

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

1. INTRODUCTION

The purpose of this Environmental Management Programme (EMPr) is to ensure 'good environmental practice' by taking a holistic approach to the management of environmental impacts during the construction and operation of the proposed clearance of 127.5 ha of indigenous vegetation, partially located within an Ecological Support Area for the proposed township establishment to be located on a Portion of the remaining extent of the Farm Churchill 211-HM and a Portion of the Remaining Extent of Portion 2 of the Farm Nyra 213-HM, Joe Morolong Local Municipality, Northern Cape Province. This EMPr therefore sets out the methods by which proper environmental controls are to be implemented by the applicant and his nominated contractor. However, where necessary, these methods have been expanded upon and additional issues addressed in order to ensure that all environmental aspects are appropriately considered and monitored.

It is important to note that this EMPr is focused primarily on the construction and operational phases of the project. Due to the projected lifespan, a detailed Site Closure and Decommissioning has not been included in this document as it is not intended for a project of this nature. Design specifications from an environmental point of view were taken into consideration, the Environmental Assessment Practitioner (EAP) have provided input with regard to possible mitigation measures for reducing environmental impacts.

This EMPr is also intended to ensure that the principles of sound Environmental Management and the general "Duty of Care" specified in the National Environmental Management Act are promoted on site during all phases of the development

This EMPr has been designed to suit the particular activities and needs of the proposed clearance of 127.5 ha of indigenous vegetation, partially located within an Ecological Support Area for the proposed township establishment to be located on a Portion of the remaining extent of the Farm Churchill 211-HM and a Portion of the Remaining Extent of Portion 2 of the Farm Nyra 213-HM, Joe Morolong Local Municipality, Northern Cape Province, and incorporates specific project mitigation measures. This EMPr therefore identifies the following:

- Construction and operation activities that will impact on the environment;
- Specifications with which the contractor shall comply in order to protect the environment from the identified impacts; and
- Actions that shall be taken in the event of non-compliance.

It is important to note that the EMPr is a dynamic document subject to similar influences and changes as are brought by variations to the provisions of the project specification. Any substantial changes shall be submitted to the contractor, resident engineer and relevant environmental authorities in writing for approval.

A professional team consisting of the following experts have been assembled in order to ensure the success of the proposed development:

- A dolomite stability specialist

- A Civil Engineer
- A Town and Regional Planner
- A SAHRA Specialist and Palaeontological specialist.
- An Ecological Fauna and Flora Habitat specialist
- A Wetland Specialist
- Registered Environmental Assessment Practitioner (EAP)

They were responsible for the following actions:

- 1) The EAP was contracted by the Applicant, the **Joe Morolong Local Municipality** as their Independent Environmental Assessment Practitioner.
- 2) A dolomite stability specialist was appointed to determine whether the site is suitable for the proposed development
- 3) The Civil Engineer was appointed to determine the capability of existing infrastructure to be linked to proposed development and readily available bulk services. He also designed the proposed infrastructure.
- 4) A SAHRA Specialist has been appointed to determine the possible impact of the development on Archaeological and Cultural features.
- 5) A Palaeontologist has been appointed to conduct a Palaeontological desktop assessment in order to assess the likelihood of palaeontological finds.
- 6) A Fauna and Flora and Wetland specialist has been appointed to determine the impact of the proposed development on the Fauna and Flora of the area.
- 7) A Civil Engineer was appointed to determine the 1:100 year flood line affecting the proposed development.
- 8) An Environmental Screening Process was conducted by the EAP to ensure that all the relevant Environmental Legislation is taken into consideration.
- 9) Desk top studies were conducted and alternatives assessed.
- 10) Site inspections were carried out to verify the outcomes of the desktop studies, and the preferred alternative defined.
- 11) A full Public Participation Process is being followed to obtain inputs from interested and affected parties.
- 12) All the information obtained from the above mentioned processes is being used to assess the Environmental Impact that the proposed development may have on the Environment and vice versa.
- 13) The inputs from Specialists, interested and affected parties, together with the knowledge of the EAP is being used to determine measures to avoid, mitigate and manage potential impacts. These measures are described in the Environmental Management Programme.

2. Contents of the Environmental Management Programme

The contents of an EMPr, shown below, are contained in Appendix 4 of the NEMA EIA Regulations 982 of 2014 as amended and published in Appendix 4 of Government Notice No. R 326 of 2017.

1. (1) 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 should be avoided, including buffers;
- (d) a description of the impact management outcomes, 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;
- (f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes and outcomes contemplated in paragraphs (d) 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) an 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.

3. Details of Environmental Assessment Practitioner

Environmental Assessment Practitioner (EAP):¹

Mrs. JE du Plooy of AB Enviro consult cc

Contact person:	Mrs. JE du Plooy		
Postal address:	7 Louis Leipoldt Street		
Postal code:	2531	Cell:	071 202 4027
Telephone:	018 294 5005	Fax:	018 293 0671
E-mail:	hannieduplooy@abenviro.co.za		
Professional affiliation(s) (if any)	EAP-EAPASA		
Project Consultant:	Mrs. JE du Plooy		

4. Expertise of the Environmental Assessment Practitioner

AB Enviro Consult (CC) is a registered consultancy, owned and operated as an independent unit by the registered owner and consultant: **Prof. A.B. de Villiers**

- **Mr J.P. De Villiers** joined the consultancy during 2004
- **Mrs J.E. du Plooy** is a consultant since 2001

EXPERIENCE OF THE CONSULTANCY

Over a period of 25 years (1996-2021) this consultancy has successfully applied for, and obtained positive ROD's and EA's for more than 380 projects. Environmental Control Officer's duties are also performed on various projects.

The company was involved (from 1992-1994) in evaluation of 114 applications for the subdivision of land, 23 applications for resort developments, and 54 applications for business rights for the Department of Agriculture, Conservation and the Environment - North West Province.

The consultancy is qualified to undertake professional studies in waste management and is still involved in the development of waste disposal- (solid and liquid effluent), and emission studies. These studies are conducted both academically and practically. This work relates to mine waste, domestic waste and effluent as well as to the monitoring of waste disposal. Environmental audits in this respect are undertaken on a regular basis.

PERSONAL PARTICULARS AND CAREER HISTORY OF PROF DE VILLIERS

ACADEMIC AND PROFESSIONAL QUALIFICATIONS

Post-Matric Qualifications

YEAR	Qualification	Institution	Field of Study
1968	B.Sc.	PU FOR CHE	Geography, Geology
1970	HONNS. B.Sc.	PU FOR CHE	Soil Science
1974	M.Sc.	PU FOR CHE	Geography
1981	Ph.D.	UOFS	Geography

PROFESSIONAL QUALIFICATIONS AND REGISTRATIONS

YEAR	Qualification/ Registration	Institution	Field of Study
1986	Professional Natural Scientist	S.A. Council for Natural Scientists	Environmental Science
1994	Quality Auditor	ESKOM	Auditing
1998	Personnel & Verifying Auditor	SAATCA	Environmental Auditing
2006	Environmental Assessment Practitioner	Interim Certification Board EAPSA	Environmental Science

MEMBERSHIP AND PARTICIPATION IN SOCIETIES, COUNCILS, ETC.

Name of professional societies	YEAR	Capacity
S.A. Geographical Society.	1967-1996	Board Member
Society for Geography	1968-2004	Member
SAGS Western Transvaal	1985-1989 1987-1989	Chairman
Africa Geographical Association	1993-1995	Vice-President.
Society for the Vaal River Catchment	1980-1999	Member
S.A. Society for Photogrammetry, Remote Sensing and Cartography	1984-1996	Member
Dendrological Society	1986-2005	Member
Birdlife South Africa	2003-present	Member
British Geomorphological Research Group	1985-1997	Member
Int Com on Water Resource Systems	1985-1997	Member
Int Com on Continental Erosion	1986-1990	Member
Int Com on Remote Sensing and Data Transmission	1986-1991	Member
Society for S.A. Geographers	1995-2005	Member
SA Photogrammetrical and Geo. Info.	1995-2003	Member
S.A. Association of Geomorphologists	1994-1999	Board Member and member
SADC Mine Dump Study Group	1996-2005	Member

ACADEMIC AND PROFESSIONAL QUALIFICATIONS MR J.P. DE VILLIERS

YEAR	Qualification	Institution	Field of Study
1993	BA	PU FOR CHE	Geography, Economics
1994	HED	PU FOR CHE	Geography Economics
2006	B.Sc.(Honns) Cum Laude	North-West University	Environmental Management
2007	M.Sc.	North-West University	Geography

PROFESSIONAL QUALIFICATIONS AND REGISTRATIONS

YEAR	Qualification/ Registration	Institution	Field of Study
2008	Basic Principles of Ecological Rehabilitation and Mine Closure	Centre for Environmental Management (North West University)	Ecological Rehabilitation

2019	Registered as Environmental assessment Practitioner	EAPASA Registration number: 2019/808	
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ACADEMIC AND PROFESSIONAL QUALIFICATIONS MRS J.E. DU PLOOY

YEAR	Qualification	Institution	Field of Study
1999	BA	PU FOR CHE	Geography, Tourism
2000	BA (Honns) Cum Laude	PU FOR CHE	Geography
2002	Master's degree: Environmental Management	PU FOR CHE	Environmental Management
2001	Aquabase Intro	AQUABASE	Hydrology
2001	Geomedia Professional	INTERTECH	GIS
2001	Map Info	SPATIAL TECHNOLOGY	GIS

PROFESSIONAL QUALIFICATIONS AND REGISTRATIONS

YEAR	Qualification/ Registration	Institution
2020	Registered as Environmental assessment Practitioner	EAPASA Registration number: 2019/1573

5. DESCRIPTION OF THE ACTIVITY

The Applicant, the **Joe Morolong Local Municipality** has appointed **AB Enviro Consult CC**, an independent environmental consultancy, to undertake an Environmental Impact Assessment for the proposed clearance of 127.5 ha of indigenous vegetation, partially located within an Ecological Support Area for the proposed township establishment to be located on a Portion of the remaining extent of the Farm Churchill 211-HM and a Portion of the Remaining Extent of Portion 2 of the Farm Nyra 213-HM, Joe Morolong Local Municipality, Northern Cape Province.

The site is influenced by a number of design factors that were considered for the proposed layout plan to be acceptable. These factors include the slope of the site, flood lines, environmental sensitivity, service provision, erf size, access, road layout and community facilities as well as the geotechnical features. To ensure that the proposed development do not infringe on any design principles and the environmental sensitive areas, development of residential units will only be allowed to take place according to the prescribed methods: subsequently no residential development is proposed to take place within the 1:100 year flood line.

The proposed Township will consist of the following (See Figure 1&2 for a copy of the Layout Plans):

Proposed township Churchill extension 1:

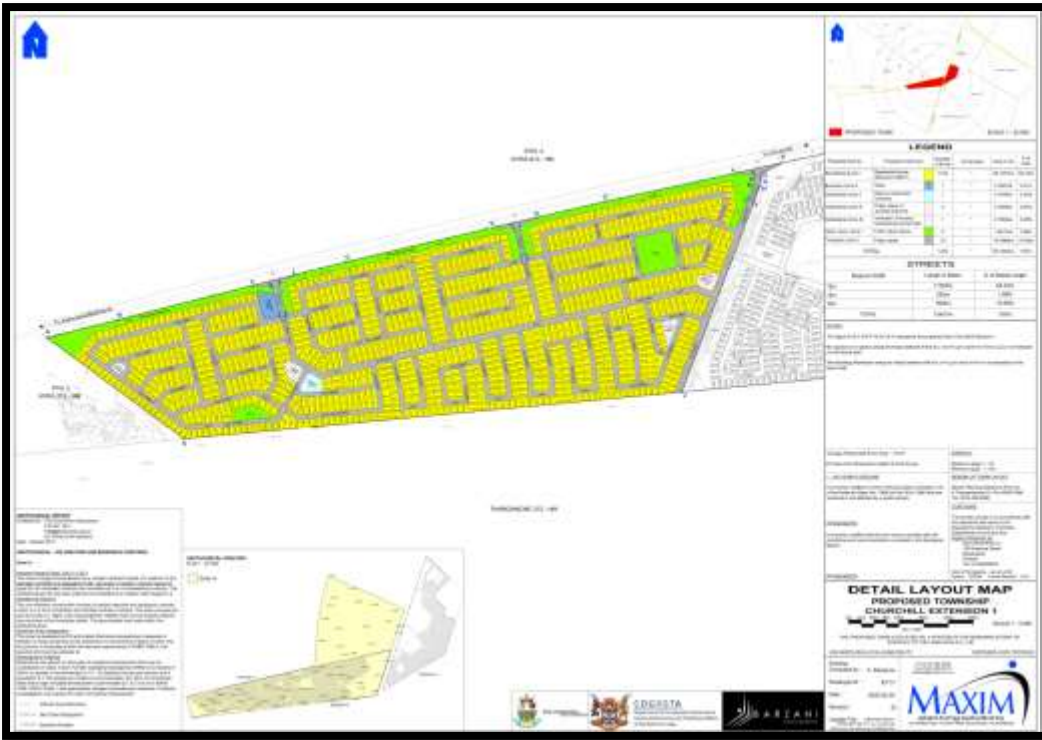


Figure 1: Proposed Churchill extension 1

Residential (Minimum 300 m ² erven)	1216 Stands
Business	1 Stands
Churches	3 Stands
Crèche	1 Stands
Community Facility	1 Stands
Parks	5 Stands
Area of township	60.7444 ha

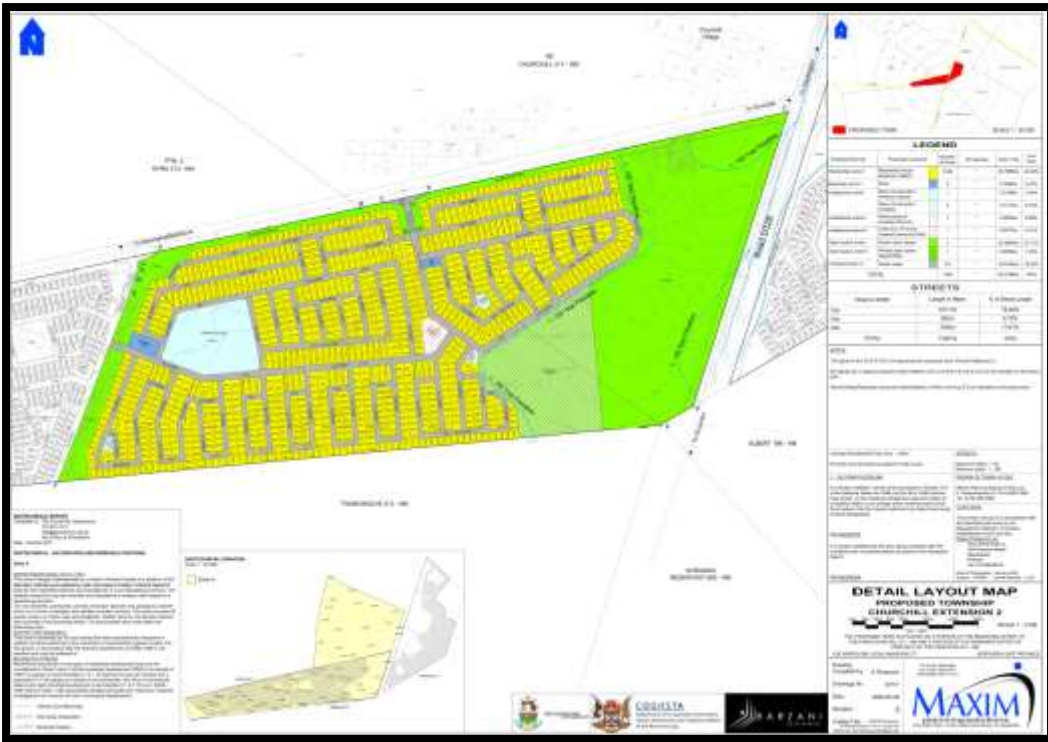


Figure 2: Proposed Churchill extension 2

Residential (Minimum 300 m ² erven)	1229 Stands
Business	2 Stands
Churches	1 Stands
Crèche	2 Stands
Primary School	1 Stand
Sports Field	1 Stand
Community Facility	1 Stands
Parks	3 Stands

Area of township **92.3198 ha**

WATER COURSES

A stream was identified where flood lines will have an effect on the proposed development. The **Stream 1** has a catchment of **51,9 km²** at the study area. Figure 4 illustrates the calculated 1:100 year flood lines.

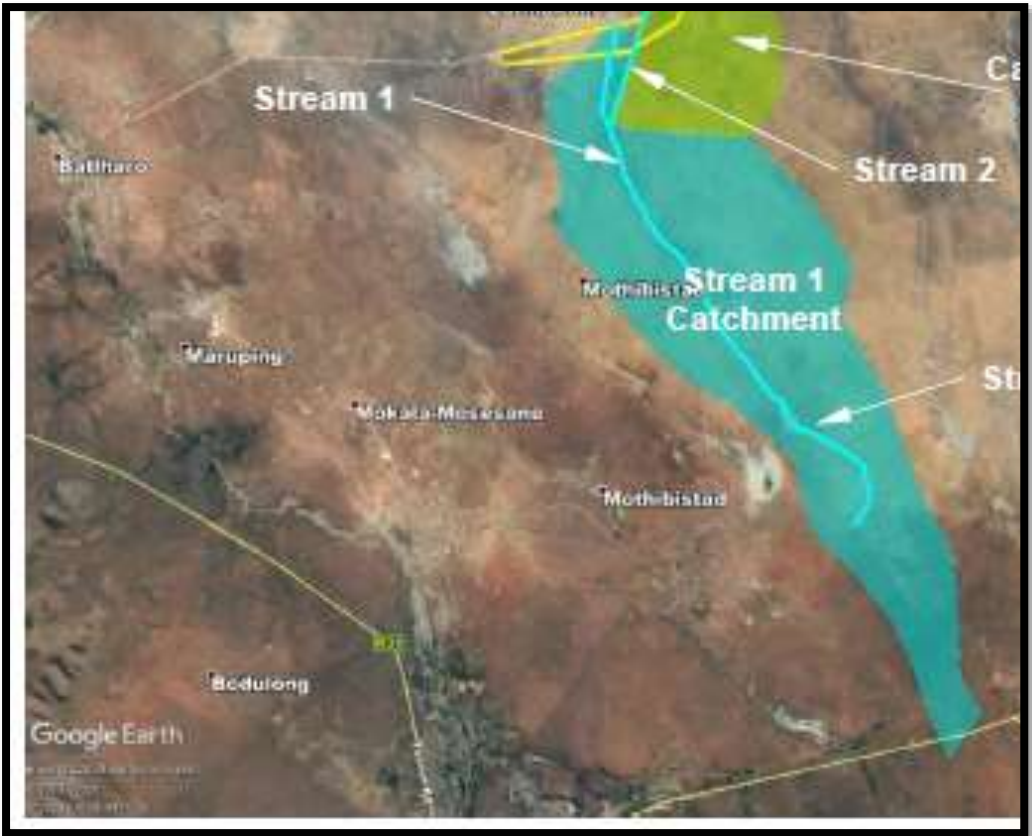


Figure 3: Streams in the area.

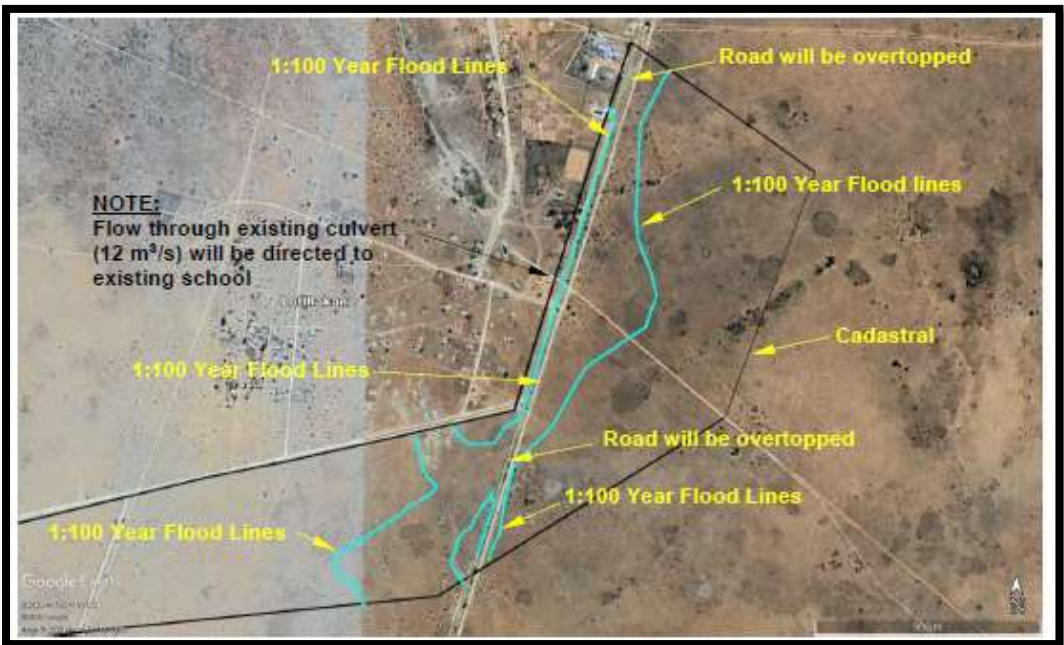


Figure 4: 1:100 year flood lines in the area

These features has been incorporated into the Layout Plan and only services will cross the water course.

CIVIL SERVICES

Bulk services will be connected to Municipal infrastructure. A Civil Engineer has been appointed to assess the availability and design of services in the area and his report will be included in the EIAr.

WATER

The Civil Engineer found that the services will be designed to accommodate all requirements for developments of this nature. The internal services will be according to accepted engineering specifications and principles as well as acceptable environmental requirements and specifications. Drawings indicating the proposed preliminary water, sewer, access roads and parking layouts are included in this report. The layout of the water, sewer, roads and storm water infrastructure will be finalised during the preliminary engineering and detail design phases of the project.

Due to the dolomitic classification (D3) of the area it is essential that all requirements of SABS 1936-3:2012 is adhered to. An extract of selected items that needs to be considered as stipulated in SABS 1936-3:2012 is listed below:

De-watering and groundwater recharging

Before abstracting groundwater on dolomite land, the person or entity undertaking such abstraction shall obtain a water use licence from the relevant national authority in accordance with the relevant national legislation. The application for such licence shall clearly state that the ground from which the water is to be abstracted is dolomite land.

Where abstraction or recharging of ground water could result in changes of more than 6 m in the original groundwater level, the person or entity undertaking such abstraction or recharging shall notify the relevant national authorities.

Existing Water Infrastructure:

Churchill is supplied with ground water abstracted from 4 boreholes situated in the vicinity of the proposed development. See **Borehole details below:**



Bulk Supply: Potable Water:

The only bulk water supply to the area is by means of 4 boreholes. These boreholes are currently being used to provide water to the existing inhabitants of Churchill. Borehole Results DWS the permissible abstraction rate (**269kℓ/day**) is less than the required summer peak demand for the proposed development. Bearing in mind that the existing boreholes are used to provide domestic water to the current residents, the supply of the 4 boreholes will not suffice to accommodate the required supply of the proposed development. It is proposed that in depth specialised study is done to explore the option of using more boreholes in the area to supply the development with the required amount of domestic water. The water quality is therefore unknown which makes the possibility of the construction of some form of

water treatment infrastructure a reality. Further studies regarding this is also proposed. However, in accordance with the dolomitic study, the dewatering of dolomitic area poses a risk for the formation of sink holes and as stated the water rest level has subsided from 3m in 2012 to more than 10m in 2017. Taking into consideration that the yield of the existing boreholes are minimal and acquiring additional water sources could pose a challenge, the alternative would be to provide a bulk water pipeline from Kuruman which could serve as a water source to other villages in the vicinity.

The proposed trunk main to serve the proposed Churchill development shall be installed from Kuruman to a Reservoir approximately 25kms away.

It is important to note that alternative water sources need to be investigated as the existing boreholes in the vicinity are insufficient.

SEWER

According to the Department of Water and Sanitation (DWS) dry sanitation is commonly used in Joe Morolong Local Municipality due to the vast expanses of the municipality. Therefore, there is no formal bulk sewer infrastructure in the proximity of the proposed development. Following discussions with Joe Morolong Local Municipality and the idea of developing Churchill as a nodal point, waterborne sanitation will be provided.

Proposed Design Criteria

A waterborne gravitational sewerage system is recommended to convey sewer effluent from all the areas of the proposed development to common low points. In order to keep excavations as shallow as possible a Pumpstation will have to be built. The Pumpstation will lift the sewage a second gravity network which will further convey the sewage to the proposed oxidation ponds. Due to the dolomitic classification (D3) of the area it is essential that all requirements of SABS 1936-3:2012 is adhered to.

Proposed Bulk Sewer Infrastructure

The proposed bulk infrastructure will consist of the following components namely:

- Bulk Sewer Lines
- Bulk Electrical connection
- Bulk sewer pump station
- Construction of new oxidation pond system (aerobic and non aerobic ponds)

(This does not form part of the application and requires an application for a Waste licence)

STORM WATER DESIGN

All storm water on the roads will gravitate and flow via drifts towards the lined channel and daylight into open veldt.

Due to the dolomitic classification (D3) of the area it is essential that all requirements of SABS 1936-3:2012 is adhered to. An extract of selected items that needs to be considered as stipulated in SABS 1936-3:2012 is listed below.

- Stormwater drainage
- Stormwater drainage systems shall discharge into a natural watercourse unless the land upon which it is discharged is
 - a) not dolomite land; or
 - b) dolomite land categorized as dolomite area designation D1 in accordance with SANS 1936-1.
- Storm water drainage
- Channels and canals which are constructed to reroute water from natural drainage paths shall be lined. Any joints in such channels shall be suitably sealed to be watertight.

- Unlined storm water cut-off or diversion trenches shall be avoided as far as possible.
- All concentrated storm water entering any parcel of land shall be diverted away from any building and structures by means of concrete-lined channels. Where necessary, earth berms and contouring shall be used to enhance site drainage.
- Storm water drainage systems shall incorporate measures to ensure watertightness (zero leakage) of conveyance systems, culverts and other compartments, including the sealing of all joints, and shall be designed to minimize the effects of settlement. All manholes, junction boxes and conveyance systems shall be tested for watertightness during construction. Reinforced concrete manholes shall be designed as liquid-retaining structures.
- Storm water drainage conveyance systems shall be designed to gradients which are self-cleansing. Such systems shall have an internal diameter equal to or greater than 300 mm.
- For drainage purposes, surfaced roadways and parking areas should be constructed at a level below the surrounding buildings, developed or landscaped areas and gardens.
- All storm water from downpipes and gutters from buildings and structures shall discharge onto concrete-lined channels which, in turn, shall discharge the water at least 1,5 m away from structures onto areas permitting surface drainage away from buildings and structures. Joints between any open channel drains and buildings shall be suitably sealed.
- Small diameter storm water drainage pipes shall not be placed parallel to buildings unless they are at least 5 m (if stand size allows) from the structure. If this is not practical, a rational design shall be performed by a competent person (engineer).
- Buildings and structures without gutters shall be provided with impervious paving not less than 1,5 m wide with a minimum slope of 1:20 all around. Joints between such paving and the building or structure, as well as any joints to control shrinkage/expansion, shall be suitably sealed. The ground surface shall be shaped to fall away from the building at a minimum slope of 1:20 for a further 1 m from the edge of the slab and shall thereafter fall continuously towards the closest drainage point.
- Water shall not be permitted to accumulate against boundary walls. Suitable drainage ports shall be incorporated in boundary walls, particularly at the lowest point of the site, to permit the passage of surface runoff water. Such ports shall be provided (on both the inlet and outlet sides of the wall or fence) with a concrete slab 1,0 m wide, 100 mm thick, and extending 400 mm beyond the edges of the drainage port along the fence. The concrete slab shall have a minimum fall of 1:15 to ensure self-cleaning drainage characteristics. Any security outlet grids that are provided shall not impede the flow of water through the port.
- The type, size and pressure rating of the pipe to be used shall be specified by the competent person (engineer).

ROADS

Existing infrastructure

Currently there is a surfaced road running in a North-Easterly direction. All roads within the proposed development will connect to the main road through well designed intersections. It is proposed that a thorough traffic impact assessment is done by a specialist in order to design these intersections. Since there is an existing road there is no need for any new bulk road infrastructure.

6. DESCRIPTION OF THE PROPERTY

The property is located on a Portion of the remaining extent of the Farm Churchill 211-HM and a Portion of the Remaining Extent of Portion 2 of the Farm Nyra 213-HM, Joe Morolong Local Municipality, Northern Cape Province.

The site is located approximately 20 km northeast of Kuruman (Figure 6a and b); and is accessible via Seoding Road from Kuruman CBD. The village is named **Letlhokane** in most of available maps e.g. GPS maps, topographical map and on Google Earth. The town is commonly known as Churchill.

The northeastern portion of the site is built up with schools, playing fields, small business premises and residential houses. The southern part of the site is a Greenfield and is generally used for sheep and goats grazing. In places there are small borrow pits (See Photograph 1) for natural gravel material (calcrete) particularly towards the main road in the eastern boundary.



Photograph 1: Borrow pits on site.

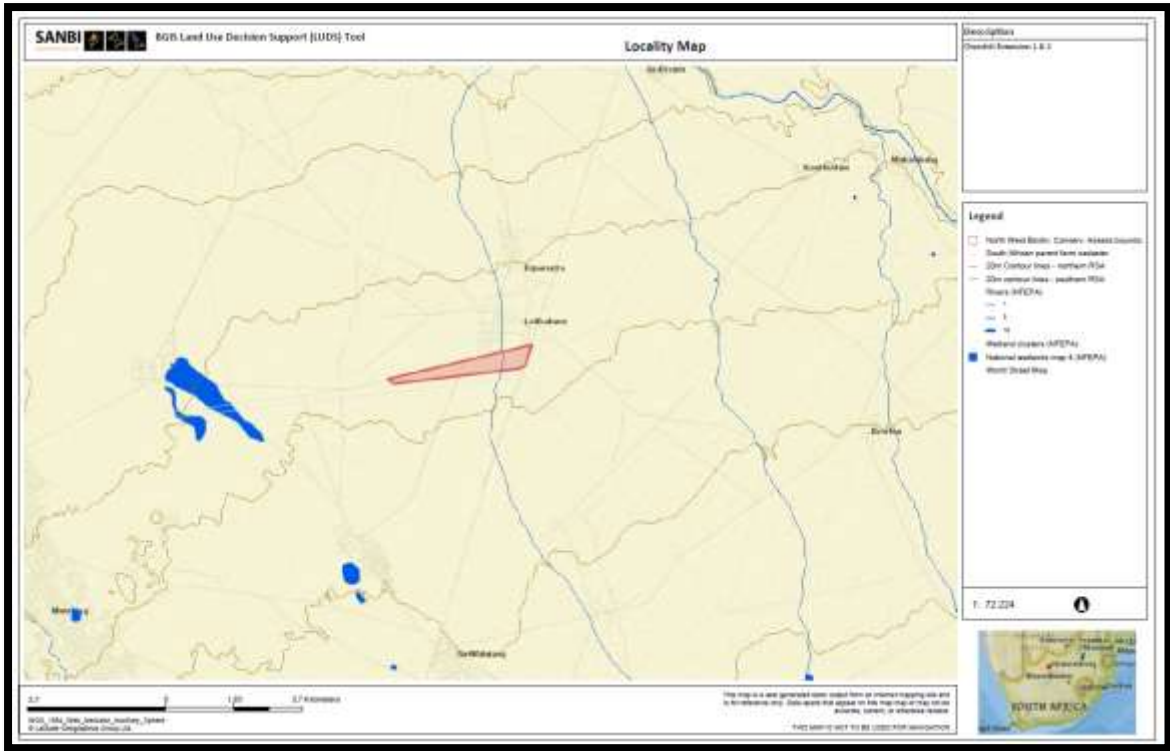


Figure 6a: Locality Map



Figure 6b: Locality Map

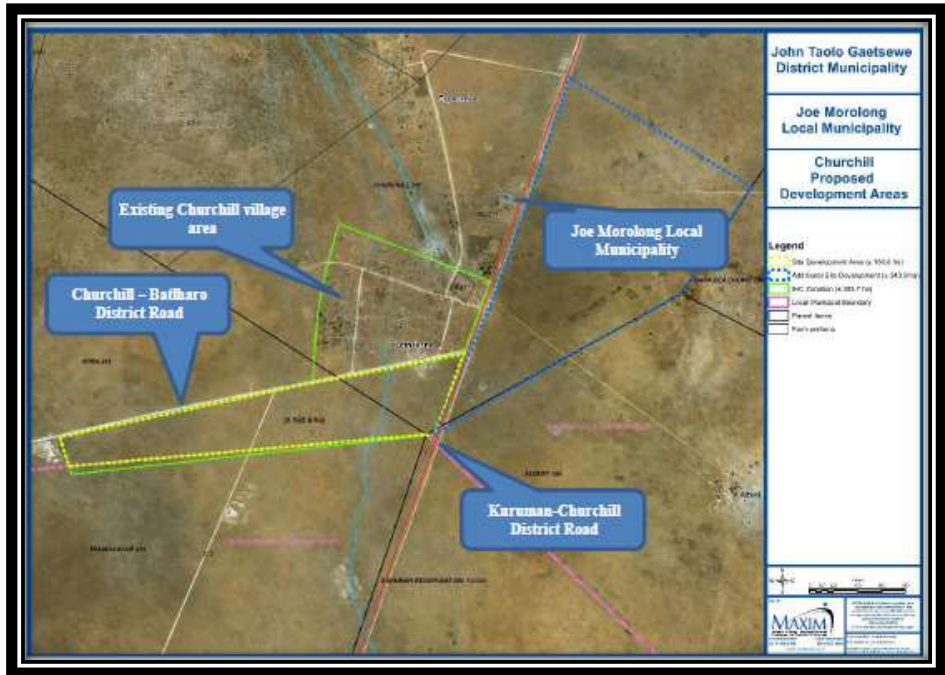
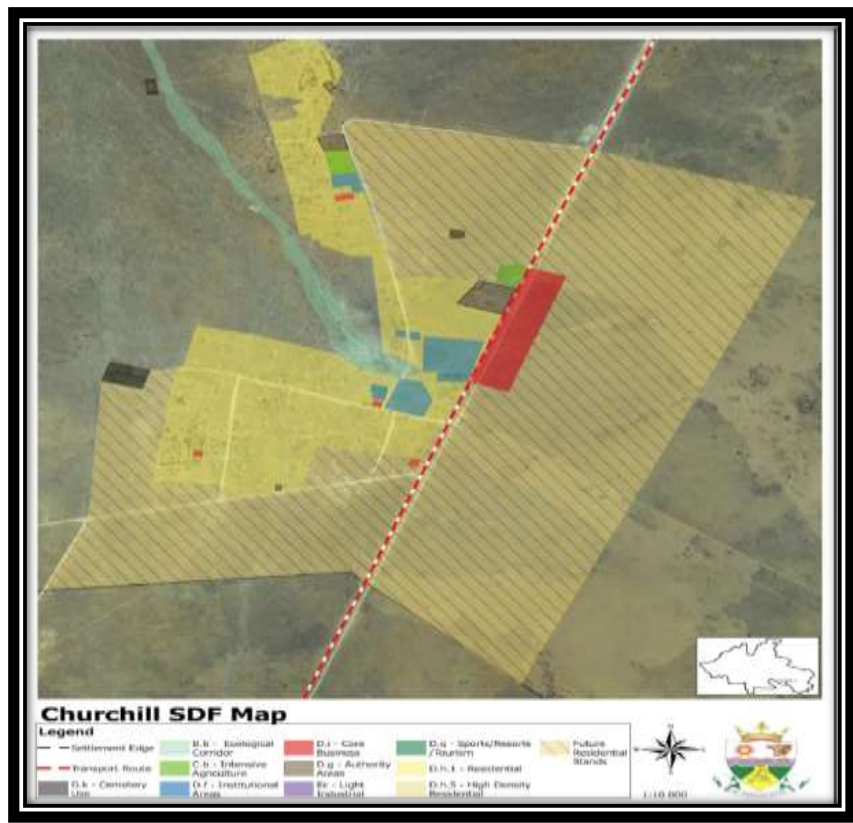


Figure 6c: Locality of development area in relation to the Churchill urban area.

In terms of the Spatial Development Framework of the Joe Morolong Local Municipality (2017), the proposed development area earmarked for the development is located within the demarcated urban edge of the Churchill urban area. The urban edge is reflected on the following map.



7. DESCRIPTION OF THE ENVIRONMENT THAT MAY BE AFFECTED BY THE PROJECT

7.1 BIO-PHYSICAL ASPECTS

According to the 1:250 000 scale, geological map, 2722 KURUMAN, the site is predominantly underlain by aeolian sands, calcrete and calcified pan dunes of Gordonia Formation. The area also hosts surface limestone of tertiary age.

The Ghaap Group outcrops are found within 10 kilometres from the study area. According to the Ghaap Group is subdivided into four subgroups of different depositional composition, namely; Schmidtdrift (siliclastic carbonates), Campbell Rand (dolomite and siliclastic mudstone), Asbestos Hill (banded and granular Banded Iron Formation) and Koegas (submarine fans) Subgroups (Kendal *et al*, 2012). The beds tend to dip 5° in a south westerly direction.

Dolomitic rock is composed mainly of the mineral dolomite, which is a carbonate of calcium and magnesium. Groundwater that is weakly acidic through enrichment with carbon dioxide, dissolves and removes the calcium and magnesium in the form of bicarbonates as it percolates through the network of joints, fractures and faults in the rock mass. This dissolution gives rise to karst features in the form of cave systems and voids. In many parts of South Africa, the karst landscape is buried beneath younger deposits and/or weathering products of the dolomitic formation, and these materials can either collapse or be transported into voids or cave systems, resulting in catastrophic ground movement at surface. Because of risks of sinkhole and subsidence development associated with the presence of these soluble dolomitic rocks, it is required that a dolomite stability assessment be conducted, in accordance with SANS 1936-2:2012. It is further stated that developments on such dolomitic land shall be in accordance with the Inherent Hazard Classes and the Dolomite Area Designations as determined by the geotechnical site investigations.

Summary of Dolomite Hazard

The hazard zonation is based on geophysical surveys and drilling results from 62 boreholes. An assessment of all these based on the method of scenario supposition, Buttrick *et. al.* (2001) favours the site being zoned into one (1) Inherent Hazard Zone as dictated by geological conditions revealed by the drilling results. Based on the percussion drilling results, geohydrological data and geological information, the dolomite stability of the site is described in terms of the following zones as:

Zone A

Inherent Hazard Class: 3/4 (1) // 3(1)

This zone is largely characterised by a medium inherent hazard of a medium (2-5 m diameter) sinkhole and subsidence (with sub areas of medium inherent hazard of large [5-15 m diameter] sinkhole and subsidence) in a non-dewatering scenario. The inherent hazard for any size sinkhole and subsidence is medium with respect to a dewatering scenario.

The non-dolomitic overburden consists of aeolian deposits and pedogenic calcrete which is in a form of hardpan and calcified nodules in places. This zone occupies all gravity zones (i.e. highs, lows and gradients). Neither wad nor low density material was recorded in the boreholes drilled. The groundwater level rests within the blanketing layer.

Dolomitic Area Designation

This zone is assessed as D3 and implies that extra precautionary measures in addition to those pertaining to the prevention of concentrated ingress of water into the ground, in accordance with the relevant requirements of SANS 1936-3, are required and must be adhered to.

Location

The zone covers the entire site boundary area.

If the proposed mitigation measures as described in the report is adhered to, it will ensure a sustainable development as far as this variable is concerned.

7.1.2 TOPOGRAPHY

The site topography is essentially flat but slightly undulating in places. The highest and lowest elevations within the site boundary are 1 287 m and 1 271 m above minimum sea level in the eastern and western boundaries respectively. The site generally slope towards south east with average slope of less than 2% (<1°). What appears to be a non-perennial and dry drainage course occurs in the eastern boundary and traverses the site from north to south. Site drainage is largely by sheet wash.

A detailed site survey has been carried out to establish levels. The Engineering report and the Layout plan will address issues regarding storm water. As the proposed development will be in close proximity to residential areas, safety of children and people need to be taken into consideration.

7.1.3 CLIMATE

A summer maximum rainfall and a dry winter is the norm. Extreme climatic events may have an influence on the project during the construction and operation phase and will have to be considered.

Frost is frequent in winter. Mean monthly maximum and minimum temperatures ranging from 35.9°C and -3.3°C for January and June, respectively (Mucina and Rutherford, 2006). Churchill receives about 300 – 450 mm of rain per year with most of its rainfall occurring during summer and autumn with very dry winters (Mucina and Rutherford, 2006). The climatic N-value for the area is greater than 5 indicating that the environment is more arid and the predominant mode of weathering is physical weathering.

Extreme climatic events may have an influence on the project during the construction and operational phase and will have to be taken into consideration.

Climate Change

According to: WIREs Climate Change 2014, 5605-620. Doi:10.1002/wcc.295: "Climate change is a key concern within South Africa. Mean annual temperatures have increased by at least 1.5 times the observed global average of 0.65°C over the past five decades and extreme rainfall events have increased in frequency. These changes are likely to continue. Climate change poses a significant threat to South Africa's water resources, food security, health, infrastructure, as well as its ecosystem services and biodiversity. Considering South Africa's high levels of poverty and inequality, these impacts pose critical challenges for national development. In relation to water, impact studies for the water resources sector have begun to look beyond changes in streamflow to changes in the timing of flows and the

partitioning of streamflow into base flows and stormflows, reservoir yields, and extreme hydrological events. Spatially the eastern seaboard and central interior of the country are likely to experience increases in water runoff. Higher frequencies of flooding and drought events are projected for the future. Complexities of the hydrological cycle, influences of land use and management and the linkages to society, health, and the economy indicate far higher levels of complexity in the water resources sector than in other sectors. What has emerged is that land uses that currently have significant impacts on catchment water resources will place proportionally greater demands on the catchment's water resources if the climate were to become drier. The influence of climate change on water quality is an emerging research field in South Africa, with assessments limited to water temperature and non-point source nitrogen and phosphorus movement. A critical interaction that has not been explored is between changes in water quality and quantity and the combined impacts, such changes might have impact on various types of water use, e.g., irrigation, domestic consumption, or aquatic ecosystems support”.

Water availability and demand has been calculated by the consulting Civil Engineers, to enable a sustainable waterborne sewage system as well as potable water supply for both the existing and future developments in the area.

7.1.4 SURFACE DRAINAGE, WETLANDS AND RIPARIAN ZONES

Two poorly defined narrow non-perennial streambeds with indistinctive riparian zones are found at the northeaster part and the central-eastern part of the site respectively.

The narrow poorly defined non-perennial streambeds should be viewed as important conservation corridors in the larger area. If the development is approved careful planning should take place to conserve the functioning of non-perennial streambeds. The riparian areas are likely to be degraded by overgrazing and are overall largely indistinctive. The scope for large buffer zones at the site is small and probably not practical. A 10 m buffer zone from the outer edge of the active channels are recommended. Proper planning of stormwater as well as the cultivation of indigenous tree species are key to sustainable functioning of the active channels and riparian zones.



Figure 4 Indications of important aspects relevant to watercourses at the site.

- Light blue outline and shading Wetlands at the site
- Blue outline and shading Artificial waterbodies (with groundwalls; dams)

Two streams were identified where flood lines will develop that may have an effect on developments on each site.

The main stream in this study area is **Stream 1** with a catchment of **51,9 km²** at the study area. **Stream 2** will form along the tarred road (no number) and will drain partially underneath the tarred road at an existing installed culvert.

Figure 6 illustrates the calculated 1:100 year flood lines.

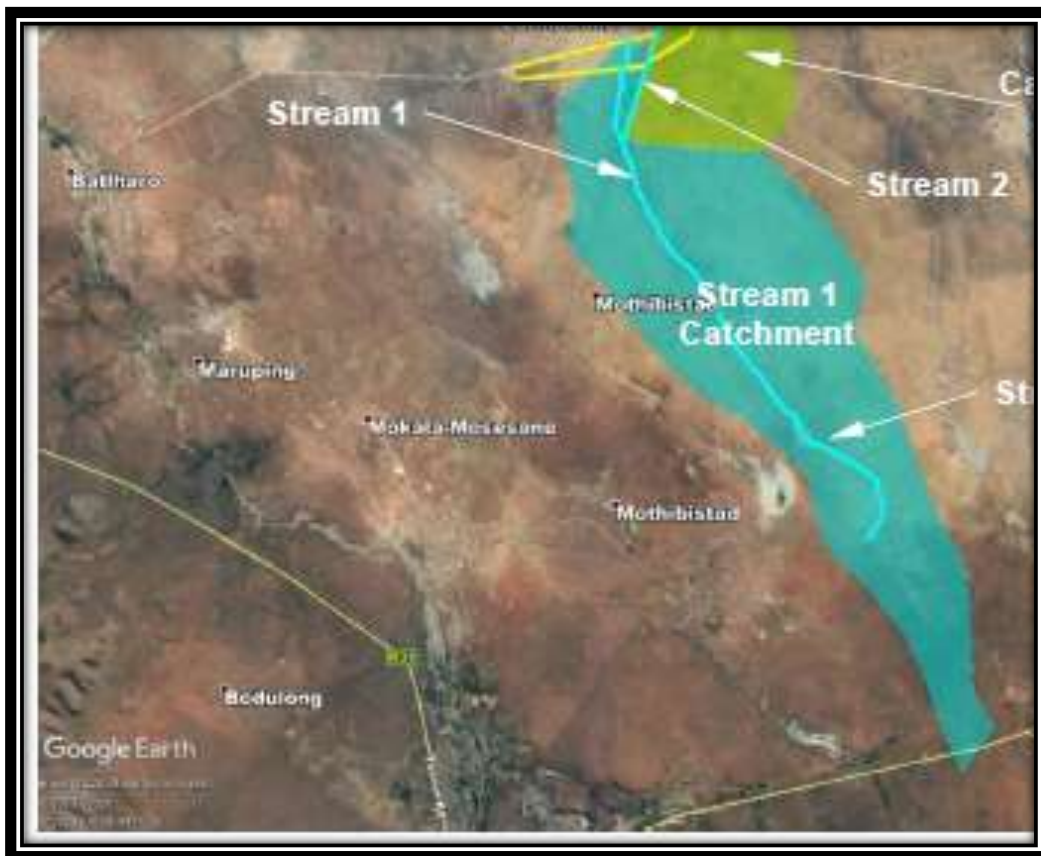


Figure 5: Streams in the area.



Figure 6: 1:100 year flood lines

The poorly defined drainage lines at the site are anticipated to comprise a low\ moderate risk. If the development is approved the surface flow and erosion of the wetland are likely to be limited. There is no distinct indication that interflow play of the wetlands would be impacted significantly by the proposed developments. The geomorphological setting and flow regime likely to be similar post development, if the development is approved according to the mitigation measures stated. Loss of any wetland animal or plant species of particular conservation importance are not expected.

In summary the Wetland Specialist Concluded the following:

- Two poorly defined narrow non-perennial streambeds with indistinctive riparian zones are found at the northeastern part and the central-eastern part of the site respectively.
- Site is situated at the Lower Vaal Water Management Area (WMA 10). Site falls outside any FEPA (Freshwater Ecosystem Priority Area) (Nel et al., 2011a, 2011b). The site is part of an Upstream Management Area which are sub-quadernary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.
- The narrow poorly defined non-perennial streambeds should be viewed as important conservation corridors in the larger area. If the development is approved careful planning should take place to conserve the functioning of non-perennial streambeds. The riparian areas are likely to be degraded by overgrazing and are overall largely indistinctive. The scope for large buffer zones at the site is small and probably not practical. A 10 m buffer zone from the outer edge of the active channels are recommended. Proper planning of stormwater as well as the cultivation of indigenous tree species are key to sustainable functioning of the active channels and riparian zones.
- Impacts on the poorly defined drainage lines at the site are anticipated to comprise a low\ moderate risk. If the development is approved the surface flow and erosion of the wetland are likely to be limited. There is no distinct indication that interflow play of the wetlands would be impacted significantly by the proposed developments. The geomorphological setting and flow regime likely to be similar post development, if the development is approved according to the mitigation measures stated. Loss of any wetland animal or plant species of particular conservation importance are not expected.

- A key issue at the site that emerged from the risk and impact assessment is the implementation of efficient control of alien invasive plant species. Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate or low.

7.1.5 GROUND WATER

The Engineering Geoscience and Geohazard Report's findings in relation to groundwater were as follows: The groundwater scenario is a key risk assessment factor in the engineering-geological characterisation of dolomitic environments. According to a 1:500 000 hydrogeological Map 2722 KIMBERLERY, the principal groundwater occurrence system is a fractured, karstic and fissured dolomite aquifer type. The borehole yield (i.e. groundwater potential) class is >2.0 (median l/sec). The probability of such borehole for this yield class is between 50% and 60%. The municipality exclusively relies on groundwater resources for domestic, agricultural and business water supply. According the Department of Water Affairs' (DWA) National Groundwater Archive (NGA), there are 4 groundwater monitoring boreholes in close proximity of the site. They fall under Lower Vaal Water Management Areas and D41L drainage region. According to DWA records the water rest level ranges from 1.3 m to 2.51 m.

During percussion drilling of this investigation water strikes were encountered and water rest levels readings were taken using a dip meter after 24 hours as per SANS1936-1(2012). Water rest level measurements indicated that water rest levels were around 10 m in most of drilled boreholes. Recorded water rest levels varied between 2.5 m and 58.7 m in boreholes CH57 and CH55 respectively as shown in Figure 4. This shows a drawdown fluctuation of at least 8 m when comparing the current average of 10 m to that of 3 m measured by Breytenbach (2012) study, where water rest levels in all three (3) boreholes drilled were around 3 m. Breytenbach (2012) stated that, there was very little additional information of significance for this area and he deduced that the area has historically not been dewatered extensively. He added that, the last observation (monitoring) in this area was made in 2003, with observation supposed to have continued to 2007.

The drop in water rest level from 3 m in 2012 to more than 10 m in 2017, shows that the compartment may have been impacted by excessive extraction. In terms of dolomite stability for a dewatering scenario, the risk of sinkhole and subsidence to form is medium as the groundwater generally rests within the overburden which is calcrete in this case. Accordingly, as an additional precautionary measure 2 monitoring boreholes were drilled and equipped for continuous groundwater level monitoring.

Possible infiltration into the groundwater have been taken into account. During the construction phase, no spills of lubricants or construction worker sewage should be allowed to pollute the ground water. Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures, especially within these relative flat areas.

7.1.7 FLORA

The study area is at the proposed Churchill, 19 km north of Kuruman, South Africa (elsewhere referred to as the site). Site is part of the Savanna Biome which is represented by the Kuruman Thornveld vegetation type at the central and eastern parts of the site as well as the Kuruman Vaalbosveld at the eastern parts of the site (Mucina & Rutherford 2006).

To serve as local context for the landscape and vegetation at the site an outline of the Kuruman Vaalbosveld and Kuruman Thornveld from Mucina and Rutherford (2006) follows.

SVk 8 Kuruman Vaalbosveld

Distribution: North-West and Northern Cape Provinces. East of Kuruman to Lykso, south of Bendell towards Good Hope. Altitude: 1300-1500 m.

Vegetation and landscape features: Open tree layer characterised by *Acacia erioloba*, *Acacia karroo*, *Searsia lancea* and *Ziziphus mucronata*. Shrub layer poorly developed, with *Grewia flava* and *Tarchonanthus camphoratus* and grass layer open, with much bare soil in places.

Geology and soils: Carbonates and chert of the Vaalian Griqualand West Supergroup and Kalahari sediments from flat, rocky sandy plains with shallow (0.1-0.6 m) red aeolian sands, stony and underlain by rock. Dominant land types Ae and Fc, with Hutton, Clovelly and Mispah soil forms common.

Important taxa: Tall Tree: *Acacia erioloba*. Small Trees: *Acacia karroo*, *Ziziphus mucronata*, *Searsia lancea*. Tall Shrubs: *Tarchonanthus camphoratus*, *Cadaba aphylla*, *Diospyros austro-africana*, *Diospyros lycioides* subsp. *lycioides*, *Grewia flava*, *Gymnosporia buxifolia*. Low Shrubs: *Amphiglossa triflora*, *Anthospermum rigidum* subsp. *pumilum*, *Anthospermum rigidum* subsp. *rigidum*, *Helichrysum zeyheri*. Geoxylic Suffrutex: *Elephantorrhiza elephantina*. Succulent Shrub: *Ebracteola wilmaniae*. Herbaceous Climber: *Rhynchosia holosericea*. Graminoids: *Antheophora pubescens*, *Aristida meridionalis*, *Eragrostis lehmanniana*, *Stipagrostis uniplumis*, *Aristida stipitata* subsp. *spicata*, *Cymbopogon caesius*, *Digitaria eriantha* subsp. *eriantha*, *Fingerhuthia africana*, *Pogonarthria squarrosa*, *Schmidtia pappophoroides*, *Themeda triandra*, *Tragus koelerioides*. Herbs: *Acrotome inflata*, *Dicoma schinzi*, *Geigeria ornativa*, *Heliotropium strigosum*, *Stachys spathulata*, *Triptaris aghillana*.

SVk 9 Kuruman Thornveld

Distribution: In South Africa the Kuruman Thornveld is found at the North West and Northern Cape Provinces. Kuruman Thornveld occurs on the flats from the vicinity of Postmasburg and Danielskuil (here west of the Kuruman Hills) in the south extending via Kuruman to Tsineng and Dewar in the north. Altitude is 1100 – 1500 m (Mucina & Rutherford, 2006).

Vegetation and landscape features: Flat rocky plains and some sloping hills with very well-developed, closed shrub layer and well-developed open tree stratum consisting of *Acacia erioloba* (Mucina & Rutherford, 2006).

Geology and soils: Some Campbell Group dolomite and chert and mostly younger, superficial Kalahari Group sediments, with red wind-blown (0.3 – 1.2 m deep) sand. Locally, rocky pavements are formed in places. Most important land types Ae, Ai, Ag and Ah, with Hutton soil form (Mucina & Rutherford, 2006).

Important taxa: Tall tree: *Acacia erioloba*. Small trees: *Acacia mellifera* subsp. *detinens*, *Boscia albitrunca*. Tall Shrubs: *Grewia flava*, *Lycium hirsutum*, *Tarchonanthus camphoratus*, *Gymnosporia buxifolia*. Low Shrubs: *Acacia hebeclada* subsp. *hebeclada*. *Monechma divaricatum*, *Gnidia polycephala*, *Helichrysum zeyheri*, *Hermannia comosa*, *Pentzia calcarea*, *Plinthus sericeus*. Geoxylic Suffrutex: *Elephantorrhiza elephantina*. Graminoids: *Aristida meridionalis*, *Aristida stipitata* subsp. *stipitata*, *Eragrostis lehmanniana*, *Eragrostis echinochloidea*, *Melinis repens*. Herbs: *Dicoma schinzii*, *Gisekia*

africana, *Harpagophytum procumbens* subsp. *procumbens*, *Indigofera daleoides*, *Limeum fenestratum*, *Nolletia ciliaris*, *Seddera capensis*, *Triptelis aghillana*, *Vahlia capensis* subsp. *vulgaris*.

Note: Though some plant species of the above listed vegetation type are present at the site, not necessarily all of the plant species listed above are present at the site.

Most of the site has been cultivated in the past. Areas with noticeable densities of alien invasive *Eucalyptus* trees are found at the central-western and southwestern parts of the site. Few trees and some diversity of grasses and forbs remain at the site.

Terrestrial vegetation at the site is an open savanna with few trees that are taller than shrub-height. Patches of shrub-height *Diospyros lycioides* subsp. *lycioides* are present in some areas. Other indigenous tree species at the site include *Vachellia hebeclada* subsp. *hebeclada*, *Senegalia mellifera* subsp. *detinens* (Black Thorn), *Ziziphus mucronata* (Buffalo-thorn), *Tarchonanthus camphoratus* (Camphor Bush), *Grewia flava* (Velvet Raisin Bush) and *Searsia lancea* (Karee). *Vachellia erioloba* (Camel Thorn) is sparsely distributed across the site. Shrublets such as *Gnidia polycephala*, *Elephantorrhiza elephantina* and *Lycium horridum* are found at the site.

Herbaceous plant species include *Hermannia tomentosa*, *Heliotropium ciliatum*, *Barleria macrostegia*, *Hermbsstaedtia odorata*, *Gazania krebsiana* and *Acrotome inflata*. Indigenous grass species at the site include *Eragrostis lehmanniana*, *Eragrostis rigidior*, *Eragrostis superba*, *Schmidtia pappophoroides*, *Enneapogon cenchroides* and *Aristida congesta* subsp. *barbicollis*.

Some of the alien invasive weed species at hitherto bare ground or ecologically disturbed areas are *Nicotiana glauca* (Tree Tobacco), *Argemone ochroleuca* (Mexican Poppy), *Schkuhria pinnata* (Dwarf Marigold), *Xanthium spinosum* (Spiny Cocklebur), *Chenopodium album* (White Goosefoot), *Alternanthera pungens* (Paper Thorn) and *Verbesina encelioides* (Wild Sunflower). Conspicuous alien invasive tree species at the site are *Prosopis glandulosa* (Mesquite), *Agave americana* and *Opuntia ficus-indica* (Prickly Pear).

Typical wetland plant species are sparse at a small pan (wetland depression) at the site. The grass species *Cynodon dactylon* (Couch Grass) and the sedge *Scirpoides dioecus* are found at the pan at the site. Encroachment by terrestrial plant species such as the exotic *Opuntia ficus-indica* and *Vachellia hebeclada* subsp. *hebeclada* occurs at the pan (wetland depression).

The Ecological Specialist Concluded in relation to the Flora on site the following:

- Terrestrial vegetation at the site is an open savanna with few trees that are taller than shrub-height. Patches of shrub-height *Diospyros lycioides* subsp. *lycioides* are present in some areas. Other indigenous tree species at the site include *Vachellia hebeclada* subsp. *hebeclada*, *Senegalia mellifera* subsp. *detinens*, *Ziziphus mucronata*, *Tarchonanthus camphoratus*, *Grewia flava* and *Searsia lancea*. *Vachellia erioloba* (Camel Thorn) is sparsely distributed across the site. Some indigenous shrublets, herbaceous plant species and grass species remain at the visibly degraded savanna.
- Alien invasive weed species are conspicuous are hitherto bare ground or ecologically disturbed areas. Noticeable alien invasive tree species at the site are *Prosopis glandulosa* (Mesquite), *Agave americana* and *Opuntia ficus-indica* (Prickly Pear).
- Site appears trampled and overgrazed in many areas. Numerous tracks and some diggings are found at the site. Some old dirt roads at the site are deeply eroded. Numbers of free roaming goats, cattle and donkeys are likely cause of overgrazing. Site is, for large parts, surrounded by settlements, roads, scraped areas and fences. Informal dumping occurs at some parts.

- No Threatened or Near Threatened plant species appear to be present at site.
- None of the protected plant species according to Northern Cape Nature Conservation Act No. 9 of 2009 (Updated in Provincial Gazette No. 1566, December 2011 with date of commencement 1 January 2012) have been found at the site.
- One plant species that is not threatened but listed as Protected tree species (and also Declining species), *Vachellia erioloba* (Camel Thorn) occurs at the site. In terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.
- If avoidance of any *Vachellia erioloba* (Camel Thorn tree) at the site is not practical, application for a permit to remove the tree would be imperative because in terms of a part of section 15(1) of the National Forests Act No. 84 of 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.
- The vegetation types representing the Savanna Biome at the site are Kuruman Vaalbosveld (SVk 8) Kuruman Thornveld (SVk 9). Kuruman Vaalbosveld and Kuruman Thornveld are not listed as threatened according to the National List of Threatened Ecosystems (2011).
- Ecological sensitivity at the terrestrial zone of the site is medium. Ecological sensitivity at the two poorly defined narrow non-perennial streambeds and their buffer zones are medium based on their importance to connectivity of watercourses in the larger area .
- Ecological sensitivity is medium-high at the pan (wetland depression) and its buffer zone (30 m). Kindly also see Wetland Assessment report which accompanies this Ecological Habitat Survey Report.
- Following the mitigations which will be upheld and planned footprint for development all the impact risks listed above are moderate or low.
- Establishment of exotic weeds should be monitored and exotic weeds at the site should be eradicated. A declared invader such as the mesquite tree (*Prosopis* species), should not be planted or allowed to spread from adjacent areas to the proposed footprint.

7.1.7 FAUNA

ASSESSMENT OF VERTEBRATE SPECIES OF PARTICULARLY HIGH CONSERVATION PRIORITY

Mammals of particular high conservation priority

Threatened mammal species of the North West Province and Northern Cape Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status	Site is part of range	Recorded at site during survey	Likely to be found based on habitat assessment

<i>Bunolagus monticularis</i> Riverine Rabbit	Critically Endangered	No	No	No
<i>Chrysothalax villosus</i> Rough-haired golden mole	Vulnerable	No	No	No
<i>Chrysochloris visagiei</i> Visagie's Golden Mole	Critically Endangered	No	No	No
<i>Cryptochloris wintoni</i> De Winton's Golden Mole	Vulnerable	No	No	No
<i>Chrysochloris zyl</i> Van Zyl's Golden Mole	Critically Endangered	No	No	No
<i>Cloeotis percivali</i> Short-eared Trident Bat	Vulnerable/ Near- threatened	No	No	No
<i>Cistugo lesueur</i> Lesueur's Hairy Bat	Vulnerable	No	No	No
<i>Diceros bicornis</i> Black rhinoceros	Critically Endangered	No	No	No
<i>Eremitalpa granti</i> Grant's Golden Mole	Vulnerable	No	No	No
<i>Felis nigripes</i> Black-footed Cat	Vulnerable	No	No	No
<i>Lycaon pictus</i>	Endangered	No	No	No

African wild dog				
<i>Loxodonta africana</i>	Vulnerable	No	No	No
African elephant				
<i>Mystromys albicaudatus</i>	Endangered	Yes	No	No
White-tailed mouse				
<i>Neamblysomus julianae</i>	Critically Endangered	No	No	No
Juliana's Golden Mole				
<i>Panthera leo</i>	Vulnerable	No	No	No
Lion				
<i>Rhinolophus blasii</i>	Vulnerable	No	No	No
Blasi's Horseshoe Bat				
<i>Smutsia temminckii</i>	Near threatened	No	No	No
Ground Pangolin				

Near threatened mammal species known to occur in the North West Province and Northern Cape Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status	Site is part of range	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Ceratotherium simum</i>	Near threatened	No	No	No
White Rhinoceros				
<i>Cistugo seabrai</i>	Near Threatened	No	No	No
Angolan Hairy Bat				

<i>Rhinolophus capensis</i> Cape Horseshoe Bat	Near Threatened	No	No	No
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Data deficient (or uncertain) mammal species of the North West Province and Northern Cape Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Threatened Status	Recorded at site during survey	Likely be a resident at the site
<i>Myosorex varius</i> Forest shrew	Uncertain	No	No
<i>Rhinolophus denti</i> Dent's Horseshoe Bat	Data Deficient	No	No

Birds of particular high conservation priority

Threatened bird species of the North West Province and Northern Cape Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Not recorded at site/ Unlikely to use site as breeding area or particular habitat on which the species depends. Yes = Recorded at site/ Likely to use site as breeding area or particular habitat on which the species depends.

Species	Common name	Threatened Status	Recorded at site during survey	Likely to use site as breeding area or habitat
<i>Aegypius tracheliotos</i>	Lappet-faced Vulture	Vulnerable	No	No
<i>Anthropoides paradiseus</i>	Blue Crane	Vulnerable	No	No
<i>Aquila rapax</i>	Tawny Eagle	Vulnerable	No	No
<i>Ardeotis kori</i>	Kori Bustard	Vulnerable	No	No
<i>Balearica regulorum</i>	Grey Crowned Crane (Mahem)	Vulnerable	No	No
<i>Botaurus stellaris</i>	Eurasian Bittern	Critically Endangered	No	No
<i>Calendulauda burra</i>	Red Lark	Vulnerable	No	No

<i>Circus ranivorus</i>	African Marsh- Harrier	Vulnerable	No	No
<i>Crex crex</i>	Corn Crake	Vulnerable	No	No
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable	No	No
<i>Falco naumanni</i>	Lesser Kestrel	Vulnerable	No	No
<i>Geronticus calvus</i>	Southern Bald Ibis	Vulnerable	No	No
<i>Gorsachius leuconotus</i>	White-backed Night-heron	Vulnerable	No	No
<i>Gypaetus barbatus</i>	Bearded Vulture	Endangered	No	No
<i>Gyps africanus</i>	White-backed Vulture	Vulnerable	No	No
<i>Gyps coprotheres</i>	Cape Vulture	Vulnerable	No	No
<i>Neophron percnopterus</i>	Egyptian Vulture	Regionally almost extinct	No	No
<i>Neotis ludwigii</i>	Ludwig's Bustard	Vulnerable	No	No
<i>Pelecanus rufescens</i>	Pink-backed Pelican	Vulnerable	No	No
<i>Polemaetus bellicosus</i>	Martial Eagle	Vulnerable	No	No
<i>Rhynchops flavirostris</i>	African Skimmer	Endangered	No	No
<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	No	No
<i>Sarothrura ayresi</i>	White-winged Flufftail	Critically Endangered	No	No
<i>Therathopius ecaudatus</i>	Bateleur	Vulnerable (in South Africa)	No	No
<i>Tyto capensis</i>	African Grass-Owl	Vulnerable	No	No

* Though some of the above bird species that roams over large areas may occasionally be found at the site, the site does not appear to be a habitat of particular importance to these birds, and these birds also do not use the site as breeding area.

Near threatened bird species of the North West Province and Northern Cape Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Not recorded at site/ Unlikely to be particularly dependent on the site as breeding area or habitat. Yes = Recorded at site/ Likely to be particularly dependent on the site as breeding area or habitat.

Species	Common name	Threatened Status	Recorded at site during survey	Likely to use site breeding area or habitat
<i>Buphagus erythrorhynchus</i>	Red-Billed Oxpecker	Near threatened	No	No
<i>Certhilauda chuana</i>	Short-clawed Lark	Near threatened	No	No
<i>Calendulauda barlowi</i>	Barlow's Lark	Near Threatened	No	No
<i>Charadrius pallidus</i>	Chestnut-banded Plover	Near threatened	No	No
<i>Ciconia nigra</i>	Black Stork	Near threatened	No	No
<i>Circus macrourus</i>	Pallid Harrier	Near threatened	No	No
<i>Circus maurus</i>	Black Harrier	Near threatened	No	No
<i>Eupodotis caerulescens</i>	Blue Korhaan	Near threatened	No	No
<i>Falco biarmicus</i>	Lanner Falcon	Near threatened	No	No
<i>Falco peregrinus</i>	Peregrine Falcon	Near threatened	No	No
<i>Glareola nordmanni</i>	Black-winged Pratincole	Near threatened	No	No
<i>Leptoptilos crumeniferus</i>	Marabou Stork	Near threatened	No	No
<i>Mirafra cheniana</i>	Melodious lark	Near threatened	No	No
<i>Mycteria ibis</i>	Yellow-billed Stork	Near threatened	No	No
<i>Pelecanus onocrotalus</i>	Great White Pelican	Near threatened	No	No

<i>Phoenicopus minor</i>	Lesser Flamingo	Near threatened	No	No
<i>Phoenicopus ruber</i>	Greater Flamingo	Near threatened	No	No
<i>Rostratula benghalensis</i>	Greater Painted-snipe	Near threatened	No	No
<i>Spizocorys sclateri</i>	Sclater's Lark	Near Threatened	No	No
<i>Sterna caspia</i>	Caspian Tern	Near threatened	No	No

** Though some of the above bird species that roams over large areas may occasionally be found at the site, the site does not appear to be a habitat of particular importance to these birds, and these birds also do not use the site as breeding area.

Reptiles of particular high conservation priority

Threatened reptile species in North West Province and Northern Cape Province. Main Source: (Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers, 2014). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Threatened Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Crocodylus niloticus</i> Nile Crocodile	Vulnerable	No	No	No
<i>Homopus signatus</i> Speckled Dwarf Tortoise	Vulnerable	No	No	No
<i>Pachydactylus goodi</i> Good's Gecko	Vulnerable	No	No	No
<i>Pachydactylus rangei</i> Namib Web-footed Gecko	Critically Endangered (Regionally)	No	No	No

Near threatened reptile species in North West Province and Northern Cape Province. Main Source: Bates, Branch, Bauer, Burger, Marais, Alexander & de Villiers (2014). Though *Homoroselaps dorsalis* has not yet been recorded from the North West Province, its presence in some areas of the Province is anticipated. No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Threatened Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
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<i>Cordylus imkeae</i> Rooiberg Girdled Lizard	Near Threatened	No	No	No
<i>Cordylus macropholis</i> Large-scaled Girdled Lizard	Near Threatened	No	No	No
<i>Goggia gemmula</i> Richtersveld Pygmy Gecko	Near Threatened	No	No	No
<i>Homopus boulengeri</i> Karoo Dwarf Tortoise	Near Threatened	No	No	No
<i>Homoroselaps dorsalis</i> Striped Harlequin Snake	Near threatened	No	No	No
<i>Typhlosaurus lomiae</i> Lomi's Blind Legless Skink	Near Threatened	No	No	No

Amphibian species of particular high conservation priority

Threatened amphibian species in Northern Cape Province. Sources: Du Preez & Carruthers (2009), Carruthers & Du Preez (2011). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Red Listed Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Breviceps macrops</i> Desert Rain Frog	Vulnerable	No	No	No

Near threatened (currently least concern) amphibian species in North West Province and Northern Cape Province. No = Amphibian species is not a resident on the site; Yes = Amphibian species is found to be resident on the site.

Species	Threatened Status	Resident at site	Recorded at site during survey	Likely to be found based on habitat assessment
<i>Pyxicephalus adspersus</i> Giant Bullfrog	Near threatened (Currently Least Concern)	No	No	No

ASSESSMENT OF INVERTEBRATE SPECIES OF PARTICULAR HIGH CONSERVATION PRIORITY

Butterflies of particular conservation priority

Threatened butterfly species in North West Province, northern Cape Province and Gauteng Province. Sources: Henning, Terblanche & Ball (2009), Mecenero *et al.* (2013). Invertebrates such as threatened butterfly species are often very habitat specific and residential status imply a unique ecosystem that is at stake.

Species	Threatened Status	Recorded at site during survey	Residential status at the site: Yes confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
<i>Aloeides dentatis dentatis</i> Roodepoort Russet	Endangered	No	Highly unlikely
<i>Anthene lindae</i> Kalahari Hairtail	Vulnerable	No	Unlikely
<i>Chrysoritis aureus</i> Golden Opal	Endangered	No	Highly unlikely
<i>Chrysoritis trimeni</i> Diamond Opal	Vulnerable	No	Highly unlikely
<i>Lepidochrysops praeterita</i> Highveld Blue	Endangered	No	Highly unlikely
<i>Orachrysops mijburghi</i> Mijburgh's Blue	Endangered	No	Highly unlikely

Butterfly species of the Gauteng Province, North West Province and Northern Cape Province that are not threatened and not near threatened but of which are of particular conservation concern and listed as **Critically Rare/ Rare/ Data Deficient** category (Mecenero *et al.*, 2013). No = Butterfly species is unlikely to be a resident at the study area; Yes = Butterfly species is a resident at the study area.

Species	Threatened Status	Recorded at site during survey	Residential status at the site: Yes confirmed, Highly likely, Likely, Medium possibility, Unlikely, Highly unlikely
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<i>Chrysoritis beaufortia charlesi</i> Roggeveld Opal	Rare (Restricted Range)	No	Highly unlikely
<i>Chrysoritis beaufortia stepheni</i> Hantam Mountain Opal	Rare (Habitat Specialist)	No	Highly unlikely
<i>Chrysoritis turneri wykehami</i> Hantam Opal	Rare (Habitat Specialist)	No	Highly unlikely
<i>Chrysoritis violescens</i> Violescent Opal	Rare (Habitat Specialist)	No	Highly unlikely
<i>Colotis celimene amina</i> Lilac Tip	Rare (Low density)	No	Highly unlikely
<i>Lepidochrysops jamesi claassensi</i> Hantamsberg Nimble Blue	Rare (Habitat Specialist)	No	Highly unlikely
<i>Lepidochrysops jamesi jamesi</i> Karoobush Nimble Blue	Rare (Habitat Specialist)	No	Highly unlikely
<i>Lepidochrysops mcgregori</i> Copper-brown Nimble Blue	Rare (Habitat Specialist)	No	Highly unlikely
<i>Lepidochrysops penningtoni</i> Arid Nimble Blue	Data Deficient	No	Highly unlikely
<i>Lepidochrysops procera</i> Savanna Blue	Rare (Habitat specialist)	No	Highly unlikely
<i>Metisella meninx</i> Marsh Sylph	Rare (Habitat specialist)	No	Highly unlikely
<i>Platylesches dolomitica</i> Hilltop Hopper	Rare (low density)	No	Highly unlikely
<i>Pseudonympha southeyi kamiesbergensis</i> Kamiesberg Pepperbrown	Rare (Habitat Specialist)	No	Highly unlikely
<i>Thestor calviniae</i> Calvinia Skolly	Rare (Restricted Range)	No	Highly unlikely
<i>Tuxentius melaena griqua</i> Griqua Black Pie	Data Deficient	No	Highly unlikely

Beetles of particular conservation priority

Fruit chafer species (Coleoptera: Scarabaeidae: Cetoniinae) in the Gauteng Province and North-West Province which are of known high conservation priority.

Species	Threatened Status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Ichneostoma stobbiai</i>	Uncertain	No	No
<i>Trichocephala brincki</i>	Uncertain	No	No

Scorpion species of particular conservation priority

Rock scorpion species (Scorpiones: Ischnuridae) species that are of known high conservation priority in the Gauteng Province and North-West Province.

Species	Threatened Status	Recorded at site during survey	Likely to be resident at site based on habitat assessment
<i>Hadogenes gracilis</i>	Uncertain	No	No
<i>Hadogenes gunningi</i>	Uncertain	No	No

7.1.8. AIR QUALITY

Air quality will have no influence on the project. The project will however create a certain amount of dust during the construction phase. If proper dust suppression measures are implemented this variable will have very little impact (low in intensity and significance during the construction phase).

7.1.9 NOISE

It is a fact that a certain amount of noise will be generated during the construction phase of the project. Noise levels should however rarely exceed the allowable limits. It is unlikely that the project will create any more noise during the operational phase than that already experienced on site.

7.2 SOCIOLOGICAL AND ECONOMIC ISSUES

7.2.1 SOCIAL AMENITIES

As in the rest of South Africa, there is a housing shortage in the area. This is totally unacceptable as Informal settlements consist of non-conventional housing built without complying with legal building procedures. Broadly, these crude dwellings mostly lack proper indoor infrastructure, such as water supply, sanitation, drainage, waste disposal and proper road access. There is also a bond between poor housing and environmental conditions in informal settlements which also reflects poverty. Linking basic services such as water to health is viewed as a false separation as these services are 'intimately related to housing'. It becomes a housing issue if children playing outside the house contract diarrhea via ingesting pathogens from fecal matter which contaminates the land on which they play. Otherwise, it is the house which provides for shelter against injury, weather and disease. Improving the surroundings of the house is to limit severe health risks existing within poor quality housing.

The development guidelines from the Guidelines for human settlement planning and design were taken into account to develop a sustainable area for people to have job opportunities and public facilities close to home. This will encourage a sustainable community and by implementing these guidelines, will help contribute to the upliftment of the community as a whole.

The proposed development also conforms to the following principals and guidelines for development:

- Correction of historically distorted spatial patterns
- Discouragement of land invasion and ensuring equitable access to land
- Discouragement of urban sprawl and the promotion of more compact towns
- Promotion of a diverse combination of land use, also at a detailed level
- Optimization of the use of existing resources, including bulk infrastructure
- Sustainable land development patterns and practices
- Promotion of spatial integration

All of the above conclude that there is a need for residential development, and that the proposed township is favorable by the counsel as well as the community.

During the construction phase, temporary employment will be created. The increased employment in the area during the construction phase will also result in increased expenditure, which, in addition, will mean that more than just the proposed jobs required for the construction on the site will be created due to economic spin-offs that will result.

7.2.2 ARCHAEOLOGY AND CULTURAL SITES

A number of known cultural heritage sites (archaeological and/or historical) exist in the larger geographical area within which the study area falls. There are no known sites on the specific land parcel. Besides a few Stone Age objects identified in one area, no other sites, features or material of cultural heritage (archaeological and/or historical) origin or significance were identified in the study area during the assessment. This includes graves and the ruins of earlier homesteads and related structures.

The Stone Age-related site identified and recorded consisted of a few pieces of flakes and possible core material from which stone tools were manufactured. The objects were found in an area exposed by trenching for a possible pipeline and occur on top of calcrete levels underlying the sands covering the study area. It is therefore possible that similar finds could be situated in undisturbed sections of the development area and that it will get exposed during development activities (such as trenching, the digging of foundations).

In isolation the site and material recorded is not of high significance as the scatter of Stone Age material is not dense and not in situ. However the possibility of in situ deposits and sites do exist and the following is therefore recommended:

“Once the final layout of the proposed township development has been determined and the installation of services (sewerage, water, roads) commences an archaeologist should be contracted to undertake a watching brief so that if any sites or material are exposed by the development activities that the finds can be investigated and recommendations on the way forward be provided.”

It should be noted that although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) there is always a possibility that some might have been missed as a result of grass cover and other factors. The subterranean nature of these resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or invisible sites, features or material be uncovered during any development actions then an expert should be contacted to investigate and provide recommendations on the way forward.

From a cultural heritage point of view the proposed Churchill Township Development can therefore continue, taking cognizance of the above recommendations.

7.2.3 PALEAONTOLOGICAL DESKTOP STUDY

The entire study area is deeply underlain by rocks of the Precambrian Transvaal Supergroup and more superficially by late Cenozoic wind-blown sand of the Kalahari Group. Dolomites of the Transvaal Supergroup are known to contain fossil stromatolites, and there is a slight, but unlikely, possibility that the unconsolidated wind-blown sand of the Tertiary-Quaternary Kalahari Group could contain fossils.

As the Precambrian Transvaal Supergroup rocks are overlain by thick Tertiary-Quaternary sands and are not exposed in the study area no stromatolites are evident and it is highly unlikely that palaeontological heritage will be affected by the proposed township development. The overlying Cenozoic sediments are not consolidated and it is very unlikely that any fossils will be present.

This desktop study has indicated that no stromatolites are exposed, and if deep excavations are undertaken for the development it could expose fossil stromatolites and could create an opportunity for further study. It is thus recommended that if in the unlikely event that fossils are exposed in the Precambrian Transvaal Supergroup rocks or Cenozoic sediments during the proposed development, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

7.2.3 AESTHETICS

Aesthetics have very little influence as the area is already highly disturbed.

8. ENVIRONMENTAL MANAGEMENT OBJECTIVES AND TARGETS

The following table is a summary 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.

ENVIRONMENTAL ASPECTS	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS
DOCUMENTATION AND TRAINING		
The necessary documentation must be available in the site office	Ensure that all concerned is aware of the EMPr and related environmental aspects	Availability of documents Trained and informed workforce.
SITE ACCESS & TRAFFIC MANAGEMENT		
Access roads may increase the construction footprints	Construction vehicles, machinery and workers must be restricted to the designated access roads, and may not drive through undeveloped vegetation outside of the existing access route except where that vegetation falls within the authorised working area (development footprint) at the site.	Minimizing eradication of vegetation.
VEGETATION CLEARING		
Vegetation will be cleared from within the footprint of the working area, before earthmoving and construction activities commence.	Vegetation clearing may only commence once the working area has been clearly demarcated to the ECO's satisfaction.	Land clearing must be restricted to the demarcated working area, and no vegetation may be cleared outside of the demarcated working area.
TOPSOIL & SUBSOIL MANAGEMENT		
Topsoil (where present) will be removed from any area where physical disturbance of the surface will occur.	Removed topsoil and subsoil should be stockpiled for the duration of the active construction period, and utilized for the final landscaping and rehabilitation of disturbed areas on site	The topsoil must be adequately protected from being blown away or eroded by storm water. Removed subsoil should be stockpiled separately from topsoil. Topsoil should be the final layer applied during rehabilitation, after subsoil/ spoil material has been placed and shaped on the site
EXCAVATIONS & EARTHWORKS		
It will be necessary to employ heavy machinery (excavators, back-actors, bulldozers, dump trucks etc.) for the earthmoving required	Use of heavy machinery can substantially increase the likelihood, intensity and significance of potential negative environmental impacts, and it is thus essential that earthworks be performed under constant supervision, and that operators must be made aware of all the environmental obligations, as there is always the potential to inflict damage to sensitive areas.	Use of machinery should be restricted to only that which is strictly required, and the unnecessary or excessive movement/ use of such machinery must be kept to a minimum. Machinery must enter and exit the site via the indicated access roads, and may not enter/ exit the river channel at any other location. Excavations and earth-moving may only take place within the demarcated working area
DANGEROUS AND TOXIC MATERIALS (CHEMICALS)		
Safe storage of chemicals See also below for further aspects on this subject	Clean environment	No spills of chemicals

ENVIRONMENTAL ASPECTS	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS
<p>Availability of safety kits to prevent oils/toxic materials spreading in the environment</p> <p>Proper storage must be provided for chemicals , paint and construction materials needed</p>	Safe storage of materials	Proper storage provided
STORAGE OF OIL AND FUEL		
Safe handling of fuel and oil and prevention of spills.	Clean environment	<p>No spills of oil or fuel</p> <p>No leakages of oil</p>
USE OF OIL AND CHEMICALS		
<p>Drip trays must be provided for vehicles in storage yard</p> <p>Wash bay and oil trap to be provided</p>	<p>No spills of oil</p> <p>Cleaning area for vehicles</p>	<p>No oil spills from vehicles</p> <p>No oil or fuel into environment due to cleaning of vehicles or equipment</p>
STORAGE OF CEMENT		
Safe handling of cement	Clean environment	No spills of cement
STORAGE OF EQUIPMENT AND MATERIALS		
Safe and proper storage of equipment and material	Safe and proper storage of equipment and material	Neat, clean and ordered storage of material
CONCRETE		
The contractors must provide information on proposed handling of concrete.	Minimise the possibility of concrete residue entering into the surrounding environment	No evidence of contaminated soil on the construction site
TOILETS AND ABLUTION FACILITIES		
Clean sanitary environment	Clean and sanitary environment	Toilets for workers in accordance with the instructions in the EMP
WASTE MANAGEMENT		
A clean and waste free environment	Clean environment with waste handled in accordance with the EMP	No waste in the environment
WORKSHOP EQUIPMENT, MAINTENANCE AND STORAGE OF MATERIAL		
Clean and safe work area	Clean and safe work area	Safe and clean work and storage area
FIRES		
No burning of waste and or fires originating from the construction area	No burning of waste and or fires originating from the construction area	No fire incidents
OTHER ENVIRONMENTAL ASPECTS		
<p>Stockpiles</p> <p>All stockpiled material must be easily accessible without any environmental damage to adjacent grasslands/farmlands.</p> <p>All temporarily stockpiled material must be stockpiled in such a way that the spread of materials are minimised.</p> <p>The stockpiles may only be placed within the demarcated areas - the location of which must be approved by the ER or ECO.</p> <p>Stockpiled material at batching plant must be contained to prevent the spread of gravel in the area.</p> <p>Erosion, sedimentation and storm water</p> <p>No erosion and or sedimentation</p>	<p>Properly constructed and well maintained stockpiles</p> <p>• Minimise scarring of the soil</p>	<p>No erosion or spread of material from stockpiles</p> <p>Gravel stockpiles must be properly managed</p> <p>No erosion or sedimentation.</p>

ENVIRONMENTAL ASPECTS	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS
<p>Vegetation</p> <p>The contractor must avoid vegetated areas that will not be cleared.</p>	<p>surface and land features</p> <ul style="list-style-type: none"> Minimise disturbance and loss of soil Minimise construction footprint <p>Minimise impacts on vegetation</p>	<p>Limit impact on vegetation</p>
<p>Waste management</p> <p>Any illegal dumping of waste must not be tolerated. This aspect must be closely monitored and reported on; proof of legal dumping must be able to be produced on request. Bins must be clearly marked for ease of management. Sufficient closed containers must be strategically located around the construction site to handle the amount of litter, wastes, rubbish, debris, and builder's wastes generated on the site.</p>	<ul style="list-style-type: none"> Sustainable management of waste; to keep the site neat and tidy. This will control potential influx of vermin and flies thereby minimising the potential of diseases on site and the surrounding environment. It will also minimise the potential to pollute soils, water resources and natural habitats 	<ul style="list-style-type: none"> Disposal of rubble and refuse in an appropriate manner with no rubble and refuse lying on site Sufficient containers available on site
<p>Dust</p> <p>Dust production must be controlled by regular watering of roads and works area, should the need arise.</p>	<p>Reduce dust fall out</p>	<p>No visible signs of dust</p>
<p>SAFETY</p>	<p>Children's access to construction site controlled,</p> <p>Access to construction camp controlled</p> <p>Safety aspects considered</p>	<p>No children on construction site</p> <p>Safety fence and controlled access available</p> <p>Safety signs with necessary information displayed</p>

9. ENVIRONMENTAL IMPACT MANAGEMENT OUTCOMES

9.1 ASSESSMENT CRITERIA

Impacts were rated using the following methodology:

Nature of the potential impact		Description of the effect, and the affected aspect of the environment
Duration (time scale)	Short term	Up to 5 years
	Medium term	6 – 15 years
	Long term	More than 15 years
Extent (area)	Local	Confined to study area and its immediate surroundings
	Regional	Region (cadastral, catchment, topographic)
	National	Nationally (The country)
	International	Neighboring countries and the rest of the world.
Magnitude (Intensity)	Low	Site-specific and wider natural and/or social functions and processes are negligibly altered. ((A low intensity impact will not affect the natural, cultural, or social functions of the environment).
	Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way. (Medium scale

Nature of the potential impact		Description of the effect, and the affected aspect of the environment
		impact will alter the different functions slightly).
	High	Site-specific and wider natural and/or social functions and processes are severely altered. (A High intensity impact will influence these functions to such an extent that it will temporarily or permanently cease to exist).
Probability	Improbable	Possibility of occurrence is very low. (Such an impact will have a very slight possibility to materialise, because of design or experience).
	Possible	There is a possibility that the impact will occur
	Probable	It is most likely that the impact will occur
	Definite	The impact will definitely occur
Significance	Insignificant	Impact is negligible and will not have an influence on the decision regarding the proposed activity (No mitigation is necessary)
	Very Low	Impact is very small and should not have any meaningful influence on the decision regarding the proposed activity (No mitigation is necessary)
	Low	The impact may not have a meaningful influence on the decision regarding the proposed activity (No mitigation is necessary)
	Medium	The impact should influence the decision regarding the proposed activity (The project can only be carried through if certain mitigatory steps are taken)
	High	The impact will influence the decision regarding the proposed activity
	Very High	The proposed activity should only be approved under special circumstances
Reversibility	Low	There is little chance of correcting the adverse impact
	Medium	There is a moderate chance of correcting the adverse impact
	High	There is a high chance in correcting the adverse impact
Risk	Low	Assessing a risk involves an analysis of the consequences and likelihood of a hazard being realized. In decision-making, low-consequence / low-probability risks (green) are typically perceived as acceptable and therefore only require monitoring.
	Medium	Other risks (amber) may require structured risk assessment to better understand the features that contribute most to the risk. These features may be candidates for management
	High	High-consequence / high-probability risks (red) are perceived as unacceptable and a strategy is required to manage the risk.

Attributes associated with the alternatives were assessed and is outlined below:

Geographical attributes

The Geographical attributes of an area relates to the characteristics of a particular region, area or place. It influences the determination of site alternatives as it relates to the location of a site in relation to relevant features in the area.

Physical attributes

Physical attributes of an area relates to the processes and patterns in the natural environment. For the purpose of this assessment, the following processes and patterns have been investigated. Geology, soil, topography and landforms, climate and meteorology, surface water and ground water.

Biological attributes

Biological attributes for the purpose of this study includes the distribution of species and ecosystems in geographic space and through geological time. Organisms and biological communities often vary in a regular fashion along geographic gradients of latitude, elevation, isolation and habitat area. The two main branches assessed will be:

Phytogeography is the branch of biogeography that studies the distribution of plants.

Zoogeography is the branch that studies distribution of animals.

Social attributes

Social attributes is closely related to social theory in general and sociology in particular, dealing with the relation of social phenomena and its spatial components.

Economic attributes

Economic attributes includes the location, distribution and spatial organization of economic activities and also takes into account social, cultural, and institutional factors in the spatial economy of the development.

Heritage attributes

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of paleontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural attributes

Cultural attributes relates to the specific characteristics such as language, religion, ethnic and racial identity, and cultural history & traditions of people. These attributes influences family life, education, economic and political structures, and, of course, business practices.

It should be noted that the above mentioned attributes do not occur in isolation and it is not uncommon for an identified impact to overlap with two or more of these attributes. Also note, not all risks require comprehensive and detailed assessment. Solid problem formulation should allow decision-makers to evaluate the extent of subsequent analysis required. The level of effort put into assessing each risk should be proportionate to its significance and priority in relation to other risks, as well as its complexity, by reference to the likely impacts. Consideration should be given to stakeholders' perceptions of the nature of the risk.

9.2 ENVIRONMENTAL IMPACT MANAGEMENT OUTCOMES

The following **Environmental Impact Management Outcomes** has been identified:

1. A full copy of the signed EA from DENC in terms of NEMA, granting approval for the development must be available on site
2. A copy of the EMPr as well as any amendments thereof must be available on site
3. A suitably qualified ECO must be appointed.

4. Impacts on the environment must be minimised during site establishment and the development footprint must be kept to the approved development area.
5. Vegetation clearing may not commence until such time as the development footprint has been clearly defined.
6. No clearance of vegetation outside of the development footprint may occur.
7. At the end of the construction phase the site and its surrounding area must be free from any pollution that originated as a result of the construction activities.
8. No disturbance of topsoil & subsoil may commence until such time as the development footprint has been clearly defined.
9. No disturbance of topsoil & subsoil outside of the development footprint may occur.
10. At the end of the construction phase the site and its surrounding area must be free from any chemical, fuel, oil and cement spills that originated as a result of the construction activities.
11. At the end of the construction phase the site and its surrounding area must be free from any sewage that originated as a result of the construction activities.
12. At the end of the construction phase the site and its surrounding area must be free from any hazardous or general waste pollution that originated as a result of the construction activities.
13. Dust prevention measures must be applied to minimise the generation of dust.
14. Noise prevention measures must be applied to minimise the generation of unnecessary noise pollution as a result of construction activities on site.
15. Absolutely no burning of waste is permitted.
16. Fires will only be allowed in facilities especially constructed for this purpose.
17. No hunting of animals will be allowed.
18. No intentional destruction of any sites, features or material of cultural heritage (archaeological and/or historical) origin or significance may occur.
19. All Contractors and sub-contractors must abide to the rules and regulations of the Occupational Health and Safety Act, 85 of 1993.

10. MITIGATION MEASURES

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
ENVIRONMENTAL DOCUMENTATION REPORTING AND COMPLIANCE	A full copy of the signed EA from DENC in terms of NEMA, granting approval for the development must be available on site	Obtain the Environmental Authorization and plan to have a copy of the signed EA on site.	Ensure that a signed copy of the EA is available in the site office	No action required	The Applicant, assisted by the EAP to be monitored by the ECO
	A copy of the EMPr as well as any amendments thereof must be available on site	Ensure that a site specific EMPr is compiled and approved and plan to have a copy of the approved document on site	Ensure that a copy of the approved EMPr is available in the site office	No action required	The Applicant, assisted by the EAP to be monitored by the ECO
	A suitably qualified ECO must be appointed.	Prior to the start of construction activities, an ECO must be appointed to ensure that an Environmental Control document is compiled. This document must explain the roles and	Ensure that the ECO document is available on site and that everyone on site is informed and trained regarding their Environmental obligations in terms of the EA and EMPr. Records of training sessions must be kept on site.	No action required	The Applicant and the ECO

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
		responsibilities of everyone involved and must also contain an Environmental awareness training manual.			
			ECO's report must be an item on monthly site meeting agenda	No action required	The project manager.
		The ECO must ensure that the contractor provides method statements for the various environmental aspects.	The method statements must be available in the site office	No action required	The Applicant and the contractor must ensure that the method statements are developed and approved by the ECO
SITE ESTABLISHMENT	Impacts on the environment must be minimised during site establishment and the development footprint must be kept to the approved development area.	A Land surveyor must peg the parameters of the development footprint.	Construction vehicles, machinery and workers must be restricted to only operate within the approved development footprint.	No action required	The developer must ensure that a Land surveyor pegs the parameters of the development footprint and that all concerned are trained in this regard. The ECO
			The development footprint must be clearly demarcated and the extent of this area must be communicated to all contractors and sub-contractors.		
			Existing access roads must be utilised to access the site camp(s) and working/ construction areas		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			Appropriate traffic management strategies must be implemented to ensure the safety of construction vehicles and other road-users. If needed, signage to warn other road users of the presence of construction vehicles should be erected at appropriate locations, where the signage will be clearly visible to potentially affected road users.		will monitor compliance.
VEGETATION CLEARING	Vegetation clearing may not commence until such time as the development footprint has been clearly defined.	A Land surveyor must peg the parameters of the development footprint.	Land clearing must be restricted to the demarcated working area, and no vegetation may be cleared outside of the demarcated working area.	Infestation by alien invasive species could replace indigenous vegetation or potential areas where indigenous vegetation could recover. It is in particular declared alien invasive species such as <i>Melia azedarach</i> (Syringa) or alien invasive Australian <i>Acacia</i> species (Australian Wattles) that should not be allowed to	The developer must ensure that a Land surveyor pegs the parameters of the development footprint and that all concerned are trained in this regard. The ECO will monitor compliance.
	No clearance of vegetation outside of the development footprint may occur.				

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
				<p>establish. Once established combatting these alien invasive plant species may become very expensive in the long term. If the development is approved an opportunity presents itself to cultivate indigenous plant species which would benefit urban nature conservation</p>	
STORM AND WASTE WATER MANAGEMENT	At the end of the construction phase the site and its surrounding area must be free from any pollution that originated as a result of the construction activities.	The developer must compile a storm water management plan.	<p>Runoff from the cement/ concrete batching areas must be strictly controlled, and contaminated water must be collected, stored and either treated or disposed of off-site, at a location approved by the project manager</p> <p>All spillage of oil onto concrete surfaces must be controlled by the use of an approved absorbent material and the used absorbent material disposed of at an appropriate waste disposal facility.</p>	No action required	<p>The developer must ensure that a storm water management plan is developed.</p> <p>The ECO must monitor compliance.</p>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>No wastewater may run freely into any naturally vegetated areas. Run-off containing high sediment loads must not be released into drainage channels</p> <p>Approval must be obtained from DW&S for any activities that require authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998).</p> <p>Surface water or storm water must not be allowed to concentrate, or to flow down cut or fill sloped routes without erosion protection measures being in place</p> <p>Ensure that storm water channels do not discharge straight down contours. These must be aligned at such an angle to the contours that they have the least possible gradient</p> <p>To reduce the loss of material by erosion, the contractor must ensure that disturbance on site is kept to a minimum. The contractor is responsible for rehabilitating all eroded areas in such a way that the erosion potential is minimised after construction has been completed</p>		
TOPSOIL & SUBSOIL	No disturbance of topsoil & subsoil may commence until such time as the	A Land surveyor must peg the parameters of the	Land clearing must be restricted to the demarcated working area, and no disturbance of topsoil & subsoil outside of the demarcated working area will be allowed.	No action required	The developer must ensure that a Land surveyor pegs the

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	development footprint has been clearly defined.	development footprint.	<p>Removed topsoil and subsoil should be stockpiled for the duration of the active construction period, and utilized for the final landscaping and rehabilitation of disturbed areas.</p> <p>The topsoil must be adequately protected from being blown away or eroded by storm water. The topsoil storage area must be located on a level area outside of any surface drainage/ storm-water channels, and at a location where it can be protected from disturbance during construction and where it will not interfere with construction activities.</p> <p>Removed subsoil should be stockpiled separately from topsoil. Handling of topsoil should be minimized as much as possible, and the location of the topsoil berm should be chosen carefully to avoid needing to relocate the topsoil berm at a later date. Ideally, topsoil is to be handled twice only, once to strip and stockpile, and once to replace, level, shape and scarify. The topsoil berm may be a few meters wide but should ideally not be more than 0.5m high to allow sufficient light and air penetration.</p>		<p>parameters of the development footprint and that all concerned are trained in this regard.</p> <p>The Contractor will be responsible for the removal and correct stockpiling of the topsoil and subsoil.</p> <p>The ECO will monitor compliance.</p>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	No disturbance of topsoil & subsoil outside of the development footprint may occur.		Topsoil should be the final layer applied during rehabilitation, after subsoil/ spoil material has been placed and shaped.		
DANGEROUS AND TOXIC MATERIALS	At the end of the construction phase the site and its surrounding area must be free from any chemical, fuel, oil and cement spills that originated as a result of the construction activities.	CHEMICALS			The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard. The ECO will monitor compliance.
		The Contractor must provide method statements for the storage and handling of chemicals on site.	All hazardous substances must be stored in suitable containers as defined in the Method Statement;	No Action required	
			Containers must be clearly marked to indicate contents, quantities and safety requirements		
			All storage areas must be bunded. The bunded area must be of sufficient capacity to contain a spill / leak from the stored containers		
			Bunded areas to be suitably lined with a SABS approved liner		
			An Alphabetical Hazardous Chemical Substance (HCS) control sheet must be drawn up and kept up to date on a continuous basis		
			All hazardous chemicals that will be used on site must have Material Safety Data Sheets (MSDS);		
			All employees working with HCS must be trained in the safe use of the substance and according to the safety data sheet		
Employees handling hazardous substances / materials must be aware of the potential					

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			impacts and follow appropriate safety measures. Appropriate personal protective equipment must be made available		
		FUEL AND OIL			
		The Contractor must provide method statements for the storage and handling of fuel and oil on site.	The Contractor must ensure that diesel and other liquid fuel, oil and hydraulic fluid is stored in appropriate storage tanks or in bowsers	No Action required	The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard. The ECO will monitor compliance.
			Fuel storage tanks must be located in a portion of the construction camp where they do not pose a high risk in terms of water pollution (i.e. they must be located away from water courses)		
			The tanks/ bowsers must be situated on a smooth impermeable surface (concrete) with a permanent bund. The impermeable lining must extend to the crest of the bund and the volume inside the bund must be 110% of the total capacity of all the storage tanks/ bowsers		
			The floor of the bund must be sloped, draining to an oil separator		
			Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained		
			All empty externally dirty drums must be stored on a drip tray or within a bunded area		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>Spill kits must be available on site and in all vehicles that transport hydrocarbons for dispensing to other vehicles on the construction site. Spill kits must be made up of material/product that is in line with environmental best practice (SUNSORB is a recommended product that is environmentally friendly)</p> <p>Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used</p> <p>The responsible operator must have the required training to make use of the spill kit in emergency situations</p> <p>In the event of a spill, contaminated soil must be collected in containers and stored in a central location and disposed of according to the National Environmental Management: Waste Act 59 of 2008.</p> <p>During servicing of vehicles or equipment, a suitable drip tray must be used to prevent spills onto the soil.</p> <p>Leaking equipment must be repaired immediately or be removed from site to facilitate repair</p>		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>Construction area must be monitored for oil and fuel spills</p> <p>Drip trays (minimum of 10cm deep) must be placed under all vehicles that stand for more than 24 hours. Vehicles suspected of leaking must not be left unattended, drip trays must be utilised. The surface area of the drip trays will be dependent on the vehicle and must be large enough to catch any hydrocarbons that may leak from the vehicle while standing.</p>		
		CONCRETE AND CEMENT			
		<p>The contractors must provide and maintain a method statement for "cement and concrete batching". The method statement must provide information on proposed storage, washing & disposal of cement, packaging, tools and plants</p>	<p>The mixing of concrete must only be done at specifically selected sites on mortar boards or similar structures to contain run-off into soils rocky outcrops, streams and natural vegetation</p>	<p>No Action required</p>	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
	<p>Cleaning of cement mixing and handling equipment must be done using proper cleaning trays</p>				
	<p>All empty containers must be stored in a dedicated area and later removed from the site for appropriate disposal at a licensed facility</p>				
	<p>Any spillage that may occur must be investigated and immediate remedial action must be taken</p>				
	<p>The visible remains either of concrete, solid, or from washings, must be physically removed</p>				

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>immediately or disposed of as waste to a registered landfill site</p> <p>Cement batching areas must be located in an area where residues are contained and that the location does not fall within storm water channels</p>		
TOILETS AND ABLUTION FACILITIES	At the end of the construction phase the site and its surrounding area must be free from any sewage that originated as a result of the construction activities.	The contractor must provide method statement for the operation and maintenance of toilets and ablution facilities	The contractor is responsible for providing all sanitary arrangements for his and the sub-contractors team. A minimum of one chemical toilet must be provided per 30 persons and should include male and female toilets.	No Action required	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
			Sanitary arrangements must be to the satisfaction of the ECO. The contractor must keep the toilets in a clean, neat and hygienic condition. The contractor must supply toilet paper to all toilets at all times. Toilet paper dispensers must be provided in all toilets		
			The contractor must be responsible for the cleaning, maintenance and servicing of the toilets. The contractor must ensure that no spillage occurs when the toilets are cleaned or emptied.		
			The use of ablution facilities and or mobile toilets must be used at all times and no indiscriminate use of the veld for the purposes of ablutions must be permitted under any		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>circumstances</p> <p>Toilets out on site must be secured to the ground and have a sufficient locking mechanism operational at all times</p>		
WASTE MANAGEMENT	At the end of the construction phase the site and its surrounding area must be free from any hazardous or general waste pollution that originated as a result of the construction activities.	The contractors must provide and maintain a method statement for "solid waste management". The method statement must provide information on the proposed licensed facility to be utilised and details must be kept of record keeping for auditing purposes	<p>Waste must be separated into recyclable and non-recyclable waste, and must be separated as follows:</p> <ul style="list-style-type: none"> • Hazardous waste: including (but not limited to) old oil, paint, etc. • General waste: including (but not limited to) paper, plastic, glass and construction rubble 	No Action required	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
			Any illegal dumping of waste must not be tolerated, this action will result in a fine and if required further legal action will be taken. This aspect must be closely monitored and reported on; proof of legal dumping must be able to be produced on request.		
			Bins must be clearly marked for ease of management		
			All refuse bins must have a lid secured so that animals cannot gain access		
			Sufficient closed containers must be strategically located around the construction site to handle the amount of litter, wastes, rubbish, debris, and builder's waste generated on the site		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>Subcontractor(s) contracts must contain a clause to the effect that the disposal of all construction-generated refuse / waste to an officially approved dumping site is the responsibility of the subcontractor in question and that the subcontractors are bound to the management activities stipulated in this EMP. Proof of this undertaking must be issued to the ECO</p> <p>All solid and chemical wastes that are generated must be removed and disposed of at a licensed waste disposal site. The contractor is to provide proof of such to the ECO</p> <p>Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site</p> <p>A suitably positioned and clearly demarcated waste collection site must be identified and provided The waste collection site must be maintained in a clean and orderly manner. A covered container (Like a skip, with a cover), must be used to contain refuse from campsite bins, rubble and other construction material</p>		
DUST	Dust prevention measures must be applied to minimise the generation of dust.	The contractors must provide and maintain a method statement for "dust control". The	All forms of dust pollution must be managed in terms of the National Environmental Management: Air quality Act, 2004 (Act No 39 of 2004)).	No Action required	The Contractor will be responsible for providing method statements. He

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
		method statement must provide information on the proposed source of water to be utilised.	<p>Acceptable dust fall rates for residential areas are: Dust fall rate (D) (mg/m²/day, 30 days average): D<600 Permitted frequency of exceeding dust fall rate: Two within a year, not sequential months</p> <p>A standard test method to be used for measuring dust fall rate and the guideline for locating sampling points shall be ASTM D1739. The latest version of this method shall be used.</p> <p>Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces must be revegetated or stabilised as soon as is practically possible.</p> <p>Excavation, handling and transport of erodible materials must be avoided under high wind conditions or when a visible dust plume is present</p> <p>The construction camp must be watered during dry and windy conditions to control dust fallout.</p> <p>Dust production must be controlled by regular watering of roads and work area, should the need arise</p>		<p>will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>During high wind conditions, the ECO must evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level</p> <p>Where possible, soil stockpiles must be located in sheltered areas where they are not exposed to the erosive effects of the wind</p> <p>Where erosion of stockpiles becomes a problem, erosion control measures must be implemented at the discretion of the ECO</p> <p>Vehicle speeds must not exceed 40 km/h along dust roads or 20 km/h when traversing unconsolidated and non-vegetated areas</p>		
NOISE	Noise prevention measures must be applied to minimise the generation of unnecessary noise pollution as a result of construction activities on site.	The contractors must provide and maintain a method statement for noise.	<p>All vehicles and machinery must be fitted with appropriate silencing technology and must be properly maintained.</p> <p>Develop a Code of Conduct for the construction phase in terms of behaviour of construction staff. Operating hours as determined by the environmental authorisation are adhered to during the development phase. Where not defined, it must be ensured that development activities must still meet the impact management outcome related to noise Management.</p>	No Action required	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>It is proposed that normal working hours are between 08h00 and 17h00 (Mondays to Saturdays). No work will be allowed on Sundays or outside of the abovementioned hours.</p> <p>Any complaints received by the Contractor regarding noise must be recorded and communicated. Where possible or applicable, provide transport to and from the site on a daily basis for construction workers.</p>		
FIRES	Absolutely no burning of waste is permitted.	The contractors must provide and maintain a method statement for "fires", clearly indicating where and for what, fires will be utilised plus details on the fuel to be utilised	Absolutely no burning of waste is permitted.	No Action required	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
	Fires will only be allowed in facilities especially constructed for this purpose.		Fires will only be allowed in facilities especially constructed for this purpose within fenced Contractor's camps. Wood, charcoal or anthracite are the only fuels permitted to be used for fires. The contractor must provide sufficient wood (fuel) for this purpose.		
			Fires within the designated areas must be small in scale so as to prevent excessive smoke being released into the air.		
			The contractor must designate a smoking area for the labour force so as to prevent unanticipated incidents of veldt fires.		
			No wood is to be collected, chopped or felled for fires from private or public property as well		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			as from no-go or sensitive areas within the site and any surrounding natural vegetation		
FAUNA	No hunting of animals will be allowed.	Plan to ensure that all activities on site must comply with the regulations of the Animal Protection Act, 1962 (Act No. 71 of 1962)	<p>All construction workers must be informed that the intentional killing of any animal is not permitted as faunal species are a benefit to society. Poaching is illegal and it must be a condition of employment that any employee caught poaching will be dismissed. Employees must be trained on how to deal with fauna species as intentional killing will not be tolerated. In the case of a problem animal e.g. a large snake, a specialist must be called in to safely relocate the animal.</p> <p>Environmental induction training and awareness must include aspects dealing in safety with wild animals into and on site. Focus on animals such as snakes and other reptiles that often generate fear by telling workers how to move safely away and to whom to report the sighting. Workers should also be informed where snakes most often hide so that they can be vigilant when lifting stones, etc.</p>	No Action required	<p>The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
HERITAGE	No intentional destruction of any sites, features or material of cultural heritage	Conduct a Phase 1 HIA for the development to identify any sites, features or material	In terms of the National Heritage Act, 1999 (Act No. 25 of 1999), construction personnel must be alert and must inform the local heritage agency within 48 hours should they come across any signs of heritage resources.	No action required.	<p>The developer and applicant.</p> <p>Study to be conducted by a</p>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	(archaeological and/or historical) origin or significance may occur.	of cultural heritage (archaeological and/or historical) origin or significance, as well as a Paleontological desktop study to determine the likelihood of fossils to be found on site.	<p>Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance.</p> <p>Should any archaeological artefacts / fossils be exposed during site activities, work on the area where the artefacts / fossils were found must cease immediately and the ECO must be notified immediately.</p> <p>All work must cease immediately, if any human remains are uncovered. Such material, if exposed, must be reported to the South African Police Services, so that a systematic and professional investigation can be undertaken. Sufficient time must be allowed to remove/collect such material before development recommences</p>		<p>suitable qualified specialist.</p> <p>Findings to be monitored by the ECO.</p>
CRIME, SAFETY AND SECURITY	All Contractors and sub-contractors must abide to the rules and regulations of the Occupational Health and Safety Act, 85 of 1993.	Plan to appoint a health and safety officer for the construction site.	The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the National Building Regulations	No actions required	Health and safety officer.
		Compile an Emergency Response Action Plan (ERAP) prior to the commencement of the project	The contractor must ensure that all emergency procedures are in place prior to commencing work. Emergency procedures must include (but not be limited to) fire, spills, contamination of the ground, accidents to employees, use of hazardous substances and materials, etc.		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>The contractor must ensure that lists of all emergency telephone numbers / contact persons are kept up to date and that all numbers and names are posted at relevant locations throughout the construction site.</p> <p>Identify fire hazards, demarcate and restrict public access to these areas as well as notify the local authority of any potential threats e.g. large brush stockpiles, fuels etc.</p> <p>All unattended open excavations must be adequately fenced or demarcated.</p> <p>Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.</p> <p>Ensure that the workforce is sensitised to the effects of sexually transmitted diseases, especially HIV AIDS. The Contractor must ensure that information posters on AIDS are displayed in the Contractor Camp area</p> <p>Workers must be instructed not to trespass onto adjacent land. Trespassers will be prosecuted.</p>		

11. ENVIRONMENTAL AWARENESS PLAN

11.1 INTRODUCTION

Training is essential for ensuring that the EMP provisions are implemented efficiently and effectively. It is vital that all personnel are adequately trained to perform their designated tasks to an acceptable standard.

The Construction Contractor should make allowance for all construction workers, including all subcontractors that will be working at the site, to attend environmental awareness training sessions (undertaken by the ECO) before commencing work on site. During this training, the ECO will explain the EMP and the conditions contained therein. Attention will be given to the construction process and how the EMP fits into this process.

In addition to training, general environmental awareness must be fostered among the project's workforce to encourage the implementation of environmentally sound practices throughout its duration. This ensures that environmental accidents are minimized and environmental compliance maximized.

Environmental awareness training and education should be ongoing throughout the construction phase, and should be undertaken regularly if deemed necessary (especially if it becomes apparent that there are repeat contraventions of the conditions of the EMP), or as new workers come to site. Translators should be utilized where needed.

Environmental awareness could be fostered in the following manner:

- Induction course for all workers on site, before commencing work on site.
- Refresher courses as and when required.
- Daily toolbox talks at the start of each day with all workers coming on site, where workers might be alerted to particular environmental concerns associated with their tasks for that day or the area/habitat in which they are working.

Courses must be given by suitably qualified personnel and in a language and medium understood by workers/employees.

11.2 ORGANISATIONAL STRUCTURE

This section describes the roles and responsibilities of the key stakeholders involved in the development, implementation and review of the EMP.

11.2.1 PROJECT PROPONENT

The Project Proponent will be the **Joe Morolong Local Municipality**. Ultimately, they will be responsible for the development and implementation of the EMP and for ensuring that the conditions in the eventual Environmental Authorization (EA) are satisfied. Although construction activities will be contracted out, the

liability associated with non-compliance still rests with the Project Proponent. The Project Proponent (and not the Contractor) is therefore responsible for liaising directly with the relevant authorities with respect to the preparation and implementation of the EMP and meeting EA conditions.

The Project Proponent must inform the Contractor of the EA and EMP obligations, as well as **Method Statements** to be prepared and environmental training to be undertaken by the Contractor in terms of these obligations.

The Project Proponent must identify a **Project Manager (PM)** who has overall responsibility for managing the Project, Contractors and for ensuring that the environmental management requirements are met. During the construction phase, the Project Manager will be the Proponent's construction manager; during the operations phase this role will be fulfilled by the operations manager.

All decisions regarding environmental procedures and protocol must be approved by the Project Manager, who also has the authority to stop any construction activity in contravention of the EMP or EA.

An **Environmental Control Officer (ECO)** must be employed by the Project Proponent for the duration of the project. The ECO should have appropriate training and experience in the implementation of environmental management specifications. The ECO provides feedback to the Project Manager regarding all environmental matters. Contractors are answerable to the ECO (or Project Manager, depending on contractual arrangements) for non-compliance with the requirements stated in the EMP or EA.

11.2.2 ENVIRONMENTAL CONTROL OFFICER (ECO)

The appointed Environmental Control Officer (ECO) is responsible for monitoring the site at regular intervals (including pre-construction set-up and final rehabilitation), in order to ensure that the provisions of this EMP is adhered to and that sound environmental management is ensuing on site.

The ECO must inspect all areas of the site that may be affected by construction-related activities, including the working area, site camp, stockpile areas and access roads. After each ECO inspection the ECO must compile an ECO report detailing the ECO's observations on site, any instances of non-compliance and any issues or aspects that require attention, follow-up or remedial action. The ECO reports must be submitted to the Applicant, the ER, Construction Contractor(s) and the Competent Authority. The ECO inspection reports should include both photographic and written records.

The ECO will have the following responsibilities:

- Maintenance, update and review of the EMP.
- Liaison between the Project Proponent, Contractors, authorities and other lead stakeholders on all environmental concerns.
- Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective.
- Monitoring the performance of the Contractor (and Sub-contractors) and ensuring compliance with the EMP and associated Method Statements.

- Validating the regular site inspection reports, which are to be prepared by the Contractor's Environmental Officer (EO).
- Checking the EO's *record of environmental incidents* (spills, impacts, legal transgressions etc) as well as corrective and preventive actions taken.
- Checking the EO's *public complaints register* in which all complaints are recorded, as well as action taken.
- Issuing of site instructions to the Contractor for corrective actions required.
- Assisting in the resolution of conflicts.
- Communication of all modifications to the EMP to the relevant stakeholders.
- Conducting regular audits to ensure that the system for implementing the EMP is operating effectively.

11.2.3 CONTRACTOR

The Contractor should appoint a **Contractor's Representative**, who is responsible for the on-site implementation of the EMP and EA. The Contractor's representative can be the site agent; site engineer; a dedicated environmental officer; or an independent consultant. The Contractor must ensure that the Contractor's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the Environmental Control Officer and the public. The Contractor's Representative ensures that all Sub-contractors working under the Contractor abide by the requirements of the EMP.

The Contractor is answerable to the Project Manager (PM) for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria.

The Contractor will be required to provide the following **Method Statements**, setting out in detail how the management actions contained in an EMP and EA will be implemented in order to ensure that the environmental management objectives are achieved. The Method Statements must be reviewed and approved by the Project Proponent.

- > Stockpiles
- > Excavation stabilisation
- > Oil and chemicals
- > Cement
- > Storage of fuel and oils
- > Use of dangerous and toxic materials
- > Toilets and ablution facilities

- > Waste Management
- > Dust
- > Workshop equipment, maintenance and storage
- > Noise
- > Fires
- > Erosion and sedimentation
- > Flora and Fauna (Including no-go areas)
- > Crime, safety and security
- > Hydrology

The Contractor may appoint an **Environmental Officer (EO)**, or officers, if more than one is required. Their primary role is to coordinate the environmental management activities of the Contractor on site. The EO may be required to perform the following roles:

- Support the ECO in the monitoring and execution of the Contractors or Sub-contractors' Method Statements by maintaining a permanent presence on site.
- Inspect the site as required to ensure adherence to the management actions of the EMP, EA and the Method Statements.
- Complete Site Inspection Forms on a regular basis (eg. daily or weekly).
- Provide inputs to the regular (eg. monthly) environment report to be prepared by the ECO.
- Liaise with the construction team on issues related to implementation of, and compliance with, the EMP and EA.
- Maintain a *record of environmental incidents* (spills, impacts, legal transgressions etc) as well as corrective and preventive actions taken, for submission to the Project Proponent.
- Maintain a *public complaints register* in which all complaints are recorded, as well as action taken, for submission to the Project Proponent.

11.3 CHECKLISTS

The table below provide the main mitigation measures and/or management interventions to minimise or reduce the negative impacts and enhance positive impacts identified by the specialists associated with the proposed development.

The intent is for the document to be a live, dynamic document that should be maintained and updated throughout the project lifecycle, *inter alia*, by including the necessary Environmental Authorisation from the approving Authority as an attachment.

The table below provide the main mitigation measures and/or management interventions appropriate to the Planning and Construction Phases of the proposed project. The tables present the objectives to be achieved and the management actions that need to be implemented in order to reduce the negative impacts and enhance the positive impacts per management activity. The associated monitoring and implementation frequencies and the responsible person(s) are indicated.

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
1. Construction and operational activities planning	The construction/operational activities must conform to the conditions of authorisation contained in the Environmental Authorisation and mitigation measures contained within this EMPr	Proponent	Continuous
2. Appointment of the ECO	The Proponent must appoint an independent Environmental Control Officer (ECO) who must monitor the Contractor's compliance with the EMPr and who must complete ECO checklist reports (audits) on a regular basis (at least once a month).	Proponent	Once-off
	The Proponent must provide the ECO with a copy of the EMPr.	ECO	Once-off
	The ECO must form part of the project management team and should attend the monthly project progress meetings.	ECO	Continuous
	The Contractor must ensure that the construction crew attend an environmental briefing and training session presented by the ECO prior to commencing activities on site.	ECO, Contractor	Once-off
3. EMPr	This EMPr must be made binding to the main Contractor and to individual Contractors, and must be included in the tender documentation for the construction contract.	Proponent	Once-off
4. Licences/ permits and permissions	The Proponent must ensure that all pertinent licences/permits, certificates and permissions required for the project have been obtained prior to any activities commencing on site and ensure that they are strictly enforced/adhered to. These documents must be made available on site at all times, and the Contractor must be made aware of their content.	Contractor, Proponent, ECO	Prior to commencement of work
	The Contractor must maintain a database of all pertinent permits and permissions required for the contract.	Contractor, Proponent, ECO	Continuous
5. Method Statements	The Contractor must submit written Method Statements to the PM and ECO for the activities identified during consultation.	Contractor, PM, ECO	As required
	Method Statements must be submitted at least five working days prior to the proposed commencement of work on an activity to allow the PM (and/or ECO) time to study and approve the method statement.	Contractor, PM, ECO	As required
	The Contractor may not commence work on that activity until such time as the Method Statement has been approved in writing.	Contractor, PM, ECO	Continuous
	The Contractor must carry out the activities in accordance with the approved Method Statement.	Contractor, PM, ECO	Continuous

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	Under certain circumstances, the PM may require changes to an approved Method Statement. In such cases the proposed changes must be agreed upon in writing between the Contractor and the PM, and appropriate records retained.	Contractor, PM, ECO	Continuous
	Approved Method Statements must be readily available on the site and must be communicated to all relevant personnel. Approval of the Method Statement shall not absolve the Contractor from any of his/her obligations or responsibilities in terms of the EMPr specifications.	Contractor, Proponent	Continuous
6. Existing services and infrastructure	The Contractor must ensure that existing services (e.g. roads, pipelines, power lines and telephone services) are not damaged or disrupted unless required by the contract and with the permission of the PM, ensuring the necessary way-leaves; permissions and permits are in place.	Contractor, PM, ECO	Continuous
	The Contractor must be responsible for the repair and reinstatement of any existing infrastructure that is damaged, or services which are interrupted, at his/her own cost.	Contractor	As required
	The Contractor must adhere to any time limits for the repairs that may be stipulated by the PM in consultation with the Contractor.	Contractor, ECO	As required
7. Environmental incidents	The Contractor must take timeous corrective action to mitigate an incident appropriate to the nature and scale of the incident and must also rehabilitate any residual environmental damage caused by the incident or by the mitigation measures themselves. The Contractor must adhere to any time limits for such corrective actions that may be stipulated by the ECO in consultation with the PM.	ECO, Contractor	Continuous
8. Labour	Local labour must be used wherever possible to stimulate the local economy.	Contractor	Once-off
	The Contractor should use labour intensive construction measures where appropriate, practical and financially feasible.	Contractor	Once-off
	The workforce should be trained to benefit individuals beyond the completion of the project.	Contractor	Once-off
	The Contractor should use local suppliers where possible.	Contractor	Once-off
	The PM must ensure that all staff working on the project must be in possession of a South African Identity Document or a relevant work permit. A register must be kept on site of all staff working on site.	PM	Continuous
	Equal opportunities for employment should be created to ensure that all sectors of society (especially women) have equal access to such opportunities.	Contractor	Continuous
9. Training of staff	The Contractor must ensure that all construction staff receive environmental awareness training concerning, amongst others, the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts, protection of any animals encountered on site, no-go areas, the use of toilets and basic sanitation, and basic health and safety on site.	Contractor, ECO	Once-off
	It is the Contractor's responsibility to provide the site foreman with environmental training (including explaining the content of the EMPr and any Conditions of Approval) and is to ensure that the foreman has sufficient understanding to pass this information onto the construction staff.	Contractor, ECO	Once-off
	Training must be provided to the staff members in the use of the appropriate fire-fighting equipment.	Contractor, Health and Safety Officer	Once-off
	The Contractor must ensure that all staff operating machinery/construction vehicles are adequately trained to carry out the designated tasks.	Contractor, Health and Safety Officer	Once-off

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
10. Worker health and safety	<p>A Health and Safety Plan must be developed and implemented by the Contractor for the construction period to ensure worker safety.</p> <p>Should any injury be obtained as a result of work the Contractor must ensure the necessary medical attention is received.</p> <p>The necessary Health and Safety file and incident register must be kept on site at all times.</p>	Contractor, Health and Safety Officer	Continuous
11. Site access & traffic management	Construction vehicles, machinery and workers must be restricted to the designated access roads, and may not drive through undeveloped vegetation outside of the existing access route except where that vegetation falls within the authorised working area (development footprint) at the site.	Contractor ECO	Continuous
12. Vegetation clearing	Vegetation clearing may only commence once the working area has been clearly demarcated to the ECO's satisfaction.	Proponent Contractor ECO	Once-off
13. EMPr	This EMPr must be made binding to the main Contractor and to individual Contractors, and must be included in the tender documentation for the construction contract.	Proponent	Once-off
14. Topsoil & subsoil management	<p>Removed topsoil and subsoil should be stockpiled for the duration of the active construction period, and utilized for the final landscaping and rehabilitation of disturbed areas on site.</p> <p>The topsoil must be adequately protected from being blown away or eroded by storm water.</p> <p>Removed subsoil should be stockpiled separately from topsoil.</p> <p>Topsoil should be the final layer applied during rehabilitation, after subsoil/ spoil material has been placed and shaped on the site</p>	Contractor ECO	Continuous
15. Excavations earthworks &	<p>Use of heavy machinery can substantially increase the likelihood, intensity and significance of potential negative environmental impacts, and it is thus essential that earthworks be performed under constant supervision, and that operators must be made aware of all the environmental obligations, as there is always the potential to inflict damage to sensitive areas.</p> <p>Use of machinery should be restricted to only that which is strictly required, and the unnecessary or excessive movement/ use of such machinery must be kept to a minimum.</p> <p>Machinery must enter and exit the site via the indicated access roads, and may not enter/ exit the river channel at any other location.</p> <p>Excavations and earth-moving may only take place within the demarcated working area</p>	Contractor ECO	Continuous
16. Groundwater contamination	Ensure vehicles are serviced and refuelled in bunded areas	Contractor	Continuous
	Ensure vehicles are checked weekly for faults and serviced timeously if faulty	Contractor	As required
	Should any leaks occur ensure contaminated soil is dug up to 1 cm below the level of visible contamination and disposed of as hazardous waste	Contractor	As required
	Drip trays should be placed under all vehicles remaining stationary for more than 24 hours	Contractor	Continuous
17. Noise	Limit construction activities to normal working hours	Contractor	Continuous
	Coincide any excessively noisy activities to minimise duration of inconvenience	Contractor	As required

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	Ensure noise standards are complied with and that construction staff are provided with personal protective equipment when undertaking noisy operations	Contractor	Continuous
18. Safety	No children on construction site. Safety fence and controlled access should be enforced Safety signs with necessary information displayed	Proponent Contractor ECO	Continuous
19. Stockpiles	Soil stockpiles must not be situated within 50m of any water course.	Contractor, ECO	Monthly
	If stockpiles are exposed to windy conditions or heavy rain, they should be covered either by vegetation or cloth, depending on the duration of the project. Stockpiles may further be protected by the construction of berms or low brick walls around their bases.	Contractor, ECO	Monthly
	Stockpiles must be kept clear of weeds and alien vegetation growth by regular weeding.	Contractor, ECO	Monthly
	Where contamination of soil is expected, analysis must be done prior to disposal of excess soil to determine the appropriate disposal method. Proof from an applicable waste disposal site where contaminated soils are dumped if and when a spillage / leakage occur must be provided to the ECO upon request.	Contractor, ECO	Monthly
	Stockpiles must not exceed 2m in height unless otherwise permitted by the PM and / or ECO.	Contractor, ECO	Monthly
20. Erosion control	Wind screening and stormwater control must be undertaken where required by the ECO to prevent soil loss from the site.	Contractor, ECO	Twice monthly
	The use of silt fences and sand bags must be implemented in areas that are susceptible to erosion, if required by the ECO. Other erosion control measures that can be implemented are as follows:	Contractor, ECO Contractor, ECO	Twice monthly
	<ul style="list-style-type: none"> • Brush packing with cleared vegetation; • Mulch or chip packing; • Planting of vegetation; and • Hydro-seeding / hand sowing. 		
	Sensitive areas need to be identified prior to construction so that the necessary precautions can be implemented.	Contractor, ECO	Twice monthly
	All erosion control mechanisms need to be regularly maintained.	Contractor, ECO	Twice monthly
	Re-vegetation of disturbed surfaces must occur as soon as possible after construction activities are completed.	Contractor, ECO	Twice monthly
	No impediment to the natural water flow on site other than approved erosion control or rehabilitation works is permitted.	Contractor, ECO	Twice monthly
	Stockpiles not used in three (3) months after stripping should be seeded to prevent dust and erosion, as advised by the ECO	Contractor, ECO	Twice monthly
21. Hazardous materials	Use and or storage of materials, fuels and chemicals which could potentially leak into the ground must be controlled.	Contractor, ECO	Monthly
	Any hazardous substances must be stored at least 50m from any of the watercourses on site in a bunded area.	Contractor, ECO	Monthly
	The Contractor must ensure that potentially harmful materials are properly stored in a dry, secure, ventilated environment, with concrete or sealed flooring and a means of preventing unauthorised entry. Such materials may also be temporarily stored on drip-trays.	Contractor, ECO	Monthly
	Contaminated wastewater must be managed by the Contractor to ensure existing water resources on the site are not contaminated. All wastewater from general activities in the camp must be collected and removed from the site for appropriate disposal at a licenced waste disposal facility or sewage works.	Contractor, ECO	Monthly
	All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The	Contractor, ECO	Monthly

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	bund wall must be high enough to contain 110% of the total volume of the stored hazardous material. Such bunded areas must be regularly emptied of accumulated rainwater. Wastewater from such emptying, if contaminated, must be disposed at an appropriately licenced waste disposal facility or sewage works.		
	In the event of a spill, the Contractor must take prompt action to clear polluted areas and prevent spreading of the pollutants. The Contractor will be liable to arrange for professional service providers to clear affected areas, if required.	Contractor, ECO	As required
	Proper facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater. These pollution prevention measures for storage must include a bunded containment area with a wall high enough to contain at least 110% of any stored volume. This containment area must be sited at least 50m away from any drainage line, in a site approved by the ECO.	Contractor, ECO	Monthly
	Cement storage and batching must only take place in a bunded area, and any runoff		
	Any spillage, which may occur, must be investigated and immediate action must be taken. This must be reported to the ECO and to the relevant authorities if so required by the ECO.	Contractor, ECO	As required
22. Cement and concrete batching	Concrete must not be mixed on the ground, but in a bunded area with any runoff captured for disposal as hazardous wastewater.	Contractor, ECO	Continuous
	The batching area is to be located in an area of low environmental sensitivity, as approved by the ECO.	Contractor, ECO	Once-off
	Cement bags must only be stored in a covered, bunded area and not directly on the ground. Used cement bags must be disposed of as hazardous waste.	Contractor, ECO	Weekly
23. Hydrology and stormwater	Silt fences must be used where required by the ECO to remove any suspended silt from stormwater before it enters the stormwater system.	Contractor, ECO	Monthly
	Temporary cut-off drains and berms must be used where necessary to capture stormwater and promote infiltration.	Contractor, ECO	Monthly
	Stormwater and surface water must be diverted away from excavation trenches, and care must be taken to avoid surface stormwater from the site running into the seasonal pan on the site.	Contractor, ECO	Monthly
	No rubble, litter or sand may be deposited into any freshwater systems or water courses.	Contractor, ECO	Monthly
24. General materials handling, use and storage	Choice of location for storage areas must take into account prevailing winds, distances to the seasonal watercourses (50m minimum), general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.	Contractor, ECO, Health and Safety Officer	Once-off
	Storage areas must be designated, demarcated and fenced. Storage areas must be secure so as to minimize the risk of crime. They must also be safe from access by unauthorised persons. Fire prevention facilities must be present at all storage facilities.	Contractor, ECO	Monthly
	Material Safety Data Sheets (MSDSs) must be readily available on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs should include information on ecological impacts and measures to minimise negative environmental impacts during accidental spills.	Contractor, ECO, Health and Safety Officer	Once-off, as required
	Clear signage must be placed at all storage areas containing hazardous substances / materials.	Contractor, ECO, Health and Safety Officer	Once-off

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	The Contractor must be responsible for the training and education of all personnel on site who will be handling the hazardous material about its proper use, handling and disposal. The Contractor must ensure that information on the management of spill and accidental ingestion is kept on site. Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.	Contractor, Health and Safety Officer	Once-off
	The provisions of the Hazardous Chemical Substances Regulations promulgated in terms of the Occupational Health and Safety Act 85 of 1993 and the SABS Code of Practice must be adhered to. This applies to solvents and other chemicals possibly used in the construction time.	Contractor, Health and Safety Officer	Continuous
	The Contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.	Contractor, Health and Safety Officer	Continuous
	All excess cement and concrete mixes must be contained on the construction site prior to disposal off site.	Contractor, ECO	Monthly
	Hazardous substances must be stored at least 50m away from any water bodies on site to avoid pollution.	Contractor, ECO	Monthly
25. Fuel storage	Topsoil and subsoil to be protected from contamination.	Contractor, ECO	Monthly
	Fuel and material storage must be away from stockpiles on site in appropriate containers in a bunded area.	Contractor, ECO	Twice monthly
	Chemicals must be mixed on an impermeable surface and provisions must be made to contain spillages or overflows into the soil.	Contractor, ECO	Monthly
	Any storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material. Drip trays may be used for temporary storage of such materials.	Contractor, ECO	Monthly
	Contaminated soil must be contained and disposed of off-site at an approved hazardous waste disposal site.	Contractor, ECO	Monthly
26. Transportation	Material must be appropriately secured to ensure safe passage between destinations during transportation. Loads must have appropriate cover to prevent them spilling from the vehicle during transit. The Contractor must be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Contractor, ECO, Health and Safety Officer	Monthly
27. General management	waste Litter generated by the construction crew must be separated on site into general waste and recyclables and collected in covered rubbish bins. General waste is to be removed to a licenced landfill site on a weekly basis and recyclables must be taken to a recycling centre monthly.	Contractor, ECO	Weekly/ Monthly
	Ensure that no refuse wastes are burnt on the premises or on surrounding premises. No fires shall be allowed on site, unless in designated areas approved by the PM and by the ECO or by the Health and Safety Officer.	Contractor, ECO, PM, Health and Safety Officer	Monthly
	The Contractor must supply waste bins/skips throughout the site at locations where construction personnel are working. The bins must be provided with lids and an external closing mechanism to prevent their contents blowing out and must be scavenger-proof to deter animals that may be attracted to the waste. The Contractor must ensure that all personnel immediately deposit all waste in the waste bins for removal by the Contractor. Bins must be emptied on a weekly basis and the waste removed to the construction camp where it must be properly contained in scavenger, water and windproof containers until disposed of.	Contractor, ECO	Monthly

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	The bins must not be used for any purposes other than waste collection.		
	Ensure that no litter, refuse, wastes, rubbish, rubble, debris and builders waste generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period of the project.	Contractor, ECO	Monthly
	If possible and feasible, all waste generated on site must be separated into glass, plastic, paper, metal and wood and recycled.	Contractor, ECO	Monthly
28. Hazardous waste management	The waste, resulting from the use of hazardous materials, must be disposed of at a registered hazardous waste disposal site by a certified waste disposal Contractor as approved by the ECO. A disposal certificate must be obtained from the disposal Contractor.	Contractor, ECO	As required
	Staff must be trained in the identification of hazardous waste.	Contractor, ECO	As required
	Temporary storage and disposal of hazardous waste is regulated by legislation which must be complied with, i.e. the Occupational Health and Safety Act.	Contractor, ECO	Monthly
29. Noise	The Contractor must aim to adhere to the relevant noise regulations and limit noise to within standard working hours.	Contractor, ECO	Monthly
	Construction site camp and other noisy facilities must be located well away from noise sensitive neighbours.	Contractor, ECO	Once-off
	Truck traffic must be routed away from noise sensitive areas, where possible.	Contractor, ECO	As required
	All noise and sounds generated must adhere to SABS 0103 specifications for maximum allowable noise levels for residential areas. No pure tone sirens or hooters may be utilised except where required in terms of SABS standards or in emergencies.	Contractor, ECO	Monthly
	Noisy operations must be combined so that they occur where possible at the same time.	Contractor, ECO	Monthly
	Construction activities must be contained to reasonable working hours. Night-time activities near noise sensitive receptors must not be allowed.	Contractor, ECO	Monthly
	With regard to unavoidable noisy construction activities, the Contractor must liaise with local residents to inform them of such events.	Contractor	As required
	As construction workers operate in a noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Where necessary, ear protection gear must be worn.	Contractor, ECO, Health and Safety Officer	Monthly
	Noise suppression measures must be applied to all construction equipment where required. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order. Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.	Contractor, ECO, Health and Safety Officer	Monthly
30. Worker health and safety	Safety measures, work procedures and first aid must be implemented on site.	Contractor, Health and Safety Officer	Monthly
	A Health and Safety Plan in terms of the Occupational Health and Safety Act (Act No. 85 of 1993) must be drawn up to ensure worker safety.	Contractor, Health and Safety Officer	Once-off
	Workers must be thoroughly trained in using potentially dangerous equipment.	Contractor, Health and Safety Officer	As required
	Contractors must ensure that all equipment is maintained in a safe operating condition.	Contractor	Monthly

Activity/Impact	Action Required	Responsible Party	Monitoring Frequency
	A safety officer must be appointed.	Contractor	Once-off
	A record of health and safety incidents must be kept on site.	Contractor, , Health and Safety Officer	Monthly
	Any health and safety incidents must be reported to the project manager immediately.	Contractor, , Health and Safety Officer	As required
	First aid facilities must be available on site at all times. All incidents requiring first aid occurring on site must be recorded in the incidents book on site.	Contractor, , Health and Safety Officer	Monthly
	A record must be kept of medication administered or precautions taken and the time and dates when this was done. This can then be used as evidence in court should any claims be instituted against the Contractor.	Contractor, , Health and Safety Officer	Monthly
	Material stockpiles or stacks must be stable and well secured to avoid collapse and possible injury to site workers / local residents.	Contractor, ECO, Health and Safety Officer	Monthly
31. Personal Protective Equipment	Personal Protective Equipment (PPE) must be made available to all construction staff and must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc.	Contractor, ECO, Health and Safety Officer	Monthly
	No person is to enter the portion of the site where construction activities are being undertaken without the necessary PPE.	Contractor, ECO, Health and Safety Officer	Monthly
	SABS Standards and specifications governing dangerous processes such as welding must be strictly applied, with a view to proper protection of the public and workers.	Contractor, ECO, Health and Safety Officer	As required
32. Fauna and Flora	Implement the eradication programme for invasive species in terms of the Conservation of Agricultural Resources Act (Act No. 43 of 1983).	Contractor, ECO	Monthly
	Institute the rehabilitation of areas as soon as construction activity allows it.	Contractor, ECO	As required
	No disturbance, capture or injury of any fauna will be permitted. Should any fauna be found on site it must be removed from site by the ECO or a suitably qualified person.	Contractor, ECO	Continuous

12. MONITORING, AUDITING AND REPORTING

The Applicant **Joe Morolong Local Municipality** is responsible for ensuring that all environmental management measures prescribed in this EMP, as well as any other conditions specified by the relevant authorities, are implemented and adhered to during all phases of the proposed development. The Applicant may delegate the responsibilities for implementing the requirements to other persons/entities, however the Applicant remains responsible for ensuring that the delegated responsibilities are carried out.

It is the responsibility of the project team or their delegate to ensure that regular monitoring of environmental issues addressed in this management plan is undertaken. The applicant is responsible for the monitoring of the infrastructure.

Site inspections to determine maintenance needs during the operational phase are imperative for good housekeeping.

Internal environmental audits must be undertaken at regular monthly intervals throughout the construction phase to ensure compliance.

The applicant will be responsible for maintaining a database of all records pertaining to the environment for the study area.

All incidents such as spills of toxic or any other substance that may negatively affect the environment must be reported to the relevant authorities.

FINES

The ECO can impose fines on the Contractor for any contraventions of this EMPR. The imposition of fines will enable the ECO to ensure that the requirements of the EMPR are taken seriously by the Contractor.

The Contractor shall be advised in writing of the nature of the infringement and the amount of the fine. The Contractor shall also take the necessary steps (e.g. training) to prevent a recurrence of the infringement.

The Contractor is also advised that the imposition of spot fines does not replace any legal proceedings the authorities, landowners and/or members of the public may institute against the Contractor.

In addition to the fine, the Contractor shall be required to make good any damage caused as a result of the infringement at his own expense.