



Excel Dynamic Solutions
(PTY) Ltd



Comprehensive Environmental Management Plan (EMP) for the Operations and Maintenance of the Existing Effluent Treatment Plant in Lüderitz, //Karas Region



Document Type: Draft EMP

ECC Application No.: APP-001181

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January 2023

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LIST OF ABBREVIATIONS

| Abbreviation | Meaning |
|--------------|----------------------------------------------------------------|
| BNR | Biological Nutrient Removal |
| DEAF | Department of Environmental Affairs and Forestry |
| EAP | Environmental Assessment Practitioner |
| ECC | Environmental Clearance Certificate |
| EDS | Excel Dynamic Solutions |
| ETP | Effluent Treatment Plant |
| EHO | Environmental Health Officer |
| EIA / EMA | Environmental Impact Assessment / Environmental Management Act |
| EMP | Environmental Management Plan |
| LTC | Lüderitz Town Council |
| MAWLR | Ministry of Agriculture, Water and Land Reform |
| MEFT | Ministry of Environment, Forestry and Tourism |
| PPE | Personal Protective Equipment |
| RAS/WAS | Return activated sludge and waste activated sludge |
| SHE Officer | Safety, Health & Environmental Officer |

1 INTRODUCTION

1.1 Project Background and Locality

The Lüderitz Town Council (hereinafter referred to as The Proponent) operates an existing effluent treatment plant (ETP) to manage the sewage waste produced by its residents. Constructed in 2008, facility is located about 2km northeast of the Town (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 Town 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 Proponent 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 Town Council has chosen the effluent treatment facility/Plant of the Town.

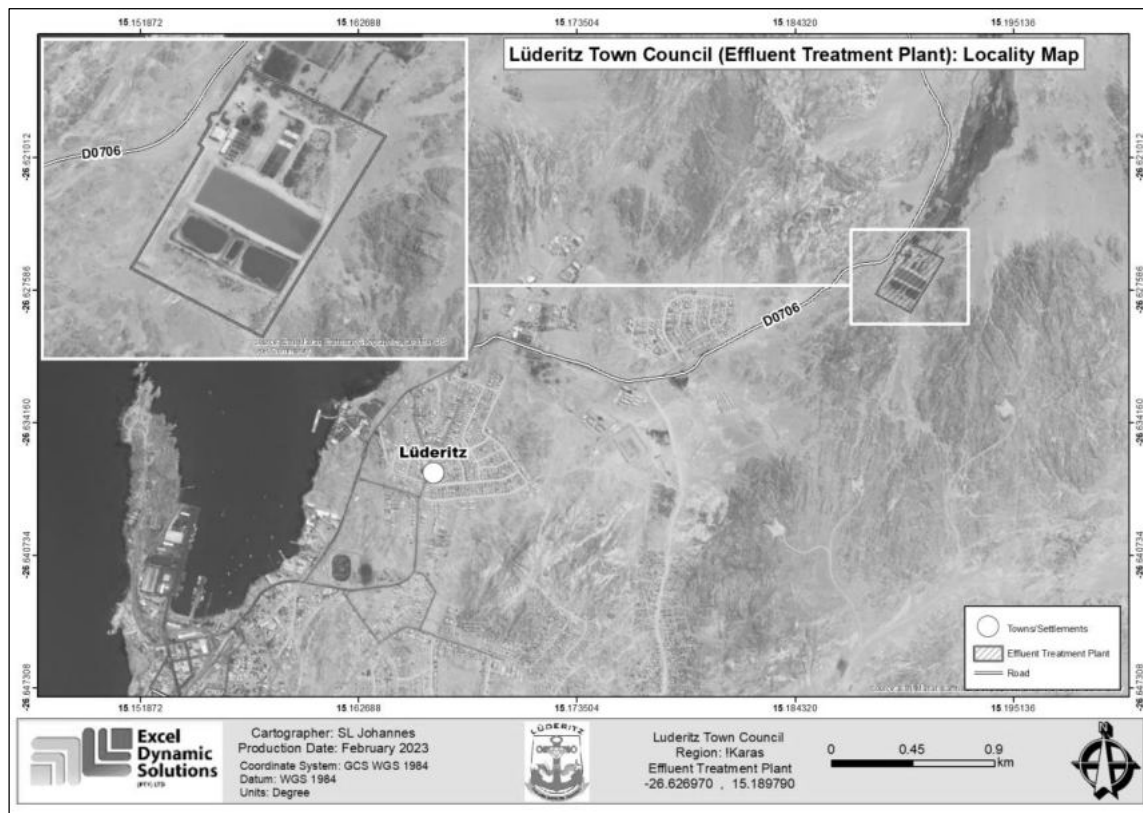


Figure 1-1: Locality map of the Lüderitz Effluent Treatment Plant

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 (including the LTC ETP) 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 Town's effluent Plant are as follows:

"2. WASTE MANAGEMENT, TREATMENT, HANDLING AND DISPOSAL ACTIVITIES

- *Listed Activity 2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste.*

8. WATER RESOURCE DEVELOPMENTS

- *Listed Activity 8.6 The construction of industrial and domestic wastewater treatment plants and related pipeline systems.*
- *Listed Activity Regulation 9.2 Any process or activity which requires a permit, license or other form of authorization, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, license, or authorization or which requires a new permit license or authorization in terms of a law governing the generation or release of emissions, pollution, effluent, or waste."*

Although, the Plant was commissioned one year (2008) after the promulgation of the Environmental Management Act No. 7 of 2007 and has been in operation, it has not been environmentally cleared. This could be attributed to the fact that like other similar local authorities' waste management facilities in Namibia, have been established years ago before or early on after the promulgation of the Environmental Management Act (EMA) No. of 7 of 2007 and its EIA regulations in 2012.

To ensure that the site obtains full compliance with the environmental legislation and ensure environmental protection, an environmental clearance certificate must be issued by the Environmental Commissioner at the Ministry of Environment, Forestry and Tourism: Department of Environmental Affairs and Forestry (MEFT: DEAF). In other words, the ECC Application accompanied by the Draft Environmental Management Plan (EMP) will be submitted and evaluated by the Environmental Commissioner for consideration of the site 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 operational (and maintenance), and closure (decommissioning) phases:

- **Operations and Maintenance:** the ETP is operational (the Town' sewage/effluent is treated at the Plant) and maintenance is currently done by the Proponent and where, necessary, maintenance is done by contractors.
- **Closure (Decommissioning)** – This is the stage at which the ETP would be considered for closure. However, given that the Town will always need to deliver services to its residents and businesses, there will always be the need for the Plant.

This EMP has been prepared for the management of potential impacts associated with its operations and maintenance.

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 on the 12th of July 2022. The activities currently undertaken onsite are presented under the following sections.

2.1 Current Operational and Maintenance (Upkeep) Activities

There are 2 lined ponds onsite and seven pumps onsite supply the sewage to the Plant. According to the Plant Maintenance Report, the Plant was designed to treat a total of 2,000m³ of raw sewage per day from the Town in an activated sludge process. The inflow to the Plant is split into two trains which each treat 50% of the incoming flow with the provision for Biological Nutrient Removal (BNR). The Plant is fitted with nitrate rich, return activated sludge and waste activated sludge pumps and controls to ensure efficient nitrification/denitrification takes place and phosphate removal can be achieved.

The treatment Plant incorporates the following unit processes during operation:

- Inlet works with mechanical screen, manual bypass hand screen and sluice gates
- Two (2) anaerobic/oxidation ponds (with surface areas of 545m², 3m deep and capacity of 1,635m³)
- Two (2) BNR Activated sludge reactors
- Two (2) secondary clarifiers
- Return activated sludge and waste activated sludge (RAS/WAS) pump station
- Final disinfection using chlorine gas, in chlorine tank
- Sludge drying beds.

Some of the site infrastructures listed above are shown in Figure 2-1.



Figure 2-1: A view of the oxidation ponds, chlorine tank and associated infrastructure onsite

Maintenance of the Plant is done internally and sometimes by external service providers (if the Town Council does not have capacity for certain activities, services or goods). For detailed information on the Plant Maintenance, please refer to the summarized Report by the Town Council attached hereto as Appendix B.

2.1.1 Resources, Services and Infrastructure

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

- Human Resources: The Plant operations employ eight people workers on shift, one cleaner and three interns. The workers are accommodated in Town, therefore, there is no need for onsite accommodation.
- Equipment and Vehicles: The vehicles involved in the Plant operations include small trucks and pickup trucks (bakkies) to transport workers, services and goods required at the Plant. One of the site vehicles was parked at the site as shown in Figure 2-2.



Figure 2-2: One of the Plant operation vehicles (bakkie) parked onsite

- Water supply: The water required for Treatment Plant and its operations as well as ablution and drinking is sourced from the Town Council water supply line.
- Power supply: The Plant operations are supplied with electricity by NamPower via the Lüderitz Town Council connection line. There is also an onsite backup generator that kicks in immediately, in case of power failure.

- Site accessibility: The site is accessible from the Town via a well-maintained site gravel access road (D0706).
- Site Security: To control access to the Plant, the site is fenced off with a high mesh wire (jackal proof fence) with a brick wall at the entrance – Figure 2-3.



Figure 2-3: The fencing and security around the treatment Plant

- Health and Safety: The site personnel have protective gear, i.e., Personal Protective Equipment (PPE). There is one partially equipped first aid kit onsite (Figure 2-4) and administering training has been provided to some of the workers onsite.



Figure 2-4: The first aid kit at the Plant (in the administration building)

- Potential Accidental Fire Outbreaks: There are three well-serviced fire extinguishers onsite - Figure 2-5. For site fire outbreaks, some of the site workers are trained in basic fire response procedures.



Figure 2-5: The fire extinguishers onsite

- Waste management: the waste is currently poorly managed onsite. However, the following changes will be implemented onsite to improve operations:
 - Solid waste: The site is equipped with secured waste bins for domestic waste for site personnel to store the waste before disposal to the Town' solid waste site. Some of the onsite waste collection bins are shown below.



Figure 2-6: The solid waste collection bins onsite

- Hazardous waste: all the fuels and lubricants produced onsite are properly handled and stored in containers for disposal at the Town Council's hazardous waste management facility.
- Human waste (sewage): the site is equipped with ablution facilities (toilets and washroom) for the site operation workers.

2.2 The Effluent Treatment Plant Challenges

The following challenges are experienced by the Town Council and these are as follows:

- Groundwater pollution: there are visible flow of effluent on the northern side of the Plant premises. If untreated, this wastewater may potentially seep into the ground and pollute groundwater over time.
- Odour: Although it is common for wastewater treatment facilities, the odour from the Plant is currently not an issue because there are no residents towards the north-eastern side of the Plant. The wind is blowing from southwest to northeast. Therefore, the complaints would be from people living northeast of the Plant in the future.
- Vandalism: No anthropogenic vandalism at the Plant or its fence. This is probably because the Plant is outside town and in the middle of nowhere. The only observed slight damage to the Plant fence is caused by the strong winds in the area.
- The Mismanagement of the Town's solid waste: the Town Council dumpsite is not fenced off that the waste flies off to the Plant fence and trapped on the Plant premises fence, resulting in a visual nuisance.

2.3 Opportunities for the Lüderitz Town Council (and possibly Residents)

The following recommendations and opportunities have been identified to maximize the Plant's existence.

- Opportunities for the Lüderitz Town Council (and possibly community/residents):
- There are some gardens to the immediate north of the Plant belonging to community members. The community gets water from the Plant to water their crops. There are also some vegetables such as onions and crops (maize) grown inside the Plant premises (by some of the personnel) on the northern side - Figure 2-7.



Figure 2-7: A - The crops grown by the community to the immediate north of the Plant and B – Crops grown by some personnel within the Plant premises

- The Town Council can also consider setting up their own gardens and recreational sites for the Town and utilize the treated water for these purposes.
- -Recommendations for the EMP: Irrigation purposes (such as some vegetables such as onions grown on the northern inside of the Plant), finding a practical solution for the sludge that is currently just piled up onsite (find a market for it?) and Research on other possible ways of utilizing the treated water.

The summary of legal requirements that govern the project 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): <u>Regulated under the Ministry of Environment, Forestry and Tourism (MEFT)</u> | 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. The Act provides for the clearance certification for "2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste. | 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 |
| Environmental Impact Assessment (EIA) Regulations Government Notice 28-30 (Government Gazette 4878) of February 2012: <u>Regulated under the MEFT</u> | for "2.1 The construction of facilities for waste sites, treatment of waste and disposal of waste. <i>9.2 Any process or activity which requires a permit, license or other form of authorization, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, license, or authorization or which requires a new permit license or authorization in terms of a law governing the generation or release of emissions, pollution, effluent, or waste" which is relevant to the Project.</i> | - 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 |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>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.</p> <p>Details requirements for public consultation within a given environmental assessment process (Government Notice No. 30 Section 21).</p> <p>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).</p> | <p>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.</p> |
| <p>Pollution Control and Waste Management Bill: <u>Regulated under the MEFT</u></p> | <p>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.”</p> <p>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.”</p> | <p>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.</p> <p>No permit or license required.</p> |
| <p>Soil Conservation Act (No 76 of 1969): <u>Regulated under the Ministry of Agriculture, Water and Land Reform (MAWLR)</u></p> | <p>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.</p> | <p>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.</p> |

| Legislation/Policy/ Guideline | Relevant Provisions | Implications for this Project |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The National Heritage Act (No. 27 of 2004): <u>Regulated under the Ministry of Education, Arts and Culture through National Heritage Council (NHC) of Namibia</u></p> <p>The National Monuments Act (No. 28 of 1969): <u>Regulated under the NHC</u></p> | <p>The Act extends the protection of archaeological and historical sites to private and communal land and defines permit procedures regarding activities at such sites.</p> <p>The Act extends the protection of archaeological and historical sites to private and communal land and defines permit procedures regarding activities at such sites.</p> | <p>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.</p> <p>Contact: Mrs. Erica Ndalikokule (Director)</p> <p>Or Ms. Agnes Shiningayamwe (Regional Heritage Officer)</p> <p>Tel: 061 301 903</p> |
| <p>Public Health Act (No. 36 of 1919): <u>Regulated under the Ministry of Health and Social Services</u></p> | <p>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.”</p> | <p>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.</p> |
| <p>Health and Safety Regulations GN 156/1997 (Government Gazette 1617): <u>Regulated under the Ministry of Health and Social Services</u></p> | <p>Details various requirements regarding health and safety of labourers.</p> | <p>This includes safety and health of the Town's community.</p> <p>No permit or license required.</p> |
| <p>Public and Environmental Health Act No. 1 of 2015: <u>Regulated under the Ministry of Health and Social Services</u></p> | <p>To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.</p> | |

| Legislation/Policy/ Guideline | Relevant Provisions | Implications for this Project |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Road Traffic and Transport Act, No. 22 of 1999: <u>Regulated under the Ministry of Works and Transport (Roads Authority of Namibia)</u></p> | <p>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.</p> | <p>The Proponent should consider applying for a formal access road permit to the site. This permit is to be applied from Roads Authority.</p> <p>Contact: Mr Eugene de Paauw (Roads Authority – Specialist Road Legislation)</p> <p>Tel.: 061 284 7027</p> |
| <p>Water Act 54 of 1956: <u>Regulated under the Ministry of Agriculture, Water and Land Reform</u></p> | <p>The Water Resources Management Act 11 of 2013 is presently without regulations; therefore, the Water Act No 54 of 1956 is still in force:</p> <ul style="list-style-type: none"> -Prohibits the pollution of water and implements the principle that a person disposing of effluent or waste has a duty 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)). | <p>The protection (both quality and quantity/abstraction) of water resources should be a priority.</p> <p>The Plant was issued with a 5-year treated effluent discharge into the environment. The permit was issued on the 15th of July 2016 and expired on the 31st of July 2021. Therefore, the permit should be renewed.</p> <p>Mr. Franciskus Witbooi (Deputy Director: Water Policy and Water Law Administration.</p> <p>Tel: (061) 208 715</p> |
| <p>Water Resources Management Act (No 11 of 2013): <u>Regulated under the Ministry of Agriculture, Water and Land Reform</u></p> | <p>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).</p> <p>The Proponent will be required to apply for or renew 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).</p> | <p>Ms. Elise Mbandeka (Chief Hydrologist): Water Environment</p> <p>Tel: (061) 208 7167</p> |

| Legislation/Policy/ Guideline | Relevant Provisions | Implications for this Project |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Atmospheric Pollution Prevention Ordinance (1976): <u>Regulated under the Ministry of Health and Social Services</u> | 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. |
| Hazardous Substance Ordinance, No. 14 of 1974: <u>Regulated under the Ministry of Health and Social Services</u> | 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: <u>Regulated under the Ministry of Urban and Rural Development</u> | 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. | The Lüderitz Town 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): <u>Regulated under the Ministry of Labour, Industrial Relations and Employment Creation (MLIREC)</u> | 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 operations, and maintenance works, do not compromise the safety and welfare of workers. No permit or license required. |

The Plant 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 by the development 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

4.1.1 Rainfall

The Lüderitz area receives an average annual rainfall of less than 50mm (Mendelsohn et al., 2002). According to the 13-year period of rainfall data on the World Weather Online website (2022), the Lüderitz area received the highest rainfall of 90mm in March 2011, followed by 66mm in March 2012 as shown in Figure 4-1.

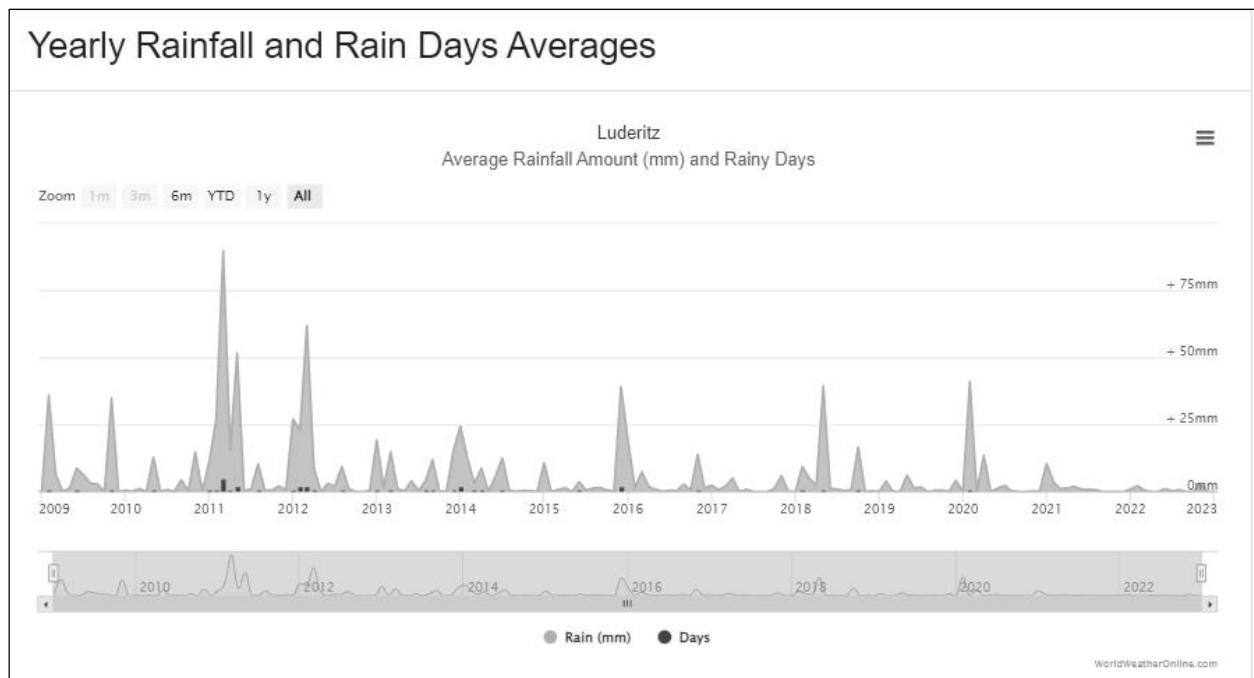


Figure 4-1: The average rainfall and rainy days for Lüderitz (World Weather online, 2022)

The highest average rainfall for the area is 14mm in March, followed by 12mm in February and 8mm in January as shown in the chart in Figure 4-2.

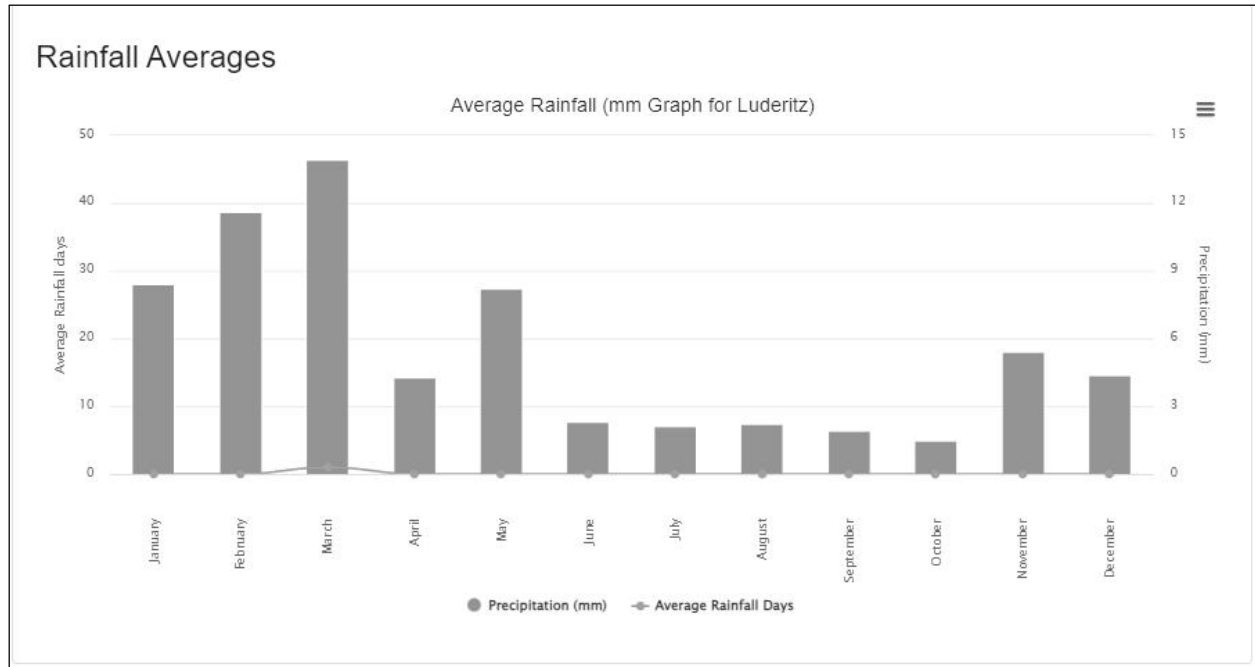


Figure 4-2: The monthly average rainfall for Lüderitz (World Weather online, 2022)

4.1.2 Temperature

Mendelsohn et al, (2002) indicated that the Lüderitz area has annual temperature of less than 16°C, minimum temperatures ranging between 10 and 12°C and maximum temperatures within the range of 20 to 22°C. According to World Weather Online (2022), the minimum and maximum temperatures for Lüderitz area are 12°C (in August), and 31 °C (in April), respectively (Figure 4-3).

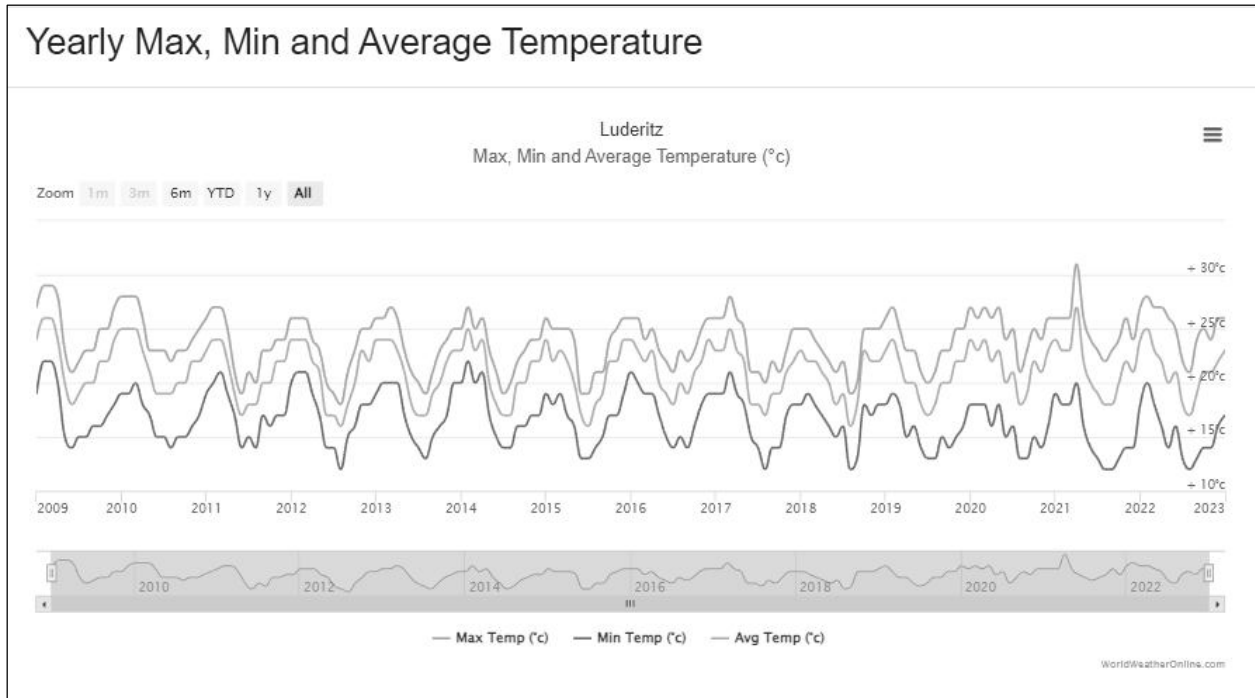


Figure 4-3: The maximum, minimum and average temperature for Lüderitz (World Weather online, 2022)

The monthly average high and low temperatures are 26°C and 13°C, respectively (

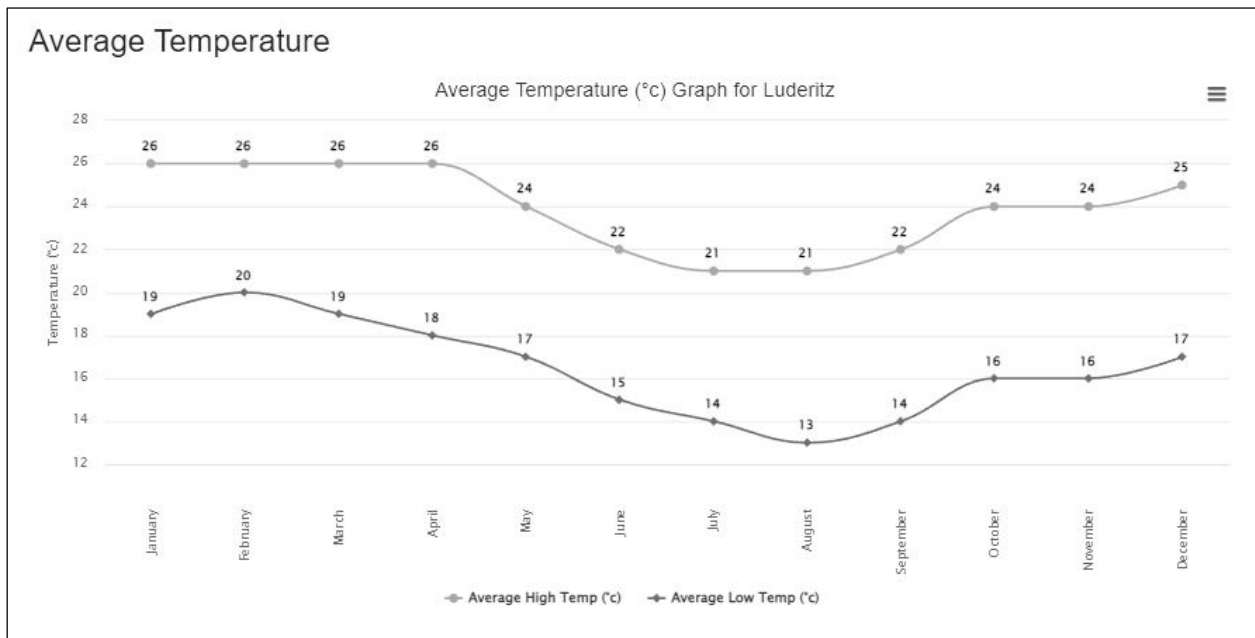


Figure 4-4).

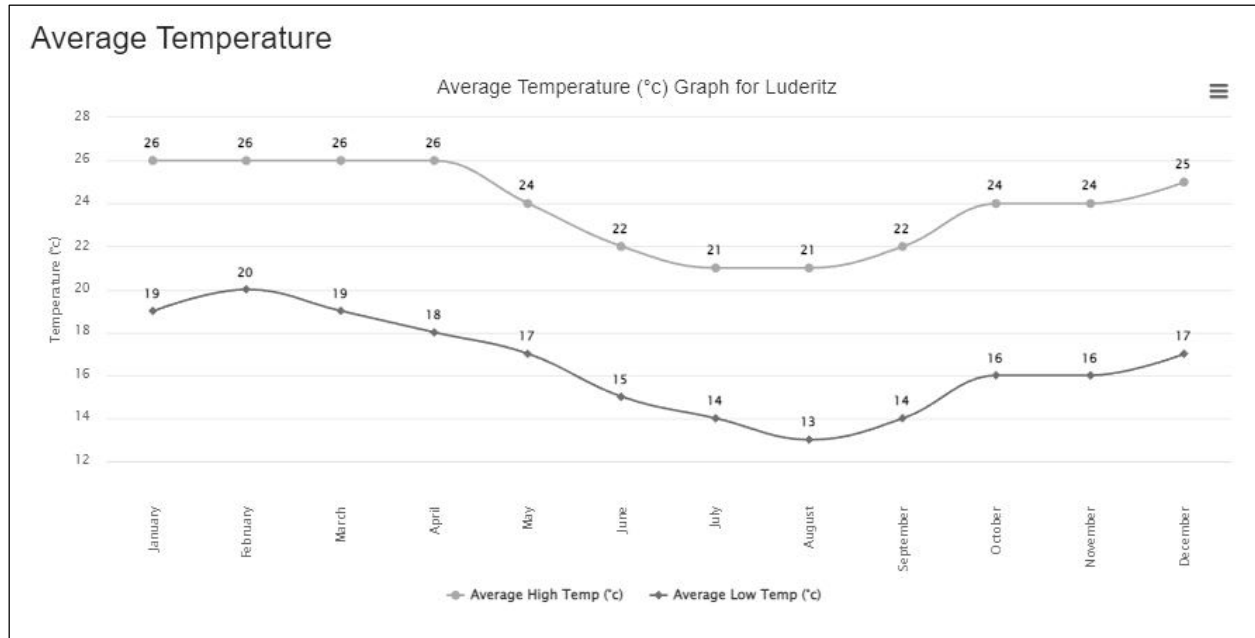


Figure 4-4: The monthly average temperature for Lüderitz (World Weather online, 2022)

4.1.3 Air Quality

According to IQ Air (2022), the current air pollution level around in and around Lüderitz area, air is good. The air quality index (AQI) is 17 US AQI, and the main pollutant is the atmospheric particulate matter (PM) 2.5. PM are microscopic solid or liquid matter suspended in the air with a diameter of 2.5 micrometres (µm) or less. The PM2.5 concentration in the Lüderitz is 4.1 µg/m³ which is currently meets the WHO annual air quality guideline value (IQ Air, 2022).

4.1.4 Wind Direction and Speed

The predominant wind in the Lüderitz area is blowing from southwest (SW) to northeast (NE). (Meteoblue, 2022) at a speed ranging between 12 and 19 kilometers per hour as shown in Figure 4-5 (left-hand side). The strong winds (with a speed greater than 19km/h) occur mainly between October and March as shown in the chart (Figure 4-5 right-hand side).

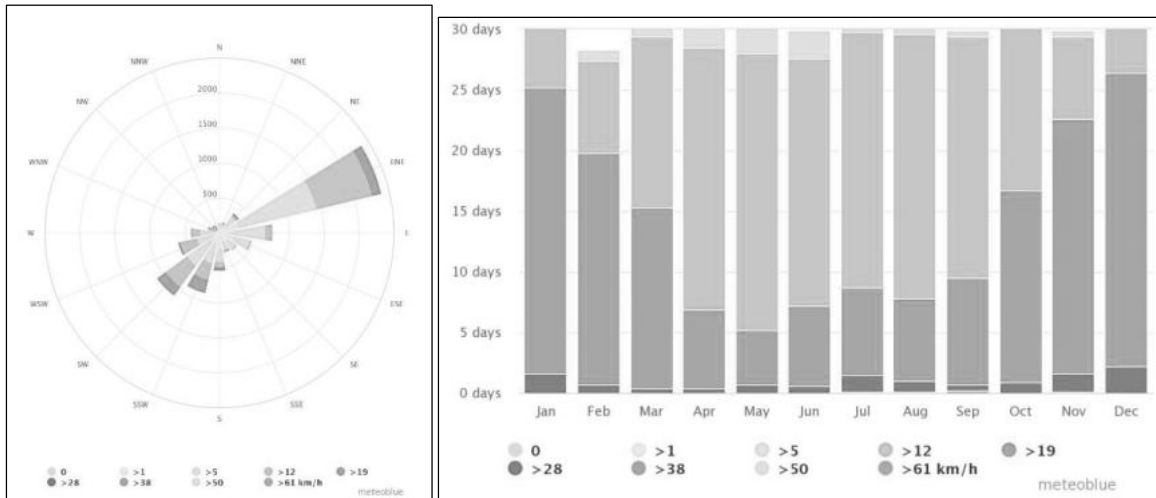


Figure 4-5: The modelled wind speed and chart for Lüderitz (Meteoblue, 2022)

4.2 Landscape

The landscape of the Lüderitz Town and surroundings is characterized by the Namib Plains (Mendelsohn et al, 2002). The Namib Plains gravel and thin layers of sand cover most of the Namib Plains out of which many rocky outcrops and hills protrude. Some of these are large hills or mountains that are included under the ‘inselbergs’ category or landscapes, but there are also many smaller outcrops of granite, dykes and sills. The very arid coastal climate means that water erosion is limited, thus, the overall landscape is predominantly flat (Mendelsohn et al., 2002).

4.3 Geology and Soils

The geology of Lüderitz area is characterized by the Namaqua Metamorphic Complex (Mendelsohn et al., 2002). The geological map created for the site area (Figure 4-6) indicates that the Pant site overlies the pre-to-syntectonic biotite-rich augen gneiss, while the southeastern side of the site, the geology is defined by the syn-to-post-tectonic gneiss granite, and pegmatites.

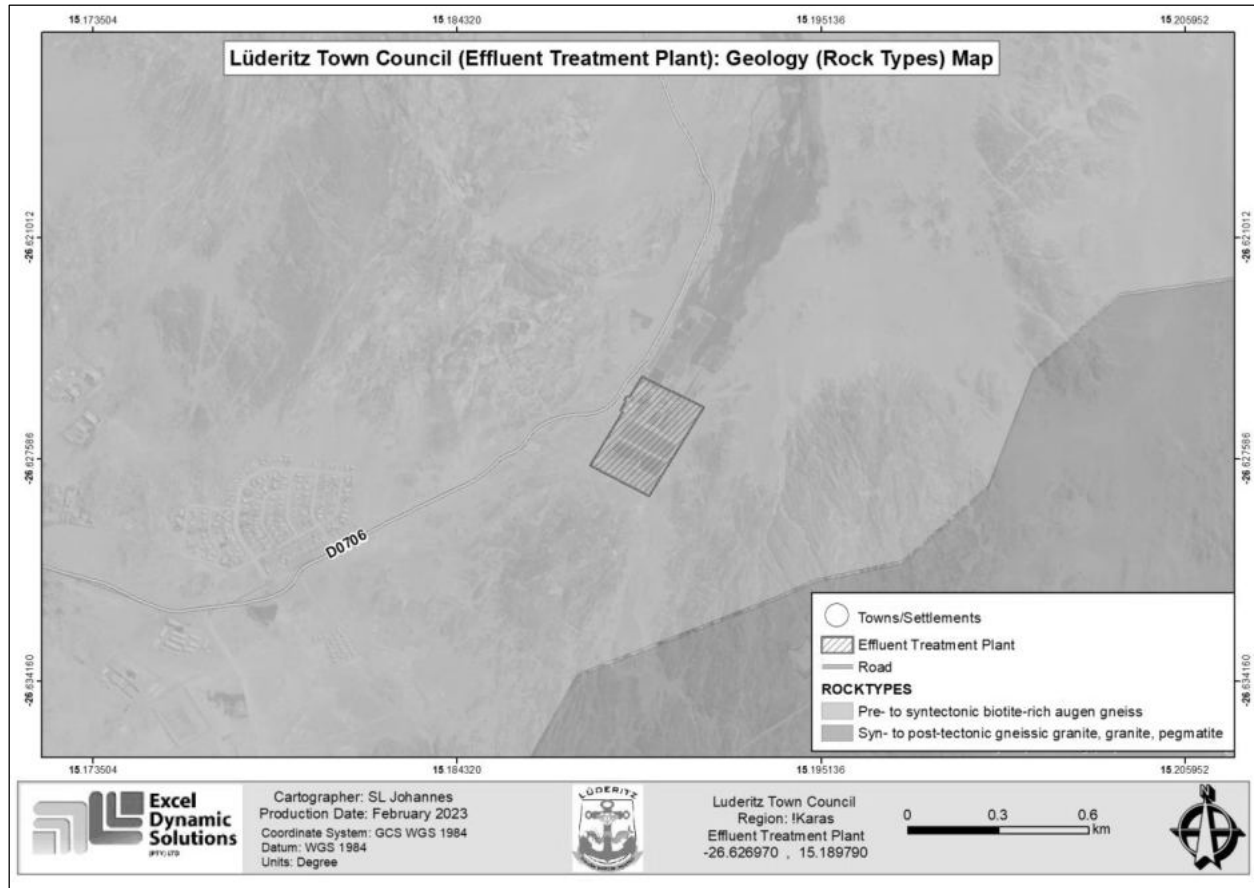


Figure 4-6: The geology of the site and Lüderitz at large

The project site and its surrounding are overlain by eutric regosols as shown in Figure 4-7. According to Mendelsohn et al (2002), the eutric soils are fertile with high base saturation, and regosols soil name component means that these are medium or fine-textured soils of actively eroding landscapes, the thin layers lying directly above the rock surfaces from which they formed. Although not as shallow as the leptosols, these soils never reach depths of more than 50cm (Mendelsohn et. al, 2002).

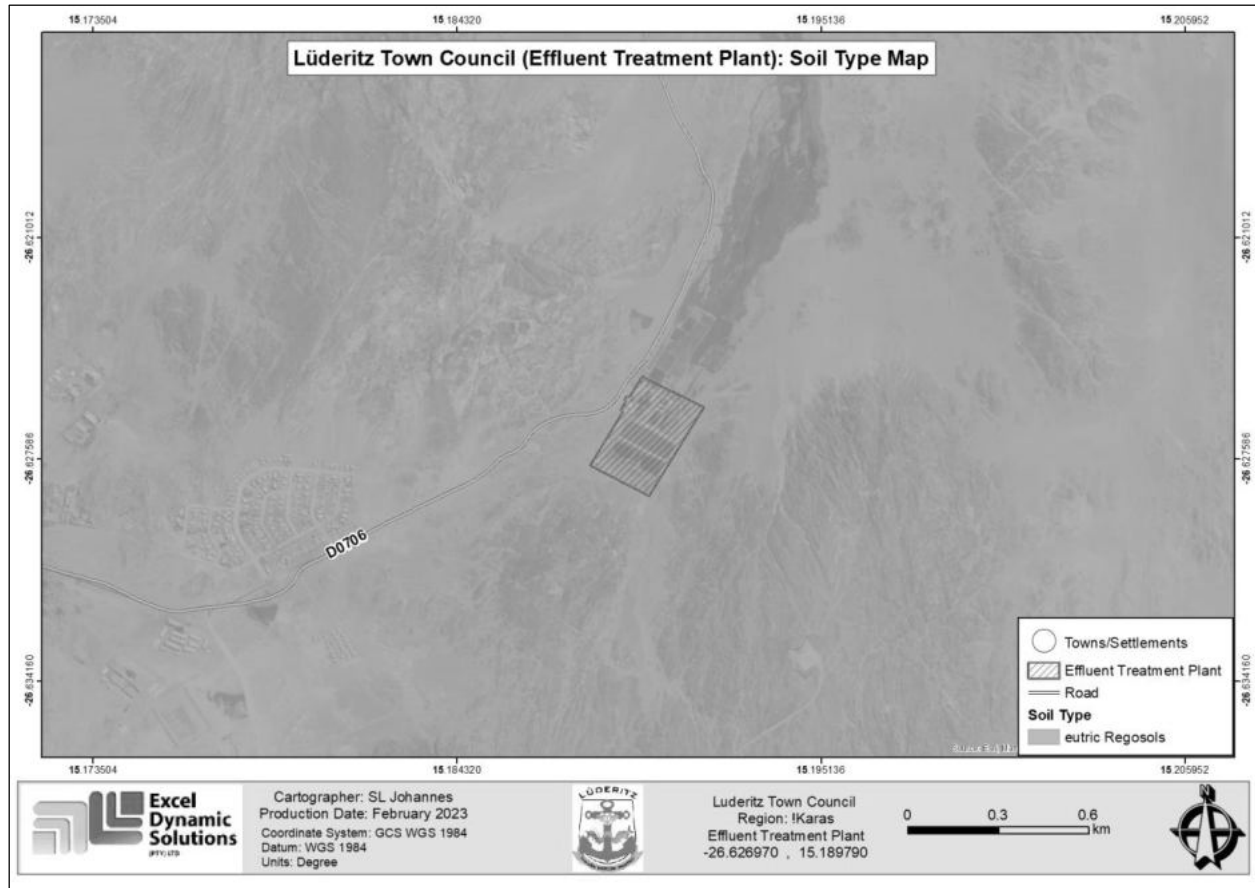


Figure 4-7: The dominant soil on and around the site

4.4 Hydrogeology

Groundwater in the project site area is hosted in rocks bodies with little groundwater potential. The groundwater map of the site area is shown in Figure 4-8.

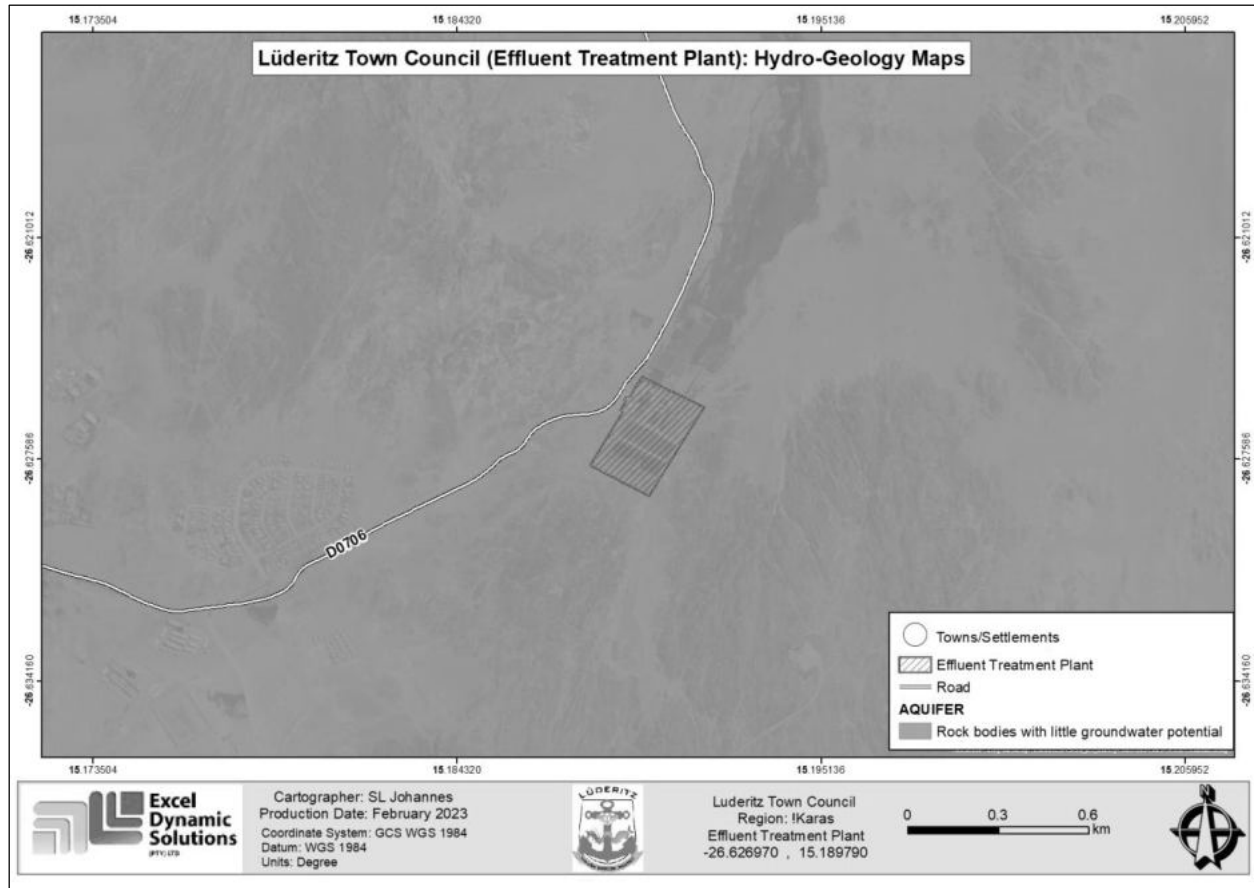


Figure 4-8: The hydrogeological map of the Lüderitz area

4.5 Fauna

The Lüderitz Town is in a desert environment, with wildlife and very little to no domestic animals. However, no wildlife was observed on and around the Plant (site area) during site visit.

4.6 Flora

The area is bare due to the desert conditions. The only vegetation observed on and around the site are the garden crops and man-planted trees at the Plant.

4.7 Social and Economy

4.7.1 Demography

Based on 2011 Namibia Population and Housing Census, the population of the //Karas Region was 77,421 (38,014 females and 39,407 males) with a population density of 0.5 people per square kilometre (Namibia Statistics Agency (NSA), 2014). The NSA also indicated that 54% of the population in the Region lived in urban areas and 46% in rural areas. The Plans site falls within the Lüderitz Constituency which in 2011 had a population of population of 13,859 (6,887 females and 6,972 males).

4.7.2 Economic Activities

The Lüderitz Urban Constituency's main sources of household income include farming (1%), wages & salaries (79%), cash remittance (3%), business (non-farming) accounting for 8% and pension at 5% (NSA, 2014).

The economy of Lüderitz depends heavily on the local fishing industry and the port. The expansion of the waterfront, increased passenger liners and the Crayfish Festival and other tourism activities have contributed to the growth of Lüderitz.

4.7.3 Services and Infrastructure

The Town of Lüderitz is well-equipped with services and infrastructure to aid in running the Town. Some of the services and infrastructure are summarized below:

- Roads: there are good roads connecting the Town to other areas. The site is accessed from Town via a gravel road (D0706).
- Water supply: the NamWater Koichab water supply plot supplies Lüderitz with consumable water. It comprises about nine production boreholes, providing groundwater from the alluvial aquifer formed in a paleo-channel of the Khoichab River.
- Electricity: the Lüderitz Town is supplied with power (electricity) by the NamPower.
- Logistical services: the main logistics activities in the //Karas Region are focused on the export of mining minerals, grapes, and fish. Imports include heavy machinery, equipment, and chemicals. Ship agency services are provided to the offshore diamond mining and oil and gas exploration activities (Lüderitz Town Council, 2020). The port of Lüderitz provides direct access to shipping routes. It caters for shipping and offshore activity in the southern part of the country and provides access to markets in neighbouring countries.

The Lüderitz Town Council (2020) further stated that there are expectations of the repairing and upgrading of the railway will attract increased exports of commodities through the port of Lüderitz. Namport's plan to dredge and deepen the port will also attract larger vessels and help promote the port as attractive logistics import and export alternative for Southern African Development community (SADC) countries such as Botswana and South Africa

- Other services: The town of Lüderitz is furnished with services such as healthcare facilities, police station, fire station, fuel station, supermarkets, as well as mechanical services. Equipment and supplies are more readily available locally, and if specialized items necessary for project operations are not available in Namibia, such items can be outsourced regionally from neighbouring countries such as South Africa (Geo-Pollution Technologies, 2020).

4.7.4 Surrounding Land Uses

The site is bordered to the south by three 6MW windmills that are connected to the town grid. Towards the east-north trend, is an area forming part of the NAMDEB concession. To the immediate north, there are community garden works where they grow sugar cane and other crops. These gardening works are supplied with water by the Plant. There are mountains to the west and further to these, is the ocean.

4.7.5 Waste Management

A. Garbage and Waste Disposal

According to NSA (2014), the most common means of disposing garbage in //Karas Region was regular collection (63.2%). Burning accounted for 19.2% of the households. In urban areas, 88.9% of the households benefit from regular waste collection. In rural areas, however, only 32.9 percent of households rely on regular collection, and 41 percent burn their refuse as a means of waste disposal. 11.6% of households in rural areas dump their waste on the roadside. At constituency level, regular waste collection was most common in the Oranjemund (81.5%) and Luderitz (77.4%) constituencies, as the rest of the constituencies depended on either burning or roadside dumping as means of disposing of their household waste/garbage. The waste disposal statistics as per the 2011 Census of the Regions per constituency in the //Karas Region is shown in Table 4-1, with Lüderitz Constituency marked in red.

Table 4-1: The percentage of distribution of households by means of waste (garbage) disposal

| Area | Households | Regularly Collected | Irregularly Collected | Burning | Roadside Dumping | Rubbish Pit | Others |
|--------------------|------------|---------------------|-----------------------|---------|------------------|-------------|--------|
| //Karas | 20 988 | 63.2 | 3.6 | 19.2 | 6.6 | 6.9 | 0.5 |
| Urban | 11 347 | 88.9 | 2.3 | 0.7 | 2.3 | 5.5 | 0.2 |
| Rural | 9 641 | 32.9 | 5.2 | 41.0 | 11.6 | 8.4 | 0.9 |
| Berseba | 2 597 | 30.7 | 0.8 | 58.7 | 2.0 | 7.7 | 0.2 |
| Karasburg | 4 609 | 34.2 | 3.4 | 36.0 | 17.7 | 8.4 | 0.4 |
| Keetmanshoop Rural | 1 735 | 36.1 | 0.9 | 42.2 | 2.2 | 18.3 | 0.3 |
| Keetmanshoop Urban | 4 304 | 96.0 | 0.3 | 0.8 | 1.4 | 1.3 | 0.2 |
| Lüderitz | 4 362 | 77.4 | 5.7 | 1.8 | 4.2 | 10.7 | 0.2 |
| Oranjemund | 3 381 | 81.5 | 9.2 | 0.3 | 6.9 | 0.4 | 1.8 |

4.7.6 Archaeology and Heritage Resources

Lüderitz is a historical Town with many memories and history of the southern part of Namibia. Most of the Town's archaeological and heritage sites are concentrated within the Town itself, as there were no evidence of surface findings of such on and within the immediate surroundings of the Plant site. However, although there was no physical evidence of this onsite, the absence of surface findings does not mean an absence of subsurface resources that may be in the subsurface.

For the successful implementation of this EMP, the roles and responsibilities need to be assigned to different parties at the Lüderitz Town Council (and contractors appointed by the Town Council to undertake maintenance work, when needed). Although the Town Council holds overall responsibility of implementing the EMP, individual parties operating under the Town 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 Lüderitz Town Council, 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 (Lüderitz Town Council) | <ul style="list-style-type: none"> -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) | <ul style="list-style-type: none"> -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 | <ul style="list-style-type: none"> -Collaborate with the ECO to ensure the implementation of the EMP, especially on the technical aspects regarding the ETP 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 and maintenance works. |

6 ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

6.1 Identification of Key Impacts

The key potential impacts associated with the effluent treatment Plant operations and maintenance thereof are as follows:

| <u>Positive impacts</u> | <u>Potential Negative impacts (Continued)</u> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>-Improved wastewater management in the Town, thus preventing the amount of wastewater that would otherwise be uncontrollably released into the environment. This would improve the local public and environment health.</p> <p>-Availability of extra water for uses like renovation works, irrigation in the Town, etc.</p> | <p>-Air pollution by potential dust on untarred roads during delivery of goods and services from/to site.</p> <p>-Occupational & public Health and safety: improper handling of site materials and equipment may cause health and safety risks and operational hazards.</p> <p>-Environmental pollution (poor waste management, i.e., solid, hazardous and sewage)</p> |
| <u>Potential Negative impacts</u> | |
| <p>-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).</p> <p>-Odour: Some by-products of anaerobic digestion used in wastewater treatment plants, may give off a strong, nauseating smell. This may affect the locals in proximity of the facility.</p> | <p>-Vehicular traffic safety</p> <p>-Archaeological impact (during unearthing as part of maintenance and site upgrading)</p> |

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

6.2 Environmental Management and Mitigation Measures for the Plant

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 operational phase (Table 6-1) and decommissioning (if it ever comes to that -Table 6-2).

Table 6-1: The Environmental management and mitigation measures for the continued Operational and Maintenance of the Plant site

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Continued Operational and Maintenance Mitigation Measures | | | | |
| 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 <u>the project activities (bi-annually)</u> . -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. | -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 | -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: <ul style="list-style-type: none"> ○ Treated Wastewater (Effluent) Discharge Permit ○ Petroleum storage permits (if fuel is stored on site) ○ Waste disposal authorization | -Applicable permits and licenses to obtained from relevant authorities and kept on site for records keeping and future inspections | -Site Manager |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|-------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Specialised procurement of services | Plant 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 (//Karas Region) and lastly, nationally, or international, if all efforts lead to no success. | -The hired contractors are from Lüderitz or nearby areas in the Region | -Site Manager |
| 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 Town gardens (urban agriculture and aquaculture to grow fruits and vegetables) and recreational sites in the Town 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 Town is utilizing treated water for medium to large scale urban agriculture and recreational sites for the Town | -Site Manager |
| Soils | Physical soil / land disturbance | -The Site soils should not be disturbed, if not needed. -All site maintenance trenches should be backfilled, and areas rehabilitated. | -No stockpiled soils onsite -No new erosion gullies. | -SHE Officer / EHO -Site Manager |
| | Soil Contamination | -A Soil Scientist should be appointed to undertake a Full Soil Contamination and Impact Assessment for the site to assess the nature and extent of contamination from site. -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. | -Soil Study undertaken by a Specialist -Implementation of contamination management measures -Remedial actions taken and implemented -Soil contamination monitoring -No further signs of contaminated soils | |
| Stormwater and Pond | Runoff of polluted water | -Stormwater management plans (discharge points) should be designed and implemented on site to prevent potential contaminated run-off during heavy rain seasons. | -Stormwater discharge points are incorporated and maintained frequently. | -Site Manager |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|---------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| overflow management | into the environment | -The ponds should be equipped with a robust wastewater flow monitoring system to ensure that the first sign of overflow is detected and addressed in time (for flow and capacity monitoring in the ponds). | -Pond capacity detection forms part of the ponds' system | |
| Health and Safety | Occupational Health and Safety | -Undertake bi-annual health & safety refresher trainings for personnel. -Provide induction to all new personnel and site visitors. -Personnel and visitors should be properly equipped with adequate personal protective equipment (PPE) such as coveralls, gloves, safety boots, earplugs, dust masks, safety glasses, etc. -Avail adequate and appropriate PPE to all workers and visitors. -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 mesh fence should be maintained to secure it and prevent possible public unauthorized access through wind-damaged fence areas. -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. | -Mesh fence upgraded 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 the Plant and ponds | -The ponds and Treatment sections of the Plant should include odour control caps. | -Odour is controlled and impact minimized | -Site Manager |
| | Dust generation, | -Vehicles should only be driven at the authorized site speed of 40km per hour to avoid dust generation. | -No complaints from the public about vehicle emissions and dust generation. | -Site Manager |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|-------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| | fumes (poor air quality) | -The heavy vehicles and fumes generating equipment (during site maintenance) should not be left idling when not in use. | -Visible efforts to curb dust | -SHE Officer / EHO |
| Post-Treatment Effluent | Handling | <p>-The effluent must be treated thoroughly and tested/analysed to ensure full compliance with the Standards before used or discharged into the environment.</p> <p>-The effluent logistics should be properly handled and done onsite when delivering to the intended consumers.</p> <p>-Effluent that awaits to be transported from site should be stored on a designated storage area and loaded correctly without it spilling on the soils.</p> <p>-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.</p> | <p>-Effluent stored on lined storage area</p> <p>-No mishandling of effluent on site</p> <p>-Records of Effluent production and distribution</p> <p>-Compliance with the Standards and Regulations</p> | <p>-Site Manager</p> <p>-SHE Officer / EHO</p> |
| Fire outbreaks | Accidental fire outbreaks risks | <p>-Warning signs of “No Smoking” and “No open fires” should be clearly written in English and pasted at site entrance.</p> <p>-Continue with the regular servicing of site fire extinguishers, and personnel trained on how to use extinguishers (basic fire firefighting skills).</p> <p>-No open fires should be created onsite.</p> <p>-The contact details of fire services should be readily and visibly displayed onsite.</p> <p>-All personnel must be sensitised about responsible fire protection measures and good housekeeping such as the</p> | <p>-No open fires by site personnel or visitors</p> <p>-Fire extinguishers are readily available and up to date with service</p> | <p>-SHE Officer / EHO</p> <p>-Site Operator</p> |

| 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 | <ul style="list-style-type: none"> -The Plant fence should be upgraded and maintained. -The site should be equipped with 24-hour security surveillance in case of opportunistic activities such as theft and vandalism. This should include a CCTV surveillance for improved supervision and security | -The site fence and security measures are in place. | -Site Manager |
| Waste generation and management | Environmental Pollution (littering) | <ul style="list-style-type: none"> -The issue of wind-blown waste from the dumpsite to the Plant should be addressed by ensuring that the waste is contained in the dumpsite and not scattered on and around the Plant and surroundings -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 Town's waste disposal site on a weekly basis. -Waste separation at source should be enforced by availing clearly labelled or differently coloured general waste (paper, plastic, organic waste) rubbish bins at all site areas. -A penalty system for irresponsible disposal of waste on site and anywhere in the area should be implemented. | <ul style="list-style-type: none"> -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 | <ul style="list-style-type: none"> -Site Manager -Proponent: Solid waste division (dumpsite management) -SHE Officer / EHO |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|--------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| | Wastewater generated by workers and visitors (sanitation) | <ul style="list-style-type: none"> -Provision of sufficient ablution facilities (washrooms and toilets) for project workers and visitors. -Open defecation on /around the site is strictly prohibited | Adequate toilet facilities on site. | -Site Manager |
| | Hazardous waste | <ul style="list-style-type: none"> -All hazardous materials shall 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). -Hazard identification signage shall 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. -As an emphasis on the preceding point, empty hazardous substance containers should not be disposed of anywhere on the project site or its surrounding, but instead they should be kept at a designated storing place on site until such time that they can be safely taken to the nearest approved hazardous waste sites. | <ul style="list-style-type: none"> -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 generated on site is kept on site -All waste disposal permits from relevant authorities are available on site | -SHE Officer / EHO |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|--------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <p>Vehicular Traffic</p> | <p>Traffic safety</p> | <ul style="list-style-type: none"> -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. -The site access road(s) should be upgraded to an unacceptable standard to be able to accommodate project related vehicles and access permits obtained from the Roads Authority. -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. -Vehicle's drivers should not be allowed to operate vehicles while under the influence of alcohol. -Sufficient parking area for all project vehicles should be provided for and clearly demarcated on sites. -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. | <ul style="list-style-type: none"> -Site access road permits obtained, and requirements fulfilled -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. | <ul style="list-style-type: none"> -Site Manager -SHE Officer / EHO |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|---------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| 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 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 where 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. -Project 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 offsite (at filling stations in Town). -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 |
| Biodiversity | Loss Fauna and Flora | -Avoid the harvesting of the already scarce desert flora. -Avoid the killing or hunting of animals (birds, reptiles, mammals) encountered onsite or within site proximity. -Environmental awareness on importance of biodiversity preservation should be provided to personnel and contractors. | -No killing or disturbance of biodiversity | -SHE Officer / EHO |

| Aspect | Impact | Management and Mitigation Measure(s) | Key Performance Indicator (KPI) | Implementation Responsibility |
|--------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Archaeology and heritage | Accidental disturbance of archaeological or heritage objects | -During site maintenance, the contractor should be sensitized to exercise and recognize Heritage “Chance Finds Procedure (CFP)” – <u>Appendix A</u> . -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 |

6.3 Decommissioning of the Treatment Ponds and Plant

Table 6-2 presents the measures to be implemented for the decommissioning of the Plant structures and associated infrastructure (if it ever comes to that) to meet the requirements of the Environmental Management Act. It is crucial for the Proponent to ensure that they make provision of both financial and technical resources for decommissioning.

Given the above, it is therefore crucial for the Town Council to make provision for both financial and technical resources for site decommissioning and rehabilitation in the financial budget.

Table 6-2: The Management Plan Actions for the Demolition of sewage ponds, Plant structures and associated infrastructure

| Aspect | Mitigation Measure(s) | Completion criteria |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Existing pond structures | <p><u>DEMOLITION OF SEWAGE PONDS AND TANK</u></p> <p>-A progressive demolition of the sewage ponds and tanks should be done once the effluent has been emptied to avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into the ground (groundwater).</p> <p><u>The decommissioning of these ponds will entail the following:</u></p> <p>-The treatment of liquids as well as removal and disposal of biosolids accumulated at the bottom of the ponds.</p> <p>-Proper demolition, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities.</p> <p>-The demolition of ponds should also be planned and done in consultation and collaboration with the Water Environment Division at the Department of Water Affairs of MAWLR to ensure compliance to Regulations pertaining to handling Wastewater. If required, a Permit should be applied for and obtained from the Division.</p> <p>-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. Please refer to the Code of Practice: Volume 6 – Wastewater Re-Use of July 2012.</p> | <p>-A Wastewater treatment specialist should be involved in this process</p> <p>-Sign off by the Wastewater treatment specialist and Department of Water Affairs</p> |
| Existing contaminated Soils | <p>-Undertake a site-wide contaminated soil to determine the nature and extent of contamination and to identify appropriate remediation measures.</p> <p>-Rehabilitate contaminated by excavating contaminated material to a depth of 300 mm and remove and dispose of at the nearest capable landfill site and approved waste management facility.</p> | <p>-A Soil Scientist should be appointed to undertake a full Soil Contamination Assessment and thus, recommending site specific remediation measures</p> <p>-Sign-off by the Soil Scientist upon completion of the rehabilitation/remediation of contaminated soils</p> |

| Aspect | Mitigation Measure(s) | Completion criteria |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| | <p>-Treat organic contamination by means of biological remediation via the establishment of a bioremediation site and monitor soil quality against a selected control site.</p> | <p>to ensure successful exercise and safety of site soils</p> |
| <p>Stockpiled topsoil, and disturbed areas</p> | <p><u>POST-USE DECOMMISSIONING</u></p> <p>-All site excavated pits and trenches and depressions (such as dry beds) should be backfilled.</p> <p>-The stockpiled topsoil on and around the site due to the project activities should be levelled.</p> <p>-Provision of both financial and technical resources for site rehabilitation should be made.</p> | <p>-All stockpiled soils are levelled, and pits/depressions backfilled</p> |
| <p>Surface infrastructure and structures</p> | <p><u>Service infrastructure to be removed</u></p> <p>-All infrastructures and structures that will no longer be required onsite should be dismantled and removed from site. These structures include buildings, storage tanks, onsite offices, ablution facilities and other supporting structures erected for the project. These will be transported to designated storage facilities offsite.</p> <p>-All project related vehicles, machinery, and equipment should be removed from site to designated parking and storage sites off site, respectively.</p> <p>-All access roads that may have been created for the project and no longer required further, should be closed off.</p> | <p>-All other infrastructure decommissioned to ground level and removed from site</p> |
| <p>Waste (general and hazardous)</p> | <p>-All waste storage containers should be removed, and waste disposed of at designated and approved waste management sites.</p> <p>-Decontaminate hazardous waste storage tanks and containers at a dedicated decontamination bay at the nearest capable facilities. A pre-disposal permit should be obtained from the facility operator.</p> <p>-Remove oil drums and petroleum products off site for resale/use.</p> | <p>-All waste and associated containers removed from site and transported to designated and authorized sites</p> |

7 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 (every 6 months throughout the project) as required by the Environmental Commissioner on 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.

8 LIST OF REFERENCES

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APPENDIX A: 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 objectmust 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:

Action by person identifying archaeological or heritage material:

- 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

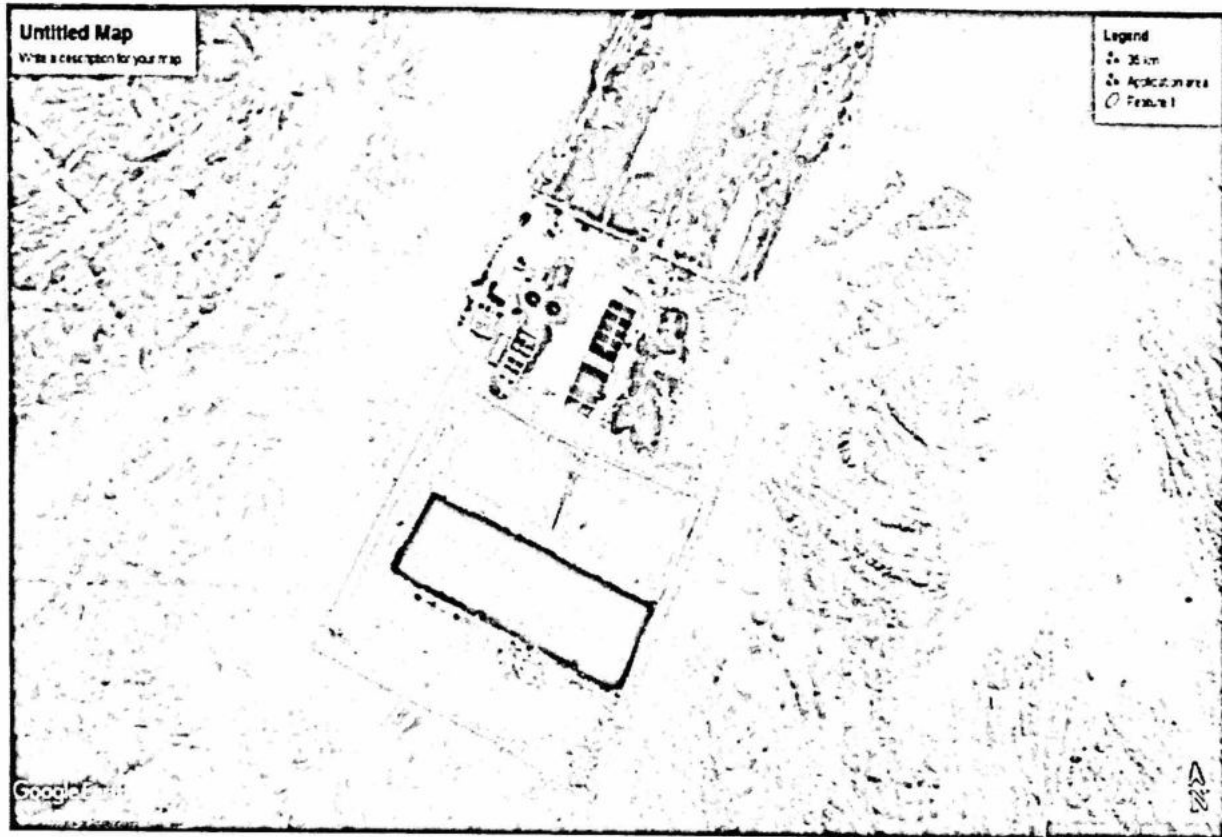
- a) Inspect site and confirm addition to project GIS
- b) Advise NHC and request written permission to remove findings from work area
- c) Recovery, packaging and labelling of findings for transfer to National Museum

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.

APPENDIX B: EFFLUENT TREATMENT PLANT MAINTENANCE REPORT

LÜDERITZ EFFLUENT PLANT MAINTENANCE REPORT



JANUARY 2021

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1. INTRODUCTION

The Lüderitz effluent treatment plant was built and put into operation towards the end of 2007 to provide a new and modern wastewater treatment facility for the town. This decision was driven by the general growth experienced at the time coupled with the inability of the oxidation ponds situated in the vicinity of Area 7 to produce a final effluent conforming to the latest wastewater discharge legislation. These oxidation Ponds are no longer in use.

The plant was issued with a five (5) year permit which allows it to discharge treated effluent into the natural environment. The permit was issued on 15 July 2016 and lapses on 31 July 2021. The Lüderitz Town Council must re-apply to the Ministry of Agriculture Water & Forestry provided that all conditions are met.

The purpose of this report is to provide an overview of the processes and motivate for capital to maintain the infrastructure at the effluent plant in order to comply with the latest wastewater legislation.

2. BACKGROUND

The treatment plant is designed to treat a total of 2000m³ per day of raw sewage from Town in an Activated Sludge process. Inflow to the plant is split into two trains which each treat 50% of the incoming flow with the Provision for Biological Nutrient Removal (BNR). The plant is fitted with nitrate rich, return activated sludge and waste activated sludge pumps and controls to ensure efficient nitrification/ denitrification takes place and phosphate removal can be achieved.

The treatment plant incorporates the following unit processes in its operation:

- a) Inlet works with mechanical screen, manual bypass hand screen and sluice gates
- b) Two (2) anaerobic/ oxidation ponds.
- c) Two (2) BNR Activated sludge reactors.
- d) Two (2) Secondary Clarifiers.
- e) Return Activated Sludge and waste Activated Sludge (RAS/WAS) pump station.
- f) Final disinfection using chlorine gas, in chlorine contact Tank.
- g) Sludge drying Beds.

3. MAINTENANCE REPORT

The maintenance report follows in sequence of the unit processes above.

- a) **Inlet works with mechanical screen, manual bypass hand screen and sluice gates.**

The inlet channel is fitted with a Huber rotating, mechanical screen that can handle a maximum incoming flow of 85l/sec. The function of the screen is to remove solids, compress it and discharge it into a skip container.

The Mechanical Screen was out of operation for more than five (5) years. In November 2020 it was removed completely for inspection and repairs.

Pump Station No.6 discharge raw sewage into a catchment manhole to which Five (5) intermediate manholes are connected. These manholes need urgent replacement as

some of the sidewalls has collapsed causing a safety hazard and environmental hazards.

The overall plant has Twenty-seven (27) Precast manholes of which 90% of lids must be replaced.

Maintenance

- Repair mechanical screen.
- Replace Five (5) concrete manholes completely on the inlet line to the screen.
- Replace Four (4) Manholes completely from the screen to pond 1.
- Replace 24 Manhole lids.
- Repair manholes where needed.

b) Anaerobic/ oxidation ponds

There are Two (2) Anaerobic ponds, both have;

- Surface area of 545m²
- Depth of 3m
- Volume of 1635m³

At this moment one dry bed is in operation and must be desludged every 1 to 2 years. This is because the estimated sludge production based on the design flow and load is 3-4m³ per day.

Each Pond is fitted with a floating draw-off weir capable of handling 35l/sec. The outlet of the weir discharges into a 12m composite rubber pipe connected to a 250mm nominal diameter (DN) gate valve which is used to isolate the flow from the ponds.

Maintenance

Pond 1

- The valves from both ponds needs replacement. The valve from Pond 2 was removed and installed at Pond 1. The valves were in use for about 12 years.
- Repair of wooden fence on southern side of the pond.
- Desludging of pond 1.
- Replace discharge pipeline with UPVC.
- Replace Lifebuoy donuts.

Pond 2

- Replace isolation valve.
- Waterproofing and minor concrete repairs to the dam walls.
- removal of excess sand.
- Repair of wooden fence on eastern side of the pond.
- Overflow pipeline must be cleaned and manholes restored.
- Replacement of mild steel hand- railing to stairs
- Replacement of life-buoy donut.

c) Biological nutrient removal (BNR) Activated sludge reactors.

The plant has Two (2) biological nutrient removal activated sludge reactor modules (basins) and identify as Reactor 1 and Reactor 2 each with a capacity of 880m³. Each reactor consists of an anaerobic- anoxic- and aerobic compartment.

The outflow from the anaerobic pond is discharged into the first anaerobic zone of the reactor and equally mixed with the denitrified return activated sludge. This mainstream flows through the anoxic zone and then into the aerobic zone where aerators add oxygen to it.

The nitrate rich recycle pumps return mixed liquor from the end of the aerobic zone back to the first anoxic zone. Valves are provided to direct the liquor. The denitrification is improved if the anoxic zone is increased but biological phosphate removal is reduced and vice versa.

The BNR Reactor basins are fitted with three (3) mixers in each anaerobic and anoxic zones of the BNR reactors which operates continuously in each tank. The oxygen that is added to the liquor is controlled by means of varying the immersion depth of the aerators. This is achieved via the tilting overflow weir.

Each basin is equipped with two(2) sensors each which measures the dissolved oxygen of the liquor. The readings from the two sensors are averaged and this value is used to control the tilting weir. The dissolved oxygen level in the basin must be maintained between 1.5mg/l to 2.5mg/l. if it is less the tilting weir will close to increase the water level in the tank increasing the immersion level of the aerators. The opposite happens if the dissolved oxygen exceeds 2.5mg/L.

Maintenance

- Minor concrete repairs to the structure.
- Replacement of Four (4) Life buoy Donuts.
- Six (6) Stirrers must be cleaned and motors maintained.
- Reactor 1 and 2 have 2 Aerators each. One Aerator in Reactor 1 is running on maintenance and is controlled manually. It must be fixed to function automatically. The second aerator functions normal. Normal routine maintenance must be done to the motors, gearboxes etc. This must be done every 20 days.
- In Reactor 2, The one aerator runs on hand. It is bypassed. It must also be fixed to run automatically and communicate with the SCADA system. The second Aerator makes noise when running. It must be inspected to determine whether it needs maintenance, repairs or replacement. The motors also need routine maintenance.
- The dissolved oxygen sensors/ analysers are dysfunctional for reactor two and needs urgent replacement. For reactor 1 only one analyser is working. This means three (3) of the sensors must be replaced and calibrated with the SCADA system. This also have a direct effect on the operation of the tilting weir because the average readings of the dissolved oxygen control the operation of the tilting weir. If the sensors are dysfunctional the tilting weir cannot operate accordingly.

- The two (2) tilting Weirs needs inspection, maintenance or replacement. This can be done after the analysers are restored. The tilting Weirs are currently operated manually which directly impacts the quality of the liquor in the basins.

d) The Secondary Clarifiers

The plant has two (2) secondary clarifiers each with the following geometry

- Diameter= 12m
- Depth= 4m

The function of the clarifiers is to allow the biomass from the activated sludge reactors to settle out.

Each settler is fitted with a rotating bridge with a sludge scraping mechanism.

Maintenance

Clarifier 1

- Maintenance must be done on the central sludge hopper every 12 Months.
- The motors need to be serviced
- The motor runs automatically
- Bridge must be painted.
- Replace lifebuoy donut

Clarifier 2

- Maintenance must be done on the central sludge hopper every 12 Months.
- The motors need to be serviced
- The motor runs on bypass and must be fixed to run automatically and communicate with the SCADA.
- Bridge must be painted.
- Replace lifebuoy donut.

e) Waste activated sludge/ return activated sludge (WAS/RAS) Pump station

The pump station is equipped with Four (4) activated sludge pumps (RAS) pumps. One on duty and one on standby.

The waste activated sludge section is equipped with two (2) (WAS) pumps. The function of the WAS pump is to control the sludge-age of the Activated sludge reactor. The WAS pumps discharge into the drying beds.

Maintenance

- Two (2) Submersible Pumps are running. One for each reactor.
- Two Standby pumps must be replaced. One Pump must be kept in stock for breakdown purposes.
- The division is looking into a dry well installation setup in the near future.

f) Final disinfection using chlorine gas, in chlorine contact Tank.

Disinfection is achieved by using chlorine gas in 70Kg bottles. Two bottles are connected to the vacuum gas chlorination system. The bottles are housed on an electronic scale and each bottle fitted with a gas chlorinator. An automatic Change over device ensures that when one bottle is empty the second bottle will be put automatically in operation. The chlorine is abstracted from the bottle with a chlorine regulator. The booster pump abstracts water from the contact chamber and provides motion for the vacuum system. The water is filtered in a pressure sand filter before it is pushed through the injector and released at the overflow weir at the inlet of the chlorine contact chamber.

The chlorine should be in range of 2 to 4mg/l cl₂.

A residual chlorine concentration, measured at the final overflow weir of the chlorine contact chamber must be 0.1mg/l and must be maintained at all times to ensure that proper disinfection of the final water before being discharged into the environment.

Maintenance

- The pressure Tank of the booster pump is punctured and must be replaced.
- The Irrigation pump installation must be done.

g) Sludge drying Beds.

Sludge generated during the biological process is wasted every day. The plant has 10 dry beds with a geometry of;

- 8m*20m= 160m²
- 300mm depth (+200mm freeboard)

The dry beds are used on a rotational basis. They are filled through the central inlet channel and a particular bed is filled by opening the hand sluice to that particular dry bed. When full the bed is left to dry out. The dry sludge is manually removed with a

shovel and wheelbarrowed and stockpiled. The same dry beds are used to desludge the oxidation pond by using the mobile pump to pump the sludge from the oxidation ponds to the dry beds.

Maintenance

- Minor Concrete repair on wall surfaces.

h) Other Requirements

- The Jackal proof fence at the southern side of the plant is broken at various sections and need fixing.
- Due to a depression on the south eastern side, fine sand deposits accumulates and the fence is buried below the surface. This allows wild animals into the premises as well as unauthorized people from accessing the facilities. It was recommended that the fence be fixed and a second fence be constructed on the inside which is slightly taller to trap waste blown over the mountains.
- A security room be constructed at the entrance to the facility.
- CCTV surveillance be installed for improved supervision and security.

- The Air-conditioners in the building to be inspected, serviced, or replaced.
- The Back-Up Generator be repaired which is out of order since January 2020. ^{repaired}
- The Building needs to be painted and all doors maintained.
- A carport must be constructed at the entrance to the building. The building will act as a wind shield to protect the structure.
- Laboratory analysis tests are done once a week or once every two weeks because of poor stock levels. It is a requirement that LAB analysis and tests be done at every shift.
- Upgrading of the SCADA software and integration of Sewer Pumpstations on the SCADA.
- Continuous development training programs for staff be implemented.

4. Financial breakdown

The Effluent plant has identified critical areas which need immediate intervention. The overall budget for the treatment plant and the sewage division has been depleted for the financial year 2020/2021 hence the need for maintenance.

The activities listed on the financial breakdown are estimated values which was projected to guide the budget of the future.

The division needs close to N\$ 300,000 for the FY 2021/2021 in order to address maintenance needs. The Maintenance works can be executed within the remaining period of the financial year.

5. RECOMMENDATIONS

- 1) Management to note that the plant be operated by skilled personnel to ensure that the final effluent discharged meets the requirements of wastewater legislation.
- 2) Management to implement continuous training development programs for the staff at the effluent treatment plant. Various online training platforms are available. Bilateral agreements between LTC and City of Windhoek can also be maximised.
- 3) Management to solicit funds for the remainder of the financial year for maintenance and compliance.
- 4) Management to look into the operations at the dumpsite because of the waste blown towards the effluent plant.