APP-003502

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED NEW OXIDATION PONDS AT KAI//GANAXAB YOUTH CENTRE, MARIENTAL

CONSULTANT:

Matrix Consulting Services
P.O. Box 25824 Windhoek
Tel: +264-61 224 197
Fax: +264-61 212 165
info@matrixconsultingcc.com

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PROPONENT:

Namibia Training Authority
PO Box 70407, Windhoek
Tel: (+264) 61 207 8565
Fax: (+264) 61 207 8137

NAMIBIA TRAINING AUTHORITY

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PROJECT DETAILS

TEAM MEMBERS		
NAME	**POSITION**	**COMPANY**
M. Shippiki	Environmental Hydrogeologist	Matrix Consulting Services
D. Bille	Environmental Technician	Matrix Consulting Services

CLIENT:	**Namibia Training Authority (NTA)** **P.O. Box 70407, Windhoek**
ENVIRONMENTAL CONSULTANT	Matrix Consulting Services Mize Shippiki (B.Sc (Hon) Hydrogeology, UOVS) Environmental Hydrogeologist P.O. Box 25824 Windhoek Tel: +264-61 224197 Fax: +264-61 212165
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CLEARANCE ISSUED TO:

Please note that the environmental certificate should be made out to the proponent:

Namibia Training Authority
P.O. Box 70407
Windhoek
Tel: +264-61 207 8565
Fax: +264-61 207 8137

However, please forward the clearance certificate to the consultant:

Matrix Consulting Services
P. O. Box 25824
Windhoek
Tel: +264-61 224197
Fax: +264-61 212165

GLOSSARY OF TERMS

Project area - Refers to the entire study area encompassing the total area as indicated on the study area map.

Project site - Refers to the geographical setting (piece of land) on which the proposed development is to be located.

Assessment - The process of collecting, organising, analysing, interpreting and communicating information relevant to decision making.

Proponent (Applicant) – means a person who intends or undertakes a project, policy, programme or plan.

Significant Impact - means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sewage - Sewage is water-carried waste, in solution or suspension, which is intended to be removed from a community.

Environmental Clearance Certificate - This Certificate obtained from the Ministry of Environment and Tourism (Directorate of Environmental Affairs) approving the EIA study and providing clearance to the proponent to initiate work.

Alternatives - A possible course of action, in place of another, that would meet the same purpose and need but which would avoid or minimize negative impacts or enhance project benefits. These can include alternative locations/sites, routes, layouts, processes, designs, schedules and/or inputs. The "no-go" alternative constitutes the 'without project' option and provides a benchmark against which to evaluate changes; development should result in net benefit to society and should avoid undesirable negative impacts.

Cumulative Impacts - in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Evaluation – means the process of ascertaining the relative importance or significance of information, the light of people's values, preference and judgements in order to make a decision.

Environment – As defined in the Environmental Policy and Environmental Management Bill of Namibia - "land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, paleontological or social values".

Environmental Impact Assessment (EIA) – process of assessment of the effects of a development on the environment.

Environmental Management Plan (EMP) - A working document on environmental and socio-economic mitigation measures, which must be implemented by several responsible parties during all the phases of the proposed project.

Environmental Clearance Certificate - This Certificate obtained from the Ministry of Environment and Tourism (Directorate of Environmental Affairs) approving the EIA study and providing clearance to the proponent to initiate work.

Environmental Assessment Practitioner - A person designated by a proponent to manage the assessment process.

Hazard - Anything that has the potential to cause damage to life, property and/or the environment. The hazard of a particular material or installation is constant; that is, it would present the same hazard wherever it was present.

Interested and Affected Party (I&AP) - any person, group of persons or organization interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

Proponent (Applicant) – means a person who intends or undertakes a project, policy, programme or plan.

Significant Impact - means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sustainable Development - "Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs and aspirations" – the definition of the World Commission on Environment and Development (1987). "Improving the quality of human life while living within the carrying capacity of supporting ecosystems" – the definition given in a publication called "Caring for the Earth: A Strategy for Sustainable Living" by the World Conservation Union (IUCN), the United Nations Environment Programme and the World Wide Fund for Nature (1991).

Interested and Affected Party (I&AP) - any person, group of persons or organization interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

1. BACKGROUND AND INTRODUCTION

Namibia Training Authority (NTA). has commissioned an Environmental Impact Assessment (EIA) for the proposed construction and operation of the Kai//Ganaxab Oxidation Ponds (24.56868°S; 17.89703°E) at the Kai//Ganaxab Youth Skills Centre, in Mariental, Hardap Region.

The Kai //Ganaxab Youth Skills Training Centre is situated approximately 10km west of Mariental. The centre has been under the management and administration of the Ministry of Sport, Youth, and National Service (MSYNS) and has been offering skills training programmes to out-of-school and unemployed young people from all corners of Namibia.

Matrix Consulting Services was appointed to undertake the Environmental Impact Assessment of the proposed oxidation ponds. This study will enable decision makers to make an informed decision regarding the development and make sure it does not have significant impacts on the environment and that they are mitigated. The environmental scoping assessment was conducted to comply with Namibia's Environmental Assessment Policy and the Environmental Management Act.

1.1. Project Rationale

The recent population growth at the centre has resulted into extensive waste generation including wastewater effluent. Inadequate management of this wastewater is harmful to the environment and human health. It is thus imperative that measures are put in place in order to ensure effective management of sewage-effluent.

The proposed oxidation pond treatment process is natural, as it uses microorganisms such as bacteria and algae. This makes the method of treatment cost-effective in terms of its construction, maintenance, and energy requirements.

Potential spin-offs:

- Employment: The creation of approximately 20 temporary jobs is expected during the construction phase. It is estimated that the new jobs will improve the livelihoods of the new workers and their families. Given the unemployment rate of 35% in the region, this in itself is regarded as a significant benefit to the socio-economic situation in the region (Census Regional Profile, Namibia Statistics Agency, 2011).
- Skills development: As the construction and operation of the development requires specialised work and skills it can be expected that experts will be training locals in certain skills during development and operation.
- Contribution to economic development (e.g. supply of materials and goods for construction purposes; new businesses, employment etc.).
- Technology transfer to Namibia: The new facility includes state-of-the-art technology. The construction, operation, maintenance and support of these new technologies will expose local artisans and industries to these technologies. This can have a positive effect on the area.

- General enhancement of the quality of life at the centre and at the town, especially the immediate businesses and residence; and

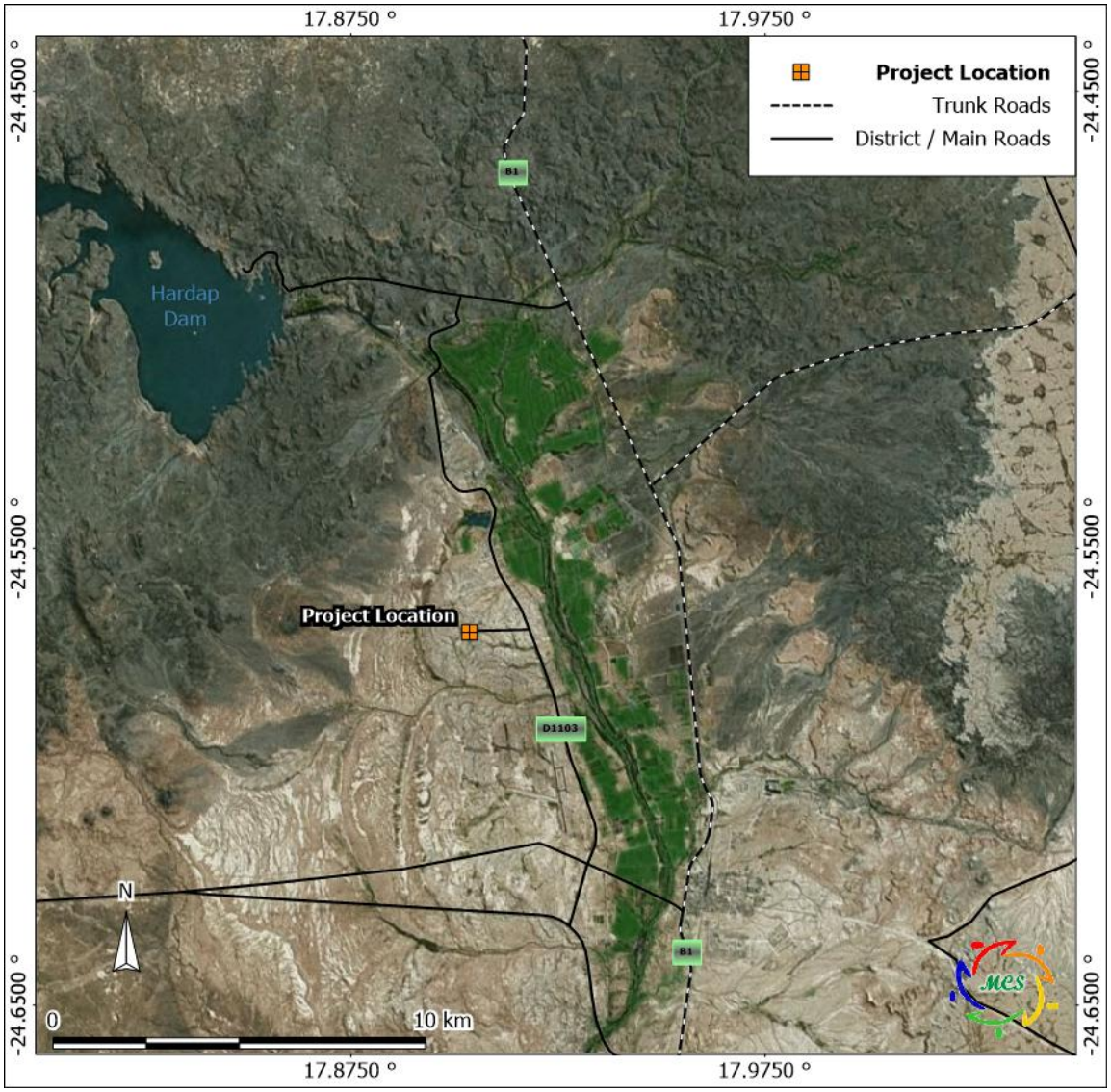

Figure 1. Project location (24.56868°S; 17.89703°E)

1.2. Project Phases

The project is made up of 3 phases, namely the construction, operation and possible decommissioning phase. Activities involved in all phases are as follows:

Construction Phase:

- Site preparation.
- Excavation and construction of ponds.
- Construction of spill control measures.
- Progressive rehabilitation.

Operational Phase:

- Reticulation of waste to oxidation ponds.
- Storage and handling of waste at the oxidation ponds.

Decommissioning Phase:

- Removal of all infrastructure not reused during future use of land; and
- Rehabilitation of the land.

2. TERMS OF REFERENCE

Namibia Training Authority (NTA) has commissioned an Environmental Impact Assessment (**EIA**) for the proposed oxidation ponds, in Mariental. The proposed oxidation ponds will be located at 24.56868°S; 17.89703°E.

Matrix Consulting Services was appointed to undertake the Environmental Impact Assessment of the proposed Kai//Ganaxab Oxidation Ponds. This study will enable decision makers to make an informed decision regarding the development and make sure it does not have significant impacts and that they are mitigated. The environmental impact assessment was conducted to comply with the Environmental Assessment Policy (1995) and the Environmental Management Act (2007) and its regulations of 2012.

3. ENVIRONMENTAL STUDY REQUIREMENTS

According to the Environmental Management Act no. 7 of 2007, the proponent requires an environmental clearance from the Ministry of Environment and Tourism (Department of Environmental Affairs) to undertake of the construction of the oxidation ponds. The certificate means that the Ministry of Environment and Tourism is satisfied that the activity in question will not have an unduly negative impact on the environment. It may set conditions for the activity to prevent or to minimise harmful impacts on the environment.

The proposed development is listed as a project requiring an environmental assessment as per the following listed activities in the Environmental Management Act no 7 of 2007 and its Guidelines (06 February 2012):

Table 1. Activities identified in the EIA Regulations relevant to proposed project

Activity Description and No(s):	Description of Activity	Activity Triggers
Activity 2.1 Waste Management, Treatment, Handling and Disposal Activities	The construction of facilities for waste sites, treatment of waste and disposal of waste.	The project entails the construction of a wastewater treatment facility
Activity 8.9 Water resource developments	Construction of industrial and domestic wastewater treatment plants and related pipeline systems.	The construction of oxidation ponds at //Kai Ganaxab Youth Skills Training Centre.

Activity 8.9 Water resource developments	Construction and other activities within a catchment area.	There is a possibility of some construction taking place within catchment areas.
Activity 9.2 Hazardous Substance Treatment, Handling and Storage	Any process or activity which requires a permit, licence or other form of authorisation, or the modification of or changes to existing facilities for any process or activity which requires an amendment of an existing permit, licence or authorisation or which requires a new permit, licence or authorisation in terms of a law governing the generation or release of emissions, pollution, effluent or waste.	The project requires authorization from the relavent authorities.
Activity 10.1 (a) (Infrastructure)	The construction of – Oil, water, gas and petrochemical and other bulk supply pipelines.	The proposed project includes the installation of bulk services

4. DESCRIPTION OF ALTERNATIVES

4.1 No-Go Alternative

The no-development alternative is the option of not establishing the oxidation ponds. Should the proposed development not take place, proper management of sewage-effluent and development of the area in general will be hindered. The No-development option is thus not considered to be a feasible alternative at this stage.

4.2 Site Alternative

The project site is generally suitable for this type of operation. The environmental footprint is expected to be minimal as the project site is already disturbed. The possible impacts at the project location, both environmental and socio-economic, are of such a nature that they can be mitigated through good practice and compliance to the EMP.

The proximity of the Fish River (approximately 2km east) to the site increases the risk of surface water contamination and pollution from leaking oxidation ponds; however the risk will be lowered by the design and management of the facility. Proper containment mechanisms installed should be able to contain any leakages that might occur during the operation of the facility.

5. SCOPE

The scope of the EIA aims at identifying and evaluating potential environmental impacts emanating from the construction, operations and possible

decommissioning of the proposed oxidation ponds. Relevant data have been compiled by making use of secondary sources and from project site visits. Potential environmental impacts and associated social impacts will be identified and addressed in this report.

The environmental impact assessment report aims to address the following:

a) Identification of potential positive and negative environmental impacts.
b) Provide sufficient information to determine if the proposed project will result in significant adverse impacts.
c) Identification of "hotspots" which should be avoided where possible due to the significance of impacts.
d) Evaluation of the nature and extent of potential environmental impacts
e) Identify a range of management actions which could mitigate the potential adverse impacts to required levels.
f) Provide sufficient information to the Ministry of Environment to make an informed decision regarding the proposed project.
g) Conduct a public participation exercise.
h) Present and incorporate comments made by stakeholders.

6. METHODOLOGY

The following methods were used to investigate the potential impacts on the social and natural environment due to the construction and operation of the oxidation ponds:

a) Information about the site and its surroundings was obtained from existing secondary information and site visits.
b) Neighbours, interested and affected Parties (I&APs) were consulted and their views, comments and opinions are presented in this report.

7. STATUTORY REQUIREMENTS

The EIA process is undertaken in terms of Namibia's Environmental Management act no. 7 of 2007 and the Environmental Assessment Policy of 1995, which stipulates activities that may have significant impacts on the environment. Listed activities require the authorisation from the Ministry of Environment and Tourism (DEA). Section 32 of the Environmental Management Act requires that an application for an environmental clearance certificate be made for the listed activities. The following environmental legislation is relevant to this project:

I. The Namibian Constitution

The Namibian Constitution has a section on principles of state policy. These principles cannot be enforced by the courts in the same way as other sections of the Constitution. But they are intended to guide the Government in making laws which can be enforced.

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

II. Environmental Management Act No.7 of 2007

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

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

The Environmental Management Act has three main purposes:

(a) to make sure that people consider the impact of activities on the environment carefully and in good time

(b) to make sure that all interested or affected people have a chance to participate in environmental assessments

(c) to make sure that the findings of environmental assessments are considered before any decisions are made about activities which might affect the environment.

Line Ministry: Ministry of Environment and Tourism

III. The Water Act (Act No 54 of 1956)

The Water Act No. 54 of 1956 as amended, aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users.

The Act broadly controls the use and conservation of water for domestic, agricultural, urban and industrial purposes; to control, in certain respects, the use of sea water; to control certain activities on or in water in certain areas; and to control activities which may alter the natural occurrence of certain types of atmospheric precipitation.

IV. Water Resources Management Act of Namibia (2004) *(Guideline only)*

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

Line Ministry: Ministry of Agriculture, Water Affairs and Forestry

V. Environmental Assessment Policy of Namibia (1995)

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

All listed policies, programmes and projects, whether initiated by the government or the private sector, should be subjected to the established EA procedure as set out in Figure 2.

Line Ministry: Ministry of Environment and Tourism

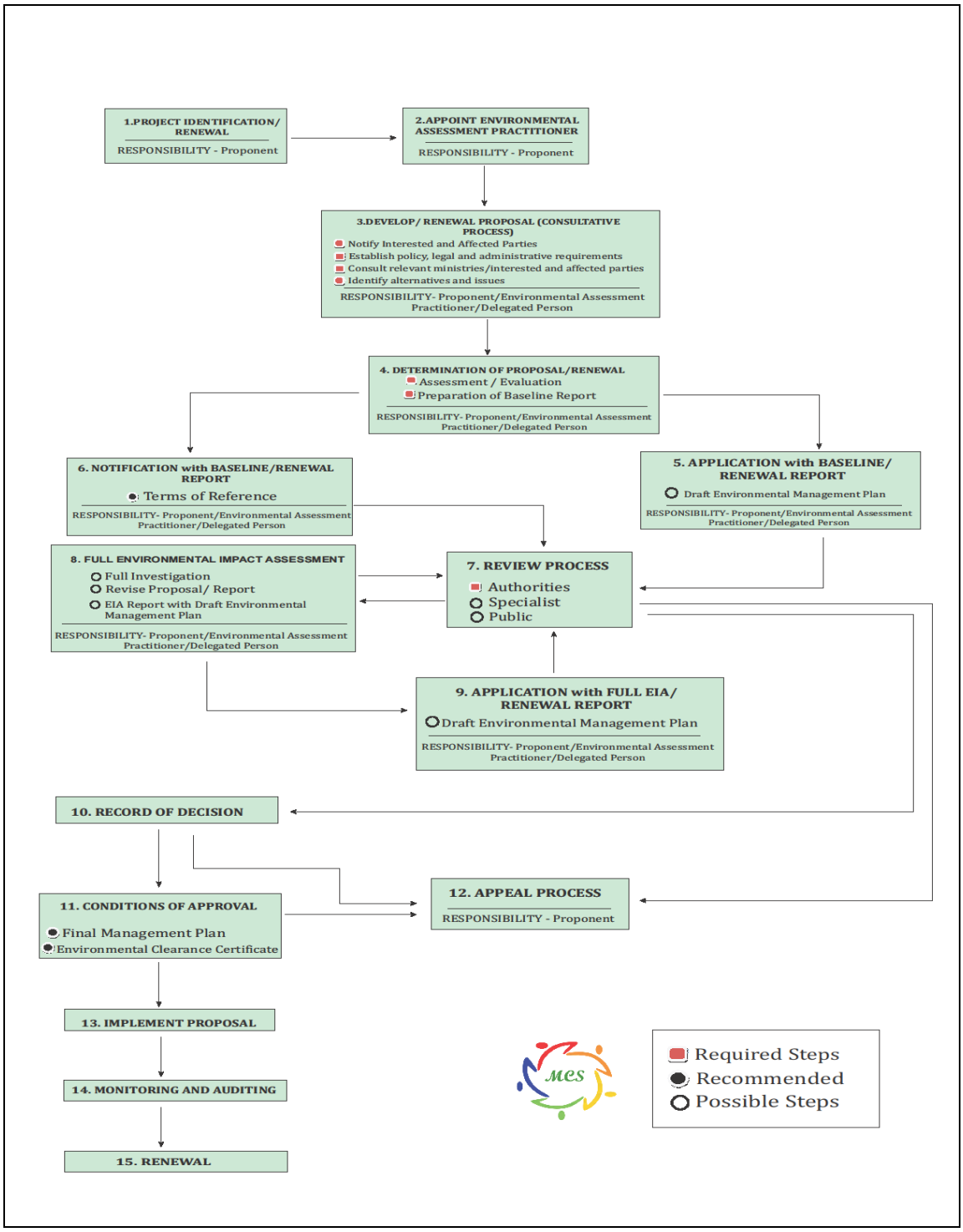

Figure 2: Environmental Assessment Procedure of Namibia *(Adapted from the Environmental Assessment Policy of 1995)*

Apart from the requirements of the Environmental Assessment Policy, the following sustainability principles needs to be taken into consideration, particularly to achieve proper waste management and pollution control:

- ✓ **Cradle to Grave Responsibility**

This principle provides that those who manufacture potentially harmful products should be liable for their safe production, use and disposal and that

those who initiate potentially polluting activities should be liable for their commissioning, operation and decommissioning.

- ✓ **Precautionary Principle**

There are numerous versions of the precautionary principle. At its simplest it provides that if there is any doubt about the effects of a potentially polluting activity, a cautious approach should be adopted.

- ✓ **The Polluter Pays Principle**

A person who generates waste or causes pollution should, in theory, pay the full costs of its treatment or of the harm, which it causes to the environment.

- ✓ **Public Participation and Access to Information**

In the context of environmental management, citizens should have access to information and the right to participate in decisions making.

VI. Draft Pollution Control and Waste Management Bill *(Guideline only)*

The proposed oxidation ponds at Kai//Ganaxab Youth Centre, only applies to Parts 2, 7 and 8 of the Bill.

Part 2 stipulates that no person shall discharge or cause to be discharged any pollutant to the air from a process except under and in accordance with the provisions of an air pollution licence issued under section 23. It further provides for procedures to be followed in licence application, fees to be paid and required terms of conditions for air pollution licences.

Part 7 states that any person who sells, stores, transports or uses any hazardous substances or products containing hazardous substances shall notify the competent authority, in accordance with sub-section (2), of the presence and quantity of those substances.

Part 8 calls for emergency preparedness by the person handling hazardous substances, through emergency response plans.

VII. Atmospheric Pollution Prevention Ordinance of Namibia (No. 11 of 1976)

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

Line Ministry: Ministry of Health and Social Services

VIII. Hazardous Substances Ordinance No. 14 of 1974

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

Line Ministry: Ministry of Health and Social Services

IX. Atmospheric Pollution Prevention Ordinance of Namibia (No. 11 of 1976)

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

Line Ministry: Ministry of Health and Social Services

X. Soil Conservation Act (No.76 of 1969)

The Act advocates for the prevention and combating of soil erosion, conservation, improvement and manner of use of soil and vegetation, and protection of water resources.

XI. Public Health Act 36 of 1919 and Subsequent Amendments

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

- ✓ any dwelling or premises which is or are of such construction as to be injurious or dangerous to health or which is or are liable to favour the spread of any infectious disease;
- ✓ any area of land kept or permitted to remain in such a state as to be offensive, or liable to cause any infectious, communicable or preventable disease or injury or danger to health; or
- ✓ any other condition whatever which is offensive, injurious or dangerous to health.
- ✓ Potential impacts associated with the upgrade and operations are expected to include dust, air quality impacts, noise nuisance and smoke emissions.

Line Ministry: Ministry of Health and Social Services

8. PROPOSED INSTALLATIONS

The proposed oxidation ponds are designed to total volumetric inflow into the pond calculated as 85% of the water supply for 500 people, which is 44m3/day. The complete pond system for sewage treatment at Kai Ganaxab Youth Training Centre consists of 2 anaerobic pond, followed by a facultative pond and evaporation pond.

- Anaerobic ponds receive all the raw sewage (primary treatment) and will be constructed deeper than ponds downstream. They have a retention period of 2 to 5 days and might release odour but this can be mitigated by alkaline methane fermentation. The ponds are to be constructed between 2.5 to 6.0m deep and will be impenetrable.
- Facultative ponds (secondary ponds) will be constructed between 1.0 to 1.5m deep. Aerobic conditions will prevail in the upper layers while anaerobic conditions prevail in the deeper layers. About 30% of the total BOD reduction will occurs here. These are to be lined with a reasonably impenetrable geotextile.
- Aerobic ponds are mainly used in algal culture and harvesting rather than treatment. Algae is there to ensure that levels of desired DO are maintained for the aerobic organisms to proliferate. They are constructed at 0.3 to 0.5m depths and also lined with impenetrable geotextile.
- Maturation ponds will allow algae to grow on the surface, which will provide the water with oxygen leading to both anaerobic digestion and aerobic oxidation of the organic pollutants. Due to the algal activity, the pH rises leading to inactivation of some pathogens and volatilisation of ammonia.
- Evaporation ponds will ensure that no final outflow to the environment is allowed so all discharged water should evaporate. This pond has the largest surface area for all the water to evaporate. Sizing is based on evaporation-infiltration rate and annual rainfall. This pond will be built on fairly impenetrable soil.

The oxidation pond site will be protected by a perimeter fence, with signs to be placed inside the fenced off pond area that warn people of the danger of the ponds, which pose a health and safety risk.

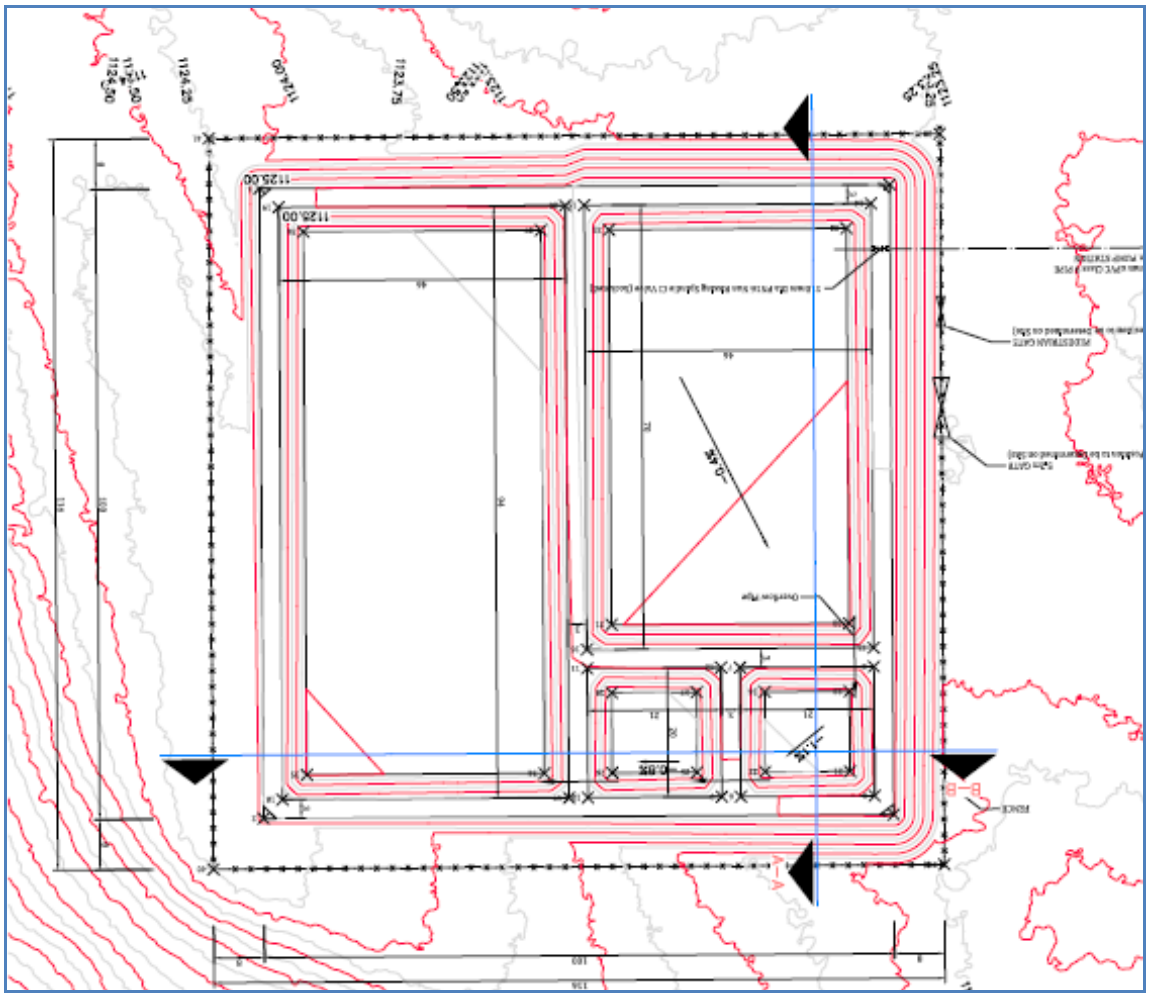

Figure 3: Proposed design of the facility

9. GENERAL ENVIRONMENT OF THE STUDY AREA

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

9.1 Location and Land Use

The proposed oxidation ponds (24.56868°S; 17.89703°E) will be developed at the existing Kai//Ganaxab Youth Skills Training Centre. The project site is located on the western outskirt of the centre, approximately 550m west of the boundary fence. The site measures a land size of 10,000Ha, and is surrounded by open undeveloped land. The town of Mariental is situated 10km east of the site.

The D1103 road and Hardap Irrigation Scheme lies east of the proposed Hardap VTC location. The following photos indicate the neighbouring properties to the centre.

Figure 1. View of the site and surrounding

9.2 Topography and Surface Water

The site is relatively flat to erosive, small-medium sized ridges seen in and around the site. The Nama Karoo basin falls within a large, flat lying plateau that dominates most of Southern Namibia. Sedimentary rocks form the foundation of the landscape. The Fish, Lowen and Konkiep rivers drain the landscape, all flowing south towards the Orange River. The Fish River is situated approximately 2km east of the site.

Local drainage will flow from the site westward towards the Fish River. The relief of small drainage systems are present and well defined in the area. This promotes good surface drainage in the area.

Site specific drainage systems should however be developed at the site to control the flow of surface water at the site to avoid flooding (e.g. erection of culverts). A storm water management system should form part of the engineering designs.

9.2.1 Fish River Flood Risk Assessment

According to the Fish River Flood and Hydrological Report (DHI, 2015), the maximum water depth and water velocity for each return period was used to calculate the flood hazard caused by flood events with the probability of occurrence of 1 in 5, 10, 20, 50 and 100 years. Flood hazard is highest when the water depth/velocity combination is also highest, as expected this corresponds to the river channels for all return periods shown in orange and red.

Flood vulnerability was determined by combining physical, economic and social indicators and attributing weights which determines their relevance. In order to quantify these indicators, census data was used, Google Earth imagery was analysed, and GIS calculations were carried out.

Determined by the weighted overlay of the overall flood hazard estimate, the weighted sum of the flood hazard for each event, and the vulnerability estimate achieved. From the equal weighted intersection of these two parameters, a corresponding risk category was calculated.

The results indicate a clear distinction between the Hardap irrigation scheme and the urban areas. The results from this assessment indicate where priority action should take place in the study area in terms of implementing flood protection plans.

A priority area for intervention is the risk zone of Mariental town between the B1 road and the railway line; Agricultural fields close to the Aub Bridge, the pivot fields and adjacent fields by Maltahohe Bridge. The proposed project is located within a low flood risk area, as per flood risk assessment results conducted in 2015. See Figure 4 below.

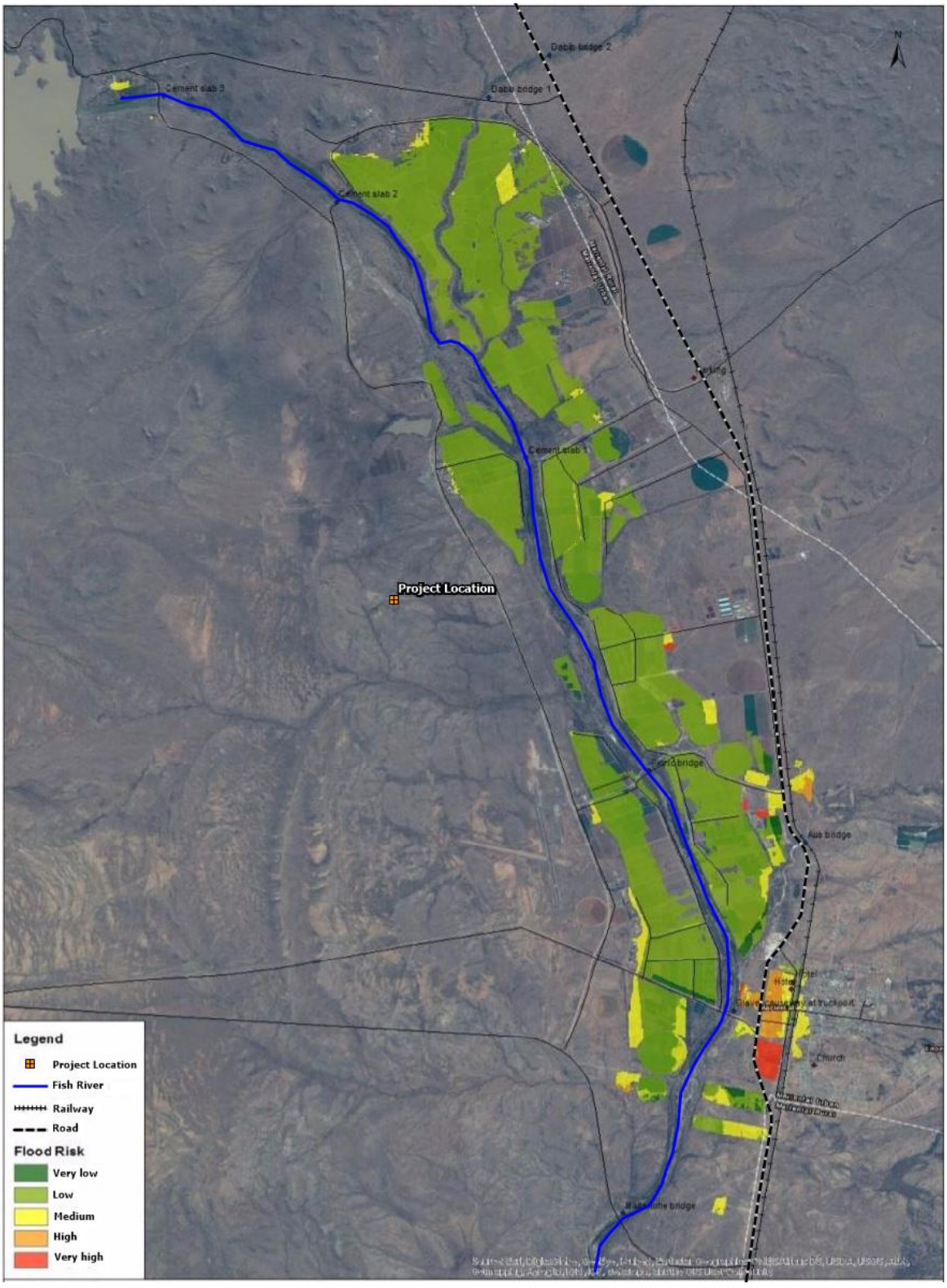

Figure 4. Final flood risk assessment results for the area (DHI, 2015)

9.3 Climate *(Mandelsohn et al, 2003)*

Classification of climate:	Semi-arid area
Average rainfall:	Rainfall in the area is averaged to be between 200 mm-250 mm per year.
Variation in rainfall:	Variation in rainfall is averaged to be 50-60 % per year.
Average evaporation:	Evaporation in the area is averaged to be between 2100-2240 mm per year.
Precipitation:	The highest summer rains are experienced from January-March.
Water Deficit:	Water deficit in the area is averaged to be between 2100-2300mm per year.
Temperatures:	Temperatures in the area are averaged to be between 20-22°C per year.
Wind direction:	Wind direction in the area is predominantly southerly winds.

Mariental and its surroundings can be classified as a water deficit area with annual evaporations exceeding the mean annual rainfall by far. Summer rainfall dominates precipitation in the form of thundershowers and seasonal run off events might occur in the form of flash floods. The aridity of the region causes the water resource to be a scarce commodity and has to be conserved and protected from pollution at all cost.

9.4 Geology *and Hydrogeology*

The geology of Fish River Basin consists of flat lying Nama sediments, Namaqua Metamorphic Complex rocks, Quaternary calcretic and conglomerate deposits. The oldest units belong to the Namaqua Metamorphic Complex (NMC); they were deposited about 1800 millions years.

Some 770 million years ago, the metamorphic units (amphibolites, schists and granulite) were swarmed by dark mafic dolerite dykes that are quite prominent in the NE areas of Gibeon. Due to tectonic uplift and erosion over the years the Namaqua rocks were exposed further into lift grabens resulting into formation of a shallow sea. Within this sea the shales, siltstones, limestones and sandstones of the Nama Group where deposited. The original sediments are believed to have originated from the northern Damara Orogen, after their deposition no major metamorphic and deformation occurred. Thus to this day the Nama rocks preserve the spectacular horizontal structures and forming the sharp plateau geomorphology with Namaqua rocks. Moreover, some 350 Ma modern erosion formed large valleys and depressions.

During the Dwyka glaciations stage the valleys and grabens where widened deeper by southwards flowing rivers, forming the Karoo Sequence. The canyon present today was formed during post-Karoo times, during this time severe erosion

removed most of the Karoo units, preserving the NMC and some Nama units. Quaternary calcretes are deposited more easterly of Mariental giving a more flat lying morphology.

West of Mariental, geomorphology is less plateaus like but depicts an undulating mountainous terrain. Within the valleys of the Mariental Fish River, the geomorphology (30km radius) is rather flat and rising higher in the western, eastern and northern directions.

From a hydrogeological perspective, it is quite difficult to find primary groundwater aquifers, unless of very recent river sediments. In and around Mariental town the main aquifer is the recent surficial sedimentary overburden that have accumulated over time, this could be ± 10m deep before bed rock. It is known that the water table in the town vicinity has risen up by 1.8m due to over grow of organic material.

The dominant aquifers are the secondary aquifers of the Nama and Karoo sediments that have been structurally faulted and jointed to form storage volumes for water. Springs are also common which are as a result of groundwater rising in major fault zones forming an artesian aquifer (water table/potentiometric surface above ground surface). In areas where erosion has incised till undeformed units of the Namaqua Complex and Namaqua rocks it may be quite difficult to find any water within these rocks. This is a very common event in the south-western and western areas of Mariental. High evaporation events have affected the groundwater quality mostly in the south and eastern areas of the Mariental district.

The water supply to Mariental is supplied by Namwater and is sourced from the Hardap Dam, situated approximately 18km northwest of Mariental. Subsurface water in the area is utilized with no borehole known to exist within a 5km radius of the site. Boreholes present in the area are situated more than 5km southwest of the site, and are used for agricultural purposes.

The area does not fall within a groundwater control area; however groundwater remains the property of the government of Namibia. This means that government controls the exploration and usage of it.

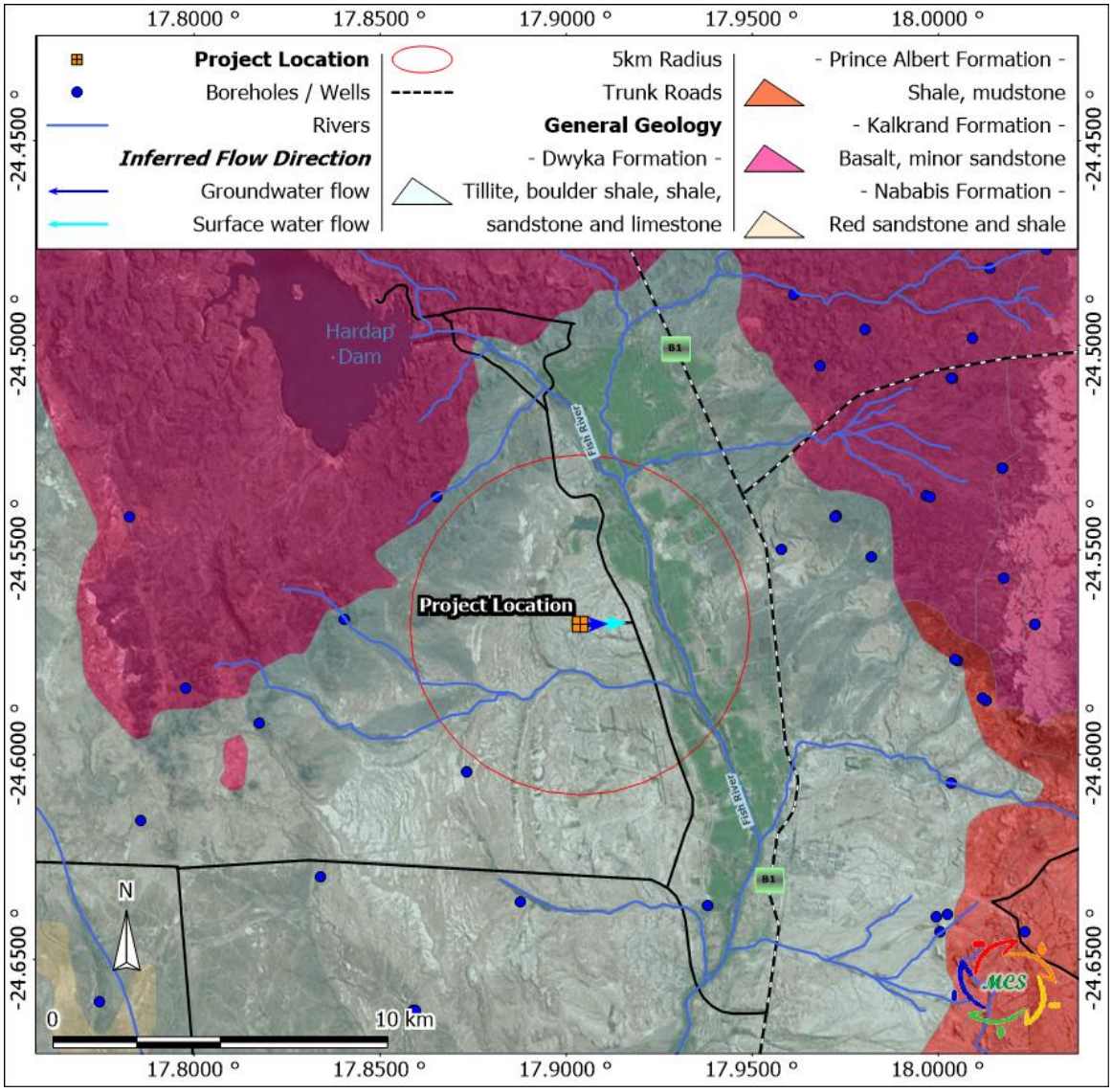

Figure 5: Hydrogeological map of study area

9.4.1 Groundwater Pollution Vulnerability

The geological framework that hosts the groundwater systems of the project area consists of intensely folded Namaqua Metamorphic Complex rocks. The numerous tectonic uplifts and erosion, graben lifts, thrusting and faulting episodes, of which the geology of the area was subjected to, resulted in geological structures and lineaments been created. Structures are not, however, easily visible on the surface because of cover of unconsolidated sands. Landsat and aerial photographs are therefore of limited use, but aeromagnetic data combined with the satellite imagery has been used successfully in detecting fault-related lineaments in sand-covered areas (e.g. Zeil et al., 1991).

The presence of sensitive geological structures present in the area may form preferential pathways to the underlying aquifer. In order to protect these groundwater resources, pollution to these structures should be avoided at all cost.

9.4.2 Groundwater and Surface-water Pollution Monitoring

Groundwater and surface water are therefore essentially one resource, physically connected by the hydrologic cycle. Streams interact with groundwater in three basic ways, *i.e. streams gain water from inflow of groundwater through the streambed, streams lose water by outflow through the streambed, or they do both depending upon the location along the stream*. It is the groundwater contribution that keeps streams flowing between precipitation events. Groundwater from the local fractured network is used for human consumption and stock watering purposes.

The consultant recommends that groundwater pollution be monitored with the installation of atleast three (3) monitoring boreholes in and around the site. A protective manhole should be placed over each borehole installed. The purpose of these boreholes will be to monitor any contamination in the subsurface emanating from the oxidation ponds; and to monitor the migration of possible contamination off site.

Baseline water samples should be collected from the boreholes immediately after drilling completion, in order to represent baseline conditions at the site. As such, these conditions can be important in forecasting potential environmental impacts during the site operations, and can become measurements against which future changes are compared. Water samples should be collected from these holes on a regular basis and send to laboratories for chemical of concern analysis.

9.5 General Ecology

The site falls within the Nama Karoo biome, which is characterised by Dwarf Shrub Savanna vegetation type. See Figure 6. The dominant vegetation structure is low shrubs that usually grow on Eutric Leptosols soils present in this area.

The Nama Karoo is known to support a varied assemblage of plant communities, ranging from deciduous shrub vegetation to perennial grasslands and succulent shrubs. The great wealth of plant species in the area is brought about by the geological substrates, soils and land forms. Seven vegetation types occur within the Nama Karoo biome of which most is arid.

The dominant vegetation on at the site consists mainly of medium height grass, scattered shrubs, weedy species, *Prosopis glandulosa*, *Datura inoxia and Eucalyptus*. No conservation worthy vegetation exists at the project site itself. The following photos below illustrate the vegetation on site.

Deducing from the Atlas of Namibia, the proposed site is within the area that is known to have between 50 to 99 plant species (Mandelsohn et al, 2003). With regards to fauna, it is estimated that at least 51 to 60 reptiles, 61 to 75 mammal and 141 to 170 bird species (breeding residents) are known to or are expected to occur in the project area of which only a very few proportions are endemics.

Faunal species diversity is presented in the table below:

Table 2. General Fauna Diversity (Atlas of Namibia)

	Diversity	Endemism
Mammal	61 - 75 Species	5 - 6 Species
Scorpion	12 - 13 Species	0 Species
Bird	141-170 Species	0 Species
Reptile	51 - 60 Species	9 - 12 Species
Frog	8 - 11 Species	N/A
Lizard	28 - 31 Species	N/A
Termite	1 - 6 Genera	N/A

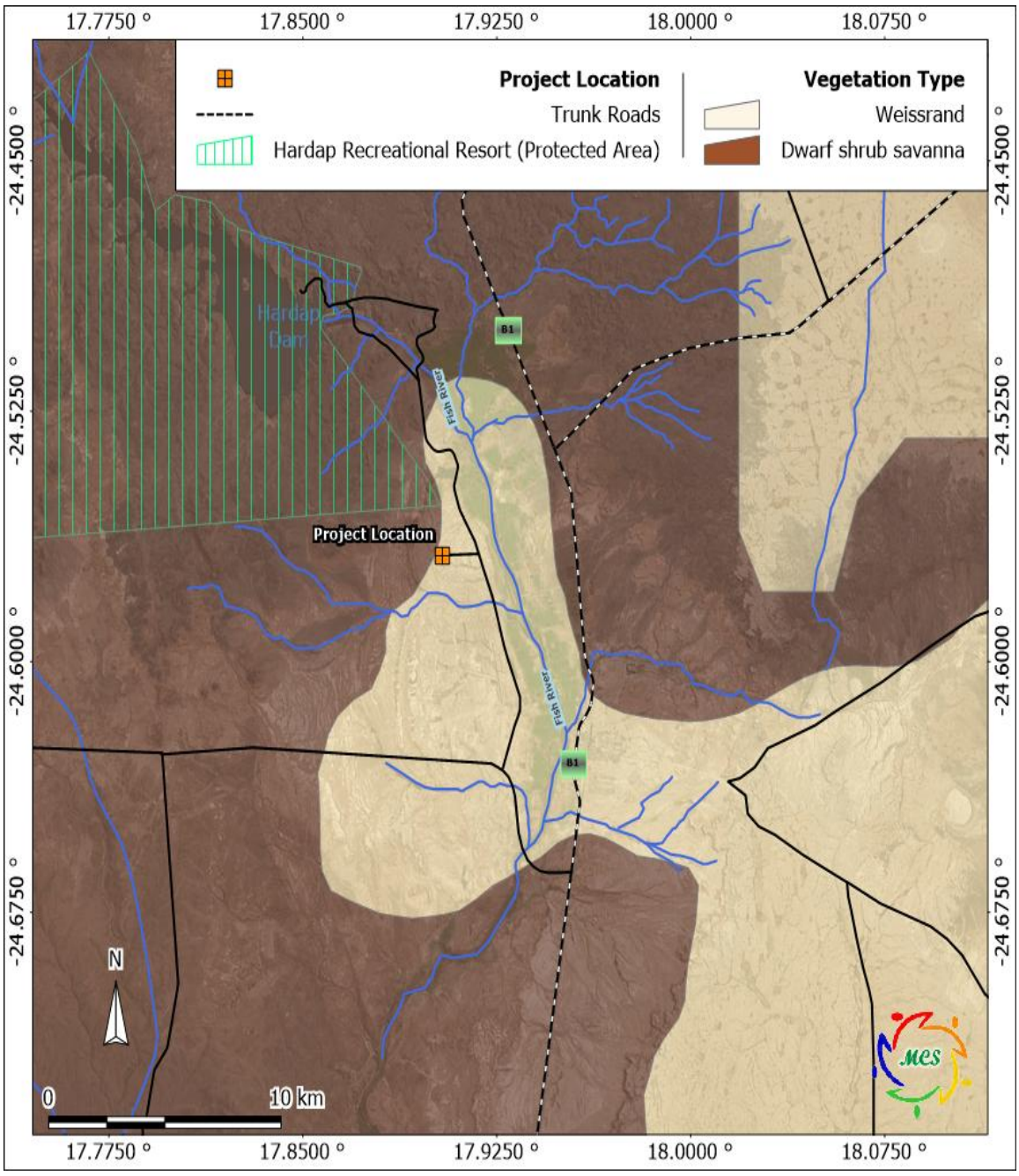

Figure 6: Vegetation map

9.6 Socio-Economic Aspects

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

9.6.1 Regional information

The proposed Hardap VTC will be situated in the Hardap Region of Namibia. The total current population is estimated to be 79,507 with 38,935 females and 40,572 males (NSA, 2011). Ninety-one percent of the population living in the Hardap Region over 15 years of age are literate (NPC, 2004). The estimated unemployment rate in Hardap region is 35% (NPC, 2001). The population density in the Hardap Region is 0.7 persons per km^2. The life expectancy in Hardap region is 53 years for females and 51 years in males (NPC, 2001). The Human poverty index (HPI) in Hardap Region is compared to 25.0 of the National HPI.

9.6.2 Mariental

Mariental is a town in south-central Namibia. It is located 221km north of Keetmanshoop and 261km southeast of Windhoek, along the main road B1.

9.6.2.1 Economic activities

Mariental is the administrative centre and capital town of the Hardap Region. The town forms part of the hub for all economic activities in the area and the region at large.

9.6.2.2 Employment (Job Opportunities)

The Kai//Ganaxab Oxidation Ponds project is considered a win-win opportunity for all parties involved, whether they are the land owner (NTA), potential residents, local government, and the surrounding community. The project will address the lack of public higher institution of learning in the southern region o f Namibia.

In the Hardap region only 71 percent of the population older than 15 years belong to the economically active group, which form the labour force, while 23 percent is outside the labour force. Of the 23 percent outside the labour force 31 are students, 20% stay at home, and 49% are retired or too old. While in the active labour force only 65% are actually employed.

The proposed project will provide job opportunities, of which atleast 80% are expected to be unskilled and semi-skilled people, and can be sourced from the unemployed labour force of the local communities and the region at large. The principle of maximising local employment creation can be applied by identifying suitable construction contractors in the region.

It is highly likely that suitable construction contractors would be identified from Mariental, and the region at large. The town is well-supplied with competent small and medium enterprise (SME) construction companies to develop the project. The project would also give rise to indirect economic benefits through the procurement of materials, goods and local to regional services.

The local economy of the town and surrounding communities is expected to benefit from the project. A percentage of moneys derived from salaries and wages earned by construction workers is likely to be spent in the vicinity of the project area. The moneys spent at the town or nearby communities would create substantial flows of revenue within the town and communities, thus acting as a catalyst for growth in the local economy.

Procurement of construction materials, goods and services would have beneficial downstream economic impacts by stimulating demand up the supply chain. The more goods and services procured from local SMEs or enterprises at the town, the greater the project's contribution to the growth of the local economies.

It is therefore recommended that, where feasible, contractors employ local labour by recruiting from local communities and the region at large; and that procurement of materials, goods and services from local suppliers be encouraged.

9.6.2.3 Livelihoods

Livestock farming and formal employment are the main livelihood activities in the Region. Game farming, hunting and ecotourism yield alternative income for some farmers. Nearly half of the population is employed in the private and public sectors. Therefore making wages and salaries the main source of income for 64% of households in the Region. Pensions constitute the second main source of income for 13% of households, farming make up 7%, cash remittance 7% and non-farming business 4% of the population. The livelihoods of the local community are likely to be positively impacted therefore predicted to be better than before the development of the facility in the area.

9.6.2.4 Tourism

Many tourists that visit the Mariental and the Hardap Region come to enjoy the safari and hunting experiences offered here in the south. In addition, private game farms and conservancies offer protection for wildlife, which then becomes an attraction to tourists and trophy hunters.

The area attracts a lot of tourists from all over the world. Excessive waste, dust, noise and vibrations can have negative impacts on the tourism

industry in the area, as it can become a nuisance to tourists. Mitigation measures at the site must be put in place to reduce these impacts.

9.6.2.5 In - Migration

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

9.6.2.6 HIV & Prostitution

Namibia is one of the ten worst affected countries in terms of the HIV/AIDS epidemic. The HIV prevalence rate for the age group 15 to 49 is estimated at 21.3% for Namibia (UNDP, 2005). The HIV/AIDS prevalence rate in pregnant women aged 15 to 49 years in the Hardap Region is 14.9%.

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

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

- ✓ Reduced workforce in the Hardap Region.
- ✓ Diversion of income expenditure to medical care.
- ✓ Increase in orphans and households headed by children.
- ✓ Increase in pregnancy related mortality.
- ✓ The current rate of 16,624 people per doctor could increase.

9.6.2.7 Infrastructure & Increased Traffic

The Hardap Region currently has a well developed infrastructure. Even though Mariental still has gravel roads that need upgrading. The main trunk road which provides a direct link from Windhoek to South Africa passes through Mariental. Plus the town has an all-weather landing strip for small to medium sized planes.

92% of households have access to safe water. Over 22% have no access to toilet facilities. Less than a half of all households have access to wood or charcoal for cooking, and nearly 85% of all households have access to electricity.

The number of traffic in the area is expected to increase slightly and it might contribute to heavy traffic during peak hours and a higher number of

car accidents. The nearby access and D1103 roads will be affected due to increased traffic and heavy-duty cargo trucks accessing the site.

9.6.2.9 Regional Education Status

According to EMIS (2011), there are a total number of 55 schools of which 52 are state owned and 3 privately owned in the Hardap Region. In addition, of the 21,886 learners in the Hardap 20,497 are enrolled in public schools while the remaining 1,389 attend private schools. Only 57 of all 845 teachers in the Hardap Region are without training. The percentage literacy for persons older than 15 years is 83% which is high in comparison with the 81% of Namibia. The Hardap Region has high levels when it comes to academic ratings in the country, most schools offer quality education to the young ones as from primary to high school.

10. STAKEHOLDER PARTICIPATION

The principles of EMA govern many aspects of EIA's, including consultation with interested and affected parties (I&APs). Consultation with the public forms an integral component of an EIA investigation and enables I&APs e.g. neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with the proposed development and to identify additional issues which they feel should be addressed in the EIA.

The primary aims of public participation were:

- ❖ To initiate participation of Interested and affected parties (I&APs).
- ❖ To inform I&APs and key stakeholders about the proposed development
- ❖ To identify issues and concerns of key stakeholders and I&Aps with regards to the proposed development.
- ❖ To provide information to enable informed decision making
- ❖ To develop a communication structure with stakeholder and I&APs
- ❖ To promote transparency of the project
- ❖ To ensure the public and stakeholders comments are considered for the development.
- ❖ To provide answers to I&APs queries
- ❖ To encourage shared responsibility and sense of ownership.

Decision-making authorities were consulted throughout from the outset of the study, and have been engaged throughout the project process. Public participation notices were advertised in two local newspapers on two different occasions, namely; (See Appendix C).

- ✓ The Confidente Newspaper, 05 and 12 November 2021
- ✓ New Era Newspaper, 04 and 12 November 2021

In the adverts an e-mail address, phone number and fax number was provided to the general public to register as interested and affected parties; and to request a background information document for the project. Posters (A3 size) were placed at strategic locations to invite interested and affected parties to the meeting, e.g. at the Municipal offices, Police Station, Spar Supermarket and Nampost.

Some background information posters placed

Mr Paul Nghiwilepo (CEO of Mariental Municipality) was consulted regarding the project. He indicated that the municipality was aware of the proposed development and indicated no environmental objections or concerns regarding the project.

A public consultation meeting was held on 22 November 2021, at the Eimablaagte Municipal Offices (Boardroom) in Mariental. No attendance was recorded at the meeting. At the time of report writing, no further environmental or social concerns regarding the facility were received by the consultant from the general public.

Table 3. Interviewed Stakeholders/I&APS

NAME	ORGANISATION/ERF	INPUT
Ms. Saima Angula	Ministry of Environment and Tourism, Directorate of Environmental Affairs.	EA procedure
Mr. Festus Kapembe	Ministry of Education, Arts and Culture / Project Manager	Installation Information
Mr. Paul Nghiwilepo	Mariental Municipality / Chief Executive Officer	Local Authorities
Mr. Fillemon Hasheela	NICE Consulting Engineers / Project Manager	Installation Information

Consultation with the department of Environmental Affairs (MET) included the environmental assessment procedure and application procedure.

11. ENVIRONMENTAL IMPACT EVALUATION

The Environmental Impact Assessment sets out potential positive and negative environmental impacts associated with the proposed development. The following assessment methodology will be used to examine each impact identified, see Table 4:

Table 4. Impact Evaluation Criterion *(DEAT 2006)*

Criteria	Rating (Severity)	
Impact Type	**+VE**	Positive
	0	No Impact
	-VE	Negative
Significance of impact being either	**L**	Low (Little or no impact)
	M	Medium (Manageable impacts).
	H	High (Adverse impact).

Probability:	Duration:
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term (impact ceases
3 - Medium probability	3 - Medium-term (5-15 years)
2 - Low probability	2 - Short-term (0-5 years)
1 – Improbable	1 - Immediate
0 – None	
Scale:	**Magnitude:**
5 – International	10 - Very high/don't know
4 – National	8 - High
3 – Regional	6 - Moderate
2 – Local	4 - Low
1 - Site only	2 - Minor
	0 - None

11.1 Construction Phase

11.1.1 Erosion and Sedimentation

Clearing of vegetation during earthworks is expected to take place and can make the project site susceptible to soil erosion especially during rainy seasons. The constant movement of heavy construction vehicles during construction also tend to compact the soil surface, which can reduce infiltration capability, and increase surface water runoff.

Proposed Mitigation Measures

- Avoid unnecessary removal of topsoil cover during construction.
- Ensure stockpiles are located within the boundary of the site and are protected from erosion.
- Stabilise cleared areas as soon as possible to prevent and control surface erosion.
- Limit clearing of vegetation to those areas within the footprint of construction.
- Minimise open areas and reduce the frequency of disturbance.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated

Erosion and Sedimentation	-VE	1	1	4	2	M	L

11.1.2 Dust Pollution and Air Quality

Dust problems are expected to be localised and site specific. This may pose a slight nuisance to students on campus and nearby road users. Dust will be generated during the construction phase and might be worse during the winter months when strong winds occur. Dust is regarded as a nuisance as it reduces visibility, affects the human health and retards plant growth.

Release of various particulates and exhaust fumes from construction vehicles and machinery during construction activities is also expected to take place.

Proposed Mitigation Measures

- Ensure measures are in place to minimise dust generated during the construction phase.
- Use appropriate dust suppression measures when dust generation is unavoidable, e.g. dampening with water, particularly during prolonged periods of dry weather.
- Avoid excavation, handling and transport of materials which may generate dust under high wind conditions.
- Locate stockpiles of construction materials in sheltered areas where they are not exposed to erosive effects of the wind.
- Ensure all vehicle, plant and equipment are in good condition.
- Encourage reduction of engine idling.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Dust	-VE	1	2	6	3	L	L

11.1.3 Noise Impact

An increase of ambient noise levels at the construction site is expected due to construction activities. Noise pollution due to heavy-duty equipment and machinery will be generated. It is not expected that the noise generated during construction will impact any nearby land or properties.

Proposed Mitigation Measures

- Ensure the use of construction vehicles and equipment that emit reduced noise levels.
- Ensure proper maintenance is conducted on vehicles to ensure the reduction of noise emission.
- The construction staff should be equipped with ear protection equipment.
- Audio equipment (if any) should not be played at levels considered intrusive by others.

- Construction activities will be limited to a period between 07h00 and 19h00.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Noise	-VE	1	2	4	3	L	L

11.1.4 Safety & Security

Safety issues could arise from construction vehicles, earthmoving equipment and tools that will be used on site during the construction phase. This increases the possibility of injuries and the contractor must ensure that all staff members are made aware of the potential risks of injuries on site. Construction sites usually house construction building material and equipment on site which may attract criminal activities.

Proposed Mitigation Measures

- Display telephone numbers of emergency services at the project site.
- Provide suitable emergency and safety signage on site (manufactured of durable, weatherproof material). The signage signs should be placed at strategic locations to ensure awareness.
- Demarcate and barricade any areas which may pose a safety risk (including hazardous substances, deep excavations etc). These notices must be worded in English language.
- Enforce the use of appropriate Personal Protective Equipment (PPE) for the right task or duties at all times.
- Prevent illegal access to the construction site by implementing appropriate security measures. These security measures must not pose a threat to surrounding communities.
- Should a construction camp be necessary, it should be located in such a way that it does not pose a risk to the public.
- Equipment housed on site must be placed in a way that does not encourage criminal activities.
- For safety and security reasons it is recommended that the entire site (construction site and camp) be fenced-off and security personnel be employed to safeguard the premises and to avert criminal activates.
- Sensitize operators of earthmoving equipment and tools to switch off engines of vehicles or machinery not being used.
- The contractor is advised to ensure that the team is equipped with first aid kits and that they are available on site, at all times.
- Proper barricading and/or fencing around the work sites should be erected to avoid entrance of animals and/or unauthorized persons.
- Adequate lighting within and around the construction location should be erected, when visibility becomes an issue.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Safety	-VE	1	2	4	2	M	L

11.1.5 Traffic

Construction vehicles will access the project location from the nearby access and D1103 roads. Construction related activities are expected to have a minimal impact on the movement of traffic along these roads, due to the fact that construction vehicles will frequent the site only periodically.

No diversion of traffic or closure of the road is expected, however a slight nuisance might be experienced by motorists using the road. This will most likely be caused by slow moving vehicles frequenting the construction site. It is however expected to be short-lived.

Proposed Mitigation Measures

- Install and maintain official traffic signalling (where necessary) along the access roads / intersection in conjunction with local or national traffic regulations.
- Speed limit warning signs must be erected to minimise accidents.
- Construction vehicles and machinery must be tagged with reflective signs or tapes to maximise visibility and avoid accidents.
- Where feasible, Construction vehicles should not travel to and from the site during peak times (07h00 to 09h00 and 16h00 to 18h00), to minimise impacts on traffic.
- Construction vehicles should not be allowed to obstruct the road, hence no stopping in the road, wholly or partially, but rather pull off the road or park on the roadside.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Traffic	-VE	1	2	2	2	L	L

11.1.6 Groundwater

Groundwater quality could be impacted through leachate of petroleum, chemical, harmful and hazardous substances. In particular, oil leakages, diesel, lubricants and grease from construction vehicles, equipment and machinery utilised during the construction phase may occur. Care must be taken to avoid contamination of soil and groundwater.

Any overflow of the temporary sewage systems available, may transport the effluent to any nearby surface water bodies; or to areas where sensitive geological structures and formations are present. Inflow into these structures and formations would cause a pollution threat.

Proposed Mitigation Measures

- Prevent spillages of any chemicals and petroleum products (i.e. oils, lubricants, petrol and diesel). Use drip trays, linings or concrete floors when evidence of leaks are observed on vehicles or equipment.
- No major servicing and maintenance of vehicles and/or equipment should be conducted at the site.
- All fuelling, storage and chemical handling should be conducted on surfaces provided for this purpose. Drip trays, linings or concrete floors must be used when removing oil from machinery.
- Spillage control procedures must be in place according to relevant SANS standards or better. Waste water collection systems should be connected to these systems.
- Should temporary toilet facilities be necessary, adequate containment systems should be erected at the site for use during the construction phase.
- Waste should properly be contained to avoid any leakages and/or spillages, and should regularly be disposed off at a suitable sewage disposal site. Run-off from these toilets due to overflows should be avoided at all cost.
- Proper environmental awareness and remedial response training of operators must be conducted on a regular basis.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Groundwater	-VE	1	3	4	2	L	L

11.1.7 Surface Water

Local drainage is well developed and runoff takes place through small streams and drainage lines in the area, towards the Fish River. Contamination of surface water might occur through petroleum, chemical and hazardous substances. Contaminants in the form of oil leakages, diesel, lubricants and grease from the construction equipment and machinery may occur during the construction phase.

Proposed Mitigation Measures

- Use drip trays, linings or concrete floors when evidence of leaks are observed on construction vehicles or equipment.
- Remove leaking vehicles from project location immediately.
- No servicing and maintenance of vehicles and/or equipment should be conducted on site.
- Any spillage of hazardous substances including fuel, oil, paint or cleaning solvent must be cleaned up immediately and disposed off at a designated disposal facility.
- Prevent discharge of any pollutants, such as cements, concrete, lime, chemicals, and hydrocarbons into the nearby water courses.
- Prevent illegal washing out of containers in nearby water courses.

- Properly secure all temporary / portable toilets (if any) to the ground to prevent them toppling due to wind or any other cause.
- Maintain toilets in a hygienic state and remove waste to a licensed disposal facility.
- Ensure that no spillages occur when the toilets are cleaned or emptied. Prohibit urination on site, other than at designated facilities.
- Contain contaminated water from batching operations and allow sediments to settle before being disposed of as waste water.
- Stabilise cleared areas as soon as possible to prevent and control surface erosion.
- Proper environmental awareness and remedial response training of operators must be conducted on a regular basis.
- An emergency plan should be in place on how to deal with spillages and leakages during this phase.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Surface water	-VE	2	3	6	2	M	L

11.1.8 Generation of Waste

Waste material will be generated during the construction activities of the ponds. Waste in the form of rock cuttings, pipe cuttings, oil spills or leakages of petroleum products might occur during the construction phase.

Proposed Mitigation Measures

- Ensure that sufficient weather- and vermin- proof bins / containers are present on site for the disposal of solid waste. Waste and litter generated during this phase must be placed in these disposal bins.
- Empty bins regularly as required.
- Contractor shall institute a waste control and removal system for the site.
- All waste shall be disposed off site at an approved landfill site.
- No disposal of /or burying of waste on site should be conducted.
- No waste should be burned on site.
- The hazardous waste storage is to be clearly marked to indicate the presence of hazardous substances, and the protocols associated with handling of such hazardous wastes shall be known by all relevant staff members.
- Solid and liquid hazardous waste shall be stored in separate containers. Hazardous waste should be disposed of at the approved hazardous waste disposal site at Kupferberg.
- Regular inspection and housekeeping procedure monitoring should be maintained at all times.
- Awareness of the hazardous nature of various types of waste should be enforced.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Waste	-VE	1	3	6	4	M	L

11.1.9 Heritage Impacts

There are no known heritage areas envisaged to be impacted by the new development; however the contractor might come across archaeological features or objects that possess cultural values during construction activities.

Proposed Mitigation Measures

- If such remains or objects with cultural values (e.g. bones, weapons, ancient cutlery, graves etc) are uncovered at the project location or surrounding, it should be barricaded off, and
- The relevant authorities (i.e. the local police and National Heritage Council of Namibia) should be contacted immediately.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Heritage	-VE	1	2	2	2	L	L

11.1.10 Ecological Impacts

No other conservation worthy vegetation is present at the site.

Proposed Mitigation Measures

- Limit clearing of vegetation to those areas within the footprint of construction site.
- Disturbance of areas outside the designated working zone is not allowed.
- No vegetation should be removed outside the designated project area.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Ecology	-VE	1	2	2	2	L	L

11.1.11 Socio-Economic Aspects

Temporary employment opportunities are anticipated to be created during construction, both directly through construction workers and indirectly through suppliers, service providers, and informal traders attracted to the project site.

Proposed Mitigation Measures

- Construction contractor(s) should be sourced from Mariental, and surrounding areas.
- Construction workers should be sourced from Mariental, and surrounding areas.

- Suppliers of construction materials should be sourced from Mariental, and surrounding areas.
- Locally source services required during the construction process, such as securities, rental of portable toilets, plant hire, etc.
- Designate an area outside the construction site for informal traders (if any), to allow them to trade.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Socio-economic	-VE	1	1	8	2	L	L

Summary of all potential impacts during the construction phase:

In general, impacts are expected to be low to medium, mostly short lived and site specific. Mitigation options recommended in the Environmental Management Plan (EMP) will guide and ensure that the impacts of the construction work are minimised. Proper storm water management plans must be in place to minimise the risk of flooding and pollution, and must form part of the engineering designs.

The appointed contractor should be made aware of the content and environmental requirements of this report through proper induction training..

11.2 Operational Phase

11.2.1 Air Quality

Air quality around the site could be impacted by bad smell from decomposition of organic matter. Odours from the wastewater ponds can result in complaints from neighbouring communities.

Proposed Mitigation Measures

- Ensure frequent removal of waste solids from the settlement ponds.
- Introduce aeration methods to increase decomposition when odours become unbearable.
- Regular air quality monitoring should be conducted at the site.
- Keep a complaints register regarding bad odour / smells at the site; and act on it if becomes a regular complaint.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Air Quality	-VE	1	4	4	2	L	L

11.2.2 Generation of Waste

Waste such as contaminated soil, oil and litter will generated during the maintanance activities. Waste solids will be removed regularly from the ponds during the operational phase.

Proposed Mitigation Measures

- Removed collected solids from the ponds using appropriate equipment.
- Ensure the use of proper equipment, containers and/or vehicles, and then dispose off the collected solids at an approved dumpsite.
- Ensure all workers wear proper personal protective equipment.
- Any waste generated must be contained and disposed off accordingly.
- Waste bins / containers must be readily available at the project site at all times.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Waste	-VE	1	2	5	2	L	L

11.2.3 Surface and groundwater

Although the oxidation ponds will be equipped with impermeable containment layers that are designed to prevent wastewater from contaminating surface and groundwater resources; failure of this layers may occur, allowing the wastewater to potentially infiltrate these water resources. Leakages may also occur due to failure of reticulation sewer pipelines.

Proposed Mitigation Measures

- Proper containment mechanisms installed should be able to contain any leakages that might occur during the operation of the facility.
- Proper monitoring of the oxidation pond levels must take place to eliminate overfilling.
- Maintaining the installation in good operating order is of paramount importance in preventing ponds and equipment failure.
- During maintanance operations, remove leaking vehicles and/or equipment from project location immediately.
- The presence of an emergency response plan and suitable equipment is advised, so as to react to any spillage or leakages properly and efficiently.
- Ensure all stormwater drains or channels are clear of litter or obstructing material.
- Remove all excess sedimentation, rubble and any other waste material present in waterways and dispose of in a suitable manner to ensure proper drainage runoff.
- Ensure that stormwater management systems are regularly maintained and tested, and are in good working order.
- Develop and implement a groundwater monitoring system and programme, with the aim of monitoring possible contamination from the ponds.

- Groundwater monitoring boreholes should be installed, sampled and analysed periodically.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Surface water	-VE	2	2	6	3	M	L

11.2.4 Health and Safety

The operations of the ponds can cause health and safety risks to workers on site. Employees could be exposed through to the skin contact with the potentially hazardous wastewater. The potential risk of someone falling and drowning in the ponds exists.

Oxidation ponds can serve as breeding grounds for mosquitos, which are a risk to human heath. This is especially aggravated if there is vegetation growth in the ponds.

Safety issues could also arise from the operational vehicles, equipment and tools that will be used on site during maintenance activities. This increases the possibility of injuries and all project personnel must be made aware of the potential risks of injuries on site. Unauthorised persons entering the pond premises are exposed to safety and health risks.

Proposed Mitigation Measures

- Staff must be properly trained and made aware of safety and hazardous nature of the ponds and wastewater.
- Fire fighting equipment and first aid kit should be made available at the project site and serviced regularly.
- Display contact details of emergency services in the area at strategic locations of the facility.
- Demarcate and place signage on any areas which may pose a safety risk (including trenches, excavations etc).
- The project personnel are advised to ensure that proper personal protective gear and first aid kits are available, at all times.
- Staff should be properly trained in first aid and safety awareness.
- Ensure no unauthorised entry to the ponds. Regulary inspect the perimeter security fence and repair immediately if there is any breach.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Health & Safety	-VE	1	3	6	3	M	L

11.2.5 Ecological Impacts

The proposed facility operations will have minimal impacts on fauna and flora; however vegetation control in and around the ponds must be maintained.

Proposed Mitigation Measures

- The operational activities would not exceed the demarcated area of the development.
- Regularly remove vegetation growth from the ponds and pond embankment walls and dispose of accordingly.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Ecology	-VE	1	2	2	2	L	L

11.2.6 Socio-Economic Aspects

The oxidation ponds will treat the wastewater, and allow for a safe sewage and sanitation system at the training centre. This represents an important positive impact on human well-being. The creation of new employment opportunities is eminent for construction and maintanance activities; and is considered to be a positive impact. At this stage, it is unclear how many temporary and permanent employment positions will be created but jobs will be created.

Proposed Mitigation Measures

- Employment creation should be targeted at the immediate communities of the project site, or Mariental.
- Maintanance contractors should be sourced from Mariental, or the region at large.
- Locally source services required during the operational process, such as securities, plant hire, etc.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Socio-economic	-VE	1	1	8	2	L	L

11.3 Decommissioning Phase

The impacts associated with this phase will be similar to that of the construction phase. The Environmental Management Plan for this phase will have to be reviewed at the time of decommissioning to cater for changes made to the development.

12. CUMMULATIVE IMPACTS

Construction: Possible cumulative impacts associated with the construction of the oxidation ponds include an increase in traffic visiting the site. An increase in emissions, noise and movement from these vehicles will be experienced, thus decreasing the air quality, peace and tranquillity around the project location. Wear

and tear on the roads could be expected, coupled with increased risks of road traffic incidences. These impacts will be short lived for the duration of construction.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Cummulative impacts	-VE	2	2	6	2	L	L

Operational: Potential cumulative impacts associated with the operational phase include increase bad odour emissions from ponds, thus impacting the air quality. These impacts can be long-term as long as the ponds are operational.

Impact Evaluation:

Aspect	Impact Type	Scale	Duration	Magnitude	Probability	Significance	
						Unmitigated	Mitigated
Cummulative impacts	-VE	2	2	6	2	M	L

13. ENVIRONMENTAL MANAGEMENT PLAN

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

The objectives of the EMP are:

- ✓ to include all components of the development;
- ✓ to prescribe the best practicable control methods to lessen the environmental impacts associated with the construction of the development;
- ✓ to monitor and audit the performance of construction personnel in applying such controls; and
- ✓ to ensure that appropriate environmental training is provided to responsible construction personnel.

The EMP acts as a stand-alone document, which can be used during the various phases of the proposed development. All contractors taking part in the construction of the facility should be made aware of the contents of the EMP. An EMP for the construction, operational and decommissioning phases of the proposed development has been developed and is attached as Appendix A.

14. CONCLUSIONS

In general, the proposed development would pose limited environmental and social risks.

The site is generally suitable for the proposed stabilising or oxidation ponds. All environmental risks can be minimised and managed through implementing preventative measures and sound management systems. It is recommended that this information be made available to the community on a regular basis.

The Environmental Management Plan should be used as an on-site tool during all phases of the proposed development. Monitoring of surface and groundwater pollution should be conducted on a regular basis.

Future environmental audits should be carried out to ensure compliance of the EMP and environmental regulations of Namibia. Parties responsible for non-conformances of the EMP will be held responsible for any rehabilitation that may need to be undertaken.

The environmental clearance is valid for 3 years only, as per the environmental management act No.7 of 2007, thus it is the responsibility of the proponent to commission an application for renewal of the permit by submitting an updated EIA/EMP document before it expires.

Matrix Consulting Services

M. Shippiki
Principal Hydrogeologist / Environmental Practitioner
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