Comprehensive Environmental Management Plan (EMP) for the Operations and Management of the Existing Oxidation Ponds in Divundu, Kavango East Region

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Appendix A: Example of the Recommended Site Wall (as per Oshakati Town Council Site)

Appendix B: Archaeology Chance Finds Procedures (CFP)

LIST OF ABBREVIATIONS

Abbreviation	Meaning
DEAF	Department of Environmental Affairs and Forestry
DVC	Divundu Village Council
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EDS	Excel Dynamic Solutions
EIA	Environmental Impact Assessment
EHO	Environmental Health Officer
EMA	Environmental Management Act
EMP	Environmental Management Plan
HDPE	High Density Polyethylene i
MAWLR	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
PPE	Personal Protective Equipment
SHE Officer	Safety, Health & Environmental Officer
WHO	World Health Organization

1 INTRODUCTION

1.1 Project Background and Locality

The Divundu Village Council (hereinafter referred to as The Proponent or the *Village Council / Village*) operates five oxidation ponds of varying sizes and one eco-smart wastewater Treatment Plant (recycling waste management) to manage the sewage waste produced by its residents. The first pond is a receiver, which receives the sewage water from homesteads and offices. When it gets full, the water flows to the second pond. The first two ponds are lined with plastic, while the other three ponds have no linings. The depth and the sizes of the ponds are unknown.

Located to the western side of the Village, the ponds are managed by the Village Council and. The locality of the pond is shown on the map in Figure 1-1.

Following the Free Training of Environmental Health Officers (EHO) and representatives by Excel Dynamic Solutions (Pty) Ltd (EDS) from 12 local authorities in November 2021, EDS had requested the Village Council to share with EDS some of their existing facilities or planned projects that are listed activities in the Environmental Management Act (EMA) No. 7 of 2007 and its 2012 EIA Regulations requiring Environmental Clearance Certificates (ECCs). EDS then offered to assist the Divundu Village with one project of their choice (existing) to obtain an ECC at no cost to the Local Authority. Therefore, to ensure compliance with the environmental legal requirements, the Proponent chose the oxidation ponds, the Village's waste management facilities.

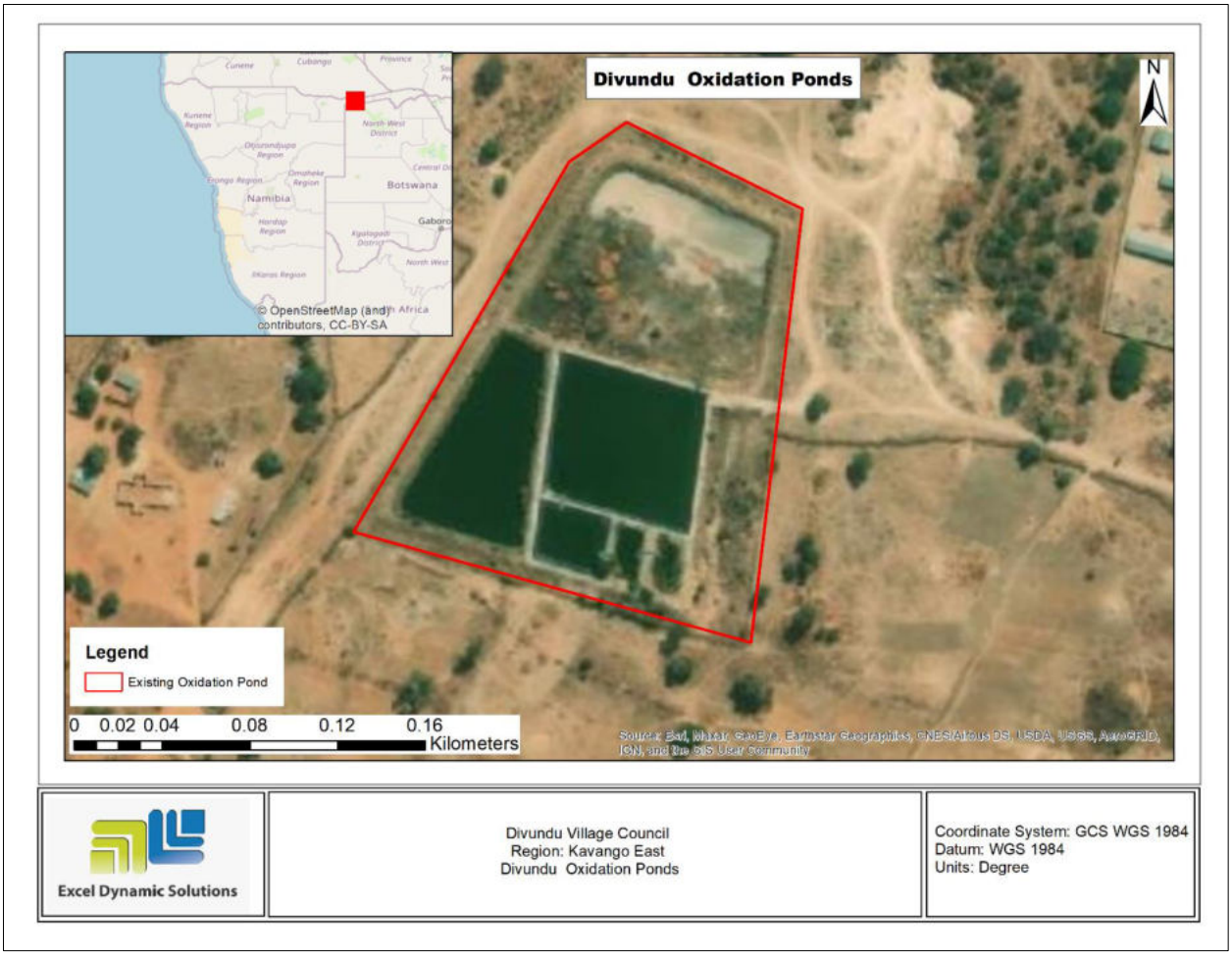

Figure 1-1: Locality map of the oxidation ponds in Divundu

1.2 The Need for Environmental Clearance Certificate (ECC)

The Environmental Management Act (Act No. 7 of 2007) (EMA) and its 2012 EIA Regulations lists activities that need an Environmental Clearance Certificate (ECC). Waste management facilities are one of the listed activities that requires an EIA study and or for existing facilities, an Environmental Management Plan (EMP) should be developed. The relevant listed activities to the Village's waste management site are as follows:

'*'WASTE MANAGEMENT, TREAMENT, HANDLING AND DISPOSAL ACTIVITIES*

- *Listed Activity 2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste.*
- *Listed Activity 8.6 The construction of industrial and domestic wastewater treatment plants and related pipeline systems*.

8. WATER RESOURCE DEVELOPMENTS

- *Listed Activity 8.6 The construction of industrial and domestic wastewater treatment plants and related pipeline systems."*

The ponds are currently not environmentally cleared as this could be explained by their establishment before the promulgation of the EMA and had not been cleared to date.

Subsequently, to ensure environmental management compliance of the ponds, the Village Council requires an Environmental Management Plan (EMP) developed and apply for the ponds' ECC. The application for an ECC and the EMP will be submitted by EDS to the MEFT for evaluation and consideration of the ECC.

1.3 The Need for Environmental Management & Closure Plan

Regulation 8(j) of the EIA Regulations (2012) requires that a draft Environmental Management Plan (EMP) shall be included as part of the Environmental Assessment (EA) scoping report (please note that since the site is already in operation, there was no EA conducted nor scoping report for it). A '**Management Plan**' is defined as:

> *"…a plan that describes how activities that may have significant environments effects on the environment are to be mitigated, controlled and monitored."*

It is important to note that an EMP is a statutory document and a person who contravenes the provisions of this EMP may face imprisonment and/or a fine. This EMP is a living document and can be amended to adapt to address project changes and/or environmental conditions and feedback from compliance monitoring.

The purpose of this document is, therefore, to guide environmental management throughout the site upgrading, operational (and maintenance) of the oxidation ponds, and closure phases:

- **Planning phase** - This is the stage during which the Proponent prepare all the administrative and technical requirements needed for the site upgrading. This planning will include the procurement of services such as site upgrading contractor.
- **Site upgrading phase -** This is the phase where during which the ponds' associated infrastructure are revamped through the appointed contractor(s). This will entail the

earthworks for the erection of the ponds' wall'/fencing and installation of additional and necessary services, infrastructures.

- **Continued (for the ponds) Operations, and Maintenance:** the Proponent will continue operating the oxidation ponds and maintain the site throughout the operational phase.
- **Closure (Decommissioning)** – This is the stage at which the Proponent will stop using the site for wastewater (effluent) management, leading to the decommissioning and closure of the facilities. However, this is unlikely that the site operations will cease as there will always be the needed for wastewater management in the Village.

This EMP has been prepared for the management of potential impacts associated with the site upgrading, operations and maintenance for the oxidation ponds. The Village Council will be required to operate the facility in accordance with the management measures provided in the EMP and adhere to the ECC conditions set by the Environmental Commissioner.

The description of the project activities is briefly provided under the next heading (Chapter 2).

2 THE DESCRIPTION OF PROJECT ACTIVITIES

This EMP was developed based on the site visit and assessment, consulted literature, information provided by the Proponent. The site visit was conducted by the EDS Consultant on the 07th of July 2022 - Figure 2-1.

Figure 2-1: An EDS Consultant at the oxidation ponds in Divundu on 07 July 2022

Once the ECC is issued, administrative and technical tasks completed, and the Village Council is ready, the site works, and associated activities will commence. There will be some earthworks to prepare the site for the site upgrade and installation necessary services infrastructure and structures required for the site to improve the oxidation ponds.

The activities currently undertaken onsite are presented under the following sections.

2.1 Existing Oxidation Ponds

The pond system consists of five (5) oxidation ponds of varying sizes. The first pond is a receiver, which receives the sewage water from homesteads and offices. When it gets full, the water flows to the second pond. The first two ponds are lined with plastic, while the other three ponds have no linings. The depth and the sizes of the ponds are unknown. The operation of the ponds is monitored twice a week. The Ponds site is fenced off with a gate that locks, but with mesh wire but there are visible signs of fence vandalism.

According to the Village Council, the ponds were established in before the promulgation of the Environmental Management Act in 2007 and its Regulations in 2012. The Oxidation Pond's establishment date was not known as the ponds were established under the Kavango Regional Council before Divundu was proclaimed a Village Council.

The remaining life span of the ponds is estimated to be about 10 years, as urbanization is on the rise in the village.

The current status of the ponds is shown in Figure 2-2.

Figure 2-2: The current status of the oxidation ponds in Divundu

The ponds currently do not have an Effluent Discharge permit. Therefore, it needs to be applied for from the Department of Water Affairs (DWA) of MAWLR.

2.2 Summary: Site Upgrading and Operational Phases

During the upgrading phase, earth works will be carried out in certain areas of the project site to install the necessary additional services infrastructure. The general site works will include soil excavation.

The Proponent, through the appointed contractor will construct a security boundary wall for upgrading period and better fence for operational phase. The wall will provide controlled access to the site.

Once operational, the wastewater will be better managed. The wastewater would be sourced from the existing sewage system of the Village, and where necessary, maintenance will be done by the appointed specialist/maintenance contractor.

2.3 Resources, Services and Infrastructure

The required resources and services are provided by the Village Council as presented below:

- Equipment and Vehicles: The vehicles to be involved in the site upgrade include small trucks and pickup trucks and other small to medium sized vehicles services and goods required onsite.
- Water supply: There is no requirement for freshwater supply. However, any future needs will be sourced from the Village Council water supply line by connecting the project site to the line.
- Power supply: The site currently does not use electricity. However, during the site upgrade, diesel powered machinery and equipment will be used. The Village is supplied with power from the existing NORED grid.
- Site accessibility: The ponds site is accessible from the Village by a single-track sandy road.
- Site Security: The site is fenced off with mesh wire with lockable gate to control access to site as shown in Figure 2-3. A 24-hour site security will be considered to protect the site and equipment (properties) from possible theft and vandalism.

Figure 2-3: The gate at the oxidation ponds' site in Divundu

- Health and Safety: There are no onsite personnel, but this will be improved as part of the site upgrading works. The site personnel will be equipped with appropriate protective gear, i.e., Personal Protective Equipment (PPE). A first aid kit will also be availed onsite and administering training provided to the personnel.
- Potential Accidental Fire Outbreaks: There is currently no fire extinguishers onsite. However, as part of the site upgrading, at least one fire extinguisher will be availed onsite and basic firefighting and response training provided to site personnel.
- Solid waste: The site will be equipped with waste bins for domestic waste for site personnel and visitors. The waste will be disposed of at the Village' solid waste site.
- Hazardous waste: all the fuels and lubricants produced onsite during site upgrading will be properly handled and stored in containers for disposal at the nearest hazardous waste management facility.
- Human waste (sewage): the site currently has no ablution facilities (toilets and washroom), therefore, these will be considered for implementation as part of the site upgrade.

2.4 Challenges faced by the Divundu Village Council

The following challenges are faced by the Village Council in terms of the current wastewater (effluent) management at the ponds:

- Distance from nearby houses: The ponds were probably constructed away from houses, back in the days, but due to human growth, Village expansion and shortage of land, people

started occupying empty land until they built very close to the ponds (beyond the approved 500m distance between residence and sewage facilities.

- Odour: there is an issue of odour from the ponds by the communities.
- Lack of Services: There is a need to put or connect electricity with street lights at the site.
- Monitoring: There is a need to drill monitoring holes for monitoring potential leakage from the ponds, to ascertain soil and groundwater contamination. This is because the village is near the Kavango River, and groundwater table is said to be near the surface, and the site overlie porous aquifers.
- Vandalism: the ponds' fence is visibly vandalized at the gate and at the fence corners. It is suspected that some community members cut the fence to gain access to commit criminal activities like slaughtering stolen livestock (goats) inside the ponds' fence. During cultivation time (rainy season), people cut the site fence to keep their animals within the fence for grazing.
- Fire incidents: In the past, there was a fire incident that burned the plastic lining and sewage pipes that are above the ground. This caused some leakages that might have led to possible groundwater and soil contamination.
- There is no Effluent / Wastewater discharge permit. The permit has not been renewed yet.

The summary of legal requirements that govern the project activities are provided under the next chapter.

3 LEGAL FRAMEWORK: APPROVALS, LICENSES AND OR PERMITS

The project and its associated activities are governed by certain legislative and legal requirements that are necessary to consider and outlined herein. This is done in terms of institutional (local) and national perspective. Therefore, the summary of these relevant legal requirements and these that require permitting and licensing for certain project activities are presented under Table 3-1.

Table 3-1: The legal requirements and permits and licenses applicable to the project activities

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Environmental Management Act EMA (No 7 of 2007): Regulated under the Ministry of Environment, Forestry and Tourism (MEFT) Environmental Impact Assessment (EIA) Regulations Government Notice 28-30 (Government Gazette 4878) of February 2012: Regulated under the MEFT	The Act and its 2012 EIA Regulations aims to ensure that the potential impacts of the development on the environment are carefully considered. The Act aims at promoting sustainable management of the environment and use of natural resources. The Environmental Management Act (EMA) is broad; it regulates land use development through environmental clearance certification and/or Environmental Impact Assessments. For new projects, the Act requires that projects with significant environmental impacts are subject to an environmental assessment process (Section 27). Regardless to the site, mitigation measures should be developed for implementation during operations.	The EMA should inform and guide this EMP development and its implementation for: -ECC Amendment/Transfer and Renewal: Should the Proponent consider amending/Transferring the Project activities - The ECC needs to be renewed every 3 years (at least 3 months prior to its expiry date). The applications as deem necessary should be made with the Department of Environmental Affairs and Forestry (DEAF) as follows: **Office of the Environmental Commissioner:** **Mr. Timoteus Mufeti** **Tel: 061 284 2701**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
	Details requirements for public consultation within a given environmental assessment process (Government Notice No. 30 Section 21). The details the requirements for what should be included in an Environmental Scoping Report (Government Notice No. 30 S8) and an EIA Report (Government Notice No. 30 Section 15).	Part of the Project is already in its operational phase. However, if necessary and required, constant consultations and engagements with the interested and affected parties (stakeholders) should be continued. In case of grievances raised by some members of the public, this should be addressed and resolved amicably.
Water Act 54 of 1956: Regulated under the Ministry of Agriculture, Water and Land Reform	The Water Resources Management Act 11 of 2013 is presently without regulations; therefore, the Water Act No 54 of 1956 is still in force: -Prohibits the pollution of water and implements the principle that a person disposing of effluent or waste has a duly of care to prevent pollution (S3 (k)). -Provides for control and protection of groundwater (S66 (1), (d (ii)). -Liability of clean-up costs after closure/abandonment of an activity (S3 (l)).	The protection (both quality and quantity/abstraction) of water resources should be a priority. The Village Council should apply for the permit to discharge treated effluent into the environment. **Mr. Franciskus Witbooi (Deputy Director: Water Policy and Water Law Administration.** **Tel: (061) 208 715**
Water Resources Management Act (No 11 of 2013): Regulated under the Ministry of Agriculture, Water and Land Reform	Ensure that the water resources of Namibia are managed, developed, used, conserved and protected in a manner consistent with, or conducive to, the fundamental principles set out in Section 66 - protection of aquifers, Subsection 1 (d) (iii) provide for preventing the contamination of the aquifer and water pollution control (Section 68). The Proponent will be required to apply for the Treated Wastewater/effluent Discharge Permit from the Department of Water Affairs (DWA): Directorate of Water Resources Management (Water Environment Division). When issued, Proponent, the Permit should be renewed as required (as stipulated in therein).	**Ms. Elise Mbandeka (Chief Hydrologist): Water Environment**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Pollution Control and Waste Management Bill: Regulated under the MEFT	The bill aims to "prevent and regulate the discharge of pollutants to the air, water and land" Of particular reference to the Project is: Section 21 "(1) Subject to sub-section (4) and section 22, no person shall cause or permit the discharge of pollutants or waste into any water or watercourse." Section 55 "(1) No person may produce, collect, transport, sort, recover, treat, store, dispose of or otherwise manage waste in a manner that results in or creates a significant risk of harm to human health or the environment."	The Proponent and their workers/contractors should continue with the good waste management work (directly or indirectly) to ensure that the waste does not cause environmental threat and degradation. **No permit or license required.**
Soil Conservation Act (No 76 of 1969): Regulated under the Ministry of Agriculture, Water and Land Reform (MAWLR)	The Act makes provision for the prevention and control of soil erosion and the protection, improvement and conservation of soil, vegetation and water supply sources and resources, through directives declared by the Minister.	Duty of care must be applied to soil conservation and management measures must be included in the EMP. This is mainly aimed at soil disturbance through unnecessary creation of new tracks and pollution from project related activities.
The National Heritage Act (No. 27 of 2004): Regulated under the Ministry of Education, Arts and Culture through National Heritage Council (NHC) of Namibia The National Monuments Act (No. 28 of 1969): Regulated under the NHC	To provide for the protection and conservation of places and objects of heritage significance and the registration of such places and objects; to establish an NHC; to establish a National Heritage Register; and to provide for incidental matters. This impact is likely during site preparation for the site upgrade when there is a potential of inadvertent unearthing and damage of heritage resources such as old and unmarked graves, for instance. The Act extends the protection of archaeological and historical sites to private and communal land and defines permit procedures regarding activities at such sites.	Should heritage resources (e.g., artefacts, human remains/bones in the subsurface etc.) are discovered at some point on and /or around the site, these should be reported to the National Heritage Council of Namibia for relocation. **Contact: Mrs. Erica Ndalikokule (Director)** **Or Ms. Agnes Shiningayamwe (Regional Heritage Officer)** **Tel: 061 301 903**

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Public Health Act (No. 36 of 1919): Regulated under the Ministry of Health and Social Services	Section 119 states that "no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health."	The Proponent and all its employees should ensure compliance with the provisions of these legal instruments. This includes the provision of health and safety measures, wearing of Personal Protective Equipment (PPE), Health & Safety Trainings, etc. This includes the safety and health of the Village's community. **No permit or license required.**
Health and Safety Regulations GN 156/1997 (Government Gazette 1617): Regulated under the Ministry of Health and Social Services	Details various requirements regarding health and safety of labourers.	
Public and Environmental Health Act No. 1 of 2015: Regulated under the Ministry of Health and Social Services	To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.	
Road Traffic and Transport Act, No. 22 of 1999: Regulated under the Ministry of Works and Transport (Roads Authority of Namibia)	The Act provides for the establishment of the Transportation Commission of Namibia; for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, the control and regulation of road transport across Namibia's borders; and for matters incidental thereto.	The Proponent should consider applying for a formal access road permit to the site. This permit is to be applied from Roads Authority. **Contact: Mr Eugene de Paauw (Roads Authority – Specialist Road Legislation)** **Tel.: 061 284 7027**
Atmospheric Pollution Prevention Ordinance (1976): Regulated under the Ministry of Health and Social Services	This ordinance provides for the prevention of air pollution and is affected by the Health Act 21 of 1988. Under this ordinance, the entire area of Namibia, apart from East Caprivi, is proclaimed as a controlled area for the purposes of section 4(1) (a) of the ordinance.	The project and related activities should be undertaken in such a way that they do not pollute or compromise the surrounding air quality.

Legislation/Policy/ Guideline	Relevant Provisions	Implications for this Project
Hazardous Substance Ordinance, No. 14 of 1974: Regulated under the Ministry of Health and Social Services	The ordinance provides for the control of toxic substances. It covers manufacture, sale, use, disposal and dumping as well as import and export. Although the environmental aspects are not explicitly stated, the ordinance provides for the importing, storage, and handling.	The Proponent should handle and manage the storage and use of hazardous substances on site so that they do not harm or compromise the site environment
Local Authorities Act No. 23 of 1992: Regulated under the Ministry of Urban and Rural Development	To provide for the determination, for purposes of local government, of local authority councils; the establishment of such local authority councils; and to define the powers, duties and functions of local authority councils; and to provide for incidental matters. This includes the management of waste.	Divundu Village Council is the responsible Local Authority of the area, and the project Proponent. Regardless, they should ensure that the Site activities follow the Act and its Regulations, as relevant to the project.
Labour Act (No. 6 of 1992): Regulated under the Ministry of Labour, Industrial Relations and Employment Creation (MLIREC)	MLIERC is aimed at ensuring harmonious labour relations through promoting social justice, occupational health and safety and enhanced labour market services for the benefit of all Namibians. This ministry ensures effective implementation of the Labour Act No. 6 of 1992, specifically its Regulations, No. 156 Labour Act, 1992: Regulations relating to the health and safety of employees at work	The Proponent should ensure that the site upgrade, operations, and maintenance works, do not compromise the safety and welfare of workers. **No permit or license required.**

The project site is located in a specific biophysical and social environment. Understanding the existing environment would aid in identifying the sensitive or potentially affected features and how these can be protected from the site operations and implementation of mitigation or management measures. Therefore, the relevant features of this environment are presented under the next chapter.

4 ENVIRONMENTAL BASELINE: BIOPHYSICAL AND SOCIAL

The baseline current) environmental conditions of the site and surroundings are presented under the subheadings below. The information has been sourced from consulted literature (relevant books, reports, and websites) and observations made onsite by EDS Consultants in July 2022.

4.1 Climatic Conditions

Kavango East Region receives an annual average rainfall varies between 450 and 600 mm, with a clear increasing trend from south to north. Rains fall almost entirely in summer, with the months from May to September usually being dry, and the first early rains coming to the region in October and November. Highest rainfalls usually occur in January and February. The Region is usually warm to hot with average maximum temperatures above 30°C for nine months of the year, and average minimums are below 10 °C during the coolest months June, July and August. Temperatures below freezing are occasionally recorded but are rare and are usually only experienced in low-lying valleys such as found along the Kavango River and drainage lines (Omurambas) (Stubenrauch *et al*., 2015).

From a local perspective, Divundu area has annual temperature of more than 22°C, minimum temperatures ranging between 4 and 6°C and maximum temperatures varying from 32 to 36°C. The average annual rainfall in the ranges of 500 to 600mm and humidity ranging between 10 and 20% (Mendelsohn et al., 2002).

4.2 Landscape and Topography

The landscape of Divundu and surroundings is characterized by the Kalahari sediments, hence Kalahari Sandveld (Mendelsohn et al., 2002). This landscape is found in much of the northern and eastern Namibia dominated by Savanna woodlands growing on sands deposited by wind over the last 70-63 million years ago. The landscape is particularly flat, although the sands have been molded into dunes in some areas. Altitudes are highest in the central and western areas, from where the whole landscape slopes gently down to lower ground in the east and south.

4.2.1 Wind Direction and Speed

The predominant wind in the project area is Northeast (NE) as per Meteoblue (2022) - Figure 4-1 (top photo). The area is dominated by wind speed of more than 12 and 19 kilometers per hour occurring throughout the year. Strong winds (with a speed greater than 28km/h) occur in September and October as shown in the chart (Figure 4-1 – bottom photo).

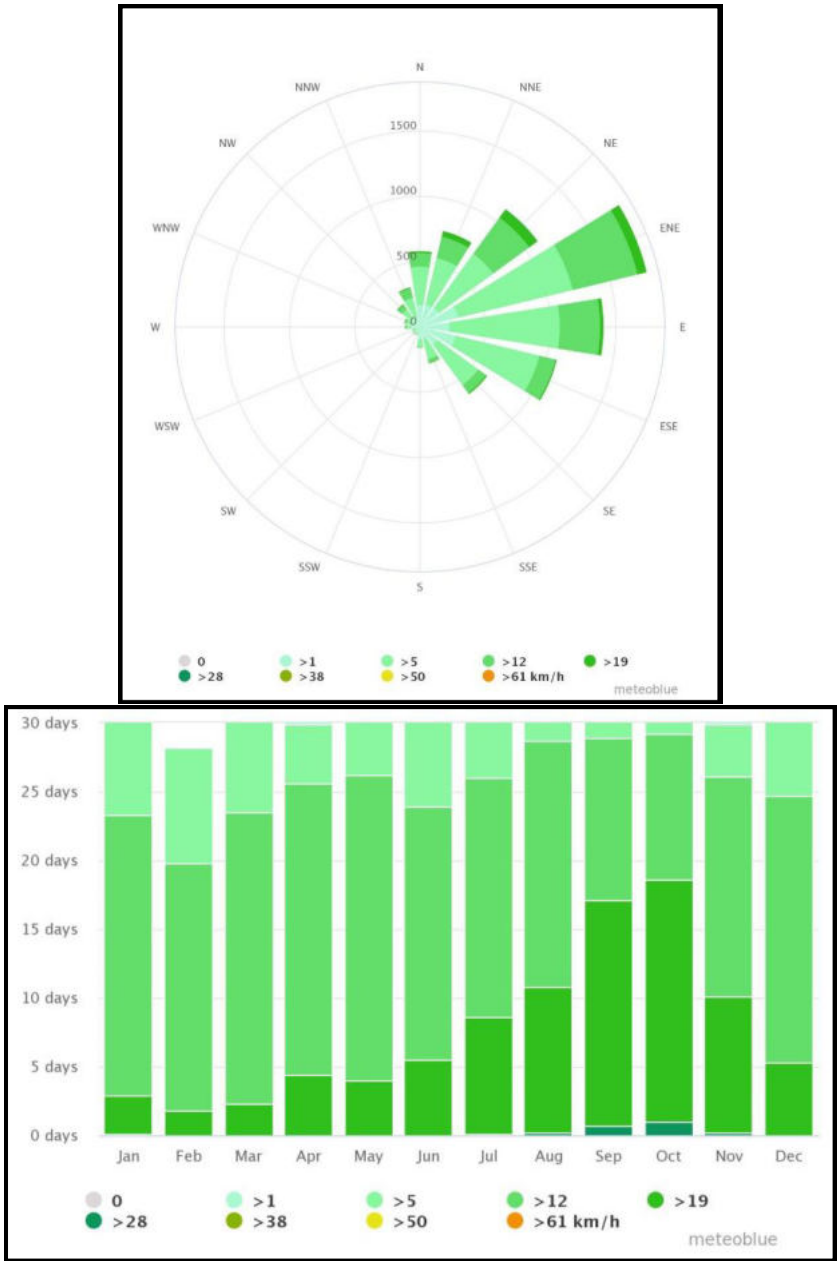

Figure 4-1: The modelled wind speed and chart for Divundu (Meteoblue, 2022)

4.3 Geology and Soils

The Okavango Basin is part of the greater Kalahari Basin, which covers most of the northern and eastern parts of Namibia and extends across the Namibian border into Botswana and Angola. The bedrock underlying the basin filled with Kalahari Sequence deposits consisting of basal rocks of the Damara Sequence, followed by the Karoo Sequence sediments, overlain and intruded by volcanics of Karoo age. The unconsolidated to semi- consolidated clay, sand and gravel of the Kalahari Sequence fill the Okavango Sub-basin, which thickens from the northeast towards the northwest, from 0 to >400 m along the north-west trending basin axis (Bittner, 2002).

The geology of Divundu area is characterized by the Kalahari sands (Mendelsohn et al., 2002) on the surface. The bedrock underlying the project site and the surrounding area comprises of quartzite, conglomerate, schist and marble as shown on the geological map in Figure 4-2 below.

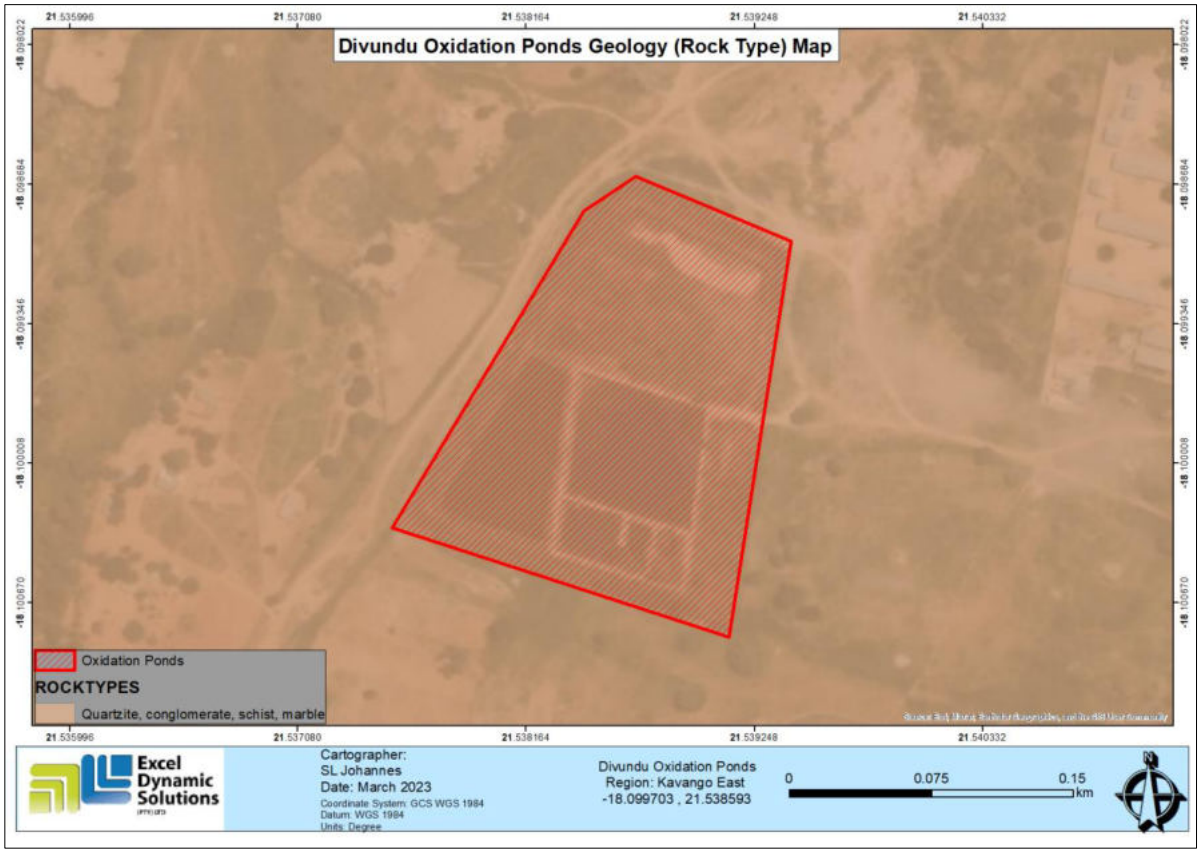

Figure 4-2: The geology of the site

The project site and its surrounding are overlain by eutric fluvisols as shown in Figure 4-3. According to Mendelsohn *et al.,* (2002), eutric are fertile oils with high base saturation, and fluvisols are soils found along the margins and valleys of larger river courses in eastern Namibia.

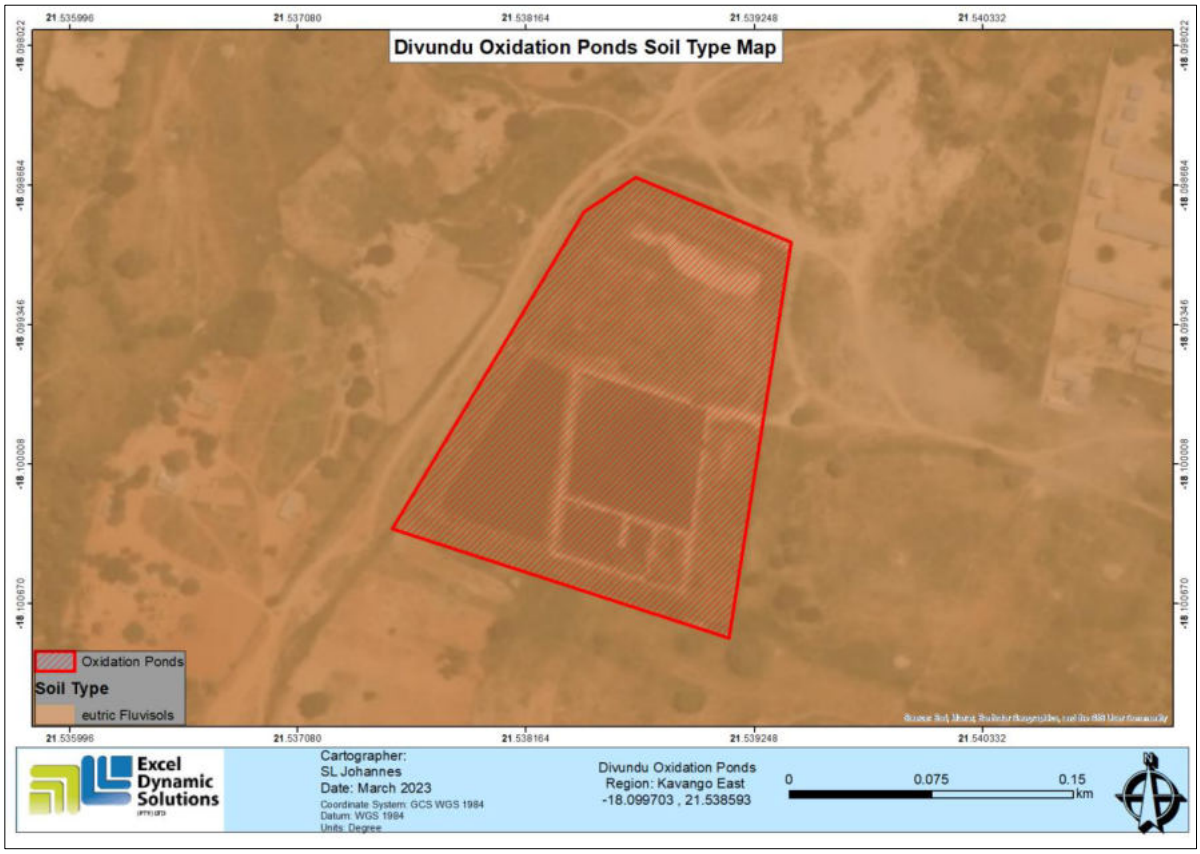

Figure 4-3: The dominant soil on and around the site

4.4 Hydrology and Hydrogeology

According to the hydrogeological map of Namibia (Christelis and Struckmeier, 2011), the regional groundwater potential is moderate. Groundwater within the wider area of the Kavango Regions (Kavango East and West), is hosted in two distinct aquifer systems, Kalahari aquifers and fractured bedrock aquifers. These two aquifers are treated separately in this study as they have different characteristics. Kalahari aquifers hold water in intergranular pore spaces, whereas water in fractured aquifers is held in cracks and fractures in otherwise impermeable strata. Kalahari aquifers are common in the Kavango Regions (Christelis and Struckmeier, 2011).

The Kalahari Sequence sediments constitute the most important aquifers in the region and the vast majority of boreholes drilled for rural and bulk water supply intersect the Kalahari aquifers.

Boreholes drilled in close proximity to the Okavango River, intersecting paleo-channels, are often high yielding and most of the bulk water schemes are developed along the River.

Groundwater on the project site area is hosted in porous aquifers with the western-northern-eastern trend areas underlain by rock bodies with little groundwater potential as shown in Figure 4-4.

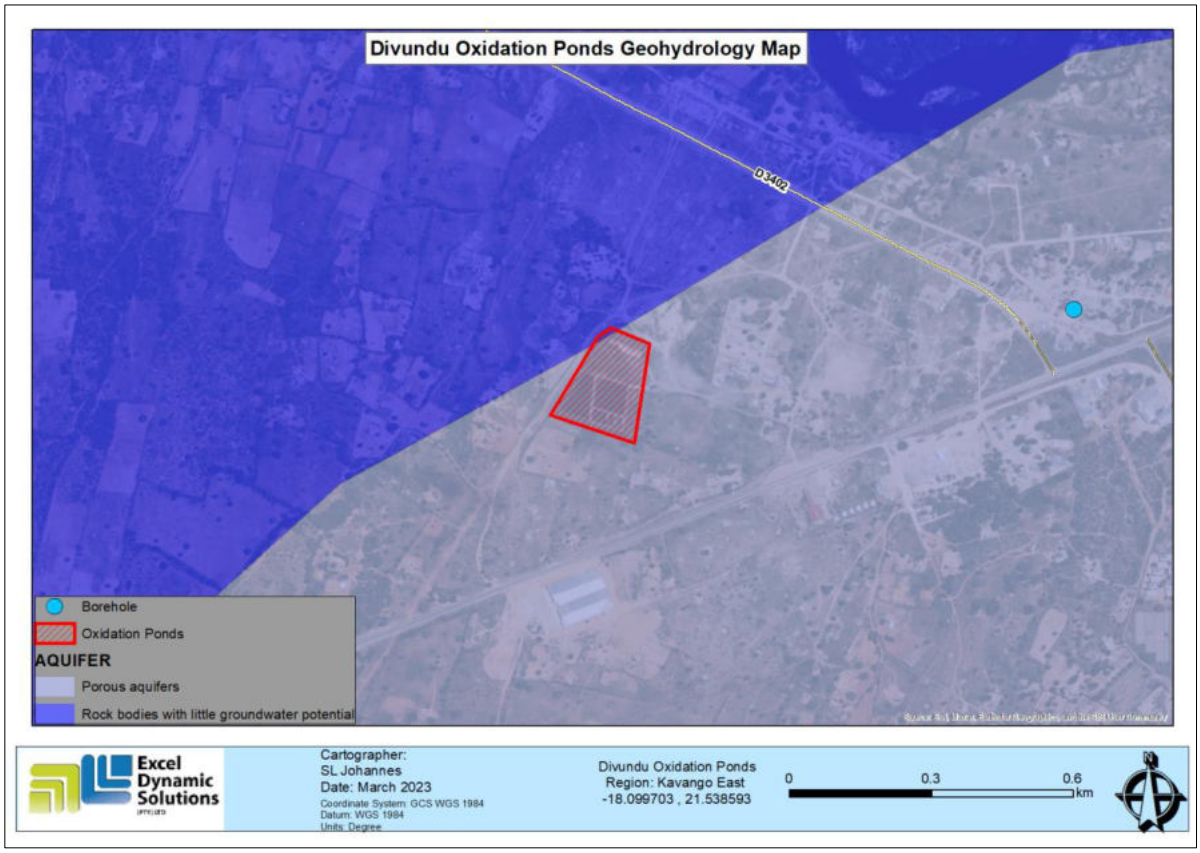

Figure 4-4: The geohydrology map of the site and surroundings

It is important to note that groundwater vulnerability does not equate pollution, but a possibility of groundwater being exposed to something (pollution), its level and significance when and if it occurs.

In semi-arid rural areas, like in the Kavango Regions, where extensive agriculture is practised and with little industrial development taking place, groundwater pollution is a minor threat. However, with the increasing number of economic developments along the Okavango River, the aspects of groundwater pollution and groundwater protection have increasingly become an issue.

The porous Kalahari aquifers (aeolian and alluvial sediments) in the area could provide a ready passage for the flow of pollutants from the ground surface to the water table (groundwater). Other areas of great concern are areas with a shallow water table (along the Okavango River), where wastewater (sewage) can easily percolate into the aquifer.

According to the Groundwater Vulnerability Map of the Site area in Figure 4-5, the vulnerability of groundwater to pollution is moderate (the area enclosed by the red ellipse). The vulnerability of groundwater to pollution in the project area could be explained by the presence of unconsolidated sediments and possibly fractures/faulted bedrocks. These types of formations could provide ready pathways for pollution transport (fast spreading of polluted water) if any pollution escape from the site surface and into the ground mainly the operational phase, if there is a mishandling and storage of wastewater.

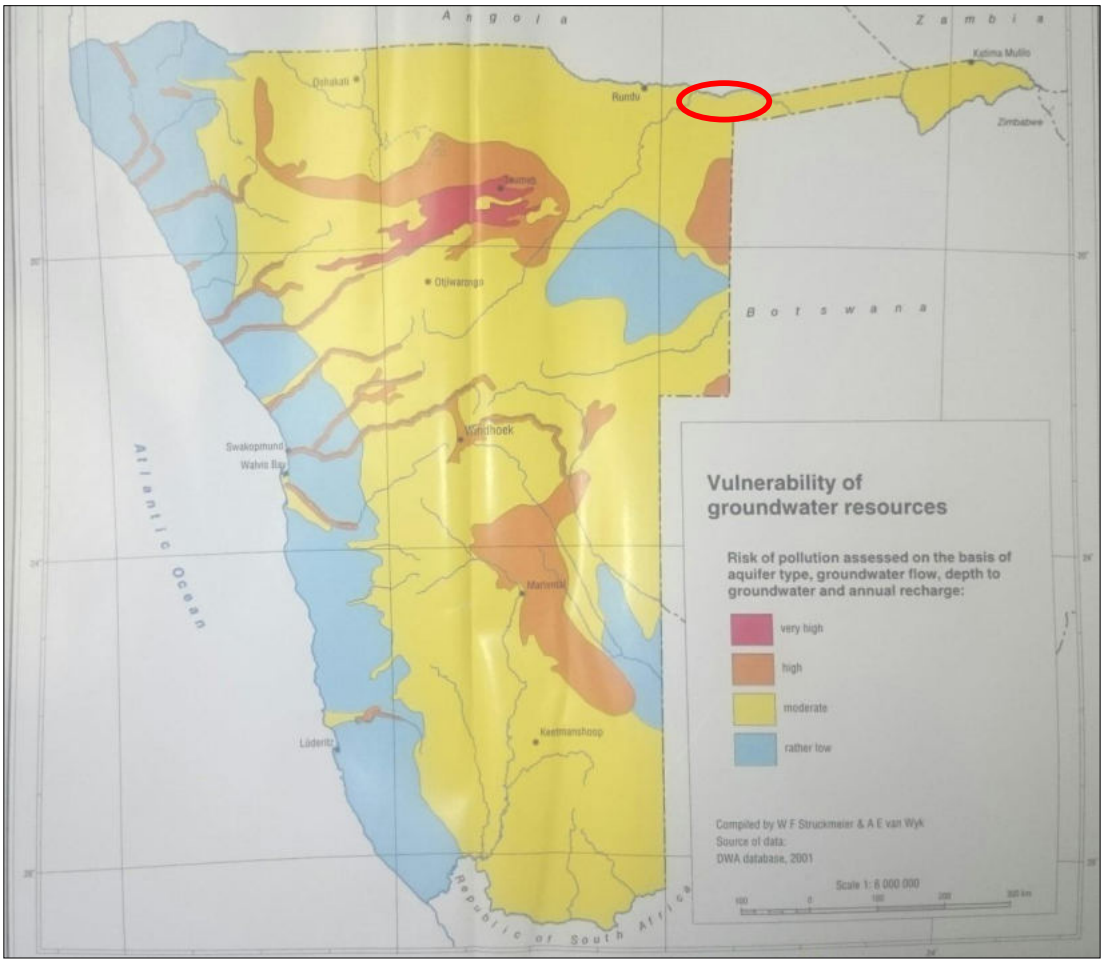

Figure 4-5: Vulnerability of groundwater resources to Pollution on and around the site

4.5 Fauna

Livestock: given the fact that Divundu is in a rural and communal set up, there are domestic animals on and around the project site. The observed and known animals along the roads, and in proximity of the site were some local goats (Figure 4-6).

Figure 4-6: One of the local goats spotted at the oxidation ponds during site visit

In terms of wildlife, there were no observed wildlife on and around the project site. However, according to Village Council personnel, there used to be some crocodiles found in the oxidation ponds.

4.6 Flora

The project site vegetation comprises of grass, shrubs and trees. The dominant vegetation types on, around the site and in the broader area are *Baikiaea plurijuga, Terminalia spp, Combretum spp, Burkea africana, Pterocarpus angolensis, Lonchocarpus spp,* etc. The dominant vegetation map of the site area (project site) is shown in Figure 4-7 and shows that the vegetation structure of Divundu area is characterized by dense shrubland.

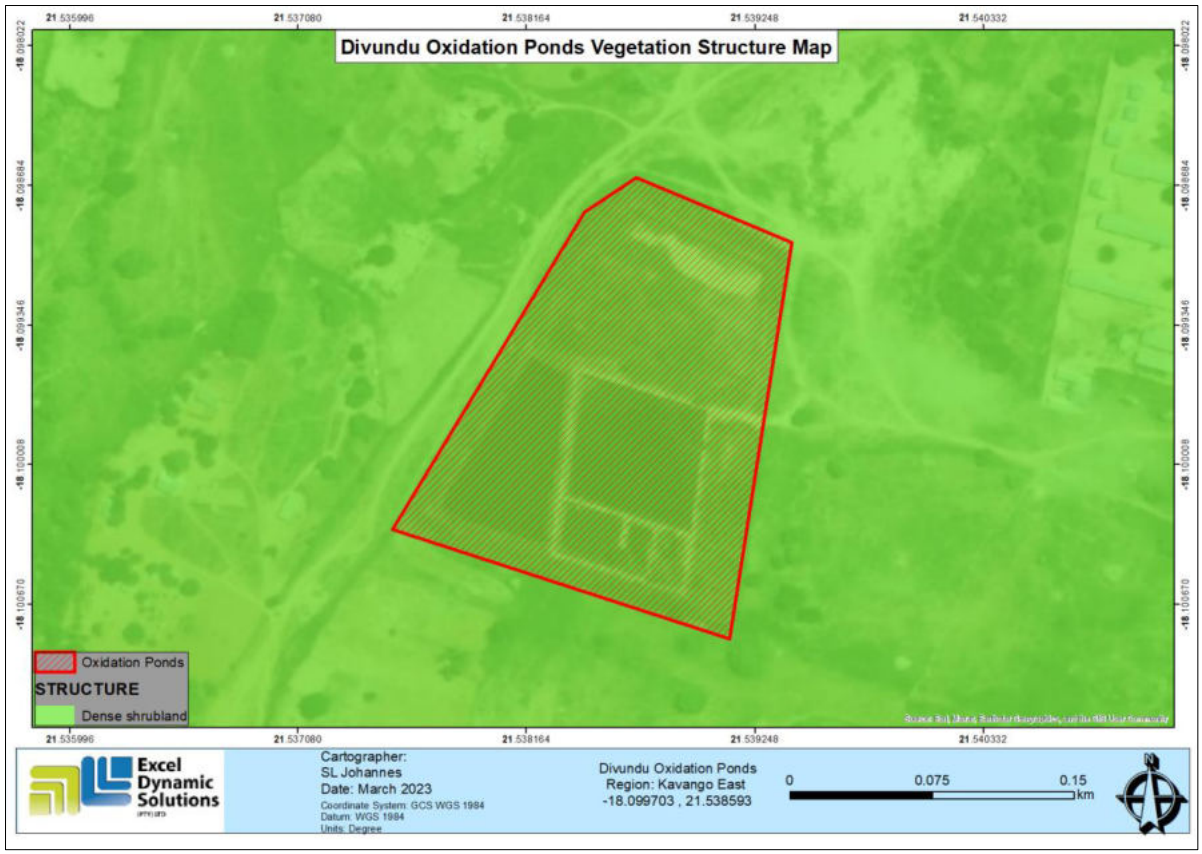

Figure 4-7: The vegetation map of the project site

Photos of some of the vegetation observed onsite are shown in Figure 4-8. These vegetation include mainly grass, bitterbrush (*Pechuel-Loeschea leubuitziae*), young and older trees of *Acacia (Vachellia) reficiens (*red-thorn / bark thorn tree).

Figure 4-8: The vegetation (acacia trees in the background, bitterbrush along the site fence with other small vegetation) observed on and around the site

4.7 Social and Economy

4.7.1 Demography

Divundu area falls under Kavango East Region, which in 2011 was part of the initial Kavango Region (before split in Kavango East and West). According to the 2011 Namibia Population and Housing Census, the Kavango Region had a population of 176,674 (96,559 females and 80,115 males) with a population density of 20.4 people per square kilometer (Namibia Statistics Agency (NSA), 2014). The site falls within Mukwe Constituency which at the time had a population of population of 36,846 (19,744 females and 17,102 males).

4.7.2 Economic Activities

The main sources of household income for Mukwe Constituency's by 20211 was farming contributing 12%, wages & salaries 44%, cash remittance 4%, business (non-farming) amounting to 20% and pension at 16% (NSA, 2014).

4.7.3 Surrounding Land Uses

The site is bordered to the immediate west and north by homesteads in a radius of about 50m (this disqualifies the ponds' location in accordance with the Wastewater Regulation of not less than 500m from residence). The new shopping mall is located south of the ponds at a distance of about 100m. To the east side, there is a proposed Village Extension with some open areas where residents are taught how to drive (driving school spot).

4.7.4 Services and Infrastructure

Divundu is well-equipped with services and infrastructure, and some of the services and infrastructure are summarized below:

- Water and power supply: The Village gets its water supply from boreholes operated by NamWater through a bulk water supply scheme. Electricity is provided by northern regional electricity distributor (NORED)'s power grid.
- Roads: The Village is connected to towns such as Rundu by the B8. There are gravel and single-track roads that provide access within the Villages and connecting Divundu to the surroundings.
- Health Care and education: there is a health centre in Divundu. There are also primary and secondary education facilities (schools) in the Village.

4.7.5 Waste Management

A. Garbage and waste disposal

The most common means of disposing of garbage in the Kavango East Region was through burning (65.8%). followed by dumping in rubbish pits (12.1%) and roadside dumping (11.8%).

Regular waste collection accounted for only 7.3% of waste disposal. About 20.5% of urban households benefitted from regular waste collection. Close to 80% of rural households burned their waste/garbage. Regular waste collection in rural areas was only available to about 1.5% of households.

At the constituency level, all constituencies depended on burning as a means of disposing of their waste /garbage. The percentages of solid waste disposal in the Region and at a constituency level is shown is shown in Table 4-1.

Table 4-1: Percent distribution of households by means of waste/garbage disposal and area (NSA, 2014)

Area	Households	Regularly Collected	Irregularly Collected	Burning	Roadside Dumping	Rubbish Pit	Others
Kavango	36 741	7.3	1.9	65.8	11.8	12.1	1.0
Urban	11 223	20.5	3.0	36.9	13.6	24.9	1.1
Rural	25 518	1.5	1.5	78.6	11.0	6.5	1.0
Kahenge	4 877	0.9	2.0	79.4	9.6	5.5	2.6
Kapako	4 193	2.1	1.4	75.3	12.8	7.9	0.4
Mashare	2 542	1.6	0.2	72.9	18.2	7.0	0.2
Mpungu	3 173	2.2	3.0	70.2	16.6	7.3	0.7
Mukwe	4 511	3.3	1.8	83.8	4.6	5.5	1.1
Ndiyona	3 436	0.8	1.7	86.9	4.5	5.6	0.5
Rundu Rural West	6 487	9.7	2.4	49.8	13.8	24.1	0.3
Rundu Urban	3 860	41.7	3.3	20.7	16.6	14.9	2.8
Rundu Rural East	3 662	1.3	1.1	62.3	11.9	23.4	0.1

B. Sewage Management

With respect to the type of the main toilet facility, about 74.7% of the households in the Region had no toilet facilities and only 7.5% had access to flush toilets.

According to NSA (2014), various types of flush toilets were common in urban areas and were used by about 30% of households, while more than 85% of households in rural areas did not have any toilet facilities. However, almost half of urban households in the region also did not have toilet facilities. About 7% of households used pit latrines with a slightly higher share in urban than rural households. The bucket system was also common in both the urban and rural area (1.9%).

The percentage of toilet facilities in the Mukwe Constituency and the broader Kavango East Region are shown in Table 4-2.

Table 4-2: Percent distribution of households by type of main toilet facility and area (NSA, 2014)

Area	Households	Private & shared Flush Connected to Sewer	Private & shared Flush Connected to Septic/Cesspool	Pit Latrine with Ventilation Pipe	Covered Pit Latrine without Ventilation Pipe	Uncovered Pit Latrine without Ventilation Pipe	Bucket Toilet	No Toilet Facility	Others
Kavango	36 741	10.2	1.5	5.0	3.0	3.1	1.9	74.7	0.5
Urban	11 223	27.0	3.0	7.0	6.5	7.0	1.9	47.0	0.6
Rural	25 518	2.8	0.9	4.2	1.5	1.3	1.9	86.9	0.5
Kahenge	4 877	2.3	0.7	3.3	1.3	1.4	2.3	88.0	0.7
Kapako	4 193	1.3	0.7	2.8	1.2	0.8	1.7	91.4	0.2
Mashare	2 542	2.6	2.0	4.8	0.8	0.6	0.7	87.5	1.0
Mpungu	3 173	5.0	1.0	4.2	1.4	1.4	1.9	84.4	0.6
Mukwe	4 511	4.8	0.6	3.3	1.2	0.5	2.4	86.9	0.4
Ndiyona	3 436	4.1	0.9	5.9	2.5	4.2	2.0	80.1	0.3
Rundu Rural West	6 487	14.4	2.7	4.6	3.3	4.6	2.3	67.4	0.8
Rundu Urban	3 860	51.5	2.5	9.3	8.8	8.3	1.7	17.6	0.3
Rundu Rural East	3 662	2.6	2.4	8.2	6.3	5.1	1.2	73.5	0.8

4.7.6 Archaeology and Heritage Resources

Like many Namibian towns, villages and settlement towards the Namibia-Angolan borders that host many memories and history of the liberation struggle, Divundu is not an exemption. However, during site visit, there was no observed heritage or archaeological site. Although, there was no physical evidence onsite, the absence of surface findings does not mean an absence of subsurface resources that may be unintentionally unearthed during site maintenance and grave digging.

For the successful implementation of this EMP, the roles and responsibilities need to be assigned to different parties at DVC. Although the Village Council holds overall responsibility of implementing the EMP, individual parties operating under the Village Council holds the responsibility of implementing specific measures (as entirely individually or collectively), therefore, the EMP roles and responsibilities are provided under the next chapter.

5 EMP IMPLEMENTATION: ROLES & RESPONSIBILITIES

The Divundu Village Council (DVC), as the project Proponent has the overall responsible for the implementation of the EMP and the associated Closure Plan. The roles and responsibilities of all delegates/parties involved in the effective implementation of this EMP are set in Table 5-1.

Table 5-1: The list of responsible parties and their roles in implementing the EMP & Closure Plan

Role (Person and or Institution)	Responsibilities
The Proponent (Divundu Village Council)	-Managing the implementation of this EMP and updating and maintaining it when necessary. -Management and monitoring of individuals and/ or equipment on-site in terms of compliance with this EMP and issuing fines for contravening EMP provisions.
Safety, Health & Environmental (SHE) Officer / Environmental Health Officer (EHO)	-Conducting site inspections of all areas with respect to the implementation of this EMP (monitor and audit the implementation of the EMP). -Advising the Proponent on the removal of person(s) and/or equipment not complying with the provisions of this EMP. -Undertaking an annual review of the EMP and recommending additions and/or changes to this document.
Site Manager / Operator	-Collaborate with the SHE Officer to ensure the implementation of the EMP, especially on the technical aspects regarding the site upgrading/maintenance and operations. -Collaborate with the SHE Officer / EHO to ensure the implementation of the EMP, especially on the technical aspects regarding the site upgrading, operations and maintenance works.
Site upgrading Contractor	-Collaborate with the SHE Officer and Site Manager to ensure the implementation of the EMP, especially on the technical aspects regarding the site upgrading and maintenance. -Ensure that their works onsite comply with the EMP components and requirements relevant to their works.
Technical Staff and Consultants	The project's technical experts and consultants will be responsible for safely and effectively monitoring various technical parameters related to: mechanical designs of the oxidation ponds and associated facilities, waste management, water resources management, soil preservation/ protection, oxidation ponds operations and maintenance, and employee/ contractor health.

6 ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

6.1 Identification of Key Impacts

The key potential impacts associated with the site upgrading, its operations and maintenance of the oxidation ponds thereof are as follows:

Positive impacts

-Improved wastewater management in the Village, thus preventing the amount of wastewater that would otherwise be uncontrollably released into the environment due to the overflowing state of the existing ponds. This would improve the local public and environment health

-Availability of extra water for uses like renovation works, irrigation (agricultural activities) in and around the Village, etc.

Potential Negative impacts

-Soil and water pollution: improper handling of wastewater (sewage) may lead to pollution of surrounding soils and eventually water resources systems (through wastewater runoff and infiltration).

-General environmental pollution through mishandling of project related waste during site upgrading and operational phases.

Potential Negative impacts (Continued)

-Odour: This may affect the locals in proximity of the ponds without odour control caps.

-Vehicular traffic: potential increase in local traffic due to site upgrade activities on site.

-Occupational and community health and safety: improper handling of site materials and equipment may cause health and safety risks (if unfenced, there is a risk of children and animals drowning in the ponds).

-Archaeological or cultural heritage impact through uncovering of unknown objects on site (when carrying out earthworks).

-Air pollution by potential dust on untarred roads and gas emissions from site upgrading activities (excavations, heavy vehicles, and machinery).

-Loss of biodiversity through the removal of vegetation that may be found within the planned upgrading of the site footprints.

The impacts will be mitigated by the implementation of measures provided under the next section.

6.2 Environmental Management and Mitigation Measures for the Project

The management actions provided under this section are aimed at avoiding the above-listed potential negative impacts, where possible. Where it is impossible to avoid the impacts, mitigation measures are provided to reduce the impacts' significance. The measures are recommended for the planning & design (Table 6-1), site upgrading & operational phases of the ponds (Table 6-2) and decommissioning (Table 7-1).

Table 6-1: The Environmental management and mitigation measures for the Planning of the Site upgrading works

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility	Timeline
Planning Phase					
EMP implementation and training	Lack of EMP awareness and implications thereof	-A Comprehensive Health and Safety Plan for the project activities should be compiled. This will include all the necessary health, safety, and environmental considerations applicable to respective works on sites. -An EMP non-compliance penalty system should be implemented on site. -The Proponent should appoint a SHE Officer to be responsible for managing the EMP implementation and monitoring.	-All required Plans and systems are compiled and in place Safety, Health and Environmental (SHE) Officer is appointed -Records of EMP implementation Plans and Systems	-Proponent	Pre-site upgrade
Oxidation Ponds Maintenance	Cleaning and reconditioning of ponds	-The cleaning and reconditioning works of the ponds should be planned and provided for. This included the provision for maintenance and repairing of associated pond system infrastructure.	-Financial and technical provision made for the operational & maintenance and updated regularly -Provision for maintenance works -Site inspections conducted by relevant authorities -Reports and records of maintenance work and repairs undertaken	-Proponent -Planning & Design Engineer	Throughout the project phases
Stormwater and Pond	Runoff of polluted water	-Stormwater management plans (discharge points) should be designed and implemented on site to prevent	-Stormwater discharge points are included the ponds upgrading works	-Proponent: Design/Structural Engineer	Pre-site upgrade

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility	Timeline
overflow management	into the environment	the on potential contaminated run-off from reaching surface water resources during heavy rain seasons. -The ponds should be equipped with a robust wastewater flow monitoring system ensure that the first sign of overflow is detected and addressed in time (for flow and capacity monitoring in the ponds).	-Pond capacity detection incorporated into the ponds' upgrading design		
Employment opportunities	Unfair practices of labour recruitment an opportunity leads to conflicts	-Local should be given preference for works (skilled, semi and unskilled) at the site. -Equal opportunities should be given to women and men.	-There is a fair recruitment process -Locals are given preference for the work	-Proponent (Human Resources Department) for site operations -Site upgrading contractor	When deemed necessary during operations
Goods and services procurement	Conflicts from procurement of goods and service by outsiders over local business	-The procurement of works for site upgrade works should follow a fair and transparent process. -Procurement should be open only to local and Namibian companies with strong local participation. -The business opportunities such as site cleaning services and maintenance should be given to local companies	-Goods and services are procured from Divundu and nearby towns such as Rundu. -Local businesses are considered for procurement opportunities	-Proponent (Procurement Department)	When deemed necessary throughout the project -Contractor to be appointed before works

Table 6-2: The Environmental management and mitigation measures for the site upgrade and continued Operational & Maintenance

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Site upgrading, Operational & Maintenance Mitigation Measures				

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
EMP implementation and training	Lack of EMP awareness and implications thereof	-EMP trainings should be provided to all site personnel. -All site personnel should be aware of necessary health, safety, and environmental considerations. -The implementation of this EMP should be monitored. The site should be inspected, and a compliance audit done throughout the project activities (bi-annually). -Implement EMP non-compliance penalty system onsite.	-Compliance monitoring conducted bi-annually and should be recorded. -The ECC is renewed every 3 years -Bi-annual reports -Records of EMP training conducted.	-SHE Officer / EHO
Oxidation Ponds' Maintenance	Cleaning and reconditioning of ponds	-The cleaning and reconditioning of the ponds should be regularly done. This included the provision for maintenance and repairing of associated pond system infrastructure. -The overgrown weeds inside the ponds should be regularly removed and ponds kept clean.	-Financial and technical provision made for the operational & maintenance and these are updated regularly -Provision for maintenance works -Site inspections conducted by relevant authorities -Reports and records of maintenance work and repairs undertaken	-Site Manager
Authorizations	Lack of Permits/ Licenses	-All the required agreements and licenses or permits should be applied for and obtained. The permits, agreements referred to herein include: ○ Treated Wastewater (Effluent) Discharge Permit ○ Waste disposal authorization	-Applicable permits and licenses to obtained from relevant authorities and kept on site for records keeping and future inspections	-Site Manager
Specialised procurement of services	Ponds maintenance and related services	-All services related to project activities such as maintenance that the Proponent may need, preference should be given to local services providers. If not available locally, the services search should be extended to a Regional level (Kavango East Region) and lastly, nationally, or international, if all efforts lead to no success.	-The hired contractors are from Divundu, then Rundu and if not available, then Kavango East Region.	-Site Manager

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Wastewater	Treated Wastewater / Effluent discharge	-A Permit to discharge treated effluent/wastewater should be renewed with the Department Water Affairs (DWA)' Water Environment Division at MAWLR. -Consider setting up gardens (urban agriculture to grow fruits and vegetables) and recreational sites in the Village to make use of the treated water for these purposes.	-Permits obtained -Adherence to permit conditions -Records of volumes of discharge and post-use effluent -The Village is utilizing treated water for medium to large scale urban agriculture and recreational sites for the Village.	-Site Manager
Soils	Physical soil / land disturbance	-The Site soils should not be disturbed, if not needed. -All site upgrading related excavated pits and trenches that will not be utilized for the subsequent phase should be backfilled, and areas rehabilitated. -The stockpiled topsoil on and around the site due to the project activities should be levelled.	-No stockpiled soils onsite -No new erosion gullies.	-SHE Officer / EHO -Site Manager
	Soil Contamination	-The appropriate and suitable measures and method(s) to remediate the contaminated site soils should be recommended by a specialist (soil scientist) and implemented accordingly and under the specialist' supervision.	-Implementation of contamination management measures -Remedial actions taken and implemented -Soil contamination monitoring -No signs of contaminated soils	
Stormwater and Pond overflow management	Runoff of polluted water into the environment	-Stormwater management plans (discharge points) should be installed on site to prevent potential contaminated run-off during heavy rain seasons. -A robust wastewater flow monitoring system should be installed to ensure that the first sign of overflow is detected and addressed in time (for flow and capacity monitoring in the ponds).	-Stormwater discharge points are installed and maintained frequently. -Pond capacity detection forms part of the ponds' system	-Site Manager

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Health and Safety	Occupational Health and Safety	-Provide induction to all new personnel and site visitors. -Avail adequate and appropriate PPE to all workers and visitors. These include coveralls, gloves, safety boots, dust masks, safety glasses, etc. -Timeously recording and reporting of all health and safety incidences.	-Regular health screening of workers (annually) -Bi-annual health and safety audits done	-Site Manager -SHE Officer / EHO
	Public safety	-The site fence should be maintained to secure it and prevent possible public unauthorized. -The warning signage of ''*do not enter, do not swim and the water is not safe for human and livestock consumption*'' should be clearly written in English, and Rukwangali or other local languages and pasted at the site gate. -Consider installing the site wall similar to that of Oshakati Town Council Solid Waste site – **Appendix A.** -Empty hazardous containers that may be used onsite should be securely kept on site, inside the boundary wall before transporting the containers to the nearest approved waste site.	-The site fence has been upgraded to vandalism-resistant wall and maintained regularly. -Empty hazardous containers and waste container kept within the site fence boundaries and out of public reach	-Site Manager
Air Quality	Odour from pond operation	-Install odour control caps at the ponds.	-Odour is controlled and impact minimized -Less to no odour complaints from the public	-Site Manager
	Dust generation, fumes (poor air quality)	-Vehicles to and from site should only be driven at the speed of 40km per hour to avoid dust generation. -The heavy vehicles and fumes generating equipment should not be left idling when not in use.	-No complaints from the public about vehicle emissions and dust generation. -Visible efforts to curb dust	-Site Manager -SHE Officer / EHO

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Post-Treatment Effluent	Handling	-An Effluent Discharge permit should be applied for from the Department of Water Affairs (DWA) of MAWLR. -The effluent must be treated thoroughly and tested/analysed to ensure full compliance with the Standards before used or discharged into the environment. -The treated effluent logistics should be properly handled and done onsite when delivering to the intended consumers. -The effluent transportation pipelines should be maintained and checked for breakages to prevent soil and groundwater pollution. -Other options of utilizing the effluent should be investigated and implemented to ensure that effluent is sufficiently treated to the Standards and utilized for other applications in the environment.	-Effluent stored on lined storage area -No mishandling of effluent on site -Records of Effluent production and distribution -Compliance with the Standards and Regulations	-Site Manager -SHE Officer / EHO
Fire outbreaks	Accidental fire outbreaks risks	-Warning signs of ‘’*No Smoking*’’ and ‘’*No open fires*” should be clearly written in English and Rukwangali or other local languages to be pasted at site entrance. -Continue with the regular servicing of site fire extinguishers, and personnel trained on how to use extinguishers (basic fire firefighting skills). -No open fires should be created onsite. -The contact details of fire services should be readily and visibly displayed onsite. -All personnel must be sensitised about responsible fire protection measures and good housekeeping such as the	-No open fires by site personnel or visitors -Fire extinguishers are readily available and up to date with service	-SHE Officer / EHO -Site Operator

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		removal of flammable materials (e.g., rubbish, dry vegetation, and hydrocarbon-soaked soil) onsite.		
Site safety and security	Compromised site security and safety	-The site fence should be upgraded and maintained.	-The site fence and security measures are in place.	-Site Manager
Waste generation and management	Environmental Pollution (littering)	-Project workers should be sensitized to dispose of waste in a responsible manner and not to litter. -No waste should be left scattered on site. Dispose of in allocated site waste containers. -The burning and burying of waste on site or anywhere else is prohibited. -All solid waste produced daily should be contained until such that time it will be transported to the Village's waste disposal site on a weekly basis. -A penalty system for irresponsible disposal of waste on site and anywhere in the area should be implemented.	-Site wide evaluation of the general condition of all waste storage sites must be conducted as part of the bi-annual environmental audits -A register of all waste generated on site is kept on site -All waste disposal permits are available on site -No littering on and around the project site	-Site Manager -Proponent: Solid waste division (dumpsite management) -SHE Officer / EHO
	Wastewater generated by workers and visitors (sanitation)	-Provision of sufficient ablution facilities (toilets) for project workers and visitors. -Open defecation on /around the site is strictly prohibited.	Adequate toilet facilities on site.	-Site Manager
	Hazardous waste	-All hazardous materials used for site upgrade and maintenance should be stored (on bunded area), handled and disposed of according to the applicable material safety data sheets (MSDS), as well as applicable regulations (e.g., the Health and Safety Regulations).	-Site wide evaluation of the general condition of all hazardous waste storage sites must be conducted as part of the bi-annual environmental audits -A register of all waste	-SHE Officer / EHO

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-Hazard identification signage should be erected at appropriate site locations. -All hydrocarbon substances should be contained in designated containers on site and later disposed of at nearby approved waste sites. -Hazardous waste, including emptied chemical containers should be safely stored on site where they cannot be accessed and used by uniformed locals for personal use. These containers can then be transported to the nearby approved hazardous waste sites for safe disposal. -No waste should be improperly disposed of on site or in the surroundings, i.e., unapproved waste sites.	generated on site is kept on site -All waste disposal permits from relevant authorities are available on site	
Vehicular Traffic	Traffic safety	-The transportation of project materials, equipment and machinery should be limited to twice a week only. -The deliveries of goods and services to the site should be done during weekdays between 8am and 5pm only. -Drivers of all project phases' vehicles should be in possession of valid and appropriate driving licenses. -Vehicle drivers should adhere to the road safety rules. -Drivers should drive slowly (40km/hour or less). -Project vehicles should be in a road worthy condition and serviced regularly to avoid accidents due to mechanical faults of vehicles. -Vehicle drivers should only make use of designated site access roads provided.	-No complaints from members of the public regarding vehicular traffic issues related to the project -All personnel operating the project vehicles and machinery are appropriately licensed and possession of valid driving licenses. -Demarcated areas for parking, offloading, and loading zones are on site.	-Site Manager -SHE Officer / EHO

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
		-Vehicle's drivers should not be allowed to operate vehicles while under the influence of alcohol. -Make provision for safe materials and equipment offloading and loading areas on sites. -Project loads should be properly fastened onto the vehicles to prevent falling causing injuries on the roads.		
Water Resources Use	Over-utilization of water resources	-Water conservation awareness and saving measures training should be provided to all the project workers so that they understand the importance of conserving water and become accountable.	-Water is recycled and re-used where possible	-SHE Officer / EHO
Soils and water resources	Soils and water resources contamination	-Spill control preventive measures should be in place on site to management soil contamination. -Site areas were hazardous waste will be used, consider using an HDPE liner or natural clay liner to eliminate the risk of possible leakage/leachate. -Sensitized personnel on the impacts of soil contamination. -Site upgrading machines and equipment should be equipped with drip trays to contain possible oil spills. -Contaminated soil should be removed immediately and disposed of at an approved and appropriately classified hazardous waste treatment facility. -Refuelling of vehicles should be done in the Village only. -Washing of equipment contaminated hydrocarbons, as well as the washing and servicing of vehicles should take place at a dedicated area offsite.	-No complaints of contamination on the soils due to project activities -No visible oil spills on the ground or pollution spots. -Sufficient waste containers provided onsite -Non-permeable material are used on areas where hydrocarbons and potential pollutants are utilized.	-SHE Officer / EHO

Aspect	Impact	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility
Biodiversity	Loss Fauna and Flora	-Avoid the illegal harvesting of site vegetation and collection of firewood onsite. -Limit the site working areas to open land, thus preventing the disturbance of site vegetation. -Avoid leaving equipment or machinery leaning on vegetation. -Avoid the killing or hunting of animals (birds, reptiles, mammals) encountered onsite or within site proximity. -Provide environmental awareness on importance of biodiversity preservation to personnel and contractors.	-No killing or disturbance of biodiversity -Site vegetation is preserved and conservation awareness is raised	-SHE Officer / EHO
Archaeology and heritage	Accidental disturbance of archaeological or heritage objects	-The site upgrading and maintenance contractor should be sensitized to exercise and recognize Heritage "Chance Finds Procedure (CFP)" – Appendix B. -Adhere to the provisions of Section 55 of the National Heritage Act in event significant heritage and culture features are discovered while conducting site works. -When the removing topsoil and subsoil on the site for site upgrade works, the site should be monitored for subsurface archaeological materials.	-Preservation of all artefacts and objects that are discovered on and around the project site during earthworks	-Site Manager -SHE Officer / EHO
Noise	Nuisance	-Noise from operations' vehicles and equipment on the sites should be at acceptable levels. -The site upgrading and maintenance activities should not be carried out during the night or before 08h00 in the morning and should be carried out during weekdays only. -Site workers and contractors should be equipped with PPE such as earplugs to reduce exposure to excessive noise during noisy site operations.	-No complaints of excessive noise from site -Noise protective equipment for workers	-Site Manager -SHE Officer / EHO

7 CLOSURE MEASURES FOR THE OXIDATION PONDS AND ASSOCIATED FACILITIES

Table 7-1 below contains few measures to be taken by the DVC should they consider decommissioning the oxidation ponds in future.

Table 7-1: The Management measures for the Closure (Decommissioning) of the oxidation ponds

Aspect	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility	Timeline
Closure Phase				
Site Fencing and associated infrastructure	-The site fencing should be maintained to ensure the security of the site at least until decommissioning is completed. The fencing can then be dismantled once all decommissioning activities are completed. -Alternatively, the site fencing can be used for other project activities such as agricultural developments upon decommissioning of oxidation ponds that may not be needed for the post-sewage treatment activities and the site is treated for the next intended use.	-The site is looked after and used appropriately	-Proponent	Upon cessation of sewage/effluent treatment activities
Infrastructure and structures: Decommissioning of services and infrastructures	-Dismantling of structures and materials that are no longer required upon decommissioning/closure. These, if still in usable condition can be utilized for other purposes in the Village. If cannot be reused, the materials should be taken to the Village Council dumpsite. -All the waste generated from leading to the last days on site should be transported to the Village Council dumpsite. -Transport all equipment to offsite storage facilities. -The sewage pipelines should be emptied and properly removed for dismantling to prevent sewage spills into the ground.	-Structures are used for other purposes in the Village -Waste transported to an approved dumpsite	-Proponent -SHE Officer / EHO	At the end of the site operations

Aspect	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility	Timeline
	-All access roads that may have been created for site upgrading contractor phase and no longer required for operational phase should be closed off.			
Existing contaminated Soils	-Undertake a site-wide contaminated soil to determine the nature and extent of contamination and to identify appropriate remediation measures. -Rehabilitate contaminated by excavating contaminated material to a depth of 300mm and remove and dispose of at the nearest capable landfill site and approved waste management facility. -Treat organic contamination by means of biological remediation via the establishment of a bioremediation site and monitor soil quality against a selected control site.			
Handling of Existing Sewage during Ponds' Demolition Stage	To ensure that no further safety, environmental and human health hazards and to provide land/space for other land uses, through the Demolishing Contractor, the Village Council may need to decide on **carrying out progressive demolition** by determining the feasibility of either of the two options or both: -This will need to be done by demolishing one or two ponds at a time to ensure that there is still one or two ponds to still contain incoming wastewater from the Village sources and avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into the ground (groundwater) -Alternatively, provision to be made for industry standard temporary storage facilities such as sewage tanks to contain sewage for disposal at a new selected site.	-The ponds infrastructures are successfully demolished without causing environmental damages such as pollution.	-Proponent -SHE Officer / EHO	At the end of the site operations

Aspect	Management and Mitigation Measure(s)	Key Performance Indicator (KPI)	Implementation Responsibility	Timeline
	The decommissioning of these ponds will entail the following: -The treatment of liquids as well as removal and disposal of biosolids accumulated at the bottom of the ponds. These solids need to be handled properly before re-using the ponds, i.e., for the construction of new ones and cleaned up. -Cleaning up and closure of the ponds. -Proper demolition, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities. -The demolition of old ponds should also be planned and done in consultation and collaboration with the Water Environment Division at the Department of Water Affairs of the MAWLR to ensure compliance to Regulations pertaining to handling Wastewater. If required, a Permit should be applied for and obtained from the Division. The most important end component of pond demolition will be to determine the quantity and quality of the biosolids that will have to be removed from the ponds and the option that will be appropriate for land use or disposal (Minnesota Pollution Agency, 2010).			
Waste (solid and sewage from site facilities)	-All waste storage containers should be removed, and waste disposed of at designated and approved waste management sites. -Sanitation facilities should be carried away by a designated sewer removal expert.	-All waste and removed from site and transported to authorized sites	-Proponent -SHE Officer / EHO	At the end of the site operations

8 ENVIRONMENTAL MONITORING

To ensure that the implementation of recommended environmental management and mitigation measures is working and produces the desired results (to minimize and or eliminate adverse impacts), implementation of measures will need to be monitored and reported on. Monitoring is crucial as it helps with early identification of new adverse impacts that would arise during project operations/implementation and timely development of mitigation measures for implementation.

The Bi-annual environmental monitoring reports should be compiled by the Proponent's availed resources (Environmental Health or SHE Officer) and submitted to the DEAF for archiving on a bi-annual basis as required by the conditions to be attached to the ECC. The reports should be audited annually by an Independent Environmental Consultant and prior to applying for an ECC renewal.

9 LIST OF REFERENCES

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4. Meteoblue. (2022). Meteoblue Weather: Simulated historical climate & weather data for Divundu, Kavango East Region. Available from https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/divundu_namibia_11048946
5. Namibia Statistics Agency (NSA). (2014). 2011 Population and Housing Census: Kavango Regional Profile - Basic Analysis with Highlights. Windhoek: Namibia Statistics Agency.
6. Stubenrauch Planning Consultants, Geocarta Namibia, SAIEA and AHT Group AG. (2015). Integrated Regional Land Use Plan for the Kavango East Region, Namibia: Baseline Report Vol. 1. Windhoek: Ministry of Lands and Resettlements.

APPENDIX A: EXAMPLE OF THE RECOMMENDED SITE WALL (AS SEEN WITH THE OSHAKATI TOWN COUNCIL)

Oshakati Town Council solid waste dumping site entrance and eastern side wall

Oxidation Ponds

APPENDIX B: CHANCE FINDS PROCEDURE (AFTER KINAHAN, 2020)

Areas of proposed project are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found during development work. The procedure set out here covers the reporting and management of such finds.

Scope: The "*chance finds*" procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

Compliance: The "chance finds" procedure is intended to ensure compliance with relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): "*a person who discovers any archaeological …. object ……must as soon as practicable report the discovery to the Council*". The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.

Manager/Supervisor must report the finding to the following competent authorities:

- National Heritage Council of Namibia (Head Office: +264 61 244 375 / Technical Office +264 61 301 903)
- National Museum (+264 61 276 800),
- National Forensic Laboratory (+264 61 240 461).

Archaeological material must NOT be touched. Tempering with the materials is an offence under the heritage act and punishable upon conviction by the law.

Responsibility:

Operator:	To exercise due caution if archaeological remains are found
Foreman:	To secure site and advise management timeously
Superintendent:	To determine safe working boundary and request inspection
Archaeologist:	To inspect, identify, advise management, and recover remains

Procedure:

<u>Action by person identifying archaeological or heritage material:</u>

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a) If operating machinery or equipment stop work

b) Identify the site with flag tape

c) Determine GPS position if possible

d) Report findings to foreman

Action by foreman

a) Report findings, site location and actions taken to superintendent

b) Cease any works in immediate vicinity

Action by superintendent

a) Visit site and determine whether work can proceed without damage to findings

b) Determine and mark exclusion boundary

c) Site location and details to be added to project GIS for field confirmation by archaeologist

Action by Archaeologist

a) Inspect site and confirm addition to project GIS

b) Advise NHC and request written permission to remove findings from work area

c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains

a) Actions as above

b) Field inspection by archaeologist to confirm that remains are human

c) Advise and liaise with NHC and Police

d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

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