

ENVIRONMENTAL MANAGEMENT PLAN

EXISTING OKURYANGAVA SATELLITE WASTE DISPOSAL FACILITY



Prepared by:

MATRIX CONSULTING SERVICES
PO BOX 25824
WINDHOEK
NAMIBIA

Tel: +264-61 224197



Prepared for:

CITY OF WINDHOEK
PO BOX 59
WINDHOEK
NAMIBIA

Tel: +264-61 290 2690



January 2015

This document is for the use of City of Windhoek only and may not be transmitted to any other party, in whole or in part, in any form without written consent permission of Matrix Consulting Services

TABLE OF CONTENTS

1. INTRODUCTION	4
1.1. BACKGROUND	4
1.2. PROJECT LOCATION	5
1.3. PURPOSE OF THIS DOCUMENT.....	6
2. LEGAL REQUIREMENTS.....	7
3. MINICIPAL WASTE AT OKURYANGAVA LANDFILL.....	11
4. RECEIVING ENVIRONMENT	12
4.1. CLIMATE	12
4.2. TOPOGRAPHY AND DRAINAGE.....	13
4.3. SOIL AND GEOLOGY	13
4.4. HYDROGEOLOGY.....	14
4.4.1. <i>Groundwater Pollution Vulnerability</i>	16
5. ECOLOGICAL IMPACTS	18
6. ENVIRONMENTAL SENSITIVITY	19
7. SOCIO-ECONOMIC ASPECTS.....	21
7.1. REGIONAL INFORMATION	21
7.2. WINDHOEK.....	21
7.2.1. <i>Economic Activities</i>	21
7.2.2. <i>Employment (Job Opportunities)</i>	22
7.2.3. <i>Livelihoods</i>	22
7.2.4. <i>Tourism</i>	22
7.2.5. <i>In - Migration</i>	22
7.2.6. <i>HIV & Prostitution</i>	23
7.2.7. <i>Infrastructure & Increased Traffic</i>	23
8. ENVIRONMENTAL MANAGEMENT STRUCTURES	24
8.1. CONSTRUCTION PHASE	24
8.1.1. <i>Roles of the Project Manager</i>	24
8.1.2. <i>Roles of the Environmental Manager (EM)</i>	25
8.1.3. <i>Roles of the Environmental Control officer (ECO)</i>	26
8.1.4. <i>Roles of the Contractor</i>	27
8.2. OPERATIONAL PHASE	29
8.2.1. <i>Roles of the Solid Waste Manager</i>	29
8.2.2. <i>Roles of the Environmental Site Officer (ESO)</i>	29
8.2.1. <i>Roles of the Operational Sub-Contractors</i>	30
9. IMPLEMENTATION AND MONITORING	31
9.1. CONSTRUCTION PHASE PROCEDURES	31
9.1.1. <i>Environmental Awareness Training</i>	31
9.1.2. <i>Method Statements</i>	31
9.1.3. <i>Flood Management</i>	32
9.1.4. <i>Non-Compliance and Corrective Action</i>	32
9.2. OPERATIONAL PHASE PROCEDURES	32
9.2.1. <i>Environmental Awareness Training</i>	33
9.2.2. <i>Environmental Incident Reporting</i>	33
9.2.3. <i>Environmental Monitoring</i>	34
9.2.4. <i>EMP Administration</i>	34
9.2.5. <i>EMP Amendments</i>	34
9.2.6. <i>EMP Amendments</i>	34
9.2.7. <i>Environmental Register</i>	35
9.2.8. <i>Site Management</i>	35
9.2.9. <i>Access Routes and Work Sites</i>	35
9.2.10. <i>Fire and Safety Management</i>	36
9.2.11. <i>Staff Management</i>	36
9.2.12. <i>Waste Management</i>	36
9.2.13. <i>Progressive Rehabilitation</i>	36
10. ENVIRONMENTAL MANAGEMENT MEASURES FOR OPERATIONAL PHASE.....	38
10.1. OPERATIONAL PHASE: GENERAL.....	38
10.2. OPERATIONAL PHASE: HAZARDOUS SUBSTANCES MANAGEMENT.....	40
10.3. OPERATIONAL PHASE: VEHICLES AND EQUIPMENT	40

10.4.	OPERATIONAL PHASE: WASTE MANAGEMENT	44
10.5.	OPERATIONAL PHASE: WASTE WATER MANAGEMENT	47
10.6.	OPERATIONAL PHASE: AIR QUALITY MANAGEMENT	49
10.7.	OPERATIONAL PHASE: FIRE MANAGEMENT	52
10.8.	OPERATIONAL PHASE: NOISE MANAGEMENT	53
10.9.	OPERATIONAL PHASE: VISUAL/AESTHETICS MANAGEMENT	53
10.10.	OPERATIONAL PHASE: NO GO AREAS	56
10.11.	OPERATIONAL PHASE: ENVIRONMENTAL AND HEALTH AWARENESS	56
10.12.	OPERATIONAL PHASE: SAFETY AND SECURITY	58
10.13.	OPERATIONAL PHASE: REHABILITATION	60
11.	ENVIRONMENTAL MANAGEMENT MEASURES FOR CONSTRUCTION AND DECOMMISSIONING PHASE.....	61
11.1.	CONSTRUCTION PHASE: CONSTRUCTION VEHICLES AND EQUIPMENT	61
11.2.	CONSTRUCTION PHASE: WASTE MANAGEMENT	64
11.3.	CONSTRUCTION PHASE: WASTE WATER MANAGEMENT	66
11.4.	CONSTRUCTION PHASE: DUST MANAGEMENT	67
11.5.	CONSTRUCTION PHASE: NOISE MANAGEMENT	68
11.6.	CONSTRUCTION PHASE: FIRE MANAGEMENT	69
11.7.	CONSTRUCTION PHASE: CONSTRUCTION SITE CAMP AND BOUNDARIES	71
11.8.	CONSTRUCTION PHASE: SAFETY AND SECURITY	74
11.9.	CONSTRUCTION PHASE: SITE CLEARING	75
11.10.	CONSTRUCTION PHASE: HERITAGE RESOURCES.....	79
11.11.	CONSTRUCTION PHASE: SITE REHABILITATION	79
12.	CONCLUSIONS	81
13.	REFERENCES	82

LIST OF FIGURES

Figure 1.	Location Map	6
Figure 2.	Hydrogeological Map	16
Figure 3.	Groundwater Vulnerability Map	17
Figure 4.	Vegetation Sensitivity of the Project Area.....	19
Figure 5.	Environmental Sensitivity of the Project Area	20

1. INTRODUCTION

1.1. Background

The City of Windhoek has commissioned an Environmental Management Plan (EMP) for the operation and possible decommissioning of the existing Okuryangava satellite waste disposal facility (*hereto also referred to as "landfill"*), in Windhoek. The management plan will also address possible construction phase (i.e. future rehabilitation, upgrade, and extension of the facility). This EMP is developed in light of the Environmental Commissioner's call to have all waste disposal sites within the local authorities registered and equipped with site specific EMPs.

Windhoek has 7 satellite landfill sites of which Okuryangava landfill is one of them. The satellite sites were developed in an effort to minimise illegal dumping by creating places where residents can dump harmless waste. These sites are located in places that are easily accessible and dumping is for free. Waste disposed of at these sites consists mainly of garden refuse and building rubbles.

Municipal solid wastes have both a direct and an indirect impact on our environment and welfare. Direct effects include the impact on animal and plant life and the effects on human health and the environment. Indirect impacts are mostly long-term such as climate change and ecosystem contamination that may have a profound impact on some regions in the world, because people in these areas depend on some of the natural systems for survival (Woodwell GM, 1970).

According to the Environmental Management Act no. 7 of 2007, and its regulations, the Okuryangava waste disposal facility is listed as an activity requiring an environmental impact assessment and management plans. The proponent is also required to register the site with the Ministry of Environment and Tourism (Department of Environmental Affairs).

This document will thus assess the potential impacts of the facility on the surrounding biophysical and socio-economic environment and identified mitigation measures to manage (i.e. avoid, minimise or optimise) impacts. The mitigation measures recommended in this document will apply to all three phases of the project cycle:

Phases covered by the EMP:
Construction Phase (<i>i.e. future rehabilitation, upgrade and extension of the facility</i>)
Operational Phase (<i>i.e. collects, transports, stores, treats or disposes</i>)
Decommissioning Phase (<i>i.e. site closure</i>)

Construction Phase: These mitigation measures are applicable during site preparation and construction on site, and will thus need to be implemented by the

relevant Contractor(s) and Sub-contractors. The Construction Phase of the project is considered to include all activities associated with:

- Site preparation;
- Construction activities (associated with all phases of development); and
- Rehabilitation (where required).

Operational Phase: These mitigation measures are applicable during the operation of the landfill and must therefore be implemented by the City of Windhoek, relevant Contractor(s) and Sub-contractors during operations at the landfill site; and

The operational phase of the waste disposal site entails:

- ✓ Transport of waste with vehicles and road transport trucks; and
- ✓ Storage and handling of waste on the landfill.

Decommissioning Phase: These mitigation measures are similar to those of the construction phase activities.

The decommissioning phase will entail:

- ✓ Removal of all infrastructure not reused in the future use of land.
- ✓ site closure; and
- ✓ Rehabilitation of property.

Matrix Consulting Services, an independent environmental consultant, was appointed by the City of Windhoek to compile and submit an EMP for the Okuryangava waste disposal facility. The aim of an operational Environmental Management Plan (EMP) is to ensure that all waste is disposed off, handled and stored in an environmentally acceptable and safe manner.

1.2. Project Location

The Okuryangava waste disposal facility (22.49379°S; 17.05100°E) is situated along Omuvalu Street, on the northwestern outskirts of the Okuryangava suburb, in Windhoek. See Figure 1.

Directly north and west of the site is undeveloped land (open land). Approximately 500m west of the site are informal settlements. Directly east of the site is the Omuvalu Street, followed by informal settlement. South of the site is undeveloped land (open land). The Consultant does not expect that the proposed development will directly affect any nearby land and/or property in any manner during all phases of the development. Indirect impacts may however occur through ground or surface water pollution and the interaction thereof.

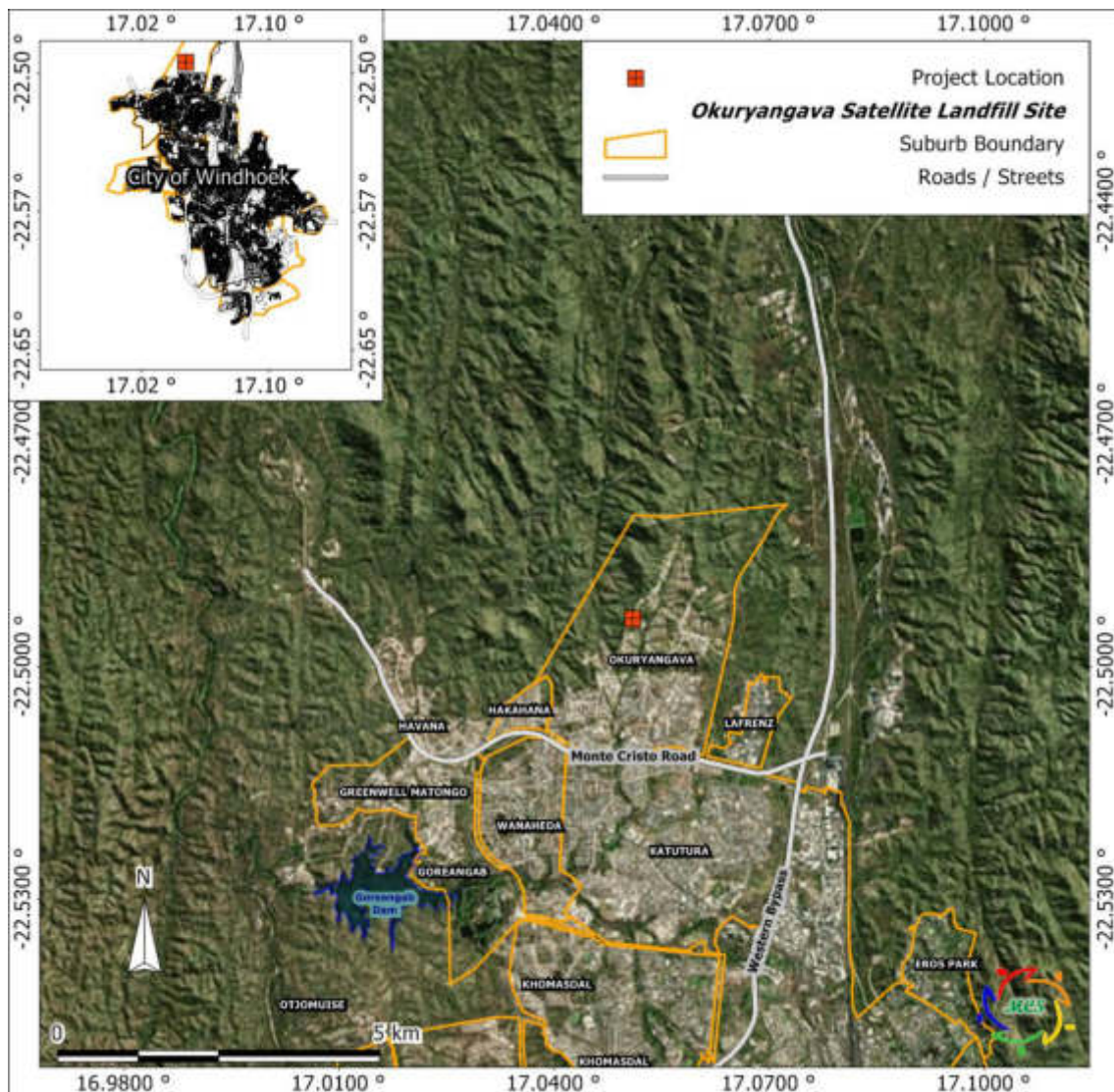


Figure 1. Location Map (22.49379°S; 17.05100°E)

1.3. Purpose of this Document

The Environmental Management Plan (EMP) provides management options to ensure impacts of the proposed development are minimised. An EMP is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented, and the positive benefits of the projects are enhanced.

The objectives of the EMP are:

- ✓ to include all components of the development;
- ✓ to prescribe the best practicable control methods to lessen the environmental impacts associated with the construction of the development;
- ✓ to monitor and audit the performance of construction personnel in applying such controls; and

- ✓ to ensure that appropriate environmental training is provided to responsible construction personnel.

The EMP acts as a stand-alone document, which can be used during the various phases of the development. The document serves as a guiding tool for the contractors and workforce on their roles and responsibilities concerning environmental management at the site, and also provides an environmental monitoring framework for all project phases of the development.

2. LEGAL REQUIREMENTS

The Namibian constitution clearly indicates that the state shall actively promote and maintain the welfare of the people by adopting policies aimed at management of ecosystems, essential ecological processes and biological diversity of Namibia for the benefit of all Namibians, both present and future.

According to the constitution, local governments are responsible for waste management activities in the various regions of the country, and, therefore, they are compelled to keep their environment clean. For example, waste recovery and disposal are the responsibility of the local government.

Furthermore, a series of legislations and declarations in Namibia have been endorsed to guide waste management activities in the country. The following legislations are relevant to this development:

➤ ***Environmental Management Act No.7 of 2007***

This Act provides a list of projects requiring an Environmental assessment. It aims to promote the sustainable management of the environment and the use of natural resources and to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

The Act defines the term “*environment*” as an interconnected system of natural and human-made elements such as land, water and air; all living organisms and matter arising from nature, cultural, historical, artistic, economic and social heritage and values.

The Environmental Management Act has three main purposes:

- a) to make sure that people consider the impact of activities on the environment carefully and in good time.
- b) to make sure that all interested or affected people have a chance to participate in environmental assessments.
- c) make sure that the findings of environmental assessments are considered before any decisions are made about activities which might affect the environment.

Line Ministry: Ministry of Environment and Tourism

➤ ***Water Resources Management Act of Namibia (2004)***

This Act repealed the existing South African Water Act No.54 of 1956 which was used by Namibia. The Act ensures that Namibia's water resources are managed, developed, protected, conserved and used in ways which are consistent with fundamental principles depicted in section 3 of this Act. Part IX regulates the control and protection of groundwater resources. Part XI, titled Water Pollution Control, regulates discharge of effluent by permit.

Line Ministry: Ministry of Agriculture, Water and Forestry

➤ ***Environmental Assessment Policy of Namibia (1995)***

Environmental Assessments (EA's) seek to ensure that the environmental consequences of development projects and policies are considered, understood and incorporated into the planning process, and that the term ENVIRONMENT (in the context of IEM and EA's) is broadly interpreted to include biophysical, social, economic, cultural, historical and political components.

All listed policies, programmes and projects, whether initiated by the government or the private sector, should be subjected to the established EA procedure.

Line Ministry: Ministry of Environment and Tourism

➤ ***Draft Pollution Control and Waste Management Bill***

The current legislation on waste management in Namibia is fragmented, inadequate and basically non-existent. A Pollution & Waste Management Bill (The Act) has been drafted and submitted to Parliament for approval. The Act will, for the first time in Namibia, create a legal framework for waste management and disposal. The Act will impose a general duty on all persons and organs of state to minimise waste generation and promote re-use and recycling. The Act will further provide for a classification of waste into different types, depending on their source and characteristics. These will include the following categories:

- ✓ household waste;
- ✓ commercial waste;
- ✓ industrial waste;
- ✓ hazardous waste, including clinical waste (which will have highly specialised disposal requirements);
- ✓ mining waste and building waste (which is inert but bulky); and radioactive waste.

The Act will establish a waste management and disposal licensing system, which will establish two types of licence. A waste management licence will be required by any person, who *collects, transports, stores, treats or disposes of* waste. Each licence of this type will specify the category or categories of waste to which it applies (for example hazardous waste). There will be *de minimis* exemptions for example for householders. A waste disposal-site licence will be required by the owner of any land on which a waste disposal site is located (such as a landfill site or an incinerator).

A person who unlawfully undertakes any of the above activities without an appropriate licence, or in breach of the licence conditions will commit an offence.

➤ ***Atmospheric Pollution Prevention Ordinance of Namibia No. 11 of 1976)***

The Ordinance prohibits anyone from carrying on a scheduled process without a registration certificate in a controlled area. A certificate must be issued if it can be demonstrated that the best practical means are being adopted for preventing or reducing the escape into the atmosphere of noxious or offensive gases produced by the scheduled process. Best practice would be to notify the line Ministry about emissions but it is not a legal requirement.

Line Ministry: Ministry of Health and Social Services

➤ ***Hazardous Substances Ordinance No. 14 of 1974***

The Ordinance applies to the manufacture, sale, use, disposal and dumping of hazardous substances, as well as their import and export and is administered by the Minister of Health and Social Welfare. Its primary purpose is to prevent hazardous substances from causing injury, ill-health or the death of human beings.

Line Ministry: Ministry of Health and Social Services

➤ ***Public Health Act 36 of 1919 and Subsequent Amendments***

The Act, with emphasis to Section 119 prohibits the presence of nuisance on any land occupied. The term nuisance for the purpose of this EIA is specifically relevant specified, where relevant in Section 122 as follows:

- ✓ any dwelling or premises which is or are of such construction as to be injurious or dangerous to health or which is or are liable to favour the spread of any infectious disease;
- ✓ any area of land kept or permitted to remain in such a state as to be offensive, or liable to cause any infectious, communicable or preventable disease or injury or danger to health; or
- ✓ any other condition whatever which is offensive, injurious or dangerous to health.

- ✓ Potential impacts associated with the Okuryangava waste disposal site are expected to include dust, air quality impacts, noise nuisance and smoke emissions.

Line Ministry: Ministry of Health and Social Services

➤ ***International Conventions and Regulations***

Article 144 of the Namibian Constitution states that “the general rules of public international law and international agreements binding upon Namibia form part of the law of Namibia.” This means that all the international agreements that Namibia signed become part of the law of our country. These laws and/or agreements are:

- ✓ Convention on Biological Diversity, 1992;
- ✓ United Nations Framework Convention on Climate Change, 1992;
- ✓ Kyoto Protocol on the Framework Convention on Climate Change, 1998;
- ✓ Stockholm Convention of Persistent Organic Pollutants, 2001.

➤ ***Municipal By-Laws (City of Windhoek)***

○ ***Groundwater Protection Regulations***

In addition to the national legislations, the City of Windhoek has adopted municipal by-laws in an effort to protect and manage the groundwater resources within its townlands. The Municipality of Windhoek has under section 94 (1) of the Local Authorities Act, 1992 (Act No. 23 of 1992), adopted the Groundwater Protection Regulations (2005). The regulation delineates the entire Windhoek aquifer into 3 groundwater control areas, namely

- ✓ Very high control zone;
- ✓ High control zone; and
- ✓ Medium control zone.

The purpose of these control zones is to identify critical environmental features in the local authority area which contributes to the makeup and recharge of the Windhoek Aquifer. The functioning of the groundwater control zones are based upon their inherent sensitivity to pollution. Two components affect the implementation namely the respective groundwater control zone sensitivity, and the current approved zoning of land within the respective sensitivity zone.

These zones are incorporated into the Windhoek Town Planning Scheme (WTPS) in order to streamline the application procedure for authorisations within the groundwater control area by identifying specific activities which will detrimentally impact on the Windhoek Aquifer if allowed to proceed.

According to the groundwater protection control regulations, the Okuryangava waste disposal facility is situated within the medium groundwater control zone.

- ***Environmental Structure Plan and Policy***

The Environmental Structural Plan & Policy provides sufficient information for those making decisions regarding a particular development so that proper environmental evaluation can be conducted, which is appropriate to the scale of the proposed project and the risks to the environment which it may pose.

It establishes where there are potential and real problem environmental areas, such as land degradation, pollution, indiscriminate resource use etc. The Environmental Structural Plan is the baseline upon which the policy is established.

- ***Town Planning Scheme***

The Town Planning Scheme enables the comprehensive management of all property and related public sector functions across the city. The guidelines on the Conservation of Natural Resources should be addressed in this project.

3. MUNICIPAL WASTE AT OKURYANGAVA LANDFILL

Okuryangava landfill is one of the seven (7) general landfill sites known as 'satellite sites' in Windhoek. The aim of these sites is to provide facilities where the public can dispose of waste that is already relatively separated. Dedicated containers for garden waste, glass, paper and clean plastic are provided. The satellite sites are designed for easy access and off-loading by the public.

The Solid Waste Management Division (City of Windhoek) provides households and business areas with 240 litre containers referred to as 'wheelie bins', with the aim of addressing waste management needs. These bins are only meant for some types of waste such as food waste, domestic refuse, commercial waste and all light materials that may not cause any damage to the containers. Other types of waste such as stones, wood, bricks, iron sheet, sand, heavy metals, tree branches and grass are stored in bigger containers called 'skips'. The 'Skip' containers are distributed in some residential areas, including informal residential areas where illegal dumping of waste has been experienced.

Provision of garbage bins and skips within the residential area and central business district (CBD) is mainly a responsibility of the City of Windhoek. However, this job is shared with private contractors, one of which is the Rent-a-Drum Group of Companies; which also goes beyond providing services within residential areas and business areas to industrial areas.

Waste generated from households is collected by the Solid Waste Management Division. Business waste is collected by both the Solid Waste Management Division

and private companies, while the waste generated from industrial areas and from open spaces is specifically collected by individual contractors and private companies. The responsibility over skip removal is shared between the Solid Waste Management Division and a private company, Rent-a-Drum. In addition, contractors employ individuals to do the collection of waste from business areas and informal areas, to pick litter, and to clean open spaces. The waste is safely transported to the nearest landfill in the area (Hasheela, 2009).

To reduce the amount of wastes disposed of in the landfill, a recycling initiative is practised at this landfill. For the purpose of collecting recyclable materials, individuals known as 'litter pickers' are formally employed and trained by private contractors on how to sort out recyclable materials from the unwanted waste disposed of at the landfill site.

The remaining waste is then compacted using earth-moving machinery, referred to as a trash compactor. Compaction of waste at the site is essential, as it saves space on the landfill, while at the same time controlling wind-blown litter.

4. RECEIVING ENVIRONMENT

This section lists the most important environmental characteristics of the study area and provides a statement on the potential environmental impacts.

4.1. Climate

The landscape is classified as being in the Khomas Hochland Plateau.

Classification of climate:	semi-arid highland savannah
Average rainfall:	Rainfall in the area is averaged between 300 to 350mm per year
Average evaporation:	Evaporation in the area is averaged 3000 to 3200mm per year.
Precipitation:	sporadic and unpredictable, high intensity, highly localised storm events between October and April does occur. Evaporation exceeds precipitation by approximately 90%.
Water Deficit:	Water deficit in the area is averaged 1701-1900mm/a
Temperatures:	Highest temperatures are measured in December with an average daily maximum of 31°C and minimum of 17.3°C; the coldest temperatures are measured in July with an average daily maximum of 20.4°C and minimum of 6.4°C.

Wind direction: Predominantly southeasterly. Southerly, easterly, and northerly airflow is also common. Wind seldom blows from the northwest and southwest. Strong westerly winds blow in the afternoons and evenings in early summer.

The Okuryangava area and its surroundings can be classified as a water deficit area with annual evaporations exceeding the mean annual rainfall by far. Summer rainfall dominates precipitation in the form of thundershowers and seasonal run off events might occur in the form of flash floods.

The aridity of the region causes the water resource to be a scarce commodity and has to be conserved and protected from pollution at all cost. Groundwater in Windhoek is an important source of potable water for the City of Windhoek.

4.2. Topography and Drainage

The landscape in the area is classified as being in the Khomas Hochland Plateau, which is characterised by rolling hills in the west with many summit heights equivalent reflecting older land surfaces.

Drainage in the area is well developed and runoff is expected to take place through small nearby drainage channels or streams. The site is located within the catchment of the Goreangab Dam which is situated approximately 5km southwest of the site.

The relief of most of the streams or channels running in the area remain intact and are useful for good drainage from the site. Care should be taken to avoid contamination of these surface water bodies in the area, especially during rainy seasons, as water in these bodies is used for aquifer recharge.

4.3. Soil and Geology

Windhoek generally has poorly developed thin topsoil that is the product of alluvial and colluvial deposition of mainly fine sands and silts intermixed with residual quartz pebbles. The soils in the study area are largely shallow, described as lithic leptosols (Mendelsohn, et al. 2002), and tend to have a sandy-to-sandy loam texture depending upon slope position, with a lot of gravel and stones embedded in the surface. On the slopes and ridges, much of the soil is covered by resistant quartzitic pebbles, which may act as "pebble mulch" providing effective protection from rain splash erosion (Joubert, in prep.), thus reducing overall erosion on steep slopes.

The project site itself has been subjected to cut and fill earthworks for landfill purposes; hence depth to bedrock may vary from place to place due to filled-up backfills. The rock formations underlying the site consist mainly of mica rich schist, containing quartz veins. All of the intersected rock formations belong to

the Kuiseb formation of the Damara Sequence. In this area the formation is known to have a dip of $\pm 30^\circ$ in a northerly direction.

North-south striking faults are present approximately 500m and 300m west and east of the site respectively.



Cut and fill earthworks; and schistose bedrock



The overall complex geology of the Windhoek area is a result of numerous folding and faulting episodes, including thrusting and rifting, to which the area has been subjected. Metasedimentary rocks of the Swakop Group, which is part of the Damara Sequence, constitute the Windhoek Aquifer.

4.4. Hydrogeology

A number of north-southerly striking faults and joints found in Windhoek form the major underground water conduits of the Windhoek Aquifer and hence determine the conditions of the aquifer. Secondary porosity giving rise to high aquifer transmissivity is best developed in faults with post-hydrothermal alteration brecciation in quartzitic environments. Moreover host rock fracturing along fault planes results in better development of secondary porosity in quartzite compared to schistose terrain such that the aquifer reaches its maximum potential in this type of setting. The sedimentary

formations of the study area strike in an east-north-easterly direction and dip 25-30° to the north.

The micaceous schist found in the area, is prone to plastic deformation rather than brittle, fracturing, exhibiting significantly lower secondary porosity and permeability. Groundwater flow would be mostly through secondary porosity along fractures, faults and other geological structures present within the underlying formations in the area.

According to the City of Windhoek, Namwater and the Department of Water Affairs database (DWA), 7 boreholes exist within a 2km radius of the landfill site. Depth to water table is expected to be less than 85m below groundwater level (mbgl).

Groundwater belongs to the government of the Republic of Namibia; hence the area does fall within the Windhoek-Gobabis Subterranean Water Control Area, of Government Notice 189 of 6 February 1970. This means that Government controls groundwater usage in this area.

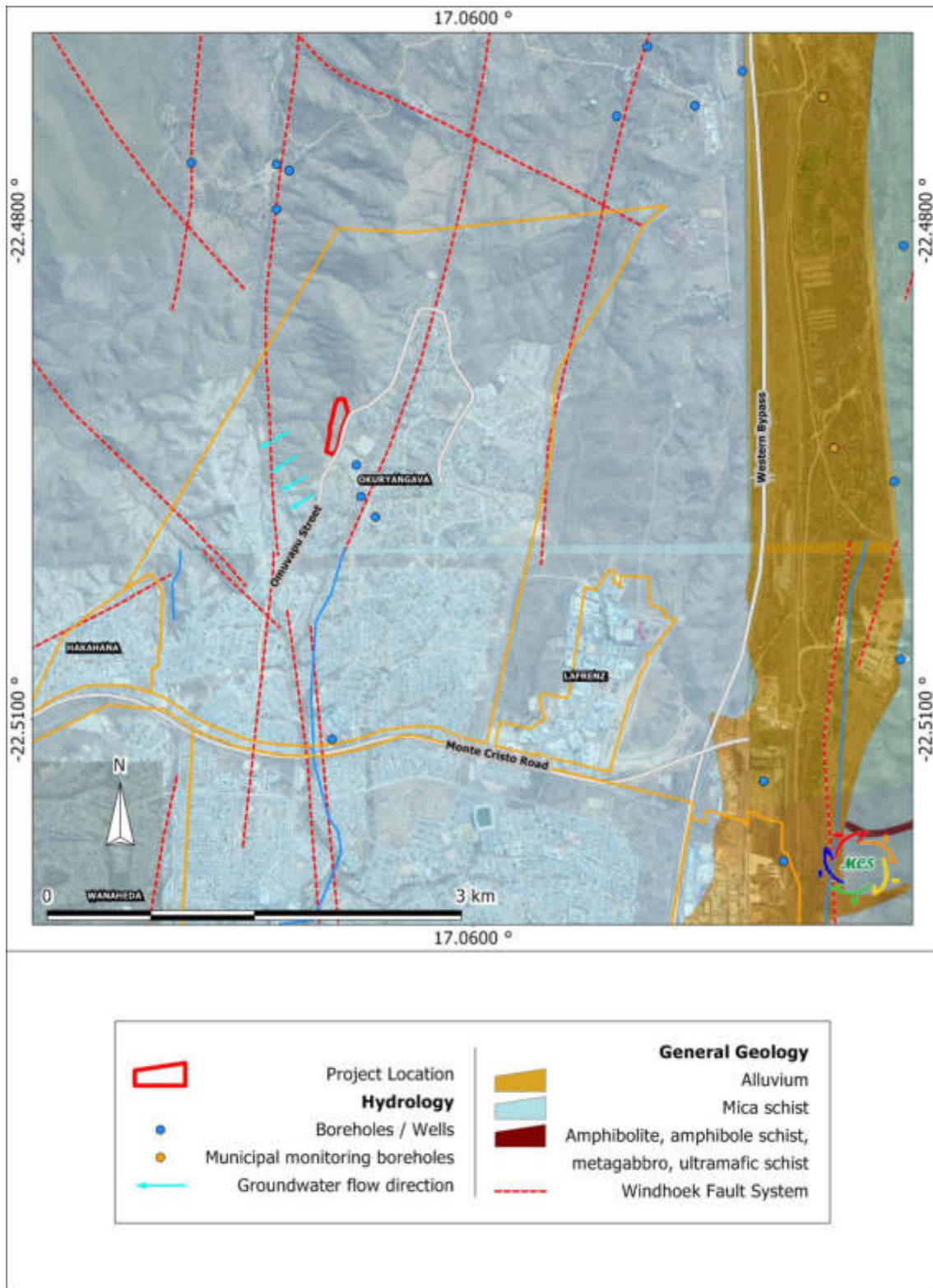


Figure 2. Hydrogeological Map

4.4.1. Groundwater Pollution Vulnerability

In order to protect groundwater resources from pollution, the need to assess and map the vulnerability of the Windhoek aquifer was identified to prove the municipality with a planning tool that will form the basis for setting priorities in protecting the groundwater resource. Infiltration water transports a large proportion of pollutants either directly or indirectly on

the groundwater to underlying aquifers. As a result, a vulnerability study of Windhoek aquifer was conducted in the year 2000.

The project area was mapped during the study as having low aquifer pollution vulnerability, mainly due to the absence of sensitive geological structures at the landfill site and immediate surrounding (see Figure 3). Geological features may form preferential pathways to the underlying aquifer.

This map does however not consider impacts to surface water bodies in the area, as well as direct impacts to human health.

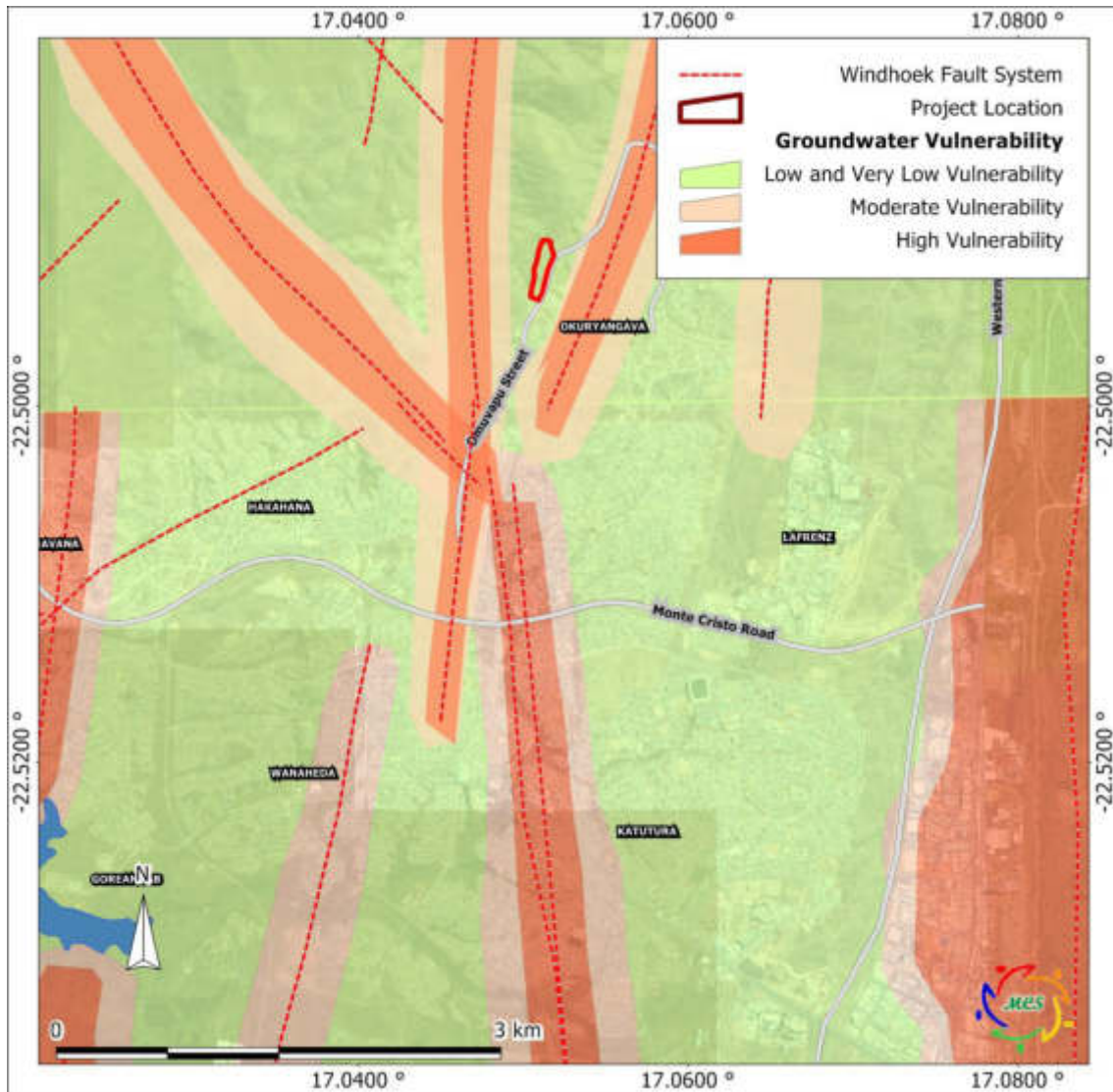


Figure 3. Groundwater Vulnerability Map

5. ECOLOGICAL IMPACTS

The site falls within the Tree and Shrub Savanna biome, which is characterised by high shrubland and thorn bush type vegetation. The vegetation structure type is classified as Dense Shrubland.

Most of the vegetation at the Okuryangava waste disposal premises was cleared for the purpose of developing the landfill site. A few undisturbed vegetations are however observed along the boundaries of the landfill site.

This vegetation consists mainly of short to medium grass and shrubs present at the site. Some scattered thorn bush (*Acacia species*) and invasive plant species exist at the landfill site. The alien plant species are observed mainly on the active areas (disturbed areas) of the landfill. The following photos illustrate the vegetation on site.



Thorn bush (*Acacia species*); and short to medium grass

Invasive plant species



Deducing from the Atlas of Namibia, the proposed site is within the area that is known to have >500 plant species (Mandelsohn et al, 2003). The general sensitivity of the vegetation in the area is considered to be medium sensitive. See figure 4 below for vegetation sensitivity map.

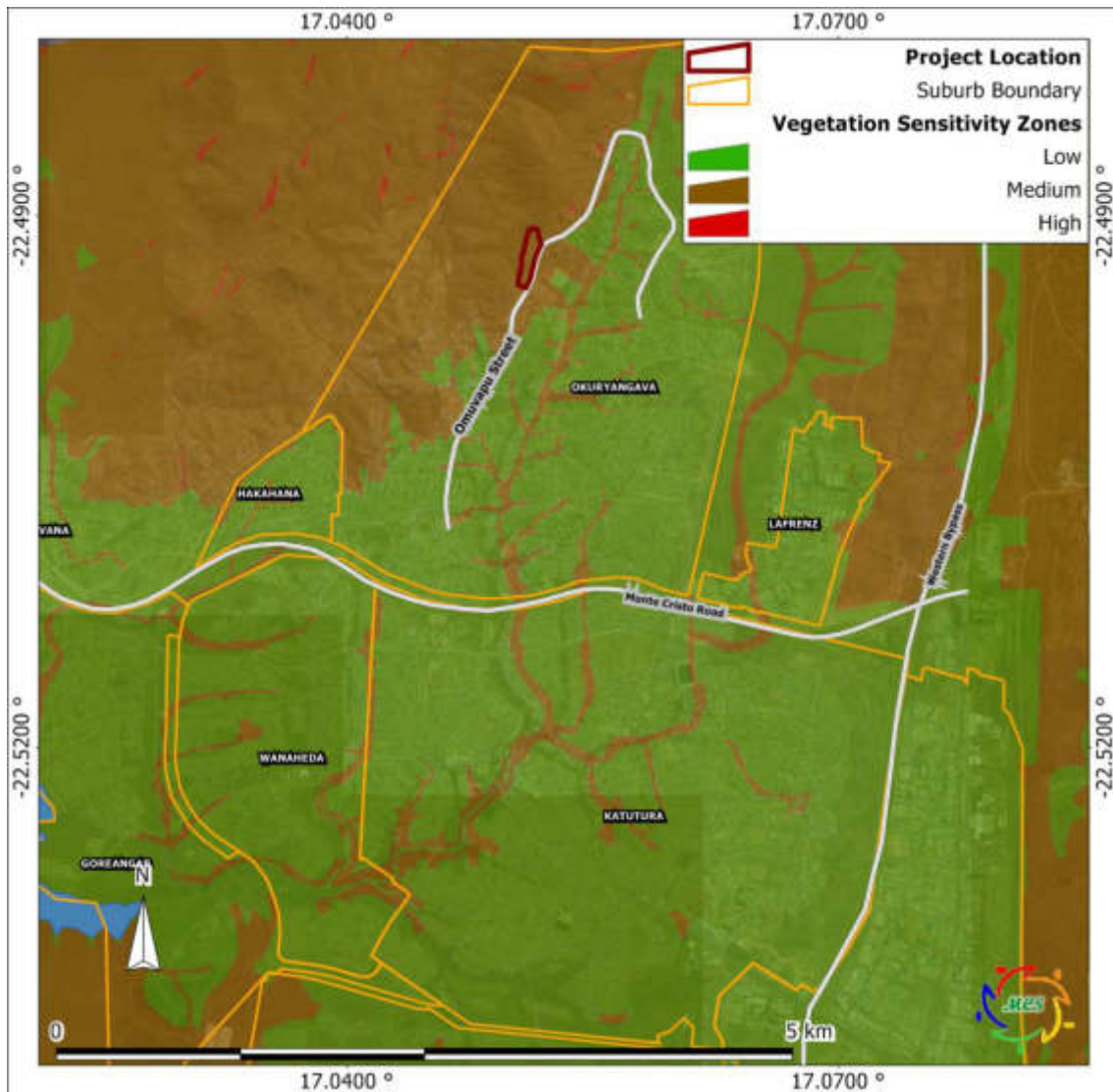


Figure 4. Vegetation Sensitivity of the Project Area

With regards to fauna, it is estimated that at least 71 to 80 reptile, 8 to 11 amphibian, 61 to 75 mammal, 201 to 230 bird species (breeding residents), 35 to 39 snakes and more than 35 lizards are known to or are expected to occur in the project area of which only a very few proportion are endemics.

The landfill site area is known to have Baboon scavengers that illegally survive by scavenging from the rubbish dump. Illegal human scavengers residing in the vicinity also exists in the area.

6. ENVIRONMENTAL SENSITIVITY

According to City of Windhoek Environmental Structure Plan of 2004, an environmental assessment and mapping study was conducted to provide a strategic overview of the environmental aspects of Windhoek. As a result, control zones are based upon the following;

- ✓ The critical sensitivity of the southern Windhoek aquifer.

- ✓ The sensitivity of the catchment of the Goreangab Dam, and surface water resources, including rivers and streams throughout Windhoek.
- ✓ The sensitivity of the environment or a specific critical environmental component.
- ✓ The relative importance of the 'sense of place' or the specific character of Windhoek determined through resident participation, which includes topography and landscape quality as well as cultural / historical resources.
- ✓ The need to protect open space in Windhoek, which includes the river and aquatic systems, as well as the ridgelines, hills and mountains, and natural areas surrounding the city.
- ✓ The need to protect, manage and conserve sensitive natural vegetation cover.

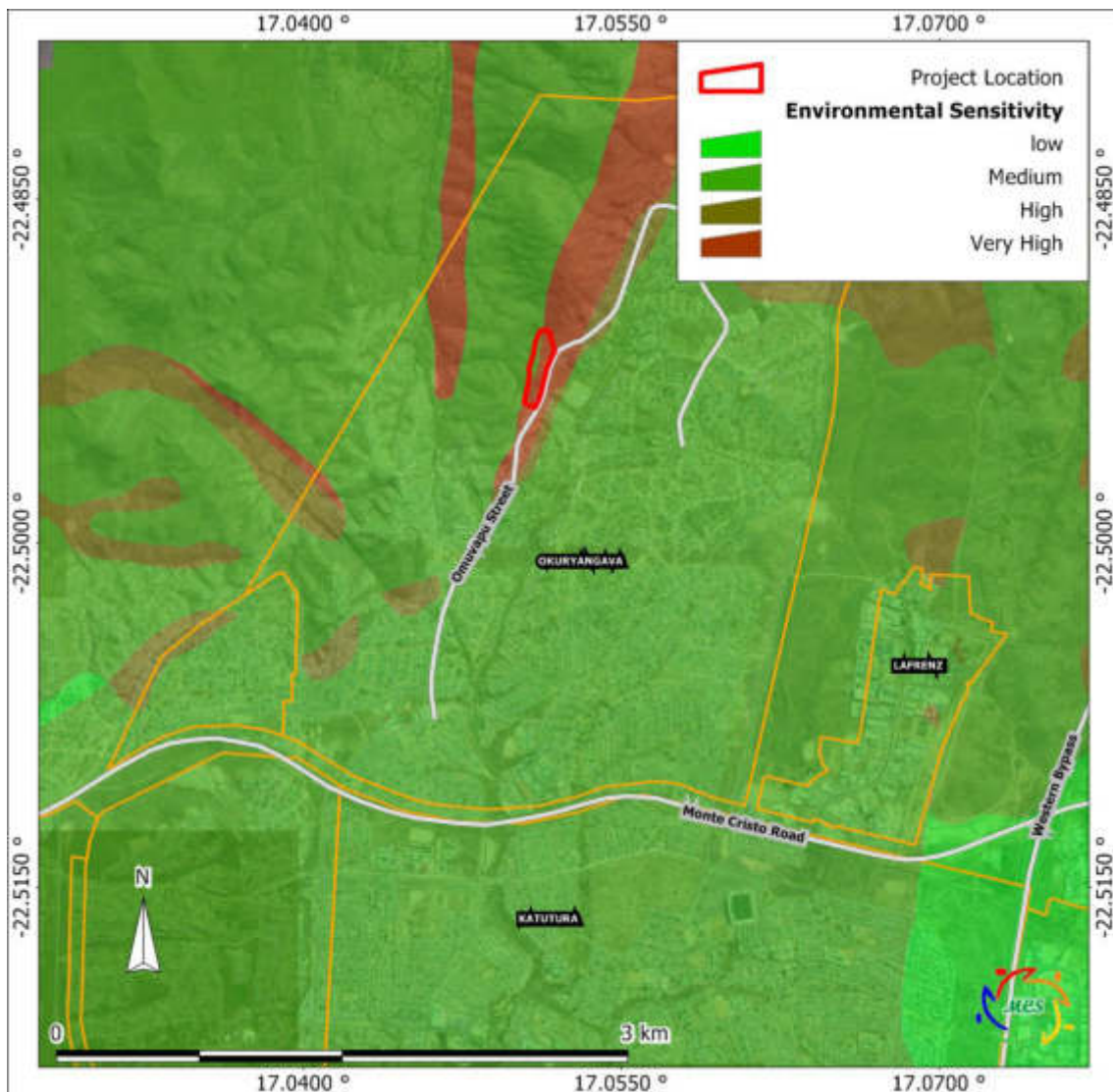


Figure 5. Environmental Sensitivity of the Project Area

The area of the landfill site is considered to have a high environmental sensitivity status. See Figure 5 for the environmental sensitivity map.

7. SOCIO-ECONOMIC ASPECTS

This section provides an overview of socio-economic characteristics of the study area. It provides regional and local information on the, economic activities, population dynamics, vulnerability, and social services currently available in the area.

7.1. Regional Information

The Okuryangava satellite waste disposal facility is situated in Windhoek, in the Khomas Region of Namibia. The current population of Windhoek is estimated to be 325,858, whereas the total Khomas population is estimated to be 342,141 (169,672 males and 172,469 females) (Khomas 2001, Census Regional Profile). Ninety-seven percent of the population of the Khomas Region over 15 years of age are literate. The estimated unemployment rate in Khomas region is 30%. The population density in Khomas region is relatively high at 6.8 persons per km², compared to the national average of 2 persons per km².

The life expectancy in Khomas region is 56 years in females and 54 years in males. The Human Poverty Index in Khomas region is 17.09, meaning almost a quarter of all people living in Khomas are poverty stricken.

7.2. Windhoek

7.2.1. Economic Activities

The City of Windhoek is the capital city of Namibia and is often referred to as the cleanest city in Africa. The city is the hub for all economic activities in the Khomas Region and is linked to Namibia's air, rail and road network, making it well situated to service Zambia, Zimbabwe, Botswana, Southern Angola and South Africa.

The waste disposal facility is a win-win opportunity for all parties involved, be it the land owners (City of Windhoek) and/or the surrounding residents and community, businesses and local government. The Okuryangava landfill will address the waste management issues in Okuryangava area, and in Windhoek as a whole.

It is crucial that sustainable development should contribute to the needs of people, and to the national economy at large. Nonetheless, relying on economic growth solely is not enough to achieve sustainable development; institutional development, social development and natural resource management are also essential (UNDP, 2008; World Bank, 1990). Furthermore, using policy and legal frameworks as well as stakeholder involvement in environmental management

contribute to achieving sustainable development (Camagni *et al.*, 1998; UNCHS, 1996).

7.2.2. Employment (Job Opportunities)

Unemployment still hampers most of the developing world and Windhoek is not an exception. The Okuryangava landfill project is likely to increase the job opportunities in Windhoek. The operational phase of the project will provide job opportunities, of which 80% are expected to be unskilled and semi-skilled people and can be sourced from the unemployed labour force of Windhoek (unemployment rate is 35 to 40% in Windhoek).

Some of the services in the operational phase will be outsourced e.g. maintenance of the landfill, waste recycling, waste compaction etc. The outsourcing of these services will strengthen existing business operating in the area and provide employment to people.

7.2.3. Livelihoods

Economic activities in Windhoek and the surrounding areas are limited and livelihoods are heavily dependent on the business sector and salaries of civil servants. The livelihoods of the locals are likely to be positively impacted therefore predicted to be better than before the construction and operations of the landfill in the area.

7.2.4. Tourism

Windhoek is the major tourism gateway to the rest of Namibia. The city itself also attracts a lot of tourists from all over the world, due to its range of attractions in and around the city; and the rich cultural diversity found in the capital.

This tourist city renowned for being one of the cleanest in the world, therefore the landfill helps waste management in and around the city. Excessive waste, dust, noise, vibrations and appalling air quality can have negative impacts on the tourism industry in the area, as it can become a nuisance to tourists.

7.2.5. In - Migration

Due to enhanced employment opportunities that could be created by the envisaged project, some in-migration of job seekers to Windhoek can be expected. Depending on the amount of in-migration, local areas may start experiencing overcrowdings, over use of infrastructure, local conflicts, increase of goods prices due to increased demand etc.

7.2.6. HIV & Prostitution

Namibia has a high incidence of HIV/AIDS, which has a strong and adverse socio-economic impact on livelihoods of people in the region. The HIV prevalence rate for the age group 15 to 49 is estimated at 21.3% for Namibia (UNDP, 2005).

The spending power of locals working on this project is likely to increase, and this might be a perfect opportunity for sex workers to explore. Migrant labourers from other regions and expatriates are normally vulnerable and may use the services rendered by the sex workers.

Should the HIV prevalence increase, the following consequential issues could arise:

- ✓ Reduced workforce in the Khomas Region.
- ✓ Diversion of income expenditure to medical care.
- ✓ Increase in orphans and household headed by children.
- ✓ Increase in pregnancy related mortality.
- ✓ The current rate of 3,129 people per doctor could increase.

7.2.7. Infrastructure & Increased Traffic

The traffic in the area would be expected to increase slightly and it might contribute to heavy traffic during peak hours and a higher number of car accidents. Infrastructure like roads will be affected due to increased traffic and heavy-duty cargo trucks accessing the site from Omuvapu Street.

8. ENVIRONMENTAL MANAGEMENT STRUCTURES

8.1. Construction Phase

It is important for the City of Windhoek to ensure that the implementation of the project complies with the requirements of the Department of Environmental Affairs (DEA) in the Ministry of Environment and Tourism (MET), as well as any obligations emanating from other relevant environmental legislation. Although part of this obligation is being met by the development of the EMP, and the appointment of the Project Manager, the Project Proponent cannot delegate or defer these obligations. Accordingly, the City of Windhoek must retain an oversight role and retain some key roles and responsibilities as it relates to environmental management during the construction phase. The City of Windhoek as an organisation must ensure that adequate funding is made available for the implementation and monitoring of the environmental controls.

The City of Windhoek's responsibilities include the following:

- ✓ Identify and appoint a suitably qualified independent Environmental Control Officer (ECO) and issue a clear Terms of Reference (ToR);
- ✓ Ensure that the contents of the EMP, legal constraints and the City of Windhoek's standards and procedures pertaining to the project, specifically with regards to environment management, are highlighted to the Contractor(s) so that they are aware of these;
- ✓ Ensure that the EMP is correctly implemented throughout the project by means of site inspections and monthly site meetings;
- ✓ Make financial provisions for the inclusion of an Environmental Manager (EM) as part of the Project Manager's Contract, inclusive of all staff and equipment resources needed to execute their functions; and
- ✓ Issue ad hoc instructions, corrective action requests, or initiate punitive proceedings where non-compliances are not adequately addressed.

The general roles and responsibilities of various parties during the Construction Phase of the project are outlined below.

8.1.1. Roles of the Project Manager

The role of the Project Manager will be to manage contracts and oversee activities of the relevant Contractors during the construction or decommissioning phases.

His roles will entail:

- ✓ Appoint a suitably qualified EM on a full time basis to be on-site permanently, who shall be responsible for all environmental monitoring

set forth in the Construction EMP. He will also be the on-site contact for the Project manager and the Contractor and Sub-contractors.

- ✓ Ensuring that the Contractor is duly informed of the EMP and associated responsibilities and implications of this EMP prior to commencement of construction, ensuring the necessary environmental documents are included in tenders and expression of interests;
- ✓ Ensuring that non-compliance is remedied timeously and to the satisfaction of the relevant authorities and the ECO; and
- ✓ Ensuring that all environmental monitoring programmes (sampling, measuring, recording etc.) are carried out according to protocols and schedules;
- ✓ Monitoring the Contractors' activities (together with the EM) with regard to the requirements outlined in the EMP;
- ✓ Ensuring that issues pertaining to environmental management (all recommendations of the EM) are handled and resolved as any other construction or contractual relater matter by providing adequate support to and authority to the Environmental Manager and ECO.

8.1.2. Roles of the Environmental Manager (EM)

The EM, supported by the authority of the Project Manager, will be responsible for the oversight of all environmental aspects and compliance monitoring across all Contacts. The responsibilities of the EM and assistants shall include the following:

- ✓ Be fully knowledgeable with the contents of the Construction EMP;
- ✓ Review the weekly checklist reports compiled by the Contractor;
- ✓ Attend monthly site meetings and report back on environmental monitoring and compliance issues;
- ✓ Request method statements from the Contractor prior to the start of relevant construction activities and approve these (as appropriate) without causing undue delay to the Contractor;
- ✓ Review and make recommendations regarding all environmental matters contained in the Contractor's method statements;
- ✓ Conduct daily site inspections of all construction areas and liaise with Contractor's staff in terms of compliance with the EMP.
- ✓ Keep the Project Manager abreast of all environmental issues on a continuous basis;
- ✓ Liaise frequently with the ECO on all environmental matters and appropriate measures to be instituted;

- ✓ Investigate all environmental incidents and report the findings to the ECO and Project Manager and propose corrective and remedial actions. Identify the need for remedial measures with regard to proposed works;
- ✓ Establish and implement the environmental monitoring programmes for the full construction duration, including:
 - General compliance monitoring;
 - Visual monitoring;
 - Surface / Groundwater monitoring.
 - Maintain a complete set of environmental monitoring records.
- ✓ Compile monthly environmental monitoring reports, per primary Contract, for submission to the ECO and MET: DEA comprising:
 - General construction progress and notable events;
 - Photographic record of progress on site from an environmental perspective;
 - Incident and accident reports (including all responses and corrective actions taken);
 - Compliance monitoring of the various Contractors;
 - Site instructions issued of environmental significance;
 - Public queries or complaints received;
 - Environmental monitoring data; and
 - Recommendations and motivations relating to amendments to the EMP.
- ✓ Keep site documentation related to environmental management on site (e.g. permits, EMP, Environmental Method Statements, RoD, WML, reports, audits, monitoring results, receipts for waste removal etc.)
- ✓ Ensure there is frequent communication with the relevant parties on matters concerning the environment; and
- ✓ Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.

It is suggested that general compliance monitoring and inspections by the Environmental Manager occur and are reported on daily. These daily reports, or daily site diary entries can then be submitted collectively as monthly, allowing tracking of progress and corrective actions from day-to-day over the period.

8.1.3. Roles of the Environmental Control officer (ECO)

The ECO for the site is an independent environmental consultant appointed by the City of Windhoek to monitor and review the on-site environmental management and implementation of this EMP on the construction site.

The duties of the ECO:

- ✓ Ensure that all construction or decommissioning activities on site are undertaken in accordance with the EMP;
- ✓ Undertake monthly visual inspections of the activities of employees with regard to implementation of the requirements outlined in the EMP;
- ✓ Inform key, on-site staff of their roles and responsibilities in terms of the EMP, through initial environmental awareness training;
- ✓ Review the weekly reports compiled by the Contractor;
- ✓ Immediately notify the Contractor and the Environmental Manager of any non-compliance with the EMP, or any other complaints or issues of environmental concern;
- ✓ Approve environmental training programmes and other awareness initiatives and ensure induction material includes project appropriate environmental issues;
- ✓ Compile and submit an audit report to the Project Manager and Environmental Manager;
- ✓ Submit an Environmental Audit Report to the authorities every 6 months; and
- ✓ Compile and submit a Site Closure Report to the Project Manager and Environmental Manager once construction activities have been completed.

8.1.4. Roles of the Contractor

The City of Windhoek will employ all Contractors through its Project Manager. The Contractor's most important responsibilities are to build, upgrade or decommission the landfill and ensure compliance with the Construction Phase EMP. The Contractor will coordinate with the EM on site. It will be the responsibility of the Contractor to ensure that all work is conducted according to approved Environmental Method Statements and that the requirements of the EMP are implemented in a timeous and proper manner in his / her work area.

By virtue of the environmental obligations delegated to the Contractor through the Contract Document, all staff (including subcontractors and staff), suppliers, and service providers appointed for the project would be responsible for:

- ✓ Ensuring adherence by providing adequate staff and provisions to meet the requirements of the EMP;
- ✓ Compile a final EMP

- ✓ Ensuring that Method Statements are submitted to the Environmental Manager for approval before any work is undertaken, and monitor compliance with the EMP and approved Environmental Method Statements;
- ✓ Ensuring that any instructions issued by the Project Manager, on the advice of the Project Proponent, the ECO or Environmental Manager, are adhered to;
- ✓ Ensuring the representation of a report at each site meeting, documenting all incidents that have occurred during the period before the site meeting;
- ✓ Undertake daily, weekly and monthly inspections of the work area(s);
- ✓ Ensuring that a register of all the transgressions issued by the ECO is kept in the site office;
- ✓ Ensuring that a register of all public complaints is maintained; and
- ✓ Ensure that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the success full implementation of the environmental requirements of the Contract.
- ✓ Report and record any environmental incidents caused by the Contractor or due to the Contractor's activities;
- ✓ obtain required corrective action within specified time frames and close out of environmental incidents;
- ✓ Provide weekly checklists to the EM and ECO.

The Contractor will nominate an Environmental Site Officer (ESO) who will be responsible for ensuring that the requirements of the EMP and the associated documents are complied with on the construction site on behalf of the Contractor. The ESO shall:

- ✓ Identify areas of non-compliance and recommend measures to rectify them in consultation with the Project Manager, the EM and the ECO as required;
- ✓ Ensure that environmental problems are remedied timeously and to the satisfaction of the Project Manager, the EM and the ECO as required;
- ✓ Set up activity based method statements prior to the start of relevant construction activities and submit these to the Project Manager, the EM and the ECO as required;
- ✓ Perform ongoing environmental awareness training of the Contractor's site personnel;

8.2. Operational Phase

The City of Windhoek will be responsible for ensuring implementation of the conditions of authorisation of the project and thus for the required management and monitoring during the Operational Phase of the project. The proponent may appoint a Solid Waste Manager, to undertake management of the project on their behalf.

8.2.1. Roles of the Solid Waste Manager

In consultation with the City of Windhoek, the Solid Waste Manager's role entails planning, directing, evaluating and managing a variety of programs on collection, recycling, and diversion of solid waste. When required, he likewise also performs related tasks and duties.

- ✓ Manages programs on the collection, diversion, and recycling of solid wastes.
- ✓ Plans, reviews, assign and evaluate staff work.
- ✓ Interviews staff and recommends those for hire.
- ✓ Trains staff members in collection and recycling of solid wastes.
- ✓ Prepares and monitors budget of the unit in areas of solid waste diversion and planning programs.
- ✓ Develops and reviews performance of staff.
- ✓ Authorizes payments for solid waste contracted services.
- ✓ Participates in discussion of unresolved contractual matters.
- ✓ Directs staff members to collect, divert and recycle solid wastes.

8.2.2. Roles of the Environmental Site Officer (ESO)

The ESO is expected to administer and control all environmental matters relating to operations of the landfill. The ESO will conduct the following:

- ✓ Ensure the integration of environmental management controls into the daily activities;
- ✓ Ensure that activities are conducted in accordance with the requirements of the EMP;
- ✓ Assign and manage funds to ensure adequate management of environmental matters;

- ✓ Develop environmental awareness and training materials and implement during training and induction sessions for new workers at regular periods as appropriate;
- ✓ Undertake and review environmental monitoring reports and verify that environmental monitoring results are within specified limits;
- ✓ Compile and submit monthly environmental compliance reports to the Solid Waste Manager; and
- ✓ Prepare annual Environmental Audit Reports for submission to the authorities.

8.2.1. Roles of the Operational Sub-Contractors

It is expected that during the operational phase, only a very limited number of activities will be managed and undertaken by Sub-contractors. By virtue of the environmental obligations delegated to the Contractor through the Contract Document, all staff (including sub-contractors and staff), suppliers, and service providers appointed for the project, have a duty to demonstrate respect and care for the environment. Each has a direct responsibility for ensuring that satisfactory environmental performance is achieved.

All operational Sub-contractors shall:

- ✓ Comply with applicable Construction Phase and Operational Phase environmental management commitments, procedures, restrictions and guidelines specified in the EMP and co-operate fully in implementing applicable environmental procedures, and be contractually responsible for doing so;
- ✓ Comply with the adopted project standards and applicable procedures as applicable to the Operational Phase;
- ✓ Abide by instructions issued by the Solid Waste Manager regarding the implementation of the EMP;
- ✓ Ensure that all their personnel on site are familiar with and understand the requirements of the EMP that are relevant to their activities;
- ✓ Record any environmental incidents and report to the Solid Waste Manager; and
- ✓ The Sub-contractor will fully implement the requirements of the EMP and ensure that any problems and non-conformances are remedied in a timely manner, to the satisfaction of the Solid Waste Manager.

9. IMPLEMENTATION AND MONITORING

9.1. Construction Phase Procedures

9.1.1. Environmental Awareness Training

It is important for the Contractor to ensure that all personnel are aware of the purpose and specific requirements of the EMP. The ECO will undertake the first training session for key personnel on site, after which the Contractor will provide training for all new employees and Sub-contractors that come onto site, as deemed necessary. Environmental awareness training courses should be provided to all personnel on site. The environmental training courses will include, amongst others, aspects such as:

- ✓ Environmental issues on site;
- ✓ Roles and responsibilities;
- ✓ The construction environmental management measures; and
- ✓ Heritage discovery procedures.

Courses shall be held during normal working hours, at a suitable venue. All attendees shall remain for the duration of the course and, on completion, sign an attendance register that clearly indicates participants' names. A copy of the register shall be handed to the ECO.

9.1.2. Method Statements

The EMP provides the overall project strategy for management of environmental issues; however, a Construction Method Statement (CMS) will address environmental management issues at a site level. The CMS provides an environmental manual for use by management and construction staff involved in the works.

It addresses the environmental issues that are specific to an activity and/or site. CMS's should be produced for all major construction activities and/or major construction sites, and will typically provide detailed descriptions of items including, but not necessarily limited to:

- ✓ Nature, timing and location of activities;
- ✓ Procedural requirements and steps;
- ✓ Management responsibilities;
- ✓ Material and equipment requirements;
- ✓ Transportation of equipment to and from site;

- ✓ Develop methods for moving equipment/material while on site;
- ✓ How and where material will be stored;
- ✓ Emergency response approaches, particularly related to spill containment and clean-up;
- ✓ Response to compliance/non-conformance with the requirements of the EMP; and
- ✓ Any other information deemed necessary by the EM/ECO.

9.1.3. Flood Management

The waste disposal facility should be designed in a way that it can withstand flood. Storm water management of the site should be a key aspect of flood management on site. All culverts should be kept clean to allow storm water to flow freely.

9.1.4. Non-Compliance and Corrective Action

As the EMP is an integral part of the Contractor's contract, if criteria within the EMP are not fulfilled and appropriate and corrective action is not taken a non-conformance may be raised by the environmental manager. Examples of circumstances where this may arise include:

- ✓ Receipt of a complaint regarding pollution or other environmental impacts caused by the project.
- ✓ Departure from approved or agreed procedures.
- ✓ Non-conformance identified as a consequence of any self-assessment, formal audit or other environmental survey or inspection.

Corrective action may include changes to work instructions (frequency of testing, test method etc.), alterations further staff training etc. Non conformances should be reviewed by the environmental manager and form part of construction meeting agendas. The Corrective Action Plan must be submitted to the ECO and EM for approval prior to implementation. Once it has been approved, the corrective action must be carried out within the time limits stipulated. The ECO will then be required to confirm the success or failure of the corrective action.

9.2. Operational Phase Procedures

Key procedures for the implementation and monitoring of the requirements of the EMP in the Operational Phase are outlined below, with relevant details provided in subsequent sections:

- ✓ The Solid Waste Manager shall facilitate a series of environmental awareness training workshops with all site personnel regarding the importance of the EMP, prior to commencement of operations;
- ✓ The Solid Waste Manager will monitor the day-to-day performance of staff and Sub-contractors (if any) against the commitments of the EMP using techniques such as:
 - Interviews with staff (including Sub-contractors and suppliers);
 - Document review/verification;
 - Visual Observations;
 - Monitoring; and
 - Measurement and verification.
- ✓ The Solid Waste Manager (or ESO, as required) will prepare monthly compliance reports, detailing any environmental issues, non-compliance and actions to be implemented, to be submitted to the City of Windhoek;
- ✓ The Solid Waste Manager (or the ESO) will prepare Environmental Audit Reports on an annual basis for submission to the authorities.

9.2.1. Environmental Awareness Training

The City of Windhoek is bound to be responsible for ensuring that environmental awareness education of all employees and contractors is done satisfactorily. The City should ensure that employees and contractors are made aware of the environmental requirements of the project.

The EMP should form part of the Terms of Reference for all contractors, sub-contractors and suppliers. All contractors, sub-contractors and suppliers will have to sign an agreement to assure that they understand the EMP and that they will comply. All parties should familiarise themselves with the full contents of the EMP and its implications.

Environmental awareness training courses should be provided to all personnel on site on a regular basis. It is incumbent upon the Solid Waste Manager (or the ESO) to ensure that all personnel are aware of the objectives and specific provisions of the EMP. Environmental awareness will also include workshops, posters and tool time talks.

9.2.2. Environmental Incident Reporting

All environmental incidents occurring at the proposed site will be recorded. The incident report will have to include time, date, location, and nature of the incident, extent of the incident, actions taken, and personnel involved.

All complaints received from the neighbouring community should be directed to the ESO of the facility and channelled to the appointed Solid

Waste Manager. The Solid Waste Manager / City of Windhoek should be able to respond to the complainant within a week (even if pending further investigation). It is important that the issues raised are considered and that the complainant feels that their concerns have been addressed to and wherever possible actions taken to address these. All complaints should be entered in the environmental register and all responses and actions taken to address these should be recorded.

9.2.3. Environmental Monitoring

Periodic environmental monitoring must be taken on a regular basis. Monitoring should be done in order to ensure compliance with all aspects of the EMP. Findings should be liaised with to all responsible officers as chain command.

9.2.4. EMP Administration

Copies of this EMP shall be kept at the site office and should be distributed to all senior staff members, including those of the contractors.

9.2.5. EMP Amendments

The EMP amendments can only be made with the approval of the solid Waste Manager and ultimately the DEA. Amendments to the EMP should be liaised to all employees and contractors.

9.2.6. EMP Amendments

Problems may occur in carrying out mitigation measures or monitoring procedures that could result in non-compliance of the EMP. The responsible personnel should encourage staff to comply with the EMP, and address acts of non-compliance and penalties.

The ESO is responsible for reporting non-conformance with the EMP, to the Solid Waste Manager. The ESO, in consultation with the Solid Waste Manager must, thereafter, undertake the following activities:

- ✓ Investigate and identify the cause of non-conformance.
- ✓ Report matters of non-conformance to City of Windhoek Environmental Department (depending on the severity of the incident).
- ✓ Implement suitable corrective action as well as prevent recurrence of the incident.
- ✓ Assign responsibility for corrective and preventative action.

- ✓ Any corrective action taken to eliminate the causes of non-conformance shall be appropriate to the magnitude of the problems and commensurate with the environmental impact encountered.

9.2.7. Environmental Register

An environmental register should be kept on site in which incidents related to actual impacts are recorded. This will include information related to incidents as spillages, dust generation and complaints from adjacent neighbours. It should also contain information relating to actions taken. Any party on site may complete the register, however, it is envisaged that the

Solid Waste Manager, the ESO and the contractor(s) will be the main contributors, and who will also be the main parties involved in suggesting mitigation measures.

9.2.8. Site Management

Areas outside this designated working zone shall be considered “no go” areas. The offloading zones must be clearly demarcated when offloading goods to enhance safety around the waste disposal site.

9.2.9. Access Routes and Work Sites

Road transport trucks will access the waste disposal site from the Omuvapu Street. No new tracks/roads shall be established and only existing roads may be used. Work sites shall be clearly demarcated and road signs erected where needed. The general public should not have unauthorised/uncontrolled access to the waste disposal site during both construction and operational phases.

Vehicle access will be limited to a single entrance to facilitate control. Access must be of a high standard to prevent unacceptable waste types from entering the site.

The entrance will be manned during the operation hours, but will be locked during non-operational hours to prevent unauthorised entry. A notice board, in two languages or more, must be erected at the entrance and must state the class and operating hours of the landfill, the operator/responsible person and emergency telephone numbers. Suitable signs must also be erected on the approach roads and on-site, to direct drivers and to control speed.

Road access to the working face of the general waste disposal operation must be maintained at all times in a manner suitable to accommodate vehicles normally expected to use the facility. Roads must be regularly graded and wetted to control dust, where necessary.

Furthermore, on-going controls, such as fencing and policing, must be implemented.

9.2.10. Fire and Safety Management

Should there be a need for electrical wiring at the facility, it must be approved by a qualified electrician who will issue a Certificate of Compliance.

This waste disposal site does not accommodate hazardous waste (e.g. hydrocarbons, paint, pesticides, mercury, batteries, radioactive waste etc.). Hydrocarbons are volatile under certain conditions and their vapours in specific concentrations are flammable. If precautions are not taken to prevent their ignition, fire and subsequent safety risks may arise.

No fire, whether for cooking or any other purpose, is to be made at the waste disposal facility during any of the two phases (construction and operational). The Contractor shall take all reasonable measures and active steps to avoid increasing the risk of fire through activities on site and prevent the accidental occurrence or spread of fire; and shall ensure that there is sufficient fire-fighting equipment on site at all times. This equipment shall include fire extinguishers. The Contractor should be prepared for such events.

9.2.11. Staff Management

The Contractor must ensure that their employees have suitable personal protective equipment and properly trained in fire fighting and first aid. Training records must be kept for future references.

9.2.12. Waste Management

Prior to waste being accepted at the gate, it must be verified accordingly through visual inspection by the facility operator or ESO. The waste type must be confirmed with the waste transporter. All potentially hazardous waste, such as industrial wastes, liquids, sludges and drummed wastes must be correctly handled and disposed off at the Kupferberg hazardous waste site.

Loads are also to be checked for problematic waste types, such as rotten foodstuff, dead animals and other malodorous wastes. These must be disposed of in a specific manner and covered immediately to minimise negative impacts. All windblown litter must be collected by hand around the site on a daily/weekly basis depending on the severity.

9.2.13. Progressive Rehabilitation

All final levels and slopes must be in conformance with the landfill design and the end-use plan, with slopes no steeper than 1:3. Rehabilitation must

commence as soon as possible on areas where no further waste deposition is to take place, i.e. on completed side slopes. Once the final level is achieved the area must be capped and covered with the final cover and vegetating the berms.

10. ENVIRONMENTAL MANAGEMENT MEASURES FOR OPERATIONAL PHASE

This section will look at the potential environmental impacts, which may arise during the operational phase of the Okuryangava waste disposal facility (*i.e.* short and long-term impacts).

10.1. Operational Phase: General

Table 1. Documentations of Administration






Operational phase	
Management Aspect	Documentations of Administration
Proposed Mitigation Measures	<ul style="list-style-type: none">  Maintain records and attendance registers of environmental awareness training courses on site.  Ensure a Complaints Register is available on-site and is up-to-date.  Maintain environmental authorisations/permits/licences on site.  Take photographs of any areas of concern for record purposes e.g. before and after photos of non-compliance and corrective action.  Revise the EMP should any environmental issues crop up during the Operational Phase. Submit the revised EMP to DEA and DWA for review.
Proposed Monitoring	Weekly inspections; Internal audit.
Performance Indicators	Record of complaints and action; Records of licence and permits; Evidence and records of updated EMPs (when necessary).
Responsible Party	Solid Waste Manager/City of Windhoek

Table 2. Operational Plan


Operational phase	
Management Aspect	Operations
Proposed Mitigation Measures	 Comply with the procedures set out in the Operations Plan.
Proposed Monitoring	Internal audit.
Performance Indicators	Performance report.
Responsible Party	Solid Waste Manager

Table 3. Environmental Audit Reports

Operational phase	
Management Aspect	Environmental Audit Reports
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Provide an environmental audit report to DEA regularly (preferably once a year) when operations begin. ✚ Specify the performance and conformity of the project with all the conditions of authorisation and all the commitments made by the applicant. ✚ Submit the audit reports to the relevant authorities for approval.
Proposed Monitoring	Internal audit.
Performance Indicators	Evidence and record of correspondence with DEA; Submission of audit reports; Acceptance notices from DEA and DWA.
Responsible Party	Solid Waste Manager

Table 4. Control of Alien Vegetation

Operational phase	
Management Aspect	Control of Alien Vegetation
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Planting of invasive alien species should not be planted in project area.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Evidence and record of invasive vegetation on site.
Responsible Party	Solid Waste Manager/City of Windhoek

10.2. Operational Phase: Hazardous Substances Management

Table 5. Disposal of Hazardous Substances

Operational phase	
Management Aspect	Disposal of Hazardous Substances
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ No hazardous waste should be stored and handled (no disposal) at the Okuryangava landfill site. ✚ All hazardous waste should be safely contained, transported and disposed of at the designated Kupferberg hazardous waste disposal cell.
Proposed Monitoring	Regular visual inspection; Internal audit; Weekly inspections; Audit of records/labelling.
Performance Indicators	Record of no hazardous material received.
Responsible Party	Solid Waste Manager

10.3. Operational Phase: Vehicles and Equipment

Table 6. Speed Management

Operational phase	
Management Aspect	Speed Management
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Notify drivers of vehicles of relevant speed limits and put into practice speed control methods, where feasible.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Records of number of complaints.
Responsible Party	Solid Waste Manager

Table 7. Spillages and Leakages

Operational phase	
Management Aspect	Spillages and Leakages
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure compliance to the maintenance and service plans. ✚ Ensure that transportation vehicles are equipped with sufficient equipment and material to contain and remediate any accidental spills; and to remove any contaminated soil or water. ✚ Ensure that any petroleum products, such as grease, waste oils and lubricants are contained in containment structures (e.g. plastic liners, drip trays etc.). These structures are to be used during all servicing or refuelling of vehicles and equipment. ✚ Vehicle and equipment should be serviced and maintained regularly. All leaks should be properly contained and repaired immediately. ✚ Leaking equipment should be removed from the work area to a designated containment area, which should be equipped with a waste water collection system. ✚ Equipment and materials to deal with spill cleanup must be readily available on site and staff must be trained as to how to use the equipment and briefed about reporting procedures.
Proposed Monitoring	Regular weekly visual inspection; Records of remediation.
Performance Indicators	Records of vehicle maintenance, visible contaminants from trucks and equipment, evidence that leaking equipment decommissioned, evidence of soil and water contamination..
Responsible Party	Solid Waste Manager

Table 8. Transport of Materials

Operational phase	
Management Aspect	Transport of Materials
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Make sure all loads are secure to prevent spillage during transportation of material. ✚ All operational surfaces at the facility must be installed with spill containment areas. ✚ All vehicles should be parked on designated containment areas. Drip trays must to be used if there is any chance of fuel or oil spills from vehicles.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Records of number of spills and incidences.
Responsible Party	Solid Waste Manager

Table 9. No Go Areas

Operational phase	
Management Aspect	No Go Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ No movement of persons outside designated footprint is allowed. ✚ Confine all vehicles to designated access roads and parking areas. Prevent use of vehicles in “No Go” Areas.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Number of disturbances outside designated area
Responsible Party	Solid Waste Manager

Table 10. Noise Pollution

Construction/Decommissioning phase	
Management Aspect	Noise Pollution
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure the use vehicles, equipment and machines that emit reduced noise levels, compatible with the most recent environmental standards. ✚ Ensure proper maintenance are conducted on vehicles to ensure the reduction of noise emission. ✚ Where necessary, workers should be equipped with ear protection equipment. ✚ Daily operational activities should be limited to 07H00 - 19H00.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Evidence of no excessive noise.
Responsible Party	Solid Waste Manager

Table 11. Emissions from vehicles and machinery

Construction/Decommissioning phase	
Management Aspect	Emissions
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Air quality around the site could be impacted by exhaust fumes from trucks and vehicles accessing the landfill site. ✚ Ensure all vehicle, plant and equipment are in good condition. ✚ Promote the reduction of engine idling at the landfill site.
Proposed Monitoring	Regular visual inspections of air quality at site; and of vehicle exhaust emissions.
Performance Indicators	Vehicle exhaust emissions; Evidence of vehicles idling too long.
Responsible Party	Solid Waste Manager

10.4. Operational Phase: Waste Management

Table 12. General Operations



Operational phase	
Management Aspect	General Operations
Proposed Mitigation Measures	<ul style="list-style-type: none">  Ensure transport vehicles are suitable to transport the class and type of waste.  No illegal waste dumping outside designated landfill footprint (exact area of disposal at time); or burning of waste on site.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Evidence of no waste dumped or burned on site; Suitable vehicles for transportation of waste.
Responsible Party	Solid Waste Manager

Table 13. Large Scrap Materials


Operational phase	
Management Aspect	Large Scrap Materials
Proposed Mitigation Measures	<ul style="list-style-type: none">  No scrap metal should be stored and handled at the Kleine Kuppe waste transfer site.
Proposed Monitoring	Weekly inspection; Regular visual inspection of scrap material temporary storage site.
Performance Indicators	Evidence of no scrap material present on site; Minimal scrap material present at site; Records of all scrap material entering and exiting site.
Responsible Party	Solid Waste Manager/Contractors

Table 14. Green Waste


Operational phase	
Management Aspect	Green Waste
Proposed Mitigation Measures	<ul style="list-style-type: none">  Ensure that all green waste is processed at the Compost Facility.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Evidence of minimal green waste placed in waste disposal site.
Responsible Party	Solid Waste Manager

Table 15. Hazardous Waste

Operational phase	
Management Aspect	Hazardous Waste
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Do not accept hazardous waste at this landfill. ✚ Maintain waste removal record with date, waste type, removal company, volume or mass and name of driver with signatures. ✚ Waste transporters to Okuryangava landfill may not accept hazardous waste for transport and disposal at any other landfill but the Kupferberg hazardous landfill site. ✚ Awareness of the hazardous nature of various types of waste should be enforced.
Proposed Monitoring	Regular visual inspection at landfill site; Record/Receipts for type of waste disposal or delivery; Review documents at delivery; Internal auditing.
Performance Indicators	Record of disposal certificates; Evidence of no hazardous waste at landfill site.
Responsible Party	Solid Waste Manager

Table 16. Medical Waste

Operational phase	
Management Aspect	Medical Waste
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Do not accept medical waste at this landfill. ✚ Dispose of, treat and handle all medical waste at hazardous waste disposal site at the Kupferberg hazardous landfill site. ✚ Treatment of waste is made possible through the use of various technologies, one of which is incineration.
Proposed Monitoring	Records of medical waste disposals.
Performance Indicators	Evidence of proper containment of medical waste.
Responsible Party	Solid Waste Manager

Table 17. Waste Handling

Operational phase	
Management Aspect	Waste Handling
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Waste must not be mixed or otherwise treated where this would reduce the potential for re-use, recycling or recovery; or the result of treatment is not controlled and permanent. ✚ Waste may be blended or pre-treated to improve the potential for re-use, recycling or recovery; or reduce the risk associated with the management of the waste.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Evidence of waste treatment awareness; Evidence of untreated waste.
Responsible Party	Solid Waste Manager

Table 18. Used Tyres

Operational phase	
Management Aspect	Used Tyres
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Storage and handling of used tyres at this landfill should be kept to a minimal, and the protocols associated with handling of such wastes shall be known by all relevant staff members. ✚ Used tyres must be stored in a manner that minimises fire risk. Tyres are flammable and when they are stored together in large volumes, they can create a fire hazard. ✚ Emergency response procedures should be in place so as to alert the employees on how to react to fire incidents.
Proposed Monitoring	Regular visual inspection at landfill site; Record/Receipts for type of waste disposal or delivery; Review documents at delivery; Internal auditing.
Performance Indicators	Record of disposal certificates.
Responsible Party	Solid Waste Manager

10.5. Operational Phase: Waste Water Management

Table 19. Stormwater Management

Operational phase	
Management Aspect	Stormwater Management
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure that proper and adequate stormwater system exists at the site. Stormwater from the site should be directed away from the landfill site accordingly. ✚ Ensure all stormwater drains or channels are clear of litter or obstructing material. Remove all excess sedimentation, rubble and any other waste material present in the waterway and dispose of in a suitable manner to ensure proper drainage runoff. ✚ Ensure that stormwater management systems are regularly maintained and tested, and are in good working order.
Proposed Monitoring	Regular visual inspections of storm water channels; Visual monitoring of stormwater pooling or overflowing into water courses; Internal audit.
Performance Indicators	Evidence of no storm water pooling or overflowing into water courses; Evidence of no leakages or pollution from stormwater ways.
Responsible Party	Solid Waste Manager

Table 20. Oil Containing Water

Operational phase	
Management Aspect	Oil Containing Water
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure the landfill is equipped with a proper working oil-water separator ✚ Oil contaminated water should be drained into an oil-water separator for segregation. The separated oil should be properly contained and disposed of at the Kupferberg hazardous waste site.
Proposed Monitoring	Record of oil/water separator on site; Regular visual inspection.
Performance Indicators	Records of disposal.
Responsible Party	Solid Waste Manager

Table 21. Contaminated Water/Leachate

Operational phase	
Management Aspect	Contaminated Water/Leachate
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Develop and implement a surface water and groundwater monitoring system and programme, with the aim of monitoring possible contamination to the water resources. ✚ Monitoring boreholes, monitoring points and surface sampling point should be sampled on a monthly basis. The sampling data should be evaluated by a hydrologist or geohydrologist. ✚ Avoid discharge of pollutants (such as cement, concrete, lime, chemicals, contaminated waste water or leachate) into stormwater channels and water courses. ✚ The landfill must be lined with appropriate materials in accordance with the relevant legislative requirements. Containment liners must be inspected for any possible wall failure, such as pinholes, cracks, holes etc. ✚ Implement a leak detection and monitoring system.
Proposed Monitoring	Regular visual inspections of storm water channels; Internal audit.
Performance Indicators	Evidence of correspondence with Hydrologist/Geohydrologist; Evidence of no contamination water flowing into water courses; Evidence of waste water discharged to suitable approved location; Evidence of leak detection system in place.
Responsible Party	Solid Waste Manager/Hydrologist/Geohydrologist

Table 22. Methane Contamination

Operational phase	
Management Aspect	Methane Contamination
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Monitor methane levels on a regular basis (frequency can be adjusted based on initial results). ✚ If methane levels exceed 5% in ambient air condition, then permanent gas collection and venting may be required.
Proposed Monitoring	Collect monitoring samples; Regular assessment of monitoring.
Performance Indicators	Records of monitoring data.
Responsible Party	Solid Waste Manager

10.6. Operational Phase: Air Quality Management

Table 23. Minimise Dust

Operational phase	
Management Aspect	Minimise Dust
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✦ Acquire all reasonable measures to minimise dust generated by operational activities. ✦ Avoid handling and transporting of materials which may generate dust under high wind conditions or when a visible dust plume is present. Also avoid excavating material which may generate dust in the process. ✦ Establish stockpiles of materials in secluded areas where they are not exposed to the erosive effects of the wind. ✦ Appropriate dust suppression measures should be deployed when dust generation is unavoidable, e.g. dampening with water (wet suppression.), particularly during prolonged periods of dry weather. ✦ Sweep roads at site entrance and exit points regularly, to prevent the spread of mud by vehicles, which would later result in dust.
Proposed Monitoring	Regular visual inspections by ESO; Records of complaints.
Performance Indicators	Records of number of dust complaints; Visible dust plumes; Visible wind erosion.
Responsible Party	Solid Waste Manager

Table 24. Vehicle Control

Operational phase	
Management Aspect	Vehicle Control
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Establish a controlled speed limit in and around the landfill site. Speed limits of 20 km/h on paved and 15 km/h on unpaved roads may be adopted. ✚ Ensure that all operational vehicles, plant and equipment are in good running state. ✚ Clean roads at site entrance and exit points regularly, to prevent the spread of mud by vehicles, which would later result in dust. ✚ Control dust on site roads through wet suppression. ✚ Reduction in engine idling should be encouraged.
Proposed Monitoring	Regular visual inspections; Regular inspections of vehicles and equipment; Records of complaints.
Performance Indicators	Records of number of dust complaints; Visible dust plumes and/or excessive exhaust fumes; Evidence of excessive engine idling.
Responsible Party	Solid Waste Manager

Table 25. Emissions of Gases

Operational phase	
Management Aspect	Emissions of Gas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Gas emissions at the landfill should be monitored regularly (e.g. every 5 years). If the monitored levels exceed the modelled emission rates, then the model must be rerun to determine whether the impacts have changed and appropriate mitigation measures must be implemented to remedy the impacts in an updated EMP. ✚ Close up each cell of the landfill at the end of the life of each cell.
Proposed Monitoring	Regular visual inspection; Collect monitoring samples.
Performance Indicators	Records of monitoring data.
Responsible Party	Solid Waste Manager

Table 26. Control of Odours

Operational phase	
Management Aspect	Control of Odours
Proposed Mitigation Measures	✚ In order to minimise odours at the landfill, the saturated landfill cells should be closed up, in order to minimise odour levels.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Records of complaints about odours.
Responsible Party	Solid Waste Manager

Table 27. Air Quality Management

Operational phase	
Management Aspect	Air Quality Management
Proposed Mitigation Measures	✚ Retain the objection mechanism to capture public perceptions and complaints with regard to air quality impacts, track investigation actions and introduce corrective measures for continuous improvement.
Proposed Monitoring	Regular visual inspection; Internal audit.
Performance Indicators	Records of grievance procedure.
Responsible Party	Solid Waste Manager

10.7. Operational Phase: Fire Management

Table 28. Control of Fires

Operational phase	
Management Aspect	Control of Fires
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Avoid smoking in areas that are close to fire hazard areas and environments, such as fuel storage areas and areas of dry vegetation. ✚ Ensure that sufficient fire-fighting equipment is available on site. Fire fighting equipment is to be suitably maintained. ✚ Supply appropriate signage and relevant emergency contact details on site and displayed outside the main administration building. ✚ Do not allow informal cooking or warming fires on the site. ✚ Appoint a fire officer who shall be responsible for co-ordinating emergency response in the event of a fire according to the Emergency Response Plan. ✚ Staff to be sufficiently trained in the operation of fire-fighting equipment. ✚ Establish and maintain designated smoking areas.
Proposed Monitoring	Regular visual inspections; Designated smoking areas; Records of fire fighting training and awareness .
Performance Indicators	No evidence of fires on site; Certification from local fire services; Appointment of fire officer(s); Number of uncontrolled fires.
Responsible Party	Solid Waste Manager

Table 29. Risk

Operational phase	
Management Aspect	Risk
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Conform to fire safety measures to protect the site against fires originating from outside the site.
Proposed Monitoring	Internal audit
Performance Indicators	Fire safety measures
Responsible Party	Solid Waste Manager

10.8. Operational Phase: Noise Management

Table 30. Noise

Operational phase	
Management Aspect	Construction Equipment
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Utilise stringent vehicle and equipment noise specifications. ✚ Comply with the Service Plan. ✚ Perform appropriate and timeous maintenance of equipment and vehicles. ✚ Ensure proper design and maintenance of silencers on diesel-powered equipment. ✚ Maintain the grievance mechanism to capture public perceptions and complaints with regard to noise impacts, track investigation actions and introduce corrective measures for continuous improvement.
Proposed Monitoring	Regular visual inspections; Suitable maintenance schedules; Internal audit; Records of noise complaints.
Performance Indicators	Record of noise complaints; Evidence of no excessive noise; Records of grievance procedure.
Responsible Party	Solid Waste Manager

10.9. Operational Phase: Visual/Aesthetics Management

Table 31. Landform/Scarring

Operational phase	
Management Aspect	Landform/Scarring
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Cover working faces of cells with cover material every day. ✚ Begin rehabilitation of each cell as soon as it is filled. ✚ Retain and rehabilitate as much of the natural vegetation on site as possible.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Record of complaints; Evidence of no excessive clearing.
Responsible Party	Solid Waste Manager

Table 32. Buildings

Operational phase	
Management Aspect	Buildings
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Plant additional vegetative screening around office buildings.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Evidence of trees planted around buildings.
Responsible Party	Solid Waste Manager

Table 33. Litter

Operational phase	
Management Aspect	Litter
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Implement measures to manage litter from the site. These measures should include the following: (a) Cover waste timeously i.e. daily and immediately after disposal when wind speeds exceed 20km/h; (b) Dispose of waste in areas of the site that are sheltered from the wind when high wind speed conditions prevail; and (c) Erect physical barriers such as fences to prevent windblown litter from leaving the immediate confines of the working (disposal) area or plant trees around the site to act as wind breakers. ✚ Regularly clear windblown litter that gathers along fencing or beyond. ✚ Employ people from the local community to collect litter, in areas surrounding the landfill, should windblown litter become a problem.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Evidence of no litter in and around the site.
Responsible Party	Solid Waste Manager

Table 34. Dust

Operational phase	
Management Aspect	Dust
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Implement dust suppression/control measures, if conditions are windy.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Records of number of dust complaints; Visible dust plumes.
Responsible Party	Solid Waste Manager

Table 35. Trucks

Operational phase	
Management Aspect	Trucks
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Service waste trucks regularly and ensure speed limits are maintained at all times. ✚ Cover all waste on the trucks.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Records of number of dust complaints; Visible dust plumes.
Responsible Party	Solid Waste Manager

Table 36. Signage

Operational phase	
Management Aspect	Signage
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Keep external signage to a minimum.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Evidence of no excessive signage.
Responsible Party	Solid Waste Manager

10.10. Operational Phase: No Go Areas

Table 37. No Go Areas

Operational phase	
Management Aspect	No Go Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Limit movement of machinery and vehicles to the defined network of roads. ✚ Maintain 400m buffer zone around the site. ✚ Inform construction personnel that the picking of grapes on neighbouring properties is strictly prohibited.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Number of disturbances outside designated area; Evidence of no alien species.
Responsible Party	Solid Waste Manager

10.11. Operational Phase: Environmental and Health Awareness

Table 38. Environmental Awareness

Operational phase	
Management Aspect	Environmental Awareness
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Inform all workers that the hunting of any fauna species on or around the site is prohibited. Include penalty clauses in work contracts associated with the hunting of wildlife. ✚ Ensure that all site personnel and all sub-contractors are aware of their environmental obligations on site, through an environmental awareness training programme. ✚ Provide information posters at strategic points on site for site personnel. Posters should include emergency contact details, emergency procedures, and a simple list of key environmental requirements or “do’s” and “don’ts”.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Occurrence of training sessions; Evidence of signage in place.
Responsible Party	Solid Waste Manager

Table 39. Fauna Management

Operational phase	
Management Aspect	Fauna Management
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ All fauna found on site must be relocated to a safe area without being harmed in any way.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Records of relocation
Responsible Party	Solid Waste Manager

Table 40. Health Awareness

Operational phase	
Management Aspect	Health Awareness
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Implement an awareness program and continuous information actions on health issues with lectures, posters and informal information sessions for all workers employed. ✚ Ensure employees are familiar with and adhere to the Health, Security and Safety Plan.
Proposed Monitoring	Attendance register; Internal audit.
Performance Indicators	Records of attendance; Evidence of suitable signage in place; Number of awareness sessions conducted.
Responsible Party	Solid Waste Manager

10.12. Operational Phase: Safety and Security

Table 41. Signage

Operational phase	
Management Aspect	Signage
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Display telephone numbers of emergency services, including the local fire fighting service, in the administration office and at the entrance to the site. Contact the emergency services in the area in the case of an emergency. ✚ Provide suitable emergency and safety signage on site (manufactured of durable, weatherproof material) displayed at prominent and conspicuous places along the fences and entry gates. Demarcate any areas which may pose a safety risk (including hazardous substances, deep excavations etc). These notices must be worded in the official languages applicable to the area.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Evidence of suitable signage in place; Number of awareness sessions conducted.
Responsible Party	Solid Waste Manager

Table 42. Personal Protective Equipment (PPE)

Operational phase	
Management Aspect	Personal Protective Equipment
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Enforce the use of appropriate Personal Protective Equipment (PPE) at all times.
Proposed Monitoring	Regular weekly inspections.
Performance Indicators	All workers working with heavy machinery, vehicles and equipment to have PPEs all the time during work.
Responsible Party	Solid Waste Manager

Table 43. Illegal Access

Operational phase	
Management Aspect	Illegal Access
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Prevent illegal access to the site by implementing appropriate security measures. These security measures must not pose a threat to surrounding communities. ✚ Ensure that recyclable goods are separated out prior to disposal reducing the temptation for handpicking of these goods which can be exchanged for cash.
Proposed Monitoring	Regular visual inspection.
Performance Indicators	Evidence of no illegal access.
Responsible Party	Solid Waste Manager

Table 44. Emergencies

Operational phase	
Management Aspect	Emergencies
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Comply with the Emergency Response Plan. ✚ Install Emergency Control System.
Proposed Monitoring	Internal auditing.
Performance Indicators	Evidence that correct procedures are followed; Evidence of adequate emergency systems in place; Records of emergency responses.
Responsible Party	Solid Waste Manager

10.13. Operational Phase: Rehabilitation

Table 45. Waste Cell Rehabilitation

Operational phase	
Management Aspect	Waste Cell Rehabilitation
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Comply with the Rehabilitation Plan and the Stability Management Plan. ✚ Cover working faces of cells with cover material every day. ✚ Begin rehabilitation of each cell as soon as it is filled. ✚ Retain and rehabilitate as much of the natural vegetation on site as possible.
Proposed Monitoring	Regular visual inspection; Internal auditing.
Performance Indicators	Evidence of no excessive clearing; Evidence of waste cell rehabilitation and closure report; Records of number of complaints.
Responsible Party	Solid Waste Manager

11. ENVIRONMENTAL MANAGEMENT MEASURES FOR CONSTRUCTION AND DECOMMISSIONING PHASE

This section will look at the potential environmental impacts, which may arise during the construction and possible decommissioning of the Okuryangava waste disposal facility (*i.e.* short and long-term impacts).

11.1. Construction Phase: Construction Vehicles and Equipment

Table 46. Transport of Construction Material





Construction/Decommissioning phase	
Management Aspect	Transport of Construction Material
Proposed Mitigation Measures	<ul style="list-style-type: none">  Secure all loads to prevent spillage during transportation.  Park delivery vehicles on impermeable surfaces for delivery of materials. If this is impractical, drip trays are to be used if there is any chance of fuel or oil spills from delivery vehicles.  Ensure haul vehicles transporting fine materials have suitable covers e.g. tarpaulins if there is any chance of dust being created during transport.  Optimise load sizes during transport of construction materials to avoid spillages.
Proposed Monitoring	Regular visual inspection by ECO .
Performance Indicators	Number and size of spills or leakages, visible contaminants from trucks, trucks are adequately equipped with proper covers and equipment.
Responsible Party	Contractors

Table 47. Control of Speed



Construction/Decommissioning phase	
Management Aspect	Speed Control
Proposed Mitigation Measures	<ul style="list-style-type: none">  Implement and enforce strict speed control measures for all vehicles and machinery operating on site or frequenting the site.  Inform drivers of construction vehicles of relevant speed limits and implement speed control mechanisms where possible.
Proposed Monitoring	Regular visual inspection by ECO.
Performance Indicators	Number of complaints, Drivers sign awareness register
Responsible Party	Project Manager/Contractors

Table 48. Spillages and Leakages

Construction/Decommissioning phase	
Management Aspect	Spills and Leaks
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Prevent spillages of any chemicals and petroleum products (i.e. oils, lubricants, petrol and diesel). Use drip trays, linings or concrete floors when evidence of leaks are observed on vehicles or equipment. ✚ No major servicing and maintenance of vehicles and/or equipment should be conducted at the facility. ✚ All fuelling, storage and chemical handling should be conducted on surfaces provided for this purpose. Drip trays, linings or concrete floors must be used when removing oil from machinery. ✚ Spillage control procedures must be in place according to relevant SANS standards or better. Waste water collection systems should be connected to these systems. ✚ Proper environmental awareness and remedial response training of operators must be conducted on a regular basis.
Proposed Monitoring	Regular visual inspection by ECO, weekly inspections, records of remediation.
Performance Indicators	Number and size of spills or leakages; visible contaminants from trucks and equipment; evidence that leaking equipment decommissioned; evidence of soil and water contamination.
Responsible Party	Contractors

Table 49. Traffic

Construction/Decommissioning phase	
Management Aspect	Traffic
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Install and maintain official traffic signalling on local roads / intersections surrounding the landfill during the construction phase in conjunction with local traffic authorities. ✚ Confine heavy vehicles to primary roads as far as possible, and avoid roads not designated for heavy cargo loads.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Adequate traffic signage; evidence of traffic congestion
Responsible Party	Environmental Manager/Contractors

Table 50. Emissions from vehicles and machinery

Construction/Decommissioning phase	
Management Aspect	Emissions
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure all vehicle, plant and equipment are in good condition. ✚ Encourage reduction of engine idling
Proposed Monitoring	Regular visual inspections of air quality at site; and of vehicle exhaust emissions.
Performance Indicators	Vehicle exhaust emissions; Evidence of vehicles idling long.
Responsible Party	Environmental Manager/Contractors

Table 51. No Go Areas

Construction/Decommissioning phase	
Management Aspect	No Go Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Confine all vehicles and equipment to designated access roads and parking areas. Prevent use of vehicles in 'no go areas'. ✚ Limit movement of construction vehicles and machinery to the defined network of road accesses.
Proposed Monitoring	Regular visual inspections.
Performance Indicators	Number of disturbances outside designated area; Evidence of disturbances to vegetation outside designated area.
Responsible Party	Environmental Manager/Contractors

Table 52. Noise Pollution

Construction/Decommissioning phase	
Management Aspect	Noise Pollution
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure the use of construction vehicles and equipment that emit reduced noise levels. ✚ Ensure proper maintenance is conducted on vehicles to ensure the reduction of noise emission.
Proposed Monitoring	Regular visual inspections by ECO.
Performance Indicators	Evidence of no excessive noise.
Responsible Party	Environmental Manager/Contractors

11.2. Construction Phase: Waste Management

Table 53. Storage of Waste

Construction/Decommissioning phase	
Management Aspect	Waste Storage
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure that sufficient weather- and vermin- proof bins / containers are present on site for the disposal of solid waste. Waste and litter generated during this phase must be placed in these disposal bins. ✚ When possible, materials used or generated by construction shall be sorted for recycling or scrap purposes. Ensure waste is segregated, classified and labelled at source ✚ No unauthorised entry into the waste storage areas.
Proposed Monitoring	Receipts for waste disposal; disposal records of recyclables; register of entries; weekly inspections.
Performance Indicators	Evidence of littering /waste disposal on site; amount of recyclable material; number of incidents of unauthorised entry.
Responsible Party	Environmental Manager/Contractors

Table 54. Disposal of Waste.

Construction/Decommissioning phase	
Management Aspect	Waste Disposal
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ No disposal of /or burying of waste on site should be conducted. ✚ No waste should be burned on site. ✚ Empty bins weekly or more regularly (when required).
Proposed Monitoring	Record/Receipts for waste disposal; weekly inspections.
Performance Indicators	Evidence of littering /waste disposal on site; number of incidents of waste burning on site; disposal certificates on record; method statement.
Responsible Party	Environmental Manager/Contractors

Table 55. Disposal of Hazardous Waste

Construction/Decommissioning phase	
Management Aspect	Disposal of Hazardous Waste
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ No hazardous waste should be stored and handled (no disposal) at the Okuryangava landfill site. ✚ All hazardous waste should be safely contained, transported and disposed of at the designated Kupferberg hazardous waste disposal cell.
Proposed Monitoring	Visual inspection by ECO.
Performance Indicators	Record of disposal certificates.
Responsible Party	Environmental Manager/Contractors

11.3. Construction Phase: Waste Water Management

Table 56. Contamination of Surface Water

Construction/Decommissioning phase	
Management Aspect	Contamination of Surface Water
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Contamination of surface water might occur through oil leakages, hydrocarbon fuel, lubricants and grease from the earthmoving (heavy-duty) vehicles and equipment during the construction phase. ✚ Spillage control procedures must be in place according to relevant SANS standards or better. ✚ Prevent discharge of any pollutants, such as cements, concrete, lime, chemicals, and hydrocarbons into water courses. ✚ Direct run-off from areas with high risk of accidental releases of oil or hazardous materials (e.g. fuelling or fuel transfer locations, truck washing bays, concrete swills etc.) into containment basins or conservancy tanks and dispose of contaminated water at an approved site. ✚ Prevent illegal washing out of containers in water courses. ✚ Conditions of any reticulation systems (i.e. fuel, sewage, water etc) both existing and new will have to be checked regularly and repaired (if necessary) to prevent leakages. ✚ Proper environmental awareness and remedial response training of operators must be conducted on a regular basis.
Proposed Monitoring	Visual inspection by ECO; Weekly inspections.
Performance Indicators	Record of contaminated water in water courses; unauthorised activity in water courses.
Responsible Party	Environmental Manager/Contractors

Table 57. Leachate

Construction/Decommissioning phase	
Management Aspect	Leachate
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Collect samples from identified monitoring points monthly and preserve and analyse accordingly.
Proposed Monitoring	Monthly sampling.
Performance Indicators	Record of sample data.
Responsible Party	Environmental Manager/Contractors

11.4. Construction Phase: Dust Management

Table 58. Minimise Dust

Construction/Decommissioning phase	
Management Aspect	Minimise Dust
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure measures are in place to minimise dust generated by construction activities, to the satisfaction of the ECO. ✚ Avoid excavation, handling and transport of materials which may generate dust under high wind conditions or when a visible dust plume is present. ✚ Locate stockpiles of construction materials in sheltered areas where they are not exposed to erosive effects of the wind. Where erosion ✚ Use appropriate dust suppression measures when dust generation is unavoidable, e.g. dampening with water, particularly during prolonged periods of dry weather. Such measures may include the use of temporary stabilizing measures (e.g. chemical soil binders, chipping etc). ✚ Sweep roads at the site entrance and exit points regularly, to prevent the spread of mud by construction vehicles, which would later result in dust. ✚ Control dust on site roads through wet suppression.
Proposed Monitoring	Visual inspection by ECO; Weekly inspections, Records of complaints.
Performance Indicators	Record of complaints about dust; visible dust plumes, visible wind erosion.
Responsible Party	Environmental Manager/Contractors

Table 59. Monitoring

Construction/Decommissioning phase	
Management Aspect	Monitoring
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Monitoring dust levels during Construction Phase when dust levels are expected to peak to determine whether on-going dust management is required.
Proposed Monitoring	Regular monitoring.
Performance Indicators	Record of monitoring data.
Responsible Party	Project Manager/Contractors

11.5. Construction Phase: Noise Management

Table 60. Construction Equipment

Construction/Decommissioning phase	
Management Aspect	Construction Equipment
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Maintain construction equipment and vehicles in good working order to prevent unnecessary noise. Where noise levels are unacceptable, the Environmental Manager may recommend that noise reduction devices/mufflers be installed on particularly noisy equipment. ✚ Ensure proper design and maintenance of silencers on diesel-powered equipment.
Proposed Monitoring	Inspections by ECO; Weekly inspections; Records of noise complaints.
Performance Indicators	Record of noise complaints.
Responsible Party	Environmental Manager/Contractors

Table 61. Blasting

Construction/Decommissioning phase	
Management Aspect	Blasting
Proposed Mitigation Measures	✚ No unregulated blasting is permitted on site.
Proposed Monitoring	Records of noise complaints.
Performance Indicators	Evidence of scheduled blasting.
Responsible Party	Environmental Manager/Contractors

Table 62. General

Construction/Decommissioning phase	
Management Aspect	General
Proposed Mitigation Measures	✚ Comply with the Noise Regulations in terms of the Environmental Management Act (No 27 of 2007)
Proposed Monitoring	Records of noise complaints.
Performance Indicators	Number of noise complaints.
Responsible Party	Environmental Manager/Contractors

11.6. Construction Phase: Fire Management

Table 63. Fire-fighting Equipment

Construction/Decommissioning phase	
Management Aspect	Fire-fighting Equipment
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Ensure that sufficient fire-fighting equipment is available on site, to the satisfaction of the Local Fire Services and RE. Fire fighting equipment is to be suitably maintained. ✚ Ensure that all personnel on site are aware of the location of fire fighting equipment on the site and how the equipment is operated. Provide appropriate signage and relevant emergency contact details on site. ✚ Provide adequate fire-fighting equipment at fuel storage and dispensing areas.
Proposed Monitoring	Record of attendance register for training sessions; Visual inspections and approvals by ECO.
Performance Indicators	Certification letter from local fire services; Record of personnel acknowledgement register of signs; Signage in place; Fire-fighting equipment in place.
Responsible Party	Environmental Manager/Contractors

Table 64. Illegal Fires

Construction/Decommissioning phase	
Management Aspect	Illegal Fires
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ No fires are permitted on site except in areas designated by the Environmental Manager. Locate such designated areas as far as possible from vegetated areas, flammable material stores and any other high fire risk areas.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Number of uncontrolled fires.
Responsible Party	Environmental Manager/Contractors

Table 65. Smoking



Construction/Decommissioning phase	
Management Aspect	Smoking
Proposed Mitigation Measures	 Establish designated smoking area(s) on site. Smoking shall not be permitted in those areas that pose a fire hazard, such as fuel storage areas and areas where vegetation is such that a fire may spread rapidly e.g. vegetation stockpiles and open dry grass.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Smoking in designated areas
Responsible Party	Environmental Manager/Contractors

Table 66. Risk

Construction/Decommissioning phase	
Management Aspect	Risk
Proposed Mitigation Measures	 Develop fire safety measures to protect the site against fires originating from outside the site.
Proposed Monitoring	Reviewed and approved by ECO.
Performance Indicators	Fire safety measures
Responsible Party	Project Manager/Environmental Manager

11.7. Construction Phase: Construction Site Camp and Boundaries

Table 67. Construction Camp

Construction/Decommissioning phase	
Management Aspect	Construction Camp
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Establish suitably fenced construction camp at the start of the contract, which will allow for site offices, vehicle, equipment, material and waste storage areas to be consolidated as much as possible. ✚ Locate the construction camp within a disturbed area within the site boundaries or within areas otherwise approved by the Project Manager.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Number of disturbances outside designated construction area; Appropriate construction camp.
Responsible Party	Environmental Manager/Contractors

Table 68. Site Boundaries

Construction/Decommissioning phase	
Management Aspect	Construction Camp
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Demarcate the construction site boundaries upon site establishment. Limit all construction and related activities, including material and waste storage within the construction site boundaries or within areas otherwise approved by the Project Manager. ✚ Designate certain areas beyond the boundary of the site as a “No Go” area for all personnel on site. No vehicles, machinery, materials or people shall be permitted in the “No Go” area at any time without the express permission of the Project Manager. Designate all environmentally sensitive areas as “No Go” Areas. ✚ Ensure the site fencing is in working order. ✚ Inform construction personnel that the picking of grapes on neighbouring properties is strictly prohibited.
Proposed Monitoring	Visual inspections and approvals by ECO; Weekly inspections.
Performance Indicators	Number of disturbances outside designated construction area; Site boundary is well demarcated and fencing is in good condition.
Responsible Party	Environmental Manager/Contractors

Table 69. Laydown Areas

Construction/Decommissioning phase	
Management Aspect	Laydown Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Contractor to use the designated lay down areas during construction, thus minimising disturbance.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Number of disturbances outside designated area.
Responsible Party	Environmental Manager/Contractors

Table 70. Maintenance Area

Construction/Decommissioning phase	
Management Aspect	Maintenance Area
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Designate an area on site for the servicing of equipment and vehicles with an impermeable lining to contain any spillage during services, and to prevent soil contamination. ✚ Surface run-off from this area must be treated as contaminated water, and must be directed to a conservancy tank / containment basin for suitable disposal.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of spills.
Responsible Party	Environmental Manager/Contractors

Table 71. Break/Canteen Areas

Construction/Decommissioning phase	
Management Aspect	Break/Canteen Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Designate areas for personnel to eat during breaks within the site boundary.
Proposed Monitoring	Regular or weekly inspections.
Performance Indicators	Evidence of designated areas in place; Number of incidences of personnel not using designated areas.
Responsible Party	Environmental Manager/Contractors

Table 72. Ablution Facilities

Construction/Decommissioning phase	
Management Aspect	Ablution Facilities
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Provide suitable toilet facilities which are covered, closed, ventilated and should offer hand-washing facilities. 1 toilet per 20 workers should be provided. ✚ Toilets should be located within a radius of 50m for construction staff in areas of concentrated construction activities and within a radius of 200m elsewhere on site. If workers are not making use of the toilet facilities due to distance from work areas, additional toilets will need to be provided. ✚ Secure all temporary / portable toilets to the ground to the satisfaction of the ECO to prevent them toppling due to wind or any other cause. ✚ Maintain toilets in a hygienic state and remove waste to a licensed disposal facility. ✚ Ensure that no spillages occur when the toilets are cleaned or emptied. ✚ Prohibit urination on site, other than at designated facilities.
Proposed Monitoring	Visual inspections and approvals by ECO; Weekly inspections; Records of waste disposal.
Performance Indicators	Sufficient ratio of toilets; Number of incidents of personnel not using facilities; State of toilets; Evidence of overflow, leakages or spillages.
Responsible Party	Environmental Manager/Contractors

11.8. Construction Phase: Safety and Security

Table 73. Signage

Construction/Decommissioning phase	
Management Aspect	Signage
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Display telephone numbers of emergency services, including the local fire fighting service, in the Contractor's office and at the entrance to the site. Contact the emergency services in the area in the case of an emergency. ✚ Provide suitable emergency and safety signage on site (manufactured of durable, weatherproof material) displayed at prominent and conspicuous places along the fences and entry gates. Demarcate any areas which may pose a safety risk (including hazardous substances, deep excavations etc). These notices must be worded in the official languages applicable to the area.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Signage in place.
Responsible Party	Environmental Manager/Contractors

Table 74. Personal Protective Equipment (PPE)

Construction/Decommissioning phase	
Management Aspect	Personal Protective Equipment
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Enforce the use of appropriate Personal Protective Equipment (PPE) at all times.
Proposed Monitoring	Weekly inspections.
Performance Indicators	Evidence of personnel using construction machinery or equipment possessing appropriate PPE.
Responsible Party	Environmental Manager/Contractors

Table 75. Illegal Access

Construction/Decommissioning phase	
Management Aspect	Personal Protective Equipment
Proposed Mitigation Measures	🚧 Prevent illegal access to the site by implementing appropriate security measures. These security measures must not pose a threat to surrounding communities.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of appropriate measures in place.
Responsible Party	Environmental Manager/Contractors

11.9. Construction Phase: Site Clearing

Table 76. Topsoil Cover

Construction/Decommissioning phase	
Management Aspect	Topsoil Cover
Proposed Mitigation Measures	🚧 Remove topsoil and stockpile on site prior to excavation. Ensure stockpiles are located within the boundary of the site and are protected from erosion.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of proper stockpiling and management.
Responsible Party	Environmental Manager/Contractors

Table 77. Erosion

Construction/Decommissioning phase	
Management Aspect	Erosion
Proposed Mitigation Measures	🚧 Stabilise cleared areas as soon as possible to prevent and control surface erosion. The method of stabilization shall be determined in consultation with the Environmental Manager.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of surface erosion.
Responsible Party	Environmental Manager/Contractors

Table 78. Vegetation Clearing



Construction/Decommissioning phase	
Management Aspect	Vegetation Clearing
Proposed Mitigation Measures	<ul style="list-style-type: none">  Avoid clearing of vegetation until such time as soil stripping is required and exposed surfaces shall be stabilized as soon as is practically possible.  Limit clearing of vegetation to those areas within the footprint of construction, minimise open areas and reduce the frequency of disturbance.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of surface erosion; Number of disturbances outside designated.
Responsible Party	Environmental Manager/Contractors

Table 79. Fauna Management


Construction/Decommissioning phase	
Management Aspect	Fauna Management
Proposed Mitigation Measures	<ul style="list-style-type: none">  All fauna found on site must be relocated to a safe area without being harmed in any way.
Proposed Monitoring	Records of relocation.
Performance Indicators	Records and evidence of no animals harmed.
Responsible Party	Environmental Manager/Contractors

Table 80. Batching


Construction/Decommissioning phase	
Management Aspect	Batching
Proposed Mitigation Measures	<ul style="list-style-type: none">  Ensure small scale cement batching (if required) occurs within the project footprint.
Proposed Monitoring	Weekly Inspections
Performance Indicators	Records of batching outside designated area.
Responsible Party	Environmental Manager/Contractors

Table 81. Cleaning


Construction/Decommissioning phase	
Management Aspect	Cleaning
Proposed Mitigation Measures	 Clean cement truck delivery chutes at a designated area on the site, if it is essential that they are cleaned before leaving the site. The area designated for cleaning of delivery chutes is to be agreed on with the Environmental Manager and is to be suitably contained to prevent contamination of soil, and to allow for the containment of contaminated water.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of cleaning inside designated area.
Responsible Party	Environmental Manager/Contractors

Table 82. Contaminated Water


Construction/Decommissioning phase	
Management Aspect	Contaminated Water
Proposed Mitigation Measures	 Contain contaminated water from batching operations and allow sediments to settle before being disposed of as waste water.
Proposed Monitoring	Weekly Inspections.
Performance Indicators	Evidence of contamination of water and soil.
Responsible Party	Environmental Manager/Contractors

Table 83. Cement Bags


Construction/Decommissioning phase	
Management Aspect	Cement Bags
Proposed Mitigation Measures	 Place cement bags in bins and dispose of bags as waste to a licensed waste disposal facility.
Proposed Monitoring	Records of disposal.
Performance Indicators	Evidence of waste on site.
Responsible Party	Environmental Manager/Contractors

Table 84. Asphalt/Bitumen

Construction/Decommissioning phase	
Management Aspect	Asphalt/Bitumen
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Prevent over spray of bitumen products outside of the road surface.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Evidence of waste on site.
Responsible Party	Environmental Manager/Contractors

Table 85. Gravel/Pavers

Construction/Decommissioning phase	
Management Aspect	Gravel/Pavers
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Sweep / rake / stack excess stone chip / gravel / pavers into piles and dispose at a licensed waste disposal facility.
Proposed Monitoring	Records of disposal.
Performance Indicators	Evidence of waste on site.
Responsible Party	Environmental Manager/Contractors

Table 86. Local Labour

Construction/Decommissioning phase	
Management Aspect	Local Labour
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Give priority to the local population with employment opportunities, provided applicants have the necessary skills. ✚ Advertise employment opportunities adequately, so as not to limit application opportunities. ✚ Implement a transparent process of contracting staff, following pre-established and accepted criteria.
Proposed Monitoring	Internal audit; Evaluation of tenders.
Performance Indicators	Tender document requirements for local labour; Records of advertisements; Targets for local labour.
Responsible Party	Project Manager

11.10. Construction Phase: Heritage Resources

Table 87. Heritage Resources

Construction/Decommissioning phase	
Management Aspect	Heritage Resources
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Report all exposed heritage remains to the National Heritage Council of Namibia (NHC). Heritage remains uncovered must not be disturbed until approval has been obtained from HWC. ✚ Ensure that all Contractors and Sub-contractors are made aware of the potential existence of heritage resources, and instructed on the correct procedure for preserving the integrity thereof.
Proposed Monitoring	Record and document findings; Visual inspections of findings; Record of heritage resources awareness programme or session.
Performance Indicators	Records of correspondence, and appointment of archaeologist; Evidence that awareness session(s) is conducted.
Responsible Party	Project Manager

11.11. Construction Phase: Site Rehabilitation

Table 88. Exposed Areas

Construction/Decommissioning phase	
Management Aspect	Exposed Areas
Proposed Mitigation Measures	<ul style="list-style-type: none"> ✚ Reshape and stabilize all exposed areas and areas damaged by construction vehicles and personnel as soon as possible to prevent and control dust and erosion. ✚ Restrict traffic and general movement over stabilised areas.
Proposed Monitoring	Weekly Inspections of cleared areas; Final approval of site closure by ECO.
Performance Indicators	Evidence of erosion.
Responsible Party	Environmental Manager/Contractors

Table 89. Construction Equipment/Materials

Construction/Decommissioning phase	
Management Aspect	Construction Equipment/Materials
Proposed Mitigation Measures	✚ Remove all vehicles, equipment, waste and surplus materials, including site offices and other facilities for workers, from the site.
Proposed Monitoring	Visual inspections and approvals by ECO.
Performance Indicators	Completion of identified actions in site closure.
Responsible Party	Environmental Manager/Contractors

Table 90. Spillages

Construction/Decommissioning phase	
Management Aspect	Spillages
Proposed Mitigation Measures	✚ Clean up and remove any spills and contaminated soil on site.
Proposed Monitoring	Records of waste disposal.
Performance Indicators	Completion of identified actions in site closure.
Responsible Party	Environmental Manager/Contractors

Table 91. Checklist

Construction/Decommissioning phase	
Management Aspect	Checklist
Proposed Mitigation Measures	✚ Ensure the RE and ECO are satisfied with the site and that all actions identified in the site closure checklist have been completed.
Proposed Monitoring	Visual inspections and approvals by Environmental Manager and ECO.
Performance Indicators	Completion of identified actions in site closure.
Responsible Party	Environmental Manager/Contractors

12. CONCLUSIONS

All known environmental and social risks can be minimised and managed through implementing preventative measures and sound management systems.

If the above-mentioned management recommendations are properly implemented, it is anticipated that most of the adverse impacts on the environment can be mitigated. It is important that the City of Windhoek through its environmental structures continuously monitor and audit all activities during the construction and operational phases of the development, to ensure that the EMP is fully implemented and complied with. This EMP caters for all project phases, but will need to be reviewed during all phases of project, especially when revisions are made to the project development plans.

The Environmental Management Plan should be used as an on-site tool during all phases of the proposed project. Parties responsible for contravention of the EMP should be held responsible for any rehabilitation that may need to be undertaken. It is the Proponent's responsibility to initiate the update of the EMP once it has expired after 3 years from the issue date of the environmental clearance.

Mize Shippiki



M. Shippiki (B.Sc (Hon) Hydrogeology, UOVS)
Environmental Hydrogeologist
April 2015

13. REFERENCES

Murray, E.C. (2000) The feasibility of artificially recharging the Windhoek Aquifer. IGS. Bloemfontein, University of the Free State. Thesis and Appendices volume.

City of Windhoek. (2005) Groundwater Protection Regulations Final Draft.

Hasheela, R. (2009) Municipal Waste Management in Namibia. The Windhoek Case Study.

Kruseman, G.P. & Ridder, N.A. (200) Analysis and evaluation of pumping test data. Amsterdam, International Institute for Land Reclamation and Improvement (ILRI).

Mandelsohn J., Jarvis A., Roberts C. And Robertson T. (2003), Atlas of Namibia, Ministry of Environment and Tourism, David Phillip Publishers, South Africa.

Lapidus, D.F. & Winstanley, I. (1987) Dictionary of Geology. Oxford, HarperCollins.

NamWater. (1998) Guidelines for the evaluation of drinking water for human consumption with regard to chemical, physical and bacteriological quality. Windhoek.

Struckmeier, W.F., van Wyk, A.E. & Strub, H. (2001) Hydrogeological map of Namibia, 1:1000 000.