



APP: APP: 250109005148

**Environmental Scoping Study For the Proposed Drilling of a Borehole for Water Supply at
Otjahorovara Village in Kunene Region.**



CONSULTANT:

Mr. Ipeinge Mundjulu (BSC, MSc)
Red-Dune Consulting CC
P O Box 27623 Windhoek
Cell: +264 81 147 7889

PROPONENT

Otjahorovara Village
P.O. Box 118
Opuwo




DOCUMENT INFORMATION	
DOCUMENT STATUS	Final
APPLICATION NO.	APP: 250109005148
PROJECT TITLE	Environmental Management Plan (EMP) for The Proposed Drilling of Boreholes for Water Supply at Otjahorovara Village, Kunene Region.
CLIENT	Otjahorovara Village
LOCATION	Otjahorovara Village, Kunene Region
AUTHOR	Mr. Ipeinge Mundjulu 
DATE	28 January 2025
<p><i>Copyright notice</i></p> <p><i>This report and its content is copyright of Red-Dune Consulting CC. Any redistribution or reproduction of part or all the content in an any form other than the intend purpose is prohibited.</i></p>	

Table of Contents

ACRONYMS	<i>i</i>
1 The Environmental Management Plan	<i>1</i>
1.1 Purpose of the EMP	<i>1</i>
2 Compliance to the EMP	<i>1</i>
3 Roles and Responsibility	<i>1</i>
3.1.1 Proponent.....	<i>1</i>
3.1.2 Site Manager	<i>2</i>
3.1.3 Employees	<i>2</i>
3.1.4 Environmental Compliance Officer.....	<i>2</i>
3.1.5 Ministry of Agriculture Water and Land Reform	<i>3</i>
4 Disciplinary Action	<i>3</i>
5 The EMP table	<i>4</i>
5.1 Part A: Construction Phase	<i>4</i>
5.1.1 Socio-Economic Consideration	<i>4</i>
5.1.2 Health and Safety of employees	<i>6</i>
5.1.3 Safety of borehole / water infrastructures.....	<i>9</i>
5.1.4 Bio-Physical Consideration	<i>10</i>
5.1 Part B: Operational Phase	<i>17</i>
5.1.1 Human wildlife Conflict.....	<i>17</i>
5.1.2 Aquifer Conservation	<i>18</i>
5.1.3 Ground Water Monitoring Plan	<i>22</i>
6 Decommissioning and Rehabilitation Plan	<i>23</i>
7 Conclusion and Recommendations	<i>23</i>
7.1 Conclusions	<i>23</i>
7.2 Recommendations	<i>24</i>
8 References	<i>25</i>

ACRONYMS

CCFN	Community Conservation Fund Namibia
DEA	Department of Environmental Affairs
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (No. 7 of 2007)
EMP	Environmental Management Plan
ESMF	Environmental Social Management Framework
GRM	Grievance Redress Mechanism
HWC	Human Wildlife Conflict
IWRMP	Integrated Water Resource Management
KfW	Kreditanstalt für Wiederaufbau
m ³	Cubic meter
MAWLR	Ministry of Agriculture Water and Land Reform
MEFT	Ministry of Environment Forestry and Tourism
PPE	Personal Protective Equipment
RDC	Red-Dune Consulting CC
SM	Site Manager
WC	Wildlife Crime

1 THE ENVIRONMENTAL MANAGEMENT PLAN

1.1 Purpose of the EMP

This Environmental Management Plan (EMP) is an output of the scoping study conducted for the project, with detailed impact assessments provided in the accompanying scoping report. The EMP serves as a comprehensive risk management strategy, incorporating a logical framework, monitoring program, mitigation measures, and management control strategies to minimize environmental impacts. Additionally, the EMP defines the roles and responsibilities of all individuals involved in the project, ensuring clear accountability throughout its implementation.

The strategies outlined in the EMP are designed to effectively reduce the project's environmental and social impacts to acceptable levels. Furthermore, the EMP aims to address and mitigate social and environmental risks identified in the project's Environmental and Social Management Framework (ESMF), providing a structured approach to safeguarding both the environment and local communities.

2 COMPLIANCE TO THE EMP

This EMP is a legally binding document under the provisions of the Environmental Management Act, 2007 (Act No. 7 of 2007) (EMA). The Conservancy with support with from CCFN and contractors should adhere to the framework of this document.

3 ROLES AND RESPONSIBILITY

3.1.1 Proponent

Otjahorovara Village, with support from CCFN, holds overall responsibility for implementing the Environmental Management Plan. The Conservancy, supported by CCFN is accountable for appointing key personnel, including the Site Manager, and ensuring all employees and contractors fully understand and comply with the EMP requirements.

3.1.2 Site Manager

The Site Manager serves as the proponent's primary representative, responsible for overseeing the borehole drilling project's environmental compliance within the conservancy. They manage daily operations, ensure wildlife conflict mitigation measures are implemented, and coordinate EMP-related communications between all stakeholders. The SM monitors environmental protection measures, supervises water extraction practices, and maintains project records. All environmental management matters must be channelled through the Site Manager.

3.1.3 Employees

Employees are responsible for implementing environmental management measures during the borehole drilling project within the conservancy. They must comply with all environmental procedures, report wildlife sightings and incidents promptly, maintain clean work areas, and properly manage waste disposal. Mandatory participation in environmental awareness training ensures they understand their role in wildlife conflict prevention and conservation. Employees must follow noise reduction protocols, especially during wildlife movement periods, adhere to resource conservation practices, and respect conservancy boundaries. Their commitment to these responsibilities is essential for minimizing environmental impact and maintaining positive relationships with local communities.

3.1.4 Environmental Compliance Officer

The Environmental Compliance Officer (ECO) is either a designated representative from the Ministry of Environment, Forestry and Tourism (MEFT) or an independently appointed environmental officer who holds the primary responsibility for monitoring and auditing environmental compliance. Their role is directly linked to ensuring adherence to the Environmental Management Plan (EMP), with enforcement powers being exercised through designated government officials.

3.1.5 Ministry of Agriculture Water and Land Reform

This ministry as mandated through the Water Resources Management Act 11 of 2013 to ensure adequate management, protection, development, use and conservation of water resources; to provide for the regulation and monitoring of water services and to provide for incidental matters. MAWLR will be responsible to ensure to that the allocated abstraction by the water permit is not exceeded to ensure a health aquifer.

4 DISCIPLINARY ACTION

This EMP is a legally binding document, non-compliance to the EMP is punishable in accordance with the provision of EMA

5 THE EMP TABLE

This Environmental Management Plan (EMP) is divided into two parts: A) Construction and B) Operation. It addresses issues related to the socio-economic environment, bio-physical environment, pollution and waste generation, and heritage resources. This document is a living resource, subject to amendments as needed to ensure effective environmental protection. Consequently, aspects that may not have been covered during its initial development can be incorporated in the future.

5.1 Part A: Construction Phase

5.1.1 Socio-Economic Consideration

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
Awareness of the EMP	To ensure that employees /contractors are familiar with the requirements of the EMP	1. All employees must go through an induction course for the provision of the EMP. 2. Ensure that a copy of the EMP is kept on site	• Induction Minutes and Attendance Register, Physical verification of the EMP on site.	Contractor
Employment Socio-Economic	To ensure that general work created during	1. Ensure that all general work is reserved for local people	• Employee register • Wages for employee	Contractor

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
advancement for local	the project is reserved for local people	2. Fair compensation and labour practise as per Namibian Labour Laws must be followed	<ul style="list-style-type: none"> Complains about payment 	
Enhanced water access for local communities	Enhance water supply for domestic and agricultural use	1. Ensure borehole water supply meets community needs	<ul style="list-style-type: none"> Water usage reports; community satisfaction surveys 	Proponent
Skill Development for Long-term Employability	Provide skills training to enhance future employment prospects	Offer youth workshops on borehole maintenance, construction, management, and its supporting infrastructure	<ul style="list-style-type: none"> Number of training sessions conducted; participant feedback 	Proponent/ Site Manager
Economic Boost to Local Businesses	Stimulate local economy through demand for goods and services	Encourage procurement of materials and services from local suppliers	<ul style="list-style-type: none"> Percentage of materials/services sourced locally 	Proponent
Enhanced Community Safety	Reduce human-wildlife conflicts through alternative water points for wildlife	Designate specific water sources for wildlife at a safe distance	<ul style="list-style-type: none"> Frequency of human-wildlife incidents reported 	Proponent

5.1.2 Health and Safety of employees

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
HIV and AIDS, Alcohol and Drug abuse	Prevent alcohol and drug use at workplace. Provide awareness of dangers on HIV/AIDS	<ol style="list-style-type: none"> 1. Provide awareness to the employees on dangers of HIV/AIDS, alcohol, and drug abuse 2. Provide Condoms to employees. 3. Ban the employees against the use of alcohol during working hours. 4. Provide awareness on the dangers and health impacts of alcohol and drug use. 5. All employees must be screen with the breathalyser to avoid intoxicated personnel on site. 6. Adopt a disciplinary system to discipline staff for non-compliance. 	<ul style="list-style-type: none"> • Monitor presence of alcohol at construction site • Awareness meeting attendance registers • Breathalyser report • Disciplinary reports • Physical assessment and logs of condom procurement 	Contractor
Health	To ensure employees and community health	1. Abide to the Occupational Health and Safety and Labour Act of Namibia and other statutory requirements such as International Labour Practise Organization (ILO).	<ul style="list-style-type: none"> • Complaints of health issues by employees • First aid kit available 	Proponent Contractor

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
		<ol style="list-style-type: none"> 2. Ensure adequate first aid kit equipped with anti-venoms. 3. Supply clean drinking water to the site. 4. Adhere to the Labour act, non-toxic human dust exposure levels may not exceed 5mg/m³ for respiratory dust and 15mg/m³ for total dust. 5. Supervisors must undergo an occupational health and first aid course, 6. Provide gender segregated ablution facilities 		
Safety	To ensure employees and community safety	<ol style="list-style-type: none"> 1. Develop a safety plan. 2. Ensure that every employee goes through an induction course about safety. 3. Provide appropriate Personal Protective Equipment (PPE) which includes helmets, overalls, safety shoes, safety glasses, gloves, etc. 4. All drivers must be in possession of appropriated driver's licenses 	<ul style="list-style-type: none"> • Safety plan / pamphlets • Training minutes and attendance register • Physical verification of PP 	Contractor

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
		5. All heavy vehicles must have a rotating flushing light installed for visibility. 6. Ensure that all vehicles are well serviced and roadworthy. 7. Adequate safety signs must be put at designated places. 8. Tipper trucks carrying concrete stones and sand for construction must be covered to avoid flying stock and dust. 9. Train employee elephant behaviour and predators		
Exposure to Dust and Noise	Minimize respiratory and hearing health risks	1. Provide masks and ear protection; implement dust suppression measures	Number of respiratory/hearing-related complaints	Contractor

5.1.3 Safety of borehole / water infrastructures

Environmental / Social Impact	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Party Responsible
Structural Integrity of Borehole	Ensure long-term functionality and safety of borehole	1. Use high-quality, durable materials; conduct regular inspections	<ul style="list-style-type: none"> Frequency of maintenance and inspection reports 	Proponent
Water Quality Protection	Provide safe, clean water for human and animal consumption	1. Install filters, test water regularly, and treat as needed	<ul style="list-style-type: none"> Water quality test results; contamination incident reports 	Contractor
Destruction of water infrastructure by elephant	To prevent destruction of boreholes and associated infrastructure by elephants.	1. Construct an elephant proof fence around the borehole and its supporting infrastructures	<ul style="list-style-type: none"> Physical verification of elephant proof fence 	Contractor

5.1.4 Bio-Physical Consideration

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
Biodiversity	To protect plant and animals (The proposed drilling sites are free of vegetation and animals (unless crawling animals))	<ol style="list-style-type: none"> 1. Do not cut down trees unnecessary. 2. Do not kill animals. 3. Poaching strictly forbidden. 4. Do not destroy nests if found on site. 	<ul style="list-style-type: none"> • Physical verification • Report of poaching 	Contractor
Hydrological Disruption and Flooding Risks	Maintain natural water flow and prevent disruption to hydrology	<ol style="list-style-type: none"> 1. Avoid blocking natural waterways; implement proper drainage systems 	<ul style="list-style-type: none"> • Condition of natural water flows; drainage system effectiveness 	Proponent
Land degradation Uncontrolled movement of drill rig at the project site may cause land degradation.	To prevent soil disturbance / erosion	<ol style="list-style-type: none"> 1. Movement of vehicles / trucks must be well coordinated to ensure minimal soil disturbance 	<ul style="list-style-type: none"> • Physical observation of tracks outside designated areas 	Contractor
Water pollution Heavy vehicle and machinery may pollute	To prevent surface and groundwater pollution	<ol style="list-style-type: none"> 1. Fuelling of heavy vehicle on site must be well coordinated at designated places. 	<ul style="list-style-type: none"> • Physical observation of drip trays, oil marks etc 	Contractor

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
water sources from leakages of oils, hydraulic fluids, lubricants, and greases.		<ol style="list-style-type: none"> Stationary vehicles must be provided with drip tray to capture oil, lubricants, and hydraulic fluids leakages. All vehicle and machinery must be well service to avoid leakages. Provide and train employees on oil spill emergency response. Soils contaminated with grease, oils and hydrocarbons must be collected and disposed of at an approved site; 	<ul style="list-style-type: none"> Vehicles service report / service books Training report on emergency response Reports of disposal of contaminated soils 	
General waste	To manage solid waste To prevent littering, pollution, contamination of water and general environmental health hazards	<ol style="list-style-type: none"> Maintain a clean and organized site with regular waste removal to prevent the accumulation of waste. Designate and clearly mark separate areas for storing building rubble, construction debris, and other materials for easy sorting and disposal. 	<ul style="list-style-type: none"> Physical inspection of waste bins and drums for labelling and proper segregation. Records of waste collection and removal (e.g., waste pickup logs, vehicle tracking). 	Contractor

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
		<ol style="list-style-type: none"> 3. Provide appropriately sized skip bins for large construction debris and regularly empty them. 4. Provide clearly labelled household waste bins to separate non-hazardous household waste from other types of waste. 5. Collect used oil, grease, and lubricants in designated, leak-proof containers or drums and ensure disposal at an approved recycling or disposal site. 6. Use well-labelled waste drums for easy identification and sorting of different waste categories (e.g., recyclable, hazardous, general waste). 7. Prohibit any form of on-site waste disposal, including burying, 	<ul style="list-style-type: none"> • Documentation of waste disposal at approved disposal sites (e.g., receipts or disposal certificates). • Waste management training attendance logs. • Incident reports for any non-compliance or illegal disposal actions. 	

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
		<p>dumping, or burning of waste materials.</p> <p>8. Ensure appropriate waste collection and removal from the site and dispose at appropriate waste disposal site.</p> <p>9. Set up a system for regular collection, proper storage, and removal of all waste from the site. Ensure that waste is disposed of at appropriate, licensed disposal sites.</p> <p>10. Provide waste management training for employees to raise awareness about waste segregation and proper disposal practices</p>		
Dust pollution	Land clearing, digging, and the movement of vehicles and heavy machinery on project sites, along with	<p>1. Limit the movement of heavy vehicles to designated areas on-site to prevent excessive dust generation</p> <p>2. Ensure all vehicles adhere to a strict</p>	<ul style="list-style-type: none"> Vehicle movement logs and restricted areas documentation. 	Contractor Site Manager

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
	concrete work, transportation of sand and concrete stones, and cement mixing, can generate fugitive dust. Additionally, uncoordinated, or reckless driving on gravel roads may reduce visibility for other road users	<p>speed limit of 30 km/h or 40 km/h on construction roads to reduce dust emissions and improve road safety</p> <p>3. Avoid excavation, offloading sand, or other dust-generating activities during periods of strong winds to prevent dust from spreading.</p> <p>4. Ensure trucks carrying sand or other dust-prone materials are fully covered to prevent spillage and dust dispersal.</p> <p>5. Stockpiles of sand and similar materials must be covered when not in use or regularly watered to minimize airborne dust.</p> <p>6. Apply dust suppression methods, such as water spraying or the use of dust palliatives, on areas where soil has been disturbed or loosened by</p>	<ul style="list-style-type: none"> • Speed limit adherence records. • Inspection reports confirming the covering of trucks and stockpiles. • Dust suppression application logs (e.g., water spraying records). • Cement handling and storage inspection reports. • Dust level measurements and air quality reports (if applicable). • Incident reports for any dust-related complaints or accidents 	Environmental Officer

Environmental / Social Impact	Objective	Proposed Mitigation Measure	Monitoring Indicator	Responsibility
		<p>vehicle movement.</p> <p>7. Cement mixing should be done using enclosed concrete mixers, not manually in open areas, to prevent dust generation.</p> <p>8. Cement bags must be properly stored and disposed of, and cannot be shaken or handled in the open to prevent airborne dust.</p>		

Heritage Resources

Heritage Resource	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Responsibility
Heritage and Archaeology	The proposed area does not have known Heritage site or archaeological material. Regardless and as standard	<p>1. Train all employees on the potential for heritage and archaeological finds in the area and outline proper procedures.</p> <p>2. Develop and implement a Chance Find</p>	<ul style="list-style-type: none"> Employee training records and attendance registers. 	Proponent Site Manager Contractor

Heritage Resource	Objectives	Proposed Mitigation Measures	Monitoring Indicator	Responsibility
	<p>practise, a chance find is developed.</p> <p>to ensure protection of artefacts, heritage, and archaeological materials.</p>	<p>Procedure to handle the discovery of heritage or archaeological materials such as rock paintings, drawings, human remains, or artefacts. This procedure should include:</p> <ol style="list-style-type: none"> i. Immediate suspension of construction activities upon discovery. ii. Informing the operational manager or supervisor. iii. Cordon off the area with danger tape and document the scene with photographs. <p>3. The supervisor/manager must report the find to the competent authorities, including the National Heritage Council of Namibia (061 244 375), National Museum (+264 61 276800), or the National Forensic Laboratory (+264 61 240461)</p>	<ul style="list-style-type: none"> • Incident report forms for chance finds. • Documentation of finds, including photographs and site maps. • Confirmation of notification to relevant authorities (e.g., email or call logs). • Records of follow-up actions. 	

5.1 Part B: Operational Phase

5.1.1 Human wildlife Conflict

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
Reduced Human-Wildlife Conflict	To reduce incidents of human-wildlife conflict by providing water for wildlife away from communities	<ol style="list-style-type: none"> 1. Construct and maintain boreholes at Otjihavarero to supply reliable water sources for wildlife, especially during droughts. 2. Monitor wildlife access to new water sources to assess reduction in crop and infrastructure damage by elephants and hyenas. 4. Develop and implement rapid response plans for any wildlife-related incidents affecting human safety or livelihoods. 5. Engage communities in regular consultations to identify ongoing or emerging conflict issues. 	<ul style="list-style-type: none"> • Pre-construction wildlife survey report. • Records of construction schedules and adherence to low-activity periods. • Inspection reports on temporary fencing and barriers. • Incident logs for wildlife encounters and resolutions. • Meeting minutes and agreements with communities and wildlife authorities. 	Proponent

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
			<ul style="list-style-type: none"> • Borehole placement approvals in line with conflict mitigation plans. 	

5.1.2 Aquifer Conservation

Aquifer conservation refers to the sustainable management and protection of underground water resources to ensure their long-term viability. This aspect is critical part of this EMP owing to the low yield fractured aquifers and known over-abstraction which led to degraded water quality especially increase in salinity in the area. Therefore, this EMP put strong emphasis on monitoring to ensure the aquifer healthy.

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
Water abstraction	To conserve the aquifer	<ol style="list-style-type: none"> 1. Do not abstract more than what is allocated by the permit. 2. Develop and implement a ground water monitoring plan. 3. Install and maintain automatic measuring gauges for real-time monitoring of abstraction levels 	<ul style="list-style-type: none"> • Abstraction reports • Ground water monitoring plan • Report of test pumping • Physical verification of vegetation 	Proponent

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
		<p>4. Conduct periodic test pumping and aquifer recharge assessments</p> <p>5. Monitor local vegetation, especially indicator species, for signs of stress.</p> <p>6. Undertake systematic and seasonal water quality assessments to detect changes in key parameters.</p> <p>7. Educate local communities on sustainable water use practices.</p> <p>8. Implement mitigation measures if aquifer stress indicators are observed, such as reduced abstraction or alternative water sources.</p>	<ul style="list-style-type: none"> • Water quality • Records of community engagement and education sessions. 	
Aquifer Sustainability	Ensure long-term water availability for ecosystem and community use	<p>1. Establish a recharge assessment to understand natural replenishment rates.</p> <p>2. Adjust abstraction levels based on aquifer recharge rates and test pumping results.</p> <p>3. Collaborate with hydrologists to assess aquifer health.</p>	<ul style="list-style-type: none"> • Recharge rate analysis reports. • Documentation of adjustments to abstraction rates based on recharge data. 	Proponent/ Site Manager

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
			<ul style="list-style-type: none"> Hydrologist assessment reports 	
Ecology	Rangeland Management	1. Monitor the vegetation health condition during abstraction and vice versa.	<ul style="list-style-type: none"> Vegetation monitoring 	Proponent
Skill and Knowledge transfer	To build local capacity	1. Identify and train competent people (Preferable youth) to do basic maintenance of the borehole and its supporting infrastructure.	<ul style="list-style-type: none"> Training report 	Proponent
Risk of water infrastructure destruction by elephant	To prevent infrastructure destruction by elephant	1. Build high and thick enough that will prevent elephants access to the water tank and solar infrastructures.	<ul style="list-style-type: none"> Elephant incident report 	Proponent
Conflict of water use by the communities	To prevent conflict among communities of the borehole Ensure fair and equitable water distribution among community members	1. Raise awareness of the indented purpose of the borehole. 2. Ensure no one is made to be entitled to owning or have controlling power on who should use the borehole 3. Implement the grievance procedures	<ul style="list-style-type: none"> Community consultation and awareness raising report 	Proponent

Environmental / Social Aspect	Objective	Action Required	Monitoring Indicator	Party responsible
		4. Form a community water committee to mediate disputes and oversee water distribution.		
Corrosion of borehole metal casing	To ensure the casing are not corroded that could affect pump yields and water quality	1. Use non-corrosive casing materials like PVC or coated steel. 2. Conduct regular inspections to check for signs of wear.	<ul style="list-style-type: none"> Corrosion monitoring reports 	Proponent

5.1.3 Ground Water Monitoring Plan

The purpose of the Groundwater Monitoring Plan is to establish appropriate procedures for monitoring and assessing the response of the aquifer and surrounding environment to the water abstraction process. The plan aims to manage the impacts of groundwater extraction and contaminant loads, while also tracking changes in aquifer response and water quality. Additionally, the monitoring system will serve as an early warning mechanism for detecting potential over-abstraction or other issues that could arise over time.

5.1.3.1 Groundwater Quality

It is essential to monitor the quality of abstracted groundwater on a regular and realistic basis. This ongoing assessment will serve as an early warning system for any changes in water quality that may arise due to the abstraction process, natural factors, or pollution. Regular monitoring will help identify potential issues before they become significant problems, allowing for timely interventions.

To effectively achieve this, it is recommended to conduct intermittent water quality testing. This testing should include a comprehensive analysis of various parameters, such as chemical composition, microbial presence, and overall water quality indicators. By implementing a systematic approach to water quality testing, the project can ensure the sustainability of groundwater resources and protect both human health and the surrounding environment.

5.1.3.2 Groundwater Level Measurements

The level of groundwater in the aquifer plays a crucial role in assessing the relationship between water quantity and the rate of abstraction. This information is particularly important given the limited recharge rates due to low rainfall in the area. To facilitate this monitoring, a provision has been included in the monitoring sheet for water meter readings provided by the Ministry of Agriculture, Water and Land Reform (MAWLR) to the borehole operator.

It is essential that baseline hydrological data on water levels is recorded to ensure consistent and time-variant data collection. This systematic approach to monitoring will not only help in managing water resources effectively but will also serve as compelling evidence of any

discrepancies or errors when the MAWLR conducts periodic inspections. Establishing a robust framework for tracking groundwater levels, will result in a better understanding of the general groundwater resource in the area that will inform necessary actions to mitigate potential impacts.

6 DECOMMISSIONING AND REHABILITATION PLAN

The decommissioning process involves carefully removing all installed equipment and structures in essentially the reverse order of construction. While groundwater infrastructure is designed to serve multiple generations, decommissioning is only undertaken in exceptional circumstances, such as when water quality deteriorates significantly or when required by urgent national priorities.

To ensure long-term operational effectiveness, regular maintenance and equipment replacement are essential as components age. This maintenance must be conducted by qualified Namibian technicians who possess specialized knowledge and expertise in borehole management systems. This approach not only ensures proper maintenance but also builds local technical capacity.

Borehole casings are particularly vulnerable to corrosion over time, which can compromise both the structure and performance of the water supply system. Therefore, implementing regular rehabilitation programs is crucial to maintain optimal water yield and quality. These programs include systematic inspections, preventive maintenance, and targeted repairs based on performance monitoring data.

7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusions

The Otjahorovara Village, located in the Kunene North landscape, is characterized by arid environment with average annual rainfall below 100mm. The landscape presents a diverse topography comprising hills, plains, and wooded river valleys, supporting semi-desert and sparse savannah vegetation.

The proposed drilling sites are devoid of vegetation, has existing borehole infrastructures and will not require the construction of access roads, thereby significantly reducing environmental disturbances.

This study was conducted with a high level of confidence, ensuring that most potential impacts were thoroughly assessed and can be mitigated to insignificant levels. Based on the risk assessment results and proposed mitigation measures, the project is not expected to cause significant adverse environmental effects. Based on this information, the following conclusions have been drawn:

1. **Low Groundwater Potential:** The region exhibits relatively low groundwater potential, which suggests that the available water resources are limited and should be carefully managed to ensure sustainability.
2. **Risks of Excessive Groundwater Extraction:** Over-extraction of groundwater could lead to significant depletion of water resources, as well as a deterioration in water quality. This could have long-term negative effects on both the environment and the community's access to clean water.

7.2 Recommendations

The study henceforth recommend the following:

1. **Issuance of the Environmental Clearance Certificate (ECC):** It is recommended that the approving authority proceed with the issuance of the Environmental Clearance Certificate (ECC), subject to the implementation of the proposed mitigation measures to ensure sustainable water management and environmental protection.
2. **Continued Support for Otjahorovara Village:** The CCFN or the responsible government agency / ministry should support for the Otjahorovara Village to ensure regular testing of water quality, obtaining the necessary fitness-for-use approvals, and monitoring the performance of the borehole. These actions will help maintain the sustainability and safety of the water supply, while also ensuring that the community can rely on consistent, safe access to water in the long term

8 REFERENCES

- BEDMAR, A.P. (1999): Groundwater Investigation at Caprivi Region using Isotope and Chemical Techniques. – Report prepared by IAEA for DWA, Project NAM/8/002, 45 p.; Windhoek and Vienna.
- BGR-DWAF. (2006). Desk Study Report, Cuvelai-Etosha Groundwater Investigation, Version 1.1. Windhoek, Namibia
- CBA (1998): Eastern Caprivi Water Supply Project. – Final Report on the Implementation of the Drilling Programme, prepared for DWA; Windhoek.
- CES & LCE (1994): Feasibility Study for the Development of Water Supply for the Area between Katima Mulilo and Kongola in the Eastern Caprivi. – Prepared for KfW & DWA, Volume 5: Groundwater Investigation; Windhoek.
- Christelis G. and Struckmeier W. (2015). Groundwater in Namibia, an explanation to the Hydrogeological Map. Windhoek, Namibia
- DWA (2005): Groundwater Investigations in the Eastern Caprivi Region Main Hydrogeological Report. Volume IV.GW.2.1
- Hamutoko J. T. (2013). Estimation of Groundwater Vulnerability to Pollution based on DRASTIC and BTU method in the upper Cuvelai-Etosha basin. Windhoek, Namibia
- Mendelsohn, J., Jarvis, A., Roberts, C. & Robertson, T., 2009. Atlas of Namibia. 3rd ed. Cape Town: Sunbird Publishers.
- Tordif E. (2009). Notes on Hydrogeology Training for Ministry of Agriculture, Water and Forestry, Department of Water Affairs and Forestry. Windhoek, Namibia