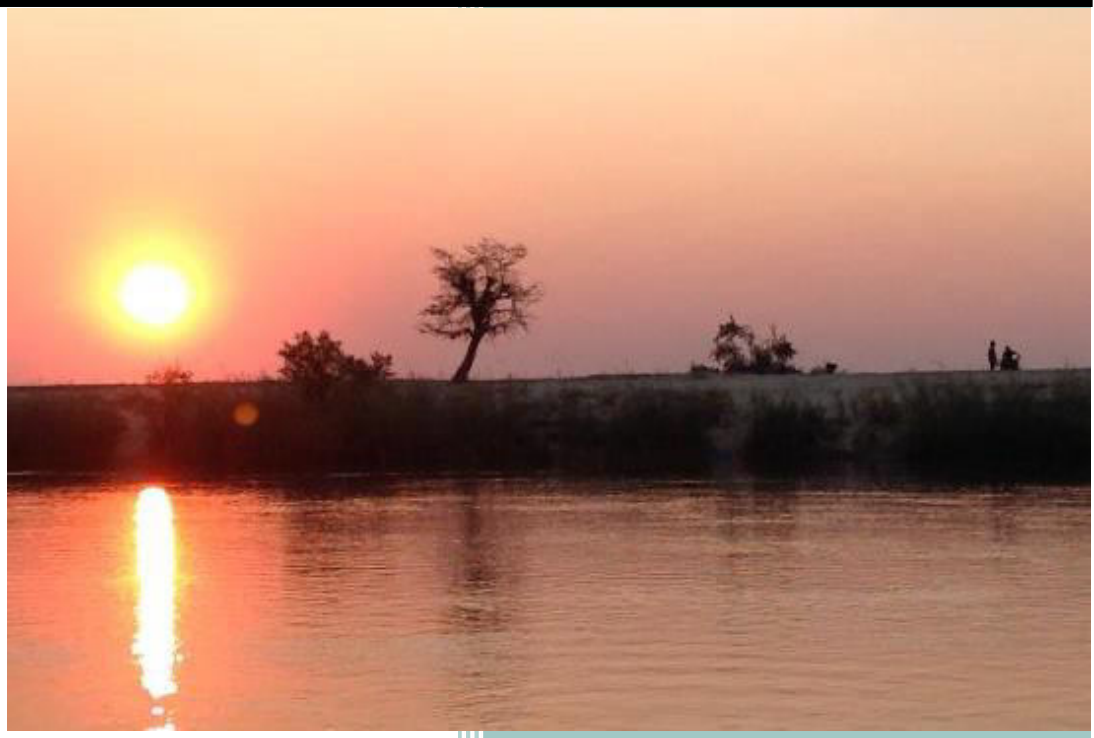
2024

ENVIRONMENTAL MANAGEMENT PLAN
Township Establishment of Kaisosi Extensions 12 and 13, Rundu, Kavango East Region



TOWNSHIP ESTABLISHMENT OF KAISOSI EXTENSIONS 12 AND 13, RUNDU, KAVANGO EAST REGION

PROPONENT

Rundu Town Council

Private Bag 2128

Rundu

Tel: +264 66 266 453

Email: adriano@rundutown.org

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APPLICATION NUMBER:

240903004646

AUTHOR

Colin P Namene

P.O. Box 24213

Windhoek

Tel: +264 81 458 4297

Fax: 061 – 258 470

Email: colin@environam.com

Signature

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LIST OF ACRONYMS

AIDS	Acquired immune deficiency syndrome
CRR	Comments and response report
dB	Decibels
DESR	Draft Environmental Scoping Report
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
EAR	Environmental Assessment Report
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
FESR	Final Environmental Scoping Report
GTZ	Gesellschaft für Technische Zusammenarbeit
HIV	Human immunodeficiency virus
I&AP	Interested and Affected Party
IUCN	International Union for Conservation of Nature
MET	Ministry of Environment and Tourism
MET: DEA	Ministry of Environment and Tourism: Department of Environmental Affairs
MURD	Ministry of Urban and Rural Development
MWTC	Ministry of Works Transport and Communication
PPP	Public participation process
p/km^2	People per square kilometre
SADC	Southern African Development Community
USAID	United States Agency for International Development

1. INTRODUCTION

1.1. Project Background

Rundu is located in the northeast of Namibia, it is the capital and largest town in the Kavango-east region. Rundu is the town with the second largest population in the country. The town is strategically located and is a gateway that links the port of Walvis Bay with a number of important countries in SADC namely Angola, Zambia, Zimbabwe and Botswana. Slow and hampered town planning has resulted in the inadequate supply of readily available serviced erven for residential and commercial use. This situation has presented a serious challenge to the leadership of the town of Rundu as the residents have taken it upon themselves to set up informal settlements. The informal nature of these settlements has meant that these areas are not provided with the basic service infrastructure in terms of water, sewer, electricity and roads.

In an effort to address this situation and to restore dignity to its residents the Rundu Town Council has resolved to formalise a number of informal settlements within the town of Rundu. This assignment will focus on the:

Township Establishment of Kaisosi Extensions 12 and 13

During 2017, the Rundu Twon Council appointed Environam Consultants Trading cc (ECT) to undertake the Environmental Assessment (EA) for Township Establishment of Kaisosi Extensions 12 and 13 in order to obtain an Environmental Clearance Certificate (ECC) for the proposed development. An Environmental Clearance Certificate (ECC) was issued for the activity in April 2017.

In order to realise the formalisation project, the following activities were to be undertaken:

- The subdivision of the Remainder of Farm Rundu Townlands No. 1329 into Portions 2136 and 2137.
- The Township Establishment of:
    - Kaisosi Extension 12, which is approximately 25ha in extent and consisting of 311 erven.
    - Kaisosi Extension 13, which is approximately 29ha in extent will consist of about 311 erven.

The town of Rundu does not generate enough revenue to address the variety of needs of its population due to many factors among which is its historic unemployment rate (around 40%) being above the national employment rate. This state of affairs has meant that the Rundu Town Council has not been able to meet its objectives of formalising these Extensions during the validity period of the ECC issued in 2017.

The Council has, however, been adamant to improve the livelihoods of its residents and has eventually mobilised funding to enable it to carry out this assignment. The Council has thus engaged Environam Consultants Trading once more to apply for the renewal of the expired ECC so as to allow it to complete this dignity restoring project. The process will be undertaken in terms of the Environmental Management Act (No 7 of 2007) (herein referred to as the EMA).

1.2. Project Location

Kaisosi Extensions 12 and 13 are located north of the B8 main road that leads to Divundu and Katima Mulilo. They are south of Kaisosi Extension 11 and to the west of Rundu Extensions 23, 24, and 25 on coordinates -17.920833, 19.804167. Refer to Figure 1 below for the locality map of Rundu and Figure 2 for the locality map of the proposed development.

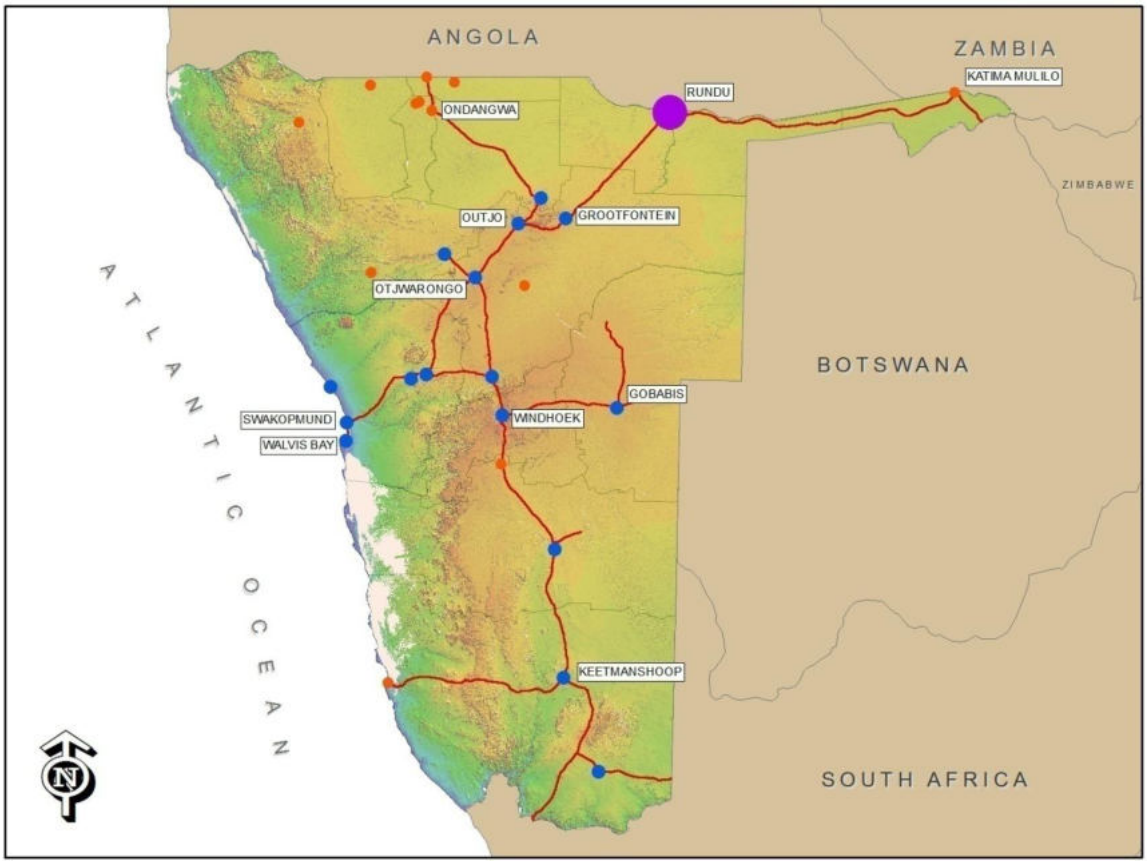

Figure 1: Locality map of Rundu

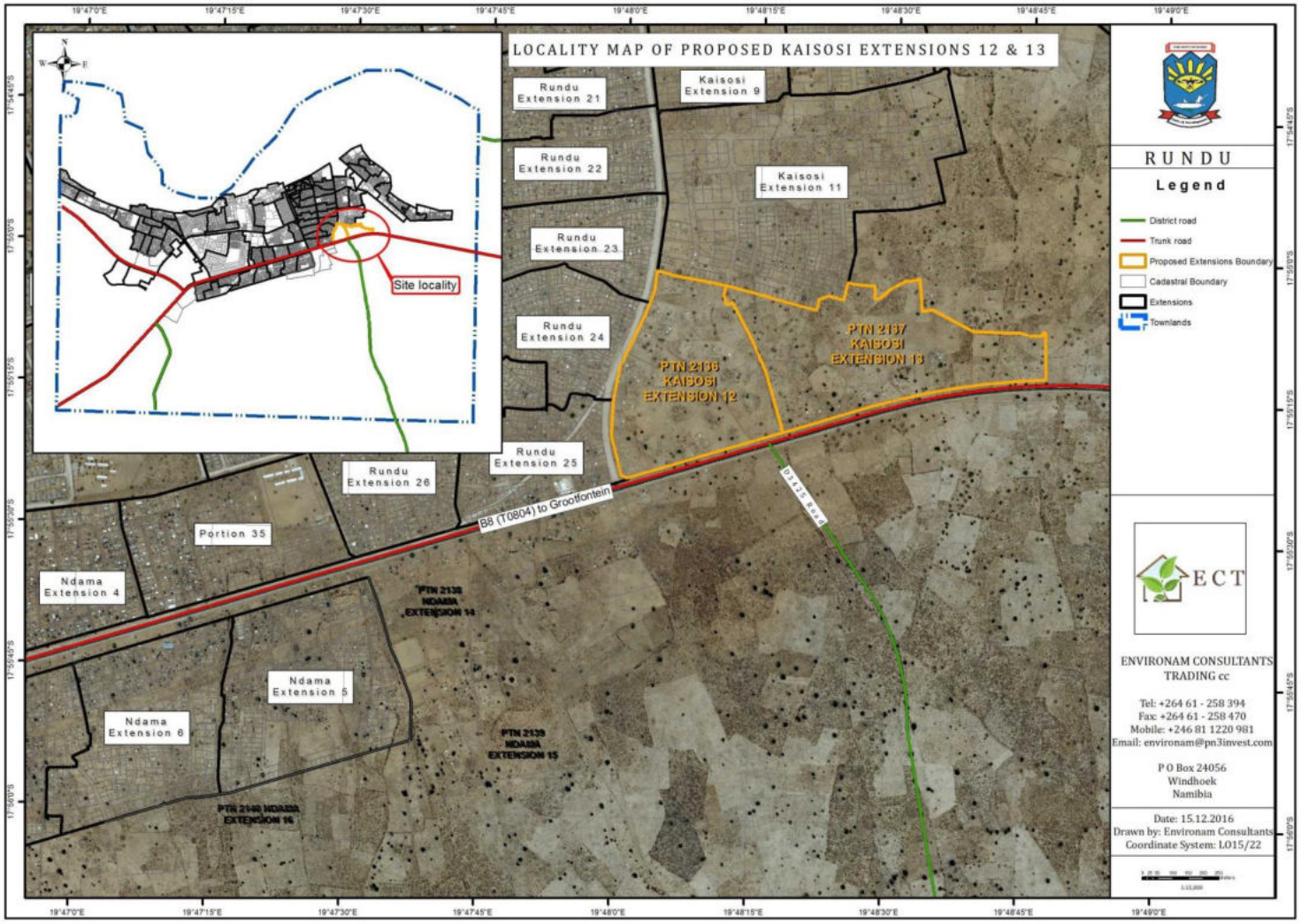

Figure 2: Locality map of the proposed development

1.3. Terms of Reference and Scope of Project

The scope of this project is limited to reviewing the existing Environmental Management Plan (EMP) and updating it. The updated EMP will then be submitted together with the application for the renewal of the ECC for the Township Establishment of Kaisosi Extensions 12 and 13.

1.4. Assumptions and Limitations

In undertaking this investigation and compiling the Environmental Assessment, the following assumptions and limitations apply:

- Assumes the information provided by the proponent is accurate and discloses all information available.

2. LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The principle environmental regulatory agency in Namibia is the Office of the Environmental Commissioner within the Directorate of Environmental Affairs of the Ministry of Environmental and Tourism. Most of the policies and legislative instruments have their basis in two clauses of the Namibian Constitution, i.e. Article 91 (c) and Article 95 (l); however, good environmental management is underpinned by multiple legal instruments. Table 1 below provides a summary of the legal framework considered to be relevant to this development and the environmental assessment process.

Table 1: Legislation applicable to the proposed development

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
The Constitution of the Republic of Namibia as Amended	Article 91 (c) provides for duty to guard against "the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia." Article 95(l) deals with the "maintenance of ecosystems, essential ecological processes and biological diversity" and sustainable use of the country's natural resources.	Sustainable development should be at the forefront of this development.
Environmental Management Act No. 7 of 2007 (EMA)	Section 2 outlines the objective of the Act and the means to achieve that. Section 3 details the principle of Environmental Management	The development should be informed by the EMA.
EIA Regulations GN 28, 29, and 30 of EMA (2012)	GN 29 Identifies and lists certain activities that cannot be undertaken without an environmental clearance certificate. GN 30 provides the regulations governing the environmental assessment (EA) process.	**Activity 10.1 (a)** The construction of oil, water, gas and petrochemical and other bulk supply pipelines. **Activity 10.1 (b)** The construction of public roads. **Activity 10.2 (a)** The route determination of roads and design of associated physical infrastructure where it is a public road.
Convention on Biological Diversity (1992)	Article 1 lists the conservation of biological diversity amongst the objectives of the convention.	The project should consider the impact it will have on the biodiversity of the area.
Draft Procedures and Guidelines for conducting EIAs and compiling EMPs (2008)	Part 1, Stage 8 of the guidelines states that if a proposal is likely to affect people, certain guidelines should be considered by the proponent in the scoping process.	The EA process should incorporate the aspects outlined in the guidelines.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Namibia Vision 2030	Vision 2030 states that the solitude, silence and natural beauty that many areas in Namibia provide are becoming sought after commodities and must be regarded as valuable natural assets.	Care should be taken that the development does not lead to the degradation of the natural beauty of the area.
Water Resources Management Act 11 of 2013	• A permit application in terms of Sections 72(1) of the Water Act is required for the disposal of industrial or domestic waste water and effluent. • Section 44 (1): a licence for abstraction and use of water, to be obtained from the Minister.	Obligation not to pollute surface water bodies. The following licences are required in terms of the Water Resources Management Act: • Licence to abstract and use water; • Groundwater disposal licence; • Borehole licence.
The Ministry of Environment and Tourism (MET) Policy on HIV & AIDS	MET has recently developed a policy on HIV and AIDS. In addition, it has also initiated a programme aimed at mainstreaming HIV and gender issues into environmental impact assessments.	The proponent and its contractor have to adhere to the guidelines provided to manage the aspects of HIV/AIDS. Experience with construction projects has shown that a significant risk is created when construction workers interact with local communities.
Urban and Regional Planning Act, 2018	The Act provides for the establishment of townships.	Section 64 defines the procedure and functionary of townships establishment.
Local Authorities Act No. 23 of 1992	The Local Authorities Act prescribes the manner in which a town or municipality should be managed by the Town or Municipal Council. Sections 34-47 make provision for the aspects of water and sewerage.	The development has to comply with the provisions of the Local Authorities Act
Labour Act no 11 of 2007	Chapter 2 details the fundamental rights and protections. Chapter 3 deals with the basic conditions of employment.	Given the employment opportunities presented by the development, compliance with the labour law is essential.
Public and Environmental Health Act of 2015	The Act serves to protect the public from nuisance and states that person may not cause a health nuisance or may not permit to exist on a land or premises owned or occupied by him or her, or of which he or she is in charge, a health nuisance or other condition liable to be injurious or dangerous to health.	The construction of infrastructure will take place across publicly accessible premises. The proponent should ensure that the site is off limits from public during construction to avoid incidences.

LEGISLATION/POLICIES	RELEVANT PROVISIONS	RELEVANCE TO PROJECT
Nature Conservation Ordinance no 4 of 1975	Chapter 6 provides for legislation regarding the protection of indigenous plants	Indigenous and protected plants have to be managed within the legal confines.
Atmospheric Pollution Prevention Ordinance (No. 11 of 1976).	The Ordinance objective is to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto.	All future activities on the sites will have to take due consideration of the provisions of this legislation.
Roads Ordinance 17 of 1972	This Ordinance consolidates the laws relating to roads.	The provisions of this legislation have to be taken into consideration in as far as access to the development site is concerned.
Roads Authority Act, 1999	Section 16(5) of this Act places a duty on the Roads Authority to ensure a safe road system.	Some functions of the Roads Ordinance 17 of 1972 have been assigned to the Roads Authority.

3. ENVIRONMENTAL BASELINE DESCRIPTION

3.1. Social Environment

3.1.1. Socio-Economic Context

Rundu is the capital and largest city of the Kavango-East Region in northern Namibia. It lies on the border with Angola on the banks of the Kavango River about 1,000 metres (3,300 feet) above sea level. Rundu's population is growing rapidly. The 2001 census counted 36,964 inhabitants; and for the 2011 census it has climbed to 63,430. The 2023 census puts the population of Rundu at 118,625 of which 54,658 are male and 63,967 females. In 2016 the Kavango East region was estimated to have a 40 percent unemployment rate above the 33 percent national average.

Rundu is a frontier town that is a major hub for trade and development in the north, particularly with Angola's rebuilding efforts and the Trans-Caprivi highway connecting the country and its main port in Walvis Bay to the rest of Africa. The diverse cultures and talents of the people in the town are evident in the creativity of its business activities. The Kavango East region borders Kavango West region on its western side, the Otjozondjupa region on its south western side, the Zambezi region on its eastern side, and Angola on its northern side while Botswana on its southern side. The location of the town connects it to the central and northern parts of the country, making it a gateway town to those parts of the country. It is located 715 kilometers away from Windhoek, the country's capital.

3.1.2. Archaeological and Heritage Context

There are no declared heritage sites by the National Heritage Council of Namibia in Rundu. It is therefore unlikely that the development site will have any significant archaeological resources; however an accidental find procedure may be required.

3.2. Bio-Physical Environment

3.2.1. Climate

Rundu has a humid subtropical climate with hot summers and relatively mild winters (with warm days and chilly to cool nights). It borders on a semi-arid climate. The average maximum temperature as indicated in Figure 3 below varies between 27 and 34°C with the average minimum temperature between 8 and 20°C.

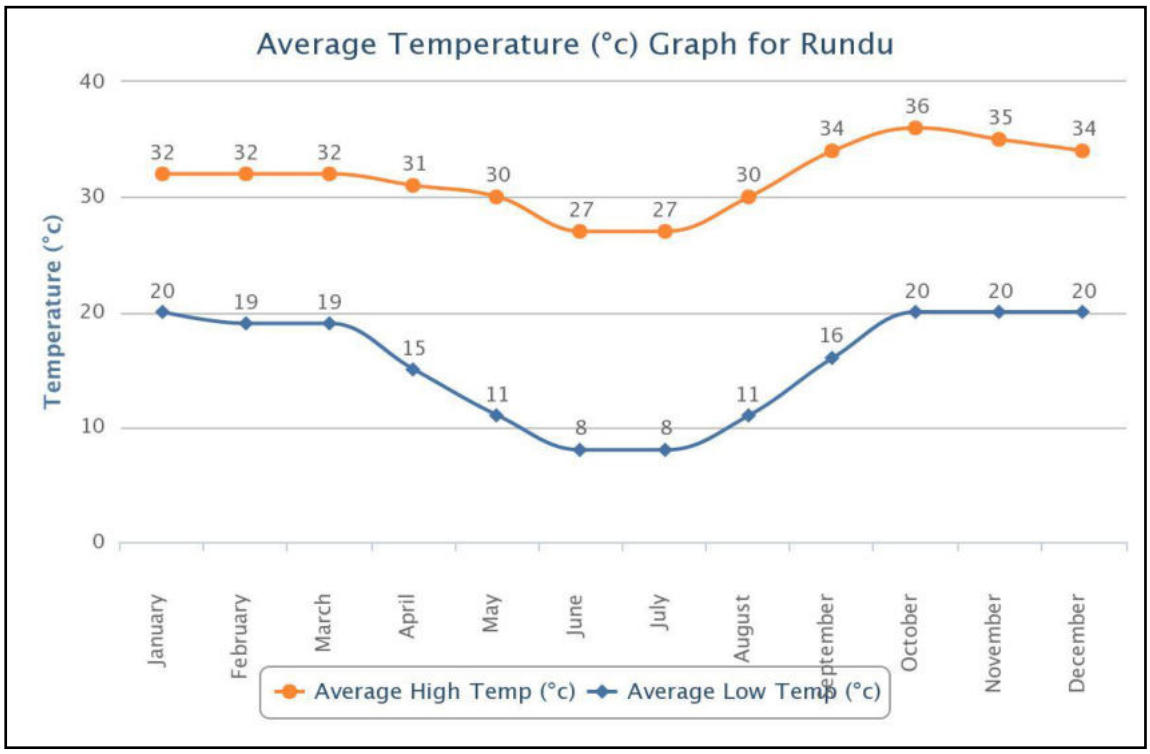

Figure 3: Temperature graph for Rundu (World Weather Online, 2024)

Rainfall is usually expected during the summer months as indicated in **Error! Reference source not found.** below and on average 95% of this rainfall is experienced from November to April. Rundu receives an annual precipitation of 571 mm. No rain of any significance falls from May to September, and the chance of rain increases progressively from October until January, the month with the highest total on average, and then decreases again until April.

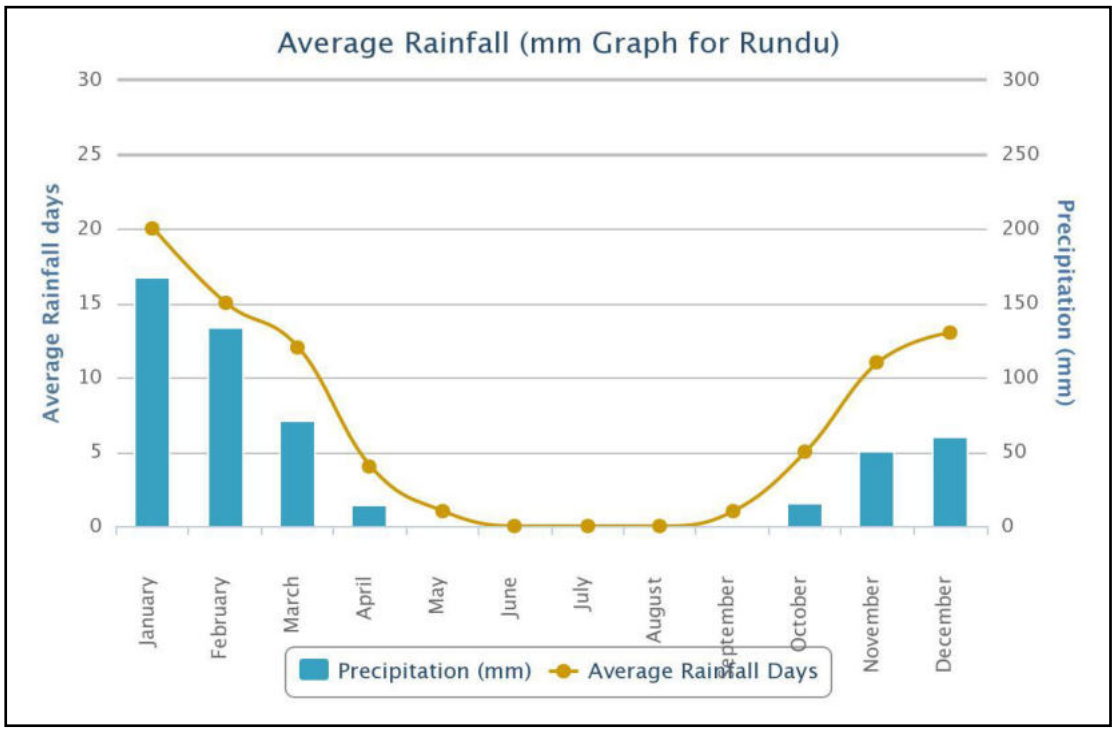

Figure 4: Climate Graph for Rundu (World Weather Online, 2024b)

3.2.2. Topography, Geology and Hydrogeology

The topography of Kavango East Region is noticeably flat and is mostly made up of swamps, floodplains, wetlands and woodlands. The main hydrological feature of the Kavango Region is the Okavango River. The Cuito River, a tributary, joins the Kavango River from Angola at Dirico, so flow volumes are greater downstream of this point. Apart from this difference, hydrological features of the upstream section are similar, but not identical, to the aforementioned description. One important difference is the timing of flooding and the contribution of each tributary. The Okavango River at Rundu experiences its highest water from January to May with the peak in April, in response to summer rain falling in the upstream catchment and making its way downstream. Water in the Cuito is delayed by a longer period and peaks in about May (Mendelsohn & el Obeid 2003).

Surface soils across the Kavango Region, like in Caprivi, are completely dominated by sand. At deeper levels of more than one metre are layers of clays, conglomerates, sands, silts and calcretes that originate from wetter climates in the geological past. Small scale variations in soil type occur, with areas close to the Okavango River containing fine sediments (silt, clay and fine sands) deposited during floods, and other sporadically-distributed areas rich in calcium carbonate. The more clayey soils are slightly more fertile than sands, and they are mostly cultivated. However, all soils in Kavango generally have low fertility (Mendelsohn & el Obeid 2006). Namwater is the main supplier of water to the town, with two treatment plants and four water tanks (Tamayo et al., 2011), namely the:

- Rundu State Water Scheme, supplying Rundu Town, the industrial area and Sauyemwa
- Nkarapamwe State Water Scheme, providing water to the airport, the military base, Nkarapamwe, Safari, Kehemu, Ndama, Donkerhoek and Kaisosi (RSP, 2014).

3.2.3. Terrestrial Ecology

In the Kavango Region, Kalahari woodlands are widespread and in places where there are dunes, woodlands alternate with thin strips of grassland representing the lowest levels of the inter-dune valleys (Mendelsohn & el Obeid 2003). The Kalahari woodlands are variable from place to place in their species composition and community structure, some places being quite open, others densely wooded with tall trees and little under-storey, others having mostly medium-sized trees and lots of undergrowth.

These variations are small-scale and not significant to the environmental assessment. The dominant trees that occur in this woodland (not in order of predominance) are kiaat (*Pterocarpus angolensis*), teak (*Baikiaea plurijuga*), syringa (*Burkea africana*), silver terminalia (*Terminalia sericea*), mangetti (*Schinziophton rautanenii*), false mopane (*Guibourtia colesperma*), camelthorn (*Acacia erioloba*), marula (*Sclerocarya birrea*), and weeping wattle (*Peltophorum africanum*). In places there are small stands of makalani palms (*Hyphaene petersiana*) (Mendelsohn & el Obeid 2003).

Typical trees found in the area are Large Kiat (*Pterocarpus angolensis*) which is mostly found in Kavango woodlands and camelthorn (*Acacia erioloba*). Grass grows between trees and shrubs in the woodlands, and certain types of tall strong grasses (mainly *Eragrostis pallens*) are harvested for thatching. Omiramba support good grazing fodder for livestock, particularly the lawn grass *Cynodon dactylon* (Mendelsohn & el Obeid, 2003). Commonly found within the floodplain is a typical riparian vegetation known as leadwood (*Combretum imberbe*) and which is a protected tree, their slow-growing nature renders them a threatened species when subjected to illegal harvesting (Mannheimer, 2016, pers.comm., 10 March).

Swamps and floodplains alongside the Okavango River host reeds, sedges and grasses depending on their degree of saturation and how frequently they are inundated. Reeds growing in areas that are regularly (annually) flooded and on the margins of permanent water are an important resource used by local people (Mendelsohn & el Obeid, 2003). The proposed development site has been largely disturbed, however a number of large trees can be found particularly within the informal properties.

Due to the clearing of much of the natural vegetation along the Okavango River, most of the wildlife that used to occur along the Okavango River has now disappeared. The bulk of the remaining wildlife is now concentrated in the Mahango Game Reserve, Caprivi Game Park and Khaudum Game Park. Mahango Game Reserve now has the highest concentration of large mammals in Namibia as well as the greatest bird diversity in the country (Mendelsohn & el Obeid, 2006). Figure 5 below provides a view of the general area and surrounds of the proposed development site.

Figure 5: General area of the proposed development site.

3.3. Surrounding Land Use

The two extensions are bordered by Kaisosi Extension 11 to the north, which is a predominantly residential neighbourhood. Towards the west lie Rundu Extensions 23, 24, and 25 which are

also dominated by residential zoned erven. The B8 Main road passes by on the southern side of the two townships.

3.4. Physical Environment

The infrastructure needs of the proposed project can be categorised into two broad classifications namely:

- Basic infrastructure that includes water supply, sewage, electricity, roads and drainage systems.
- Environmental infrastructure that consists of solid waste management and vegetation.

The service infrastructure such as water, sewer, drainage, electricity and roads will be designed by registered professional engineers to integrate with the existing build-up area of Rundu. The electricity design and connections will be carried out in consultation with NORED as the relevant regional electricity distributor. A NamPower line runs across Kaisosi Extension 13, it is to be noted that a number of properties have been constructed within the 22m servitude that applies to these infrastructures and therefore have to be relocated.

Access to the site has to be determined and agreed to in consultation with the Roads Authority. The internal road network will be designed and the construction thereof supervised by professional engineers as part of the service infrastructure. As is the case with the NamPower lines, the national roads which fall under the jurisdiction of the Roads Authority are also subject to a 60 m road reserve and 45m building restriction line. Due to the unplanned nature of the settlements many properties in both extensions encroach in these servitudes.

The affected properties will have to be relocated to conform to the Roads Authority standards. At this point an agreement has been reached with the Roads Authority to relax the restrictions to allow for the design of a 15m service road that will fall within the 45m building restriction line, but which will be outside the road reserve. This is to facilitate safe access from the B8.

The above matters have been communicated to the residents of the settlements during the separate consultative meetings held as part of the planning and environmental assessment processes.

4. PROJECT DESCRIPTION

4.1. Site Description

As previously outlined in Section 1.1, the proposed project involves the township establishment of Kaisosi Extensions 12 and 13. The township establishment will be a result of the subdivision of the Remainder of Farm Rundu Townlands No. 1329 into Portions 2136 and 2137. Kaisosi Extension 12, which is approximately 25ha in extent, and Kaisosi Extension 13, which is approximately 29ha in extent will each consist of about 311 erven each. The proposed townships will comprise of the following land uses delineated in Table 2 below:

Table 2: Land uses of the two extensions (SPC, 2016)

Land Use	Kaisosi Extension 12	Kaisosi Extension 13
Residential	259	265
General Residential	2	1
Business	24	20
Local Business	1	2
Institutional	2	1
Public Open Space	23	22
TOTAL	311	311

4.2. Decision Factors

The following factors served as informants and were considered when preparing the layout designs for the proposed development:

- Respect the natural vegetation, incorporate the large mature trees within the newly created erven;
- Comply to Roads Authority and NamWater restrictions/ servitudes;
- Formalise the existing residential and commercial developments as far as possible;
- Provide opportunities for institutional, recreational, and commercial activities;
- Provide a well-defined road network;

4.3.No – Go Alternative

As pointed out earlier various alternatives were initially considered, taking into account the restrictions encountered due to the fact that the development sites are already inhabited. Consultative meetings in connection with the proposed developments have taken place between the affected communities and the local authority and its town planners. It was evident from the public consultation meeting we held with the community that they are aware of the upcoming developments and their concerns have more to do with the aspects relating to the timelines for the developments to realise.

5. ENVIRONMENTAL MANAGEMENT PLAN

An EMP is one of the most important outputs of the EA process as it synthesises all of the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. This EMP details the mitigation and monitoring actions to be implemented during the following phases of these developments:

- Planning and Design – the period, prior to construction, during which preliminary legislative and administrative arrangements, necessary for the preparation of the land, are made and engineering designs are carried out. The preparation of construction tender documents forms part of this phase;
- Construction – the period during which the proponent, having dealt with the necessary legislative and administrative arrangements, appoints a contractor for the construction of service infrastructure, buildings as well as any other construction activities within the development areas;
- Operation and Maintenance – the period during which the development will be fully functional, operational and maintained.

The decommissioning of these developments is not envisaged; however, in the event that this should be considered some recommendations have been outlined in Table 6.

6. ROLES AND RESPONSIBILITIES

Rundu Town Council (the Proponent) is ultimately responsible for the implementation of the EMP, from the planning and design phase to the decommissioning phase of these developments (if these developments are in future decommissioned). The Proponent will delegate this responsibility as the project progresses through its life cycle. The delegated responsibility for the effective implementation of this EMP will rest on the following key individuals:

- Proponent's Representative;
- Environmental Control Officer; and
- Contractor (Construction and Operations and Maintenance).

6.1. PROPONENT'S REPRESENTATIVE

The Proponent should assign the responsibility of managing all aspects of these developments for all development phases (including all contracts for work outsourced) to a designated member of staff, referred to in this EMP as the Proponent's Representative (PR). The Proponent may decide to assign this role to one person for the full duration of these developments, or may assign a different PR to each of the development phases – i.e. one for the planning and design phase, one for the construction phase and one for the operation and maintenance phase. The PR's responsibilities are as follows:

Responsibility	Project Phase
Making sure that the necessary approvals and permissions laid out in Table 1 are obtained/adhered to	Throughout the lifecycle of these developments
Making sure that the relevant provisions detailed in Table 3 are addressed during planning and design phase.	Planning and design phase
Suspending/evicting individuals and/or equipment not complying with the EMP	• Construction • Operation and maintenance
Issuing fines for contravening EMP provisions	• Construction • Operation and maintenance

6.2. ENVIRONMENTAL CONTROL OFFICER

The PR should assign the responsibility of overseeing the implementation of the whole EMP on the ground during the construction and operation and maintenance phases to a designated member of staff, referred to in this EMP as the Environmental Control Officer (ECO). The PR /Proponent may decide to assign this role to one person for both phases, or may assign a different ECO for each phase. The ECO will have the following responsibilities during the construction and operation and maintenance phases of these developments:

- Management and facilitation of communication between the Proponent, PR, the contractors, and Interested and Affected Parties (I&APs) with regard to this EMP;
- Conducting site inspections (recommended minimum frequency is monthly) of all construction and/or infrastructure maintenance areas with respect to the implementation of this EMP (monitor and audit the implementation of the EMP);
- Assisting the Contractor in finding solutions with respect to matters pertaining to the implementation of this EMP;
- Advising the PR on the removal of person(s) and/or equipment not complying with the provisions of this EMP;
- Making recommendations to the PR with respect to the issuing of fines for contraventions of the EMP; and
- Undertaking an annual review of the EMP and recommending additions and/or changes to this document.

6.3.CONTRACTOR

Contractors appointed by the Proponent are automatically responsible for implementing all provisions contained within the relevant chapters of this EMP. Contractors will be responsible for the implementation of this EMP applicable to any work outsourced to subcontractors. Table 4 applies to contractors appointed during the construction phase and Table 5 to those appointed during the operation and maintenance phase. In order to ensure effective environmental management, the aforementioned chapters should be included in the applicable contracts for outsourced construction, operation and maintenance work.
The tables in the following chapter detail the management measures associated with the roles and responsibilities that have been laid out in this chapter.

7. MANAGEMENT ACTIONS

The aim of the management actions in this chapter of the EMP is to avoid potential impacts where possible. Where impacts cannot be avoided, measures are provided to reduce the significance of these impacts.

The following tables provide the management actions recommended to manage the potential impacts rated in the scoping-level EA conducted for these developments. These management actions have been organised temporally according to project phase:

- Applicable legislation (Table 1);
- Planning and design phase management actions (Table 3);
- Construction phase management actions (Table 4);
- Operation and maintenance phase management actions (Table 5); and
- Decommissioning phase management actions (Table 6).

The responsible persons at the Proponent's team have assessed these commitments in detail and have committed to the specific management actions were indicated in the tables below.

7.1. PLANNING AND DESIGN PHASE

The PR should ensure that the management actions detailed below should be should be adhered to during the period before the construction of the infrastructure starts.

Table 3: Proposed mitigation measures for the planning and design phase

PLANNING AND DESIGN PHASE IMPACTS	
Impact	**Mitigation Measures**
Surface and ground water	• Appoint professional engineers to develop a detailed storm water management design as part of the infrastructure service provision of the developments. • No dumping of waste products of any kind in or in close proximity to any water bodies. • Contaminated runoff from the various operational activities should be prevented from entering any water bodies. • Ensure that surface water accumulating on-site are channelled and captured through a proper storm water management system to be treated in an appropriate manner before disposal into the environment. • Wastewater should not be discharged directly into the environment. • Disposal of waste from the development should be properly managed. • The service infrastructure should be designed and constructed by suitably qualified engineering professionals. • Develop and implement a preventative maintenance plan for the service infrastructure
Fauna and flora	• Adapt the proposed developments to the local environment – e.g. small adjustments to the site layout could avoid potential features such as water bodies, existing vegetation, etc. • Plant local indigenous species of flora as part of the landscaping as these species would require less maintenance than exotic species. • Prevent the introduction of potentially invasive alien ornamental plant species such as; Lantana, Opuntia, Prosopis, Tecoma, etc. as part of the landscaping as these species could infestate the area further over time.
Existing Service Infrastructure	• It is recommended that alternative and renewable source of energy be explored and introduced into the proposed development to reduce dependency on the grid. • Solar geysers and panels should be introduced to provide for general lighting and heating of water and buildings. • Other 'green' technologies to reduce the proposed development's dependency on fossil fuel should be explored where possible.

PLANNING AND DESIGN PHASE IMPACTS	
Impact	**Mitigation Measures**
	• Designs and building materials should be as such to reduce dependency on artificial heating and cooling in order to limit the overall energy necessities. • Water saving mechanisms should be incorporated within the proposed development's design and plans in order to further reduce water demands. • Re-use of treated waste water should be considered wherever possible to reduce the consumption of potable water, for example for gardening. • Adhere to water quality guidelines in terms of The Water Resources Management Act 11 of 2013.
Traffic	• The proponent in consultation with the Roads Authority will initiate an on-site investigation to determine the suitability of the proposed access road. • Ensure that road junctions have good sightlines. • Limit the type of vehicle e.g. heavy trucks. • Adhere to the speed limit. • Implement traffic control measures where necessary.

7.2. CONSTRUCTION PHASE

The management actions listed in Table 4 apply during the construction phase. This table may be used as a guide when developing EMPs for other construction activities within this development area.

Table 4: Proposed mitigation measures for the construction phase

CONSTRUCTION PHASE IMPACTS	
Impact	**Mitigation Measures**
Fauna and flora	• Prevent contractors from collecting wood, veld food, etc. during the construction phase. • Do not clear the entire development site of vegetation, but keep the few individual trees not directly affecting the development as part of the landscaping. • Transplant removed vegetation where possible, or plant new trees in lieu of those that have been removed.
Pressure on existing infrastructure	• Ensure all potable water points are metered and regularly read. • Ensure that the workforce is provided with temporary toilets during the construction phase.

CONSTRUCTION PHASE IMPACTS	
Impact	**Mitigation Measures**
Surface and Ground Water Impacts	• It is recommended that construction takes place outside of the rainy season in order to limit flooding on site and to limit the risk of ground and surface water pollution. • No dumping of waste products of any kind in or in close proximity to water sources. • Heavy construction vehicles should be kept out of any surface water bodies and the movement of construction vehicles should be limited where possible to the existing roads and tracks. • Ensure that oil/ fuel spillages from construction vehicles and machinery are minimised and that where these occur, that they are appropriately dealt with. • Drip trays must be placed underneath construction vehicles when not in use to contain all oil that might be leaking from these vehicles. • Contaminated runoff from the construction sites should be prevented from entering the surface and ground water bodies. • All materials on the construction site should be properly stored. • Disposal of waste from the site should be properly managed and taken to the Rundu landfill site. • Construction workers should be given ablution facilities at the construction sites that are located at least 30 m away from any surface water and these should be regularly serviced. • Washing of personnel or any equipment should not be allowed on site. Should it be necessary to wash construction equipment these should be done at an area properly suited and prepared to receive and contain polluted waters.
Health, Safety and Security	• Construction personnel should not overnight at the site, except the security personnel. • Ensure that all construction personnel are properly trained depending on the nature of their work. • Provide for a first aid kid and a properly trained person to apply first aid when necessary. • A wellness program should be initiated to raise awareness on health issues, especially the impact of sexually transmitted diseases. • Provide free condoms in the workplace and to local community throughout the construction phase. • Facilitate access to Antiretroviral medication for construction personnel that need them. • Restrict unauthorised access to the site and implement access control measures. • Clearly demarcate the construction site boundaries along with signage of “no unauthorised access”. • Clearly demarcate dangerous areas and no-go areas on site. • Staff and visitors to the site must be fully aware of all health safety measures and emergency procedures.

CONSTRUCTION PHASE IMPACTS	
Impact	**Mitigation Measures**
	• The contractor must comply with all applicable occupational health and safety requirements. The workforce should be provided with all necessary Personal Protective Equipment where appropriate.
Traffic	• Limit and control the number of access points to the site. • Ensure that road junctions have good sightlines. • Construction vehicles' need to be in a road worthy condition and maintained throughout the construction phase. • Transport the materials in the least number of trips possible. • Adhere to the speed limit. • Implement traffic control measures where necessary. • Minimise the movement of heavy vehicles during peak time.
Noise	• No amplified music should be allowed on site. • Inform immediate neighbours of construction activities to commence and provide for continuous communication between the neighbours and contractor. • Limit construction times to acceptable daylight hours. • Install technology such as silencers on construction machinery. • Do not allow the use of horns/hooters as a general communication tool, but use it only where necessary as a safety measure. • Provide protective equipment such as ear muffs and ear plugs to workers.
Air quality	• All loose material should be kept on site for the shortest possible time. • It is recommended that dust suppressants such as Dustex be applied to all the construction clearing activities to minimise dust. • Construction vehicles to only use designated roads. • During high wind conditions the contractor must make the decision to cease works until the wind has calmed down. • Cover any stockpiles with plastic to minimise windblown dust. • Provide workers with dust masks. • Ensure construction vehicles are well maintained to prevent excessive emission of smoke.

CONSTRUCTION PHASE IMPACTS	
Impact	**Mitigation Measures**
Waste	• It is recommended that waste from the temporary toilets be disposed of at the Rundu Wastewater Treatment Works. • A sufficient number of waste bins should be placed around the site for the soft refuse. • A sufficient number of skip containers for the heavy waste and rubble should be provided for around the site. • The waste containers should be able to be closed to prevent birds and other animals from scavenging. • Solid waste will be collected and disposed of at an appropriate local land fill in Rundu, in consultation with the local authority.
Hazardous Substances	• All chemicals and other hazardous substances must be stored and maintained in accordance with the Hazardous Substances Ordinance (No. 14 of 1974), with all relevant licences and permits to be obtained where applicable. • Given the potential harm to human health during handling and use of any of hazardous substances it is essential that all staff be trained with regards to the proper handling of these substances as well as First Aid in the case of spillage or intoxication. • Storage areas for all substances should be bunded and capable to hold 120% of the total volume of a given substance stored on site.
Social	• Ensure locals enjoy priority in terms of job opportunities, to the extent possible, for skills that are available locally. • Ensure local procurement where commodities are available locally.

7.3. OPERATION AND MAINTENANCE PHASE

The management actions included in Table 5 below apply during the operation and maintenance phase of this development.

Table 5: Proposed mitigation measures for the operational phase

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
Surface and Ground Water	• A no-go buffer area of at least 25 m should be allocated to any water bodies in the area. • No dumping of waste products of any kind in or in close proximity to any surface water bodies. • Contaminated runoff from the various operational activities should be prevented from entering any surface water bodies. • Ensure that surface water accumulating on-site are channelled and captured through a proper storm water management system to be treated in an appropriate manner before disposal into the environment. • Wastewater should not be discharged directly into the environment. • Disposal of waste from the development should be properly managed. • The service infrastructure should be designed and constructed by suitably qualified engineering professionals. • Develop and implement a preventative maintenance plan for the service infrastructure.
Visual and Sense of Place	• It is recommended that more 'green' technologies be implemented within the architectural designs and building materials of the development where possible in order to minimise the visual prominence of such a development within the more natural surrounding landscape. • Natural colours and building materials such as wood and stone should be incorporated. • Visual pollutants can further be prevented through mitigations such as keeping existing vegetation, introducing tall indigenous trees, keeping structures unpainted and minimising large advertising billboards).
Noise	• Limit the types of activities that generate excessive noise. • No activity having a potential noise impact should be allowed after 18:00 if possible.
Air quality	• Manage activities that generate emissions or dust. • Minimise the movement of vehicles in the area.
Waste management	• A sufficient number of waste bins should be placed on the properties for the soft refuse. • A sufficient number of skip containers for the heavy waste and rubble should be provided for at appropriate sites. • The waste containers should be able to be closed to prevent birds and other animals from scavenging.

OPERATIONAL PHASE IMPACTS	
Impact	**Mitigation Measures**
	• Solid waste will be collected and disposed of at an appropriate local land fill in Rundu, this should be done in consultation with the local authority.
Quality of life	The construction of services and other related developments will greatly contribute to the well-being and quality of life of the Rundu residents.
Infrastructure development	• Ensure that the infrastructure is designed and supervised by suitably qualified engineering professionals.

7.4. DECOMMISSIONING PHASE

The decommissioning of this development is not foreseen. In the event that this development is decommissioned the following management actions should apply.

Table 6: Decommissioning phase management actions

Environmental Feature	Management Actions
Deconstruction activity	Many of the mitigation measures prescribed for construction activity for this development Table 4 above) would be applicable to some of the decommissioning activities. These should be adhered to where applicable.
Rehabilitation	In the event that decommissioning is deemed necessary, excavations need to be rehabilitated according to the management actions laid out in Table 5 above.

Appendix A – Property Development Environmental Management Plan

This Development Environmental Management Plan will form part of every Deed of Sale or to be entered into between Rundu Town Council and purchasers of the individual erven on the development site.

Environmental feature	Mitigation measure
Conservation of vegetation	• All trees listed (with co-ordinates provided) in the title deed/lease agreement for this erf should be conserved as far as practicably possible. These trees should be incorporated into the planning layout of any structures to be erected on this erf. • Where listed trees cannot be accommodated by the planned structures to be built, written motivation should be submitted to the Rundu Town Council requesting permission to remove such trees. Only once a permit has been received from the Town Council may the owner of the erf remove affected trees.
Health and safety	• No human waste may be expelled on open soil. Every construction site should have at least one portable toilet. • Only one or two security guards may reside/sleep on-site during construction. No other construction personnel may sleep/reside on-site. • No open fires may be made anywhere on-site during the construction period. Heating and cooking facilities (where necessary/applicable) should be provided by the Contractor.
Waste management	• The waste container of portable toilets should be emptied on a regular basis to avoid overflows. Waste from portable toilets should be removed to the Rundu Town Council wastewater treatment facility. • All waste should be placed in the appropriate waste containers on a daily basis. • All waste on-site should be removed on a weekly basis. • Concrete should not be mixed on open soil. Concrete should be mixed on an impermeable (i.e. lined) surface.

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Appendix B – Water Quality Guidelines

ANNEXURE

Water Quality Standards for Effluent

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	**General Standard**
DETERMINANTS	**UNIT**	**FORMAT**	**95 percentile requirements**	
PHYSICAL REQUIREMENTS				
Temperature	° C		Not more than 10^0C higher than the recipient water body	
Turbidity	NTU		< 5	< 12
pH			6,5-9,5	6,5-9,5
Colour	mg/litre Pt		< 10	< 15
Smell			No offensive smell	
Electric conductivity 25 °C	mS/m		< 75 mS/m above the intake potable water quality	
Total Dissolved Solids	mg/litre		< 500 mg/litre above the intake potable water quality	
Total Suspended Solids	mg/litre		< 25	< 100
Dissolved oxygen	% saturation		>75	>75
Radioactivity	units		below ambient water quality of the recipient water body	
ORGANIC REQUIREMENTS				
Biological Oxygen Demand	mg/litre	BOD	< 10	< 30
Chemical Oxygen Demand	mg/litre	COD	< 45	< 100
Detergents (soap)	mg/litre		< 0.2	< 3
Fat, oil & grease, individual	mg/litre	FOG	nil	< 2.5
Phenolic compounds	µg/litre	as phenol	< 0.01	< 0.10
Aldehyde	µg/litre		< 50	< 100
Adsorbable Organic Halogen	µg/litre	AOX	< 50	< 100
INORGANIC MACRO DETERMINANTS				
Ammonia (NH_4 – N)	mg/litre	N	< 1	< 10
Nitrate (NO_3 - N)	mg/litre	N	< 15	< 20
Nitrite (NO_2 - N)	mg/litre	N	< 2	< 3
Total Kjeldahl Nitrogen (TKN)	mg/litre	N	< 18	< 33
Chloride	mg/litre	Cl	< 40 mg/litre above the intake potable water quality	< 70 mg/litre above the intake potable water quality
Sodium	mg/litre	N	< 50 mg/litre above the intake potable water quality	<90 mg/litre above the intake potable water quality
Sulphate	mg/litre	SO_4	< 20 mg/litre above the intake potable water quality	< 40 mg/litre above the intake potable water quality
Sulphide	µg/litre	S	< 0.05	< 0.5
Fluoride	mg/litre	F	1,0	2,0
Cyanide (Free)	µg/litre	CN	< 30	< 100
Cyanide (recoverable)	µg/litre	CN	< 70	< 200
Soluble Ortho phosphate	mg/litre	P	< 0.2	3,0
Zinc*	mg/litre	Zn	1	5

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	General Standard
DETERMINANTS	**UNIT**	**FORMAT**	**95 percentile requirements**	
INORGANIC MICRO DETERMINANTS				
Aluminium	µg/litre	Al	< 25	< 200
Antimony	µg/litre	Sb	< 5	< 50
Arsenic	µg/litre	As	< 50	< 150
Barium	µg/litre	Ba	< 50	< 200
Boron	µg/litre	B	< 500	< 1000
Cadmium*	µg/litre	Cd	< 5	< 50
Chromium, (hexavalent)	µg/litre	Cr	< 10	< 50
Chromium, Total*	µg/litre	Cr	< 50	< 1000
Copper*	µg/litre	Cu	< 500	< 2000
Iron	µg/litre	Fe	< 200	< 1000
Lead*	µg/litre	Pb	< 10	< 100
Manganese	µg/litre	Mn	< 100	< 400
Mercury*	µg/litre	Hg	< 1	< 2
Nickel	µg/litre	Ni	< 100	< 300
Selenium	µg/litre	Se	< 10	< 50
Strontium*	µg/litre	Sr	< 100	< 100
Thallium	µg/litre	Ti	< 5	< 10
Tin*	µg/litre	Sn	< 100	< 400
Titanium	µg/litre	Ti	< 100	< 300
Uranium*	µg/litre	U	< 15	< 500
*Total for Heavy Metals (Sum of Cd,Cr,Cu,Hg,Pb	µg/litre	Cd,Cr,Cu, H g & Pb	< 200	< 500
UNSPECIFIED COMPOUNDS FROM ANTHROPOGENIC ACTIVITIES				
Agricultural chemical compounds	µg/litre		Any in-/organic compound recognized as an agro-chemical is to be avoided or reduced as far as possible. Maximum acceptable contaminant levels will be site specific, dependent on chemical usage and based the water quality of the recipient water body	
Industrial and mining chemical compounds, including unlisted metals and persistent organic pollutants	µg/litre		Any in-/ organic compound recognized as an industrial chemical including unlisted metals is to be avoided or reduced as far as possible. Maximum acceptable contaminant levels will be site specific dependent on chemical usage and based the water quality of the recipient water body	
Endocrine Disruptive Compounds (EDC)	µg/litre		Any chemical compound that is suspected of having endocrine disruptive effects is to be avoided as far as is possible. Maximum acceptable contaminant levels will be site specific dependent on chemical usage and based the water quality of the recipient water body.	
Hydrocarbons (Benzene, Ethyl Benzene, Toluene and Xylene	µg/litre		Below detection level	Below detection level
Organo-metallic compounds: methyl mercury, tributyl tin (TBT), etc.	µg/litre		Below detection level	Below detection level
DISINFECTION				
Residual chlorine	mg/litre		< 0.1 Dependent on recipient water body	< 0.3 Dependent on recipient water body

Effluent to be discharged or disposed of in areas with potential for drinking water source contamination; international rivers and dams and in water management and other areas				
			Special Standard	**General Standard**
DETERMINANTS	**UNIT**	**FORMAT**		
BIOLOGICAL REQUIREMENTS (Algae and parasites)				
Further treatment of the effluent dependent on: 1. the water quality of the recipient water body if any 2. the distance from any point of potable water abstraction 3. an acceptable maximum contaminant level downstream of the point of discharge 4. the exposure to human and animal consumption downstream of the point of discharge 5. any reuse option that may be implemented.				
MICROBIOLOGY				
Further treatment of the effluent are dependent on: 1. the water quality of the recipient water body if any 2. the distance from any point of potable water abstraction 3. an acceptable maximum contaminant level downstream of the point of discharge 4. the exposure to human and animal consumption downstream of the point of discharge 5 any water reuse option that may be implemented.				

ANNEXURE

Table 1. Water Quality Guidelines and Standards for Potable Water

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				**Ranges and upper limits**	
Interpretation				**(Ideal guideline)**	**(Acceptable Standard)**
DETERMINANTS	**Unit**	**Format**	**Concern**	**95 Percentile Requirement**	
PHYSICAL AND ORGANOLEPTIC REQUIREMENTS					
Temperature	° C		E	Ambient temperature	
Colour	PTU	or mg/litre	E	10	<15
Taste			O,E	No objectionable taste	
Odour			O,E	No objectionable odour	
Turbidity (treated surface water)	NTU	or TU	H,I	< 0,3	< 0,5
Turbidity (groundwater)	NTU	or TU	H,I	< 0,5	<2
pH @ 20 °C	pH		I	6.0 to 8,5	6 to 9
Electric Conductivity @ 25 °C	mS/m***	E.C.	H,I	< 80	< 300
Total Dissolved Solids	mg/litre		H,I	< 500	< 2 000
INORGANIC MACRO DETERMINANTS					
Ammonia	mg/litre	N	H	< 0.2	< 0.5
Calcium	mg/litre	Ca	I	< 80	< 150
Chloride	mg/litre	Cl	H,I	< 100	< 300
Fluoride	mg/litre	F	H	< 0.7	< 2,0
Magnesium	mg/litre	Mg	H	< 30	< 70
Nitrate	mg/litre	N	H	< 6	< 11
Nitrite	mg/litre	NO_2	H	< 0.2	< 0.5
Potassium	mg/litre	K	H	< 25	< 100
Sodium	mg/litre	Na	H.I	< 100	< 300
Sulphate	mg/litre	SO_4	H,O	100	< 300
Asbestos (fibres longer than 10 μm)	Fibres/litre		H	<500 000	< 1000 000
INORGANIC MICRO DETERMINANTS					
Aluminium	μg/litre	Al	H	< 25	< 100
Antimony	μg/litre	Sb	H	< 5	< 50
Arsenic	μg/litre	As	H	<10	< 50
Barium	μg/litre	Ba	H	0,5	< 2
Beryllium	μg/litre	Be	H	< 2	< 5
Bismuth	μg/litre	Bi	H	< 250	< 500
Boron	μg/litre	B	H	< 300	< 500
Bromide	μg/litre	Br	H	< 500	< 1 000
Cadmium	μg/litre	Cd	H	< 5	< 10
Cerium	μg/litre	Ce	H	<1 000	<2 000
Cesium	μg/litre	Cs	H	< 1 000	< 2 000
Chromium Total	μg/litre	Cr	H	< 50	< 100
Cobalt	μg/litre	Co	H	< 250	< 500
Copper	μg/litre	Cu	H	< 500	< 2 000

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				**Ranges and upper limits**	
Interpretation				**(Ideal guideline)**	**(Acceptable Standard)**
DETERMINANTS	**Unit**	**Format**	**Concern**	**95 Percentile Requirement**	
INORGANIC MICRO DETERMINANTS					
Cyanide (free)	**µg/litre**	**CN^-**	**H**	**< 20**	**< 50**
Cyanide (recoverable)	**µg/litre**	**CN^-**	**H**	**< 70**	**< 200**
Iron	**µg/litre**	**Fe**	**H,E**	**< 200**	**< 300**
Lead	**µg/litre**	**Pb**	**H**	**<10**	**< 50**
Manganese	**µg/litre**	**Mn**	**H**	**< 50**	**< 100**
Mercury	**µg/litre**	**Hg**	**H**	**< 1**	**<2**
Nickel	**µg/litre**	**Ni**	**H**	**< 50**	**< 150**
Selenium	**µg/litre**	**Se**	**H**	**< 10**	**< 50**
Thallium	**µg/litre**	**Ti**	**H**	**< 5**	**< 10**
Tin	**µg/litre**	**Sn**	**H**	**<100**	**<200**
Titanium	**µg/litre**	**Ti**	**H**	**< 100**	**< 300**
Uranium	**µg/litre**	**U**	**H**	**< 3**	**< 15**
Vanadium	**µg/litre**	**V**	**H**	**< 100**	**< 500**
Zinc	**µg/litre**	**Zn**	**H**	**< 1 000**	**< 5 000**
Organo-metallic compounds	**µg/litre**	**-**	**H**	**below detection limit**	**below detection limit**
ORGANIC DETERMINANTS					
Dissolved Organic Carbon	**mg/litre**	**DOC-C**	**H**	**< 5**	**<10**
Phenol compounds	**µg/litre**	**phenol**	**H**	**< 5**	**< 10**
DISINFECTION AND DISINFECTION BY-PRODUCTS					
Bromodichloromethane (Part of THM)	**µg/litre**		**H**	**< 20**	**< 50**
Bromoform (Part of THM)	**µg/litre**		**H**	**< 40**	**< 40**
Chloroform (Part of THM)	**µg/litre**		**H**	**< 20**	**< 100**
Dibromomonochloro-methane (Part of THM)	**µg/litre**		**H**	**< 20**	**< 100**
Trihalomethanes (Total)	**µg/litre**	**THM**	**H**	**< 100**	**< 150**
Bromate	**µg/litre**		**H**	**< 5**	**< 10**
Chloramines	**mg/litre**	**Cl_2**	**H**	**< 2**	**< 4**
Chlorine dioxide	**µg/litre**		**H**	**< 400**	**< 800**
Chlorite	**µg/litre**		**H**	**< 400**	**< 4000**
Chlorate	**µg/litre**		**H**	**< 200**	**< 700**
Haloacetic acids	**µg/litre**		**H**	**not detected**	**< 60**
Chlorine, free, after 30 min; GENERAL	**mg/litre**	**Cl_2**	**H,I**	**0,1 – 0,5**	**0,1 - 3,0**
Chlorine, free, after 30 min; SPECIFIC	**mg/litre**	**Cl_2**	**Turbidity: < 0,3 NTU**	**0,1**	**0,1 - 3,0**
Chlorine, free, after 30 min; SPECIFIC	**mg/litre**	**Cl_2**	**Turbidity: > 0,3 NTU**	**0,5**	**0,1 - 3,0**
Chlorine, free, after 60 min; SPECIFIC	**mg/litre**	**Cl_2**	**Turbidity: >1,0 NTU**	**1,0**	**0,1 - 3,0**

Specifications for water quality intended for human consumption from the source and piped water supply					
Status				**Ranges and upper limits**	
Interpretation				**(Ideal guideline)**	**(Acceptable Standard)**
DETERMINANTS	**Unit**	**Format**	**Concern**	**95 Percentile Requirement**	
BIOLOGICAL REQUIREMENTS					
Algae					
Chlorophyll α	**µg/litre**		**E,O**	**< 1**	**< 2**
Blue-green algae	**cells**	**/ml**	**H,O**	**< 200**	**<2 000**
Mycrocystin	**µg/litre**		**H**	**< 0.1**	**< 1**
Geosmin	**ηg/litre**		**E, H**	**< 15**	**< 30**
2-Methyl Iso Borneal (2 MIB)	**ηg/litre**		**E, H**	**< 15**	**< 30**
OTHER DETERMINANTS					
Agricultural chemical compounds			**H**	**Any organic compound recognized as an agro-chemical should be in accordance with the WHO and EPA requirements.**	
Industrial chemical compounds			**H**	**Any organic compound recognized as an industrial chemical should be in accordance with the WHO and EPA requirements.**	
Endocrine disruptive chemicals			**H**	**Any chemical compound that is suspected of having endocrine disruptive effects shall be in accordance with the WHO and EPA requirements.**	
RADIOACTIVITY				**95 Percentile Requirement**	
Gross alpha activity	**Bq/litre**		**H**	**< 0.2**	**< 0.5**
Gross beta activity	**Bq/litre**		**H**	**< 0.4**	**< 1.0**
If Gross alpha and beta is above specification calculate Dose based on individual radionuclide concentrations	**mSv/a**		**H**	**≤ 0.04**	**≤ 0.1**
ANALYSIS QUALITY CHECK* **					
Ion balance: Total anions			**-**	**< 3 -Tolerance = 0.2 m equivalent 3-10 – Tolerance 2% on +- balance 10-800 – Tolerance 5% on +- balance**	
TDS Balance: determined / calculated	**ratio**		**-**	**~ 1**	**~ 1**
Ratio TDS / EC (EC as µS/cm)	**ratio**		**-**	**~ 0,66**	**0,55 – 0,7**

"Concern" refers to impact if the limit is transgressed: H = health concern; O = organoleptic effect;
I = effect on infrastructure, structural; E = aesthetic effect

* Based on a viral cell culture-dependent method and not on cell culture-independent methods (e.g. PCR)

** Indicative of faecal pollution having occurred, even when the residual disinfectant levels are safe.

*** Comply with SANAS Guidelines

Table 2: Microbiological and Biological Requirements

MICROBIOLOGICAL REQUIREMENTS APPLICABLE TO ALL POTABLE WATER					
Microbiology	**cfu**			**95 percentile**	**1 of samples maximum**
Heterotrophic bacteria HPC or TCC	**counts**	**/ml**		**100 at 37^0 C**	**1 000 at 37^0 C**
Total Coliform	**counts**	**/100 ml**	**H**	**0**	**5**
E.Coli	**counts**	**/100 ml**	**H**	**0**	**1**
Entrerococci	**counts**	**/100 ml**	**H**	**0**	**1**
Somatic Coliphage	**counts**	**/100 ml**	**H**	**0**	**1**
Clostridium perfrigens inclusive spores	**counts**	**/100 ml**	**H**	**0**	**1**
Enteric viruses	**viral count***	**/10 L**	**H**	**0**	**1**
Parasites (Protozoa) applicable to all potable water				**95 percentile**	**99 percentile**
Giardia lamblia	**cysts**	**/100 litre**	**H**	**0**	**1**
Cryptosporidium	**oocysts**	**/100 litre**	**H**	**0**	**1**
Giardia lamblia and Giardia lamblia (Grab sample)	**cysts or oocysts**	**/10 L**	**H**	**0**	**0**

Table 3: Special Requirements for the Protection of Infrastructure

Specifications for water quality intended for human consumption from the source and piped water supply for the protection of infrastructure against corrosion					
Status				**Ranges and upper limits**	
Interpretation				**(Ideal guideline)**	**(Acceptable Standard)**
DETERMINANTS	**Unit**	**Format**	**Concern**	**95 Percentile requirement**	
CORROSIVE AND SCALING PROPERTIES					
Calcium Carbonate Precipitation Potential	**mg/litre**	**CCPP**	**I**	**4 - 5**	**3 - 6**
Alkalinity/Sulphate/ Chloride Ratio	**Equi-valents**	**Corrosivet y Ratio**	**I**	**With SO_4 and Cl above 50 mg/litre Ratio=(Alk/50)/(SO_4/48+Cl/35.5) > 5.0 Water is Stable Ratio= (SO_4/48+Cl/35.5)/(Alk/50) > 0.2 Water is Corrosive**	
Total Hardness (Ca & Mg)	**mg/litre**	**$CaCO_3$**	**I**	**<200**	**< 400**

Table 4: Frequency of Microbiological Monitoring for Bulk Water Supply

Size of population served	Turbidity 95%**	Frequency of sampling
> 250 000	< 0,5 NTU	**Thrice weekly *** **
100 001 – 250 000	< 1,0 NTU	**Twice weekly**
50 001 – 100 000	< 1,0 NTU	**Once weekly**
10 001 – 50 000	< 1,0 NTU	**Three times every month**
< 10 000 reticulated	< 1,0 NTU	**Once every 1 month***
< 10 000 non-reticulated	**1 – 2 NTU**	**Once every 1 month***

* Upon complaints by the consumers or of medical practitioners and after incidents such as pipe breaks, the frequency should be increased until the situation has returned to original counts and been declared safe;

** Average or 95 percentile turbidity of the water supplied

*** The frequency should be stepped up by one extra sampling per week for every 100 000 residents (including the estimated number of visitors residing within the area at any time) in the area served, over and above 250 000.

General Information

1. The area being monitored shall be defined by the Minister in consultation with the Minister responsible for health and, where applicable, relevant officials from the Regional and Local Authorities;
2. At the time of sampling the operator shall also take a “free chlorine” reading of the same water under examination but prior to sampling for microbiological sampling, whilst using a portable device designed for that purpose and accepted by the Minister; this ‘reading’ is to be recorded and reported together with the results from the microbiological analyses;
3. As for field ‘screening’ of water supplies for microbiological contamination there exist portable devices designed for that purpose and accepted by the Minister; these ‘readings’ are to be recorded and reported together with the results from the microbiological analyses;
4. The results of the microbiological monitoring together with the free chlorine readings is to be reported as per mutual agreement to the ultimate supplier (bulk water supplier, Local Authority, or any other supplier) for remedial action where required, and to the Minister for record and monitoring purposes and follow up actions;
5. The costs of routine monitoring shall be borne by the authority commissioning the monitoring;

Methodology for Sampling and Analyses

The methodologies followed for sampling and during transit and storage of samples prior to analysis shall be as prescribed.

1. Preferably samples are to be taken in borosilicate glass bottles with a glass or polypropylene screw-cap lid;
2. Where this is not feasible or practical polyethylene bottles with internal seal and with screw-lid can be used;
3. Samples shall, as far as practical, be analysed within 24 hours of sampling;
4. Where there are special requirements for the period between sampling and analysis to be less than 24 hours, such requirement should be attended to as far as is practical;
5. Samples are to be kept and stored, even during transit, at as low a temperature as is practically manageable, whilst preventing the risk of the sample freezing;
6. The sample shall be kept away from light and shielded from sunlight, to reduce chances of micro-/biological growth to a minimum;
7. The use of preservation chemicals should be considered, planned and executed with extreme care;
8. Where sample preservation is appropriate or required an extra smaller volume sample should be taken so as to not upset any other analyses that are affected by the preservation chemical(s);
9. Certain determinants may be monitored ‘in the field’ at the time of sampling; such field-data are to be measured in a receptacle or container different from the sample container; data so obtained shall be recorded as “field measurement” and cannot replace laboratory analysis for the parameters concerned;
10. The methodologies followed for physical, chemical and microbiological analysis shall be in agreement with the specifications listed in the latest edition of the SANS 241, Drinking Water Standards, published by the SABS.
11. The cost of routine, regulatory inspections and monitoring, for the purpose of fulfilling the provisions of this regulation shall borne by the service provider.