACINTHACEAE
Eucomis bicolor	HYACINTHACEAE
Eucomis pallidiflora	HYACINTHACEAE
Galtonia candicans	HYACINTHACEAE
Galtonia viridiflora	HYACINTHACEAE
Gladiolus dalenii	IRIDACEAE
Gladiolus papilio	IRIDACEAE
Gloriosa superba	COLCHICACEAE
Haemanthus humilis	AMARYLLIDACEAE
Hypoxis hemerocallidea	HYPOXIDACEAE
Hypoxis hemerocallidea	HYPOXIDACEAE
Hypoxis iridifolia	HYPOXIDACEAE
Kniphofia ensifolia	ASPHODELACEAE
Kniphofia praecox	ASPHODELACEAE
Littonia modesta	COLCHICACEAE
Merwillia plumbea	HYACINTHACEAE
Nerine angustifolia	AMARYLLIDACEAE
Nerine bowdenii	AMARYLLIDACEAE
Nerine frithii	AMARYLLIDACEAE
Nerine hesseoides	AMARYLLIDACEAE
Nerine laticoma	AMARYLLIDACEAE
Pelargonium spp	GERANIACEAE
Sansevieria aethiopica	DRACAENACEAE
Scadoxus puniceus	AMARYLLIDACEAE
Schizostylis coccinia	IRIDACEAE
Strelitzia reginae	STRELITZIACEA
Strelitzia juncea	STRELITZIACEA
Tulbaghia acutiloba	ALLIACEAE
Tulbaghia cernua	ALLIACEAE
Tulbaghia leucantha	ALLIACEAE
Zantedeschia aethiopica	ARACEAE
Zantedeschia albomaculata	ARACEAE
Zantedeschia rehmannii	ARACEAE

GRASSES

Hyparrhenia anamesa	POACEAE
Hyparrhenia dichroa	POACEAE
Hyparrhenia dregeana	POACEAE
Hyparrhenia filipendula	POACEAE
Hyparrhenia hirta	POACEAE
Hyparrhenia quarrei	POACEAE
Hyparrhenia tamba	POACEAE
Imperata cylindrica	POACEAE

Miscanthus capensis	POACEAE	
Phragmites australis	POACEAE	
Phragmites mauritianus	POACEAE	
Themeda triandra	POACEAE	
Thamnocalamus tessellatus	POACEAE	
SUCCULENTS		
Adromischus trigynus	CRASSULACEAE	
Aloe broomii	ASPHODELACEAE	
Aloe ferox	ASPHODELACEAE	Bitter aloe
Aloe spectabilis	ASPHODELACEAE	Mountain aloe
Aloe grandidentata	ASPHODELACEAE	
Aloe greatheadii	ASPHODELACEAE	
Aloe hereroensis	ASPHODELACEAE	
Aloe maculate	ASPHODELACEAE	
Aloe barberae	ASPHODELACEAE	Tree aloe
Aloe arborescens	ASPHODELACEAE	Krantz aloe
Carpobrotus edulis	MESEMBRYANTHEMACEAE	
Cotyledon orbiculata	CRASSULACEAE	
Cotyledon orbiculata	CRASSULACEAE	
Crassula vaginata	CRASSULACEAE	
Cyphostemma juttae	VITACEAE	Cobas
Euphorbia clavarioides	EUPHORBIACEAE	
Euphorbia pulvinata	EUPHORBIACEAE	
Kalanchoe brachyloba	CRASSULACEAE	
Kalanchoe paniculata	CRASSULACEAE	
Kalanchoe rotundifolia	CRASSULACEAE	
Kalanchoe thyrsiflora	CRASSULACEAE	
Kleinia longiflora	ASTERACEAE	
SEDGES		
Pseudoschoenus inanis	CYPERACEAE	
Scirpoides burkei	CYPERACEAE	
Typha capensis	TYPHACEAE	
LOW SHRUBS		
Dimorphotheca cuneata	ASTERACEAE	
Eriocephalus africanus	ASTERACEAE	
Euryops lateriflorus	ASTERACEAE	
Euryops tysonii	ASTERACEAE	
Euryops pectinatus	ASTERACEAE	
Euryops virgineus	ASTERACEAE	
Euryops chrysanthemoides	ASTERACEAE	
Felicia petiolata	ASTERACEAE	
Erythrina zeyheri	FABACEAE	Ground Erythrina
Indigofera nigromontana	FABACEAE	
Leonotis intermedia	LAMIACEAE	
Leonotis leonurus	LAMIACEAE	
Lippia javanica	VERBENACEAE	
Lippia scaberrima	VERBENACEAE	
Lippia wilmsii	VERBENACEAE	
Osteospermum leptolobum	ASTERACEAE	
Osteospermum muricatum	ASTERACEAE	
Osteospermum spinescens	ASTERACEAE	
Osteospermum thodei	ASTERACEAE	
Phygelius capensis	SCROPHULARIACEAE	
Rhus ciliata	ANACARDIACEAE	
Salvia dolomitica	LAMIACEAE	
Salvia africanae-lutea	LAMIACEAE	
Sphedamnocarpus pruriens	MALPIGHIACEAE	

Sutherlandia frutescens	FABACEAE	Cancer bush
Sutherlandia humilis	FABACEAE	Cancer bush
Sutherlandia microphylla	FABACEAE	Cancer bush
Ziziphus zeyheriana	RHAMNACEAE	Small Buffalo thorn

FORBS

Gazania krebsiana	ASTERACEAE
Geranium incanum	GERANIACEAE
Gerbera jamesonii	ASTERACEAE
Osteospermum jucundum	ASTERACEAE
Anchusa capensis	BORAGINACEAE

- Ensure that no foreign material is brought (e.g. seed or invasive alien plants) onto the site.
- Vegetation should only be removed where necessary i.e. within the building footprint. Vegetation to be retained during the construction phase must be clearly demarcated.
- Cordoning off of proposed open space areas and sensitive areas to restrict the movement of construction vehicles and construction personnel.
- Leaving much of the proposed open space as natural as possible.
- Vegetation disturbance on sloped areas must be avoided.
- Cleared areas must be re-vegetated as soon as possible after construction.
- To eliminate vegetation destruction, the main construction camp must be placed in an area that will be cleared for development or that is already disturbed.
- No open fires should be allowed on the site, except in a designated controlled area.
- No fires are to be ignited with the intent to destroy the flora.
- No firewood may be collected in the surrounding areas/veldt.
- Fire extinguishers must be available on site.
- The vegetation outside development footprints should be rehabilitated as close as possible to natural veldt. Construction camp and site offices must be removed and rehabilitated on completion of the contract. The site should be rehabilitated as close as possible to its original condition.
- Topsoil should be removed from the development footprints and stockpiled for use in rehabilitation efforts (Topsoil is considered to be a minimum of thickness of ± 300mm of the natural soil, including all vegetation and organic matter).
- Weeds appearing on stockpiled topsoil shall be removed by hand before seeding.
- Measures to prevent erosion such as berms, gabions, and mats must also be installed where necessary.
- Strict control measures must be in place to monitor rehabilitation activities.
- An eco-control officer should be appointed to monitor and advise with the planting of indigenous trees and shrubs along the roads and open areas.

Operational Phase:

Various impacts are expected to occur during this phase. Uncontrolled movement and poor management of the open areas will lead to deterioration of the vegetation. By planting indigenous a suitable environment for rehabilitation and a sustainable environment for animals will be created. This effort can be enhanced by planting indigenous in the gardens and recreational areas.

The operation of the development can therefore have a negative impact on the bio-diversity if it is not managed correctly. Exotic vegetation can have a negative impact on the indigenous vegetation. Veld fires especially in the winter can have a major impact on fauna and flora as well as on the safety of people living in the surrounding areas.

8.4.10 Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes - Operational Phase

Rating Criteria	Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+4) x 4 = 40	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Introduction of exotic species through gardening, etc.
- Failure to rehabilitate damaged vegetation.
- Existing exotic vegetation not removed.

Nature/Description of the Impact:

- Increased invasion by exotic plant species following vegetation disturbance and introduction of exotic species.

Receiving Environment:

- Proposed site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the operational phase and is given a high intensity rating with a probability rating of highly probable. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.4.11 Pedestrian and Vehicle Traffic will Disturb Vegetation, Create Tracks and Pathways on the Site, and Increase Erosion Risk - Operational Phase

Rating Criteria	Pedestrian and Vehicle Traffic will Disturb Vegetation, Create Tracks and Pathways on the Site, and Increase Erosion Risk Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2

Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 3 = 27	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Uncontrolled pedestrian and vehicle traffic during the operational phase of the township.

Nature/Description of the Impact:

- Pedestrian and vehicle traffic will disturb vegetation, create tracks and pathways on the site, and increase erosion risk.

Receiving Environment:

- Proposed site and surroundings. No-Go areas include the areas identified as wetland areas as well as the 50m buffer areas surrounding them.

Significance of the Impact:

The extent of the impact is on site during the operational phase and is given a medium intensity rating with a probability rating of medium. The duration of the impact will be long term. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is low negative.

8.4.12 Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to the Soil Structure - Operational Phase.

Rating Criteria	Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to the Soil Structure Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+4) x 4 = 44	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Uncontrolled fires.
- Accidents.
- Burning of garden waste etc.

Nature/Description of the Impact:

- Uncontrolled fires on the property will result in destruction of indigenous vegetation/habitats and damage to the soil structure of the site and surrounding properties. It will also have an impact on the safety of people living on the proposed site and surrounding properties.

Receiving Environment:

- Vegetation on site surroundings.
- People living on the proposed site as well as those living on surroundings areas and their properties.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a high intensity rating with a probability rating of highly probable. The duration of the impact will be long term. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is low negative.

8.4.13 Destruction of Indigenous Plants by Collection for Ethnobotanical Use-Operational Phase.

Rating Criteria	Destruction of Indigenous Plants by Collection for Ethnobotanical Use Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+3) x 4 = 40	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Collection of indigenous plants by people living or working within the proposed development.

Nature/Description of the Impact:

- Destruction of indigenous plants by collection for Ethnobotanical use.

Receiving Environment:

- Indigenous vegetation on site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the operational phase and is given a medium intensity rating with a probability rating of probable. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within the wetland areas and the 50m buffer areas surrounding them.
- Invasive exotic plants and weeds must be eradicated on the property. Follow-up clearing must be maintained for the duration of the operational phase of the development.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens.
- Vegetation disturbance must be kept to a minimum.
- Entry points and access routes to the site must be clearly marked and traffic limited to those areas as far as possible.
- Exotic invasive trees/weeds at the site must be eradicated and the litter removed from site.
- No open fires must be allowed on the site except in designated controlled areas.
- No collection of indigenous plants may be allowed on the property. Employees should undergo Environmental awareness training and be sensitized to the need to avoid disturbance in the indigenous vegetation on the property.
- The landscaping proposals and the selection of trees and shrubs must be selected to be fruit and or flower bearing and thus be specially selected to attract more birds.
- Leaving much of the open areas as natural as possible.
- Ensuring a continuum in natural open space planning that allows for linkages between open spaces, this should incorporate natural open space and formal open space.
- No fires are to be ignited with the intent to destroy or flush out any fauna present on site and the surrounds.
- No littering is to take place on site or in the surrounding areas.
- Fire breaks should be made and maintained.

8.5 IMPACTS ON FAUNA

Construction Phase:

The presence of humans and construction activities had an impact on the grassland species as well as on the natural animal populations in the area of the study site. The site is surrounded by residential development and the site itself has been impacted by man. During the survey Ground Squirrel and Yellow Mongoose were noted on the project site. Annexure D of the Ecological Specialist Report lists the potential animal species that could occur within the broader study area and the project site.

During the construction phase of the development, land will be cleared of topsoil for the construction of buildings, roads and infrastructure with the aid of heavy earth moving machinery. This will be followed by earthworks and construction with the aid of a labour force on site. Construction material will be delivered to the site as required, some of which will be stored on site. Construction at the site will include an internal road system, storm water control measures and a sewerage network. Water will be obtained by tapping into the municipal water supply, and electricity will be provided by accessing the existing power grid.

Above activities will result in movement of animals away from the proposed site. Destruction of the natural habitat, albeit severely disturbed, will furthermore result in a small scale local migration away from the site. Unnecessary removal of vegetation will destroy habitats. The workers can also kill animals in the area for food or muti by trapping or snaring the animals.

8.5.1 Loss of Fauna Due to the Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes - Construction Phase.

Rating Criteria	Loss of Fauna Due to the Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(2+2+3) \times 4 = 28$	Low Significance $(2+2+2) \times 2 = 12$
Status	Negative	Negative

Source of the Impact:

- Construction activities.
- Failure to rehabilitate damaged vegetation.
- Introduction of Exotic Species for Ornamental and Utilitarian Purposes.

Nature/Description of the Impact:

- Loss of fauna due to the increased invasion by exotic plant species following vegetation disturbance and introduction of exotic species for ornamental and utilitarian purposes.

Receiving Environment:

- Fauna on site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a medium intensity rating with a probability rating of highly probable. The duration of the impact will be short term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.5.2 Loss of Fauna Due to an Increase in Habitat Loss and Fragmentation Resulting from Vegetation Removal & Disturbance on Site - Construction Phase.

Rating Criteria	Loss of Fauna Due to an Increase in Habitat Loss and Fragmentation Resulting from Vegetation Removal & Disturbance on Site Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term	Long Term

	Ranking - 4	Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 4 = 36	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Increase in habitat loss and fragmentation resulting from vegetation clearance and disturbance on site.

Nature/Description of the Impact:

- Fauna species of conservation concern may be indirectly affected by a loss of or alteration of habitat and associated resources. Animals are mobile and, in most cases, can move away from a potential threat, unless they are bound to a specific habitat that is also spatially limited and will be negatively impacted by a development. Nevertheless, the proposed development will reduce the extent of habitat available to fauna. For any species, a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. There are a number of red data species that have been recorded for the wider area within which the study area is located.
- Loss of fauna due to an increase in habitat fragmentation resulting from vegetation disturbance and destruction on site. This impact occurs by reducing natural migratory routes and faunal dispersal patterns. Walls, buildings, roads and other infrastructure associated with the development may obstruct and constrict faunal dispersal and floral dispersal by limiting and funneling natural dispersal patterns. Loss of available habitat normally equates to a loss of species that habituate the site as well as population numbers of those species.

Receiving Environment:

- Fauna on site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a medium intensity rating with a probability rating of highly probable. The duration of the impact will be long term as most of the vegetation/habitat will be replaced by development. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.5.3 Increased Faunal Disturbance and Mortality Due to Increased Vehicle Traffic - Construction Phase.

Rating Criteria	Increased Faunal Disturbance and Mortality Due to Increased Vehicle Traffic Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Low Ranking - 2	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Low Significance (2+2+2) x 3 = 18	Low Significance (2+2+2) x 2 = 12

Status	Negative	Negative

Source of the Impact:

- Increased traffic due to construction activities on the proposed site.

Nature/Description of the Impact:

- Increased faunal disturbance and mortality.

Receiving Environment:

- Fauna on site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a low intensity rating with a probability rating of moderate. The duration of the impact will be temporary. The significance attributed to this impact without mitigation is low negative and significance of the impact with mitigation is also low negative.

8.5.4 Illegal Hunting or Collecting (Trapping, Poisoning or Snaring) of Fauna - Construction Phase.

Rating Criteria	Illegal Hunting or Collecting (Trapping, Poisoning or Snaring) of Fauna Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance $(3+2+4) \times 3 = 27$	Low Significance $(3+2+2) \times 2 = 14$
Status	Negative	Negative

Source of the Impact:

- The workers might kill animals in the area for food or muti by trapping, poisoning or snaring the animals.

Nature/Description of the Impact:

- Decline in animal numbers and biodiversity of the area.

Receiving Environment:

- Fauna on site and surroundings.
- No-Go areas include the areas identified as wetland areas as well as the 50m buffer areas surrounding them. Several red-data species have the potential to occur within the study area.

Significance of the Impact:

The extent of the impact can be regional during the construction phase and is given a high intensity rating with a probability rating of moderate. The duration of the impact will be temporary. The significance attributed to this impact without mitigation is moderate negative and significance of the impact with mitigation is also low negative.

Mitigation Measures:

- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- It is recommended that a search and rescue operation be conducted prior to construction. Fauna should be relocated to more suitable surrounding habitats.
- The environmental consultants are to be informed if any endangered species are observed during construction. The environmental control officer (ECO) will also be monitoring construction on site to ensure that any Red Data species encountered during construction are not harmed, and that the relevant persons are contacted who will then determine the most appropriate way forward.
- Invasive exotic plants and weeds must be eradicated on the property.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens.
- The landscaping proposals and the selection of trees and shrubs must be selected to be fruit and or flower bearing and thus be specially selected to attract more birds.
- Only local indigenous trees and shrubs should be planted in the open areas and along the roads.
- Open areas must be linked as far as possible to creating eco-corridors.
- The site must be rehabilitated by planting indigenous plant species occurring in the area.
- The speed must be kept to a minimum by using informative signage and speed humps.
- No collection of fauna may be allowed on the property.
- No hunting must be allowed.
- Employees should undergo environmental awareness training and be sensitized to the need to avoid disturbance in the indigenous vegetation on the property.
- Workers should be prevented from climbing on and hiking in the close vicinity of the nesting sites during the construction phase.
- Strict rules and penalties against the snaring/killing/catching of any animals for all construction workers.
- No fires are to be ignited with the intent to destroy the flora or with the intent to destroy or flush out any fauna present on site and the surrounds.
- No littering during construction is permitted.
- No animals be removed or killed on and surrounding the site.
- No insecticides or any form of pesticides should be used during the construction phase.

Operational Phase:

Various impacts are expected to occur during this phase. Uncontrolled movement and poor management of the open areas will lead to deterioration of the vegetation. The envisaged small scale local migration of animals can only be turned around if a sustainable and relatively natural habitat can be created in the gardens and open spaces. The success will to a fair extent rely on well-chosen and maintained eco-corridors, linking the different areas.

The possible presence of any solid waste or toxic substances can be the cause of unnecessary animal deaths. Poisoning of problem animals can lead to deaths of birds of prey and other prey animals in the area. Residents or domestic workers can probably catch small animals like reptiles, mammals or birds to take as pets or food.

8.5.5 Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes will Destroy Suitable Habitat for Indigenous Fauna - Operational Phase.

Rating Criteria	Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes will Destroy Suitable Habitat for Indigenous Fauna Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance $(2+4+3) \times 3 = 27$	Low Significance $(2+4+2) \times 2 = 16$
Status	Negative	Negative

Source of the Impact:

- Introduction of exotic species through gardening, etc.
- Failure to rehabilitate damaged vegetation.
- Existing exotic vegetation not removed.

Nature/Description of the Impact:

- Increased invasion by exotic plant species following vegetation disturbance and introduction of exotic species for ornamental and utilitarian purposes will destroy suitable habitat for indigenous fauna. Loss of available habitat normally equates to a loss of species that habituate the site as well as population numbers of those species.

Receiving Environment:

- Suitable habitat and fauna on the proposed site.

Significance of the Impact:

The extent of the impact is on site during the operational phase and is given a high intensity rating with a probability rating of medium probable. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.5.6 Loss of Fauna Due to an Increase in Habitat Fragmentation Resulting from Vegetation Disturbance and Destruction on Site - Operational Phase.

Rating Criteria	Loss of Fauna Due to an Increase in Habitat Fragmentation Resulting from Vegetation Disturbance and Destruction on Site Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance $(2+4+3) \times 3 = 27$	Low Significance $(2+4+2) \times 2 = 16$
Status	Negative	Negative

Source of the Impact:

- Increase in habitat fragmentation resulting from vegetation disturbance and destruction on site.

Nature/Description of the Impact:

- Loss of fauna due to an increase in habitat fragmentation resulting from vegetation disturbance and destruction on site. This impact occurs by reducing natural migratory routes and faunal dispersal patterns. Walls, buildings, roads and other infrastructure associated with the development may obstruct and constrict faunal dispersal and floral dispersal by limiting and funnelling natural dispersal patterns. Loss of available habitat normally equates to a loss of species that habituate the site as well as population numbers of those species.

Receiving Environment:

- Fauna on site and surroundings.

Significance of the Impact:

The extent of the impact is on site during the construction phase and is given a medium intensity rating with a probability rating of medium. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.5.7 Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Degradation of Suitable Faunal Habitat - Operational Phase.

Rating Criteria	Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Degradation of Suitable Faunal Habitat Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 3 = 27	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Uncontrolled fires.
- Accidents.
- Burning of garden waste etc.

Nature/Description of the Impact:

- Uncontrolled fires on the property will result in destruction of indigenous vegetation and degradation of suitable faunal habitat. It will also have an impact on the safety of people.

Receiving Environment:

- Indigenous vegetation and fauna on the proposed site and surroundings as well as surrounding landowners and their properties.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a moderate intensity rating with a probability rating of medium. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

8.5.8 Destruction of Animal Populations by Illegal Hunting or Poisoning - Operational Phase.

Rating Criteria	Destruction of Animal Populations by Illegal Hunting or Poisoning Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Medium Probability	Low Probability

	Ranking - 3	Ranking - 2
Significance	Moderate Significance (2+4+4) x 3 = 30	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Illegal hunting or collecting (trapping or snaring) of fauna by people living or working in the proposed development.

Nature/Description of the Impact:

- Deaths of animals and decline in animal numbers and biodiversity of the surrounding areas.

Receiving Environment:

- Fauna in the areas surrounding the proposed site.

Significance of the Impact:

The extent of the impact is on site during the operational phase and is given a high intensity rating with a probability rating of medium. The duration of the impact will be long term. The significance attributed to this impact without mitigation is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- All the recommendations as made in the attached Specialist Report.
- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- All exotic plant species must be cleared. This must be accompanied by a long-term monitoring and follow-up clearing program.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens.
- Only indigenous trees should be planted along the roads.
- No open fires are allowed on the site, except in designated controlled areas.
- Vehicle movement must be restricted and no movement must be allowed in open space areas.
- No hunting may be allowed on the property and surroundings.
- Strict control measures must be in place to monitor rehabilitation activities. The vegetation outside development footprints should be rehabilitated as close as possible to natural veldt, creating sanctuary for animals.
- No fauna may be collected, harmed or disturbed on the property. This is particularly important in the intact portions of the vegetation, where most of these animals are expected to occur.
- An eco-control officer should be appointed to monitor and help with the planting of indigenous trees and shrubs along the roads and open areas.
- The speed must be kept to a minimum by using informative signage and speed humps.
- Employees should undergo environmental awareness training.
- The landscaping proposals and the selection of trees and shrubs must be selected to be fruit and or flower bearing and thus be specially selected to attract more birds and to sustain the rich bird life.
- Insecticides should be discouraged and more natural means of combating insects and vermin should be implemented. A simple insecticide sprayed within an area can cause extensive long-term damage with respect to animal-plant interactions.
- When possible, locate electrical distribution power lines underground.
- Yellow lights that do not attract insects must be used where possible.
- Solid waste or toxic substances should be handled with care and not left in the open so that animals can scavenge in it.
- The use of any poisons for problem animal control should be strictly controlled.

- An education program should be started to educate residents and workers of the importance of nature conservation and the conservation of the ecological integrity of the area.

8.6 INVERTEBRATES, REPTILES AND AMPHIBIANS

Construction & Operational Phase:

Invertebrate, reptile and amphibian species are less well researched in the area. Habitat destruction threatens some of these species. Red data species that might occur on the proposed site include 1 reptile (striped harlequin snake) and 1 amphibian species (the giant bull frog). No special or particular invertebrate sensitivity is evident.

8.6.1 Impact on Invertebrates, Reptiles & Amphibians - Construction & Operational Phase

Rating Criteria	Impact on Invertebrates, Reptiles & Amphibians Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Low Ranking - 2	Low Ranking - 2
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Low Significance $(2+4+2) \times 3 = 24$	Low Significance $(2+4+2) \times 2 = 16$
Status	Negative	Negative

Source of the Impact:

- Construction activities.
- Removal of vegetation.
- Poisoning, killing or snaring.
- Lights at night during the operational phase.
- Solid waste pollution.

Nature/Description of the Impact:

- Habitat destruction.
- Decline in numbers of Invertebrates, Reptiles and Amphibians.

Receiving Environment:

- Proposed site and surroundings.

Significance of the Impact:

The extent of the impact is local and over the long term and is further given a moderate intensity rating. The weighting factor attributed to this impact is therefore low negative and significance of the impact with mitigation is therefore also low negative.

Mitigation Measures:

- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.

- Planning should allow for connecting corridors left between developments and the other existing habitats to ensure a flow of genes and taxa between the species and also for natural dispersion of species to take place. The roadways and surrounding developments prohibit any further proposal of corridors or buffers being implemented for the area, other than the existing passages through residences and road verges.
- Fencing should allow the free passage of small animals and insects. High brick or concrete walls are good for complete privacy, but act as permanent barriers to insects and small animals. Note that deep trenches are also discouraged as these become barriers and traps for migrating wildlife.
- The use of high-power security lighting for public areas and arenas have a devastating effect on the nocturnal animals and insects by attracting them away from their natural environment, leading to certain death. Mercury arc and halogen lamps emit light in the white spectrum, disorientating them and in turn prevents mating and depletes the natural environment of many species. Yellow Sodium lights are prescribed as they do not attract invertebrates at night and will not disturb the existing wildlife.
- Groves of trees and bushes provide small microhabitats for birds and invertebrates. Landscaping of tree groves or clumps is encouraged, rather than perfectly spaced lines of exotic palms as example. In nature, there are always 2-3 species of trees and shrubs growing communally, each benefiting from each other.
- To date the practice of relocating invertebrates has not been attempted, therefore should a Red Data species be encountered this action is not recommended.
- Prevent the introduction of pest species such as mice, rats, argentine ants, and dog fleas etc.
- Discourage the use of insecticides, with emphasis on outdoor chemicals, which can be dispersed by airflow and animals.

8.7 AQUATIC ECOLOGY

Construction & Operational Phase:

A number of man-made wetlands occur around the site of which four are listed as a NFEPA site.

As the study area is located within a slightly north-east sloping landscape, sloping towards the drainage system located to the east of the study area, there is a slight likelihood for some impacts such as an increase in surface runoff into the drainage system and the spread of erosion into the system. However, the possibility and extent of these impacts are still regarded as low and with the necessary monitoring and mitigation measures in place, these impacts on the ephemeral drainage line can be avoided.

A 50m buffer area was also mapped around the identified wetlands as being sensitive areas. All development activities should stay away from these areas.

8.7.1 Impact on Aquatic Ecology of the Site and Surroundings - Construction & Operational Phase

Rating Criteria	Aquatic Ecology Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+4) x 4 = 40	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Disturbances from construction and operational activities in the form of water and soil pollution, contamination and increases in hard surface structures which affect the integrity and functionality of wetlands.

Nature/Description of the Impact:

- Decrease in biodiversity and thereby decreasing the ecological state of the dam.

Receiving Environment:

- The man-made wetlands and the 50m buffer area surrounding it.

Significance of the Impact:

The extent of the impact is local and over the long term. The impact is given a high intensity rating as the site was included within the sensitive area. The weighting factor attributed to this impact is therefore moderate negative and significance of the impact with mitigation is therefore low negative.

Mitigating Measures:

- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas. Sufficient care must be taken when handling these materials to prevent pollution.
- 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.
- Oil residue shall be treated with oil absorbent such as Drizit or similar and this material removed to an approved waste site.
- All construction materials and hazardous substances must be stored away from the wetlands and the 50m buffer area surrounding them. Storage of potentially hazardous materials should be above any 100-year flood line.
- Refuelling of construction vehicles must only take place at the existing filling station and not on the construction site.
- Construction vehicles must be well serviced and maintained to prevent oil and fuel leaks. Use drip pans when servicing vehicles.
- Removal of vegetation to be limited to construction and road areas. Erosion control measures must be implemented during the construction phase. Road maintenance must be kept up to standard to prevent and reduce the incidence of erosion next to the roads.
- Cleared areas to be re-vegetated or paved as soon as practicable to limit the effect of erosion and siltation. Indigenous plant species to be given preference in re-vegetation areas.
- Oil traps etc. should be installed at strategic positions to intercept and collect the possible dirt.
- Refuse collection should take place on a regular basis. A litter patrol around the construction area is to take place twice a week to collect any litter that may have been strewn around.
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately.
- Where the use of fertilizers is warranted, slow-release natural organic fertilizers should be used sparingly, with application rates as low as possible. Rather make use of environmentally friendly herbicides and insecticides with fast environmental breakdown rates.
- The application of fertilisers should be avoided when heavy rainfall is forecast and should be applied only under calm wind conditions.
- A well-vegetated buffer zone of at least 50m should be maintained surrounding the wetlands.
- The use of biocides should be avoided.
- No chemicals should be applied to buffer zones and grass should be allowed to lengthen and thicken naturally to facilitate reduction in runoff velocity and volume and increase infiltration.

- Adequate measures must be taken to manage storm water runoff. Erosion control methods on exposed soils should also be incorporated throughout the development.
- The sewage reticulation must be inspected for blockages on a regular basis and any leakages must be attended immediately.

8.8 WATER USE/QUANTITY

Construction Phase:

During this phase water consumption will be minimal because it will be utilized mainly for dust abatement and construction purposes.

8.8.1 Impact on Water Resources due to Usage Thereof – Construction Phase

Rating Criteria	Impact on Water Resources due to Usage Thereof Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Moderate Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Moderate Probability Ranking - 3
Significance	Moderate Significance (3+2+3) x 4 = 32	Low Significance (3+2+2) x 3 = 21
Status	Negative	Negative

Source of the Impact:

- Use of water for construction activities.

Nature/Description of the Impact:

- Depletion of water resources: Water consumption.

Receiving Environment:

- Water resources.

Significance of the Impact:

The extent of the impact is regional during the short term. The impact is given a medium intensity rating as water is a scarce resource in South Africa. The status of the impact is negative with a weighting factor attributed to this impact of medium and significance of the impact with mitigation is low.

Operational Phase:

The water needs of the development will be sourced from municipal water connections. According to the attached Services Report the MMM water systems were found to have more than enough spare capacity to accommodate the proposed development.

Groundwater will not be used as domestic water supply. Groundwater might be used for the irrigation of the sport fields, small vegetable gardens and gardens of the proposed development.

8.8.2 Impact on Water Resources due to Usage Thereof – Operational Phase

Rating Criteria	Impact on Water Resources due to Usage Thereof Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Moderate Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+3) x 4 = 40	Low Significance (3+4+3) x 2 = 20
Status	Negative	Negative

Source of the Impact:

- Domestic use of municipal water.
- Ground water - Irrigation of sports fields, vegetable gardens and gardens of development.

Nature/Description of the Impact:

- Impact on MMM bulk water supply capacity.
- Depletion of water resources: Water consumption.

Receiving Environment:

- Water resources.

Significance of the Impact:

The extent of the impact is regional during the long term. The impact is given a moderate intensity rating as water is a scarce resource in South Africa. The status of the impact is negative with a weighting factor attributed to this impact of medium and significance of the impact with mitigation is low.

Mitigating Measures:

- No groundwater should be used for domestic use.
- Water consumption for domestic purposes is a given, but care must be taken not to waste any water. In the houses, half flush systems in the toilets as well as water aerators in all taps must be installed to reduce water consumption. All these criteria must fit into a set off rules for the use of water by all property owners at the development.
- A groundwater-monitoring program needs to be implemented to monitor any possible effects that the proposed development would have on the groundwater.
- Gardens must be kept natural (use indigenous plants).
- Storm water from roof coverings must be stored for later use in ground level rain water storage tanks. The rain water tanks will have to be aesthetically designed so as not degrade the overall architectural appearance of the buildings. In the most basic form the storm water can be stored in PVC/ HDPE tanks. The water can be utilised for watering of the gardens. The following benefits will be derived from the implementation of the tanks:
 - Reduction in demand on purified water for irrigation purposes
 - The flow hydrograph will flatten meaning that the peak flow will reduce burden on downstream storm water infrastructure.
- Water from the following sources can be used for grey water irrigation. The following sources is ideal for such usage:
 - Washing machine water.

- Water from baths, hand wash basins and showers.
- Grey water septic tanks and water filtration systems may be implemented depending on the quality of water that is released back into the environment. The systems requires the installation and operation of pumps to either lift grey water to aboveground septic tanks or the lift water from below ground surface septic tanks. Septic tanks provide a facility where digestion can take place, but it also serve as a place to store water until it is needed.
- Obtain all required water licenses from DWS.

8.9 SURFACE AND GROUND WATER CONTAMINATION

Construction Phase:

Stormwater drainage towards the Development is mainly from cultivated lands on the northern side of the Jagersfontein Road through a series of 400 and 600 mm diameter culverts. The road acts as a retention facility in places, however, according to local residents a part of the road is flooded after a heavy rainstorm.

No apparent erosion damage is visible on the site. The main part of the Development drains towards culverts in Denne Lane as well as an open concrete stormwater canal on the southern side. Based on comments from the community the southern part of Denne Lane is flooded after heavy rainstorms. In order to prevent this situation a berm was constructed alongside Denne Lane inside the Development to divert the stormwater to a culvert at the most southern point. Upstream of the main part of the Development a dam called Rooidam was constructed to act as a retention facility. The inflow to this dam is through three culverts with a catchment area starting from Pellisier. The outflow is over a U-shape weir into an open concrete canal on the southern side of the Development.

Hydrocarbon-based fuels or lubricants spilled from construction vehicles, construction materials that are not properly stockpiled, and litter deposited by construction workers may be washed into surface water bodies. Should appropriate toilet facilities not be provided for construction workers at the construction crew camps, the potential exists that water resources be contaminated by raw sewage.

8.9.1 Surface and Groundwater Contamination – Construction Phase

Rating Criteria	Surface and Groundwater Contamination Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance $(3+2+4) \times 3 = 27$	Low Significance $(3+2+2) \times 2 = 14$
Status	Negative	Negative

Source of the Impact:

- Spillage of fuel and lubricants from construction vehicles and storage areas. The source of the spillage may be due to negligence, accidents or poor housekeeping practises (such as fuel storage areas not being bunded).
- Lack of chemical sanitation facilities at construction sites could result in ground water or surface water pollution and associated health risks.
- Solid waste disposal – Storm water contamination by solid waste could lead to groundwater and surface water pollution.

- Removal of soil cover and vegetation (sites and roads) can cause erosion and subsequent sedimentation of water resources.

Nature/Description of the Impact:

- Water Pollution - Hydrocarbon-based fuels or lubricants spilled from construction vehicles, construction materials that are not properly stockpiled, and litter deposited by construction workers may be washed into the surface water bodies. Solid waste may be washed into surface water bodies, polluting it.
- Should appropriate toilet facilities not be provided for construction workers at the construction crew camps, the potential exists for surface water resources and surrounds to be contaminated by raw sewage.
- Siltation of water resources due to erosion.

Receiving Environment:

- Ground and surface water resources.

Significance of the Impact:

The extent of the impact is regional as contamination of water resources on site may affect the quality of ground and surface water throughout the region. The impact is given a high intensity rating. It is possible that the impact may occur but it may only last as long as it takes to clean up a spill if it does occur i.e. the risk remains as long as the clean-up takes. This results in a short term duration classification for the construction phase of the development. The weighting factor attributed to this impact is medium negative and significance of the impact with mitigation is therefore low negative.

Mitigating Measures:

- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- No on-site sanitation must be allowed closer than 100m from surface or groundwater resources.
- Conduct on-going staff awareness programs so as to reinforce the need to avoid littering.
- At least one groundwater monitoring borehole must be established down gradient of the proposed site. The groundwater monitoring should include:
 - At least one groundwater sample before construction commences;
 - Quarterly groundwater sampling during construction;
 - Groundwater sampling on a quarterly basis for up to 1 year after construction.
- Chemical sanitation facilities should be on site and regularly serviced by appropriate companies so that no spills or leaks from toilets to groundwater or surface water take place. Any spills should be cleaned up immediately.
- A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas. Sufficient care must be taken when handling these materials to prevent pollution.
- 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.
- Oil residue shall be treated with oil absorbent such as Drizit or similar and this material removed to an approved waste site.
- All construction materials and hazardous substances must be stored away from the sensitive areas. Storage of potentially hazardous materials should be above any 100-year flood line.
- Refuelling of construction vehicles must only take place at the existing filling station and not on the construction site.
- Construction vehicles must be well serviced and maintained to prevent oil and fuel leaks. Use drip pans when servicing vehicles.

- Solid waste must be kept in adequate bins and disposed of regularly at the correct and licensed site. Provide bins for construction workers and staff at appropriate locations, particularly where food is consumed.
- Waste is to be stored in access controlled enclosures such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages will have a concrete floor to ensure incidental leachate can be treated and disposed of. It is intended that waste will be sorted at the source and that it will be stored separately in the waste storage facility.
- Waste must be sorted and recycled (glass, plastic, metal, paper and wet waste). No waste may be buried on site.
- 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.
- Where construction in close proximity to sewer lines is unavoidable then excavations must be done by hand while at all times ensuring that the soil beneath the sewer lines is not destabilised.
- Removal of vegetation to be limited to construction and road areas. Erosion control measures must be implemented during the construction phase.
- Cleared areas to be re-vegetated or paved as soon as practicable to limit the effect of erosion and siltation. Indigenous plant species to be given preference in re-vegetation areas.
- Road maintenance must be kept up to standard to prevent and reduce the incidence of erosion next to the roads.
- Adequate measures must be taken during construction to manage storm water runoff.
- Oil traps etc should be installed at strategic positions to intercept and collect the possible dirt.
- Sequential construction strategy i.e. phasing the construction of the site and rehabilitating immediately after each phase.
- Timing construction so that construction takes place outside of rainy seasons, thus reducing opportunities for erosion from rainfall events.
- Refuse collection should take place on a regular basis. A litter patrol around the construction area is to take place twice a week to collect any litter that may have been strewn around.
- Concrete is to be mixed on mixing trays only, not on exposed soil. Concrete and tar shall be mixed only in areas, which have been specially demarcated for this purpose. All concrete and tar that is spilled outside these areas shall be promptly removed by the contractor and taken to an approved dumpsite. After all the concrete / tar mixing is complete all waste concrete / tar shall be removed from the batching area and disposed of at an approved dumpsite.
- Storm water shall not be allowed to flow through the batching area. Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the Consulting Engineer.
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately.

Operational Phase:

Herbicides and insecticides applied to the developments gardens may seep into water resources causing an increased nutrient load and contributing to eutrophication of river systems and water bodies. Increased car movement and human activity adds to other pollution problems on a regional scale.

The disposal of wastes and solvents (e.g. washing agents used for cleaning cars etc) into the surface water system, could contribute to the pollution of the surface water and a reduction in the water quality in the area. Dirt and possible oil dripping from vehicles on the paved areas would also accumulate during the winter months with little or no rain and could be washed off by rain storms experienced during spring and early summer.

Leakages from the sewage system may occur during the operational phase. Putative impacts of such leakages will include the release of sewage into the soil, the drainage of these wastes into the water sources within the area, and the possible infection of humans and animals in the vicinity of the area. Several bacterial pathogens, which may be present within faecal matter, can transmit,

numerous diseases through water including gastroenteritis, salmonellosis, dysentery, cholera and typhoid fever.

The proposed project is unlikely to impact highly on the groundwater. The fertilisation of gardens may result in infiltration of eutrophied water into the groundwater.

Erosion control methods on exposed soils should also be incorporated throughout the development. The effect will be much less that in the construction phase because most of the open areas will be covered and re-vegetated.

Rainwater harvesting must be considered for the development. The average rainfall for the area is estimated at 550 mm per annum. The rainwater water collected from roofs could be stored by means of a typical 5000l container above or below ground, and should be used for irrigation purposes.

8.9.2 Surface and Groundwater Contamination – Operational Phase

Rating Criteria	Surface and Groundwater Contamination Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+4) x 3 = 33	Low Significance (3+4+2) x 2 = 18
Status	Negative	Negative

Source of the Impact:

- Spillage of fuel and lubricants from vehicles and storage areas. The source of the spillage may be due to negligence, accidents or poor housekeeping practises (such as fuel storage areas not being bunded).
- Inadequate functioning of the sanitation system.
- Solid waste disposal – Storm water contamination by solid waste could lead to groundwater and surface water pollution.
- Removal of soil cover and vegetation (sites and roads) can cause erosion.

Nature/Description of the Impact:

- Water Pollution – Hydrocarbon-based fuels or lubricants spilled from vehicles or storage areas may be washed into the surface water bodies. Solid waste may be washed into surface water bodies, polluting it.
- Inadequate functioning of the sanitation system may lead to water resources contamination.
- Siltation of water resources due to erosion.

Receiving Environment:

- Ground and surface water resources.

Significance of the Impact:

The extent of the impact is regional as contamination of water resources on site may affect the quality of ground and surface water throughout the region. The impact is given a medium intensity rating. This results in a long term duration classification for the operational phase of the

development. The weighting factor attributed to this impact is medium negative and significance of the impact with mitigation is therefore low negative.

Mitigating Measures:

- Recommendations as made in the attached services and Geotechnical Reports.
- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- Rainwater harvesting must be considered for the development. The rainwater water collected from roofs could be stored by means of a typical 5000l container above or below ground, and should be used for irrigation purposes.
- No on-site sanitation must be allowed closer than 100m from surface or groundwater resources.
- At least one groundwater monitoring borehole must be established down gradient of the proposed site. The groundwater monitoring should include:
 - At least one groundwater sample annually during the operational phase of the development.
- Possible pollution from any storage tanks and/or any other contaminant spills and/or leakages must be reported to DWS within 24 hours of spillage/leakage.
- Where the use of fertilizers is warranted, slow-release natural organic fertilizers should be used sparingly, with application rates as low as possible. Rather make use of environmentally friendly herbicides and insecticides with fast environmental breakdown rates.
- The application of fertilisers should be avoided when heavy rainfall is forecast and should be applied only under calm wind conditions.
- A well-vegetated buffer zone of at least 50m should be maintained surrounding the wetland areas.
- The use of biocides should be avoided.
- No chemicals should be applied to buffer zones and grass should be allowed to lengthen and thicken naturally to facilitate reduction in runoff velocity and volume and increase infiltration;
- Adequate measures must be taken to manage storm water runoff. Erosion control methods on exposed soils should also be incorporated throughout the development.
- The site and surrounding area should be designed to permit the ready drainage of surface water and to prevent “ponding”.
- Prevent leaks and spillage of materials that may detrimentally affect water quality.
- Oil traps etc should be installed at strategic positions to intercept and collect the possible dirt.
- Provide efficient waste removal services. Refuse collection should take place on a regular basis. A litter patrol around the development is to take place twice a week to collect any litter that may have been strewn around.
- Waste is to be stored in access controlled enclosures such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages will have a concrete floor to ensure incidental leachate can be treated and disposed of. It is intended that waste will be sorted at the source and that it will be stored separately in the waste storage facility.
- All maintenance vehicles must be well serviced and maintained to prevent oil and fuel leaks.
- Refuelling of vehicles must only take place at the existing filling station.
- Solid waste must be kept in adequate waste bins and disposed of regularly at the correct and licensed landfill site. Waste must be sorted and recycled (glass, plastic, metal, paper and wet waste). Waste may not be burned on site and No waste may be buried on site.
- The sewage system must be inspected for leakages on a regular basis and any leakages must be attended immediately.
- Re-vegetation of open areas to limit erosion (use only grass seeds from grasses occurring in the area).
- Road maintenance must be kept up to standard to prevent and reduce the incidence of erosion on the roads and next to the roads.

8.10 VISUAL IMPACT

Construction Phase:

During construction phase of development the visual status of the area will change. The construction phase will not be aesthetically pleasing to the local residents, due to excavations, the construction camp, storage of building materials and general construction activities. Buildings that arise have a visual impact and lights at night can be a nuisance. It is not foreseen that the construction phase of the proposed development will result in an increase in the amount of lighting at night as the construction activities will only be allowed to take place during normal working hours.

Key factors to take into account when assessing visual impacts are:

- The nature of the surrounding environment;
- The nature of the activity; and
- Any key receptors.

Landscape receptors are defined landscape elements that will be impacted on by the proposed development. The landscape receptors that will be affected by this development are the grassland open space system. Changes to the site will negatively impact on these values of naturalness and alter the prevailing landscape character. It is considered that the sensitivity of the grassland is low to medium since large areas have already been altered.

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value, and is influenced by characteristics such as vegetative screening, diversity of colours and patterns and topographic variability. Considering the scale of the proposed development, large areas will be stripped of grass cover to clear the way for construction. Almost no vegetative screening will be provided by the landscape during the site preparation and construction phases. The VAC of the landscape is considered to be low, providing little absorption during the site preparation and construction phases.

In time, the construction sites will transform to the new township development. The conclusion is that the initial project phases will be somewhat intrusive on the landscape, but will eventually resemble the urban character of the already developed areas of the adjacent existing Lourierpark.

Visual contrast is the degree to which the physical characteristics of the proposed project differ from that of the existing landscape. Initially the site preparation and construction phases will create a low to medium level of visual contrast. The exposed soil and the presence of construction equipment, etc. will contrast in colour and texture due to the change in surface cover. Partially constructed buildings will introduce new forms in the landscape.

Within the receiving environment, specific visual receptors will be able to experience views of the proposed development. Residents of the surrounding areas are classified as visual receptors of high sensitivity owing to their potential sustained visual exposure to the proposed development as well as their attentive interest towards their living environment. Motorists are classified as visual receptors of low sensitivity due to their momentary view and experience of the proposed development.

8.10.1 Visual Impacts Due to Construction Activities – Construction Phase

Rating Criteria	Visual Impacts Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Low Ranking - 2
Probability	High Probability	Low Probability

	Ranking - 4	Ranking - 2
Significance	Moderate Significance (2+2+3) x 4 = 28	Low Significance (2+2+2) x 2 = 12
Status	Negative	Negative

Source of the Impact:

- The construction phase will not be aesthetically pleasing to the local residents, due to vegetation clearance, excavations, the construction camp, storage of building materials and general construction activities.
- Machinery on the proposed site.

Nature/Description of the Impact:

- Alteration of the landscape character.

Receiving Environment:

- Surrounding landowners and residents as well as motorists using the roads surrounding the proposed site.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a medium intensity rating. It is highly likely that the impact may occur over the short term. The significance factor attributed to this impact is moderate negative and significance of the impact with mitigation is therefore low negative.

Mitigation Measures:

- The absolute minimum amount of vegetation and topsoil should be removed from building and access route areas. Ensure that all existing natural vegetation is retained wherever possible.
- Make use of indigenous vegetation where possible to create habitats that attract the natural fauna and flora.
- Landscaping must be maintained to enhance the aesthetical appeal of the development.
- Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties including road verges, roads or public places and open spaces during or after the construction period of the development but disposed of at an approved dumping site as approved by the MMM.
- Waste is to be stored in access controlled enclosures such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages will have a concrete floor to ensure incidental leachate can be treated and disposed of. It is intended that waste will be sorted at the source and that it will be stored separately in the waste storage facility.
- The construction camp must be contained to prevent any visual intrusion and be kept in a clean and orderly state at all times. The location of the construction camp must be determined in consultation with the community through the community liaison officer (CLO).
- The construction camp and stockpile areas should routinely be checked for litter.
- The buildings that are to be erected should be aesthetically pleasing and blend into the area as far as possible.
- Ensure that outdoor advertising and signage adheres to SAMOAC (South African Manual for Outdoor Advertising Control).
- Rehabilitation of any areas disturbed by construction activities must be rehabilitated in such a manner as to approximate the visual signature of the area pre-construction as far as possible.
- The materials and colours used in the construction of the buildings and infrastructure will give preference to natural and eco-friendly choices, minimizing the visual impact on the aesthetic character of the site and surroundings.

Operational Phase:

Buildings that arise have a visual impact and lights at night can be a nuisance.

8.10.2 Visual Impacts Due to the Operation of the New Township Development – Operational Phase

Rating Criteria	Visual Impacts Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Low Ranking - 2
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 4 = 36	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Buildings and operational activities of the proposed development.

Nature/Description of the Impact:

- Buildings that arise have a visual impact and lights at night can be a nuisance.

Receiving Environment:

- Surrounding landowners and residents as well as motorists using the surrounding roads.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a medium intensity rating. It is likely that the impact will be long term. The significance factor attributed to this impact is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- If on site accommodation is found necessary for some of the maintenance people, these residences must be treated and built exactly the same way and with the same architectural theme as the rest of the development.
- Ensure that all existing natural vegetation is retained wherever possible.
- Make use of indigenous vegetation where possible to create habitats that attract the natural fauna and flora.
- Initiate and implement an indigenous tree-planting programme.
- Landscaping must be maintained to enhance the aesthetical appeal of the development.
- Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties including road verges, roads or public places and open spaces during or after the construction period of the proposed housing development but disposed of at an approved dumping site as approved by the MMM.
- The buildings that are to be erected should be aesthetically pleasing and blend into the area as far as possible.
- Ensure that outdoor advertising and signage adheres to SAMOAC (South African Manual for Outdoor Advertising Control).

- Maintain buildings and perimeter fencing etc. in order to ensure that they do not deteriorate and result in an aesthetically unpleasing development.
- All external fittings for example satellite dishes and TV aerials should be positioned in such a way that will have the least visual impact.
- All outside lighting to shine directly down. No general spotlighted areas must be allowed, which could bother neighbours.
- To reduce the visual impact of power lines on the environment the power can be distributed from existing overhead power lines to the stands by means of underground low voltage cables.

8.11 NOISE LEVELS

Construction Phase:

There will be an increase in noise levels during the construction period. Noise from construction vehicles, equipment and workers can be a potential negative aspect of construction, but this will have a temporary and localised impact.

Noise generated on site will create a disturbance to surrounding communities during the construction period. Such noise can impact on surrounding communities by causing disruptions to recreational habits, sleeping habits, the ability to concentrate and in extreme cases, hearing damage.

8.11.1 Noise Impacts Due to Construction Activities – Construction Phase

Rating Criteria	Noise Levels Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+2+3) x 4 = 28	Low Significance (2+2+3) x 2 = 14
Status	Negative	Negative

Source of the Impact:

- Noise generation on site during the construction phase.
 - Operation of machinery and heavy vehicles on site;
 - Building activities;
 - Noise generated within the site workshop and the contractors yards in general.

Nature/Description of the Impact:

- Construction activities will generate noise that will exceed the current ambient noise levels experienced over the site and surrounding areas.

Receiving Environment:

- Surrounding landowners and residents.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a medium intensity rating. It is likely that the impact may occur over the short term. The significance factor attributed to this impact is moderate negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- Vehicles must be well serviced so that it does not produce excessive noise.
- Construction must take place only during business hours in accordance with noise control regulations.
- Noise silencers can be fitted to plant and heavy construction vehicles should complaints from the surrounding communities with regard to noise levels generated on site persist at any stage of construction.
- An open and transparent complaints procedure should be established between the contractor and surrounding communities, such that the route cause of any persistent complaints can be established and appropriate mitigation implemented to alleviate the distress of the surrounding communities.
- Surrounding residents should be notified in advance of construction schedules.
- Loud music and other undue noise must not be permitted.
- Any blasting required should occur during normal working hours unless approved by environmental site officer in consultation with surrounding landowners.

Operational Phase:

Noise during operational phase will be typical that normally found in residential areas. Noise from vehicle movement accessing the development can be a nuisance.

8.11.2 Noise Impacts Due to the Operation of the Township Development – Operational Phase

Rating Criteria	Noise Levels Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(2+4+3) \times 4 = 36$	Low Significance $(2+4+3) \times 2 = 18$
Status	Negative	Negative

Source of the Impact:

- Noise generation during the operational phase from:
 - Vehicle movement;
 - Sports events;
 - Normal residential development noises.

Nature/Description of the Impact:

- Operational activities of the proposed development will generate noise that will exceed the current ambient noise levels experienced over the site and surrounding areas.

Receiving Environment:

- Surrounding landowners and residents.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a medium intensity rating. It is likely that the impact will be long term. The significance factor attributed to this impact is medium negative and significance of the impact with mitigation is low negative.

Mitigation Measures:

- It must be ensured that all vehicles and maintenance equipment are appropriately maintained.
- Loud music and other undue noise must not be permitted.
- Hobbies or other activities which produce excessive noise and nuisance to other residents must not be allowed.
- Abide by all local authority by-laws in terms of noise pollution.

8.12 AIR QUALITY

Construction Phase:

During this phase there will be a concentration of earthmoving equipment and construction vehicles that will level the area, clear vegetation for buildings and roads. This will create dust and exhaust smoke that will impact on air quality. Burning of waste and fires at construction sites may also create smoke.

Dust generated on site will also have a negative visual impact on the visual and aesthetic character of the site. In addition, dust generated on site will contribute to the “nuisance factor” associated with the proposed development on surrounding landowners. Excessive levels of air-borne dust can also impact negatively on the health and well-being of the site’s workforce and surrounding landowners.

8.12.1 Impact on the Air Quality due to Construction Activities – Construction Phase

Rating Criteria	Air Quality Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+2+3) x 4 = 28	Low Significance (2+2+3) x 2 = 14
Status	Negative	Negative

Source of the Impact:

- Dust will be generated from the following activities during the construction phase.
 - Vegetation clearance;
 - Cement batching;
 - Handling of building materials;
 - Topsoil stripping and bulk earth works;
 - Vehicular movement over bare soil surfaces; and

- Stockpiling of topsoil and other building materials.
- Exhaust smoke from construction vehicles;
- Smoke from burning of waste;
- Smoke from cooking fires.

Nature/Description of the Impact:

- Construction activities of the proposed development will have a negative impact on the current ambient air quality of the area.

Receiving Environment:

- Surrounding landowners and residents.

Significance of the Impact:

The extent of the impact is local during the construction phase. The impact is given a medium intensity rating as the dust and smoke generated will create a temporary nuisance during the construction phase, but normal daily activities within the surrounding communities can continue, albeit in a slightly modified way. The duration would be short term, as the impact should only persist during the construction period. The significance factor attributed to this impact is medium negative and the significance of the impact with effectively practised mitigation is therefore low negative. The medium weighting factor assigned to the potential impact is due to the great nuisance that dust and smoke can cause, if unmitigated, on surrounding communities.

Mitigation Measures:

- Topsoil stripping and vegetation clearing should only take place in areas where construction activities are due to commence. Clearing of the minimum area required at any one time.
- Dust suppression activities should be carried out on all major haul roads on site on a daily basis. Water tankers, or the use of an appropriate dust palliative, can be used for this purpose.
- Vehicular movements on site should be restricted to pre-determined routes over the site;
- Topsoil and building material/rubble stockpiles should be covered with plastic sheeting in excessively windy conditions.
- Contractor's yards, where heavy vehicle traffic can be expected, should be watered down regularly to prevent dust generation. Alternatively a layer of coarse aggregate can be laid in these yards to mitigate the potential impact.
- Exposed soil surfaces (particularly in the open space areas) should be ripped and re-vegetated as soon after the construction activities in those areas has concluded.
- Vehicles must be well serviced so that it does not produce excessive smoke and noise. The exhaust systems of the construction machinery must be maintained properly.
- No solid waste or vegetation may be burnt on the premises or surroundings. Keep waste in adequate waste bins and dispose of regularly and at the correct and licensed site.
- Contractors must preferably use gas stoves to cook - no collection of firewood in the area.

Operational Phase:

Generation of dust that can create atmospheric pollution during the movement of vehicles in the area. Smoke from the development (burning of solid and garden waste and braai's) can cause air pollution.

8.12.2 Impact on the Air Quality due to the Operation of the Township Development – Operational Phase

Rating Criteria	Air Quality Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+3) x 3 = 30	Low Significance (3+4+3) x 2 = 20
Status	Negative	Negative

Source of the Impact:

- Dust will be generated from the following activities during the operational phase:
 - Vehicular movement over bare soil surfaces; and
 - Strong wind over bare soil surfaces;
 - Gardening activities.
- Burning of solid and garden waste.
- Smoke from fire places and braai's.
- Exhaust smoke from vehicles.

Nature/Description of the Impact:

- Operational activities of the proposed development can have a negative impact on the current ambient air quality of the area.

Receiving Environment:

- Surrounding landowners and residents.

Significance of the Impact:

The extent of the impact is regional during the operational phase. The impact is given a medium intensity rating as the dust and smoke generated can create a nuisance during the operational phase. The duration would be long term, as the impact should persist during the operational period. The significance factor attributed to this impact is medium negative and the significance of the impact with effectively practised mitigation is therefore low negative. The medium weighting factor assigned to the potential impact is due to the great nuisance that dust and smoke can cause, if unmitigated, on surrounding communities.

Mitigation Measures:

- Speed limits and speed humps on the roads will keep speeds down. It will result in less dust.
- Vehicles and maintenance equipment must be well serviced so that it does not produce excessive smoke and noise.
- Exposed soil surfaces (particularly in the open space areas) should be ripped and re-vegetated.
- No solid waste or vegetation may be burnt on the premises or surroundings. Keep waste in adequate waste bins and dispose of regularly and at the correct and licensed site.

8.13 ARCHAEOLOGICAL AND PALEONTOLOGICAL IMPACTS

Construction & Operational Phase:

Archaeological Significance:

Dr Loyd Rossouw from the National Museum in Bloemfontein was appointed to conduct the Archaeological and Paleontological Impact Assessment for the proposed site. Phase 1 Archaeological Impact Assessment was carried out as part of a proposed township development. A foot survey of the terrain revealed no indication of historically significant structures, graves or in situ Stone Age archaeological material, capped or distributed as surface scatters on the landscape.

A small blue gum grove, consisting of what appears to be the modern remnants of older copse located near the center of the study area is not considered to be historically significant. It is unlikely that the proposed development will result in any significant archaeological impact at the site. The proposed site is regarded as of low archaeological significance and is assigned the rating of Generally Protected C (GP.C).

Paleontological Significance:

The development footprint is situated within the Beaufort Group (Karoo Supergroup), and is underlain by palaeontologically significant Adelaide Subgroup sedimentary rocks, that have been widely intruded by Jurassic-age dolerites. It is considered unlikely that the proposed development will affect palaeontological heritage resources within the superficial component (Quaternary overburden) due to the disturbed condition of the substrate and the absence of a suitable alluvial context.

The palaeontological significance of the Quaternary overburden within the boundaries of the proposed footprint is therefore considered to be very minor. This component is assigned a field rating of Generally Protected C (GP.C). The dolerite component is not palaeontologically vulnerable and is assigned a field rating of Generally Protected C (GP.C). The proposed footprint is largely located on potentially intact sedimentary bedrock and thermally derived metasediments near dolerite intrusions, but the chances of impact on palaeontological material from fresh sedimentary bedrock strata is considered low because of the low topography terrain and the considerable Quaternary overburden that caps the study area.

However, since fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution), it is advised that if in situ fossil material is exposed as a result of excavations into fresh sedimentary bedrock, SAHRA and a professional palaeontologist are informed immediately. The sedimentary bedrock component is assigned a field rating of Generally Protected B (GP.B) with the recommendation that excavations into fresh sedimentary bedrock that exceeds a depth of >1m is monitored for potential palaeontological heritage during the construction phase of the development.

8.13.1 Impact on the Archaeological and Paleontological Aspects of the Proposed Site – Construction & Operational Phase

Rating Criteria	Archaeological and Paleontological Impacts Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Low Ranking - 2	Low Ranking - 2
Probability	Low Probability Ranking - 2	Low Probability Ranking - 2
Significance	Low Significance $(2+4+2) \times 2 = 16$	Low Significance $(2+4+2) \times 2 = 16$

Status	Negative	Negative

Source of the Impact:

- Loss of Archaeological and Paleontological aspects due to:
 - Earth moving and soil clearance during construction;
 - Excavations for construction activities that include those for trenches, foundations etc.
 - Operational activities of development.

Nature/Description of the Impact:

- The damage/destruction of heritage, archaeological and cultural features.

Receiving Environment:

- Elements of cultural, archaeological or historic significance.

Significance of the Impact:

The extent of the impact is locally. The impact is given a low intensity rating as no heritage, archaeological and cultural aspects were found to occur on the site. The duration would be long term. The significance factor attributed to this impact is low negative and the significance of the impact with effectively practised mitigation is therefore also low negative.

Mitigation Measures:

- Comply at all times to the National Heritage and Resources Act (Act 25 of 1999).
- It is advised that if in situ fossil material is exposed as a result of excavations into fresh sedimentary bedrock, SAHRA and a professional palaeontologist are informed immediately. Excavations into fresh sedimentary bedrock that exceeds a depth of >1m must be monitored for potential palaeontological heritage during the construction phase of the development.
- Care must be taken in the excavations and moving of soil to observe any archaeological feature of importance, which must be left and reported to the archaeological consultant for comments and actions.
- In the event that any human remains are found that these would have to be reported to SAHRA (South African Heritage Resources Agency) as they would be protected under the National Heritage Resources Act (No 25 of 1999).

8.14 SERVICE PROVISION**Construction Phase:**

Clean water as well as sufficient sanitation systems (chemical toilets) must be provided during the construction phase of the project so as to avoid pollution of the surrounding environment.

8.14.1 Soil and Water Pollution due to Insufficient or lack of Adequate Sanitation on Site – Construction Phase

Rating Criteria	Impact on Environment due to lack of Sanitation Services or Maintenance Thereon Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	High Ranking - 4
Probability	Definite	Low Probability

	Ranking - 5	Ranking - 2
Significance	Moderate Significance $(2+2+4) \times 5 = 40$	Low Significance $(2+2+4) \times 2 = 16$
Status	Negative	Negative

Source of the Impact:

- Insufficient number of chemical toilets and number thereof.
- Insufficient maintenance of the chemical toilets.

Nature/Description of the Impact:

- Pollution of soil and water resources if chemical toilets are not available and maintained sufficiently.

Receiving Environment:

- Soil and water resources.

Significance of the Impact:

The extent of the impact is local during the construction phase and is given a high intensity rating. It is likely that the impact may occur over the short term. The significance factor attributed to this impact is medium negative without mitigation (pollution etc. due to lack of adequate services) and significance of the impact with mitigation is therefore low negative (construction personal not using the provided chemical toilets).

Mitigation Measures:

- Recommendations as made in the attached Services and Geotechnical Reports.
- It is recommended that on-site sanitation systems that do not rely on seepage for the disposal of liquid wastes (i.e.: septic tanks that drain into “French Drain”-type soak-aways) be utilized in the proposed development, mainly due to:
 - The impaired functioning thereof due to the inferred low permeability of the clayey soil material covering the area.
 - The difficulty of excavating the soak-aways into the weathered bedrock in localized areas.

In this light it is recommended that use be made of a closed sewerage reticulation system. Septic tanks and subsurface drainage systems which have a tendency to leak are not recommended.
- No on-site sanitation must be allowed closer than 100m from surface (wetlands) or groundwater resources.
- The chemical toilets must be strategically placed within easy access to the construction workers.
- The sewage system (chemical toilets) must be inspected for leakages on a regular basis and any leakages must be attended immediately.
- Sufficient number of chemical toilets must be provided and they must be emptied on a regular basis. Contents must be disposed of at a registered sewerage disposal facility.

Operational Phase:

The increased population will place increased demands on the area’s services and infrastructure. The development will also result in greater demands on key resources such as energy and water supply. Without adequate provision of services and correct provision and management of infrastructure requirements, there would be a decline in the quality of life of current and new residents. There would also be potential impacts on the natural environment e.g. pollution of the water resources, the underlying aquifer and the general surrounding area. These impacts on the natural environment would have socio-economic consequences in the form of increased threats to health and safety and closure of future opportunities to utilise key resources (such as water from

the aquifer). Impacts on the natural environment therefore have the potential to affect the sustainability of the development and the quality of life of residents of the surroundings areas.

8.14.2 Impact on Environment due to lack of Services and Maintenance Thereof – Operational Phase

Rating Criteria	Impact on Environment due to lack of Services and Maintenance Thereof Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	Low Ranking - 2
Probability	Definite Ranking - 5	Low Probability Ranking - 2
Significance	High Significance $(3+4+4) \times 5 = 55$	Low Significance $(3+4+2) \times 2 = 18$
Status	Negative	Negative

Source of the Impact:

- The proposed development and the increased population will place increased demands on the area's services (water, sanitation and electricity). Without a municipal water connection the development will need to make use of groundwater. According to the Services Report a bulk water connection is available with adequate capacity. Without a municipal sewerage connection the development will need to make use of other sanitation system like a package treatment plant. According to the Services Report a connection to bulk municipal sewer connection is available but that the sewer treatment works will not be able to handle ta extra load from the planned development. It is proposed that the proposed development in the interim makes use of an onsite package treatment plant until such time that the sewer treatment works has been upgraded. According to the Electrical Services Report enough electrical capacity is available for this development.

Nature/Description of the Impact:

- Pollution of soil and water resources if service provision is inadequate.
- Impact on existing services like for instance water availability and water pressure.
- Impact on groundwater levels.
- Impact on available electricity supply from Centlec.

Receiving Environment:

- Soil and water resources.
- Surrounding landowners and the impact on their service provision.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a high intensity rating. Both the water and electrical systems were found to have more than enough spare capacity to accommodate the proposed development. According to the Services Report a connection to bulk municipal sewer connection is available but that the sewer treatment works will not be able to handle ta extra load from the planned development. It is proposed that the proposed development in the interim makes use of an onsite package treatment plant until such time that the sewer treatment works has been upgraded. It is likely that an impact may occur over the long term. The significance factor attributed to this impact is high negative without mitigation (pollution etc due to

lack of adequate services) and significance of the impact with mitigation is therefore low negative (possible pollution due to burst pipes or leakages).

Mitigation Measures:

- Recommendations as made in the attached services and Geotechnical Reports.
 - It is recommended that on-site sanitation systems that do not rely on seepage for the disposal of liquid wastes (i.e.: septic tanks that drain into “French Drain”-type soak-aways) be utilized in the proposed development, mainly due to:
 - The impaired functioning thereof due to the inferred low permeability of the clayey soil material covering the area.
 - The difficulty of excavating the soak-aways into the weathered bedrock in localized areas.
- In this light it is recommended that use be made of a closed sewerage reticulation system. Septic tanks and subsurface drainage systems which have a tendency to leak are not recommended.
- According to the Services Report a connection to bulk municipal sewer connection is available but that the sewer treatment works will not be able to handle an extra load from the planned development. It is proposed that the proposed development in the interim makes use of an onsite package treatment plant until such time that the sewer treatment works has been upgraded.
 - Waste is to be stored in access controlled enclosures such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages will have a concrete floor to ensure incidental leachate can be treated and disposed of. It is intended that waste will be sorted at the source and that it will be stored separately in the waste storage facility.
 - The proposed development must connect to municipal water reticulations and also to municipal sewerage reticulation as soon as the sewerage treatment works has been upgraded so as to have enough spare capacity to handle the sewerage generated at the proposed development.
 - No on-site sanitation must be allowed except for a package treatment plant until such time as the sewerage treatment works has been upgraded.
 - Correct timing of the construction, staffing and opening of all services and facilities necessary to support the rapidly expanding population. A services/facilities plan should be developed to determine and set out an appropriate plan of action, ensuring that budgets and construction programmes are appropriately aligned.
 - Appropriate design and construction of development to enable efficient water and energy usage. This will be of benefit to the residents and the City.
 - Design, location, routing and management of storm-water canals in such a way that they do not become a social hazard or dumping ground.
 - Requirement to include features and fittings (specified) that contribute to the sustainability of the development, in tender documents (e.g. use of insulation, low flow water fittings etc).
 - The planning and design of the electrical installations must comply with National Building Regulations in pursuit of energy efficient power consumption. Equipment and material must be selected and the installation designed for optimum energy efficiency. Conserving power will ultimately result in reduced carbon dioxide emissions. Water heating will also have a significant impact on power consumption. Solar water heater or heat pumps can be utilized to reduce power consumption depending on the specific water heating application. LED lighting where appropriate, is proposed for all internal and external applications.
 - It would also be appropriate to ensure that roads are provided with streetlights to reduce chances of pedestrian accidents in particular. Streetlight can also be solar powered.

8.15 TRAFFIC

A traffic impact assessment was compiled by KMA Consulting Engineers as part of the environmental impact assessment of the proposed development.

Construction Phase:**8.15.1 Impact on Traffic due to Construction Activities and Construction Vehicles Accessing/Leaving the Development Site– Construction Phase**

Rating Criteria	Impact on Traffic Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance $(3+2+3) \times 4 = 32$	Low Significance $(3+2+3) \times 2 = 16$
Status	Negative	Negative

Source of the Impact:

- Slow moving construction vehicles to and from the site. The operation of heavy equipment will also contribute to an increase in congestion on the surrounding roads.

Nature/Description of the Impact:

- Traffic disturbance.

Receiving Environment:

- Road users on roads in the surrounding areas.

Significance of the Impact:

The extent of the impact is regional during the construction phase and is given a medium intensity rating. The duration would be short term, as the impact should persist during the construction period. The significance factor attributed to this impact is medium negative and the significance of the impact with effectively practised mitigation is therefore low negative.

Mitigation Measures:

- Development must comply with the recommendations as stipulated in the attached TIS.
- It must be ensured that a backlog of traffic does not develop.
- All traffic management must be done in accordance with the National road Traffic Act No. 93 of 1996.
- Construction vehicles travelling to site must follow predetermined routes and as far as possible not use external roads during peak traffic times.
- Construction vehicular traffic must be limited to a maximum speed limit of 30 km/h inside the proposed development.

Operational Phase:

It is common cause that the traffic impacts of new developments are concentrated on the immediate transportation network with these impacts dissipating further away from the development as more access opportunities become available and traffic disperses onto the broader road network.

The following recommendations were made by the traffic engineer:

- The development is expected to generate 3246 and 2539 peak hour trips as a maximum during the morning and afternoon peak hours.
- Most of the intersections in the study area will have to be upgraded and/or signalise with full development and if the area has low vehicle ownership. Actual trip generation might be lower than assumed, with the result that upgrading of intersections should only be implemented based on updated counts and capacity analyses as the development is implemented.
- Most of the identified improvements can easily be implemented with the exception of the widening of the P22/1 (Govan Mbeki Avenue) from the point where the road becomes a two lane road up to Pellisier Drive, which might require widening of the bridge over the N1.
- The layout plan is in principle acceptable.

According to the TIS the proposed development is not expected to have an adverse impact on the road network within the study area should the recommendation of the TIS be implemented.

8.15.2 Impact on Traffic due to Vehicles Accessing/Leaving the Proposed Development – Operational Phase

Rating Criteria	Impact on Traffic Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+3) x 4 = 40	Low Significance (3+3+3) x 2 = 20
Status	Negative	Negative

Source of the Impact:

- Traffic originating to and from the new development.

Nature/Description of the Impact:

- More traffic on surrounding roads and intersections

Receiving Environment:

- Road users on roads in the surrounding areas.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a medium intensity rating. The duration would be long term, as the impact should persist during the operational period. The significance factor attributed to this impact is medium negative and the significance of the impact with effectively practised mitigation is therefore low negative.

Mitigation Measures:

- Development must comply with the recommendations as stipulated in the attached TIS.
- Most of the intersections in the study area will have to be upgraded and/or signalise with full development and if the area has low vehicle ownership. Actual trip generation might be lower than assumed, with the result that upgrading of intersections should only be implemented based on updated counts and capacity analyses as the development is implemented.

- Most of the identified improvements can easily be implemented with the exception of the widening of the P22/1 (Govan Mbeki Avenue) from the point where the road becomes a two lane road up to Pellisier Drive, which might require widening of the bridge over the N1.
- It must be ensured that a backlog of traffic does not develop.
- All traffic management must be done in accordance with the National road Traffic Act No. 93 of 1996.
- Comply with all the recommendations as set out in the attached traffic impact study.

8.16 PROVISION OF MUCH NEEDED RESIDENTIAL ERVEN.

Operational Phase:

The Mangaung Metro Municipality is in need of residential erven in Bloemfontein, Lourierpark to be able to satisfy the waiting list for erven. According to the SDF and business plan there was a need of erven in Bloemfontein. This proposed layout is situated within the present and future residential areas on the attached SDF Map and therefore in line with the SDF for Mangaung.

8.16.1 Impact on Much Needed Residential Erven in the MMM Area – Operational Phase

Rating Criteria	Impact on Much Needed Residential Erven in the Area Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Very High Ranking - 5	Very High Ranking - 5
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	High Significance (3+4+5) x 5 = 60	High Significance (3+4+5) x 5 = 60
Status	Positive	Positive

Source of the Impact:

- Provision of residential erven that is much needed with the area.

Nature/Description of the Impact:

- Provision of residential erven in the MMM area of jurisdiction is seen as a positive impact. According to the SDF and business plan there was a need of erven in Bloemfontein. This proposed layout is situated within the present and future residential areas on the attached SDF Map and therefore in line with the IDP and SDF for Mangaung.

Receiving Environment:

- Identified land for future residential development in MMM.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a high intensity rating. The duration would be long term. The status of the impact is positive with a significance factor of high and the significance of the impact with mitigation also high.

Mitigation Measures:

- None Required.

8.17 IMPACTS ON ECONOMY & EMPLOYMENT CREATION**Construction Phase:**

Unemployment is a source of concern in the area, as elsewhere in South Africa. The construction phase will bring opportunities for temporary increased work opportunities, a number of which can be taken up by people from the local area (precise number is not predictable at this stage). These employment opportunities may however only be temporary and the number of positions available will relate to the project phase and the specific activities related to each phase. A large segment of the employment opportunities that will be generated will be building and construction worker related job opportunities during the construction phase of the proposed development. A large number will be created within the local and district economies during the construction phase. It is also expected that these building and construction workers will not all be employed on the construction site at any specific time. Once the construction phase is through this impact in the area will end.

These job opportunities are also not all new job opportunities as most of the workers are already employed by contractors, professional and other firms. However, for the duration of the construction phase, these workers will be sustained. The rest of the employment opportunities will be sustained by the multiplier effect of the direct private sector investment.

The construction phase of the development will therefore have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Implications:

- Mangaung's 2011 unemployment figure is estimated at 207 038 (Stats SA 2011). The proposed development will impact positively on this unemployment situation during the construction phase.
- The proposed development will induce a positive annual contribution during the development phase.

8.17.1 Impacts on Economy and Employment Creation – Construction Phase

Rating Criteria	Impacts on Economy and Employment Creation Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Very High Ranking - 5	Very High Ranking - 5
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	Moderate Significance (3+2+5) x 5 = 50	Moderate Significance (3+2+5) x 5 = 50
Status	Positive	Positive

Source of the Impact:

- The construction phase will require contractors, labourers etc. to be appointed.

Nature/Description of the Impact:

- Increased employment rate within MMM as well as training and skill development. Increase in local economy.

Receiving Environment:

- Contractors, professional and other firms as well as the unemployed in the surrounding areas.

Significance of the Impact:

The extent of the impact is regional during the construction phase and is given a very high intensity rating when taking the high unemployment rate of the area into consideration. The duration would be short term, as the impact should persist during the development period. The status of the impact is positive with a significance factor of medium and the significance of the impact with mitigation also medium.

Mitigation Measures:

- This impact would only have a positive medium significance if local workforce is utilised during the construction phases. Therefore, it is recommended that a local workforce be utilised, where practicable.
- Implement a quota system for the contractors, whereby they must employ a certain quota of individuals from the neighbouring community – the quota varying according to skill levels.
- Procurement procedure and contracts with builders should make provision for BEE and preferential procurement.
- Where possible and feasible and without compromising time, cost and quality, the principals of labour based technologies should be applied during the development phase of the proposed development, namely the government's expanded works programme's principals.
- The promotion of local involvement in providing and supplying input during the construction phase.
- Adopt procurement policies to support local suppliers of materials, goods and services.
- Adopt a policy to involve local SMME's.
- Apply BEE guidelines during the development and operational and maintenance stage of the proposed development.
- Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.

Operational Phase:

This phase will sustain an additional large number of new employment opportunities (precise number is not predictable at this stage), of which a large percentage will be created directly within the local and district economies. It is also estimated that a large number will represent semi-and unskilled employees from the local labour force to be used as domestic workers or for maintenance activities. The regional employment demand will be focused towards the supplier industries supporting the operations of this development.

The operational phase of the development will therefore have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Implications:

- Mangaung's 2011 unemployment figure is estimated at 207 038 (Stats SA 2011). The proposed development will impact positively on this unemployment situation during the construction phase.
- The proposed development will induce a positive annual contribution during the development phase.

8.17.2 Impacts on Economy and Employment Creation – Operational Phase

Rating Criteria	Impacts on Economy and Employment Creation Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Very High Ranking - 5	Very High Ranking - 5
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	High Significance (3+4+5) x 5 = 60	High Significance (3+4+5) x 5 = 60
Status	Positive	Positive

Source of the Impact:

- Workers needed for maintenance activities, domestic workers etc. during the operational phase of the planned development.

Nature/Description of the Impact:

- Increased employment rate within MMM as well as training and skill development. Increase in local economy.

Receiving Environment:

- Local and surrounding residents.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a very high intensity rating when taking the high unemployment rate of the area into consideration. The duration would be long term, as the impact should persist during the operational period of the development. The status of the impact is positive with a significance factor of High and the significance of the impact with mitigation also High.

Mitigation Measures:

- This impact would only have a positive high significance if local workforce is utilised during the operational and maintenance phases. It is therefore recommended that a local workforce be utilised, where practicable.
- Domestic workers must be sourced from established communities in the city and or residential communities and neighbouring people therefore eliminating the need for daily worker accommodation on site.
- Apply BEE guidelines during the operational and maintenance phases of the proposed development.

8.18 INCREASE LABOUR FORCE MIGRATION INTO PROPOSED AREA AND SURROUNDINGS**Construction Phase:**

The construction phase is typically associated with a variety of nuisance and social impacts. These include noise, vibration and dust associated with site clearing and building and increased concerns about personal safety due to the presence of construction workers in the area.

Families and individuals alongside the construction area are likely to experience some level of discomfort and nuisance during the construction phase, particularly during site clearing and during periods of high wind when sand may be blown around. The presence of strangers (in the form of construction workers) may make residents feel less safe. The impacts are of a temporary short term nature and there are means to prevent or mitigate them.

During the operational phase of the development the labour force will be made up of domestic workers, live-in staff as well as gardeners/maintenance workers etc.

8.18.1 Increased Labour Force Migration into Proposed Area and Surroundings – Construction & Operational Phase

Rating Criteria	Increased Labour Force Migration Into Proposed Area and Surroundings Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 4 = 36	Low Significance (2+4+3) x 2 = 18
Status	Negative	Negative

Source of the Impact:

- The presence of construction workers in the area.
- Nuisance from construction activities.

Nature/Description of the Impact:

- Impacts of the construction phase and increase labour force migration into proposed area and surroundings. Families and individuals alongside the construction area are likely to experience some level of discomfort and nuisance during the construction phase. The presence of strangers (in the form of construction workers) may make residents feel less safe.

Receiving Environment:

- Residents of surrounding areas.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a medium intensity rating. The duration would be short term during the construction activities. The status of the impact is negative with a significance factor of medium and the significance of the impact with mitigation low.

Mitigation Measures:

- Compilation and enforcement of a Construction Environmental Management Plan in which all preventative and mitigatory actions are clearly set out.
- Establishment of a communications forum or committee to facilitate information sharing on the construction and overall development process with the locally affected communities.
- Implementation of construction controls, including:
 - Clearing of the minimum area required at any one time.

- Use of mulch or other suitable stabilisation mechanisms to reduce windblown sand, both during construction and at the end of construction until the houses are occupied.
- Clear demarcation of construction areas and restriction of construction staff to these areas.
- Construction staff must wear an identifying logo.
- Set up of construction camps in areas acceptable to the most locally affected community(ies).
- Use of fencing where necessary for both security and environmental reasons.
- Restriction of construction activities to agreed working times.

8.19 IMPACT ON SURROUNDING PROPERTY VALUES

Construction Phase:

Property values are affected by a wide variety of criteria. These include the general condition of the property and its surroundings (maintenance, cleanliness etc.), its location in relation to services and amenities, and, to some extent, perceptions about the social standing and acceptability of people who live in the area.

A low negative impact might be possible during the construction phase of the project due to negative impacts on the character of the area.

8.19.1 Impacts on Surrounding Property Values – Construction Phase

Rating Criteria	Impacts on Surrounding Property Values Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Medium Ranking - 3	Medium Ranking - 3
Probability	Medium Probability Ranking - 3	Low Probability Ranking - 2
Significance	Low Significance $(2+2+3) \times 3 = 21$	Low Significance $(2+2+3) \times 2 = 14$
Status	Negative	Negative

Source of the Impact:

- Construction activities of the proposed development.

Nature/Description of the Impact:

- Impacts on property values in surrounding areas.

Receiving Environment:

- Surrounding properties and their owners.

Significance of the Impact:

The extent of the impact is locally during the construction and is given a medium intensity rating. The duration would be short term during the construction phase. The status of the impact during the construction phase is negative with a significance factor of low and the significance of the impact with mitigation also low.

Operational Phase:

A positive impact can be expected on the property values of the surrounding areas during the operational phase as the proposed development might provide an opportunity for other development opportunities in the surrounding areas.

8.19.2 Impacts on Surrounding Property Values – Operational Phase

Rating Criteria	Impacts on Surrounding Property Values Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Low Ranking - 2	Medium Ranking - 3
Probability	Medium Probability Ranking - 3	Medium Probability Ranking - 3
Significance	Low Significance (2+4+2) x 3 = 24	Moderate Significance (2+4+3) x 3 = 27
Status	Positive	Positive

Source of the Impact:

- Proposed new Lourierpark Development.

Nature/Description of the Impact:

- A positive impact can be expected on the property values of the surrounding areas during the operational phase as the proposed development might provide an opportunity for other development opportunities in the surrounding areas.

Receiving Environment:

- Surrounding properties and their owners.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a medium intensity rating with mitigation. The duration would be long term during the operational phase. The status of the impact during the operational phase is positive with a significance factor of low and the significance of the impact with mitigation moderate.

Mitigation Measures:

- Ensure timeous and parallel development of services and amenities with housing in particular.
- Encourage local communities and NGOs to build supportive structures and become involved in integrating the new residents into the life and economy of the surrounding area.
- Maximise efforts to retain the aesthetic quality of the area through appropriate management actions, building a sense of pride in the local community.
- Ensure on-going waste removal services and maintenance of development.
- Management of the open space areas. These areas have potential to be major assets but without management and maintenance could become a social liability.

8.20 VALUE ADDED TO LOCAL ECONOMY OF MMM

The development creates opportunities for the local economy, especially during the construction phase of the development. The capital investment into the development of the proposed development will result in the local economy being significantly stimulated. Building materials (during the construction phase) as well as goods and services needed for the operational phase will be bought from businesses and industries in the area, which will result in the overall production of these businesses increasing. As a result of the need to increase production, more people will need to be hired, which will result in increased household incomes. As a result of increased household incomes, the potential buying power of the local area increases, with results in further business sales in the area. These multiplier effects therefore cause the local economy to grow even further. The proposed development will therefore contribute to sustainable economic growth in the study area.

Construction Phase:

The proposed development will add to the GGP of the area during the Construction Phase. Of this it is estimated that a large portion will impact directly on the local and district economies. This implies that the economy of the study area will experience a relative large injection of capital over a short period of time. This injection will benefit a wide range of businesses in the area.

8.20.1 Impact on the Economy of MMM – Construction Phase

Rating Criteria	Impact on the Economy of MMM Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	National Ranking - 4	National Ranking - 4
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	Very High Ranking - 5	Very High Ranking - 5
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	High Significance (4+2+5) x 5 = 55	High Significance (4+2+5) x 5 = 55
Status	Positive	Positive

Source of the Impact:

- Construction of the proposed development.

Nature/Description of the Impact:

- The proposed development will add to the GGP of the area during the Construction Phase. Of this it is estimated that a large portion will impact directly on the local and district economies. This implies that the economy of the study area will experience a relative large injection of capital over a short period of time. This injection will benefit a wide range of businesses in the area.

Receiving Environment:

- MMM Economy as well as a wide range of businesses in the area.

Significance of the Impact:

A large portion will impact directly on the local and district economies. Value added to South Africa's economy is therefore given a very high intensity rating. The status of the impact is therefore high positive.

Mitigation Measures:

- None Required.

Operational Phase:

The operational and maintenance phase will generate a large sustainable contribution per annum (rates and taxes etc.). A very large portion will directly impact on the local MMM economy.

8.20.2 Impact on the Economy of MMM – Operational Phase

Rating Criteria	Impact on the Economy of MMM Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	High Ranking - 4
Probability	Definite Ranking - 5	Definite Ranking - 5
Significance	High Significance (3+4+4) x 5 = 55	High Significance (3+4+4) x 5 = 55
Status	Positive	Positive

Source of the Impact:

- Operation of new Lourierpark Development.

Nature/Description of the Impact:

- The operational and maintenance phase will generate a large sustainable contribution per annum (rates and taxes etc.). A very large portion will directly impact on the local MMM economy. Local businesses will also benefit as the development will need continues supply of maintenance products as well as food etc. for the large community that will be staying in the development.

Receiving Environment:

- MMM Economy as well as a wide range of businesses in the area.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a high intensity rating. The duration would be long term. The status of the impact is positive with a significance factor of high.

Mitigation Measures:

- Non Required

8.21 IMPACTS ON SOCIAL STRUCTURE, DYNAMICS AND RELATIONS

Operational Phase:

Positive effects relate to the presence of a larger population giving the area greater social weight and less isolation, with greater opportunities for social and economic development.

8.21.1 Impacts on Social Structure, Dynamics and Relations – Operational Phase

Rating Criteria	Impacts on Social Structure, Dynamics and Relations Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	High Ranking - 4
Probability	Highly Probable Ranking - 4	Highly Probable Ranking - 4
Significance	Moderate Significance (2+4+4) x 4 = 40	Moderate Significance (2+4+4) x 4 = 40
Status	Positive	Positive

Source of the Impact:

- During the operational phase of the township development may additional people will be either residing or working in the area.

Nature/Description of the Impact:

- The development will result in many new people coming into the area, resulting in changes in the population size, structure, interactions and dynamics. This will provide greater opportunities for social and economic development of the area and surroundings.

Receiving Environment:

- Surrounding areas.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a high intensity rating as it will help to give effect to MMM's IDP and SDF. The duration would be long term. The impacts of the proposed development on social, structure, dynamics and relations are medium positive.

Mitigation Measures:

- Involving the existing communities in the development process by keeping them informed of developments and ensuring that they are given as many opportunities as are possible in terms of work opportunities. A social facilitator/worker should be appointed for this task. It is standard practice to employ a community liaison officer to facilitate community information and consultation. This community liaison officer should also identify and work with NGO's working in the area which could possibly assist with the community development and integration process.

8.22 CRIME, SAFETY, SECURITY AND FIRE HAZARD

Construction Phase:

Currently, crime is a major socio-economic problem in South Africa. Typically an increase in the density of people in the area results in an increase in the probability of crimes, including both petty and serious crimes. The construction activities would result in an increase in the movement of people in the area and this would be an ideal situation for an increase in criminal activity. In

addition, the construction activities could injure staff or the public. On-site construction activities and the movement of vehicles to and from the site could pose a safety threat to construction workers.

Where heavy equipment is used, dangerous situations are created and the risk of injury increases. Activities like excavating trenches, the movement of delivery and construction vehicles, the use of equipment and the congregation of workers and staff on site further increase the risk of injury. The contractor will need to arrange for the safety of his staff and equipment while working on the project. The activities of construction personnel on site may also contribute to an increase in the risk for fires.

8.22.1 Crime, Safety, Security and Fire Hazard – Construction Phase

Rating Criteria	Crime, Safety, Security and Fire Hazard Construction Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Short Term Ranking - 2	Short Term Ranking - 2
Magnitude/Intensity	High Ranking - 4	High Ranking - 4
Probability	High Probability Ranking - 4	Low Probability Ranking - 2
Significance	Moderate Significance (2+2+4) x 4 = 32	Low Significance (2+2+4) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Construction activities – excavation of trenches etc;
- Security;
- Fire Hazards;
- Presence of strangers.

Nature/Description of the Impact:

- Increased risk of safety of people.
- Elevated crime levels.

Receiving Environment:

- Construction workers, physical environment and existing residents and their properties in surrounding areas.

Significance of the Impact:

The extent of the impact is locally during the construction phase and is given a high intensity rating. The duration would be short term. The status of the impact is negative with a significance factor of medium and the significance of the impact with mitigation low.

Mitigation Measures:

- The Contractor shall conform to all the stipulations of the Occupational Health and Safety act (Act 85 of 1993) and the Regulations applicable at the time of the tender. The Act requires the designation of a Health and Safety representative when more than 20 employees are employed.
- Proper access control (I.D. cards) should be enforced to ensure that no unauthorised persons enter the site.
- No solid waste or vegetation may be burnt on the premises or surrounding areas.

- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to prepare and maintain firebreaks).
- The associated risk of increased crime due to work staff being located on site would be reduced if the number of staff is limited. Development should therefore be phased.
- Ensure that the handling of equipment and materials is supervised and adequately instructed.
- Adequately barricade any exposed excavations or erect warning signs to notify the public of the inherent dangers.
- The contractor will have to provide his own security arrangements while on site.
- Ensure that construction vehicles are under the control of competent personnel.
- Provide adequate facilities on site to treat emergencies to staff.
- No fires will be allowed on site and fire fighting equipment must be available on site.
- Limit access to the construction crew camp only to the workforce.
- Do not allow for the congregation of informal workers in front of the entrance/exist road.
- Vehicles used for construction are to be in good working condition, and not the source of excessive fumes.
- Vehicular traffic during construction activities must be limited to a maximum speed limit of 30 km/h
- All materials, e.g. sand must be covered during transport to and from the site.
- In case where blasting is required, an authorisation must be obtained from DME. Full precautions should be taken to avoid missile damage to surrounding buildings and/or infrastructure should blasting be required.

Operational Phase:

Fires pose a significant risk during the operation of the development. The security measures (fences and guards) will improve safety in the area.

8.22.2 Crime, Safety, Security and Fire Hazard – Operational Phase

Rating Criteria	Crime, Safety, Security and Fire Hazard Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Moderate Ranking - 3
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (2+4+3) x 3 = 27	Low Significance (2+4+3) x 2 = 18
Status	Negative	Negative

Source of the Impact:

- Operation of the township development.

Nature/Description of the Impact:

- Increased risk of safety of people.
- Elevated crime levels.

Receiving Environment:

- Existing residents and their properties in surrounding areas.

Significance of the Impact:

The extent of the impact is locally during the operational phase and is given a medium intensity rating. The duration would be long term. The status of the impact is negative with a significance factor of medium and the significance of the impact with mitigation low.

Mitigation Measures:

- Effective policing of the proposed development and surrounding areas.
- Implementation of neighbourhood watch.

8.23 CUMULATIVE IMPACTS

Cumulative impacts are those impacts that are created as a result of the combination of the impacts of the proposed project, with impacts of other projects or operations, to cause related impacts. These impacts occur when the incremental impact of the project, combined with the effects of other past, present and reasonably foreseeable future projects, are cumulatively considerable. The assessment of cumulative impacts on a site-specific basis is however complex – especially if many of the impacts occur on a much wider scale than the site being assessed and evaluated. The following cumulative impacts have been identified in terms of the proposed development.

The following cumulative impacts have been identified in terms of the proposed development.

- Increase In flood Events
- Surface and Groundwater Pollution

Due to the increased amounts of surface water runoff from hard surfaces within the development this may increase the chance of flash floods. With a single rainfall event, many litres of water are released. These waters are usually absorbed by grasslands and other vegetation, but the increase in hard surface area contributes to runoff resulting in a cumulative amount of water that may cause flooding within the river system.

Any construction activities within the 1:100 year flood lines of the non-perennial streams cutting across the site may have to be licensed according to the National Water Act (Act 36 of 1998). The 1:100 year flood line is however situated very far from the development site.

8.23.1 Increase in Flood Events due to Increased Storm Water Runoff– Construction & Operational Phase

Rating Criteria	Increase in Flood Events Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Local Ranking - 2	Local Ranking - 2
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Low Ranking - 2	Low Ranking - 2
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Low Significance (2+4+2) x 3 = 24	Low Significance (2+4+2) x 2 = 16
Status	Negative	Negative

Source of the Impact:

- Areas cleared of vegetation as well as hard paved areas.

Nature/Description of the Impact:

- Increased storm water runoff.

Receiving Environment:

- Surrounding areas.

Significance of the Impact:

The extent of the impact is locally during both the construction and operational phase and is given a low intensity rating. The duration would be long term. The status of the impact is negative with a significance factor of low and the significance of the impact with mitigation low.

Mitigation Measures:

- Provide permeable surfaces and address increased runoff volumes at source.
- Attenuate flows within the drainage system to reduce runoff velocity.
- No chemicals should be applied to buffer zones and grass should be allowed to lengthen and thicken naturally to facilitate reduction in runoff velocity and volume, increase sediment deposition within the buffer zone and increase infiltration of storm water.
- Incorporate energy dissipaters, buffered storm water outlets, etc. were required into the final design of the development.

8.23.2 Impact on Groundwater Levels due to Usage of Groundwater in the Proposed Development and During Construction – Operational Phase

Rating Criteria	Impact on Groundwater Levels due to Usage of Groundwater in the Proposed Development Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	Moderate Ranking - 3	Moderate Ranking - 3
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance (3+4+3) x 3 = 30	Low Significance (3+4+3) x 2 = 20
Status	Negative	Negative

Source of the Impact:

- The development might make use of groundwater for the irrigation of the sports fields and gardens. All domestic supply will be from municipal water resources.

Nature/Description of the Impact:

- Possibility of impact on groundwater levels of the surrounding areas if too much water is subtracted especially during drought periods.

Receiving Environment:

- Groundwater resources of the surrounding areas.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a moderate intensity rating. The duration would be long term. The status of the impact is negative with a significance factor of moderate and the significance of the impact with mitigation low.

Mitigation Measures:

- The proposed development must make use of municipal water as the domestic water supply.
- Application for a water use licence should groundwater be used for the irrigation of sports fields and gardens where required.

8.23.3 Downstream Surface and Groundwater Pollution due to Polluted Storm Water Runoff from the Development – Construction and Operational Phase

Rating Criteria	Downstream Surface and Groundwater Pollution due to Polluted Storm Water Runoff from the Development Construction & Operational Phase	
	Without Mitigation Measures	With Mitigation Measures
Extent	Regional Ranking - 3	Regional Ranking - 3
Duration	Long Term Ranking - 4	Long Term Ranking - 4
Magnitude/Intensity	High Ranking - 4	High Ranking - 4
Probability	Moderate Probability Ranking - 3	Low Probability Ranking - 2
Significance	Moderate Significance $(3+4+4) \times 3 = 33$	Low Significance $(3+4+4) \times 2 = 22$
Status	Negative	Negative

Source of the Impact:

- Petrochemical spills, cement, pesticides, fertilizers etc.

Nature/Description of the Impact:

- Storm water runoff during heavy rainfall events will carry these pollutants to downstream water resources thereby polluting it. It can lead to eutrophication of these water bodies that in turn will have a negative impact on fish etc living in these water resources due to less oxygen in the water. Therefore also impacting on the biodiversity of these water ecosystems.
- Polluted groundwater will be a huge problem as many of the smallholdings and farms makes use of groundwater resources as potable water supply for both human and animal use.

Receiving Environment:

- Surface and groundwater resources of the surrounding areas.

Significance of the Impact:

The extent of the impact is regional during the operational phase and is given a moderate intensity rating. The duration would be long term. The status of the impact is negative with a significance factor of moderate and the significance of the impact with mitigation low.

Mitigation Measures:

- The proposed development must make use of municipal water as the domestic water supply.

- Application for a water use licence should groundwater be used for the irrigation of sports fields and gardens where required.
- The use of pesticides should not be allowed.
- Fertilizers should be used with caution.
- Sanitation systems should be maintained and inspected regularly so as to prevent any blockages and sewerage spills.

8.24 ENVIRONMENTAL IMPACT STATEMENT

The environmental impact statement in table 12 below clearly shows that the proposed development will not have any major negative impacts on the receiving environment. All impacts can be mitigated to acceptable levels. The development will however have a few major positive impacts on the socio and economic environments of the larger MMM area.

Table 12: Summary of the Significance of Identified Impacts before and after Mitigation during both the Construction and Operational Phases of the Proposed Development.

Environmental Impact	Significance Without Mitigation	Significance With Mitigation
CONSTRUCTION PHASE		
Impact of Foundation Stability.	Medium -	Low -
Impacts as a Result of Soil Erosion and Pollution.	Medium -	Low -
Agricultural Potential.	Low -	Low -
Removal/Management of Exotic and Invader Species Occurring on the Proposed Site.	High -	High +
Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes.	Medium -	Low -
Loss of Indigenous Plant Cover Through Clearing for Construction Phase.	Medium -	Low -
Trampling and Disturbance of Indigenous Vegetation.	Medium -	Low -
Disturbance or Destruction of Protected Plant Species on the Site.	Medium -	Low -
Increased Habitat Fragmentation Due to Vegetation Disturbance and Destruction on Site.	Medium -	Low -
Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to Soil Structure.	Medium -	Low +
Increased Risk of Soil Erosion Due to Vegetation Disturbance Associated with Construction Activities.	Medium -	Low -
Destruction of Indigenous Plants by Collection for Ethnobotanical Use.	Low -	Low -
Loss of Fauna Due to the Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes.	Medium -	Low -
Loss of Fauna Due to an Increase in Habitat Fragmentation Resulting from Vegetation Loss and Disturbance on Site.	Medium -	Low -
Increased Faunal Disturbance and Mortality Due to Increased Vehicle Traffic.	Low -	Low -
Illegal Hunting or Collecting (Trapping, Poisoning or Snaring) of Fauna.	Medium -	Low -
Impact on Invertebrates, Reptiles and Amphibians.	Low -	Low -
Impact on Aquatic Ecology.	Medium -	Low -

Environmental Impact	Significance Without Mitigation	Significance With Mitigation
Impact on Water Resources due to the Usage thereof.	Medium -	Low -
Surface and Groundwater Contamination.	Medium -	Low -
Visual Impact due to Construction Activities.	Medium -	Low -
Noise Impacts due to Construction Activities.	Medium -	Low -
Air Quality Impacts due to Construction Activities.	Medium -	Low -
Impact on Archaeological and Paleontological Aspects.	Low -	Low -
Soil and Water Pollution due to Insufficient or Lack of Adequate Sanitation on Site.	Medium -	Low -
Impacts on Traffic due to Construction Activities and Construction Vehicles Accessing/Leaving the Development Site.	Medium -	Low -
Impacts on Economy and Employment Creation.	Medium +	Medium +
Increased Labour Force Migration Into Proposed Area and Surroundings.	Medium -	Low -
Impacts on Surrounding Property Values.	Low -	Low -
Impact on the Economy of MMM.	High +	High +
Crime, Safety, Security and Fire Hazard.	Medium -	Low -
Increase in Flood Events.	Low -	Low -
Impact on Groundwater Levels due to the Usage of Groundwater for Construction Activities.	Medium -	Low -
Downstream Surface and Groundwater pollution due to Polluted Storm Water Runoff from the Construction Site.	Medium -	Low -
OPERATIONAL PHASE		
Foundation Stability.	Medium -	Low -
Impacts as a Result of Soil Erosion and Pollution.	Medium -	Low -
Agricultural Potential.	Low -	Low -
Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes.	Medium -	Low -
Pedestrian and Vehicle Traffic will Disturb Vegetation, Create Tracks and Pathways on the Site and Increase Erosion Risk.	Medium -	Low -
Loss of Fauna Due to an Increase in Habitat Fragmentation Resulting from Vegetation Disturbance and Destruction of Site.	Medium -	Low -
Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Damage to Soil Structure.	Medium -	Low -
Destruction of Indigenous Plants by Collection for Ethnobotanical Use.	Medium -	Low -
Increased Invasion by Exotic Plant Species Following Vegetation Disturbance and Introduction of Exotic Species for Ornamental and Utilitarian Purposes will Destroy Suitable Habitat for Indigenous Fauna.	Medium -	Low -
Uncontrolled Fires on the Property will Result in Destruction of Indigenous Vegetation and Degradation of Suitable Faunal Habitat.	Medium -	Low -
Destruction of Animal Populations by Illegal	Medium -	Low -

Environmental Impact	Significance Without Mitigation	Significance With Mitigation
Hunting or Poisoning.		
Impact on Invertebrates, Reptiles and Amphibians.	Low -	Low -
Impact on Aquatic Ecology.	Medium -	Low -
Impact on Water Resources due to Usage thereof.	Medium -	Low -
Surface and Groundwater Contamination.	Medium -	Low -
Visual Impact due to the Presence and Operation of the Development.	Medium -	Low -
Noise Impact.	Medium -	Low -
Impact on Air Quality due to the Operation of the Township Development.	Medium -	Low -
Impact on Archaeological and Paleontological Aspects.	Low -	Low -
Impact on Environment due to lack of Services and Adequate Maintenance Thereof.	High -	Low -
Impacts on Traffic.	Medium -	Low -
Provision of Much Needed Residential Erven in the Area.	High +	High +
Impacts on Economy and Employment Creation.	High +	High +
Increased Labour Force Migration Into Proposed Area and Surroundings.	Medium -	Low -
Impacts on Surrounding Property Values.	Low +	Medium +
Impact on the Economy of MMM.	High +	High +
Impacts on Social Structure, Dynamics and Relations.	Medium +	Medium +
Crime, Safety, Security and Fire Hazard.	Medium -	Low -
Increase in Flood Events.	Low -	Low -
Impact on Groundwater Levels due to the Usage of Groundwater in the Development.	Medium -	Low -
Downstream Surface and Groundwater pollution due to Polluted Storm Water Runoff from the New Lourierpark Development.	Medium -	Low -

SECTION 9: PROPOSED MANAGEMENT OF IMPACTS AND MITIGATION.

Identified impacts and mitigation measure as identified in Section 8 in this EIR above as well as in the EMP attached must be monitored and/or audited. This includes the following:

9.1 ENVIRONMENTAL MANAGEMENT PLAN

The developer and the contractors must sign that they have read and understand the attached environmental management plan. An induction course of environmental awareness must be conducted for the contractor before commencement of the activity to ensure that they are fully aware of the EMP and their responsibilities. Training of staff working on the construction site with respect to environmental awareness and the EMP is essential and the responsibility of the developer and the contractor before construction commences.

See the EMP attached in Annexure G.

9.2 ENVIRONMENTAL CONTROL OFFICER

An independent environmental control officer (ECO) must be appointed. The ECO is responsible for the implementation of the EMP during the construction phase. The ECO's responsibilities must include the following:

9.2.1 Compliance Monitoring

Environmental monitoring of the construction of the proposed development must be undertaken by the ECO on a weekly basis during the first month where after monthly audits will be conducted by the ECO. A post construction audit must also be completed. These audits can be conducted randomly and do not require prior arrangement with the project manager. The ECO must be responsible for the compliance monitoring on the site, specifically:

- Undertaking routine monitoring and appointing a competent person/institution to be responsible for specialist monitoring, if necessary.
- Ensuring compliance with the EMP, Environmental Authorisation, Specialist Reports and any other conditions which may be imposed from time to time.
- Compilation of an Audit Report with a rating of compliance with the emp. this report will be submitted to DESTEA.
- Reporting on any transgressions by the contractor.
- Completing start-up, weekly, monthly and site closure checklists.
- Monitoring and verifying that environmental impacts are kept to a minimum.
- Monitoring the undertaking by the contractor of environmental awareness training for all new personnel coming onto site.
- Monitoring the removal of person(s) and/or equipment not complying with the specifications.
- Ensuring that activities on site comply with legislation of relevance to the environment.
- Check that the environmental daily checklists are filled out on a daily basis.
- Ensure that the incident and environmental log are up to date and all incidences have been dealt with correctly and timeously.
- Ensure that the environmental complaints register is up to date and all complaints have been dealt with correctly and timeously.
- Undertaking a continual internal review of the EMP and submitting a report to the developer and DESTEA environmental official at the end of the project.

9.2.2 EMP Monitoring

The main objective of the EMP is to ensure that the activities carried out during the various phases of the development have a minimal negative effect on the natural environment. It is therefore important to ensure that the EMP is reaching that objective. This can be done through various monitoring programs designed for such a purpose. The ECO is responsible for these monitoring programmes:

- The EMP must be continually monitored to determine its effectiveness and efficiency.
- Records of all activities discussed in the EMP should be kept. These records should include any exceptions that may have been made (under permission of the eco and appropriate authorities), problems that were experienced, methods used to rectify problems as well as the final outcome. This information can then be used to determine flaws in the emp. these flaws would be guidelines or recommendations that are ineffective and inefficient. They would then need to be removed or changed/adapted until they are effective and efficient.
- Records of non-compliance must be kept. these records must include details of the offence, offender and penalty
- All aspects of the EMP need to be monitored/audited to ensure compliance and in order to remedy any problems with either the implementation or interpretation of the EMP. These audits will assist in streamlining methods to avoid future conflict situations.

9.2.3 Construction Planning

The ECO will be responsible for:

- Ensuring that Method Statements are submitted for the activities occurring on the site.
- Informing the contractors of any decisions that are taken concerning the natural and social environment during the construction phase of the development.
- Informing the contractors of the necessary corrective actions to be taken against employees transgressing the management activities stipulated in this EMP.
- Liaison with contractors regarding environmental management.
- Assisting the contractor in finding environmentally responsible solutions to problems.

9.2.4 Method Statements

Method Statements are to be completed by the person undertaking the work, the contractor. The ECO will use the Method Statement to audit compliance by the contractor with the requirements of the approved Method Statement.

9.2.5 Site Handover

The ECO will attend the site handover meeting, where the EMP will form part of the agenda. Key environmental matters discussed at this meeting will be minuted and submitted as part of the environmental reporting. The construction site layout plan is a key component of site handover and must be finalized before site handover can be completed. The approved plan must be attached to the site handover meeting minutes. Amendments to this plan must be discussed and approved at subsequent site meetings.

9.2.6 Site Inspections and Meetings

The ECO will conduct regular compliance inspections and must attend key site meetings. The EMP will be an agenda item of the monthly site meetings, and the responsible DESTEA environmental official may attend these meetings in order to provide input with respect to compliance with the emp. the eco is responsible for:

- Giving a report back on the environmental issues at the monthly site meetings and other meetings that may be called regarding environmental matters.
- Visiting the site on a regular basis to determine whether compliance with the terms and conditions of the environmental authorisation and the EMP are being maintained.
- Inspecting the site and surrounding areas regularly with regard to compliance with the EMP and will record the findings of the site inspection in a site inspection checklist, which will serve as the Environmental Compliance Report.
- If any environmental matters occur at or in between the site meetings they must be reflected in written correspondence (email/fax/letter) directed or copied to the ECO. A copy of this correspondence must be placed in the environmental management files. Should it be deemed necessary the ECO must conduct a site visit and the matter must be recorded in the next inspection checklist.

9.2.7 Substantial Completion

The ECO must attend the substantial completion inspections.

9.2.8 Final Completion and Environmental Performance Certificate

Once the environmental items on the problem list have been addressed to the satisfaction of the ECO, the ECO will provide written signoff confirming that the environmental specifications applicable to the contractor(s) have been met. This will be submitted to the project manager prior to the final certificate of completion being issued.

SECTION 10: CONCLUSIONS AND RECOMMENDATIONS

Our recommendation, based on the assessment of the available information, is that application for the Proposed Lourierpark Development should be authorised provided that sensitive planning, design and good environmental management be carried out by the proponent during all phases of development. A variety of mitigation measures have been identified that will serve to mitigate the scale, intensity, duration or significance of the impacts identified. These include guidelines to be applied during the planning and design, construction and operational phases of the project.

Specialist studies assisted with the development assessment by helping to understand the system processes and the potential impacts of the proposed development on both the social and biophysical environments. The following specialist studies were undertaken as part of this environmental impact assessment:

8. Geological and Geo-technical Investigations;
9. Civil Services Reports;
10. Electrical Report;
11. Archaeological and Paleontological Impact Assessments;
12. Traffic Impact Assessment;
13. Ecological and Wetland Report;
14. Flood Line Report.

Anticipated environmental impacts, together with potential cumulative impacts were assessed during this impact assessment phase of the project in order to predict the nature and characteristics of the impacts and establish appropriate mitigation measures to reduce the identified impacts as far as possible.

The environmental impact statement clearly shows that the proposed development will not have any major negative impacts on the receiving environment. It's submitted that the proposed mitigatory measures, if implemented, will reduce the significance of the identified negative impacts to "low", and that the proposed project should proceed. The development will however have positive impacts on the socio and economic environments of the larger MMM area. They include:

- During Construction Phase:
 - Impact on Economy and Employment Creation (Moderate +);
 - Impact on the Economy of MMM (High +);
 - Removal/Management of Exotic and Invader Species Occurring on the Proposed Site (High +) - Declared weeds and invaders of Category 1 of the Alien and Invasive Species Regulations, 2014 are prohibited and must be controlled. These weeds and invaders will be eradicated during the construction phase and managed throughout the operational phase preventing further spread.

The only environmental impacts that will have a high negative impact (without mitigation measures) on the environment during the construction phase include:

- Exotic and Invader Species currently occurring on the site (High –).
- During Operational Phase:
 - Provision of Much Needed Residential Erven in the Area (High +);
 - Impact on Surrounding Property Values (Low + without and Moderate + with mitigation);
 - Impact on Economy and Employment Creation (High +);
 - Impact on the Economy of MMM (High +);
 - Impact on Social Structure, Dynamics and Relations (Moderate +).

The only environmental impacts that will have a high negative impact (without mitigation measures) on the environment during the operational phase include:

- Impact on the Environment Due to a Lack of Adequate Services and Maintenance to these Services (High – without mitigation and Low - with mitigation).

In the light of the findings in this EIR and attached Specialist Reports it is therefore our submission that a sustainable environment can be created containing indirect benefits to the larger MMM area that outweighs the potential limited and short-lived environmental disruption during construction. The development is financially feasible, physically possible and legally permissible – and therefore passes the three tests to determine implementation possibility, development, maintenance potential and sustainability.

The following should be included within the environmental authorization if issued by DESTEA:

- All recommendations and requirements made in this EIR and the above mentioned specialist studies must be adhered to at all times.
- Environmental Authorization will be required for the package treatment facility (Might be required until such time that the sewerage treatment works has been upgraded) for the proposed development. It does not form part of this study.
- The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998). This licence must be obtained from DWS before construction may commence.
- An ECO must be appointed on a full time basis to monitor the requirements of the EIR and EMP.
- The monthly Environmental Audit Reports for the construction of the development must be submitted to DESTEA. A Post Construction audit must also be completed directly after construction is completed.
- The EMP must include litter management along the boundary fences and access roads. Refuse collection should take place on a regular basis. A litter patrol around the construction area is to take place twice a week to collect any litter that may have been strewn around.
- At least one groundwater monitoring borehole must be established down gradient of the proposed site. The groundwater monitoring should include:
 - At least one groundwater sample before construction commences;
 - Quarterly groundwater sampling during construction;
 - Groundwater sampling on a quarterly basis for up to 1 year after construction.
- Waste is to be stored in access controlled enclosures during construction such as a cage to avoid vermin feeding off the disposed waste and to avoid incidentals such as waste being blown around by wind. The cages can be enclosed by screen walls to enhance the aesthetical appearance of the waste storage facility. The cages must have a concrete floor.
- Waste must be sorted and recycled (glass, plastic, metal, paper and wet waste). No waste may be buried on site.
- In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water Affairs must be informed immediately.
- No groundwater should be used for domestic use. Approval from DWS will be required if the proposed development will be making use of groundwater for other purposes like irrigation etc.
- Wetland areas occur on the proposed site. A 50m buffer area is demarcated around these areas. No disturbance or development that includes buildings, infrastructure, sports fields or subsistence farming must be allowed within this area.
- The project site is situated inside the 500m zone from a stream which means that this proposed development does trigger a section 21(C and/or i) water use license application (National Water Act, No. 36 of 1998).
- Cordoning off of proposed open space areas and sensitive areas to restrict the movement of construction vehicles and construction personnel.
- Care must be taken to preserve the grassland areas in the wetland buffers and open areas.
- Prevent runoff to wetland areas.
- The 600mm diameter pipe in Jagersfontein Road has sufficient capacity to accommodate the development although the 220kpa reading is a concern for fire flow conditions. The pressure reducing valve in the pipeline will have to be adjusted to accommodate the water demand from the Development.

- The 600mm diameter outflow pipe to the Welvaart Waste Water Treatment Works (WWTW) is adequate for the development, but the WWTW does not have sufficient capacity to accommodate runoff from the development. For the interim a package plant can be considered until such time the WWTW has been upgraded.
- The EMP for construction must ensure that all site access is via the formal road network.
- According to the National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014, all declared aliens must be effectively controlled. In terms of this Act 198 alien species were listed as declared weeds and invaders and ascribed to one of the following categories: Category 1: Prohibited and must be controlled. This includes the following species found on site: *Argemone ocoleuca*, *Datura ferox**, and *Solanum elaeagnifolium**
- All approvals to be obtained from SANRAL, MMM and Department of Roads and Public Works regarding the proposed access roads planned and the upgrade of the existing intersections.
- Access will be obtained from the R706 road. According to the attached Traffic Impact Assessment this intersection (Nr 1 on map in figure below) must be signalized.
- The proposed development must comply with the SANRAL Act regarding signage along a national road.
- All invasive alien plants must be eradicated and replaced with indigenous vegetation. Follow-up clearing must be maintained for the duration of the operational phase of the development.
- Indigenous plants should be used for ornamental or utilitarian purposes in gardens and as visual screens. Only indigenous trees should be planted along the roads. An eco-control officer should be appointed to monitor and help with the planting of indigenous trees and shrubs along the roads and open areas.
- The open trenches and construction areas must be demarcated using red tape to ensure safety of humans and other animals. A construction Safety Plan must be prepared in line with the Occupation Health and Safety Act. Provision must be made for a full time safety office during construction. This must be included in the EMP and part of the contractor's terms of reference.
- Only sanitation systems that do not rely on seepage for the disposal of liquid wastes (i.e.: septic tanks that drain into "French Drain"-type soak-aways) must be utilized in the proposed development. In this light it is recommended that use be made of a closed sewerage reticulation system. Septic tanks and subsurface drainage systems which have a tendency to leak are not recommended, except if properly sealed.
- No on-site sanitation must be allowed closer than 100m from surface or groundwater resources. The sewage system (chemical toilets) must be inspected for leakages on a regular basis and any leakages must be attended immediately.
- Efficient surface drainage system must be installed along roads in order to prevent the ponding at the surface next to the road directly after heavy precipitation events.
- The terrain may have a vast amount of construction materials available for roads, etc. However, a more detailed study and testing of materials are required to locate these materials and to determine the suitability thereof for construction purposes. It must be noted that permits will be required for any burrow pits required to make use of this construction material.
- The fill material to be used must be obtained from a source approved by the Department of Mineral and Energy. Proof of provenance of this material must be available on site.
- Excess backfill material and larger rocks (spoil) must be disposed of at an appropriate spoil site.
- The proposed development must meet the requirements of sustainable development. It must also consider energy efficient technologies and water saving devices and technologies for the proposed development. This could include measures like recycling of waste, the use of low voltage or compact fluorescent light instead of incandescent globes, maximizing the use of solar heating, management of storm water, the capture and use of rainwater from gutter and roof and the use of locally indigenous vegetation during landscaping.
- Buildings and perimeter fencing etc. must be maintained in order to ensure that they do not deteriorate and result in an aesthetically unpleasing development.
- All external fittings for example satellite dishes and TV aerials should be positioned in such a way that will have the least visual impact.

- All outside lighting to shine directly down. No general spotlighted areas must be allowed, which could bother neighbours.
- To reduce the visual impact of power lines on the environment the power can be distributed from existing overhead power lines to the stands by means of underground low voltage cables.
- In the event that any human remains are found that these would have to be reported to SAHRA (South African Heritage Resources Agency) as they would be protected under the National Heritage Resources Act (No 25 of 1999).
- The development must comply with the recommendations as stipulated in the attached TIS.
- The development must comply with the recommendations as stipulated in the attached Floodline Report namely:
 - The culverts immediately downstream of Rooidam be enlarged to accommodate the flow (Figure 2-4 of attached Floodline Report).
 - Runoff from Catchment Areas B and D must be guided to only enter the canal at point 2.
 - If development takes place in Catchment Areas B and C, the capacity of the open concrete canal must be taken into consideration. Stormwater drainage from Catchment Areas B and C should be diverted as per The Masterplan of Mangaung Metro Municipality, September 2009, via main stormwater drainage systems alongside the Jagersfontein Road to the west at point 1 and only deposited downstream of the canal analysed in the Floodline Report. However, it is the recommendation that irrespective of these catchments' development, that stormwater be diverted to the west (point 1) as described above and not towards the Development.
 - Urgent maintenance and cleaning must be done on all the culverts as can be seen on the photos. This will enable the culverts to operate at their design capacity.
 - In view of the results of the floodline analysis, the following options can be considered:
 - Enlargement of the downstream culvert and open canal up to the third section. This is a costly option, but is still recommended.
 - A berm on both sides of the canal. This is not recommended due to aesthetical reasons, space availability on the southern side and stormwater not being able to enter the canal overland.
 - A wall built on top of the canal's edges. This option is not recommended due to the layout of the Development not being finalized and runoff from the Catchment Areas B + D should be able to enter the canal overland.
- The development must comply with the recommendations as stipulated in the attached Geotechnical Report regarding foundations etc.
- The development must comply with the recommendations as stipulated in the attached Archaeological and Paleontological Impact Assessments.
- Also important will be the training of staff and learners to implement good housekeeping techniques, to be aware of light pollution, air quality, water use, solid waste and storm water management.

It can be concluded that the proposed development will not conflict with the principles of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA] and should, therefore, be authorised. The Public Participation Process (PPP) has been duly undertaken as per the NEMA and the issues of I&AP's have been adequately addressed. It is therefore recommended that the proposed development should proceed subject to the implementation and enforcement of the recommendations and mitigation measures contained in this EIR, EMP and Specialist Reports.

SECTION 11: THE WAY FORWARD

Key dates associated with this proposed Environmental Impact Assessment Report as amended are outlined below:

January 2017	Consultation with DESTEA;
May 2017	Submission of Application and Draft Scoping Report and Plan of Study of EIR and to DESTEA;
May – June 2017	Circulation of the Draft Scoping Report and Plan of Study of EIR to I&AP's for comments from 24 May 2017 to 23 June 2017;
June 2017	Submission of Final Scoping Report and Plan of Study of EIR to DESTEA for review on 26 June 2017;
June - August 2017	Review of Final Scoping Report and Plan of Study of EIR by DESTEA from 26 June 2017 to 7 August 2017 (43 days according to 2014 EIA Regulations)
August 2017	Approval/Rejection of Scoping Report and Plan of Study of EIR not later than 7 August 2017. Approval was granted on 7 July 2017;
September - October 2017	Circulation of the Draft Impact Assessment Report and Environmental Management Plan to I&AP's for comments from 19 September 2017 to 18 October 2017;
October 2017	Amendment of Impact Assessment Report and Environmental Management Plan as required from 18 October 2017 to 20 October 2017;
October 2017	Submission of Final Impact Assessment Report and Environmental Management Plan on 20 October 2017;
October 2017 - February 2018	Review of Final Impact Assessment Report and Environmental Management Plan by DESTEA from 20 October 2017 to 5 February 2018 (107 days according to 2014 EIA Regulations);
February 2018	Approval/Rejection of Final Impact Assessment Report and Environmental Management Plan by DESTEA not later than 5 February 2018;
February 2018	Advert and notification of registered I&AP's that DESTEA issued an Environmental Authorisation for the proposed development by 12 February 2018;
February 2018 to March 2018	Public Participation on the Environmental Authorisation (EA) issued by DESTEA. I&AP's can appeal the decision made by DESTEA from 12 February 2018 to 5 March 2018 (20 days notice of intention to appeal);
February 2018	Construction can go ahead if no appeal was lodged and if all other required approvals are in place for the proposed development – March 2018;

The Final Environmental Impact Assessment Report and Environmental Management Plan, together with all Annexure's were made available at the offices of MvW Environmental Services. Stakeholders and Interested and Affected Parties were also welcome to call or email the Environmental Assessment Practitioner (Mr M van Wyk) should any question arise. I&AP's were

invited to submit comments on the Draft Environmental Impact Assessment Report and Environmental Management Plan to:

Description	
Company	MvW Environmental Services
Contact Person	Manie van Wyk
Address	Stock Crescent 9 Fichardtpark, Bloemfontein, 9301
Telephone Number	082 697 7073
Email Address	manievanwyk.ssi@gmail.com

All comments and concerns received will be incorporated in the Final EIR and EMP.

SECTION 12: REFERENCES

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