

# 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 196 ha of indigenous vegetation, partially located within a critical biodiversity area, and the installation of bulk services within a watercourse (400mm bulk sewer main), and the construction of a bridge for the proposed township establishment located on a Portion of the remaining extend of Erf 687, Barkly West, Dikgatlong 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 196 ha of indigenous vegetation, partially located within a critical biodiversity area, and the installation of bulk services within a watercourse (400mm bulk sewer main), and the construction of a bridge for the proposed township establishment located on a Portion of the remaining extend of Erf 687, Barkly West, Dikgatlong 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 Civil Engineer
- A Town and Regional Planner
- A SAHRA Specialist and Palaeontological specialist.
- An Ecological Fauna and Flora Habitat specialist
- Registered Environmental Assessment Practitioner (EAP)

They were responsible for the following actions:

- 1) The EAP was contracted by the Applicant, the **Dikgatlong Local Municipality** as their Independent Environmental Assessment Practitioner.
- 2) 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.
- 3) A SAHRA Specialist has been appointed to determine the possible impact of the development on Archaeological and Cultural features.
- 4) A Palaeontologist has been appointed to conduct a Palaeontological desktop assessment in order to assess the likelihood of palaeontological finds.
- 5) A Fauna and Flora specialist has been appointed to determine the impact of the proposed development on the Fauna and Flora of the area.
- 6) A Civil Engineer was appointed to determine the 1:100 year flood line affecting the proposed development.
- 7) An Environmental Screening Process was conducted by the EAP to ensure that all the relevant Environmental Legislation is taken into consideration.
- 8) Desk top studies were conducted and alternatives assessed.
- 9) Site inspections were carried out to verify the outcomes of the desktop studies, and the preferred alternative defined.
- 10) A full Public Participation Process is being followed to obtain inputs from interested and affected parties.
- 11) 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.
- 12) 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 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):<sup>1</sup>**

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:	<a href="mailto:hannieduplooy@abenviro.co.za">hannieduplooy@abenviro.co.za</a>		
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.

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#### PERSONAL PARTICULARS AND CAREER HISTORY OF PROF DE VILLIERS

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##### 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	

## 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

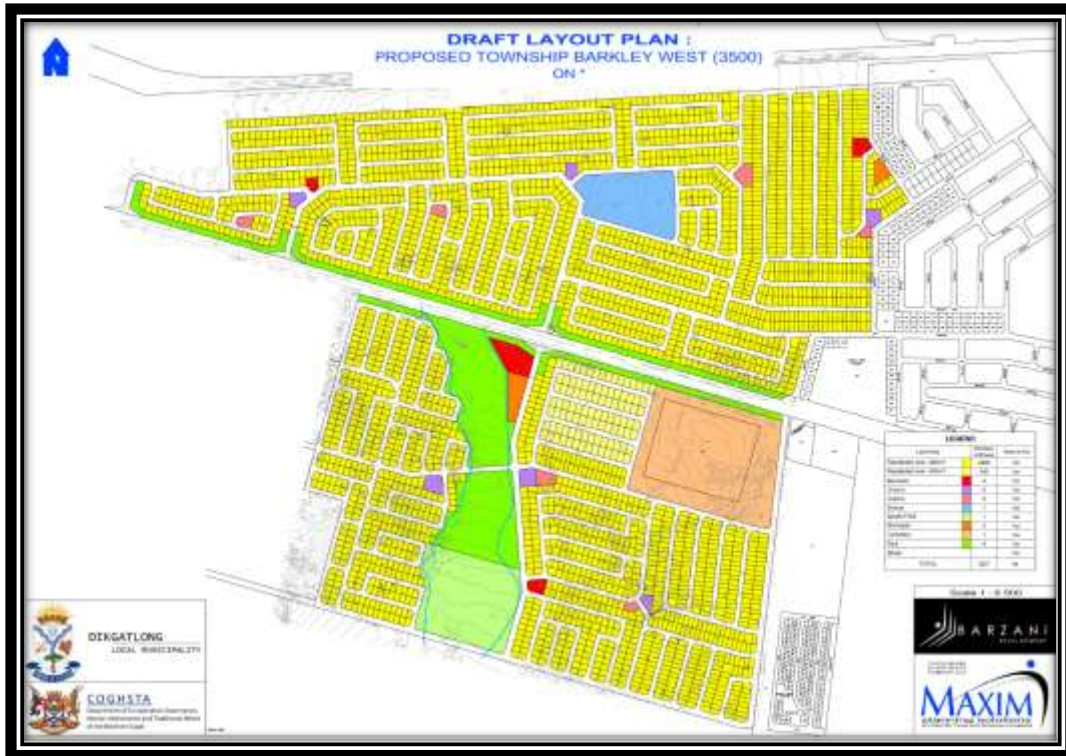
## 5. DESCRIPTION OF THE ACTIVITY

The Applicant, the **Dikgatlong Local Municipality** has appointed **AB Enviro Consult CC**, an independent environmental consultancy, to undertake an Environmental Impact Assessment for the proposed clearance of 196 ha of indigenous vegetation, partially located within a critical biodiversity area, the construction of a bridge and the installation of bulk services within a watercourse, for the proposed township establishment located on a Portion of the remaining extend of Erf 687, Barkly West, Dikgatlong Local Municipality, Northern Cape Province. The proposed development will also include the establishment of a cemetery.

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 may take place beyond the 1:100 year flood line.

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

Residential (min 260 m <sup>2</sup> )	3 400 Stands
Residential (min 400 m <sup>2</sup> )	100 Stands
Business	4 Stands
Churches	6 Stands
Crèche	6 Stands
School	1 Stand
Sports Field	1 Stand
Municipal	2 Stands
Cemetery	1 Stand
Parks	6 Stands
<b>Area of township</b>	<b>196 ha</b>

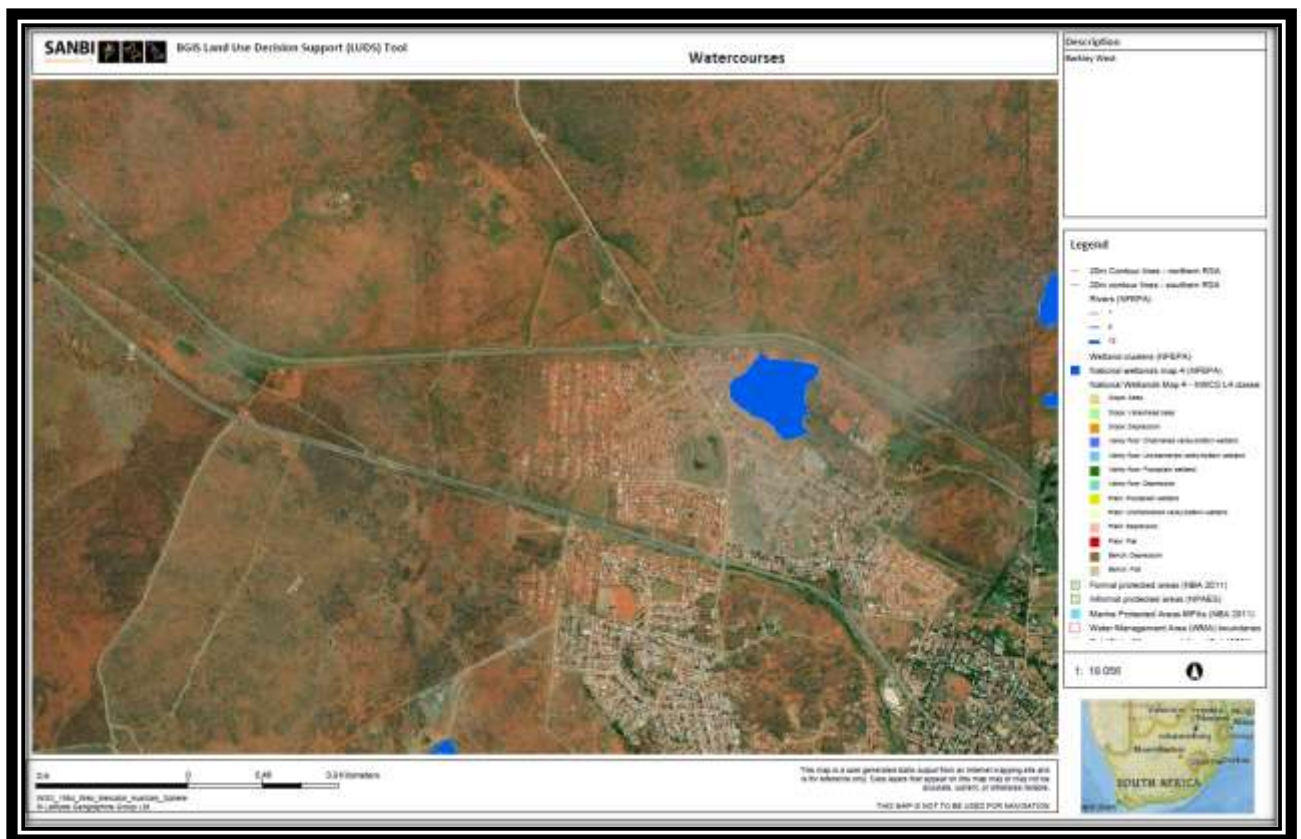


**Figure 1: Layout Plan**  
**CIVIL SERVICES**

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.

**DRAINAGE SYSTEMS**

The sensitivity map for the area (Figure 2: SANBI BGIS Land use Decision Support (LUDS) tool: Watercourses) revealed no streams on or adjacent to the site.



**Figure 2: SANBI BGIS Land use Decision Support (LUDS) tool: Watercourses**

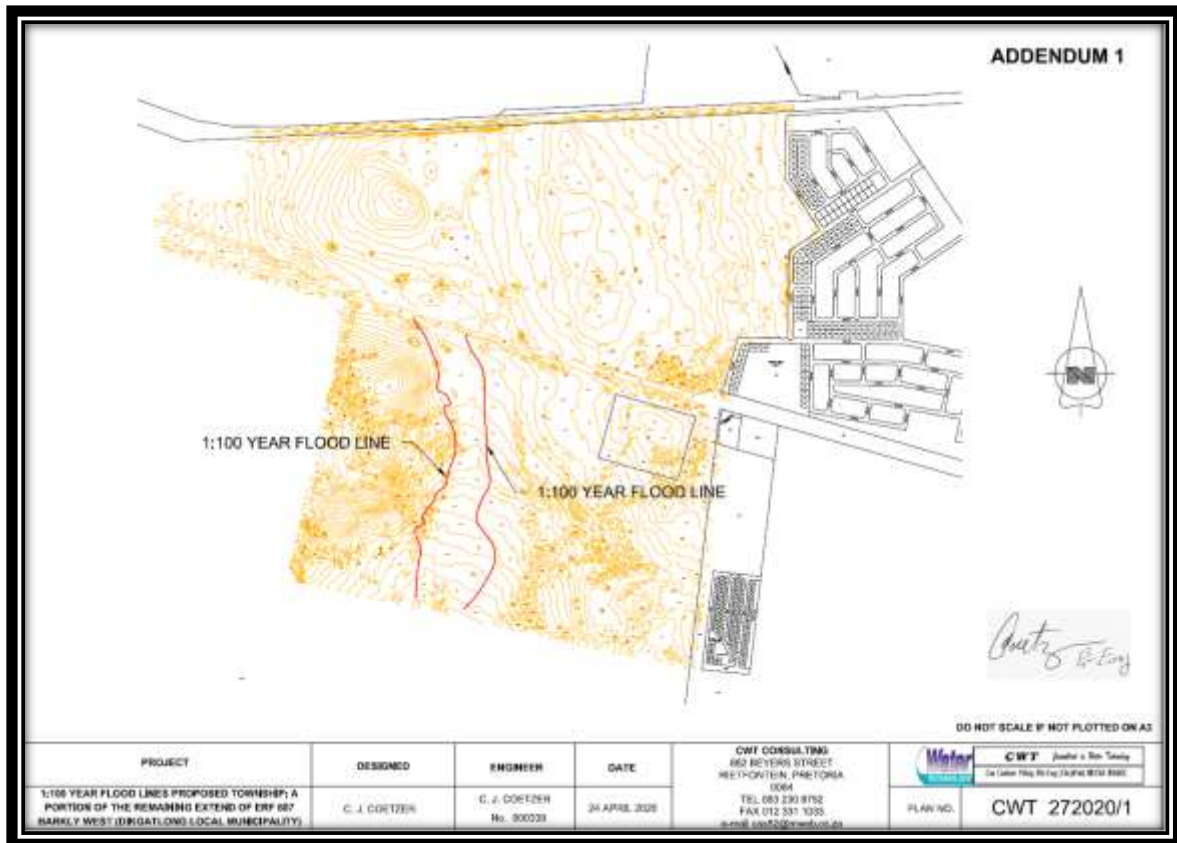
The Flood line Engineer noted the following:

*The storm water flow regime North of the R31 road will be sheet flow. No flood lines will develop in this area. The storm water will be channelled to a point where it will flow over the R31 road into the channelled stream on the Southern property.*

*The storm water flow regime South of the R31 road will be channel flow and therefore flood lines will develop here. The flood water from the Northern property will be included into the flood water generated on the Southern property.*

The above mentioned has led to the determination of the 1:100 year flood lines for the area. Please see Figure 3 below for a copy of the determined flood lines. This information was then used by the Town and Regional planner to amend the Layout Plan to ensure that no Residential development takes place below this 1:100 year flood line. See Figure 1 in this regard. In order to ensure access, a road/Bridge will have to be constructed within this area. Bulk services will also cross this area.

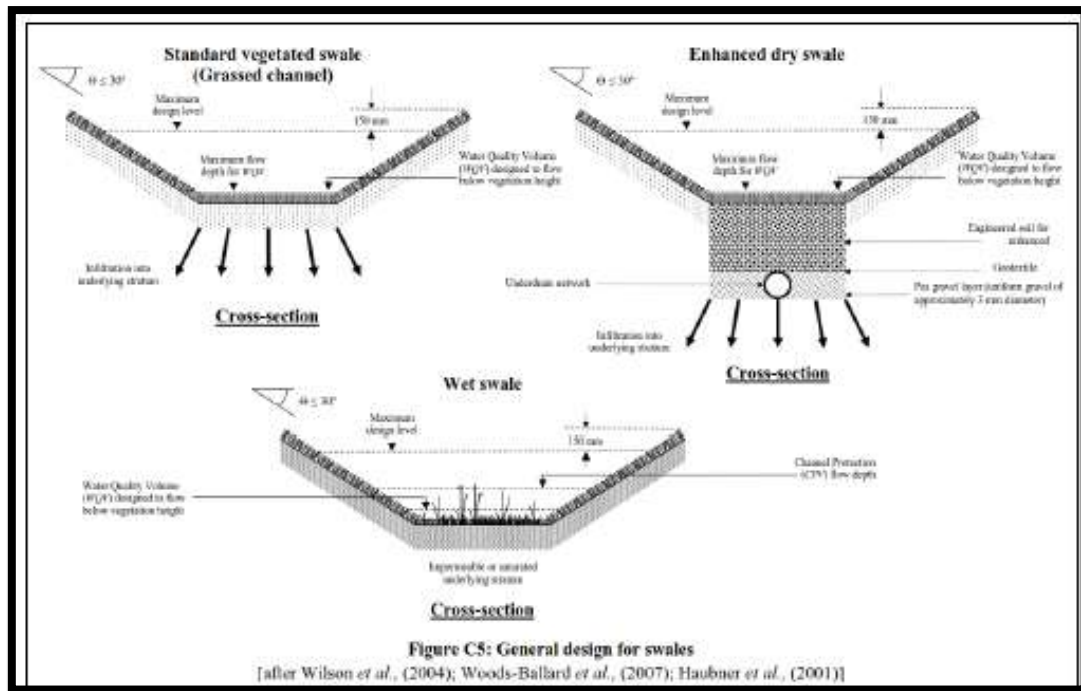




**Figure 3: Certified Flood Lines**

### SUSTAINABLE DRAINAGE SYSTEMS

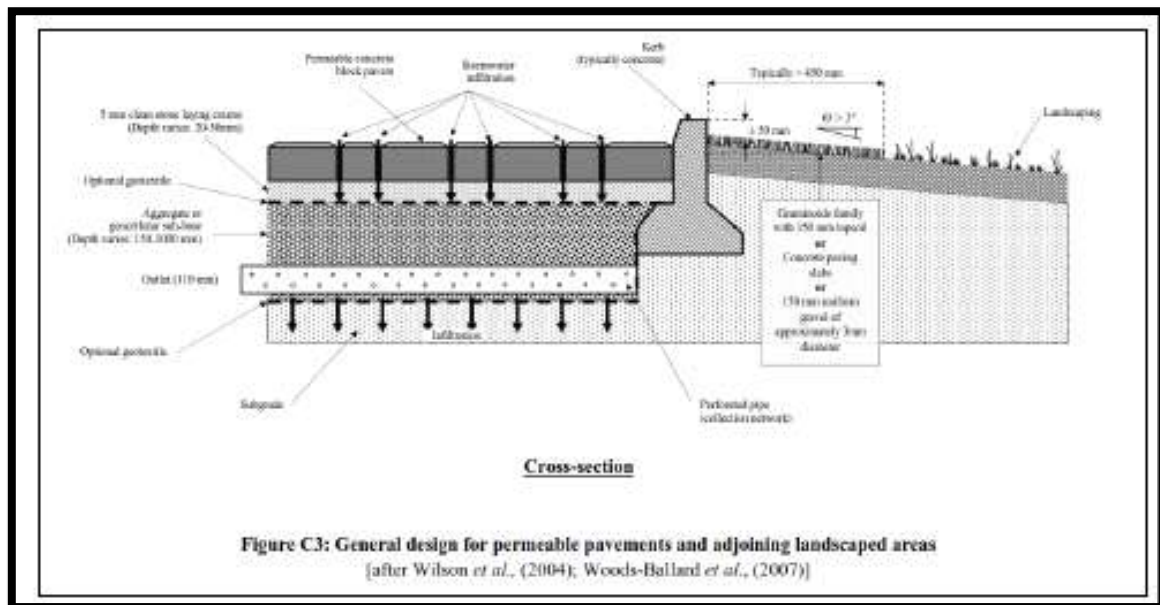
According to L. Soobiah (2020): Swales and biofiltration can be considered for implementation of ‘green building’ principles, adjacent the roadways, footpaths and for the proposed outlet channels into the main drainage courses. Swales (shallow vegetated channels which collect runoff and then releases it into the drainage system or back to surface at a reduced peak discharge and volume). Swales are constructed with permeable / gravel bases to promote infiltration to the sub-soil and improve run-off quality.



Typical swale design

**Permeable paving:**

The use of permeable pavers for footpaths, roadways and parking areas could be considered to provide reduced runoff and promote infiltration. The use of permeable paving can be implemented in tandem with swales constructed adjacent to the paved surfaces to intercept any surface flow as well as discharge from the underlying sub-base (Soobiah; L. 2020).



Typical Permeable paving design.

**CONSTRUCTION OF NEW INTERNAL WATER AND SEWAGE PIPELINES WITHIN A WATERCOURSE**

The pipes will be encased in 200 mm mass concrete and the area on top of the concrete will be soilcrete that will be compacted in 150mm layers to natural ground level.

In the planning for the design phase of the pipelines, cognisance is taken of the following reference documents;

- Red Book – Guidelines for Human Settlement Planning and Design
- SABS 1200 – Standardized Specification for Civil Engineering Construction
- Local Municipal standards

When planning or designing the pipelines, a holistic approach that adheres to all the tenets of the reference or policy documents listed above will be adopted.

The approach to design and construction will encompass the following:

- Appropriate and adequate protection of the river/stream/wetland banks in the vicinity of the pipeline will be incorporated into the design.
- The existing river/stream bank structure will be maintained to reduce disturbance to the river/stream flow.
- Where crossing or running alongside river or stream courses, the existing river/stream bank structure will be maintained to reduce disturbance to the river flow.
- Where the pipeline crosses storm water channels these will be designed to have no impact on normal storm water flow in that all pipes and concrete casing will be buried at least 1.0m below natural channel level in the case of soft material, and level with the natural channel in the case of hard rock material.
- In the case of sewer pipelines, man holes will be provided at all changes in grade and direction and at intervals not exceeding 80m to facilitate maintenance during the lifetime of the pipelines.
- The pipe crossing has been designed to have no impact on normal river/stream flow
- Where pipes are laid through a flood plain (1:100-year flood line), a minimum cover level of 1.0m will be maintained.

Construction Methodology

- Conduct a competent site investigation to build up an informed picture of the task
- Conduct a topographical survey of the pipeline route
- Adequate design of all the stages of construction
- All environmental and Health and Safety requirements and good practice to be adhered to.
- Remove topsoil and stockpile for later use
- Excavate trench for pipeline to the design level
- If the material is firm, normal excavation techniques will apply. In soft material shoring of the trench sides may be required. In hard rock material trench excavation may require the use of pneumatic breakers or blasting
- Install temporary dewatering pumps to keep the excavation dry (if required due to ground water ingress)
- Construct storm water diversion berms where required
- Place concrete to encasement if required. The top level will be determined by the storm water channel level
- Place bedding, lay pipe, place and compact selected fill over the pipeline
- Construct manholes where required. Manholes will be constructed along the pipeline route at changes in grade and direction
- Backfill to specification of drawings.

- Dress backfill, topsoil and revegetate all exposed areas.

See Figure 4 below:

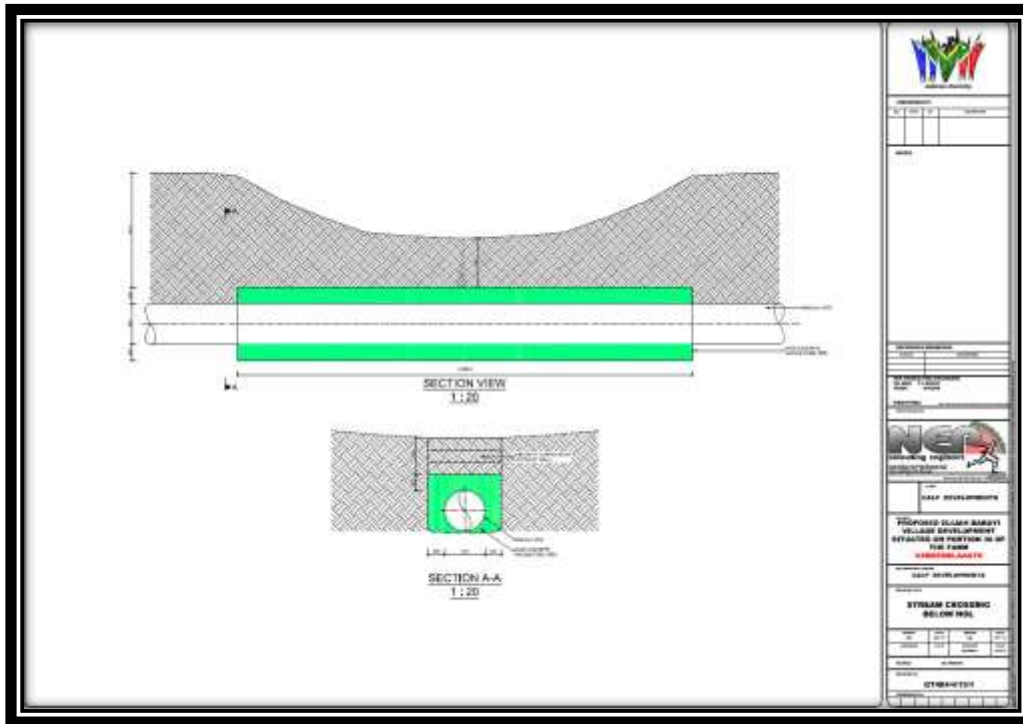
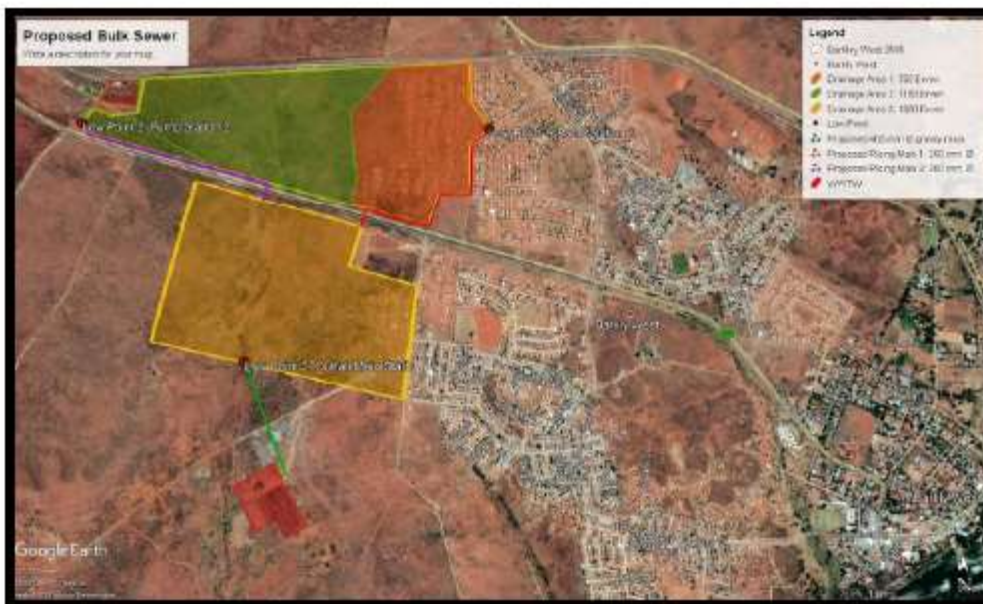


FIGURE 4: PIPELINE INSTALLATION DESIGN



Location of Pipe in Green to the south of the site to WWTWs (See Engineering services Report)

## 6. DESCRIPTION OF THE PROPERTY

The study area is located on a Portion of the Remaining Extent of Erf 687, Barkly-West, under the jurisdiction of the Digatlong Local Municipality and the Frances Baard District Municipality, Northern Cape Province. The study area is approximately 196 hectares in extent and is separated by the R31 road between Delportshoop

and Barkley-West. The Northern section is approximately 103 ha and the Southern section is approximately 86 ha in extent. See Figure 5 for a copy of the Locality Map.

70 Hectares of the site is located within a Critical Biodiversity area. See Figure 6 for a sensitivity map.

Province	Northern Cape					
District Municipality	Frances Baard District Municipality					
Local Municipality	Dikgatlong Local Municipality					
Ward number(s)	Ward 3					
Nearest town(s)	Barkley-West					
Farm name(s) and number(s)	a Portion of the remaining extent of Erf 687					
Portion number(s)	Portion of the remaining extent					
Coordinates of corner points of study area	Latitude (S) (DDMMSS)			Longitude (E) (DDMMSS)		
	28°	31'	03.71"	24°	29'	54.46"
	28°	31'	31.18"	24°	29'	47.51"
	28°	31'	58.48"	24°	29'	43.25"
	28°	31'	49.44"	24°	28'	59.29"
	28°	31'	24.14"	24°	29'	05.71"
	28°	31'	15.22"	24°	28'	44.13"
	28°	31'	06.63"	24°	28'	55.13"

Informal settlements (See Photograph 1), illegal dumping (See Photograph 2) and associated dirt roads and tracks (See Photograph 3) cover fairly large areas of the site. Numerous soil dumps, ditches and excavations are also present on site (See Photograph 4). The site is located adjacent to the existing residential area of Barkley-West that is situated towards the east. (See Photograph 5) A railway line is present at the northern boundary of the site. (See Photograph 6). Alien invasive weeds occur at disturbed and hitherto cleared areas.



Photograph 1: Informal settlement on site.



**Photograph 2: Illegal dumping on site**



**Photograph 3: Dirt roads and tracks on site**



**Photograph 4: Old diggings and soil heaps on site**



**Photograph 5: Residential area of Barkley-West that is located towards the East of the site**



**Photograph 6: A railway line is located towards the northern boundary of the site.**





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

### 7.1 BIO-PHYSICAL ASPECTS

According to the Geo-Technical Report, the area is underlain by amygdaloidal lava, agglomerate and tuff of the Platberg Group, Ventersdorp Supergroup, but is locally covered by recent aeolian sand and calcrete gravel.

No dolomite occurs on site and no stability investigation or evaluation is required. Zoning of the site revealed zones with minor constraints regarding the **compressibility**, **collapse potential** and the **expansive potential** of the soil.

The following zones were identified on the site:

#### **Normal Development with risk:**

**Site Class CR/1A3F:** This zone represents the majority of the area and comprises of a relative thin top layer sandy material less than 0,75m in thickness of slightly collapsible and compressible or low expansive soil underlain by a competent pebble marker, calcrete or gneiss, with estimated total movement of less than 7,5mm measured at surface with the risk of shallow rock, core stones and hard pan calcrete or gneiss rock outcrop adding a R or PR site class designation to the zone with problems relating to restricted excavation to less than 1,0m. Development on solid rock calcrete, calcrete rock outcrop known as hard pan calcrete or gneiss and will have an inflated cost where special pneumatic tools and blasting will be required for the installation of services. Normal foundation techniques will be adequate to enable proper development, with proper compaction within standard strip foundations and drainage provision that will be required. It is classified as CR in terms of the SAIEG & NHBRC guidelines (1995) or the SAICE Code of practice (1995), and 1A3F according to the classification for urban development (Partridge, Wood & Brink)(1993).

#### **Suitable for development with precaution**

**Site Class PQ:** Areas where small quarries or filling or dumping of spoil (Pq1) were identified must be rehabilitated before any construction can be allowed, and backfilling with an engineer's material may improve the developability of these zones, but these operations will dramatically increase the development cost in this zone.

**Undevelopable: Site Class PD:** Perennial drainage features with local steeper slopes within the upper channels and towards the river. The development is usually restricted to 32m from the centre of the river, and outside the 1:100 year floodline

No dolomite occurs on site and a stability investigation and evaluation is not required.

**Normal and special construction** techniques will be required to enable proper development. This includes the use of **compaction techniques** and **site drainage** as described

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

#### 7.1.2 TOPOGRAPHY

The topography of the area is relatively flat & open, with some small rocky ridges and outcrops present in parts. The site is located on a slope from 1125 to 1134 masl towards the western portion of the site, and then westwards into the Vaal River. The northern portion of the site have an average slope of 1.2%

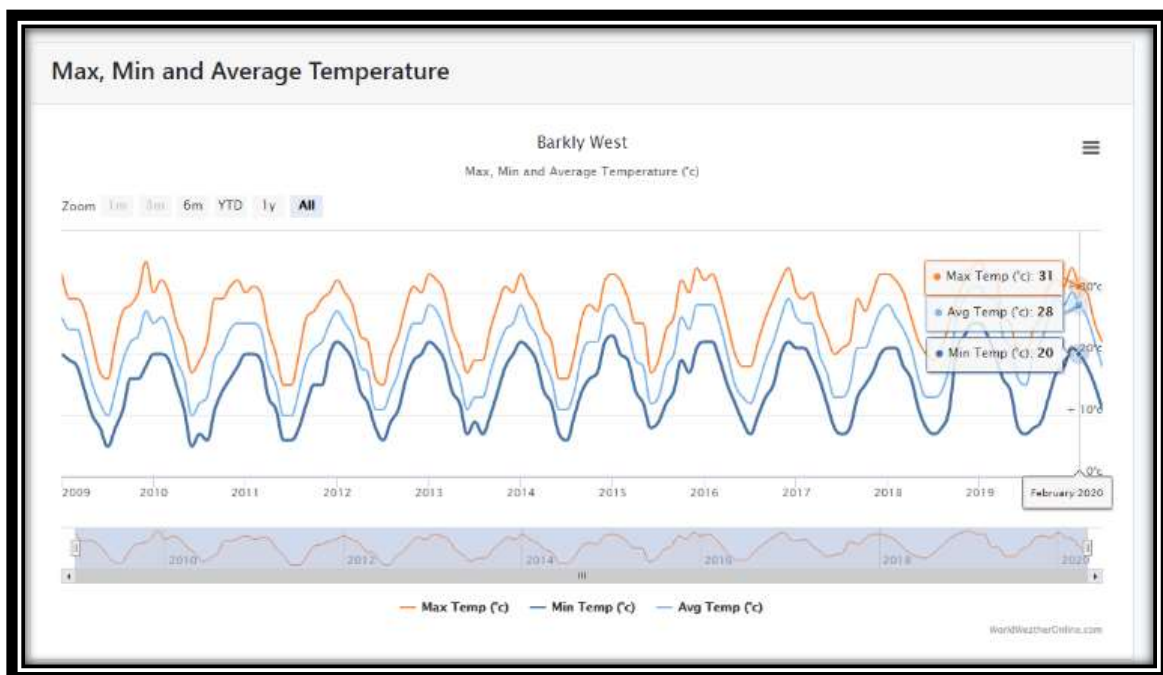
- 1,5%. The southern portion of the site also slopes gradually from east to west with an average slope of between 0,8% to 1,1%.

Large lava rock core stones and boulders on surface, possibly from previous diamond gravel mining activities will restrict accessibility and movement of small vehicles on many portions of the site. 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.

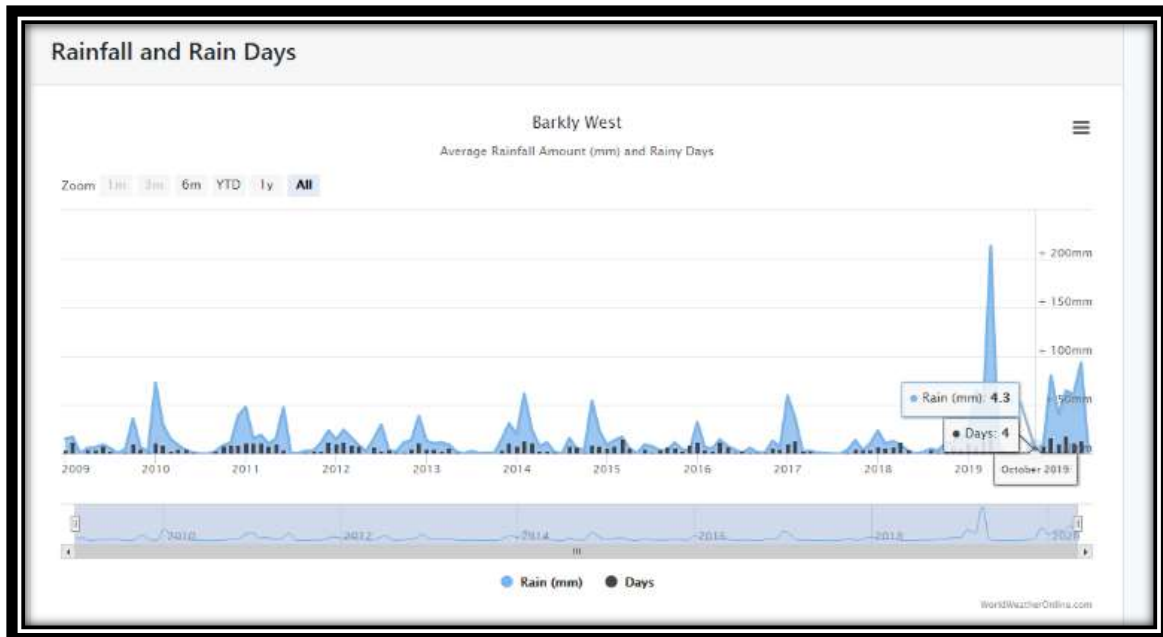
### 7.1.3 CLIMATE

The region is characterized by summer rainfall with thunderstorms, with annual very low rainfall figures of 427 mm for Barkly West recorded at the closest weather stations to the site. (According to the Flood line Report compiled by CWT, rainfall data was derived using software to estimate the rainfall in any catchment where coordinates of a reference point in the catchment is used , the Mean annual precipitation at the reference point is **376 mm**)

Winters are dry with frost common. The warmest months are normally December and January with February the warmest month, and the coldest months are June and July. The Table below provides climatic data for the past 10 years.



Source: <https://www.worldweatheronline.com/barkly-west-weather-averages/north-western-rovince/za.aspx>



Source: <https://www.worldweatheronline.com/barkly-west-weather-averages/north-western-province/za.aspx>

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

The site is located on a shallow slope towards the centre portion of the site, and then southwards into the Vaal River. The storm water flow regime North of the R31 road will be sheet flow. No flood lines will develop in this area. The storm water will be channelled to a point where it will flow over the R31 road into the channelled stream on the Southern property.

The storm water flow regime South of the R31 road will be channel flow and therefore flood lines will develop here. The flood water from the Northern property will be included into the flood water generated on the Southern property. See Figure 7.

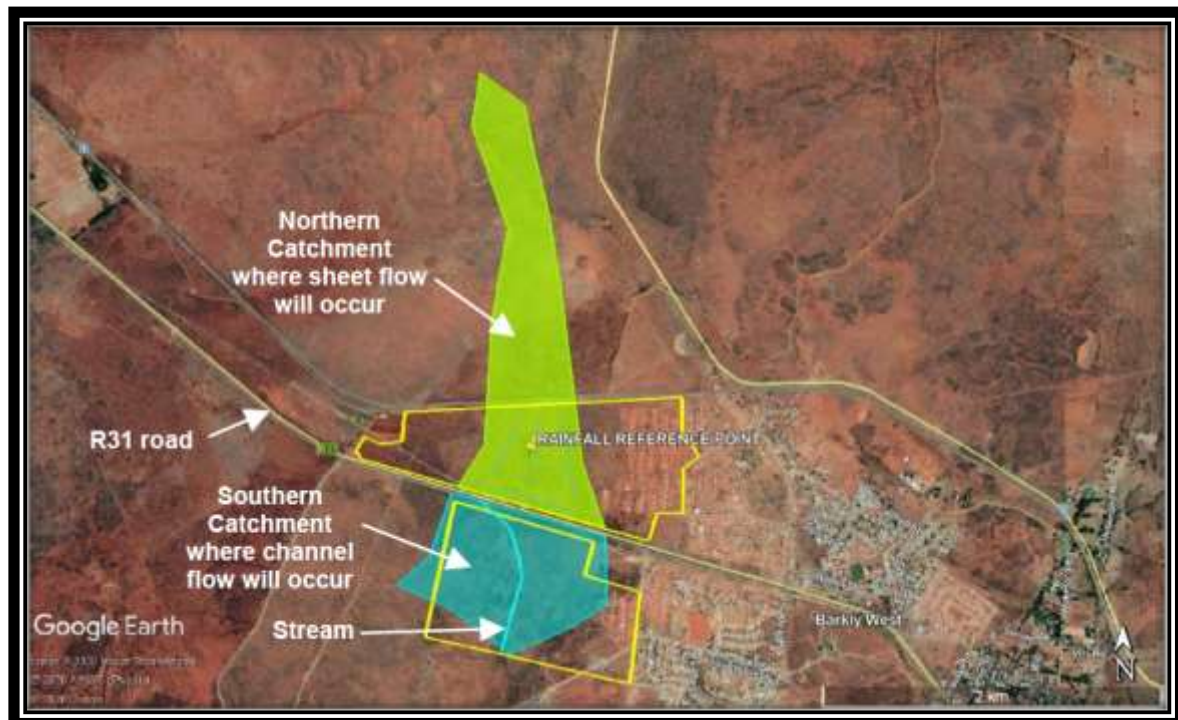


Figure 7: Drainage systems on site.

Wetlands such as those that could be classified as Floodplain Wetlands, Channelled Valley-bottom Wetlands, Unchannelled Valley-bottom Wetlands, Depressions (Pans), Seeps or Wetland Flats appear to be absent at site

### 7.1.5 GROUND WATER

Although no seepage or the presence of perennial fluctuations of ground water were not encountered on site, it is expected that a seasonal perched water table may exist. A calcified profile indicates that some perennial water level fluctuations occur.

Ground water in the form of seepage was not intersected in any test pits during the investigation, but some problems are foreseen and normal water tightening techniques such as damp course on foundation levels are required.

The expected high permeability of the silty sand may lead to leachate from sanitation systems to reach the ground water, and a closed water borne sewage system is recommended.

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 west of Barkly West, Frances Baard Local Municipality, Northern Cape Province, South Africa (elsewhere referred to as the site). Site is part of the Savanna Biome which at the site is represented by the Kimberley Thornveld vegetation type (Mucina & Rutherford 2006).

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

#### **SVk 4 Kimberley Thornveld**

**Distribution:** In South Africa the Kimberley Thornveld is found in the North West, Free State and Northern Cape Provinces. Kimberley Thornveld is present in most of the Kimberley, Hartswater, Bloemhof and Hoopstad Districts as well as substantial parts of the Warrenton, Christiana, Taung, Boshof and to some extent the Barkly West Districts. The distribution also includes pediment areas in the Herbert and Jacobsdal Districts (Mucina & Rutherford 2006).

**Vegetation and landscape features:** Plains often slightly irregular with well-developed tree layer of *Acacia erioloba*, *Acacia tortilis*, *Acacia karroo* and *Boscia albitrunca* and well-developed shrub layer with occasional dense stands of *Tarchonanthus camphoratus* and *Acacia mellifera*. Grass layer open with much uncovered soil (Mucina & Rutherford 2006).

**Geology and soils:** Andesitic lavas of the Allanridge formation in the north and west and fine-grained sediments of the Karoo Supergroup in the south and east. Deep sandy (0.6 – 1.2 m) to loamy soils of the Hutton soil form are present on slightly undulating sandy plains (Mucina & Rutherford).

**Climate:** Climate is characterized by summer and autumn rainfall and very dry winters. Mean annual precipitation from about 300 mm in the southwest to about 500 mm in the northeast. Frost frequent in winter (Mucina & Rutherford 2006).

**Important taxa of the Kimberley Thornveld listed by Mucina & Rutherford (2006):** Tall Tree: *Acacia erioloba*. Small Trees: *Acacia karroo*, *Acacia mellifera* subsp. *detinens*, *Acacia tortilis* subsp. *heteracantha*, *Searsia lancea*. Tall Shrubs: *Tarchonanthus camphoratus*, *Diospyros pallens*, *Ehretia rigida* subsp. *rigida*, *Euclea crispa* subsp. *ovata*, *Grewia flava*, *Lycium arenicola*, *Lycium hirsutum*, *Searsia tridactyla*. Low Shrubs: *Acacia hebeclada* subsp. *hebeclada*, *Anthospermum rigidum* subsp. *pumilum*, *Helichrysum zeyheri*, *Hermannia comosa*, *Lycium pilifolium*, *Melolobium microphyllum*, *Pavonia burchellii*, *Peliostomum leucorrhizum*, *Plinthus sericeus*, *Wahlenbergia nodosa*. Succulent Shrubs: *Aloe hereroensis* var. *hereroensis*, *Lycium cinereum*. Graminoids: *Eragrostis lehmanniana*, *Aristida canescens*, *Aristida congesta*, *Aristida mollissima* subsp. *argentea*, *Cymbopogon pospischilii*, *Digitaria argyrograpta*, *Digitaria eriantha* subsp. *eriantha*, *Heteropogon contortus*, *Themeda triandra*. Herbs: *Barleria macrostegia*, *Dicoma schinzii*, *Harpagophytum procumbens* subsp. *procumbens*, *Helichrysum cerastioides*, *Hermstaedtia odorata*, *Hibiscus marlothianus*, *Jamesbrittenia aurantiaca*, *Lippia scaberrima*, *Osteospermum muricatum*, *Vahlia capensis* subsp. *vulgaris*. Succulent Herbs: *Aloe grandidentata*, *Piaranthus decipiens*.

**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.

Informal settlements have transformed or modified vegetation at the eastern parts of the site. Remaining savanna at the site consists of shrub-height trees and a layer of grasses and forbs. Old diggings which resulted in numerous soil dumps, hitherto cleared areas, disturbances and bush encroachment occur at some areas. Conspicuous shrub-height trees at the site are *Tarchonanthus camphoratus* (Camphor Bush), *Senegalia mellifera* (Black Thorn) and *Vachellia tortilis* (Umbrella Thorn). Ditches, excavations and canals are also present. A railway line runs along the northern boundary of the site. Alien invasive weeds occur at disturbed and hitherto cleared areas.

The vegetation type that represents the Savanna Biome at the site, the Kimberley Thornveld (SVk 4) is not listed as threatened according to the National List of Threatened Ecosystems (2011).

The site contains two Protected tree species *Boscia albitrunca* (Shepherd's Tree) (See Photograph 8) and *Vachellia erioloba* (Camel Thorn) (See Photograph 9). Few individuals of both *Boscia albitrunca* and *Vachellia erioloba* occur at the site (Figure 8). 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.



**Photograph 7: Foliage and branches of *Boscia albitrunca* (Shepherd's Tree) at the site. The few *Boscia albitrunca* individuals at the site appear to be in a relatively poor condition.**

Photo: R.F. Terblanche



Photograph 8: Foliage and pods of one of the few *Vachellia erioloba* (Camel Thorn) trees at the site.  
Photo: R.F. Terblanche



Figure 8: Indications of the locations of individuals of the Protected tree species *Boscia albitrunca* (Shepherd's Tree) and *Vachellia erioloba* (Camel Thorn Tree) at the site.

**Green Markers: *Boscia albitrunca* (Shepherd's Tree)**

**Yellow Markers: *Vachellia erioloba* (Camel Thorn Tree)**

*Boscia albitrunca* (Shepherd's Tree) and *Vachellia erioloba* (Camel Thorn) will be marked and avoided so that they remain unharmed during construction.

One widespread *Aloe* species, *Aloe grandidentata*, is listed in Schedule 2 of the Northern Cape Nature Conservation Act No. 9 of 2009. 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) no person may pick a Specially Protected Plant species or Protected Plant species without a permit. The term “pick” includes “to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy” (NCNCA, No. 9 of 2009). A permit for the removal of indigenous vegetation at the site and in particular *Aloe grandidentata* is therefore required.

The scope for the site to be part of a corridor of particular conservation concern is small.

### 7.1.7 FAUNA

#### ASSESSMENT OF VERTEBRATE SPECIES OF PARTICULARLY HIGH CONSERVATION PRIORITY

##### Mammals of particular high conservation priority

Threatened mammal species of the 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
<b><i>Bunolagus monticularis</i></b> Riverine Rabbit	Critically Endangered	No	No	No
<b><i>Chrysospalax villosus</i></b> Rough-haired golden mole	Vulnerable	No	No	No
<b><i>Chrysochloris visagiei</i></b> Visagie's Golden Mole	Critically Endangered	No	No	No
<b><i>Cryptochloris wintoni</i></b> De Winton's Golden Mole	Vulnerable	No	No	No
<b><i>Chrysochloris zyli</i></b> Van Zyl's Golden Mole	Critically Endangered	No	No	No
<b><i>Cloeotis percivali</i></b> Short-eared Trident Bat	Vulnerable/ Near-threatened	No	No	No
<b><i>Cistugo lesueuri</i></b> Lesueur's Hairy Bat	Vulnerable	No	No	No
<b><i>Diceros bicornis</i></b> Black rhinoceros	Critically Endangered	No	No	No
<b><i>Eremitalpa granti</i></b>	Vulnerable	No	No	No



Grant's Golden Mole				
<b><i>Felis nigripes</i></b> Black-footed Cat	Vulnerable	No	No	No
<b><i>Lycaon pictus</i></b> African wild dog	Endangered	No	No	No
<b><i>Loxodonta africana</i></b> African elephant	Vulnerable	No	No	No
<b><i>Mystromys albicaudatus</i></b> White-tailed mouse	Endangered	Yes	No	No
<b><i>Neamblysomus julianae</i></b> Juliana's Golden Mole	Critically Endangered	No	No	No
<b><i>Panthera leo</i></b> Lion	Vulnerable	No	No	No
<b><i>Rhinolophus blasii</i></b> Blasi's Horseshoe Bat	Vulnerable	No	No	No

**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
<b><i>Ceratotherium simum</i></b> White Rhinoceros	Near threatened	No	No	No
<b><i>Cistugo seabrai</i></b> Angolan Hairy Bat	Near Threatened	No	No	No
<b><i>Manis temminckii</i></b> Ground Pangolin	Near threatened	No	No	No
<b><i>Rhinolophus capensis</i></b> Cape Horseshoe Bat	Near Threatened	No	No	No

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
<b><i>Myosorex varius</i></b> Forest shrew	Uncertain	No	No

***Rhinolophus denti***  
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>	<b>Lappet-faced Vulture</b>	Vulnerable	No	No
<i>Anthropoides paradiseus</i>	<b>Blue Crane</b>	Vulnerable	No	No
<i>Aquila rapax</i>	<b>Tawny Eagle</b>	Vulnerable	No	No
<i>Ardeotis kori</i>	<b>Kori Bustard</b>	Vulnerable	No	No
<i>Balearica regulorum</i>	<b>Grey Crowned Crane (Mahem)</b>	Vulnerable	No	No
<i>Botaurus stellaris</i>	<b>Eurasian Bittern</b>	Critically Endangered	No	No
<i>Calendulauda burra</i>	<b>Red Lark</b>	Vulnerable	No	No
<i>Circus ranivorus</i>	<b>African Marsh- Harrier</b>	Vulnerable	No	No
<i>Crex crex</i>	<b>Corn Crake</b>	Vulnerable	No	No
<i>Eupodotis senegalensis</i>	<b>White-bellied Korhaan</b>	Vulnerable	No	No
<i>Falco naumanni</i>	<b>Lesser Kestrel</b>	Vulnerable	No	No
<i>Geronticus calvus</i>	<b>Southern Bald Ibis</b>	Vulnerable	No	No
<i>Gorsachius leuconotus</i>	<b>White-backed Night-heron</b>	Vulnerable	No	No
<i>Gypaetus barbatus</i>	<b>Bearded Vulture</b>	Endangered	No	No
<i>Gyps africanus</i>	<b>White-backed Vulture</b>	Vulnerable	No	No
<i>Gyps coprotheres</i>	<b>Cape Vulture</b>	Vulnerable	No	No
<i>Neophron percnopterus</i>	<b>Egyptian Vulture</b>	Regionally almost extinct	No	No
<i>Neotis ludwigii</i>	<b>Ludwig's Bustard</b>	Vulnerable	No	No
<i>Pelecanus rufescens</i>	<b>Pink-backed Pelican</b>	Vulnerable	No	No
<i>Polemaetus bellicosus</i>	<b>Martial Eagle</b>	Vulnerable	No	No
<i>Rhynchops flavirostris</i>	<b>African Skimmer</b>	Endangered	No	No
<i>Sagittarius serpentarius</i>	<b>Secretarybird</b>	Vulnerable	No	No

<i>Sarothrura ayresi</i>	<b>White-winged Flufftail</b>	Critically Endangered	No	No
<i>Therathopius ecaudatus</i>	<b>Bateleur</b>	Vulnerable (in South Africa)	No	No
<i>Tyto capensis</i>	<b>African Grass-Owl</b>	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 dependant 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>	<b>Red-Billed Oxpecker</b>	Near threatened	No	No
<i>Certhilauda chuana</i>	<b>Short-clawed Lark</b>	Near threatened	No	No
<i>Calendulauda barlowi</i>	<b>Barlow's Lark</b>	Near Threatened	No	No
<i>Charadrius pallidus</i>	<b>Chestnut-banded Plover</b>	Near threatened	No	No
<i>Ciconia nigra</i>	<b>Black Stork</b>	Near threatened	No	No
<i>Circus macrourus</i>	<b>Pallid Harrier</b>	Near threatened	No	No
<i>Circus maurus</i>	<b>Black Harrier</b>	Near threatened	No	No
<i>Eupodotis caerulescens</i>	<b>Blue Korhaan</b>	Near threatened	No	No
<i>Falco biarmicus</i>	<b>Lanner Falcon</b>	Near threatened	No	No
<i>Falco peregrinus</i>	<b>Peregrine Falcon</b>	Near threatened	No	No
<i>Glareola nordmanni</i>	<b>Black-winged Pratincole</b>	Near threatened	No	No
<i>Leptoptilos crumeniferus</i>	<b>Marabou Stork</b>	Near threatened	No	No
<i>Mirafra cheniana</i>	<b>Melodious lark</b>	Near threatened	No	No
<i>Mycteria ibis</i>	<b>Yellow-billed Stork</b>	Near threatened	No	No
<i>Pelecanus onocrotalus</i>	<b>Great White Pelican</b>	Near threatened	No	No
<i>Phoenicopterus minor</i>	<b>Lesser Flamingo</b>	Near threatened	No	No
<i>Phoenicopterus ruber</i>	<b>Greater Flamingo</b>	Near threatened	No	No
<i>Rostratula benghalensis</i>	<b>Greater Painted-snipe</b>	Near threatened	No	No
<i>Spizocorys sclateri</i>	<b>Sclater's Lark</b>	Near Threatened	No	No

<i>Sterna caspia</i>	<b>Caspian Tern</b>	Near threatened	No	No
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\*\* 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.

<b>Species</b>	<b>Threatened Status</b>	<b>Resident at site</b>	<b>Recorded at site during survey</b>	<b>Likely to be found based on habitat assessment</b>
<b><i>Crocodylus niloticus</i></b> Nile Crocodile	Vulnerable	No	No	No
<b><i>Homopus signatus</i></b> Speckled Dwarf Tortoise	Vulnerable	No	No	No
<b><i>Pachydactylus goodi</i></b> Good's Gecko	Vulnerable	No	No	No
<b><i>Pachydactylus rangei</i></b> 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.

<b>Species</b>	<b>Threatened Status</b>	<b>Resident at site</b>	<b>Recorded at site during survey</b>	<b>Likely to be found based on habitat assessment</b>
<b><i>Cordylus imkeae</i></b> Rooiberg Girdled Lizard	Near Threatened	No	No	No
<b><i>Cordylus macropholis</i></b> Large-scaled Girdled Lizard	Near Threatened	No	No	No
<b><i>Goggia gemmula</i></b> Richtersveld Pygmy Gecko	Near Threatened	No	No	No
<b><i>Homopus boulengeri</i></b> Karoo Dwarf Tortoise	Near Threatened	No	No	No
<b><i>Homoroselaps dorsalis</i></b> Striped Harlequin Snake	Near threatened	No	No	No
<b><i>Typhlosaurus lomiae</i></b> 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 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>Chrysochrysis aureus</i> Golden Opal	Endangered	No	Highly unlikely
<i>Chrysochrysis trimeni</i> Diamond Opal	Vulnerable	No	Highly unlikely
<i>Lepidochrysis praeterita</i> Highveld Blue	Endangered	No	Highly unlikely
<i>Orachrysis mijburghii</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
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			possibility, Unlikely, Highly unlikely
<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 calvinia</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: Cetoninae) 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>Ichneustoma 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

*“The extent and toxicity of emissions is not necessarily a concise indicator of contributions to ground-level air pollution concentrations or of risks to health and the environment. Such contributions are also a function of the height of emission, temporal variations in the release of pollutants, and the proximity of the source to the people or the environment affected by exposure to the pollutant (such as, for instance, children, or the elderly, or people who are ill, or others who may be particularly sensitive receptors to a specific pollutant above a certain concentration). If an industry is operating close to a school or hospital or centre for the elderly, the potential exposure (in combination with the other contributing factors) is high.*

Three factors govern the significance of household fuel-burning emissions:

- (i) the low level of emissions (that is, their height above the ground is generally about 3 m, within people’s breathing zone);*
- (ii) the simultaneous occurrence of peak emissions (during the coldest months of winter and in the early mornings and throughout the evenings) and poor atmospheric dispersion (stable atmosphere with low wind speeds, with the possible development of temperature inversions); and*
- (iii) the release of such emissions within high human exposure areas, given that such emissions generally occur in dense, low-income settlements where population density is high (in addition, the pollution is not only outdoors, but frequently indoors as well, due to poor ventilation, so it affects the whole family).*

*The significance of vehicle emissions as contributors to air-pollutant concentrations and health risks is similarly increased by the low level (close to the ground) of the emissions, and their proximity to highly populated areas – on highways, for example, with emissions being particularly high when traffic is congested. Vehicle emissions tend to peak early in the morning and in the evenings, when the potential for atmospheric dispersion is reduced (for example, wind speeds are generally low in the early mornings and evenings, reducing their potential for dispersing pollution).*

*Given the high volumes of pollutants emitted from fuel-burning within the industrial and power-generation sectors, their contribution to ambient concentrations and public health risks is often lower than might be expected. This is because these sources are generally characterized by constant releases, relatively high above ground level, and further away from residential settlements than are household fuel-burning and vehicle emissions.*

*Ranking the significance of different sources of pollution on the basis of the total emissions for which each source is responsible would, for example, place industrial emissions above household fuel-burning. If the aim is to reduce impacts on human health, however, then household fuel-burning would need to be targeted as a top priority (Scorgie et al., 2004d).*

*Historically, air pollution control in South Africa has primarily emphasized the implementation of 'command and control' measures in the industrial sector. The shift from source-based control, to the management of the air that people breathe, emphasizes the importance of targeting a wider range of sources and using more flexible and varied approaches. It means paying greater attention to ambient air quality, as it is more important (and more cost-effective, in many cases) to make sure that the ambient air complies with air quality standards. This approach ensures that human and environmental health is protected and that the cumulative impact of pollution from a number of sources is addressed.*

*Approaches adopted or considered for future implementation have included: regulation (for example, the use of Atmospheric Emission Licences for Listed Activities); market instruments (such as atmospheric user-charges and pollution taxes); the potential for voluntary agreements, education and awareness raising; and emissions trading. International experience shows that adopting a mix of instruments and interventions is more effective than using a single instrument to improve air quality across various types of source. Although direct regulation remains important in controlling industrial sources, there is evidence that specifying emission limits is more effective than specifying the use of particular technologies, so as to give companies flexibility in selecting the method of achieving success that suits them best. This approach is advocated as being more cost-effective and more likely to stimulate technological advances in pollution control methods and production processes.*

*For large point sources (that is, sources of pollution that are concentrated on one site, but that have large, constant volumes of many types of pollution) that are few in number, instruments such as emissions trading have been advocated as an effective way to manage pollutant emissions and reduce the costs of compliance.*

*Implementing an efficient social protection system to alleviate poverty is central to maintaining conditions that facilitate not only economic growth but also environmental sustainability. Many South African households – including those with access to electricity – use coal, wood, and paraffin, due to the relative cost-effectiveness of such fuels for heating (that is, space heating) and cooking purposes.*

*Many low-cost housing developments and informal settlements are located close to industrial and mining operations, as such land is both available and inexpensive. Poorer communities are more likely to suffer from poor service delivery, including inadequate waste removal that sometimes results in refuse being set alight illegally. These examples show that poverty alleviation could help to improve air quality by enabling people to choose practices that are friendlier to the environment.”*

[https://www.environment.gov.za/sites/default/files/docs/stateofair\\_airqualityand\\_sustainable\\_development.pdf](https://www.environment.gov.za/sites/default/files/docs/stateofair_airqualityand_sustainable_development.pdf)

Date visited: 17/03/2020.

The proposed development is planned and will eventually be developed with the above mentioned in mind. The alleviation of poverty (Jobs that will be created) and the provision of proper accommodation facilities (Which has been designed to be as energy efficient as possible) will contribute towards lessening air pollution in the area.

In addition to the above, it should be noted that 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).

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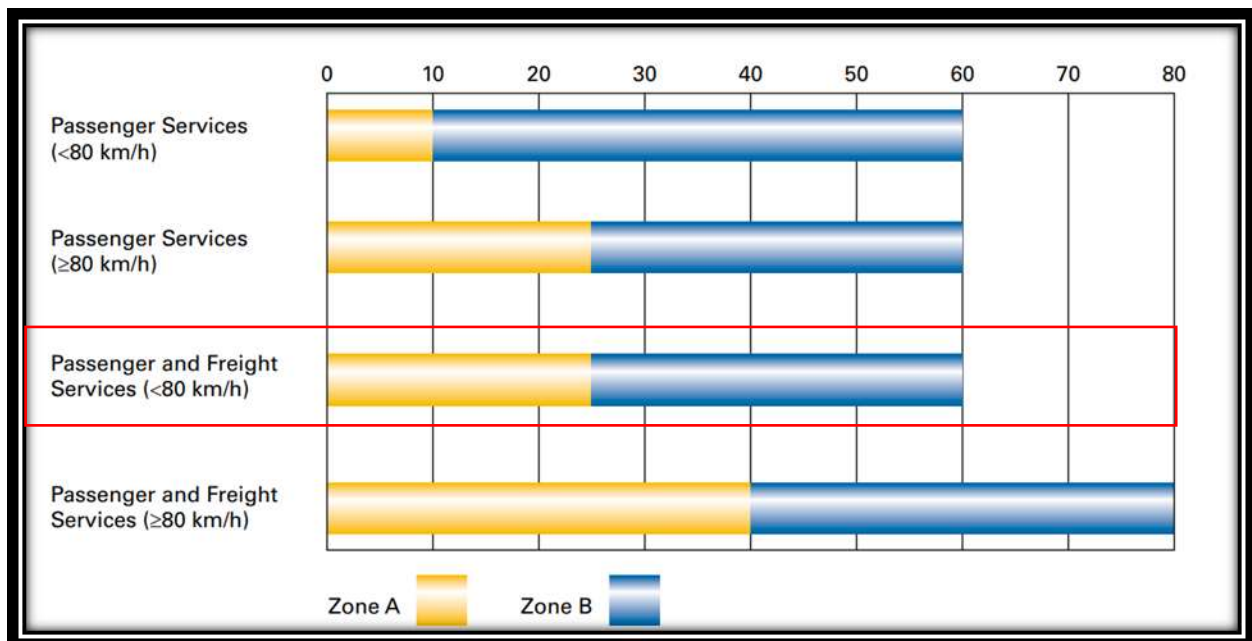
#### **7.1.9 NOISE**

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.

A Railway line is located on the northern boundary of the site. Rail operations generate noise and vibration, and people living and working near major transport corridors can be adversely affected. Figure 9 provides a guide



as to the level of assessment required when noise sensitive developments are located near existing rail lines. Zones A and B are indicative acoustic assessment zones where sensitive land-uses are likely to be adversely affected.



**Figure 9: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track. (Development Near Rail Corridors and Busy Roads – Interim Guideline; 2008)**

For single dwelling residences in Zone B, the standard mitigation measures for development will normally provide adequate mitigation to reduce internal noise levels to an acceptable level. If these measures are adopted as a minimum for single dwelling residences in Zone B, there should be no need for a specialist acoustic assessment.

The proposed development falls within Zone B. These impacts can be mitigated in order to minimise the impact of this variable on future residents.

## 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 patters
- 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.

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## **7.2.2 ARCHAEOLOGY AND CULTURAL SITES**

Background research indicates that there are a number of cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls. This includes the Canteen Koppie Archaeological Heritage site about 1.3km south-east of the town. The assessment of the study area identified some sites, features or material of cultural heritage (archaeological and/or historical) origin or significance. These sites have a Stone Age archaeological origin.

The two Stone Age sites found in the study area during the assessment contain scatters of tools that can be preliminarily dated to the Earlier, Middle & Later Stone Age. See Figure 10. The material includes core and flake tools, as well as large Acheul-type handaxes and possible choppers. This is similar to the material found at the Canteen Koppie site and is therefore fairly significant from an archaeological perspective. The two areas recorded are situated in the area where recent mining and quarrying had taken place and the material was therefore more than likely exposed by these activities and not in situ. Furthermore, it was not possible to assess all of the areas exposed by the mining activities and it is therefore envisaged many similar sites and exposures are present in the development area.



**Figure 10: Locality of the two sites that was identified**

In a small trench area investigated during the assessment, in situ river gravels and possible artifacts are visible under a layer of red Aeolian sands. This indicates that similar deposits could be present all across the study and development area and that in situ archeological material is more than likely located here. The proposed development will therefore have a big impact on the archaeological heritage of the area and necessary mitigation measures will have to be implemented. The relation to and similarity with the Canteen Koppie National Heritage Site around 3.5km to the east of the study area increases the significance of these finds. It is worth mentioning the no Stone Age material or sites were noted in the northern section of the development area, although the possibility of sites being present cannot be discounted. In situ deposits could be located underneath the red sands covering large parts of the area and once development actions (trenching, implementation of services) commence sites and material can be exposed.

The following is recommended:

- A detailed Phase 2 Assessment of the area to map the occurrence of the Stone Age sites and material.
- Comprehensive and detailed sampling of surface material after obtaining a permit from SAHRA.
- Conducting of Test excavations in selected areas to determine the presence of and the nature of the archaeological deposits. For this a SAHRA permit will also have to be obtained
- The implementation of an Archaeological Watching Brief for when the development activities commences. This will ensure that if in situ deposits are exposed that the material can be recovered and studied and preserved.

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 Township Establishment on the Remaining Extent of Erf 678, in Barkly-West could continue once the recommended mitigation measures above have been implemented.

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### 7.2.3 PALEAONTOLOGICAL DESKTOP STUDY

The entire study area is underlain by rocks of the Precambrian Allanridge Formation of the Ventersdorp Supergroup and more superficially by late Caenozoic wind-blown sand of the Kalahari Group. The igneous Allanridge does not host fossils and there is a slight, but unlikely, possibility that Quaternary Kalahari Group could contain fossils.

As the Precambrian Allanridge Formation of the Ventersdorp Supergroup does not host fossils, and the overlying Quaternary sediments are not known to have fossils it is highly unlikely that palaeontological heritage will be affected by the proposed township development.

This desktop study has indicated that the development is not positioned in a palaeontologically sensitive area. It is thus recommended that if in the unlikely event that fossils are exposed in the Quaternary sediments by the proposed development, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

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### 7.2.3 AESTHETICS

The topography of the area is relatively flat & open, with some small rocky ridges and outcrops present in parts. Informal settlements, illegal dumping and associated dirt roads and tracks cover fairly large areas of the site. Numerous soil dumps, ditches and excavations are also present on site. The site is located adjacent to the existing residential area of Barkley-West that is situated towards the east. A railway line is present at the northern boundary of the site. Alien invasive weeds occur at disturbed and hitherto cleared areas

Visual Intrusion is defined as the level of compatibility or congruence of the project with the particular qualities of the area, or its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape or townscape.

**High visual intrusion** – results in a noticeable change or is discordant with the surroundings;

**Moderate visual intrusion** – partially fits into the surroundings, but clearly noticeable;

**Low visual intrusion** – minimal change or blends in well with the surroundings.

The proposed development will change the scenic resources of the local area from an undeveloped area to a formal residential area. The visual intrusion is considered to be low as the proposed development will have minimal change and blends in well with the surroundings.

The proposed development will require additional lighting on and in buildings and possibly along roads. This will change the night landscape from unlit to lit.

Aesthetics have very little influence as the area is already highly disturbed. The project on the other hand will have a huge impact on the Aesthetics of the area as the informal settlement will be formalized and services will be provided.

## 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
<b>DOCUMENTATION AND TRAINING</b>		
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.
<b>SITE ACCESS &amp; TRAFFIC MANAGEMENT</b>		
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.
<b>VEGETATION CLEARING</b>		
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.
<b>TOPSOIL &amp; SUBSOIL MANAGEMENT</b>		
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
<b>EXCAVATIONS &amp; EARTHWORKS</b>		
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.

ENVIRONMENTAL ASPECTS	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS
		Excavations and earth-moving may only take place within the demarcated working area
<b>DANGEROUS AND TOXIC MATERIALS (CHEMICALS)</b>		
Safe storage of chemicals See also below for further aspects on this subject	Clean environment	No spills of chemicals
Availability of safety kits to prevent oils/toxic materials spreading in the environment	Safe storage of materials	Proper storage provided
Proper storage must be provided for chemicals , paint and construction materials needed		
<b>STORAGE OF OIL AND FUEL</b>		
Safe handling of fuel and oil and prevention of spills.	Clean environment	No spills of oil or fuel  No leakages of oil
<b>USE OF OIL AND CHEMICALS</b>		
Drip trays must be provided for vehicles in storage yard	No spills of oil	No oil spills from vehicles
Wash bay and oil trap to be provided	Cleaning area for vehicles	No oil or fuel into environment due to cleaning of vehicles or equipment
<b>STORAGE OF CEMENT</b>		
Safe handling of cement	Clean environment	No spills of cement
<b>STORAGE OF EQUIPMENT AND MATERIALS</b>		
Safe and proper storage of equipment and material	Safe and proper storage of equipment and material	Neat, clean and ordered storage of material
<b>CONCRETE</b>		
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
<b>TOILETS AND ABLUTION FACILITIES</b>		
Clean sanitary environment	Clean and sanitary environment	Toilets for workers in accordance with the instructions in the EMP
<b>WASTE MANAGEMENT</b>		
A clean and waste free environment	Clean environment with waste handled in accordance with the EMP	No waste in the environment
<b>WORKSHOP EQUIPMENT, MAINTENANCE AND STORAGE OF MATERIAL</b>		
Clean and safe work area	Clean and safe work area	Safe and clean work and storage area
<b>FIRES</b>		
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
<b>OTHER ENVIRONMENTAL ASPECTS</b>		
<b>Stockpiles</b>  All stockpiled material must be easily accessible without any environmental damage to adjacent grasslands/farmlands.  All temporarily stockpiled material must be stockpiled in such a way that the spread of materials are minimised.  The stockpiles may only be placed within the demarcated areas - the location of which must be approved by the ER or ECO.  Stockpiled material at batching plant must be contained to prevent the spread of gravel in the area.	Properly constructed and well maintained stockpiles	No erosion or spread of material from stockpiles  Gravel stockpiles must be properly managed

ENVIRONMENTAL ASPECTS	MANAGEMENT OBJECTIVES	MEASURABLE TARGETS
<p><b>Erosion, sedimentation and storm water</b> No erosion and or sedimentation</p> <p><b>Vegetation</b> The contractor must avoid vegetated areas that will not be cleared.</p>	<ul style="list-style-type: none"> <li>Minimise scarring of the soil surface and land features</li> <li>Minimise disturbance and loss of soil</li> <li>Minimise construction footprint</li> </ul> <p>Minimise impacts on vegetation</p>	<p>No erosion or sedimentation.</p> <p>Limit impact on vegetation</p>
<p><b>Waste management</b></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"> <li>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</li> </ul>	<ul style="list-style-type: none"> <li>Disposal of rubble and refuse in an appropriate manner with no rubble and refuse lying on site</li> <li>Sufficient containers available on site</li> </ul>
<p><b>Dust</b> 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><b>SAFETY</b></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
<b>Duration (time scale)</b>	Short term	Up to 5 years
	Medium term	6 – 15 years
	Long term	More than 15 years
<b>Extent (area)</b>	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.

Nature of the potential impact		Description of the effect, and the affected aspect of the environment
<b>Magnitude (Intensity)</b>	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 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).
<b>Probability</b>	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
<b>Significance</b>	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
<b>Reversibility</b>	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
<b>Risk</b>	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



Nature of the potential impact		Description of the effect, and the affected aspect of the environment
	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 DEDECT in terms of NEMA, granting approval for the development <b>must</b> 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 <b>must</b> 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 <b>must</b> 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	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	
		explain the roles and 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 <b>must</b> be minimised during site establishment and the development footprint must be kept to the	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
			The development footprint must be clearly demarcated and the extent of this area must be communicated to all contractors and sub-contractors.		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	approved development area.		<p>Existing access roads must be utilised to access the site camp(s) and working/ construction areas</p> <p>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.</p>		all concerned are trained in this regard. The ECO will monitor compliance.
VEGETATION CLEARING	Vegetation clearing <b>may not commence</b> 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	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 <b>may</b> occur.				

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
				(Australian Wattles) that should not be allowed to 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	
<b>STORM AND WASTE WATER MANAGEMENT</b>	At the end of the construction phase the site and its surrounding area <b>must</b> be free from any pollution that originated as a result of the construction activities.	The developer must compile a storm water management plan.	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 All spillage of oil onto concrete surfaces must be controlled by the use of an approved absorbent material and the used absorbent	No action required	The developer must ensure that a storm water management plan is developed.

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>material disposed of at an appropriate waste disposal facility.</p> <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&amp;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>		The ECO must monitor compliance.

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
TOPSOIL & SUBSOIL	No disturbance of topsoil & subsoil may 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 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 parameters of the development footprint and that all concerned are trained in this regard.  The Contractor will be responsible for the removal and correct stockpiling of the topsoil and subsoil.  The ECO will monitor compliance.
			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.		
			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.		
			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.		



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 <b>may</b> occur.		<p>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>Topsoil should be the final layer applied during rehabilitation, after subsoil/ spoil material has been placed and shaped.</p>		
<b>DANGEROUS AND TOXIC MATERIALS</b>	At the end of the construction phase the site and its surrounding area <b>must</b> be free from any chemical, fuel, oil and cement spills that originated as a result of the construction activities.	<b>CHEMICALS</b>			<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>
		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);					

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>All employees working with HCS must be trained in the safe use of the substance and according to the safety data sheet</p> <p>Employees handling hazardous substances / materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment must be made available</p>		
		<b>FUEL AND OIL</b>			
		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	<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>
			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		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<p>impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained</p> <p>All empty externally dirty drums must be stored on a drip tray or within a bunded area</p> <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>		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			<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> <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>		
		<b>CONCRETE AND CEMENT</b>			
		The contractors must provide and maintain a <b>method statement</b> for "cement and concrete batching". The method statement must provide information on proposed storage,	<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>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>	No Action required	The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
		washing & disposal of cement, packaging, tools and plants	<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 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>		The ECO will monitor compliance.
<b>TOILETS AND ABLUTION FACILITIES</b>	At the end of the construction phase the site and its surrounding area <b>must</b> 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	<p>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.</p> <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</p> <p>The contractor must be responsible for the cleaning, maintenance and servicing of the toilets. The contractor must ensure that no</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>spillage occurs when the toilets are cleaned or emptied.</p> <p>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 circumstances</p> <p>Toilets out on site must be secured to the ground and have a sufficient locking mechanism operational at all times</p>		
<b>WASTE MANAGEMENT</b>	At the end of the construction phase the site and its surrounding area <b>must</b> 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"> <li>• <b>Hazardous waste:</b> including (but not limited to) old oil, paint, etc.</li> <li>• <b>General waste:</b> including (but not limited to) paper, plastic, glass and construction rubble</li> </ul> <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.</p> <p>Bins must be clearly marked for ease of 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>All refuse bins must have a lid secured so that animals cannot gain access</p> <p>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</p> <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</p>		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			covered container (Like a skip, with a cover), must be used to contain refuse from campsite bins, rubble and other construction material		
<b>DUST</b>	Dust prevention measures <b>must</b> be applied to minimise the generation of dust.	The contractors must provide and maintain a method statement for "dust control". The method statement must provide information on the proposed source of water to be utilised.	<p>All forms of dust pollution must be managed in terms of the National Environmental Management: Air quality Act, 2004 (Act No 39 of 2004)).</p> <p>Acceptable dust fall rates for residential areas are:  <b>Dust fall rate (D) (mg/m<sup>2</sup>/day, 30 days average):</b>  D&lt;600  <b>Permitted frequency of exceeding dust fall rate:</b>  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</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>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>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>		
<b>NOISE</b>	Noise prevention measures <b>must</b> be applied to minimise the generation of unnecessary noise	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</p>	No Action required	The Contractor will be responsible for providing method statements. He will also be

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	pollution as a result of construction activities on site.		<p>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> <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>		<p>responsible for training of staff in this regard.</p> <p>The ECO will monitor compliance.</p>
FIRES	Absolutely <b>no</b> 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	Absolutely no burning of waste is permitted.	No Action required	The Contractor will be responsible for providing method statements. He will also be responsible for training of staff in this regard.
	Fires will <b>only</b> 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.		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
		plus details on the fuel to be utilised	<p>Fires within the designated areas must be small in scale so as to prevent excessive smoke being released into the air.</p> <p>The contractor must designate a smoking area for the labour force so as to prevent unanticipated incidents of veldt fires.</p> <p>No wood is to be collected, chopped or felled for fires from private or public property as well as from no-go or sensitive areas within the site and any surrounding natural vegetation</p>		The ECO will monitor compliance.
<b>FAUNA</b>	<b>No</b> 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</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	
			sighting. Workers should also be informed where snakes most often hide so that they can be vigilant when lifting stones, etc.		
<b>HERITAGE</b>	No intentional destruction of any sites, features or material of cultural heritage (archaeological and/or historical) origin or significance may occur.	Conduct a Phase 1 HIA for the development to identify any sites, features or material 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.	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.	The developer and applicant.  Study to be conducted by a suitable qualified specialist.  Findings to be monitored by the ECO.
			Carry out general monitoring of excavations for potential fossils, artefacts and material of heritage importance.		
			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.		
			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		
<b>CRIME, SAFETY AND SECURITY</b>	All Contractors and sub-contractors <b>must</b>	Plan to appoint a health and safety	The site and crew are to be managed in strict accordance with the Occupational Health and	No actions required	Health and safety officer.

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
	abide to the rules and regulations of the Occupational Health and Safety Act, 85 of 1993.	officer for the construction site.	Safety Act, 1993 (Act No. 85 of 1993) and the National Building Regulations		
		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.		
			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.		
			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		
			All unattended open excavations must be adequately fenced or demarcated.		
			Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.		
			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		

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT MANAGEMENT OUTCOME	ENVIRONMENTAL IMPACT MANAGEMENT ACTIONS			RESPONSIBLE PERSON
		Pre-construction phase	Construction phase	Operational phase	
			Workers must be instructed not to trespass onto adjacent land. Trespassers will be prosecuted.		

## 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 ***Dikgatlong 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"> <li>• Brush packing with cleared vegetation;</li> <li>• Mulch or chip packing;</li> <li>• Planting of vegetation; and</li> <li>• Hydro-seeding / hand sowing.</li> </ul>		
	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 ***Dikgatlong 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.

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## **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.