APP-002335

IRRIGATION ACTIVITIES ON PORTION 2 OF FARM OHLSENHAGEN NO. 174, PORTION 1 OF FARM ANABOOM NO. 400 AND PORTION 1 OF FARM ESCOURT NO. 713, OMAHEKE REGION

ENVIRONMENTAL ASSESSMENT SCOPING REPORT

Assessed by:

Assessed for:

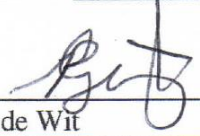
PG de Wit

May 2021

Project:	**IRRIGATION ACTIVITIES ON PORTION 2 OF FARM OHLSENHAGEN NO. 174, PORTION 1 OF FARM ANABOOM NO. 400 AND PORTION 1 OF FARM ESCOURT NO. 713, OMAHEKE REGION: ENVIRONMENTAL ASSESSMENT SCOPING REPORT**		
Report: Version/Date:	Final May 2021		
Prepared for: (Proponent)	PG de Wit P.O. Box 1 Gobabis Namibia		
~~**App Number**~~	~~APP-002335~~	~~**ID No.**~~	~~60071201904~~
Lead Consultant	Geo Pollution Technologies (Pty) Ltd PO Box 11073 Windhoek Namibia		TEL.: (+264-61) 257411 FAX.: (+264) 88626368
Main Project Team:	**Quzette Bosman** (BA. Geography/Sociology); (BA Environmental Management) **André Faul** (B.Sc. Zoology/Biochemistry); (B.Sc. (Hons) Zoology); (M.Sc. Conservation Ecology); (Ph.D. Medical Bioscience) **Pierre Botha** (B.Sc. Geology/Geography); (B.Sc. (Hons) Hydrology/Hydrogeology) **Jannie van der Merwe** (B.Sc. Geology/Geography); (B.Sc. (Hons) Hydrology/Hydrogeology) **Stefan Short** Health and Safety Supervisor/GIS Technician		
Cite this document as:	Bosman Q, Faul A, Botha P, van der Merwe J, Short S; 2021 May; Irrigation Activities on Portion 2 of Farm Ohlsenhagen No. 174, Portion 1 of Farm Anaboom No. 400 and Portion 1 of Farm Escourt No. 713, Omaheke Region: Environmental Assessment Scoping Report.		
Copyright	Copyright on this document is reserved. No part of this document may be utilised without the written permission of Geo Pollution Technologies (Pty) Ltd.		
Report Approval	 **André Faul** **Conservation Ecologist**		

I _____, the Proponent, hereby confirm that the project description contained in this report is a true reflection of the information which the Proponent has provided to Geo Pollution Technologies. All material information in the possession of the Proponent that reasonably has or may have the potential of influencing any decision or the objectivity of this assessment is fairly represented in this report.

Signed at GOBABIS on the 4th day of JUNE 2021.



PG de Wit

60071201904
ID/Company Registration Number

EXECUTIVE SUMMARY

P.G. de Wit requested Geo Pollution Technologies (Pty) Ltd to undertake an environmental assessment for the existing agricultural activities on the farming unit consisting of Portion 2 of Ohlsenhagen No. 174, Portion 1 of Anaboom No. 400 and Portion 1 of Escourt No. 713, in the Omaheke Region. For purposes of crop cultivation, the Proponent has cleared 116 ha, of which 56 ha is under irrigation and the remainder dryland cropping. The Proponent plans to clear an additional 66 ha of which 28 ha may be used for irrigation purposes, should a water allocation be provided. At present, the main crop cultivated under irrigation and dryland is maize, but alternative crops may be considered in future. Irrigation is from production boreholes by means of centre pivot irrigation systems. The main operational activities include:

- land preparation,
- planting,
- water abstraction and irrigation,
- fertilizer application and pest control,
- harvesting, and transporting activities specific to each crop, and
- cattle farming and marketing.

The environmental assessment determines all environmental, safety, health and socio-economic impacts associated with the continued agricultural activities on the farm. Relevant environmental data was compiled by making use of primary data (hydrogeological specialist study), secondary data and from a reconnaissance site visit. Potential environmental impacts and associated social impacts were identified and are addressed in this report.

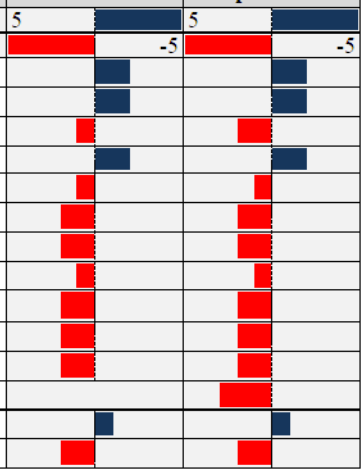
The project location lies amidst various other agricultural farms and developments. Due to the nature and location of the Proponents' agricultural activities, some impacts can be expected on the surrounding environment. These are summarised in the impacts table below. Regular environmental performance monitoring is thus recommended to ensure regulatory compliance and the implementation of corrective measures when necessary, especially with regards to water abstraction. P.G. de Wit's operations play a role in contributing to the Namibian agricultural sector as well as employment for the region.

The main concerns related to the operations are potential groundwater, surface water and soil contamination, decreased groundwater availability, ecological and social impacts. A safety, health, environment and quality (SHEQ) policy will contribute to effective management procedures, to prevent and mitigate impacts. All regulations relating to agriculture, labour and health and safety legislation should be adhered to. Groundwater and soil pollution must be prevented at all times. All staff must be made aware of the importance of biodiversity and poaching or illegal harvesting of animal and plant products prohibited. Groundwater abstraction permits must be strictly adhered to. Any waste produced must be removed from site and disposed of at an appropriate facility or re-used or recycled where possible. Hazardous waste must be disposed of at an approved hazardous waste disposal site. By appointing local employees and by implementing monitoring and training programs, the positive socio-economic impacts can be maximised while mitigating any negative impacts.

The environmental management plan included in Section 10 of this document should be used as an on-site reference document during all phases (planning, operations (including maintenance) and decommissioning) of the development. All monitoring and records kept should be included in six monthly reports to ensure compliance with the environmental management plan and the Ministry of Environment, Forestry and Tourism's requirements. Parties responsible for transgression of the environmental management plan should be held responsible for any rehabilitation that may need to be undertaken. The SHEQ policy should be used in conjunction with the environmental management plan. Operators and responsible personnel must be taught the contents of these documents. Local or national regulations and guidelines must be adhered to and monitored regularly as outlined in the environmental management plan.

Impact Summary Class Values

Impact Category	Impact Type	Construction	Operations
	Positive Rating Scale: Maximum Value	5	5
	Negative Rating Scale: Maximum Value	-5	-5
EO	Skills and Development		
EO	Revenue Generation and Employment		
SC	Demographic Profile and Community Health		
EO	Agricultural Produce and Economic Diversification		
SC	Traffic		
SC	Health, Safety and Security		
PC	Fire		
PC	Noise		
PC	Waste Production		
BE	Ecosystem and Biodiversity Impact		
PC	Groundwater, Surface Water and Soil Contamination		
BE/EO	Groundwater Abstraction		
SC	Visual Impact		
	Cumulative Impact		



BE = Biological/Ecological *EO = Economical/Operational* *PC = Physical/Chemical* *SC = Sociological/Cultural*

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

LIST OF ABBREVIATIONS

AEZ	Agro-Ecological Zone
AIDS	Acquired Immune Deficiency Syndrome
BE	Biological/Ecological
CHIRPS-2	Climate Hazards Group Infra-Red Precipitation with Station data
DWA	Department of Water Affairs
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMA	Environmental Management Act No 7 of 2007
EMP	Environmental Management Plan
EMS	Environmental Management System
EO	Economic/Operational
ES	Environmental Classification
GPT	Geo Pollution Technologies
HIV	Human Immunodeficiency Virus
IAPs	Interested and Affected Parties
IUCN	International Union for Conservation of Nature
LNAPL	Light Non-Aqueous Phase Liquids
mamsl	Meters Above Mean Sea Level
m/s	Metre per second
mbs	Metres below surface
MEFT	Ministry of Environment, Forestry and Tourism
mm/a	Millimetres per annum
MSDS	Material Safety Data Sheet
PC	Physical/Chemical
PPE	Personal Protective Equipment
ppm	Parts per million
SANS	South African National Standards
SC	Sociological/Cultural
SHEQ	Safety, Health, Environment and Quality
SRTM	Shuttle Radar Topography Mission
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

GLOSSARY OF TERMS

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.

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

Competent Authority - means a body or person empowered under the local authorities act or Environmental Management Act to enforce the rule of law.

Construction - means the building, erection or modification of a facility, structure or infrastructure that is necessary for the undertaking of an activity, including the modification, alteration, upgrading or decommissioning of such facility, structure or infrastructure.

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.

Environment - As defined in the Environmental Assessment Policy and Environmental Management Act - "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, palaeontological 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 Management System (EMS) - An Environment Management System, or EMS, is a comprehensive approach to managing environmental issues, integrating environment-oriented thinking into every aspect of business management. An EMS ensures environmental considerations are a priority, along with other concerns such as costs, product quality, investments, PR productivity and strategic planning. An EMS generally makes a positive impact on a company's bottom line. It increases efficiency and focuses on customer needs and marketplace conditions, improving both the company's financial and environmental performance. By using an EMS to convert environmental problems into commercial opportunities, companies usually become more competitive.

Evaluation –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.

Green Scheme - The Green Scheme is an initiative conducted by the Ministry of Agriculture, Water and Forestry to encourage the development of irrigation based agronomic production in Namibia with the aim of increasing the contribution of agriculture to the country's Gross Domestic Product. Its aim is also to simultaneously achieve the social development and upliftment of communities located within suitable irrigation areas and to also promote the human resources and skills development within the irrigation sub-sector. Such initiative could possibly enhance cross-border investment and facilitate the exchange of relevant and limited resources with neighbouring countries in this regard.

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 (IAP) - any person, group of persons or organisation interested in, or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

Mitigate - The implementation of practical measures to reduce adverse impacts.

Proponent (Applicant) - Any person who has submitted or intends to submit an application for an authorisation, as legislated by the Environmental Management Act no. 7 of 2007, to undertake an activity or activities identified as a listed activity or listed activities; or in any other notice published by the Minister or Ministry of Environment & Tourism.

Public - Citizens who have diverse cultural, educational, political and socio-economic characteristics. The public is not a homogeneous and unified group of people with a set of agreed common interests and aims. There is no single public. There are a number of publics, some of whom may emerge at any time during the process depending on their particular concerns and the issues involved.

Scoping Process - process of identifying: issues that will be relevant for consideration of the application; the potential environmental impacts of the proposed activity; and alternatives to the proposed activity that are feasible and reasonable.

Significant Effect/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.

Stakeholder Engagement - The process of engagement between stakeholders (the proponent, authorities and IAPs) during the planning, assessment, implementation and/or management of proposals or activities. The level of stakeholder engagement varies depending on the nature of the proposal or activity as well as the level of commitment by stakeholders to the process. Stakeholder engagement can therefore be described by a spectrum or continuum of increasing levels of engagement in the decision-making process. The term is considered to be more appropriate than the term "public participation".

Stakeholders - A sub-group of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term therefore includes the proponent, authorities (both the lead authority and other authorities) and all interested and affected parties (IAPs). The principle that environmental consultants and stakeholder engagement practitioners should be independent and unbiased excludes these groups from being considered stakeholders.

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 International Union for Conservation of Nature (IUCN), the United Nations Environment Programme and the World Wide Fund for Nature (1991).

1 BACKGROUND AND INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by Mr. P.G. de Wit (the Proponent) to undertake an environmental assessment for the existing agricultural activities on his farming unit in the Gobabis District, Omaheke Region. The farming unit consists of three farms namely Portion 2 of Ohlsenhagen No. 174, Portion 1 of Anaboom No. 400 and Portion 1 of Escourt No. 713 (Figure 1-1). The main commercial activities of the Proponent on the farm are crop cultivation and cattle farming. For purposes of crop cultivation, the Proponent has cleared 116 ha, of which 56 ha is under irrigation and the remainder dryland cropping. At present, main crop cultivated under irrigation and dryland is maize, but alternative crops may be considered in future. The Proponent plans to clear an additional 66 ha of which 28 ha may be used for irrigation purposes, should a water allocation be provided. Irrigation is from production boreholes by means of centre pivot irrigation systems. The main operational activities include:

- land preparation,
- planting,
- water abstraction and irrigation,
- fertilizer application and pest control,
- harvesting and transporting maize to markets, and
- cattle farming and marketing.

A detailed project description is provided in Section 4. The potential impacts of the project on the environment, resulting from various operational, maintenance and construction, and possible decommissioning activities, were determined through the risk assessment as presented in this report. The environment being defined in the Environmental Management Act as "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". The environmental assessment was conducted to apply for an environmental clearance certificate in compliance with Namibia's Environmental Management Act (Act No 7 of 2007) (EMA).

Project Justification – To realise agricultural related sustainability goals of the 5th National Development Plan of Namibia (NDP5), the then Ministry of Agriculture Water and Forestry (now Agriculture, Water and Land Reform) established a strategic plan 2017/18 -2021/22. As part of this plan the Ministry aims to, amongst others, increase the percentage of farmers conducting conservation agriculture while also setting targets for increased irrigation based agriculture. Both of these strategies are focussed on increasing sustainable food production and ensuring food security in Namibia. The Proponent has a well-established agriculture development, which sees an optimisation of crop production by means of irrigation, augmented by rainwater. Existing and planned agricultural activities require employment, which is required to be maintained for continued operations. Pivot irrigation systems also requires significant investment costs and therefore the development of the irrigation areas has ensured a sizeable investment into the area and the Omaheke Region. Benefits of the agricultural activities conducted by the Proponent include:

- Food production and enhanced food security for local (maize) and potential international (beef) markets.
- Employment and supporting of livelihoods of both unskilled and skilled labourers.
- Technological development and investment in agricultural practices.
- Generation of income that contributes to the national treasury.
- Support for economic resilience in the area through diversified business activities and opportunities.

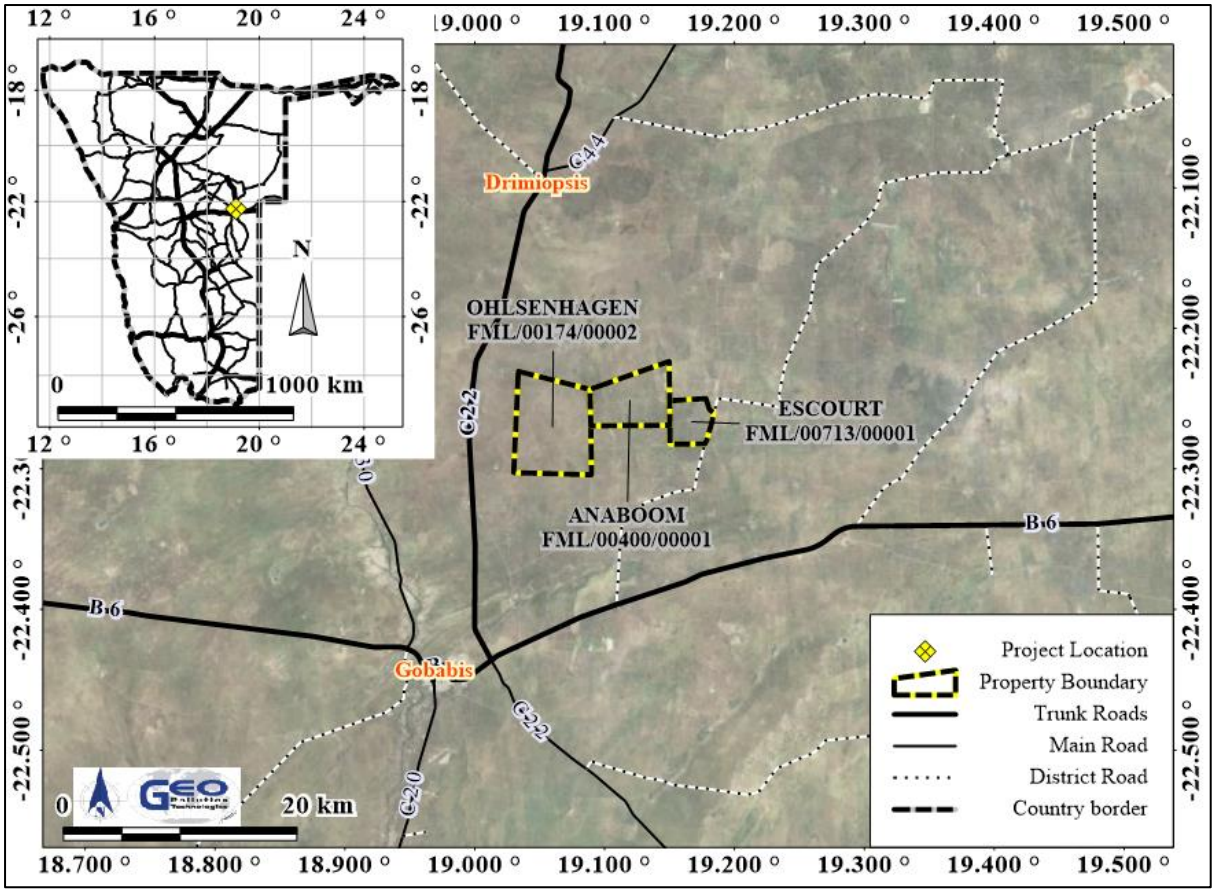


Figure 1-1. Project location

2 SCOPE

The scope of this report is to, in compliance with the requirements of EMA:

1. Present a detailed project and environmental description related to the Proponent's operational activities.
2. Determine the potential environmental impacts emanating from the Proponent's operational activities and potential future decommissioning of such activities.
3. Identify a range of management actions to mitigate the potential adverse impacts to acceptable levels.
4. Provide sufficient information to the relevant competent authority and the Ministry of Environment, Forestry and Tourism (MEFT) to make an informed decision regarding the project and the issuing of an environmental clearance certificate.

3 METHODOLOGY

Methods employed to investigate and report on potential impacts of the Proponent's operational activities on the social and natural environment include:

1. Detailed infrastructure and operational procedures received from the client are presented in this report.
2. Baseline information about the site and its surroundings were obtained from primary information (hydrogeological assessment), existing secondary information as well as from a reconnaissance site visit.

3. As part of the scoping process to determine potential environmental impacts, interested and affected parties (IAPs) were consulted about their views, comments and opinions, all of which are presented in this report.
4. As per the findings of this environmental assessment, a scoping report with an environmental management plan (EMP) were prepared and this will be submitted to the MEFT.

4 OPERATIONS AND RELATED ACTIVITIES

P.G de Wit has been the owner of the farms Portion 2 of Ohlsenhagen No. 174, Portion 1 of Anaboom No. 400 and Portion 1 of Escourt No. 713 for a number of years. Agriculture has always been the main economic activity conducted on the farms. Over recent years, agricultural practises were intensified and diversified through various agricultural initiatives on the farms. Where traditional farming practices mainly involved livestock production, it is now supplemented with crop cultivation by means of irrigation and dryland cropping as well as equestrian interests. The following sections provide a brief description of the infrastructure, operations and services supply on the farms.

4.1 LAND CLEARING

Mechanical clearing of rangeland for crop cultivation and infrastructure purposes was performed on suitable portions of the farms. Land clearing entailed the removal of trees and bushes. Grass is only removed when land preparation for crop cultivation is conducted. Some areas around crops fields are also cleared since there is greater competition for water resources when trees and bushes are too close to crop fields. Total cleared areas for irrigation, dryland crop production and rangeland amounts to approximately 116 ha as indicated in Figure 4-1. The Proponent plans to clear an additional 66 ha of which 28 ha may be used for irrigation purposes, should a water allocation be provided.

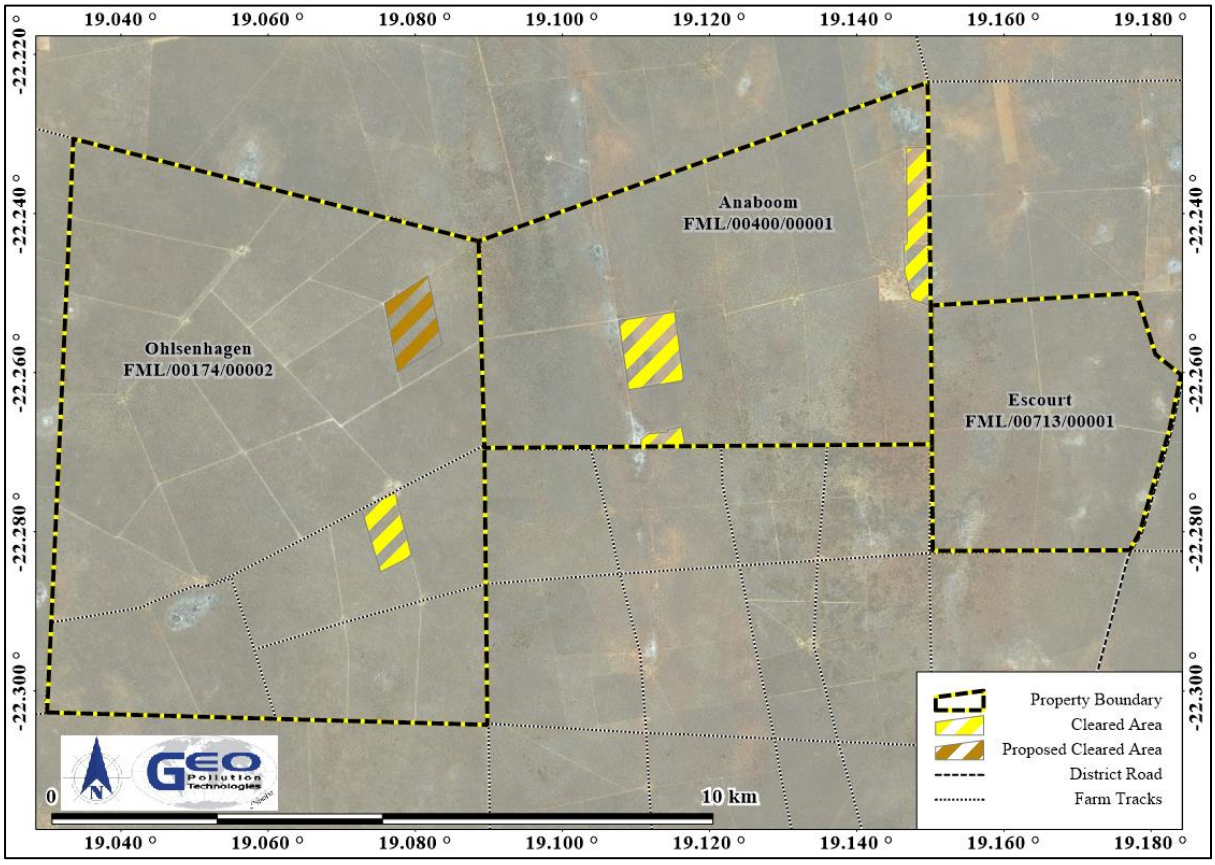


Figure 4-1. Cleared areas of the project area

4.2 CROP PRODUCTION

The main cultivated produce are maize, while oats, lucern and wheat are considered as companion crops. A combined area of approximately 60 ha is used for dryland cropping of such produce. Crop cultivation by means of irrigation is conducted over 56 ha. Of the irrigated land, 28 ha is cultivated on a rotational basis while the remainder is left fallow to allow the soil to rest and regenerate as well as for pest control purposes. This is repeated on a rotational basis, each successive year allowing a new area to remain fallow. The main crop under irrigation on the 56 ha is maize, which is sold to local Namibian mills. An additional 28 ha of irrigated area is planned to diversify current agricultural production, see Figure 4-2.

Photo 4-1. Cleared and planted pivot area

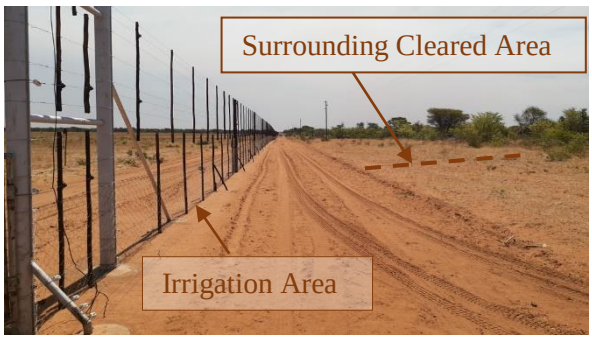


Photo 4-2. Cleared areas next to irrigated area

Preparation of the land and planting entails mechanical activities like ripping, tilling and seeding of the soil, with tractors and specialised implements. Harvesting is performed with maize harvester machines.

Fertilizers and pesticides are applied as required and according to the specifications for application. For irrigated fields, fertilisers are mixed with water in large mixing tanks. Once the desired mixing ratio is achieved, the fertilisers are fed into the respective irrigation systems for administration onto the crops. The proponent utilises a low-soluble-nutrient fertilizers which may be readily absorbed by crops and requires less water. Pesticides are administered as per the specified application procedures for the corresponding pest by means of tractor spraying. To ensure correct and safe application of pesticides, a pesticide plan is implemented and regularly updated. The proponent requires a minimum amount of pesticides as compared to conventional agricultural production. All pesticides are stored in a dedicated chemical store.

Photo 4-3. Fertilizer mixing tank on Portion 1 of Anaboom No. 400

Photo 4-4. Fertilizer mixing tank on Portion 2 of Ohlsenhagen No. 174

Irrigation agriculture is conducted to the Farms Anaboom and Ohlsenhagen, with the each having one pivot system shared between two pivot areas. Irrigation related agriculture is supported by licenced irrigation boreholes. Supporting infrastructure include fuel storage and a chemical mixing unit as indicated in Figure 4-2. Dryland crop production is conducted in the eastern areas on Anaboom. In addition, al four pivots are considered for future diversification on cultivated crops. The planned expansion area is located to the south and south-east of existing operations. All operations are serviced by NamPower while waste is sorted and where possible reused (such

as using old oil to coat fencing posts). Equipment used in cultivation (e.g. tractors) is powered by diesel, stored on the farm.

Photo 4-5. NamPower line to the farming operations

Photo 4-6. Implements used for crop cultivation

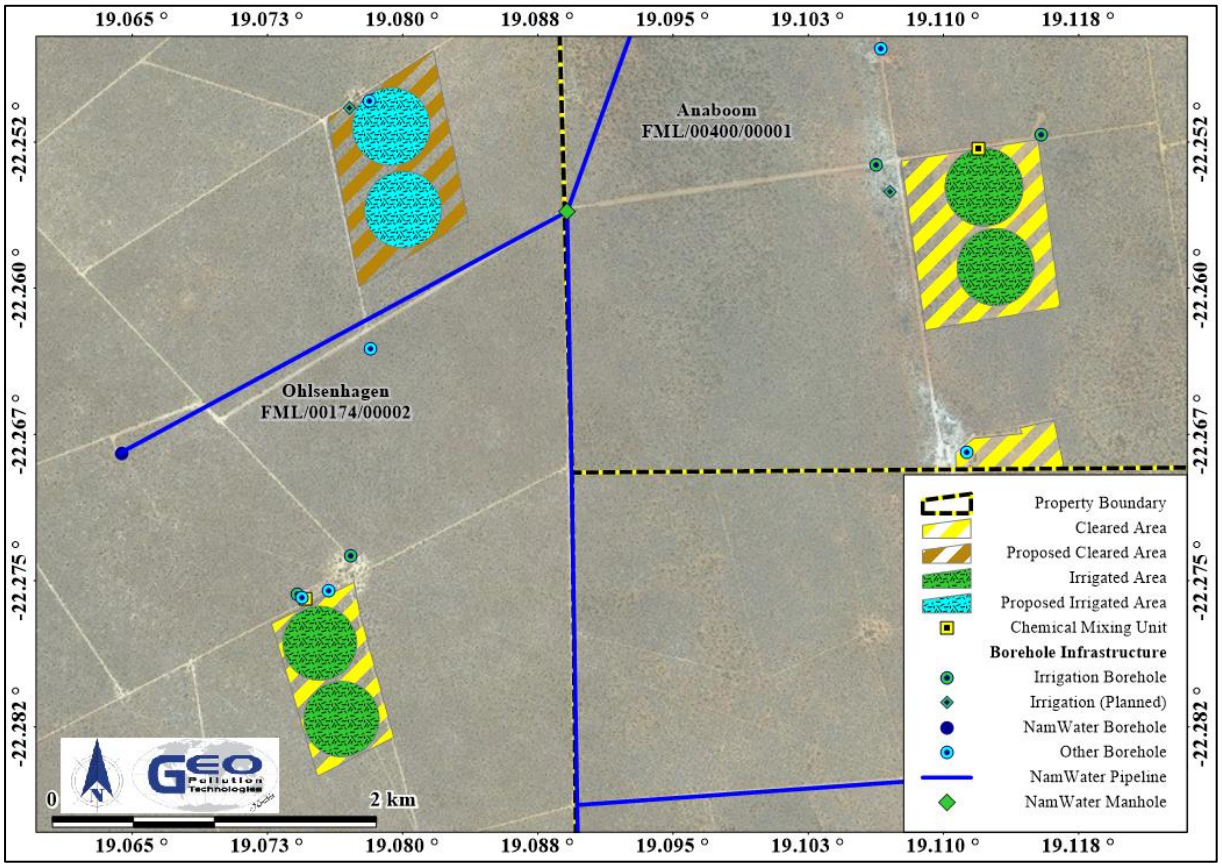


Figure 4-2. Irrigation and infrastructure layout on Portion 1 of Anaboom No. 400 and Portion 2 of Ohlsenhagen No. 174

4.3 LIVESTOCK

The main agricultural activity on the farms remain cattle ranching for commercial purposes. Cattle are accommodated in all areas of the farms except the pivot and crop cultivation areas. The ivestock is transported to national markets when they are market ready. Bush clearing was previously conducted on the farms, in an attempt to improve rangeland conditions. The Proponent also employs a feedlot on the Farm Anaboom No. 400 (Portion 1).

4.4 IRRIGATION SYSTEMS

Irrigation systems employed on the farms are centre pivots, however micro-sprayers and drip irrigation may be considered in future. A brief description of each system is provided below.

Phocaides (2007) provides a concise description of the centre pivot, being a low to medium pressure fully mechanised, automated irrigation of permanent assemble. It basically comprise a sprinkler pipeline (usually of high tensile galvanized light steel or aluminium pipes) supported above ground by mobile A-frame towers, long spans, steel trusses and/or cables. The pipeline is connected to a central tower with the "pivot mechanism" and main control panel. The central tower is a fixed structure with a concrete base secured at a fixed water supply point, in the centre of the pivot (field). The entire system is self-propelled to slowly rotate around the central tower while dispensing water through sprinklers (emitters) connected to the pipeline. An automatic alignment systems ensures the irrigation pipeline remains straight while a drive system enables the system movement.

Mobile towers are typically approximately 3 m in height while being spaced about 30 m apart. The spans are therefore roughly 30 m in length. The entire length of the system may vary from design to design and therefore the size of the irrigated area will also vary. Longer systems will have a greater circumference and larger range. Photo 4-7 depicts a typical centre pivot system while Photo 4-8 and Photo 4-9 presents some of the pivots systems which are being employed in Namibia. The system depicted in Photo 4-8 and Photo 4-9 has a system length of 300 m with spans at a width of 50 m. The irrigated area therefore covered by these systems are 30 ha.

Photo 4-7. Typical Centre Pivot System with Fixed Central Tower (Phocaides (2007)

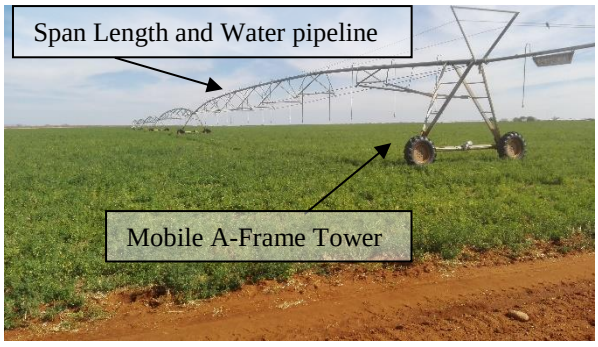


Photo 4-8. Centre Pivot System Pipeline

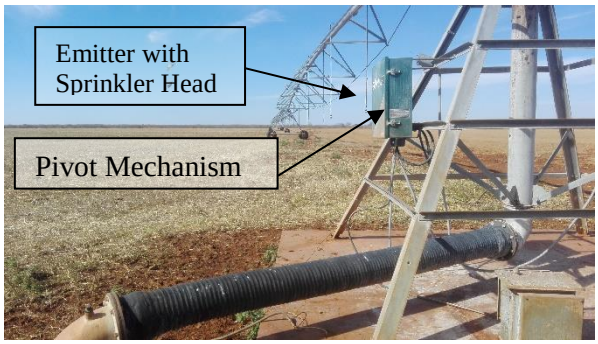


Photo 4-9. Centre Pivot System Employed in Namibia

4.5 WATER SUPPLY

The only available water source for the project is groundwater and the farms in the project area thus rely on boreholes for water supply for potable use, irrigation and livestock.

Forty (40) boreholes are present on the three farms operated by the Proponent. Two additional boreholes is planned for the project, one on farm Ohlsenhagen No. 174 (Portion 2) and another on farm Anaboom No. 400 (Portion 1). These two boreholes are intended for irrigation purposes, should a permit allocation be provided. A summary of the available borehole data received from the Proponent is provided in Table 4-1. Figure 4-3 illustrates locations of all the boreholes as received from the Proponent, as well as contained in the DWA database, on the farms and immediate vicinity. Note that the majority of the boreholes are not currently used by the Proponent. However, a number of boreholes are used for purposes of potable water supply (domestic use), irrigation and/or livestock watering.

Four boreholes are currently employed as irrigation boreholes. These are borehole WW204515, and WW204516 on farm Anaboom No. 400 (Portion 1); and borehole WW205775 and WW205776 on farm Ohlsenhagen No. 174 (Portion 2). On farm Ohlsenhagen No. 174 (Portion 2) borehole WW205919 was previously used for irrigation purposes, but it collapsed at the end of 2019. Borehole WW204517 on farm Anaboom No. 400 (Portion 1) is also registered for irrigation purposes, but is however currently employed as a stock watering borehole.

Abstracted water is used to irrigate crops via centre pivot irrigation systems. Submersible pumps are installed in the boreholes to pump water via buried pipelines to reservoirs, where, on demand, the water is mixed with fertilizer and then transferred to the irrigation systems. The irrigation boreholes are fitted with flow meters at each borehole.

Borehole WW35219 on farm Ohlsenhagen No. 174 (Portion 2) and borehole WW35234 on farm Anaboom No. 400 (Portion 1) are managed by NamWater and form part of the Gobabis - North East scheme. The scheme consist of borehole and pipeline infrastructure that supply groundwater to the Gobabis Municipality during periods of surface water shortages (Du Plessis, 2020). Borehole WW35219 and WW35234 are indicated in Figure 4-3 as Map Reference No. 5 and 17 respectively.

Three boreholes on farm Ohlsenhagen No. 174 (Portion 2) are used for stock watering purposes while one borehole at the farmhouse, is used for domestic purposes. On farm Anaboom No. 400 (Portion 1), five boreholes are used for stock watering and three boreholes used for domestic purposes. On farm Escourt No. 713 (Portion 1) there are three boreholes used for stock watering purposes. No irrigation or domestic boreholes are at present on farm Escourt No. 713 (Portion 1).

The Proponent has an abstraction permit for borehole WW204515, WW204516 and WW204517 on farm Anaboom No. 400 (Portion 1) dated 10 June 2016 and valid for 5 years. The permit allows for the abstraction of up to 140,000 m³ per year for irrigation purposes. Upon the renewal of this abstraction permit, an abstraction volume of 360,000 m³ per year will be applied for. An assessment of the last three years' abstraction and water level returns indicated that this abstraction amount is feasible

The Proponent is also in possession of two abstraction permits for farm Ohlsenhagen No. 174 (Portion 2). One is for boreholes WW205775 and WW205776 dated 21 September 2020. The other permit is for borehole WW205191 dated 18 September 2018. The permits allows for the abstraction of up to 140,000 m³ per year for irrigation purposes per permit. The second permit for the farm Ohlsenhagen No. 174 (Portion 2), which provide for the abstraction of water from borehole WW205191, will be reapplied for since there is a discrepancy with the borehole numbering. An increase of allowable abstraction will also be applied for, with an application for 360,000 m³ per year planned. Relevant permits are included in Appendix A.

Table 4-1. Summary of borehole information obtained from the Proponent

Map Ref.	Farm Name	Borehole Name(s)	Use	Borehole Depth (m)	Yield (m³/h)	Water Level (mbs)
1	Ohlsenhagen No. 174 (Portion 2)	WW205776	Irrigation	60	80	25
2	Ohlsenhagen No. 174 (Portion 2)	WW205775	Irrigation	70	150	25.15
3	Ohlsenhagen No. 174 (Portion 2)		Not Used			
4	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	15
5	Ohlsenhagen No. 174 (Portion 2)	WW35219	Not Used	102	46.2	22.75

Map Ref.	Farm Name	Borehole Name(s)	Use	Borehole Depth (m)	Yield (m^3/h)	Water Level (mbs)
6	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	15
7	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	24
8	Ohlsenhagen No. 174 (Portion 2)	WW205919	Not Used	60	40	24.7
9	Ohlsenhagen No. 174 (Portion 2)		Not Used	30	4.5	18
10	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	34	11.4	18
11	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	34	11.4	18
12	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	35	4.5	18
13	Ohlsenhagen No. 174 (Portion 2)	Planned Borehole	Potential Irrigation			
14	Anaboom No. 400 (Portion 1)	Huis Water	Domestic	65	10	
15	Anaboom No. 400 (Portion 1)	WW204515	Irrigation	72	110	26.3
16	Anaboom No. 400 (Portion 1)	WW204516	Irrigation	66	120	24.5
17	Anaboom No. 400 (Portion 1)	WW35234	Not Used (NamWater Borehole)	120	36.6	25.35
18	Anaboom No. 400 (Portion 1)		Not Used	47	2.7	40
19	Anaboom No. 400 (Portion 1)		Not Used			
20	Anaboom No. 400 (Portion 1)		Not Used			
21	Anaboom No. 400 (Portion 1)	WW31091	Not Used	84		
22	Anaboom No. 400 (Portion 1)	WW31080	Not Used	74		
23	Anaboom No. 400 (Portion 1)		Not Used			
24	Anaboom No. 400 (Portion 1)		Not Used	32	2.3	21
25	Anaboom No. 400 (Portion 1)	WW31090	Not Used	78		
26	Anaboom No. 400 (Portion 1)	WW31584	Not Used	74		
27	Anaboom No. 400 (Portion 1)		Stock Watering	30	4.5	18
28	Anaboom No. 400 (Portion 1)	WW204517	Stock Watering	37	5.4	24
29	Anaboom No. 400 (Portion 1)		Stock Watering	46	3.2	
30	Anaboom No. 400 (Portion 1)		Domestic		2.7	
31	Anaboom No. 400 (Portion 1)		Domestic		2.5	
32	Anaboom No. 400 (Portion 1)		Stock Watering	100	4.3	24
33	Anaboom No. 400 (Portion 1)		Stock Watering	30	15	
34	Anaboom No. 400 (Portion 1)	Planned Borehole	Potential Irrigation			
35	Escourt No. 713 (Portion 1)		Not Used		0.5	
36	Escourt No. 713 (Portion 1)		Not Used			
37	Escourt No. 713 (Portion 1)		Not Used	48	4.5	37
38	Escourt No. 713 (Portion 1)		Not Used			

Map Ref.	Farm Name	Borehole Name(s)	Use	Borehole Depth (m)	Yield (m^3/h)	Water Level (mbs)
39	Escourt No. 713 (Portion 1)		Not Used			
40	Escourt No. 713 (Portion 1)		Stock Watering	30	10	
41	Escourt No. 713 (Portion 1)		Stock Watering	100		
42	Escourt No. 713 (Portion 1)		Stock Watering	100		

Photo 4-10 Typical borehole installation on Ohlsenhagen No. 174 (Portion 2)

Photo 4-11. Flowmeter installation at Ohlsenhagen No. 174 (Portion 2)

Photo 4-12. Borehole cut-off valves next to installation at chemical mixing tank on Anaboom No. 400 (Portion 1)

Photo 4-13. Borehole cut-off valve on Anaboom No. 400 (Portion 1)

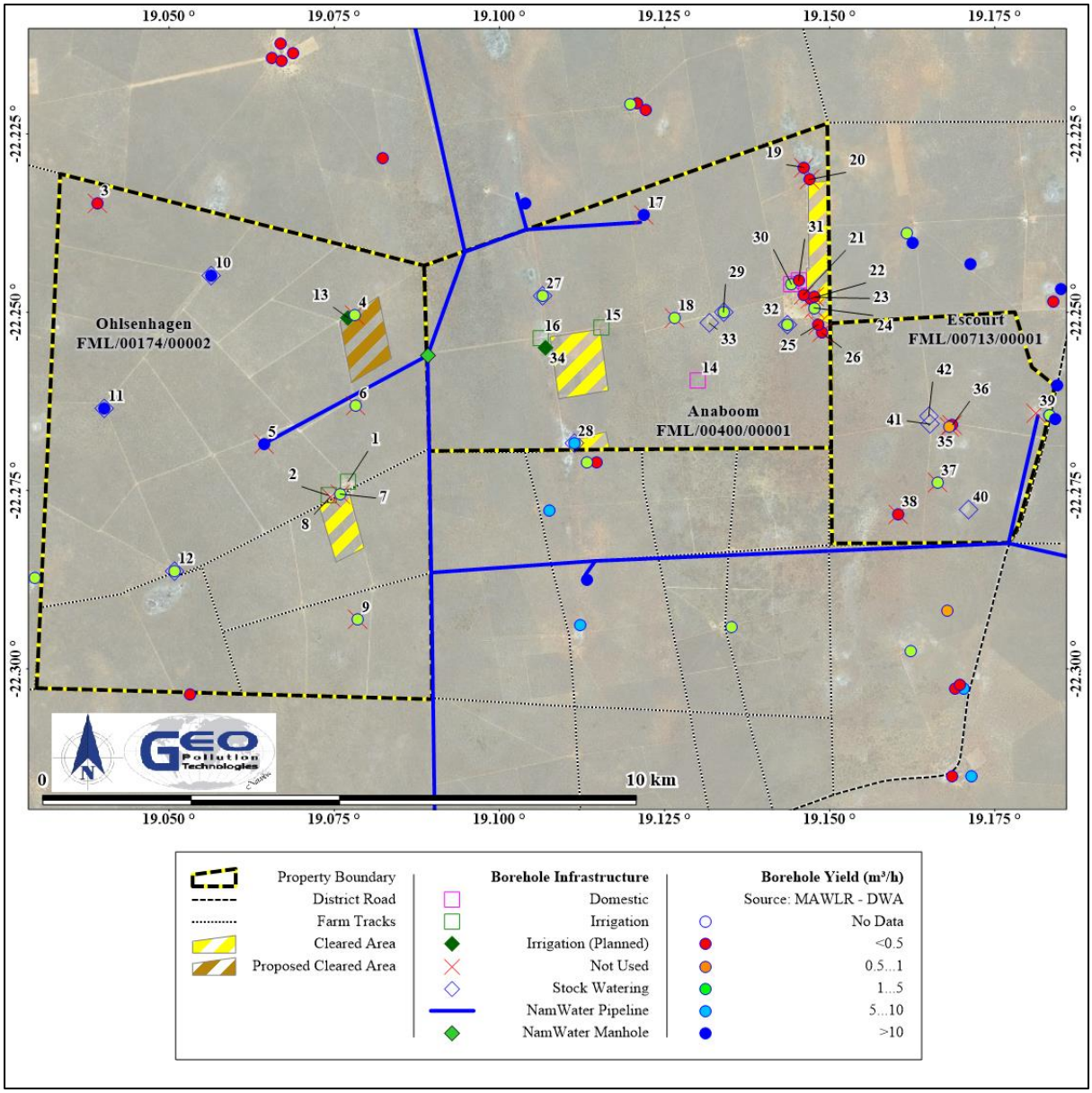


Figure 4-3. Locations of boreholes and cleared areas

4.6 SUPPORT INFRASTRUCTURE

Operations are enabled and supported by a variety of infrastructure on the farms. In many instances operations will not be possible without the support infrastructure. Figure 4-4 depicts the farm layout and indicates the location of the support infrastructure.

Fuel storage comprises of two aboveground diesel tanks of 2.2 m^3. The two tanks share a dispensing unit situated between the two tanks. Fuel is dispensed into a mobile fuel tank which is used to fill up tractors and related machines where operating. Diesel is supplied with tanker trucks by a fuel wholesaler.

Waste disposal mainly comprise an excavated pit where waste is regularly burned. Due to a lack of any recyclers in the area, recycling of certain wastes are not possible. However, where possible, certain waste items are not discarded, but rather re-used for alternative purposes. This includes the re-use of old oil when not collected by oil recycling companies.

Photo 4-14. Diesel tanks

Photo 4-15. Mobile Diesel tank

Electricity is provided by NamPower and supplemented through the use of solar geysers. Employee houses are serviced with electricity and solar geysers.

Various **storage and maintenance areas** are located on the properties and comprise of sheds and storerooms where implements and other maintenance material are stored under roof. All pesticides and other hazardous chemicals are stored in one location to which access is controlled. Maintenance and general repairs are conducted in a workshop.

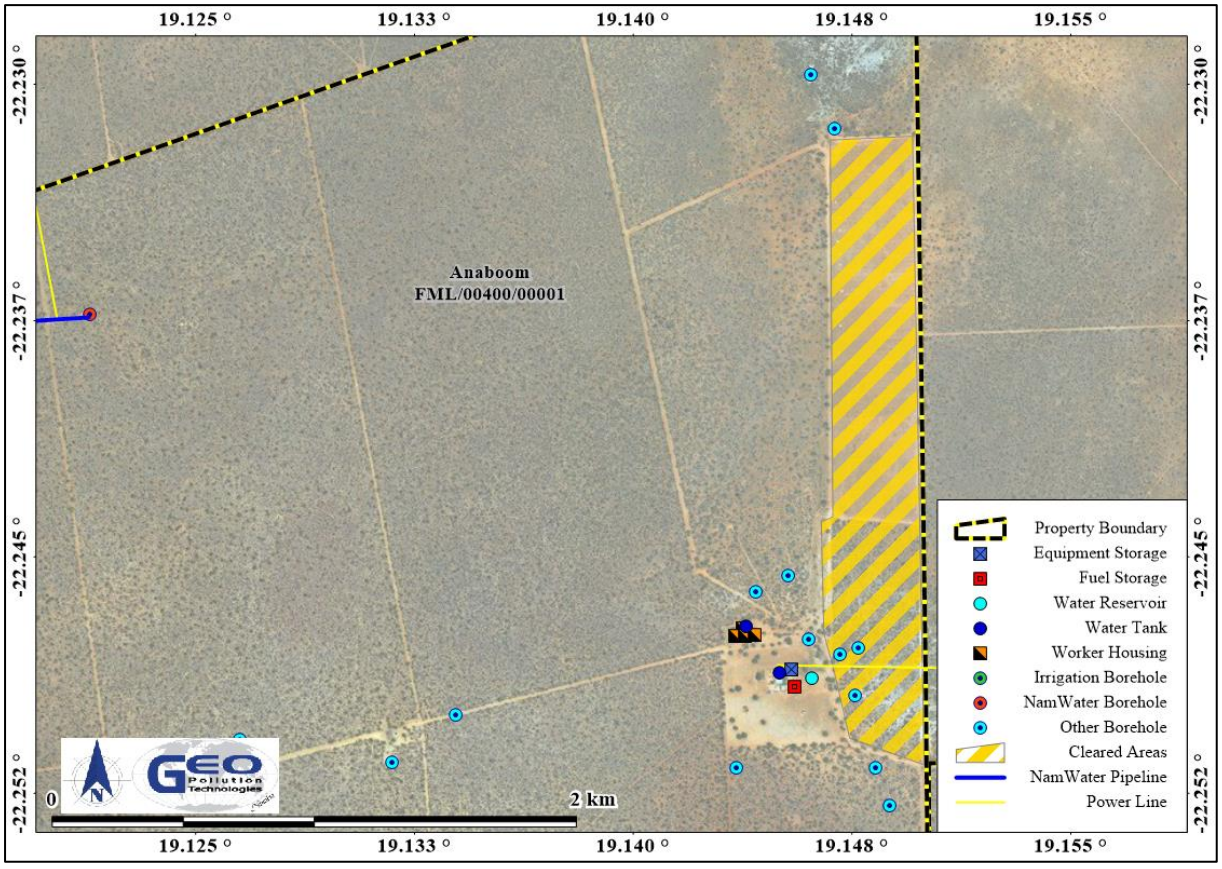


Figure 4-4. Support infrastructure of farm Anaboom No.400 (Portion 1)

4.7 EMPLOYMENT

Operations on the farm sustain approximately 15 permanent employment opportunities of which almost half are women. In addition, seasonal workers and or contract workers are employed from time to time for special tasks. Permanent workers are provided with housing on the farm. All housing have NamPower connections and running water with toilet facilities. All workers are provided with PPE and overalls. Most employees choose to have fenced units with small gardens.

Photo 4-16. Employee at his house

Photo 4-17. Water storage at labour accommodation area

Photo 4-18. Employee housing

Photo 4-19. Employee garden

5 ALTERNATIVES

Various alternatives related to the project are considered and each of these discussed. The alternatives can roughly be grouped into three main categories, namely:

- Location alternatives;
- Project implementation and design alternatives;
- No-go alternative.

5.1 LOCATION ALTERNATIVES

The proposed location for irrigation is well suited for crop production due to the availability of water and suitability of soils. Boreholes are already in place and land clearing and field establishment have already been completed. In addition, the Ministry of Agriculture, Water and Land Reform has provided the Proponent with a drilling license and water abstraction permits. No location alternatives are therefore considered feasible, as the proponent owns and or manages the properties, on which operations are conducted.

5.2 PROJECT IMPLEMENTATION AND DESIGN ALTERNATIVES

Various alternatives are continually considered to optimise crop production an irrigation. Boreholes are already in place and no surface water is available. Therefore, there are no alternative water sources for the proposed irrigation operations. However, there are a number of alternatives with regards to the application of the water used. The most pertinent relates to crop irrigation methods.

5.2.1 Irrigation Methods

When considering alternative irrigations systems, the most viable irrigation option is not only based on the irrigation system's design efficiency, but should include environmental constrains and operating costs. Some systems are simply not viable due to climatic and topographical features as well as cost implications. For example, flood irrigation is not viable on steeper gradients and are more expensive due to water pumping costs.

The type of produce cultivated also plays a determining role. It will not be feasible to install highly efficient yet expensive irrigation systems (such as drip irrigation) for crops with lower economic yields. In turn, some crops will not produce such high yields when cultivated under less efficient systems. Table 5-1 depicts different types of irrigation systems as per the South African Irrigation Institute's suggested efficiencies (IWRM Plan Joint Venture Namibia, 2010). The estimated average costs are based on 35 ha units. Although flood systems are not viable irrigation methods, these have been included for comparison with regards to capital cost and design efficiency.

Table 5-1. Irrigation system efficiency (IWRM Plan Joint Venture Namibia, 2010)

Irrigation System	Design Efficiency	Capital Costs (R /ha)
Flood: Furrow	65%	13,000
Flood: Border	60%	17,600
Flood: Basin	75%	18,800
Sprinkler: Dragline	75%	24,800
Sprinkler: Quick-coupling	75%	22,500
Sprinkler: Permanent	85%	34,500
Sprinkler: Travelling boom	80%	23,200
Sprinkler: Centre pivot	85%	43,300
Sprinkler: Linear	85%	69,400
Sprinkler: Micro sprinkler	85%	36,300
Micro: Spray	90%	53,200
Micro: Drip	95%	46,300

In the Gobabis area, climatic and soil conditions necessitate an irrigation system with a high rate of water deposition (due to evaporation and soil salinization). For purposes of irrigation, centre pivot and sprinkler systems are suitable. The proponent further only irrigates during the night to reduce evaporation losses through wind and heat. With less evaporation the Proponent has reported less limescale on crops and soil.

5.2.2 Soil Preparation

Traditionally, soil is prepared for planting by tilling and ploughing. These processes break the top layer of soil at varying depths and mix residual plant material into the soil. It also uproots weeds and provide for loose soil. There is nowadays however a shift in the approach to soil preparation that has some advantageous over traditional tilling. Conservation tillage practises aims at less disturbance of the soil and has advantages of less erosion, less evaporation and saves on time and costs of traditional tilling. Conservation tillage can either be just partial tillage as is the case with strip-tilling or no tilling at all. With strip-tillage, only narrow strips are tilled in the area where planting will take place. The areas, between planted rows, are left untilled and with residual plant material from the previous harvest. With no-tillage, seeds are planted on the field with no soil preparation at all. The Proponent should investigate the applicability and potential advantages of conservation tillage.

Table 5-2. Advantages and disadvantages of land preparation systems (adapted from https://cropwatch.unl.edu/tillage/advdisadv)

System	Major advantages	Major disadvantages
Plow	Suited for poorly drained soils. Excellent incorporation (mixing of soil for easy combination with chemical and organic elements). Well-tilled seedbed.	Major soil erosion. High soil moisture loss. Timeliness considerations. Highest fuel and labour costs. Reducing soil organic matter (micro flora and fauna), reduced soil structural stability. Increased surface runoff and water or wind erosion.

System	Major advantages	Major disadvantages
Disk	Less erosion with more residue. Well adapted for well-drained soils. Good incorporation.	Little erosion control with more operations. High soil moisture loss. Destroys soil structure. Compacts wet soil.
Strip-till	Tilled residue-free strip warms quickly. Injection of nutrients into row area. Well suited for poorly drained soils. Less wear on machinery, less use of fuel or animal power, less time devoted to soil preparation by the farmer thus a possible overall improvement in gross returns for the farm. Heavy rain, is more likely to concentrate in the seeder slots and thereby penetrate directly to the crop's root zone. Improve general water use efficiency by the crop.	Cost of preplant operation. Strips may dry too much, crust, or erode without residue. Not suited for drilled crops (mechanised seeding). Timeliness in wet falls. It also disturbs the soil but limits that disturbance to rows or slots in which the crop seeds and fertilizer are placed.
No-till	Excellent erosion control. Soil moisture conservation. Minimum fuel and labour costs. Builds soil structure and health.	No incorporation. Increased dependence on herbicides. Slow soil warming on poorly drained soils. Problems of disease and residue handling. Herbicides have long-term impacts on the environment. Some weeds have developed resistance to some herbicides, leading to a need to rotate both crops and herbicide groups in order to keep crops weed-free, or to plant GMO crop.

5.3 NO GO ALTERNATIVE

Agriculture has been a core activity in the Omaheke Region for years. Maize is supplied to Namibian mills and the stover used for fodder. Cattle are sold to local markets. This reduces the need for importing of crops, meat and fodder. Should the project not receive an environmental clearance certificate, there would be a loss in capital investment and employment. This will lead to a decrease in the spending power of the local community. Finally, less revenue will be generated for Namibia and more money will be required for importing of feed and food.

6 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

All projects, plans, programmes and policies with potential adverse impacts on the environment require an environmental assessment, as per the Namibian legislation. This promotes protection of the environment as well as sustainable development. The legislation and standards provided in Table 6-1 to Table 6-3 govern the environmental assessment process in Namibia, and are relevant to the assessed development.

Table 6-1. Namibian law applicable to the development

Law	Key Aspects
The Namibian Constitution	♦ Promote the welfare of people ♦ Incorporates a high level of environmental protection ♦ Incorporates international agreements as part of Namibian law

Law	Key Aspects
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ Defines the environment ♦ Promotes sustainable management of the environment and the use of natural resources ♦ Provides a process of assessment and control of activities with possible significant effects on the environment
Environmental Management Act Regulations Government Notice No. 28-30 of 2012	♦ Commencement of the Environmental Management Act ♦ List activities that requires an environmental clearance certificate ♦ Provide Environmental Impact Assessment Regulations
Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act Act No. 36 of 1947; Government Notice No. 1239 of 1947	♦ Governs the registration, importation, sale and use of fertilizers, farm feeds, agricultural remedies and stock remedies ♦ Various amendments and regulations
Seed and Seed Varieties Act 23 of 2018 Act No. 23 of 2018, Government Notice No. 368 of 2018	♦ Provides for restrictions on the importation of seed ♦ Not in force yet
The Water Act Act No. 54 of 1956	♦ Remains in force until the new Water Resources Management Act comes into force ♦ Defines the interests of the state in protecting water resources ♦ Controls water abstraction and the disposal of effluent ♦ Numerous amendments
Water Resources Management Act Act No. 11 of 2013	♦ Provides for management, protection, development, use and conservation of water resources ♦ Prevention of water pollution and assignment of liability ♦ Not in force yet
Forest Act (Act 12 of 2001, Government Notice No. 248 of 2001)	♦ Makes provision for the protection of the environment and the control and management of forest fires ♦ Provides for the licencing and permit conditions for the removal of woody and other vegetation as well as the disturbance and removal of soil from forested areas.
Forest Regulations: Forest Act, 2001 Government Notice No. 170 of 2015	♦ Declares protected trees or plants ♦ Issuing of permits to remove protected tree and plant species. ♦ Issuing of permits for harvesting of trees for wood and charcoal production and transport
Soil Conservation Act Act No. 76 of 1969	♦ Law relating to the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources in Namibia

Law	Key Aspects
Biosafety Act Act No. 7 of 2006	♦ Regulate activities involving the research, development, production, marketing, transport, application and other uses of genetically modified organisms and specified products derived from genetically modified organisms ♦ Prohibits planting of genetically modified organisms without registration
Petroleum Products and Energy Act Act No. 13 of 1990, Government Notice No. 45 of 1990	♦ Regulates petroleum industry ♦ Makes provision for impact assessment ♦ Petroleum Products Regulations (Government Notice No. 155 of 2000) ♦ Prescribes South African National Standards (SANS) or equivalents for construction, operation and decommissioning of petroleum facilities (refer to Government Notice No. 21 of 2002)
Local Authorities Act Act No. 23 of 1992, Government Notice No. 116 of 1992	♦ Defines the powers, duties and functions of local authority councils
Public Health Act Act No. 36 of 1919	♦ Provides for the protection of health of all people
Public and Environmental Health Act Act No. 1 of 2015, Government Notice No. 86 of 2015	♦ Provides a framework for a structured more uniform public and environmental health system, and for incidental matters ♦ Deals with Integrated Waste Management including waste collection disposal and recycling, waste generation and storage, and sanitation
Labour Act Act No 11 of 2007, Government Notice No. 236 of 2007	♦ Provides for Labour Law and the protection and safety of employees ♦ Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997)
Atmospheric Pollution Prevention Ordinance Ordinance No. 11 of 1976	♦ Governs the control of noxious or offensive gases ♦ Prohibits scheduled process without a registration certificate in a controlled area ♦ Requires best practical means for preventing or reducing the escape into the atmosphere of noxious or offensive gases produced by the scheduled process
Hazardous Substances Ordinance Ordinance No. 14 of 1974	♦ Applies to the manufacture, sale, use, disposal and dumping of hazardous substances as well as their import and export ♦ Aims to prevent hazardous substances from causing injury, ill-health or the death of human beings
Pollution Control and Waste Management Bill (draft document)	♦ Not in force yet ♦ Provides for prevention and control of pollution and waste ♦ Provides for procedures to be followed for licence applications

Table 6-2. Relevant multilateral environmental agreements

Agreement	Key Aspects
Stockholm Declaration on the Human Environment, Stockholm 1972.	♦ Recognizes the need for a common outlook and common principles to inspire and guide the people of the world in the preservation and enhancement of the human environment
United Nations Framework Convention on Climate Change (UNFCCC)	♦ The Convention recognises that developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention
Convention on Biological Diversity, Rio de Janeiro, 1992	♦ Under article 14 of The Convention, EIAs must be conducted for projects that may negatively affect biological diversity
International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	♦ Promote conservation, exploration, collection, characterization, evaluation and documentation of plant genetic resources for food and agriculture ♦ Promote the sustainable use of plant genetic resources for food and agriculture

Table 6-3. Standards or codes of practise

Standard or Code	Key Aspects
South African National Standards (SANS)	♦ The Petroleum Products and Energy Act prescribes SANS standards for the construction, operations and demolition of petroleum facilities. ♦ SANS 10131 (2004) is aimed at above-ground storage tanks for petroleum products. o Provide requirements for spill control infrastructure

The agricultural and related activities, listed in the Environmental Management Act Regulations (Government Notice No. 29 of 2012), as activities requiring an environmental clearance certificate, include the following:

Section 4: Forestry Activities

- 4. The clearance of forest areas, deforestation, aforestation, timber harvesting or any other related activity that requires authorisation in term of the Forest Act, 2001 (Act No. 12 of 2001) or any other law. The Proponent has cleared areas for crop production and conducts invader bush control.

Section 7: Agriculture and Aquaculture Activities

- 7.5 Pest control: The proponent will use conventional pest control products as approved by the Namibian government for some of the produce.

Section 8 of Government Notice No. 29 of 2012: Water Resource Developments

- 8.1. The abstraction of ground or surface water for industrial or commercial purposes: Water is abstracted from boreholes for cultivation and sale of crops and livestock ranching.
- 8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems: The proponent has installed wastewater treatment facilities in the form of french drains on the properties to manage mainly black and grey water.
- 8.7 Irrigation schemes for agriculture excluding domestic irrigation: No *irrigation scheme* was developed, however, *irrigation systems* are used on the farm. Irrigation on the farms does not contribute to or is part of any irrigation scheme as proclaimed by the Namibian Government.

Section 9 of Government Notice No. 29 of 2012: Hazardous Substance Treatment, Handling and Storage

- 9.1 The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974. The farming unit has a consumer fuel installation for diesel.

- 9.2 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 farming unit has a consumer fuel installation.
- 9.3 Construction of filling stations or any other facility for the underground and aboveground storage of dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin: The farming unit has a consumer fuel installation for diesel.

Additional national planning legislation considered include:

- Ministry of Agriculture, Water and Forestry Strategic Plan 2017/2018 – 2021/2022.
- 5th National Development Plan (NDP5).

The Ministry of Agriculture, Water and Forestry's Strategic Plan is a targeted action plan to accelerate development in clearly defined priority areas seeking to respond to the aspirations and the needs of the stakeholders within the agriculture, water and forestry sectors. The Plan was developed to complement the long-term goal of the 5th National Development Plans (NDP5) and Vision 2030. The rationale behind the Plan is to introduce an element of flexibility within the Ministry planning system by fast tracking development in areas where progress is insufficient. It also incorporates new development opportunities and aims to address challenges that have emerged after the formulation of various NDPs. In the Strategic Plan, the amount of hectares developed for irrigation, is a key performance indicator for the Plan's Second Pillar's strategic objectives, which are aimed:

> "*to increase productivity during the strategic period through the implementation of appropriate technologies e.g. Comprehensive Conservation Agriculture (CCA) and mechanization in order to ensure food security at both household and national level."*

The above ties in with NDP5 which purposes to set out a roadmap for achieving envisioned rapid industrialization while adhering to the four integrated pillars of sustainable development as identified in the plan. Irrigation activities contribute primary to the "Economic Progression" pillar by increasing the volumes of locally produced goods. One of the focus areas of the economic progression pillar of NDP5 is agriculture and food security. The NDP5 aims to decrease the amount of food insecure individuals, increase food production and increase the share of value addition in crop and livestock farming. Development and operations of irrigation activities on the farm are in line with all of these strategies as identified in the NDP5 as well as for the Strategic Plan. The operation contribute to the amount of productive, irrigated land in Namibia, provide employment, produce crops for local markets, and produces fodder for livestock farming.

7 ENVIRONMENTAL CHARACTERISTICS

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

7.1 LOCALITY AND SURROUNDING LAND USE

The farming unit is located approximately 18 km northeast of Gobabis, centred on 22.2508 °S and 19.1112 °E, about 4 km east of the C22 route (T1402 trunk road) in the Omaheke Region and Gobabis District. Adjacent properties are all farms and land use is agriculture. The adjacent properties are listed in the table below and their locations are depicted in Figure 7-1.

Table 7-1. Adjacent properties

Number on Map	Farm Name and/or Number
1	Cadillac FML/00385
2	Juliana Wes FML/01049
3	Houvas FML/00399
4	Juliana Wes FML/01049
5	Agarichas FML/00401

Number on Map	Farm Name and/or Number
6	Anaboom FML/00400/00REM
7	Anaboom FML/00400/00002
8	Ohlsenhagen A FML/00174/0000A
9	Ohlsenhagen A FML/00174/00REM

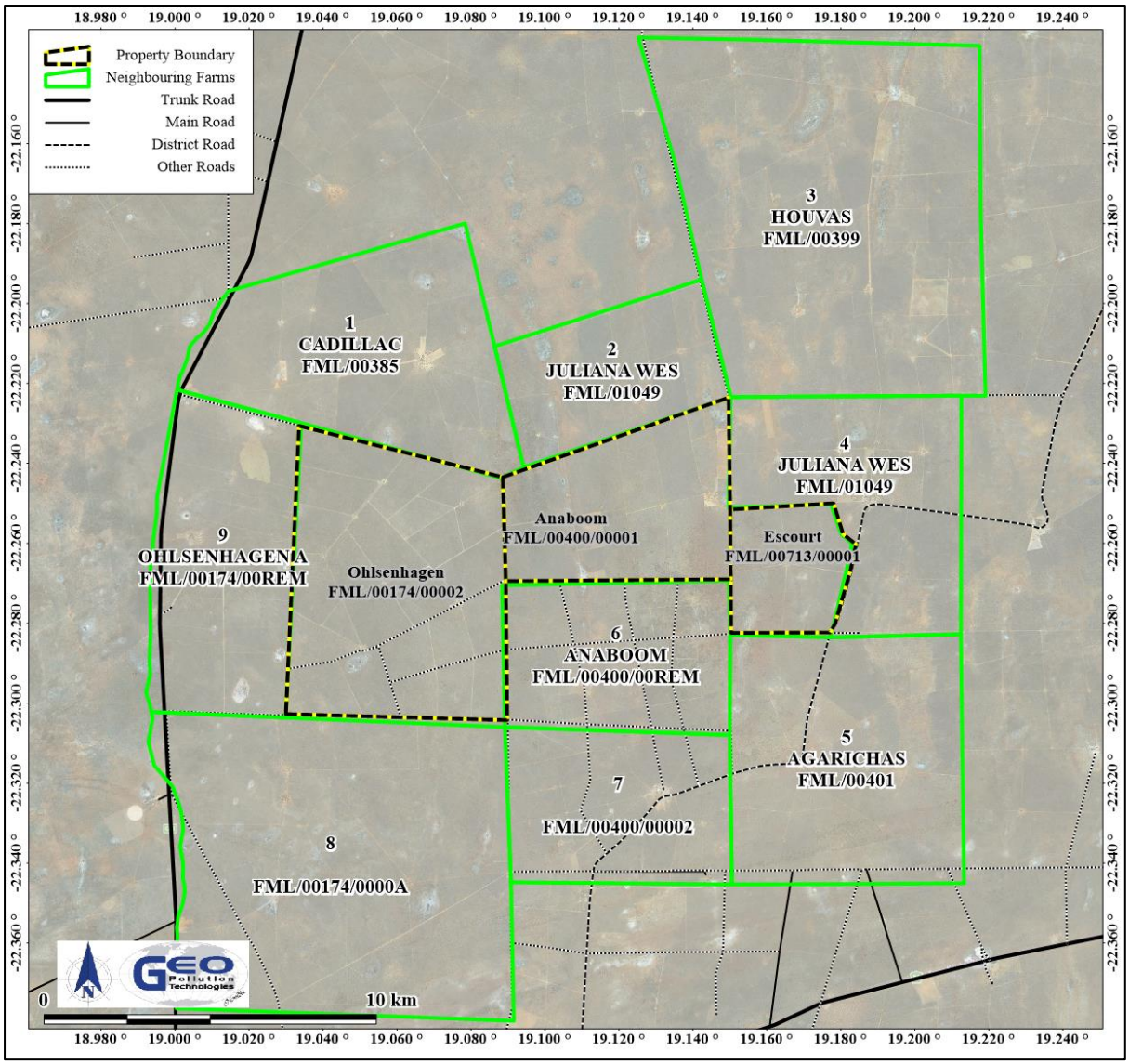


Figure 7-1. Properties adjacent to the project area

Implications and Impacts

The location is well suited for the agricultural activities. It is already zoned for agricultural use and is situated in an area suitable for irrigation. The farm is further surrounded by activities of similar nature. The farm will follow sustainable agricultural practices ensuring impacts on the surrounding land-users are minimised.

7.2 CLIMATE

The project is situated in the Savanna Biome of Namibia. Due to a relatively uniform landscape, variation in climatic conditions in the Omaheke Region is limited. The general lack of functioning weather stations in Namibia, in especially rural areas, limits the availability of long term, true weather data. As a best possible workaround, long term climate data was obtained from the Atlas

of Namibia Project (2002) and the CHIRPS-2 database (Funk et al., 2015), see Table 7-2, Table 7-3 and Figure 7-2.

Atlas of Namibia Project data was compiled from almost 300 rainfall stations across Namibia. The data was contoured in 50 mm intervals prior to 1999 for variable length data sets. The CHIRPS-2 dataset (Climate Hazards Group Infra-Red Precipitation with Station data version 2) consist of long term rainfall data (1981 to near-present) obtained from satellite imagery and in-situ station data. The resultant dataset provides a reasonably well represented overview of the climatic conditions and historic weather conditions of a general area. True values for single, site specific metereological events may however differ to some degree.

The project area is situated in a semi-arid climatic region. Days are mostly warm with very hot days during the summer months, while nights are generally cool. The rain season normally starts in October and last until April, peaking in January and February. Heavier rainfall (single day events) occur between November and April, with a single event of 54.1 mm in March (last 39 years data) being the highest. This is an obvious anomaly with most of the single day maximums being less than 54 mm. The average annual evaporation rate remains high at up to 3,000 mm/a. Table 7-2 contain a summary of the climate conditions for the area.

The average annual rainfall for the last 39 years was calculated as 343 mm/a, with a coefficient of variance of 34 % (Table 7-3). This coefficient of variance seem to correlate with Atlas of Namibia Project data of Table 7-2. Daily and seasonal rainfall data (Funk et al., 2015) is presented in Figure 7-2. Seasonal (July to June) total rainfall, centred on the average line for the last 39 years, is presented, with the daily total rainfall and the seasonal cumulative rainfall. From the figure it is clear that since 2010 to 2020 six seasons received above average rainfall, namely 2009-2010, 2010-2011, 2011-2012, 2013-2014, 2016-2017 and 2019-2020. The rest were all below average with the driest years (last 39 years data) being 1994-1995, followed by 2018-2019. The rain season 2018-2019 is part of a dry period stretching from July 2017 until June 2019.

Table 7-2. Summary of climate climatic conditions (Atlas of Namibia Project, 2002)

Variation in annual rainfall (%)	30-40
Average annual evaporation (mm/a)	2,800-3,000
Water deficit (mm/a)	1,501-,700
Temperature (°C)	19-20

Table 7-3. Rainfall statistics (Funk et al., 2015)

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum (mm)	14.6	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum (mm)	209.3	204.0	112.3	117.4	11.8	1.6	0.6	0.2	9.2	51.2	92.5	184.8
Average (mm)	70.1	74.8	54.2	33.3	1.5	0.1	0.0	0.0	1.9	13.7	29.5	64.0
Variability (%)	64.0	63.0	53.0	91.0	194.0	442.0	430.0	354.0	155.0	84.0	74.0	63.0
Daily maximum (mm)	34.2	51.2	54.1	39.2	11.8	0.6	0.6	0.2	5.3	17.6	25.6	39.0
Average rain days	8	8	5	2	0	0	0	0	1	3	6	8
Season July - June average: 343 mm				**Season coefficient of variation: 34 %**								
Data range	1981-Jul-01	to	2020-Jun-30							Lat: -22.2508°S Long: 19.1112°E		

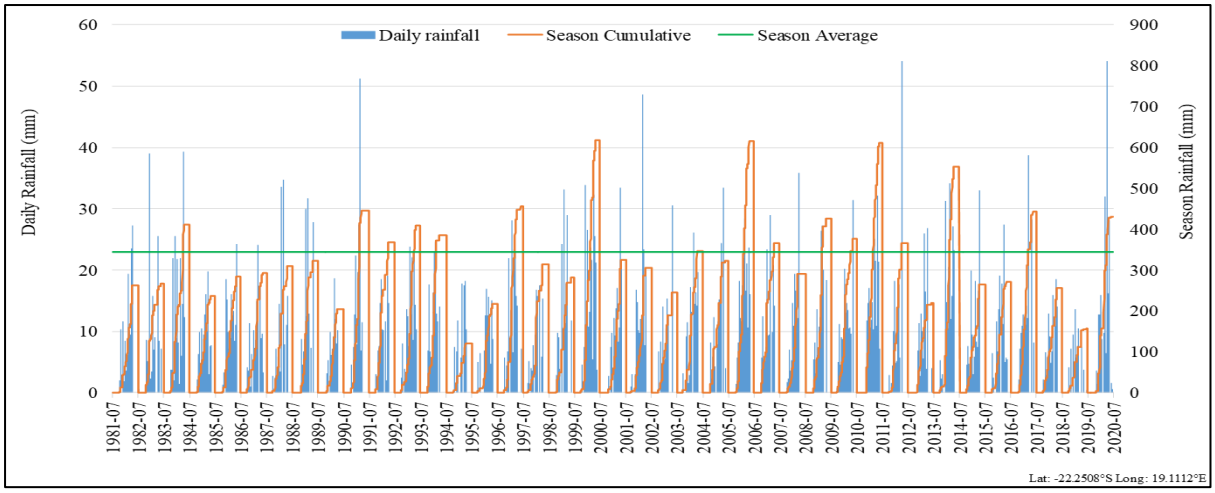


Figure 7-2. Daily and seasonal rainfall (Funk et al., 2015)

Implications and Impacts

Water is a scarce and valuable resource in Namibia. Rainfall events are often thunderstorms with heavy rainfall that can occur in short periods of time ("cloud bursts"). Rainfall in the area is above the Namibian average, but water remains a vulnerable resource. Heavy rainfall can lead to soil erosion when improper agricultural practises are employed.

Recurring drought conditions may impact on groundwater availability due to reduced aquifer recharge.

7.3 TOPOGRAPHY, DRAINAGE AND SOILS

The project is situated on a watershed area and the general topography can be described as relatively flat. Elevation of the western project footprint slope marginally towards the southwest and of the eastern project footprint slope marginally toward the east. Local surface runoff thus collects in the Black Nossob River located about 16 km to the southwest of the project and the Rietfontein River, about 18 km east of the project.

The Black Nossob River forms a confluence with the White Nossob River further downstream, forming the Nossob River. The Rietfontein River flows in an eastern direction towards the Makgadikgadi Pan in Botswana.

A map showing inferred slope and surface drainage directions, as generated from Shuttle Radar Topography Mission (SRTM) 30 m data, can be seen in Figure 7-3. It should be noted that drainage is not as well developed as what the figure might present due to high infiltration rates and flat topography. The slope of the project area is mainly less than 5°. Topography and drainage are discussed in more detail within the hydrogeological specialist report.

The project area forms part of the Khomas Hochland Plateau region with summit heights reflecting older land surfaces. Palaeo dunes and pans can be observed in the larger study area, notably toward the east where the Kalahari Sandveld is approached.

The farm is situated within the Kal3-4 agro-ecological zone (AEZ) which is a Kalahari Sands Plateau characterised by stabilized sand drift with few pans. The average growing period is 61 to 90 days and it has a very short dependable growing period. The Kalk3-4 AEZ is ranked 4th in Namibia in terms of agricultural potential and is deemed most suitable for large stock grazing. The availability of groundwater and suitable soils does however allow for crop cultivation.

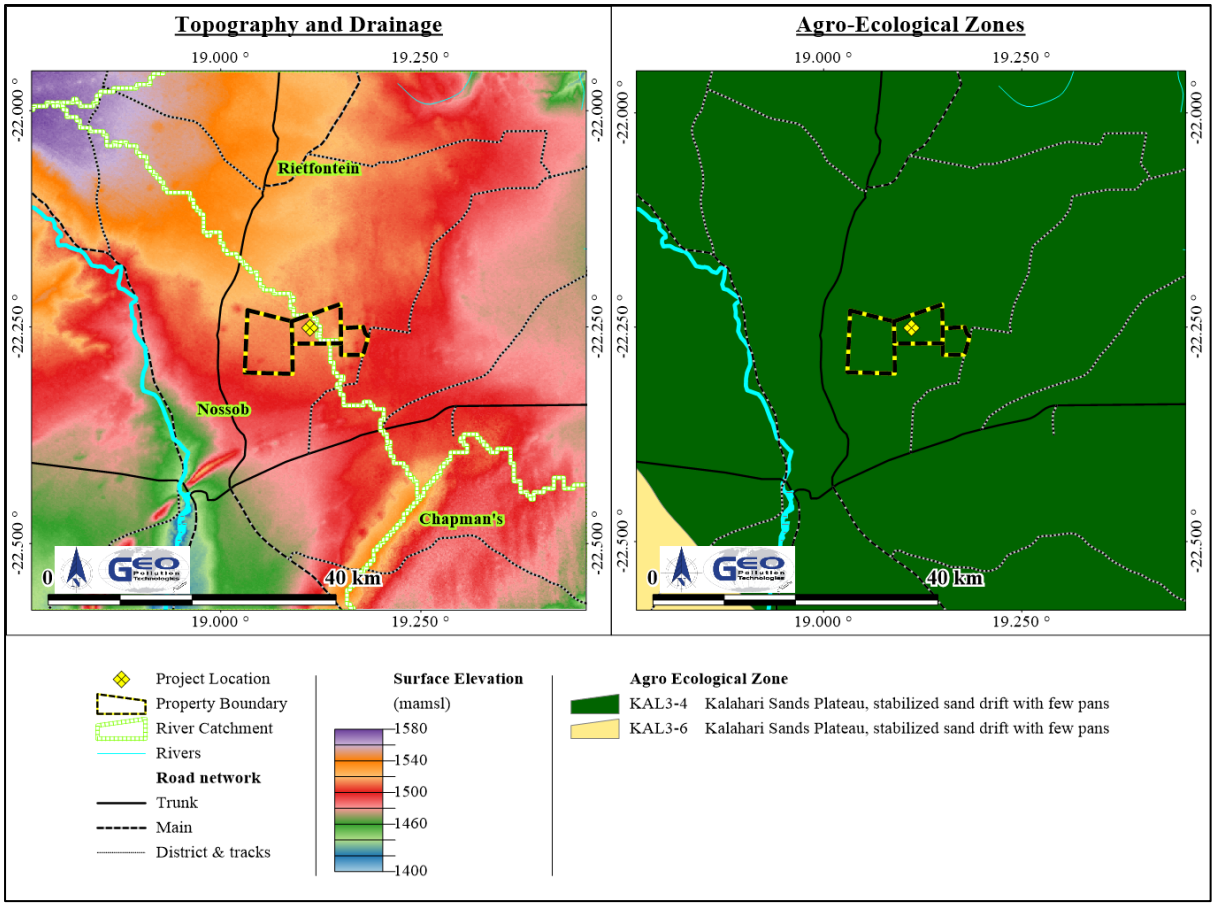


Figure 7-3. Topography, drainage and agro-ecological zones

The soils of the Kalahari Group can be locally classified as feralic Arenosols for the project. Arenosols can be described as sandy soils with poor capacity to retain nutrients. These soils are common in arid and semi-arid environments and is associated with flat to undulating topography. Landforms associated with Arenosols is typically dunes, sand plains and sand ridges. Its parent material is aeolian sand.

Fluviosols is mapped about 16 km west of the project. Fluviosols is described as well drained fine to loamy sand. A Fluviosol is associated with flat to almost flat topography in drainage lines or valley bottoms. Its parent material is alluvial deposits. Figure 7-4 indicates the soil and surface geology of the project area. Surface geology is depicted as limestone and sandstone. Rock outcrops are located about 10 km south of the project.

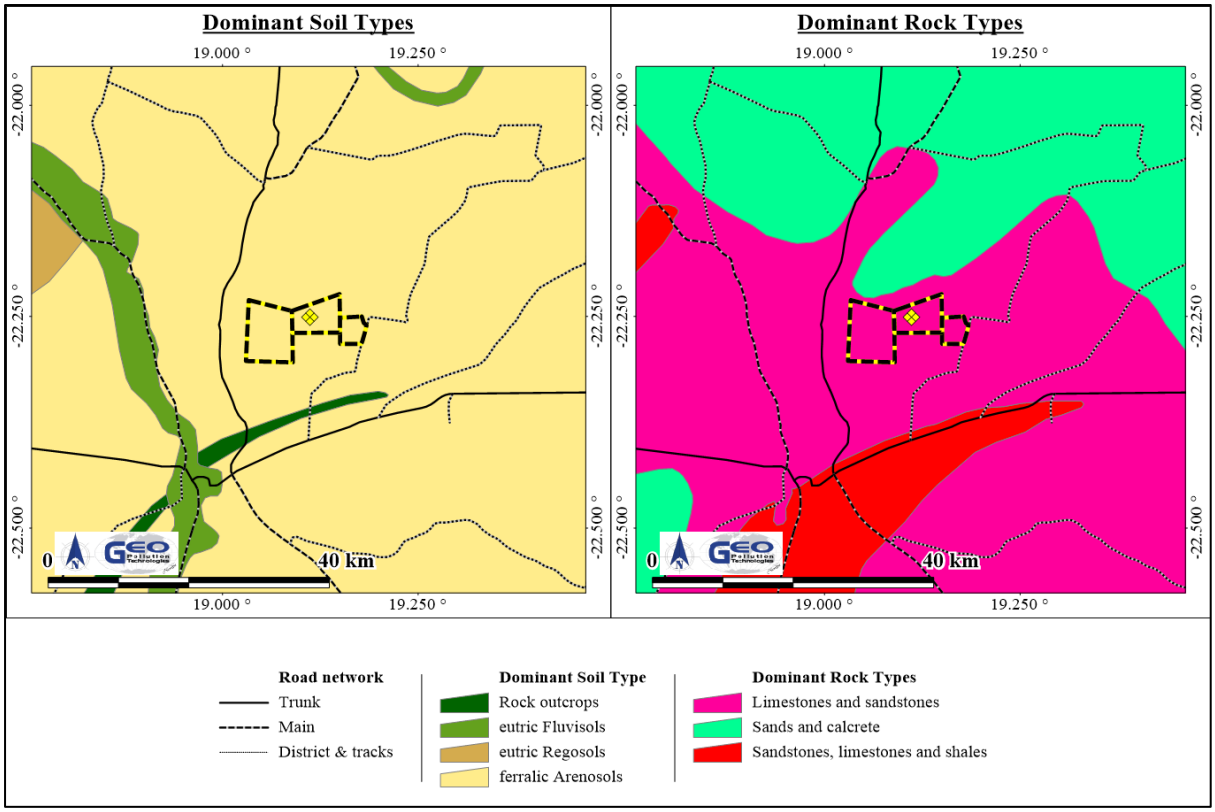


Figure 7-4. Dominant soil and rock types (Atlas of Namibia Project, 2002)

Implications and Impacts

The lack of major surface runoff and drainage may lead to pooling and even flooding of plains during heavy rainfall events which may negatively impact soil quality and crop production. Irrigation attempts outside of suitable areas may be less productive than alternatives such as livestock farming. This may lead to debushing and habitat destruction ultimately leading to desertification if farming on this land is ceased due to unproductivity. The production of crops such as maize is ideal as a high value crop justifying the abstraction of groundwater for purposes of irrigation.

7.4 GEOLOGY AND HYDROGEOLOGY

The regional stratigraphic succession of the project area can be divided into geology belonging to the Mokolian Age (pre-Damara), Namibian Age (Damara Sequence) and Late Cretaceous- to Quaternary Age (Kalahari Group). Kalahari Group surficial deposits occur as overburden of varying thickness over hard rock substrata. Figure 7-5 indicates the dominant geology of the project area and boreholes used for irrigation on the farm, as well as boreholes captured in the DWA database, with their yields.

Damara Sequence geology of the Nosib-Group Kamtsas Formation is inferred to make up the subsurface geology of the project. Rocks of the Kamtsas Formation consist of feldspathic quartzite, conglomerate, schist and marble. The Damara Sequence is divided into various tectonostratigraphic zones, the project area being within the Southern Foreland zone.

The Southern Foreland represents one of the foreland basins of the Damara Belt, separated from the Southern Margin Zone by the Frontal Thrust (Miller, 2008). Damara Sequence and Pre-Damara geology generally strike west-southwest to east-northeast. Deformation of the Damara and Pre-Damara Sequence strata occurred during the Pan African Orogeny (680 - 450 Ma) and resulted in the formation of fold and thrust structures, e.g., isoclinal folds, overturned folds and thrusted fold.

Nosib Group geology is locally thrusted as sub-parallel shear zones or thrusts over Palaeoproterozoic basement and also comprise southeast vergent open to tight folds (Carney et al., 1994). The Nina anticline structure straddles the northwestern corner of farm Ohlsenhagen No. 174 (Portion 2), with the fold axis trending in a northeastern direction, see Figure 7-5. The development of joints and fractures in the rocks are associated with the folding, which have an impact on the hydrogeological characterization of the area.

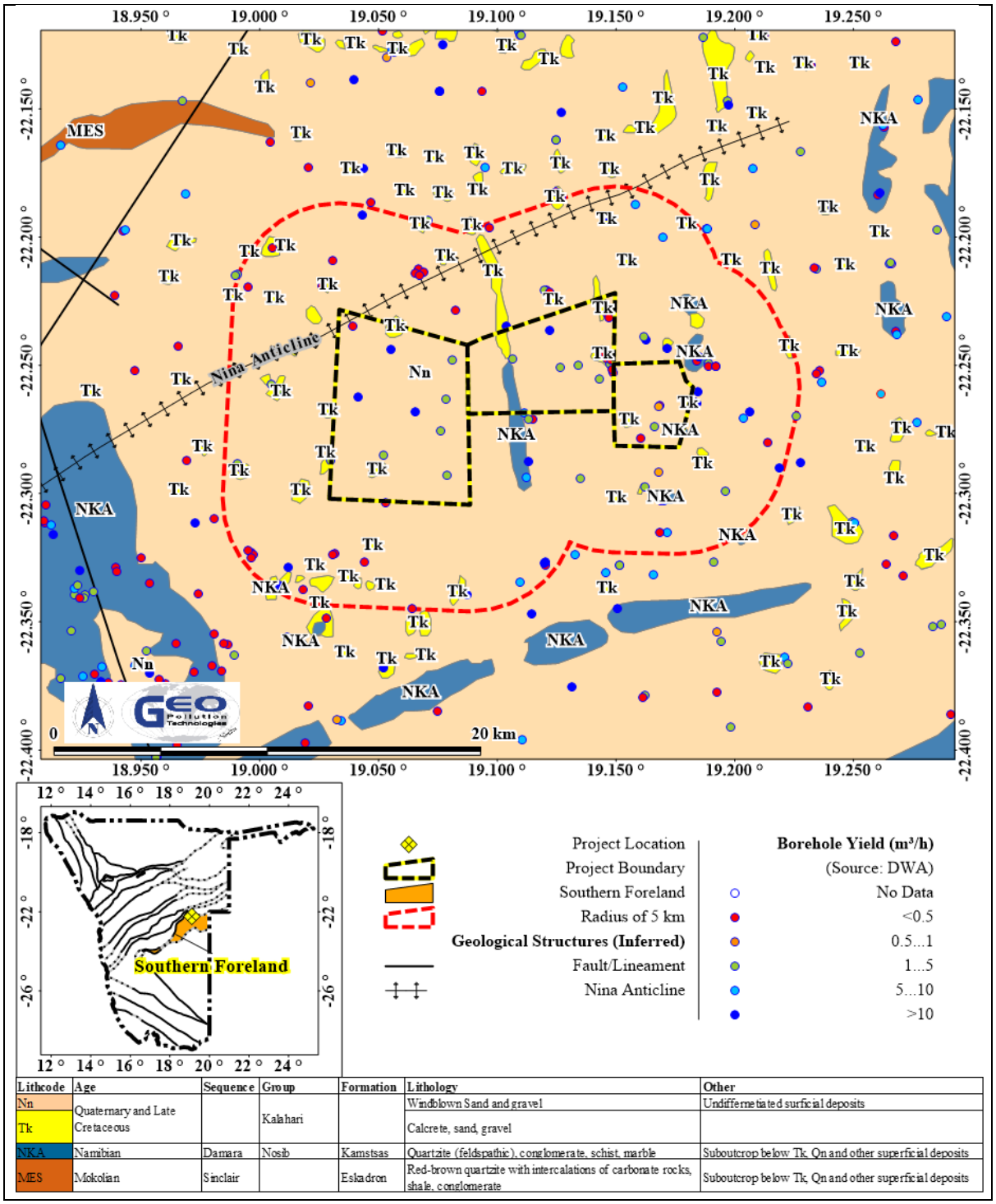
Late Cretaceous and Quaternary Age Kalahari Group deposits rest unconformly over older pre-Kalahari rock formations and consist of a wide range of terrestrial sediments such as breccia, gravel, sand, carbonate and calcrete deposits. These sediments originate mainly from fluvial deposition with some reworking through aeolian processes. The expected thickness of the surficial deposits at the project area is approximately up to 10 m (GSN Geological Map: 1:250,000, 1981).

For more detail on the geology refer to the hydrogeology specialist study conducted for this project.

The project occur in the South Eastern Kalahari groundwater basin (Figure 7-6). It should be noted that this groundwater basin is a management basin and that the actual groundwater basins differ from these boundaries. The project area straddles two groundwater basins, namely the Okwa Transboundary Aquifer (Central Kalahari Basin) and the South Eastern Kalahari groundwater basin. About 70 km down gradient of the South Eastern Kalahari groundwater basin, the Stampriet Transboundary Aquifer occurs. Both the Okwa- and Stampriet Transboundary Aquifer extends from Namibia into Botswana.

Groundwater flow of the western project footprint is projected in a southwestern direction, as part of the South Eastern Kalahari groundwater basin. Groundwater flow of the eastern project footprint is projected toward the east as part of the Okwa Transboundary Aquifer. Local groundwater flow is expected to take place through primary porosity in the surface cover (Kalahari Group), while it is expected to flow along fractures, faults, dykes/mineralised faults or along contact zones (secondary porosity) and other geological structures present within the underlying rock formations. Note that local flow patterns may vary due to groundwater abstraction and due to geological constraints.

The project is located in the Windhoek-Gobabis Subterranean Water Control Area (Government Notice 189 of 6 February 1970), see Figure 7-6. Government therefore regulates groundwater usage in this area and all other groundwater related activities like drilling, cleaning or deepening of boreholes and rates of water abstraction. All groundwater remains property of the government of Namibia.



Lithcode	Age	Sequence	Group	Formation	Lithology	Other
Nn	Quaternary and Late Cretaceous		Kalahari		Windblown Sand and gravel	Undifferentiated surficial deposits
Tk					Calcrete, sand, gravel	
NKA	Namibian	Damara	Nosib	Kamstsas	Quartzite (feldspathic), conglomerate, schist, marble	Suboutcrop below Tk, Qn and other superficial deposits
MES	Mokolian	Sinclair		Eskadron	Red-brown quartzite with intercalations of carbonate rocks, shale, conglomerate	Suboutcrop below Tk, Qn and other superficial deposits

Figure 7-5. Regional geology map (GSN Geological Map, 1:250,000)

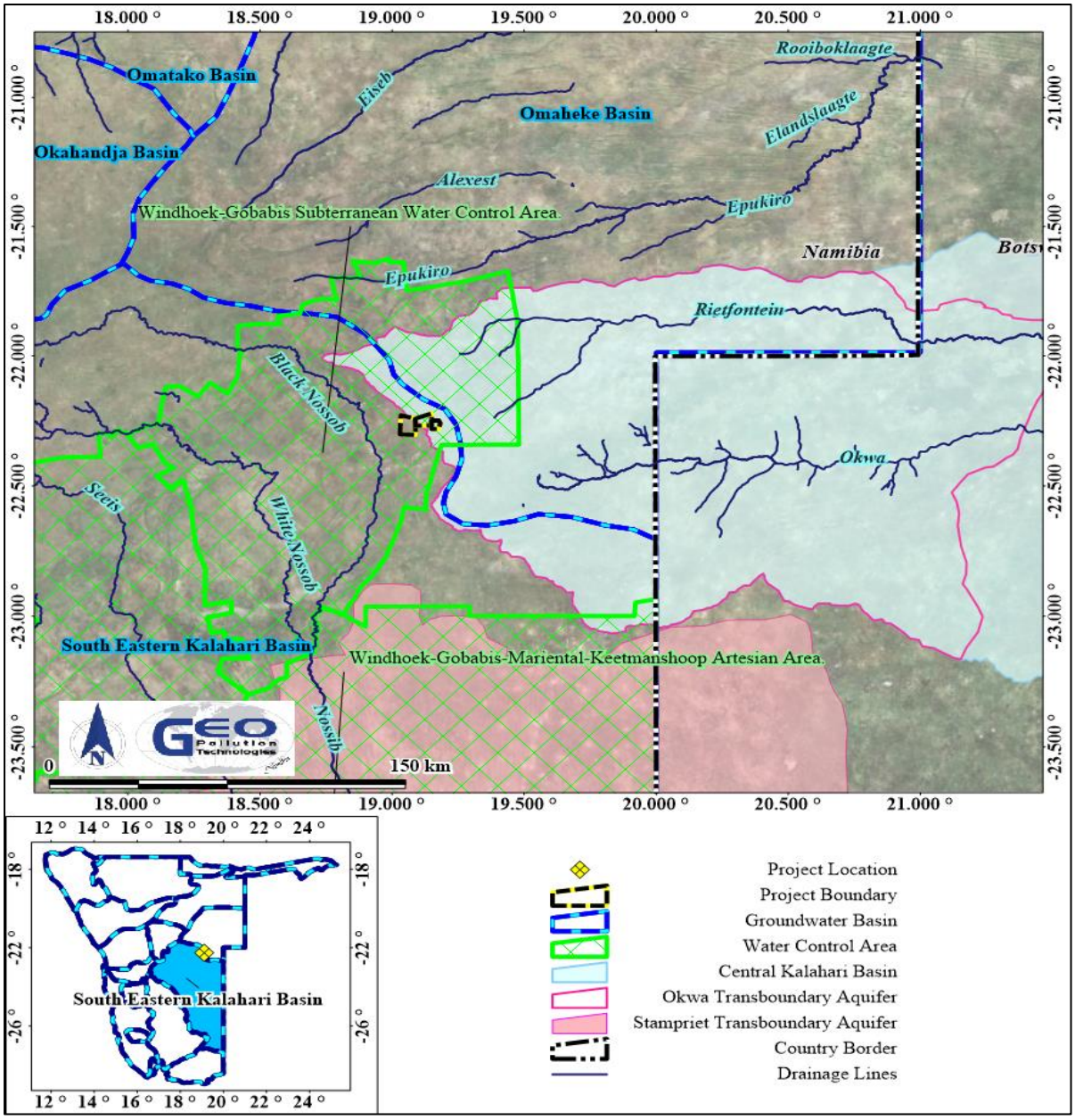


Figure 7-6. Groundwater catchments, water control areas and transboundary aquifer

Table 7-4 indicates the groundwater statistics for a radius of 5 km around the project area. The groundwater information was obtained from Department of Water Affairs (DWA) borehole database. The DWA database is generally outdated and more boreholes might be present. Groundwater is widely utilised in the study area, with 36 boreholes within a 5 km radius. The boreholes were drilled to an average depth of 61 m below surface and average yield of 10 m³/h. Groundwater quality falls mainly under Group A category, which indicates that the water is of an excellent quality, based on the provided parameters. Groundwater levels in the project area is generally shallow, averaging at 24 mbs.

Table 7-4. Groundwater statistics

Query Centre:	Anaboom; -22.2508°S; 19.1112°E										Query Box Radius: 5.0km
	NUMBER OF KNOWN BOREHOLES	LATITUDE	LONGITUDE	DEPTH (mbs)	YIELD (m3/h)	WATER LEVEL (mbs)	WATER STRIKE (mbs)	TDS (ppm)	SULPHATE (ppm)	NITRATE (ppm)	FLUORIDE (ppm)
Data points	**36**			30	27	17	16	15	15	15	15
Minimum		-22.205804	19.062584	30	0	15	18	258	3	2	0
Average				61	10	24	42	409	7	3	0
Maximum		-22.295796	19.159816	138	80	40	106	914	12	8	1
Group A				56.67%	14.81%	0.00%	0.00%	100.00%	100.00%	100.00%	100.00%
Limit				50	>10	10	10	1000	200	10	1.5
Group B				30.00%	7.41%	100.00%	68.75%	0.00%	0.00%	0.00%	0.00%
Limit				100	>5	50	50	1500	600	20	2.0
Group C				13.33%	48.15%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Limit				200	>0.5	100	100	2000	1200	40	3.0
Group D				0.00%	29.63%	0.00%	6.25%	0.00%	0.00%	0.00%	0.00%
Limit				>200	<0.5	>100	>100	>2000	>1200	>40	>3

Statistical grouping of parameters is for ease of interpretation, except for the grouping used for sulphate, nitrate and fluoride, which follow the Namibian guidelines for the evaluation of drinking-water quality for human consumption, with regard to chemical, physical and bacteriological quality. In this case the groupings has the following meaning:

Group A: Water with an excellent quality

Group B: Water with acceptable quality

Group C: Water with low health risk

Group D: Water with a high health risk, or water unsuitable for human consumption.

Groundwater quality data is presented in Figure 7-7 as a Maucha Plots. From the figure it is clear that the groundwater of the project location is mostly of a calcium - magnesium - bicarbonate water type which suggests the water is recently recharged. Regionally, an increase of sodium (Na), sulphate (SO_4) and chloride (Cl) concentrations generally tend to correlate with the extent of the ephemeral rivers, e.g., Black Nossob River. Localised evaporite mineral deposits in pans along river courses contribute to the elevated sodium (Na) and chloride (Cl) concentrations.

Implications and Impacts

A risk to groundwater pollution is expected due to the geological sensitivity of the area. Groundwater is utilized in the area and such users would be at risk if groundwater contamination occurs. Irresponsible irrigation methods like over-irrigation may result in higher demands for fertiliser, herbicides and pesticides, which in turn will increase nitrates, herbicide and pesticide concentration in the groundwater.

Over abstraction may also impact on other users of the aquifer. The hydrogeological specialist study however indicates that water levels, under current groundwater abstraction rates, are stable.

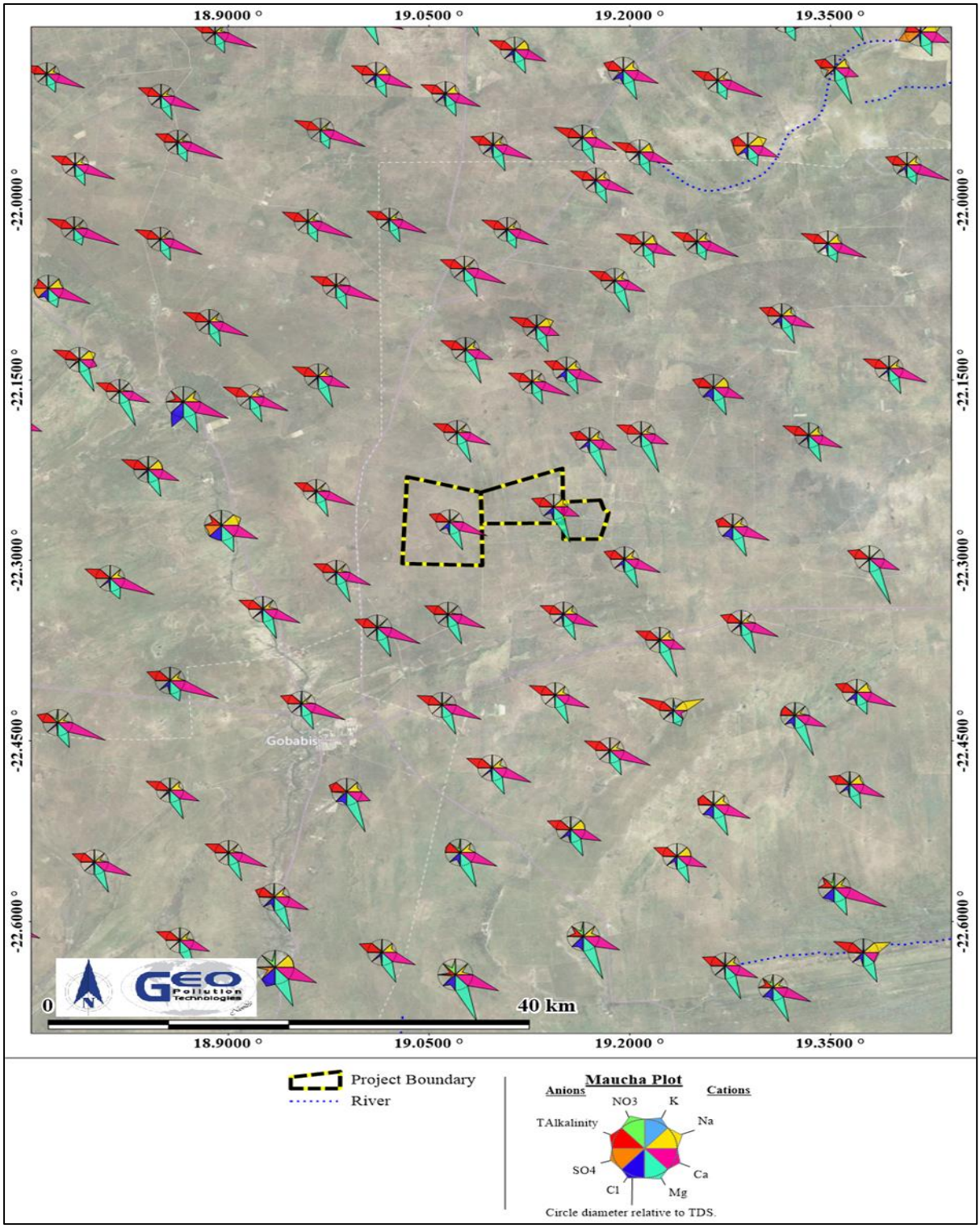


Figure 7-7. Groundwater quality (Maucha Plots)

7.5 PUBLIC WATER SUPPLY

The Proponent and surrounding farming communities are completely reliant on groundwater as a source of potable water supply. The boreholes tap into the South Eastern Kalahari basin and are located within the Windhoek-Gobabis Subterranean Water Control Area. It should be noted that this groundwater basin is a management basin and that the actual groundwater basins differ from these boundaries. The project area thus straddles two groundwater basins, namely the Okwa Transboundary Aquifer (Central Kalahari Basin) and the South Eastern Kalahari groundwater basin (Figure 7-6).

In the nearby town of Gobabis, the Namibia Water Corporation (Du Plessis, 2020) manages water supply from the Gobabis Purification Scheme. This scheme receives water from the Tilda Viljoen, Daan Viljoen and Otjivero dams. However, during periods of drought, water is sourced from three different borehole schemes (fields) around Gobabis, e.g., the Black Nossob, Gobabis North East and Gobabis South Station (Du Plessis, 2020). Two boreholes of the Gobabis North East scheme occur on the Proponent's farm, namely borehole WW35219 on farm Ohlsenhagen No. 174 (Portion 2) and borehole WW35234 on farm Anaboom No. 400 (Portion 1).

Implications and Impacts

Groundwater is a valuable resource in the farming area and is controlled by a water abstraction permit system as regulated by the Ministry of Agriculture, Water and Land Reform. Groundwater contamination may negatively impact surrounding boreholes, widely utilised for public water supply. No alternative water supply options exist if extensive contamination or deterioration of groundwater occur.

7.6 ECOLOGY

The project location is situated in the Savanna Biome with a Central Kalahari vegetation type and shrubland-woodland mosaic structure (Atlas of Namibia Project, 2002). Vegetation diversity is low to medium with between 100 and 150 plant species (Atlas of Namibia Project, 2002). The most common trees of the Central Kalahari vegetation type are *Acacia erioloba*, *Acacia mellifera*, *Tarchonanthus camphoratus*, *Grewia flava*, *Ozoroa paniculosa* and *Acacia hebeclada*. Low vegetation diversity is linked to lower animal diversity (Table 7-5), and for both the level of endemism is low. Based on the combined known endemism of selected higher taxa, not more than five endemic species are expected (Figure 7-8). The farms span two quarter degrees square grids namely 2219AA and 2219AC. An inventory of trees present in these quarter degrees is presented in Appendix C and those with protected status or conservation concerns are presented in Table 7-6. Based on this inventory, a total of 35 species of trees have been identified to occur in the area and three of these are specifically protected by forestry legislation (Curtis & Mannheimer, 2005). Four species have invasive tendencies typically associated with irresponsible land use practises such as overgrazing.

Animal biodiversity inventories in Namibia are mostly focussed on vertebrates with stronger focus on mammals, reptiles and birds. Furthermore, inventories of animals are often associated with specific areas of interest or frequently travelled roads. Limited detailed information is available for the project area. Mammals of particular importance that may be encountered here include cheetah (*Acinonyx jubatus*), Aardwolf (*Proteles cristatus*), leopard (*Panthera pardus*) bat-eared fox (*Otocyon megalotis*) honey badger (*Mellivora capensis*) African wild dog (*Lycaon pictus*) and brown hyaena (*Hyaena brunnea*). Birds like the Lappet-faced vulture (*Torgos tracheliotus*), White-backed vulture (*Gyps africanus*), African spoonbill (*Platalea alba*) and Secretary bird (*Sagittarius serpentarius*) may be present in the area. A number of these mammals and birds are listed as threatened by extinction by the IUCN and include cheetahs, leopards and secretary birds (vulnerable), brown hyaena (near threatened), African wild dog, Lappet-faced vulture (endangered) and white-backed vulture (critically endangered) (IUCN, 2020).

Table 7-5. General animal data (Atlas of Namibia Project, 2002)

Mammal Diversity	61 - 75 Species
Rodent Diversity	20 - 23 Species
Bird Diversity	111 - 140 Species
Reptile Diversity	61 - 70 Species
Snake Diversity	30 - 34 Species
Lizard Diversity	24 - 27 Species
Frog Diversity	8 - 11 Species
Termite Diversity	7 - 9 Genera
Scorpion Diversity	6 - 9 Species

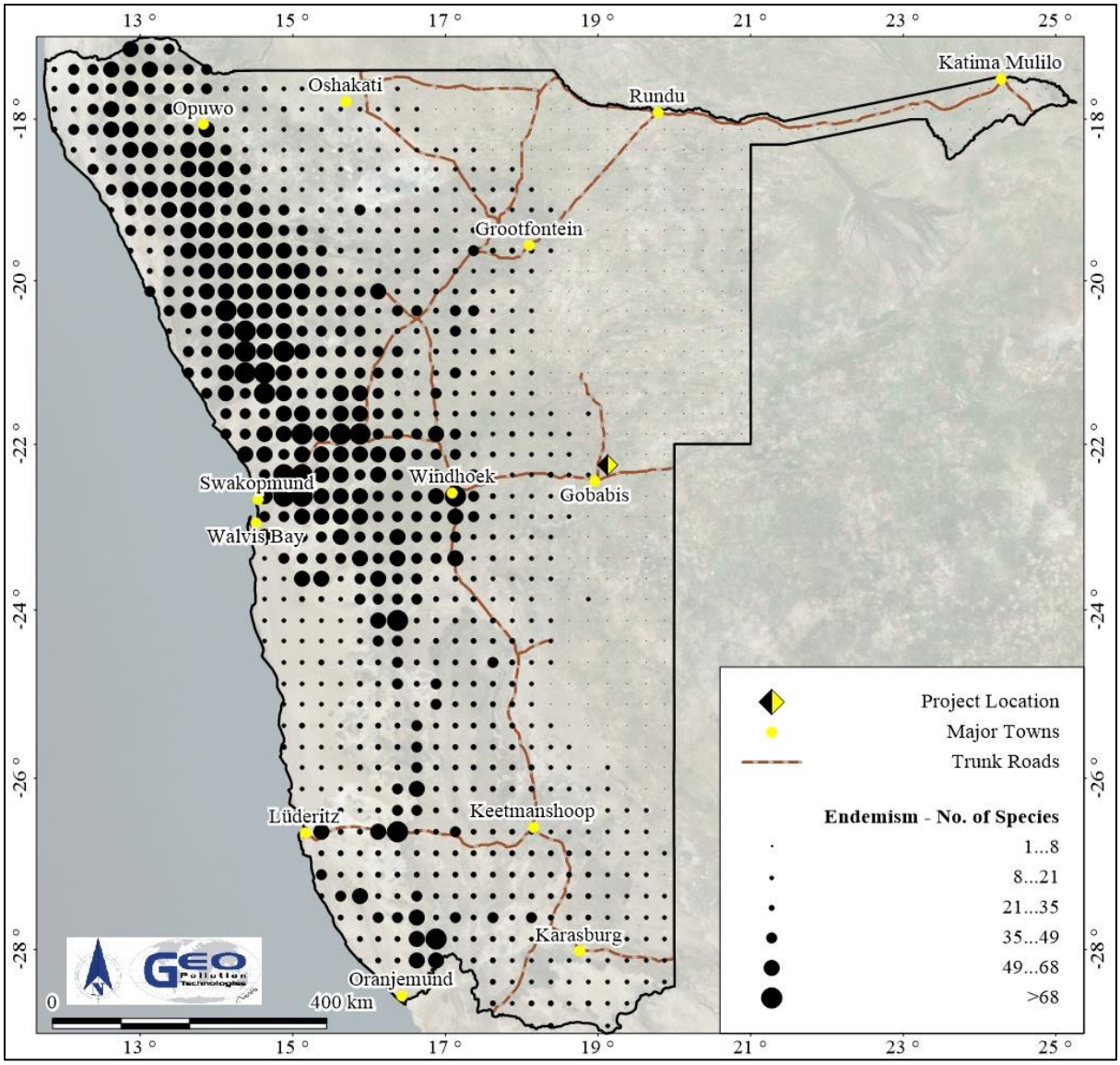


Figure 7-8. Combined higher taxa endemism in Namibia (Atlas of Namibia Project, 2002)

Table 7-6. Trees with conservation concerns in quarter degree squares 2219AA and 2219AC (Curtis & Mannheimer, 2005)

Name	Common Name	Conservation Concerns
Acacia erioloba	Camel-thorn	Protected by forestry legislation
Acacia mellifera subsp *detinens*	Blue-thorn Acacia	Aggressive invasive species
Boscia albitrunca	Shepherd's Tree	Protected by forestry legislation.
Catophractes alexandri	Trumpet-thorn; Rattlepod	Invasive in some areas
Dichrostachys cinerea subsp *africana*	Kalahari Christmas Tree; Sickle-bush	Invasive in some areas
Opuntia spp	Spiny Cactus; Prickly-pear	Alien. Some species are problematic and/or invasive
Ziziphus mucronata	Buffalo-thorn	Protected by forestry legislation

Implications and Impacts

Agricultural activities of the Proponent have long been established. Poaching and illegal collection of plant and animal material may impact on the local environment. Pollution of the soil

and groundwater by hazardous chemicals and/or the excessive use of fertilizers and pesticides may negatively impact the local ecology. Irresponsible use of pesticides to kill vermin such as jackal may further impact on already threatened vulture populations as well as other scavengers. Pesticides may also magnify (biomagnification) in higher trophic levels, especially top predators. This may lead to reproductive and other physiological defects and ultimately declining populations. Over-abstraction of groundwater may lead to ecosystem changes as groundwater levels decrease. Deep rooted terrestrial plants dependent on groundwater will dry out and eventually die.

7.7 DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

The project area is located in the Kalahari Constituency of the Omaheke Region. Located close to the border of the Gobabis Constituency, the majority of the seasonal labour force is sourced from the nearby Gobabis settlement. Gobabis had an urban population of approximately 20,993 people in 2011 (Namibia Statistics Agency, 2011). The average growth rate for Namibia for the last 10 years has been approximately 1.8% per annum, therefore the estimated population of Gobabis is now approximately 25,135. The settlement is also the district capital in the Omaheke Region. For demographic information of the 2011 population and housing census, refer to Table 7-7 (Namibia Statistics Agency, 2011) which includes the details for the Kalahari - and Gobabis Constituency in relation to the National and regional averages.

The two constituencies have similar revenue streams. The Kalahari Constituency however has 56% of employment in the agricultural sector compared to Gobabis Constituency's 14%. The economy of the area relies largely on commercial livestock farming supplemented with crop production and charcoal manufacturing. Unemployment in the Kalahari Constituency is high at 49% while Gobabis Constituency's is lower at 40%. Livelihoods in the constituency are varied engaging various sectors such as construction, wholesale and retail, administrative (public and defence) and manufacturing.

Table 7-7. Demographic characteristics of the Kalahari Constituency, the Omaheke Region and Nationally (Namibia Statistics Agency, 2011)

	Kalahari Constituency	Gobabis Constituency	Omaheke Region	Namibia
Population (Males)	3,894	10,322	37,217	1,021,912
Population (Females)	3,717	10,671	34,016	1,091,165
Population (Total)	7,611	20,993	71,233	2,113,077
Population density (people/km^2)	0.6	3.6	0.8	2.6
Unemployment (15+ years)	49%	40%	40%	37%
Literacy (15+ years)	74%	80.4%	73%	89%

Table 7-8. Main industry of employed population aged 15 years and above for the Kalahari-Gobabis Constituency and Omaheke Region

Main industry	Omaheke Region	Kalahari Constituency	Gobabis Constituency
Total	17,048	1,358	6 000
Agriculture Forestry and Fishing	7,692	821	857
Construction	1,236	45	646
Administrative and Support Service Activities	1,457	76	837
Public Administration and Defence	1,013	29	775
Activities of Private Households	1,145	69	454

The farming unit as a whole provides for a variety of employment opportunities. Apart from general farming and livestock management, skills and training are required to maintain and operate the irrigation systems.

Implications and Impacts

Operations on the farm sustain valuable full time as well as seasonal employment opportunities in a constituency that has a high unemployment rate. Some skills development and training also benefit employees during the operational phase.

7.8 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS

There are no cultural, heritage or archaeological aspects known to be present on the farm. The proximity of the farm to Gobabis allows for easy integration to cultural and related services for employees.

Implications and Impacts

No implications or expected impacts.

8 PUBLIC CONSULTATION

Consultation with the public forms an integral component of an environmental assessment investigation and enables interested and affected parties (IAPs) e.g. neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with projects and to identify additional issues that they feel should be addressed in the environmental assessment.

Public participation notices were advertised, twice in two weeks, in the national papers: The notices appeared in the Republikein and the Namibian Sun on 16 and 23 November 2020. A site notice was placed on site and notification letters were e-mailed to neighbours as well as the local farmers union. Consultation was extended to NamWater due to the presence of the NamWater Scheme: Gobabis-North East See .Appendix D for proof of the public participation processes and registered IAPs. No information for consideration in the EIA was received from any parastatal as consulted.

9 MAJOR IDENTIFIED IMPACTS

During the scoping exercise, a number of potential environmental impacts were identified. The following section provides a brief description of the most important of these impacts.

9.1 SOIL AND GROUNDWATER CONTAMINATION

Soil and groundwater contamination are possible when large quantities of fertilizers or pesticides are applied. Excessive fertilizer use may result in increased soil nutrient levels (i.e. nitrogen, phosphorus and potassium), to a point that soil is regarded as contaminated. Similarly, pesticides can accumulate in soil at levels detrimental to biota. Fertilizers and pesticides can leach deeper into the ground and eventually reach and contaminate groundwater. Chemical spills, inclusive of fertilizers and pesticides, may result in very high but localised contamination of soil, increasing the risk of groundwater pollution if spill clean-up is not performed.

Hydrocarbon pollution, resulting from the spilling of fuel, oil or hydraulic fluids, is possible. Tractor and other vehicle breakdowns, or incorrect refuelling and storage of fuel, leakages from electric transformers are the most likely causes of hydrocarbon pollution.

9.2 GROUNDWATER ABSTRACTION

Groundwater abstraction is a very sensitive topic in a dry country where the value of land is drastically reduced if no or unusable groundwater is present on the land. Abstraction of groundwater must be conducted in a sensible way to prevent impacts on other groundwater users that depend on such groundwater. This includes water abstracted for human and animal use, irrigation, and also ecosystems that depend on groundwater. A typical groundwater balance was

compiled to illustrate the potential consequences of over abstraction of groundwater, see Figure 9-1.

In a typical groundwater environment, a water balance would consist of inflow and outflow of the groundwater system. Over time an equilibrium (or steady state) is normally reached with rising water tables following good recharge events and declining water tables when recharge is below average. Inflow into the system would typically be from infiltration following rainfall in the area and in upstream areas.

Outflow would be comprised of water leaving the system through springs and as outflow over the lower boundary of the groundwater system as well as evapotranspiration losses. Groundwater abstraction through boreholes is important as this is normally necessary to sustain human and animal demands where such users became dependant on the abstracted groundwater.

Although the project is located well within the South Eastern Kalahari groundwater basin, realistically it is located on a watershed area between two actual groundwater basins. Excessive abstraction may influence upstream or downstream receptors on the long run. Typical consequences of over abstraction will include a lowering in the water table. Lowering of water table may further lead to the drying up of boreholes and springs. Vegetation will also be impacted where such vegetation has access to groundwater. It is important to note that the groundwater basin forms a transboundary aquifer that extent from Namibia into Botswana. Over abstraction in any of the countries will have a negative impact on the other countries and can causes disputes. As the groundwater flows from the recharge area in Namibia, out to Botswana, care must be taken in Namibia to ensure that the quality of water is not affected as this may later on affect the neighbouring country.

Based on current water usage data and water level fluctuations in the area, as indicated in the hydrogeological specialist report, groundwater levels are deemed stable. However, a short term threshold of 5 m below the average rest water level is set from where abstraction rates should be reduced.

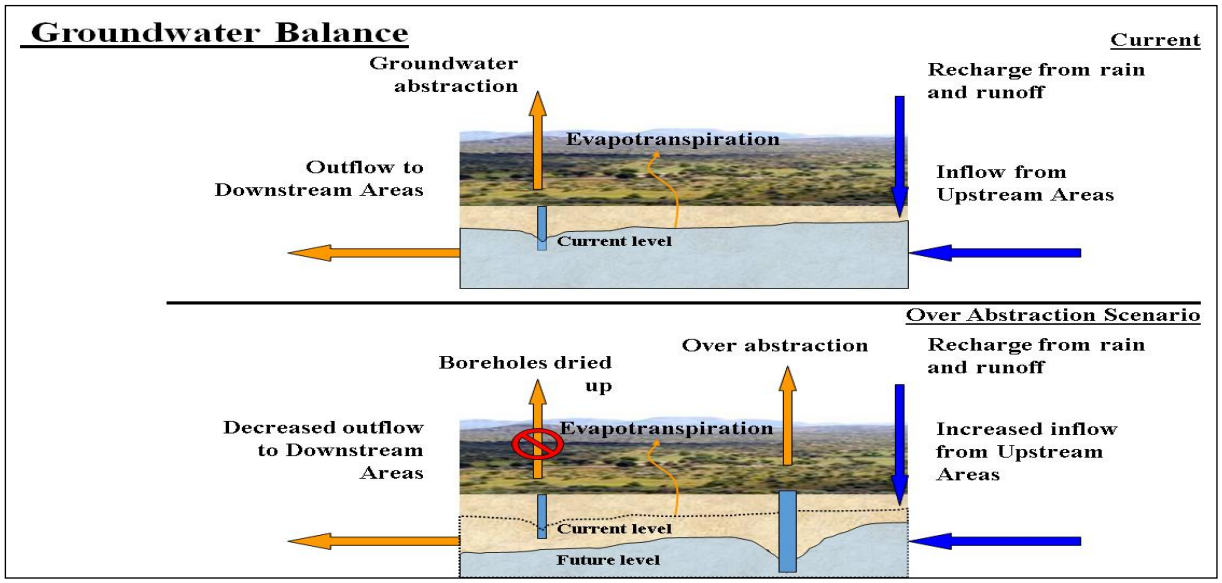


Figure 9-1. Conceptual groundwater balance with over abstraction scenario

9.3 FIRE

Fires, used for example to cook food in areas not designated for this purpose, may spread to the nearby veld. Machinery can ignite dry vegetation if sufficient heat (e.g. exhaust pipes) or sparks are produced. Chemicals and fuels stored and used for general activities may be flammable. Electrical shorts on the electricity supply network can cause fires in buildings. Lightning can be a natural ignition source for veld fires which in turn can spread and damage infrastructure and crops or pose health impacts.

9.4 DUST

Dust may become a nuisance and health risk when land is ploughed, tilled or prepared for planting. Strong winds present during periods when fields are dry and barren, such as in-between planting cycles, may aggravate dust impacts.

9.5 TRAFFIC

Additional traffic is present on the national roads passing the farms as a result of the activities on the farm. This include the transport of staff (contractor or seasonal where required), the delivery of fertilizers, seed, etc., as well as the transport of crops and cattle to markets. Since it is an existing operation, traffic impacts related to the activities on the farm will remain the same, and no additional impacts are expected.

9.6 HEALTH AND SAFETY

Injuries related to working with machinery (e.g. moving parts), chemicals, pesticides, etc. can occur. Inhalation and dermal contact with pesticides are possible where pesticides are for example applied by means of tractor mounted sprayers or via the irrigation system. Spray drift in windy conditions can reach nearby workers or the tractor driver. Vehicle accidents involving staff when transported to and from work, or during movement of machinery like tractors on the farm, can occur. Venomous animals like snakes, scorpions and spiders may be present.

9.7 ECOSYSTEM AND BIODIVERSITY IMPACT

No additional land clearing is foreseen for irrigation fields in the near future. Indiscriminate harvesting of trees for wood and charcoal production may impact on protected and/or sensitive species. It may further result in damaging of nests of birds where these are present in such trees. Poaching and illegal collection of plant and animal material by staff and/or non-staff members is possible. Pollution of the environment and groundwater, especially by fuel, pesticides and fertilizers, can deteriorate or alter the ecosystem structure and function. Irresponsible pesticide use may negatively impact ecology in the short and long term.

9.8 SOCIO-ECONOMIC IMPACTS

The project contributes to food security at a national level and contribute towards a positive trade balance. Permanent employees and seasonal employees work on the farm. Housing and amenities are available to permanent employees and their families. Proper sanitation and electrical facilities are present for all workers.

Existing and planned developments typically entice jobseekers to migrate to the area. This may lead to high levels of unemployment and its associated social ills. This include increased spread of HIV/AIDS and other diseases, alcohol or drug abuse, and theft or violence.

10 ASSESSMENT AND MANAGEMENT OF IMPACTS

The purpose of this section is to assess and identify the most pertinent environmental impacts that are expected from the operational, construction, care and maintenance, and potential decommissioning activities of the farming unit. An EMP based on these identified impacts is presented in this section.

For each impact, an environmental classification was determined based on an adapted version of the Rapid Impact Assessment Method (Pastakia, 1998). Assessment of impacts is based on the following categories: importance of condition (A1); magnitude of change (A2); permanence (B1); reversibility (B2); and cumulative nature (B3) (Table 10-1).

The environmental classification is calculated as follows:

Environmental classification = A1 x A2 x (B1 + B2 + B3)

The environmental classifications of impacts and the respective classes are provided in Table 10-2.

The probability ranking refers to the probability that a specific impact will happen following a risk event. These can be improbable (low likelihood); probable (distinct possibility); highly probable (most likely); and definite (impact will occur regardless of prevention measures).

Table 10-1. Assessment criteria

Criteria	Score
Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect	
Importance to national/international interest	4
Important to regional/national interest	3
Important to areas immediately outside the local condition	2
Important only to the local condition	1
No importance	0
Magnitude of change/effect (A2) – measure of scale in terms of benefit/disbenefit of an impact or condition	
Major positive benefit	3
Significant improvement in status quo	2
Improvement in status quo	1
No change in status quo	0
Negative change in status quo	-1
Significant negative disbenefit or change	-2
Major disbenefit or change	-3
Permanence (B1) – defines whether the condition is permanent or temporary	
No change/Not applicable	1
Temporary	2
Permanent	3
Reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition	
No change/Not applicable	1
Reversible	2
Irreversible	3
Cumulative (B3) – reflects whether the effect will be a single direct impact or will include cumulative impacts over time, or synergistic effect with other conditions. It is a means of judging the sustainability of the condition – not to be confused with the permanence criterion.	
Light or No Cumulative Character/Not applicable	1
Moderate Cumulative Character	2
Strong Cumulative Character	3

Table 10-2. Environmental classification (Pastakia 1998)

Environmental Classification	Class Value	Description of Class
72 to 108	5	Extremely positive impact
36 to 71	4	Significantly positive impact
19 to 35	3	Moderately positive impact
10 to 18	2	Less positive impact
1 to 9	1	Reduced positive impact
0	-0	No alteration
-1 to -9	-1	Reduced negative impact

-10 to -18	-2	Less negative impact
-19 to -35	-3	Moderately negative impact
-36 to -71	-4	Significantly negative impact
-72 to -108	-5	Extremely Negative Impact

10.1 RISK ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN

The EMP provides management options to ensure impacts of the agricultural and related activities on the farming unit are minimised. An EMP is a tool used to take pro-active action by addressing potential problems before they occur. This should limit corrective measures needed, although additional mitigation measures might be included if necessary. The environmental management measures are provided in the tables and descriptions below. These management measures should be adhered to during the execution of various activities on the farming unit. This section of the report is also presented as a stand-alone document for easy reference. All personnel taking part in the operations of the farms should be made aware of the contents of this section, so as to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

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

Various potential and definite impacts will emanate from the operations, maintenance/construction and decommissioning phases. The majority of these impacts can be mitigated or prevented. The impacts, risk rating of impacts, as well as prevention and mitigation measures are listed below.

As depicted in the tables below, impacts related to the operational phase are expected to mostly be of medium to low significance and can typically be mitigated to have a low significance. The extent of impacts are largely site specific to local and are not of a permanent nature. Due to the nature of the surrounding areas, cumulative impacts are possible and the most important of these are potential groundwater and biodiversity/ecological impacts.

10.1.1 Planning

During the phases of planning for the operations, maintenance/construction and decommissioning phases of the farming unit, it is the responsibility of proponent to ensure they are and remain compliant with all legal requirements. The proponent must also ensure that all required management measures are in place prior to, and during all phases, to ensure potential impacts and risks are minimised. The following actions are recommended for the planning phase and should continue during all other phases of the project:

- Ensure that all the necessary permits from the various ministries, local authorities and any other bodies that governs the operations, maintenance/construction and decommissioning activities on the farms remain valid. These include the consumer fuel installation certificate and water abstraction permit.
- Ensure all appointed contractors and employees enter into an agreement, which includes the EMP. Ensure that contractors, sub-contractors, employees and all personnel present on site understand the contents of the EMP.
- Make provisions to have a Health, Safety and Environmental (HSE) Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental related compliance.
- Make provision for a community liaison officer to deal with complaints.
- Have the following emergency plans, equipment and personnel on site, where reasonable, to deal with all potential emergencies:
    - EMP, risk management plan, emergency response plan and HSE manuals;
    - Adequate protection and indemnity insurance cover for incidents;
    - Procedures, equipment and materials required for emergencies (e.g. firefighting, first aid, etc.).
- Establish and maintain a fund for future ecological restoration, specifically for instances of environmental damage caused during operations including pollution remediation where required. Should project activities cease completely, and future land-use will not involve agriculture, the funds should be utilised to remove all redundant infrastructure and waste.
- Establish and/or maintain a reporting system to report on aspects of operations, maintenance/construction, and decommissioning as outlined in the EMP. Keep monitoring reports on file for bi-annual submission to MEFT in support of environmental clearance certificate renewal applications. This is a requirement by MEFT.
- Appoint a specialist environmental consultant to update the environmental assessment and EMP and apply for renewal of the environmental clearance certificate prior to expiry.

10.1.2 Skills and Development

During the operations and maintenance/construction phases, some training is provided to a portion of the workforce, to allow them to conduct certain tasks according to the required standards. Training include safety and technical aspects. Skills are transferred to an unskilled workforce for general tasks and irrigation-related operations. Development of people and technology are key to economic development and the success of operations. The Proponent plays a role in promoting and sustaining the agricultural industry.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Employment and transfer of skills, technological advancements	2	1	2	3	1	12	2	Probable
Daily Operations	Employment and transfer of skills	2	1	2	3	2	14	2	Definite
Indirect Impacts	Employment and transfer of skills in Namibia's agricultural sector	2	1	2	3	3	16	2	Definite

Desired Outcome: To see an increase in skills of local Namibians, as well as development and technological advancements in the agricultural industry.

Actions

Enhancement:

- Sourcing of employees and contractors must first be at local level and if not locally available, regional or national options should be considered. Deviations from this practice must be justified.
- Skills development and improvement programs must be made available as identified during performance assessments of employees.
- Inform employees about parameters and requirements for references upon employment.
- Provide managerial references for unofficial training or skills transfer.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Keep records of all training provided to employees.
- Ensure that all training is certified or managerial references provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Include all information in a bi-annual report.

10.1.3 Revenue Generation and Employment

Skilled and unskilled labour are required for the operations and maintenance/construction activities associated with the farms. Livelihoods are thus sustained and the spending power of the local community increased. Revenue is generated through the sale of products (such as maize, wheat and cattle) on national and international markets.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Employment and contribution to local and national economy	2	1	2	2	2	12	2	Definite
Daily Operations	Employment contribution to local and national economy	2	1	3	3	1	14	2	Definite
Indirect Impacts	Decrease in unemployment, contribution to local economy	3	1	3	3	3	27	3	Definite

Desired Outcome: Contribution to national treasury and provision of employment to local Namibians.

Actions

Enhancement:

- The proponent must employ local Namibians where possible.
- If the skills exist locally, employees must first be sourced from the area, then the region and then nationally.
- Deviations from this practice must be justified.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual summary report based on employee records.

10.1.4 Demographic Profile and Community Health

Farming activities rely on labour. Jobseekers migrating to the Gobabis area may lead to increased unemployment and expansion of informal settlements. Here, factors such as communicable disease like HIV/AIDS as well as alcoholism and drug abuse may thrive. These are typically aggravated when an influx of seasonal workers, and possible foreign construction teams and contractors, occur. An increase in foreign people in the area, linked to unemployment, may potentially increase the risk of criminal and socially/culturally deviant behaviour. It is however not foreseen that the project will result in significant migration to the Gobabis settlement.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	In-migration and social ills related to foreign contractors temporarily on site	2	-1	1	1	2	-8	-1	Probable
Daily Operations	Social ills possibly associated with staff and jobseekers	2	-1	1	2	2	-10	-2	Probable
Indirect Impacts	The spread of disease	2	-1	2	2	2	-12	-2	Improbable

Desired Outcome: To prevent the occurrence of social ills and prevent the spread of diseases such as HIV/AIDS.

Actions:

Prevention:

- Appointment of reputable contractors where applicable.
- Adhere to all local authority by-laws relating to environmental health, which includes, but is not limited to, sanitation requirements for employees.
- Provide educational, awareness information for employees on various topics of social behaviour and HIV/AIDs.
- Disciplinary steps, within the legal parameters of Namibia, to be taken for socially deviant behaviour at the employee-housing compound or during working hours should be clearly stipulated in employment contracts.

Mitigation:

- Take disciplinary action against employees not adhering to contractual agreements with regard to socially deviant behaviour (e.g. alcohol or drug abuse during working hours).

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Summary report based on educational programmes and training conducted.
- Employee contracts on file.
- Bi-annual report and review of employee demographics.

10.1.5 Agricultural Produce

The project is in line with the objectives of Namibia's NDP5 and contributes to the economy of, and food security in, Namibia. Locally produced crops decrease the amount of crops that needs importing.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction and Daily Operations	Contribution to economy, contribution to food security in Namibia	1	2	3	3	2	16	2	Definite
Indirect Impacts	Reduced import needs, increase in trade balance, spread of knowledge and skills, increased crop productivity	1	2	3	3	3	18	2	Definite

Desired Outcome: Maximum contribution to the food security and economy of Namibia. Provide a positive contribution to the trade balance of Namibia by reducing the amount of imported produce and exporting higher value products (such as beef).

Actions:

Enhancement:

- Teach employees on sustainable farming practices to enable the spread of knowledge and skills and thereby increase the productivity of small-scale farming as well.
- Diversification and continuous improvement to maximise sustainability of the farm.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Bi-annual reporting on educational programmes and training conducted.

10.1.6 Traffic

The C22 national roads passes west of the farms. Potential traffic impacts are mainly related to farm vehicles using the roads to access various locations on the farms as well as the transport of employees and goods to and from the farms. The turnoffs from the main road to the farming unit is a key section of concern. As this is an existing operation, an increase in traffic impacts is expected to be unlikely in the near future. The farming unit accommodated two NamWater boreholes, the related pipelines and power lines, therefore access to the farm is also open to governing officials. Additional and uncontrolled access to the farming unit will result in enhancing the potential security risk related to poaching and farm attacks.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Delivery of equipment and building supplies	1	-1	2	2	1	-5	-1	Improbable
Daily Operations	Increased traffic, road wear and tear and accidents	1	-1	2	2	1	-4	-1	Improbable

Desired Outcome: Minimum impact on traffic and no transport or traffic related incidents.

Actions

Prevention:

- Erect clear signage regarding access and exit points at the farming unit's' turnoffs as well as speed limits on the gravel roads within the farm where required.
- Only licenced drivers who are well trained to be allowed on the national roads. Only licensed drivers and vehicles of any state-owned organisation allowed on the farm.

Mitigation:

- Traffic management should be performed if any traffic impacts are expected on the national roads.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Record all traffic related complaints and the actions taken to prevent impacts from repeating itself.
- Compile a bi-annual report of all incidents reported, complaints received, and actions taken.

10.1.7 Health, Safety and Security

Daily operational and intermittent maintenance and construction activities on the farm are reliant on human labour. Such activities have varying degrees of health and safety risks. Examples include the operation of vehicles and machinery with moving parts, such as harvesters, and the handling of hazardous chemicals with inherent health hazards, such as pesticides and fuel, when ingested, inhaled or physical contact occur. Encounters with wild animals, and especially venomous species like snakes, may pose risks to employees. Security risks relates to unauthorized entry on the farming unit, theft and sabotage.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Physical injuries, exposure to chemicals and criminal activities	1	-2	3	3	1	-14	-2	Probable
Daily Operations	Physical injuries, exposure to chemicals and criminal activities	1	-2	3	3	2	-16	-2	Probable

Desired Outcome: To prevent injury, health impacts and theft.

Actions

Prevention:

- Implement and maintain an integrated health and safety management system, to act as a monitoring and mitigating tool.
- Comply with all health and safety standards as specified in the Labour Act and related legislation.
- Clearly label dangerous and restricted areas as well as dangerous equipment and products.
- Lock away or store all equipment and goods on site in a manner suitable to discourage criminal activities (e.g. theft).
- Provide all employees with required and adequate personal protective equipment (PPE) where required.
- Ensure that all personnel receive adequate training on the operational procedures of equipment and machinery and the handling of hazardous substances.
- Train selected personnel in first aid and ensure first aid kits are available on site.
- The contact details of all emergency services must be readily available.
- Implement a maintenance register for all equipment whose malfunction can lead to injury or exposure to hazardous substances.
- Apply and adhere to all industry specific health and safety procedures and regulations applicable to the handling of food produce for markets.

Mitigation:

- Treat all minor work related injuries immediately and obtain professional medical treatment if required.
- Assess any safety problems and implement corrective action to prevent future occurrences.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Record any incidents with the actions taken to prevent future occurrences.

- Compile a bi-annual report of all incidents reported. The report should contain dates when training was conducted and when safety equipment and structures were inspected and maintained.

10.1.8 Fire

Construction activities, failing electrical infrastructure, lightning and fires outside of designated areas may increase the risk of the occurrence of uncontrolled fires which may spread into the nearby fields and surrounding farms. Lightning may cause natural fires during the dry season. Farming operations do not present the same fire risk as operations which include charcoal production.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Fire risk	1	-2	2	2	1	-10	-2	Probable
Daily Operations	Fire risk	1	-2	2	2	1	-10	-2	Probable

Desired Outcome: To prevent property damage, veld fires, possible injury and impacts caused by uncontrolled fires.

Actions:

Prevention:

- Prepare a holistic fire protection and prevention plan. This plan must include evacuation plans and signage, an emergency response plan and a firefighting plan.
- Personnel training (safe operational procedures, firefighting, fire prevention and responsible housekeeping practices).
- Ensure all flammable chemicals are stored according to material safety data sheet (MSDS) and SANS instructions and all spills or leaks are cleaned immediately.
- Maintain regular site, mechanical and electrical inspections and maintenance.
- Maintain firefighting equipment and promote good housekeeping.
- Clean and maintain firebreaks at strategic locations on the properties, especially where charcoal is manufactured.
- Notify the farmers' association as well as all surrounding farmers if planned burns (e.g. to create firebreaks) are planned.
- Allow fires used for purposes such as cooking (by staff) in designated areas only.

Mitigation:

- Implement the fire protection and firefighting plan in the event of a fire.
- Quick response time by trained staff will limit the spread and impact of fire.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Maintain a register of all incidents on a daily basis. Include measures taken to ensure that such incidents do not repeat themselves.
- Compile a bi-annual incidents report. The report should also contain dates when fire drills were conducted and when firefighting equipment were tested and training given.

10.1.9 Noise

Noise is generated by various operational and possible construction activities. Machinery like wood saws, vehicles and harvesters cause elevated noise levels that may result in hearing impairment after long term exposure. Activities are generally remote from receptors other than the Proponent, his employees and their families residing on the farming unit. The nature of the noise is related mainly to the bush clearing (for maintenance records) and mechanical maintenance typically on a farm.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Excessive noise generated from construction activities – nuisance and hearing loss	1	-1	2	2	1	-10	-1	Probable
Daily Operations	Noise generated from the operational activities – nuisance and hearing loss	1	-1	2	2	1	-10	-1	Definite

Desired Outcome: To prevent any nuisance and hearing loss due to noise generated.

Actions

Prevention:

- Follow World Health Organization (WHO) guidelines on maximum noise levels (Guidelines for Community Noise, 1999) to prevent hearing impairment.
- Regularly service all machinery to ensure minimal noise production.

Mitigation:

- Hearing protectors as standard PPE for workers in situations with elevated noise levels.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- WHO Guidelines.
- Maintain a complaints register.
- Bi-annual report on complaints and actions taken to address complaints and prevent future occurrences.

10.1.10 Waste Production

Various waste streams result from the operational and possible construction and maintenance activities. Waste may include hazardous waste associated with hydrocarbon products and chemicals, as well as soil and water contaminated with such products. Construction waste may include building rubble and discarded equipment. Domestic waste will be generated by the residents and employees on the farm. Waste presents a contamination risk and when not removed regularly may become a health and/or fire hazard and attract wild animals and scavengers. Sewage is a form of liquid biological waste that needs disposal.

Since no official waste disposal facilities, especially for hazardous waste, are available, all waste that cannot be re-used are burned at dedicated waste sites.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Excessive waste production, littering, illegal dumping, contaminated materials	1	-2	2	2	2	-12	-2	Definite
Daily Operations	Excessive waste production, littering, contaminated materials	1	-2	2	2	2	-12	-2	Definite

Desired Outcome: To reduce the amount of waste produced and prevent pollution and littering.

Actions

Prevention:

- Implement waste reduction measures. All waste that can be re-used/recycled must be kept separate.
- Ensure adequate temporary storage facilities for disposed waste are available.
- Prevent windblown waste from entering the environment.
- Prevent scavenging (human and non-human) of waste at the storage facilities.
- Educate employees on the importance of proper waste handling and disposal.

Mitigation:

- Alternative waste disposal methods should be investigated for hazardous waste or waste that present specific pollution risks. This include transporting such wastes to recyclers in Windhoek when empty trucks travel there to collect goods.
- Discarded waste should be disposed of and burned regularly at a dedicated site to reduce health and pollution risks.
- Empty chemical containers that may present a contamination/health risk must be treated as hazardous waste. Workers should not be allowed to collect such containers for purposes of storing water or food. This can be achieved by puncturing or crushing such containers prior to disposal.
- Ensure all ablution facilities are connected to properly constructed septic tank systems to prevent groundwater contamination.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Maintain a register of disposal of hazardous waste. This should include type of waste, volume as well as disposal method/facility.

- Record any complaints received regarding waste with notes on actions taken.
- All information to be included in a bi-annual report.

10.1.11 Ecosystem and Biodiversity Impact

Agriculture and related activities are ongoing at the farming unit and no expansion is foreseen in the nearby future. No further impacts on vegetation are thus expected from additional land clearing. Pollution of the environment may however impact on the ecosystem and biodiversity. Poaching and illegal collection of plant and animal materials may occur. Bird nests may be destroyed during tree illegal harvesting. Irresponsible pesticide use, for example as method of vermin control, may impact on scavengers such as vultures and in the long run on top predators through biomagnification in higher trophic levels.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Impact on fauna and flora. Loss of biodiversity	2	-1	3	2	2	-14	-2	Probable
Daily Operations	Impact on fauna and flora. Loss of biodiversity – poaching, poisoning, etc.	2	-1	2	2	2	-12	-2	Probable

Desired Outcome: To avoid pollution of, and impacts on, the ecological environment.

Actions.

Prevention:

- Strictly adhere to pesticide application instructions and use pesticides only for the purposes for which it is registered and marketed. Importantly, pesticides should not be used to kill vermin unless specifically registered for that purpose, and even then alternative, environmentally friendly methods should be investigated and used.
- Prevent pesticides from ending up in the hands of potential poachers.
- Educate all contracted and permanent employees on the value of biodiversity and strict conditions prohibiting harvesting and poaching of fauna and flora must be part of employment contracts. Include prohibitions or regulations on the collection of firewood.
- Regular inspection of fences, game footpaths and other sites for snares, traps or any other illegal activities.
- Over-abstraction of groundwater may potentially have devastating effects on plant and animal populations reliant on it. This include the drying up of springs, dying of trees and migration or dying of animals.

Mitigation:

- For construction activities, if any, contain construction material to a designated laydown area and prevent unnecessary movement out of areas earmarked for clearing and construction.
- Report any extraordinary animal sightings to the Ministry of Environment, Forestry and Tourism.
- Mitigation measures related to waste handling and the prevention of groundwater, surface water and soil contamination should limit ecosystem and biodiversity impacts.
- Avoid scavenging of waste by fauna.
- Take disciplinary action against any employees failing to comply with contractual conditions related to poaching and the environment.

Responsible Body:

- Contractor
- Proponent

Data Sources and Monitoring:

- Report on all extraordinary animal or plant sightings or instances of poaching.
- Keep frequent records of borehole water levels and abstracted water volumes to identify any trends or consistent reduction in water levels.
- Compile a bi-annual report on all monitoring results.

10.1.12 Groundwater, Surface Water and Soil Contamination

Leakages and spillages of hazardous substances from vehicles and accidental fuel, oil or hydraulic fluid spills during the operational phase. Increase of nutrient levels (from over application of fertilizers) in the soil that can leach to the groundwater. Pollution due to sewerage system overflow or leakage. Overuse / incorrect application of herbicides / pesticides may also pose a risk.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2)Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Hazardous material, spillages, hydrocarbon leakages from vehicles and machinery.	2	-1	2	2	1	-10	-2	Improbable
Daily Operations	Over application of fertilizer, pesticides, herbicides, etc. Sewerage system malfunction.	2	-1	2	2	1	-10	-2	Improbable

Desired Outcome: To prevent the contamination of groundwater, surface water and soil.

Actions

Prevention:

- Appoint reputable contractors.
- Vehicles may only be serviced on a suitable spill control structure.
- Regular inspections and maintenance of all vehicles to ensure no leaks are present.
- All hazardous chemicals should be stored in a sufficiently bunded area, as per MSDS requirements.
- Follow prescribed dosage of fertilizers and pesticides / herbicides and to avoid over application.
- Maintain sewerage systems and conduct regular monitoring.
- All hazardous waste must be removed from the site and disposed of timeously at a recognised hazardous waste disposal facility, including any polluted soil or water.

Mitigation:

- All spills must be cleaned up immediately.
- Consult relevant Material Safety Data Sheet (MSDS) information and a suitably qualified specialist where needed.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Maintain Material Safety Data Sheets for hazardous chemicals.
- Soil should be sampled and analysed annually to ensure the correct amounts of fertilizer is applied and soil and groundwater quality is maintained.
- Groundwater should be sampled and analysed to test for nitrate concentrations from the fertilizer and for traces of chemicals used in pesticides and herbicides.
- Registers be kept by the Proponent on the type, quantities and frequency of application of fertiliser, pesticides and any other chemicals utilised in crop production.
- A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that such incidents do not repeat themselves.
- All spills or leaks must be reported on and cleaned up immediately.

10.1.13 Groundwater Abstraction

The over abstraction of groundwater for irrigation and other activities may lead to declining water levels. This may negatively impact on surrounding users as well as existing habitats that depend on groundwater. For example the availability of groundwater may have an impact on the farm and surrounding farms, as well at a wider spatial scale due to the cumulative impact. Over abstraction of groundwater by surrounding users may contribute to the decline in water levels (cumulative impact). It is important to note that the groundwater basin forms a transboundary aquifer that extent from Namibia into Botswana. Over abstraction in any of the countries may have a negative impact on the other countries and can causes disputes.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2)Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Over-abstraction of the local aquifer, decrease in the local hydraulic head.	2	-2	2	2	2	-24	-3	Probable

Desired Outcome: To utilise the groundwater sustainably.

Actions

Prevention:

- Spread the water abstraction points over a larger area to diffuse the impact.
- Monthly water level monitoring.
- Maintain safe abstraction rates prescribed by test pump evaluations (an abstraction permit with prescribed rates from the MAWLR is a requirement for this project).

Mitigation:

- Reduce abstraction when the water levels nears 5 m below the average rest water level of each borehole.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Monthly boreholes rest water level monitoring.
- Baseline values should be reviewed every 3 years based on all historic water level data.
- A summary report on all monitoring results must be prepared.
- The Proponent supply monitoring returns to the MAWLR, as required by the permit.

10.1.14 Visual Impact

This impact relates to the aesthetic appearance of the site during operations. This impact will be minimal due to the area already being disturbed and widely utilised for agricultural activities. The impact will therefore mostly relate to poor housekeeping and waste not disposed of timeously. Operations at the farm are well kept with the highest standard of neatness and cleanliness exhibited throughout all components of the operations, inclusive of employee housing.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Aesthetic appearance and integrity of the site	1	1	2	2	2	6	1	Probable
Daily Operations	Aesthetic appearance and integrity of the site	1	1	2	2	2	6	1	Probable

Desired Outcome: To minimise aesthetic impacts associated with the farm.

Actions

Mitigation:

- Regular waste disposal, good housekeeping and routine maintenance on infrastructure will ensure that the longevity of structures are maximised and maintain a low visual impact.

Responsible Body:

- Proponent
- Contractors

Data Sources and Monitoring:

- Compile a bi-annual report of all complaints received and actions taken.

10.1.15 Cumulative Impact

Possible negative cumulative impacts (i.e. the build-up of minor impacts to become more significant) associated with the operational phase and any maintenance/construction activities are mainly linked to traffic, reduction in soil and groundwater quality and groundwater availability. Furthermore, collective, indiscriminate wood harvesting in the area may negatively impact ecological functioning. The cumulative increase in employees in the area may put more pressure on biodiversity as a result of poaching or harvesting of plant and animal products. The cumulative positive impacts from farming in the Omaheke Region relates to increased and sustained employment, revenue generation and overall improved living conditions and livelihoods as a result of increased spending power.

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Construction and Operations (Negative)	Waste production, pollution, etc.	2	-1	2	2	1	-10	-2	Probable
Daily Construction and Operations (Positive)	The build-up of minor impacts to become more significant Employment, skills development, revenue generation	2	1	2	2	1	10	2	Definite

Desired Outcome: To minimise cumulative all impacts associated with the farm.

Actions

Mitigation:

- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact.
- Reviewing biannual reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts. Planning and improvement of the existing mitigation measures can then be implemented.

Responsible Body:

- Proponent

Data Sources and Monitoring:

- Create a summary report based on all other impacts to give an overall assessment of the impacts of the operational phase.

10.2 DECOMMISSIONING AND REHABILITATION

Closure and decommissioning of agricultural and related activities on the farms as a whole is not foreseen during the validity of the environmental clearance certificate or in the near future. However, it is more likely that certain components may be decommissioned. Decommissioning is therefore included for this purpose as well as the fact that construction activities may also include modification and decommissioning of infrastructure. Future land use after decommissioning should be assessed prior to decommissioning and rehabilitation initiated if the land would not be used for future purposes. Should decommissioning occur at any stage, rehabilitation of the area may be required. Decommissioning will entail the complete removal of all infrastructure including buildings and irrigation infrastructure. Any pollution present on the site must be remediated. The impacts associated with this phase include noise and waste production as structures are dismantled. Noise must be kept within WHO standards. Waste should be contained and disposed of at a dedicated waste disposal site and not dumped in the surrounding areas. The EMP for the farms will have to be reviewed at the time of full decommissioning to cater for changes made to the site and to implement guidelines and mitigation measures.

10.3 ENVIRONMENTAL MANAGEMENT SYSTEM

The proponent could implement an environmental management system (EMS) for their operations. An EMS is an internationally recognized and certified management system that will ensure ongoing incorporation of environmental constraints. At the heart of an EMS is the concept of continual improvement of environmental performance with resulting increases in operational efficiency, financial savings and reduction in environmental, health and safety risks. An effective EMS would need to include the following elements:

- A stated environmental policy which sets the desired level of environmental performance;
- An environmental legal register;
- An institutional structure which sets out the responsibility, authority, lines of communication and resources needed to implement the EMS;
- Identification of environmental, safety and health training needs;
- An environmental program(s) stipulating environmental objectives and targets to be met, and work instructions and controls to be applied in order to achieve compliance with the environmental policy; and
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS.
- The EMP.

11 CONCLUSION

Agricultural and related activities as performed on the farms Portion 2 of Ohlsenhagen No. 174, Portion 1 of Anaboom No. 400 and Portion 1 of Escourt No. 713, in the Omaheke Region, contributes positively to the economy of Namibia. Food and fodder is produced for national markets while cattle is produced for both local and international markets. A number of employment opportunities are sustained and skills development within the local workforce occur. Revenue is generated that contributes to the Namibian economy.

Negative impacts associated with operational and intermittent maintenance and construction activities on the farming unit, as summarised in Table 11-1, can successfully be mitigated. Implementing a HSE policy will contribute to effective management procedures to prevent and mitigate impacts. All regulations relating to the agricultural and related activities of the Proponent, including health and safety legislation, should be adhered to and implemented where applicable. Groundwater and soil pollution must be prevented at all times. Fire prevention should be key, fire response plans in place, and regular firefighting training provided to key employees. All staff must be made aware of the importance of biodiversity and the poaching or illegal harvesting of animal and plant products prohibited. This includes the proper handling and correct application of pesticides. Any waste produced must be properly disposed, re-used, or recycled where possible.

The EMP (Section 10) should be used as an on-site reference document for the operations of the farms. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. The proponent could use an in-house Health, Safety, Security and Environmental Management System in conjunction with the EMP. All operational personnel must be taught the contents of these documents.

Should the Directorate of Environmental Affairs (DEA) agree with the impacts and related mitigation measures, they may issue an environmental clearance certificate to the proponent. The environmental clearance certificate will render this document legally binding on the proponent. The assessment process's aim is not to stop the farming activities, or any of its components, but to rather determine its impact and guide sustainable and responsible development as per the spirit of the EMA.

Table 11-1. Impact summary class values

Impact Category	Impact Type	Construction	Operations
	Positive Rating Scale: Maximum Value	5	5
	Negative Rating Scale: Maximum Value	-5	-5
EO	Skills and Development		
EO	Revenue Generation and Employment		
SC	Demographic Profile and Community Health		
EO	Agricultural Produce and Economic Diversification		
SC	Traffic		
SC	Health, Safety and Security		
PC	Fire		
PC	Noise		
PC	Waste Production		
BE	Ecosystem and Biodiversity Impact		
PC	Groundwater, Surface Water and Soil Contamination		
BE/EO	Groundwater Abstraction		
SC	Visual Impact		
	Cumulative Impact		

BE = Biological/Ecological EO = Economical/Operational PC = Physical/Chemical SC = Sociological/Cultural

12 BIBLIORGAPHY

Atlas of Namibia Project. 2002. Directorate of Environmental Affairs, Ministry of Environment and Tourism (www.met.gov.na) [Accessed from http://www.uni-koeln.de/sfb389/e/e1/download/atlas_namibia/index_e.htm]

Botha P, Brunette H.C.; November 2019; Agricultural Activities on Farm Friedrichsrühe, Tsumeb District: Hydrogeological Specialist Study

Carney, J.N., Aldiss, D.T., and Lock, N.P. 1994. The geology of Botswana. Botswana Geological Survey, Bulletin, 37, 1 – 113.

Climate Engine. (2020). Desert Research Institute and University of Idaho. Accessed on (15/01/2021). http://climateengine.org.

Curtis B. & Mannheimer C. 2005. Tree Atlas of Namibia. National Botanical Research Institute, Windhoek. 674 pages.

Directorate of Environmental Affairs, 2008. Procedures and Guidelines for Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP), Directorate of Environmental Affairs, Ministry of Environment and Tourism, Windhoek.

Du Plessis, N.P., (2020). Gobabis Water Supply Scheme. Environmental Management Plan. NamWater.

Funk, C., Peterson, P., Landsfeld, M., Pedreros, D., Verdin, J., Shukla, S., Husak, G., Rowland, J., Harrison, L., Hoell, A. and Michaelsen, J., (2015) The climate hazards group infrared precipitation with stations - A new environmental record for monitoring extremes. Scientific Data, 2, 150066. Accessed on (15/01/2021). https://doi.org/10.1038/sdata.2015.66.

Geological Survey of Namibia; Geological Map 1:1,000,000.

Geological Survey of Namibia; 1981. Geological Map 1:250,000. Geological Series 2218 Gobabis (S.W.A/Namibia).

IGRAC (International Groundwater Resources Assessment Centre), UNESCO-IHP (UNESCO International Hydrological Programme), (2015). Transboundary Aquifers of the World [map]. Accessed on (15/01/2021). Scale 1:50000000. Webpage: https://apps.geodan.nl/igrac/ggis-viewer/viewer/tbamap/public/default

Klock, H., (2001). Hydrogeology of the Kalahari in north-eastern Namibia.

Miller, R.McG. (2008). The Geology of Namibia: Volume 2. Neoproterozoic to Lower Paleozoic. Geological Survey of Namibia.

Namibia Statistics Agency. Namibia 2011 Population and Housing Census Main Report.

Namibia Statistics Agency. Namibia household Income and Expenditure Survey 2009/2010.

Du Plessis, N.P. 2020. Gobabis Water Supply Scheme: Environmental Management Plan. NamWater, Windhoek.

Pastakia, C.M.R.; 1998; The Rapid Impact Assessment Matrix (RIAM) – A new tool for Environmental Impact Assessment.

Phocaides, A.; 2007; Handbook on pressurized Irrigation Techniques; Food And Agriculture Organization of The United Nations.

Appendix A: Water Abstraction Permits

205775
205776 Boargate

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND LAND REFORM

Telephone:	**(061) 2087111**	**Department of Water Affairs**
Fax:	**(061) 2087697**	**Private Bag 13193**
Enquiries:	**C GURIRAS**	**Windhoek**
Reference:	**PL 174/2**	**9000**

Mr. P. De Wit
P O Box 1
GOBABIS

Dear Sir

APPLICATION TO LEGALIZE TWO (2) BOREHOLES ON THE FARM OLSENHAGEN 174/2, GOBABIS DISTRICT, OMAHEKE REGION: MR. P. DE WIT.

1. The above-mentioned application has been approved. Attached please find permit number 11530 which authorizes the use of the borehole concerned for irrigation and stock watering purposes.

2. You are kindly requested to comply with all the permit conditions.

EXECUTIVE DIRECTOR
2020 -11- 26
Republic of Namibia
Ministry of Agriculture, Water and Land Reform

Percy W. Misika
EXECUTIVE DIRECTOR

All official correspondence must be addressed to the Executive Director

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND LAND REFORM

Telephone: (061) 2087111
Fax: (061) 2087697
Enquiries: C GURIRAS
Reference: PL 174/2

Department of Water Affairs
Private Bag 13193
Windhoek
9000

PERMIT NUMBER: 11530 **DATE: 21 SEPTEMBER 2020**

PERMIT ISSUED IN TERMS OF REGULATIONS 5 AND 9 OF GOVERNMENT NOTICE R1278 OF 23 JULY 1971 AS PROMULGATED UNDER SECTION 30(2) OF THE WATER ACT, 1956 (ACT 54 OF 1956), AS AMENDED

NAME OF PERMIT HOLDER	:	Mr. P. De Wit
ADDRESS	:	P O Box 1, Gobabis
REGISTERED PROPERTY	:	Ohlsenhagen 174 Portion 2
DISTRICT	:	Gobabis
CONTROL AREA	:	Windhoek-Gobabis Subterranian Water Control Area
BOREHOLE TO BE AUTHORIZED	:	Serial number WW 205775 and WW205776
PURPOSE FOR WHICH WATER MAY BE USED	:	Irrigation and stock watering purposes

This permit authorizes the use of the boreholes identified as WW 205775 and WW205776 on the farm planning map, attached as Annexure A, subject to the following conditions:

1. This permit is incident to the property and if the present owner sells the property, the permit shall be handed over to the new owner.

2. Enclosed please find a number plate for the boreholes. The number plates shall be prominently placed for easy identification of the boreholes. (Do not attach to movables such as the pump or engine or to the concrete block around the casing).

3. All installations, reservoirs, pipes, taps and reticulation systems shall be leak proof to prevent any spillage of water. The permit holder shall take the necessary precautions to use the water on his property to the best advantage.

4. The Executive Director or his authorized representative in consultation with the Minister shall have the right to:

   (a) withdraw, amend or replace any condition of this permit or withdraw this permit in its entirety, after reasonable notice to the permit holder; and

   (b) inspect the source and installations at all reasonable times to determine whether the permit conditions are adhered to.

5. The Executive Director shall not accept liability for damage or loss suffered by the permit holder should the relevant source wane or run dry or the period of validity of the permit not be extended or renewed.

6. Should the permit holder not comply with any of the permit conditions:

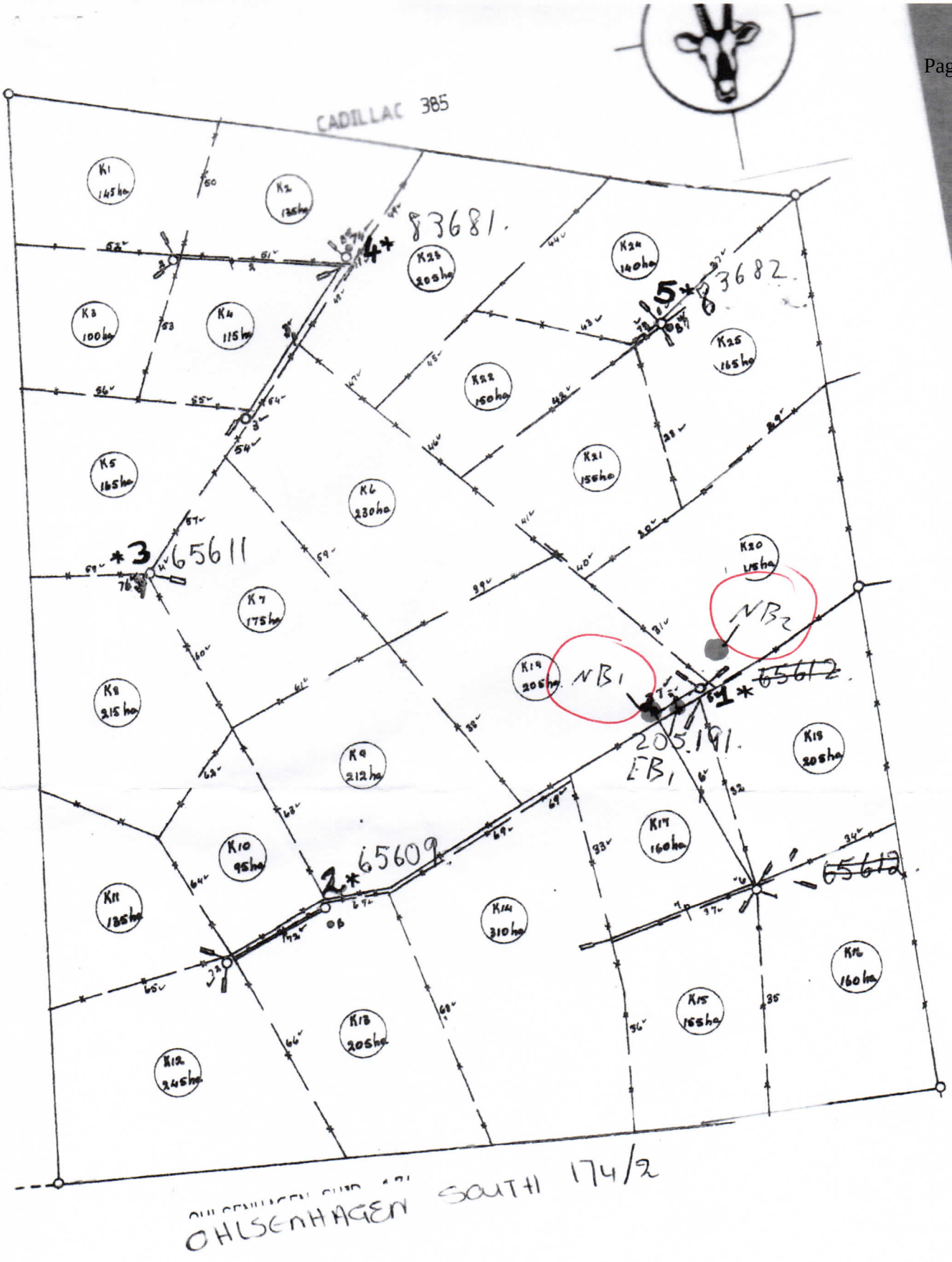
   (a) The Executive Director may seal the borehole until the conditions are complied with;

   (b) the permit holder may be held liable for any costs which the Permanent Secretary may incur as a result thereof, and

   (c) the permit holder shall be guilty of an offence and shall, on conviction, be liable to the penalties prescribed in Section 170 of the Water Act, 1956 (Act 54 of 1956).

EXECUTIVE DIRECTOR
2020 -11- 26
Republic of Namibia
Agriculture, Water and Land Reform

Percy W. Misika
EXECUTIVE DIRECTOR


CADILLAC 385
K1 145 ha
K2 135 ha
K3 100 ha
K4 115 ha
K5 165 ha
K6 230 ha
K7 175 ha
K8 215 ha
K9 212 ha
K10 95 ha
K11 135 ha
K12 245 ha
K13 205 ha
K14 310 ha
K15 155 ha
K16 160 ha
K17 160 ha
K18 205 ha
K19 205 ha
K20 145 ha
K21 155 ha
K22 150 ha
K23 205 ha
K24 140 ha
K25 165 ha
83681.
83682.
65611
65609
65612
65612
NB2
NB1
205.1 ha
EB1
1
2
3
4
5
OHLSENHAGEN SOUTH 174/2

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

Telephone: (061) 2087111
Fax: (061) 2087697
Enquiries: E Coetzee
Reference: PL 400/1

Department of Water Affairs
Private Bag 13193
Windhoek
9000

MINISTRY OF AGRICULTURE, WATER AND FORESTRY
Private Bag 13184
2016 -06- 22
REPUBLIC OF NAMIBIA

Mr P G de Wit
P. O. Box 1
GOBABIS

Sir

APPLICATION FOR A PERMIT FOR THE AUTHORIZATION OF THREE EXISTING BOREHOLES TO ABSTRACT WATER FOR IRRIGATION PURPOSES ON PTN 1 OF THE FARM ANNABOOM NO. 400, GOBABIS DISTRICT

1. The above-mentioned application has been approved. Attached please find permit number 11 168 which authorizes the abstraction of water for irrigation purposes.

2. You are kindly requested to comply with all the permit conditions, especially conditions number 4 and 5.

Yours faithfully

PERMANENT SECRETARY

All official correspondence must be addressed to the Permanent Secretary.

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

Telephone: (061) 2087111
Fax: (061) 2087697
Enquiries: E Coetzee
Reference: PL 400/1

Department of Water Affairs
Private Bag 13193
Windhoek
9000

PERMIT NUMBER: 11 168 **DATE:** 10 June 2016

PERMIT ISSUED IN TERMS OF REGULATIONS 5 AND 9 OF GOVERNMENT NOTICE R1278 OF 23 JULY 1971 AS PROMULGATED UNDER SECTION 30(2) OF THE WATER ACT,1956 (ACT 54 OF 1956), AS AMENDED

NAME OF PERMIT HOLDER	:	P G de Wit
ADDRESS	:	P. O. Box 1, Gobabis
REGISTERED PROPERTY	:	Ptn 1 of the farm Annaboom No. 400
DISTRICT	:	Gobabis
CONTROL AREA	:	Windhoek-Gobabis-Subterranean Water Control Area
VALIDITY PERIOD	:	5 (five) years
BOREHOLES TO BE USED	:	Serial numbers WW 204515, WW 204516 and WW 204517
PURPOSE FOR WHICH WATER MAY BE USED	:	Irrigation purposes
ABSTRACTION PER YEAR	:	140 000 m³ maximum

This permit authorizes the holder (or his successors in title) to abstract and use water for the purpose as stated above, from the existing boreholes identified as WW 2045157, WW 204516 and WW 204517 on the farm planning map, attached as Annexure A, subject to the following conditions:

All official correspondence must be addressed to the Permanent Secretary.

1. The validity period shall be from 10 June 2016 to 09 June 2021.

2. An application for the extension of the validity period shall be in the possession of the Permanent Secretary at least 6 (six) months before the expiry date of the permit.

3. The permit is incident to the property and if the present owner sells the property, the permit shall be handed over to the new owner.

4. Enclosed please find the number plates for the boreholes. The number plates shall be prominently placed for easy identification of the boreholes. (Do not attached to movables such as the pump or engine or to the concrete block around the casing.) Each borehole shall be identified with the correct borehole number plate.

5. All water abstracted shall pass through a water meter and the permit holder shall bear all costs for the supply, installation and maintenance of this meter. The Permanent Secretary shall be informed beforehand if a water meter is to be installed so that an inspection, if necessary, can be conducted. Installation of the meter shall be to the satisfaction of the Permanent Secretary.

6. The permit holder shall keep monthly readings in cubic metres of the above-mentioned water meter and enter it quarterly on the prescribed return form, which shall be submitted on or before the 10th day of the following quarter, in respect of the previous quarter, to the Control Officer: Abstraction Control. If no water was abstracted during a quarter, a nil return must nevertheless be submitted. If the permit holder fails to send in returns regularly, this could lead to the withdrawal of the permit.

7. The permit holder shall record the water levels of the pumped sources once in three months at a time before the pump is switched on in order to obtain the rest water levels and enter it on the above-mentioned return form.

8. Where a borehole is situated in a riverbed no embankments shall be constructed around the borehole in the riverbed which could result in the river damming up or its normal flow being impeded.

9. All installations, reservoirs, pipes, taps troughs and reticulation systems shall be leak proof to prevent any spillage of water. The permit holder shall take the necessary precautions to use the water on his property to the best advantage.

10. The Permanent Secretary or his authorized representative in consultation with the Minister shall have the right to:

    (a) withdraw, amend or replace any condition of this permit or withdraw this permit in its entirety, after reasonable notice to the permit holder.

    (b) inspect the sources and installations at all reasonable times to determine whether the permit conditions are adhered to.

11. The Permanent Secretary shall not accept liability for damage or loss suffered by the permit holder should the relevant sources wane or run dry or the period of validity of the permit not be extended or renewed.

12. Should the permit holder not comply with any of the permit conditions:

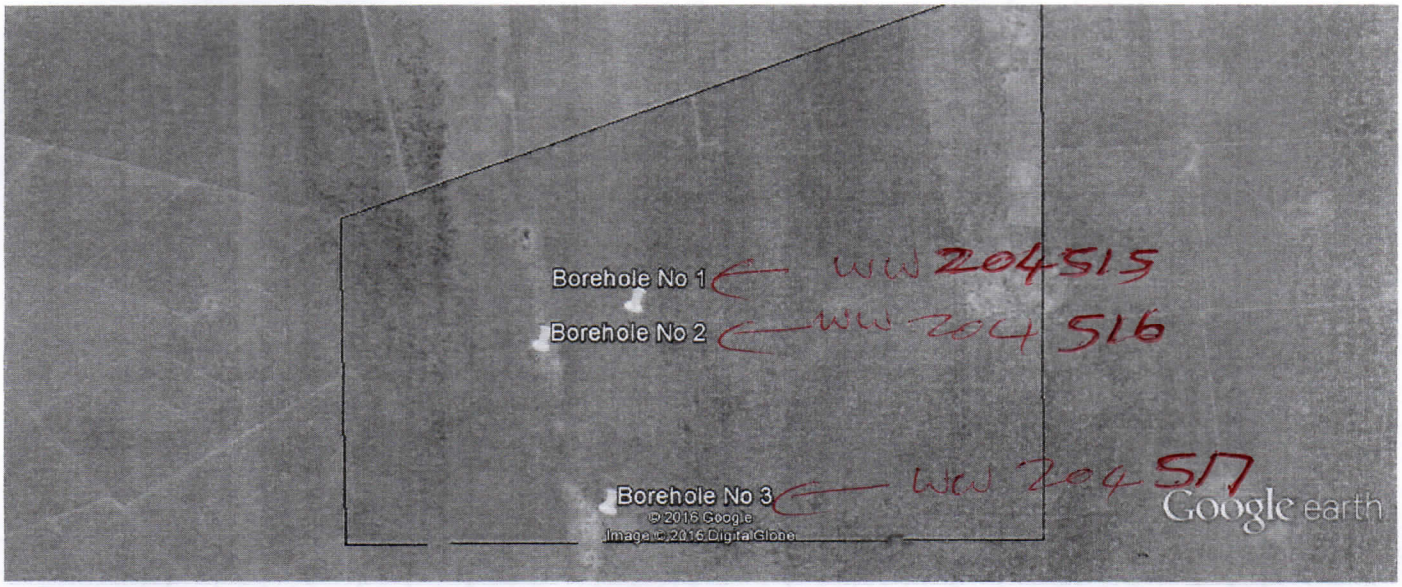
(a) the Permanent Secretary may seal the boreholes until the conditions are complied with;

(b) the permit holder may be held liable for any costs which the Permanent Secretary may incur as a result thereof, and

(c) the permit holder shall be guilty of an offence and shall, on conviction, be liable to the penalties prescribed in Section 170 of the Water Act, 1956 (Act 54 of 1956).

PERMANENT SECRETARY

Google earth



Borehole No 3

3 NEW BOREHOLES FOR IRRIGATION PURPOSES.

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43796
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 1 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	7.7		A - Excellent
Conductivity mS/m	50.0	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	335	mg/l	
Sodium as Na	17	mg/l	A - Excellent
Potassium as K	5	mg/l	A - Excellent
Sulphate as SO_4	1	mg/l	A - Excellent
Nitrate as N	1.0	mg/l	A - Excellent
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	73	mg/l	
Fluoride as F	0.8	mg/l	A - Excellent
Chloride as Cl	6.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	262	mg/l	
Total Hardness as $CaCO_3$	244	mg/l	A - Excellent
Calcium as $CaCO_3$	153	mg/l	A - Excellent
Magnesium as $CaCO_3$	92	mg/l	A - Excellent
Turbidity	25.2	NTU	Above recommended limit
Colour	12.0	mg/l Pt	Within recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class A : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43796

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43796

Stability pH : 7.25
Langelier Index : 0.45 - Scaling
Ryznar Index : 6.80 - Stable

CORROSITIVITY POTENTIAL OF WATER TOWARDS STEEL : 0.04 - Non-corrosive

IRRIGATION CLASIFICATION : C2 - S1
MEDIUM-SALINITY WATER (C2)
Can be used if a moderate amount of leaching occurs. Plants with moderate tolerance can be grown in most cases without special practices for salinity control.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43796

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43797
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 2 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	9.1		B - Good
Conductivity mS/m	22.7	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	152	mg/l	
Sodium as Na	20	mg/l	A - Excellent
Potassium as K	4	mg/l	A - Excellent
Sulphate as SO_4	<1	mg/l	A - Excellent
Nitrate as N	<0.5	mg/l	A - Excellent
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	2	mg/l	
Fluoride as F	0.5	mg/l	A - Excellent
Chloride as Cl	5.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	110	mg/l	
Phenolphthalein Alkalinity as $CaCO_3$	16.0	mg/l	
Total Hardness as $CaCO_3$	85	mg/l	A - Excellent
Calcium as $CaCO_3$	10	mg/l	A - Excellent
Magnesium as $CaCO_3$	75	mg/l	A - Excellent
Iron as Fe	0.07	mg/l	A - Excellent
Manganese as Mn	0.01	mg/l	A - Excellent
Copper as Cu	<0.01	mg/l	A - Excellent
Zinc as Zn	<0.01	mg/l	A - Excellent
Cadmium as Cd	<0.01	mg/l	A - Excellent
Lead as Pb	<0.02	mg/l	A - Excellent
Turbidity	7.4	NTU	Above recommended limit
Colour	10.0	mg/l Pt	Within recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class B : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43797

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43797

Stability pH : 8.78
Langelier Index : 0.32 - Scaling
Ryznar Index : 8.45 - Corrosive

#VALUE!

IRRIGATION CLASIFICATION : C1 - S1
LOW-SALINITY WATER (C1)
Can be used for irrigation with most crops on most soils with little likelihood that soil salinity will develop. Some leaching is required, but this occurs under irrigation practices except in soils of extremeley low permeability.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43797

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43798
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 3 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	7.9		A - Excellent
Conductivity mS/m	65.6	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	440	mg/l	
Sodium as Na	18	mg/l	A - Excellent
Potassium as K	5	mg/l	A - Excellent
Sulphate as SO_4	4	mg/l	A - Excellent
Nitrate as N	11.3	mg/l	B - Good
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	70	mg/l	
Fluoride as F	0.7	mg/l	A - Excellent
Chloride as Cl	29.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	250	mg/l	
Total Hardness as $CaCO_3$	310	mg/l	B - Good
Calcium as $CaCO_3$	173	mg/l	A - Excellent
Magnesium as $CaCO_3$	138	mg/l	A - Excellent
Turbidity	13.5	NTU	Above recommended limit
Colour	60.0	mg/l Pt	Above recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class B : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.
COLOUR: Colour in water is generally due to organic compounds together with colloidal iron and/or manganese.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43798

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43798

Stability pH : 7.23
Langelier Index : 0.67 - Scaling
Ryznar Index : 6.56 - Stable

CORROSITIVITY POTENTIAL OF WATER TOWARDS STEEL : 0.18 - Non-corrosive

IRRIGATION CLASIFICATION : C2 - S1
MEDIUM-SALINITY WATER (C2)
Can be used if a moderate amount of leaching occurs. Plants with moderate tolerance can be grown in most cases without special practices for salinity control.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43798

E.Honga
Senior Manager : Water Quality & Environmental Services

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

Telephone: (061) 2087111
Fax: (061) 2087227
Enquiries: E Coetzee
Reference: PL 174/2

Department of Water Affairs
Private Bag 13193
Windhoek
9000

The Manager
Racso Trading CC
P. O. Box 1
GOBABIS

Dear Sir

APPLICATION FOR A PERMIT FOR THE ABSTRACTION OF WATER FOR IRRIGATION PURPOSES ON PORTION 2 OF THE FARM OHLSENHAGEN NO. 174, GOBABIS DISTRICT

1. The above-mentioned application has been approved. Attached please find permit number 11389 which authorizes the abstraction of water for irrigation purposes.

2. You are kindly requested to comply with all the permit conditions, especially conditions number 4, 5 and 6.

Yours sincerely

PERMANENT SECRETARY
08-10-2018
Republic of Namibia
Ministry of Agriculture, Water & Forestry

Percy W Misika
PERMANENT SECRETARY

All official correspondence must be addressed to the Permanent Secretary

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

Telephone: (061) 2087111
Fax: (061) 2087227
Enquiries: E Coetzee
Reference: PL 174

Department of Water Affairs
Private Bag 13193
Windhoek
9000

PERMIT NUMBER: 11389 **DATE:** 18 September 2018

PERMIT ISSUED IN TERMS OF REGULATIONS 5 AND 9 OF GOVERNMENT NOTICE R1278 OF 23 JULY 1971 AS PROMULGATED UNDER SECTION 30(2) OF THE WATER ACT, 1956 (ACT 54 OF 1956), AS AMENDED

NAME OF PERMIT HOLDER	:	Racso Trading CC
ADDRESS	:	P. O. Box 1, Gobabis
REGISTERED PROPERTY	:	Ptn 2 of the farm Ohlsenhagen No. 174
DISTRICT	:	Gobabis
CONTROL AREA	:	Windhoek- Gobabis-Mariental-Keetmanshoop Artesian Area
VALIDITY PERIOD	:	5 (five) years
BOREHOLE TO BE USED	:	Serial number WW 205191
PURPOSE FOR WHICH WATER MAY BE USED	:	Irrigation purposes
ABSTRACTION PER YEAR	:	140 000 m³ maximum

All official correspondence must be addressed to the Permanent Secretary

This permit authorizes the holder (or his successors in title) to abstract and use water for the purpose as stated above, from the existing borehole identified as WW 205191 on the farm planning map, attached as Annexure A, subject to the following conditions:

1. The validity period shall be from 18 September 2018 to 17 September 2023.

2. An application for the extension of the validity period shall be in the possession of the Permanent Secretary at least 6 (six) months before the expiry date of the permit.

3. The permit is incident to the property and if the present owner sells the property, the permit shall be handed over to the new owner.

4. Enclosed please find the number plate for the one borehole. The number plate shall be prominently placed for easy identification of the borehole. (Do not attached to movables such as the pump or engine or to the concrete block around the casing)

5. All water abstracted shall pass through a water meter and the permit holder shall bear all costs for the supply, installation and maintenance of this meter. The Permanent Secretary shall be informed beforehand if a water meter is to be installed so that an inspection, if necessary, can be conducted. Installation of the meter shall be to the satisfaction of the Permanent Secretary.

6. The permit holder shall keep monthly readings in cubic metres of the above-mentioned water meter and enter it quarterly on the prescribed return form, which shall be submitted on or before the 10th day of the following quarter, in respect of the previous quarter, to the Control Officer: Abstraction Control. If no water was abstracted during a quarter, a nil return form shall be submitted. Should you have inquiries regarding the completion of the above-mentioned form, you may contact the Geohydrology or Law Administration Division at telephone numbers (061) 2087121 or 2087184.

7. The permit holder shall record the water level of the pumped source once in three months at a time before the pump is switched on in order to obtain the rest water level and enter it on the above-mentioned return form.

8. Where a borehole is situated in a riverbed no embankments shall be constructed around the borehole in the riverbed which could result in the river damming up or its normal flow being impeded.

9. All installations, reservoirs, pipes, taps troughs and reticulation systems shall be leak proof to prevent any spillage of water. The permit holder shall take the necessary precautions to use the water on his property to the best advantage.

10. The Permanent Secretary or his authorized representative in consultation with the Minister shall have the right to:

    (a) withdraw, amend or replace any condition of this permit or withdraw this permit in its entirety, after reasonable notice to the permit holder.

    (b) inspect the source and installations at all reasonable times to determine whether the permit conditions are adhered to.

11. The Permanent Secretary shall not accept liability for damage or loss suffered by the permit holder should the relevant source wane or run dry or the period of validity of the permit not be extended or renewed.

12. Should the permit holder not comply with any of the permit conditions:

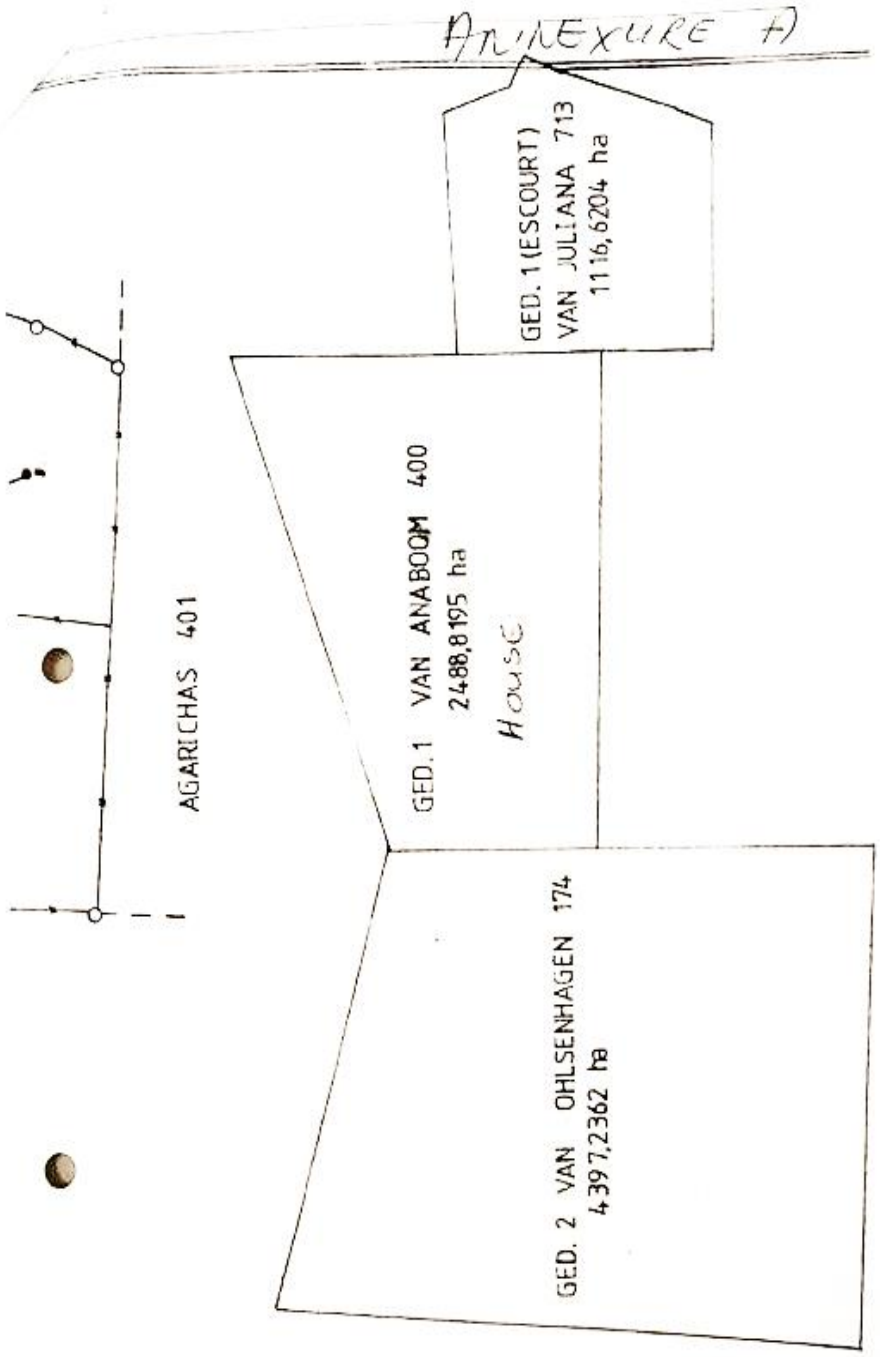
(a) the Permanent Secretary may seal the borehole until the conditions are complied with;

(b) the permit holder may be held liable for any costs which the Permanent Secretary may incur as a result thereof, and

(c) the permit holder shall be guilty of an offence and shall, on conviction, be liable to the penalties prescribed in Section 170 of the Water Act, 1956 (Act 54 of 1956).

PERMANENT SECRETARY
08-10-2018
Republic of Namibia
Ministry of Agriculture, Water & Forestry

Percy W Misika
PERMANENT SECRETARY


ANNEXURE A)
GED. 1 (ESCOURT)
VAN JULIANA 713
1116,6204 ha
GED. 1 VAN ANABOOM 400
2488,8195 ha
House
AGARICHAS 401
GED. 2 VAN OHLSENHAGEN 174
4397,2362 ha

ANNABOOM

YEAR	
Name of Property	
No. of Property	
District	
Permit Holder	
Contact number w/cell	
Postal Address	
Permit Number	
Perm. Quota in m^3/yr	

Rainfall 1 WY	
Rainfall 2 WY	
Rainfall 3 WY	
Rainfall WW	

RETURN
ABSTRACTION FOR IRRIGATION PURPOSES

	Month	Date	Type of Irrigation FI=Flood Sp=Sprinkler Dr=Drip	Area under irrigation [ha]	Crops under irrigation (use abbreviations below)	Rainfall (mm)	Water Meter Reading(s) in m^3				Water Level Reading(s) in m below surface OPTIONAL!				Evaluation (not to be changed by per	
							1st Borehole	2nd Borehole	3rd Borehole	4th Borehole	1st Borehole	2nd Borehole	3rd Borehole	4th Borehole	Abstraction in Period [m^3]	
Reading Previous	DEC															
New Readings	JAN															
	FEB															
	MAR															
	APR															
	MAY															
	JUN															
	JUL															
	AUG															
	SEP															
	OCT															
	NOV															
	DEC															

Crops under Irrigation:

Ci	Citrus Fruits (Trees)
Co	Cotton
Fr	Fruits other than Citrus (Trees)
Gr	Grapes
Lu	Lucerne
Ma	Maize, Millies
Me	Melons
Ol	Olives
Po	Potatoes
So	Sorghum
Ve	Vegetables
Wh	Wheat

Remarks:

Signature

Date

Appendix B: Hydrogeological Specialist Study

IRRIGATION ACTIVITIES ON PORTION 2 OF FARM OHLSENHAGEN NO. 174, PORTION 1 OF FARM ANABOOM NO. 400 AND PORTION 1 OF FARM ESCOURT NO. 713, OMAHEKE REGION

HYDROGEOLOGICAL SPECIALIST STUDY

Assessed by:

Assessed for:

PG de Wit

May 2021

Project:	**IRRIGATION ACTIVITIES ON PORTION 2 OF FARM OHLSENHAGEN NO. 174, PORTION 1 OF FARM ANABOOM NO. 400 AND PORTION 1 OF FARM ESCOURT NO. 713, OMAHEKE REGION: HDROGEOLOGICAL SPECIALIST STUDY**	
Report Version/Date	V1/ May 2021	
Prepared for	PG de Wit P O Box 1 Gobabis Namibia	
Lead Consultant	Geo Pollution Technologies (Pty) Ltd PO Box 11073 Windhoek Namibia	TEL.: (+264-61) 257411 FAX.: (+264) 88626368
Main Project Team	**Pierre Botha (Leader)** (B.Sc. Geology/Geography); (B.Sc. (Hons) Hydrology/Hydrogeology) **Christian Brunette** (B.Sc. Geology/Geography); (B.Sc. (Hons) Geology)	
Cite this document as:	Botha P.; Brunette C., May 2021; Irrigation Activities on Portion 2 of Farm Ohlsenhagen No. 174, Portion 1 of Farm Anaboom No. 400 and Portion 1 of Farm Escourt No. 713, Omaheke Region, Hydrogeological Specialist Study.	
Copyright	Copyright on this document is reserved. No part of this document may be utilised without the written permission of Geo Pollution Technologies (Pty) Ltd.	
Report Approval	Pierre Botha Managing Director	

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

CHIRPS-2	Climate Hazards Group Infra-Red Precipitation with Station data version 2
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GPT	Geo Pollution Technologies
ha	Hectare
IGRAC	International Groundwater Resources Assessment Centre
m/s	Metre per second
Ma	Million years
mamsl	Meters Above Mean Sea Level
MAWLR	Ministry of Agriculture, Water and Land Reform
MAR	Magnesium Adsorption Ratio
mbs	Metres below surface
MEFT	Ministry of Environment, Forestry and Tourism
mm/a	Millimetres per annum
Mm^3	Million cubic metres
MSDS	Material Safety Data Sheet
SRTM	Shuttle Radar Topography Mission
UNESCO-IHP	UNESCO International Hydrological Programme

1 INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by Mr. P.G. de Wit (the Proponent) to undertake a hydrogeological specialist study for irrigation activities on the farms: Portion 2 of Ohlsenhagen No. 174, Portion 1 of Anaboom No. 400 and Portion 1 of Escourt No. 713. The farms are located about 4 km east of the C22 route (T1402 trunk road) in the Omaheke Region (Figure 1-1). For purposes of crop cultivation, the Proponent has cleared 116 ha, of which 56 ha is under irrigation and the remainder dryland cropping. At present, the main crop cultivated under irrigation and dryland is maize, but alternative crops may be considered in future. Irrigation is from production boreholes by means of centre pivot irrigation systems. The Proponent plans to clear an additional 66 ha of which 28 ha may be used for irrigation purposes, should water abstraction rights be obtained. Other activities include livestock farming and charcoal production.

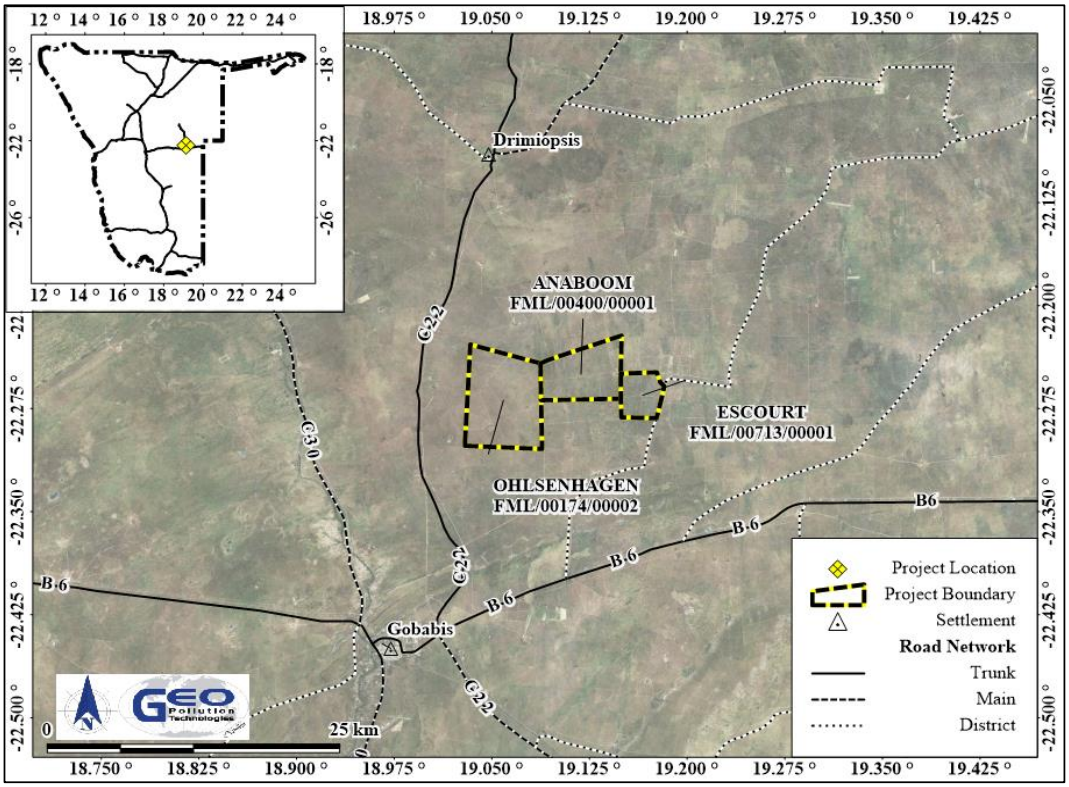


Figure 1-1. Project location

2 SCOPE OF WORK

The aims of the study were to:

1. Conduct a hydrogeological assessment based on a hydrocensus-survey of the project area.
2. Gather historic information and compile a hydrogeological assessment based on the information.
3. Prepare a specialist report of the investigation.

3 METHODOLOGY

Available geological and hydrogeological information/reports for the investigation area were obtained and reviewed. The hydrogeological catchment and sub-catchments within the investigation area were reviewed and delineated. This was based on historic groundwater level data contained in the Department of Water Affairs (DWA) database and on hydrocensus data gathered as part of this investigation. Satellite imagery such as SRTM 30 m data (Shuttle Radar Topography Mission) were utilised for the

catchment delineation and elevation mapping purposes. A specialist report were prepared for the investigation.

4 LEGAL

To protect the environment and achieve sustainable development, all projects, plans, programmes and policies deemed to have adverse impacts on the environment require an environmental impact assessment (EIA), as per the Namibian legislation. The key legislation provided in Table 4-1 govern the environmental assessment process in Namibia and/or are relevant to the project.

Table 4-1. Namibian Law applicable to the project

Law	Key Aspects
The Namibian Constitution	♦ Incorporate a high level of environmental protection. ♦ Land, water and natural resources below and above the surface of the land and in the continental shelf and within the territorial waters and the exclusive economic zone of Namibia shall belong to the State if they are not otherwise lawfully owned.
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ Defines the environment. ♦ Promote sustainable management of the environment and the use of natural resources.
The Water Act Act No. 54 of 1956	♦ Defines the interests of the state in protecting water resources. ♦ Defines and prohibits pollution of water sources. ♦ Controls the disposal of effluent. ♦ Whenever an owner of land obtains, by artificial means on his own land, a supply of water which is not derived from a public stream, such water shall be deemed to be private water. ♦ Remains in force until the new Water Resources Management Act comes into force.
Water Resources Management Act Act No. 11 of 2013 (Not in force yet)	♦ Provide for management, protection, development, use and conservation of water resources. ♦ Prevention of water pollution and assignment of liability.
Soil Conservation Act Act No. 76 of 1969	♦ Law relating to the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources Namibia.

Relevant water resource development and related activities that are listed as activities requiring an environmental clearance certificate are (Government Notice No. 29 of 2012):

8.1 The abstraction of ground or surface water for industrial or commercial purposes.

8.2 The abstraction of groundwater at a volume exceeding the threshold authorised in terms of a law relating to water resources.

8.6 Construction of industrial and domestic wastewater treatment plants and related pipeline systems.

8.7 Irrigation schemes for agriculture excluding domestic irrigation.

8.8 Construction and other activities in water courses within flood lines.

8.9 Construction and other activities within a catchment area.

It is not clear in which act a threshold, as referred to in number 8.2, is defined, if any. The Water Resources Management Act (Act No. 11 of 2013) is likely to define such a threshold and it is expected to make the whole of Namibia a water control area in which abstraction permits would be required. The current Water Act (Act No. 54 of 1956) only requires abstraction permits within water control areas, see Figure 5-1. Abstraction permits are currently issued by the Ministry of Agriculture Water and Land Reform (MAWLR). The project falls inside a control area, thus an abstraction permit is a requirement.

Within the Water Act (Act No. 54 of 1956) it is clearly stipulated that the purification and disposal of industrial water and effluents, as well as the disposal of effluents by local authorities, is subjected to the requirements of the Act. Agricultural activities are not subjected to the requirements of the Act, making the implementation of 8.6 questionable. The return period for flood lines is not provided for, nor is a definition for flood lines provided, to make 8.8 applicable. It is however in the proponent's best interest to ensure that the project area is outside a flood risk area. All land in Namibia is in some form of catchment area, making the practical implementation of 8.9 questionable. It however remains important to consider all activities that would/may impact groundwater.

5 DESCRIPTION OF NATURAL ENVIRONMENT

5.1 LOCALITY AND SURROUNDING LAND USE

The project (22.2508 °S; 19.1112 °E) is located about 18 km northeast of Gobabis, east of the C22 route, Gobabis District. All adjacent properties are farms and land use consist of agriculture. The project area is in the South Eastern Kalahari groundwater basin. It should be noted that this groundwater basin is a management basin. The actual groundwater basins differ from these "management" boundaries. The project area furthermore straddles a groundwater divide area, with the eastern project footprint falling within the Okwa Transboundary Aquifer (Cheruiyot, 2018) and the western project footprint in the South Eastern Kalahari basin. The Stampriet Transboundary Aquifer occurs about 70 km south of the project area in the South Eastern Kalahari basin, see Figure 5-1.

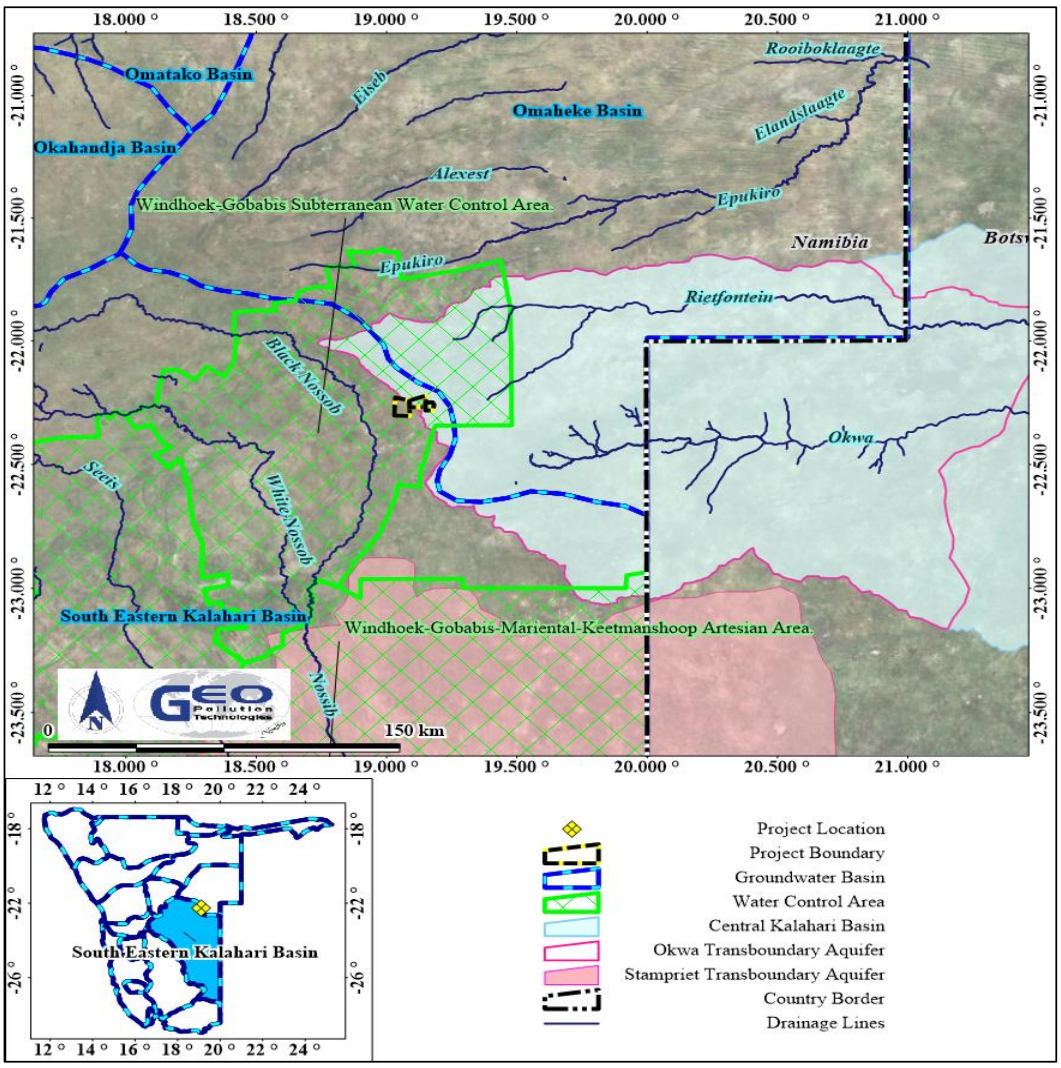


Figure 5-1. Groundwater basins, water control areas and transboundary aquifer

5.2 CLIMATE

The general lack of functioning weather stations in Namibia, in especially rural areas, limits the availability of long term, true weather data. As a best possible workaround, long term climate data was obtained from the Atlas of Namibia Project (2002) and the CHIRPS-2 database (Funk et al., 2015), see Figure 5-2, Table 5-1 and Table 5-2. Atlas of Namibia Project data was compiled from almost 300 rainfall stations across Namibia, the data was contoured in 50 mm intervals prior to 1999 for variable length data sets. The CHIRPS-2 dataset (Climate Hazards Group Infra-Red Precipitation with Station data version 2) consist of long term rainfall data (1981 to near-present) obtained from satellite imagery and, where present, in-situ station data. The resultant dataset provides a reasonably well represented overview of the climatic conditions and historic weather conditions of a general area. True values for single, site specific metereological events may however differ to some degree. This is especially true where the dominant rainfall is depended on localized storm cells that causes a high rainfall variability over short distances.

The project area is situated in a semi-arid climatic region. Days are mostly warm with very hot days during the summer months, while nights are generally cool. The rain season normally starts in October and last until April, peaking in January and February. Heavier rainfall (single day

events) occur between November and April, with a single event of 54.1 mm in March (last 39 years data) being the highest.

The average annual rainfall for the last 39 years was calculated as 343 mm/a, with a coefficient of variance of 34 % (Table 5-2). This coefficient of variance correlates with Atlas of Namibia Project data (Table 5-1). Daily and seasonal rainfall data (Funk et al., 2015) is presented in Figure 5-2. Seasonal (July to June) total rainfall, centred on the average line for the last 39 years, is presented, with the daily total rainfall and the seasonal cumulative rainfall. From the figure it is clear that since 2010 to 2020 six seasons received above average rainfall, namely 2009-2010, 2010-2011, 2011-2012, 2013-2014, 2016-2017 and 2019-2020 The rest were all below average with the driest year (last 39 years data) being 1994-1995, followed by 2018-2019. The rain season 2018-2019 is part of a dry period stretching from July 2017 until June 2019.

Table 5-1. Summary of climate conditions (Atlas of Namibia Project, 2002)

Variation in annual rainfall (%)	30-40
Average annual evaporation (mm/a)	2,800-3,000
Water deficit (mm/a)	1,501-1,700
Temperature (°C)	19-20

Table 5-2. Rainfall statistics (Funk et al., 2015)

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum (mm)	14.6	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum (mm)	209.3	204.0	112.3	117.4	11.8	1.6	0.6	0.2	9.2	51.2	92.5	184.8
Average (mm)	70.1	74.8	54.2	33.3	1.5	0.1	0.0	0.0	1.9	13.7	29.5	64.0
Variability (%)	64.0	63.0	53.0	91.0	194.0	442.0	430.0	354.0	155.0	84.0	74.0	63.0
Daily maximum (mm)	34.2	51.2	54.1	39.2	11.8	0.6	0.6	0.2	5.3	17.6	25.6	39.0
Average rain days	8	8	5	2	0	0	0	0	1	3	6	8
Season July - June average: 343 mm					**Season coefficient of variation: 34 %**							
Data range	1981-Jul-01		to	2020-Jun-30						Lat: -22.2508°S Long: 19.1112°E		

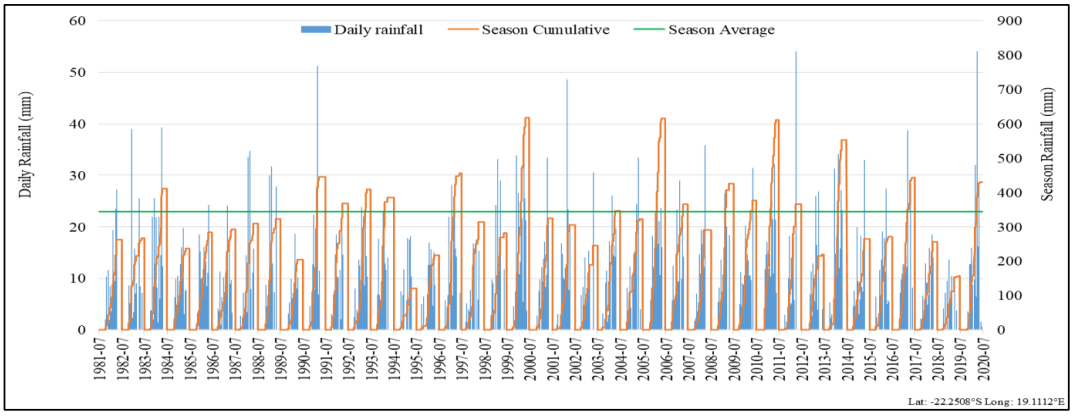


Figure 5-2. Daily and seasonal rainfall (Funk et al., 2015)

5.3 TOPOGRAPHY & DRAINAGE

The project straddles the watershed between two ephemeral river catchments, namely the catchment of the Rietfontein River, draining to the east, and the Black Nossob River, draining to the south. Although the topography is generally flat, elevation of the western project footprint slope marginally towards the southwest, and of the eastern project footprint, marginally towards the east. Local surface runoff thus collects in the Black Nossob River located about 16 km to the southwest of the project area, and the Rietfontein River, about 18 km east of the project area.

The Black Nossob River forms a confluence with the White Nossob River further downstream, forming the Nossob River. The Rietfontein River flows in an eastern direction toward the Makgadikgadi Pan in Botswana.

The project area forms part of the Kalahari Sandveld landscape known for its palaeo dunes and pans, which can be observed in the larger study area.

5.4 SOILS

The soils of the Kalahari Group can locally be classified as feralic Arenosols for the project area. Arenosols can be described as sandy soils with poor capacity to retain nutrients. These soils are common in arid and semi-arid environments and are associated with flat to undulating topography. Landforms associated with Arenosols are typically dunes, sand plains and sand ridges. Its parent material is aeolian sand.

Fluviosols are mapped about 16 km west of the project. Fluviosols are described as well drained fine to loamy sand. A Fluviosol is associated with flat to almost flat topography in drainage lines or valley bottoms. Its parent material is alluvial deposits. Figure 5-3 indicate the soil and surface geology of the project area. Surface geology is depicted as limestone and sandstone. Rock outcrop is mapped about 10 km south of the project. Detail geology and hydrogeology are depicted in Section 5.5.

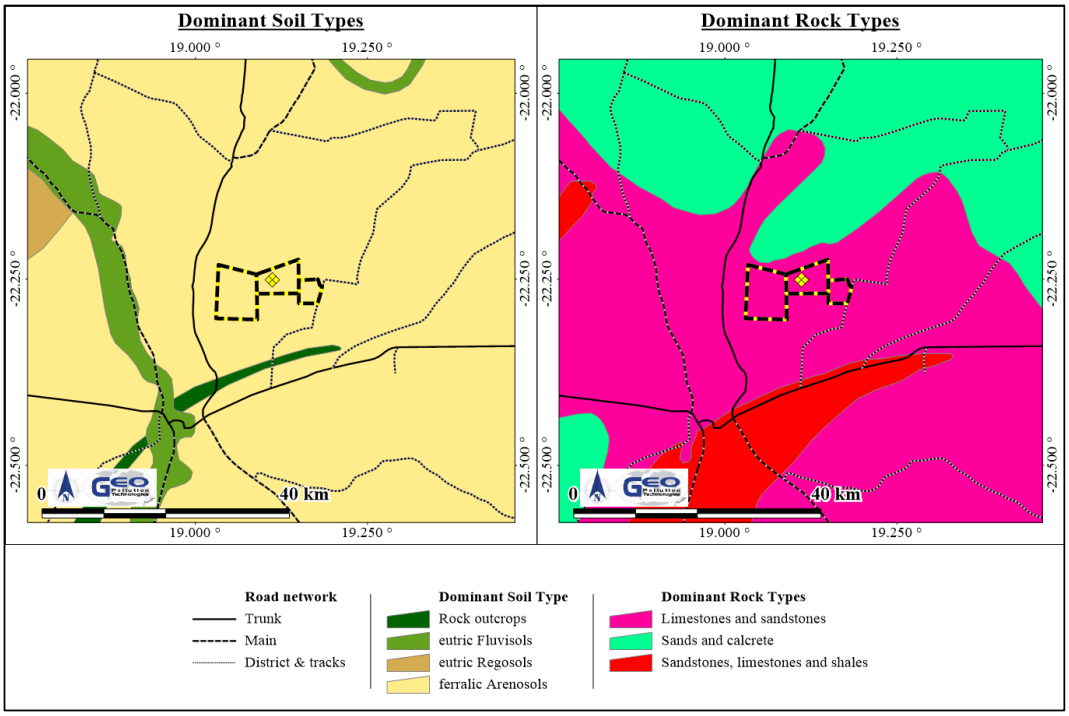


Figure 5-3. Dominant soil and rock type (Atlas of Namibia Project, 2002)

5.5 GEOLOGY AND HYDROGEOLOGY

The regional stratigraphic succession of the project area can be divided into geology belonging to the Mokolian Age (pre-Damara), Namibian Age (Damara Sequence) and Late Cretaceous- to Quaternary Age (Kalahari Group). Kalahari Group surficial deposits occur as overburden of varying thickness over hard rock substrata.

Sinclair Sequence geology of the Mokolian Age is the oldest rocks in the project area and is mapped about 9 km northwest of the project. This sequence comprise of red-brown quartzite with intercalations of carbonate rocks, shale and conglomerate of the Eskadron Formation.

Damara Sequence geology of the Nosib-Group Kamtsas Formation is inferred to make up the subsurface geology of the project. Rocks of the Kamtsas Formation consist of feldspathic quartzite, conglomerate, schist and marble. The Damara Sequence is divided into various tectonostratigraphic zones, with the project area located within the Southern Foreland, see Figure

5-4 and Figure 5-5. Figure 5-5 provides a simplified structural profile across the Damara Belt with the approximate project location.

The Southern Foreland represents one of the foreland basins of the Damara Belt, separated from the Southern Margin Zone by the Frontal Thrust (Miller, 2008). Damara Sequence and Pre-Damara geology generally strike west-southwest to east-northeast. Deformation of the Damara and Pre-Damara Sequence strata occurred during the Pan African Orogeny (680 - 450 Ma) and resulted in the formation of fold and thrust structures, e.g., isoclinal folds, overturned folds and thrusted fold.

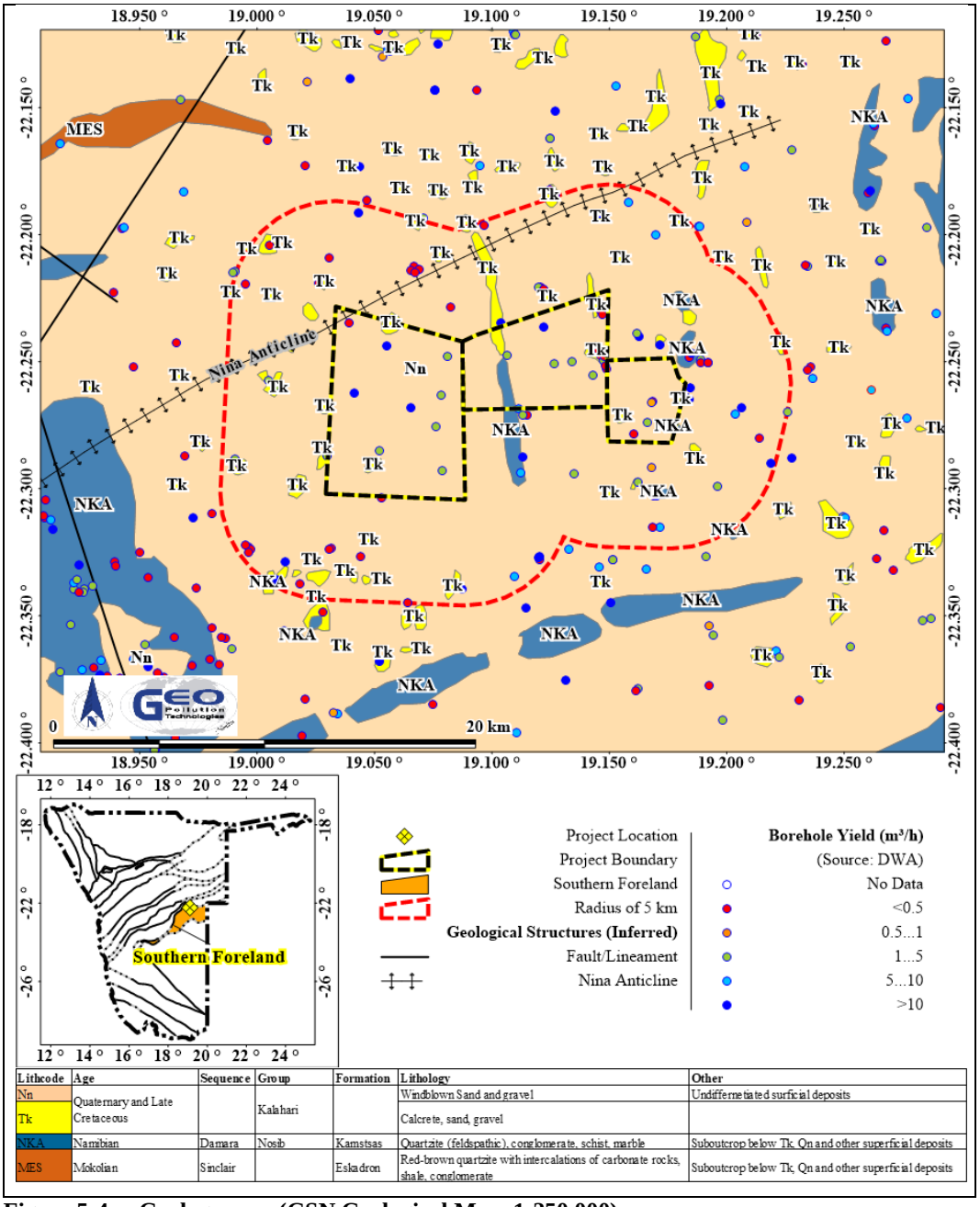
Locally, the Nosib Group geology is thrusted as sub-parallel shear zones or thrusts over Palaeoproterozoic basement and also comprise southeast vergent open to tight folds (Carney et al., 1994). The Nina anticline structure straddles the northwestern corner of farm Ohlsenhagen No. 174 (Portion 2), with the fold axis trending in a north-eastern direction, see Figure 5-4. The development of joints and fractures in the rocks are associated with the folding, which have an impact on the hydrogeological characterization of the area.

Late Cretaceous to Quaternary Age Kalahari Group deposits rest unconformly over older pre-Kalahari rock formations and consist of a wide range of terrestrial sediments. These sediments originate mainly from fluvial deposition with some reworking through aeolian processes. The expected thickness of the surficial deposits at the project farms is approximately up to 10 m (GSN Geological Map: 1:250,000, 1981).

The onset of Kalahari Group sedimentation is assumed to have started during the late Cretaceous (~ 65 Ma) when isostatic uplift of the continental margin of Namibia and South Africa started (Klock, 2001). Isostatic uplift led to the uplift of coastal escarpments and the evolution of the intracontinental hinterland basin where down warping took place. This down warping caused a change in drainage patterns into the Kalahari Basin that formed.

Rivers crossing the escarpment subsequently underwent rejuvenation due to the increase in drainage gradient with subsequent increased erosion. Rivers draining into the Kalahari Basin had a lower drainage gradient and therefore caused sedimentation in the flatter terrain. Figure 5-6 illustrates the Kalahari Basin with a profile indicating the escarpment and interior down warp. This profile example extend from the Atlantic Ocean through the Windhoek Municipal area toward the eastern border of Botswana. Elevation was obtained from SRTM 30 m data.

Terrestrial sediments tend to vary significantly between the stratigraphically equal units in the regional setting of the Kalahari Group. According to Klock (2001) a general upward-fining trend of the clast-population and an upward decrease in clast abundance are observed, consisting of the basal Tsumkwe Formation, overlain by the Eiseb Formation and then by the Omatako Formation and most recent Aeolian Unit. Due to the limited Kalahari Group sediment thickness (up to 10 m) of the project area, the basal layer can be related to the Eiseb Formation, overlayed by aeolian sands. In some areas the surface cover may even be limited to aeolian sands. Eiseb Formation strata consist of altering fluvial sands, carbonate deposits and pebble horizons. Palaeochannels present in these formations might cause local lateral changes over short distances. Aeolian sand overlies the older geology, inter-fingering with inter-dune deposits.



Lithcode	Age	Sequence	Group	Formation	Lithology	Other
Nn	Quaternary and Late Cretaceous		Kalahari		Windblown Sand and gravel	Undifferentiated surficial deposits
Tk					Calcrete, sand, gravel	
NKA	Namibian	Damara	Nosib	Kamstsas	Quartzite (feldspathic), conglomerate, schist, marble	Suboutcrop below Tk, Qn and other superficial deposits
MES	Mokolian	Sinclair		Eskadron	Red-brown quartzite with intercalations of carbonate rocks, shale, conglomerate	Suboutcrop below Tk, Qn and other superficial deposits

Figure 5-4. Geology map (GSN Geological Map, 1:250,000)

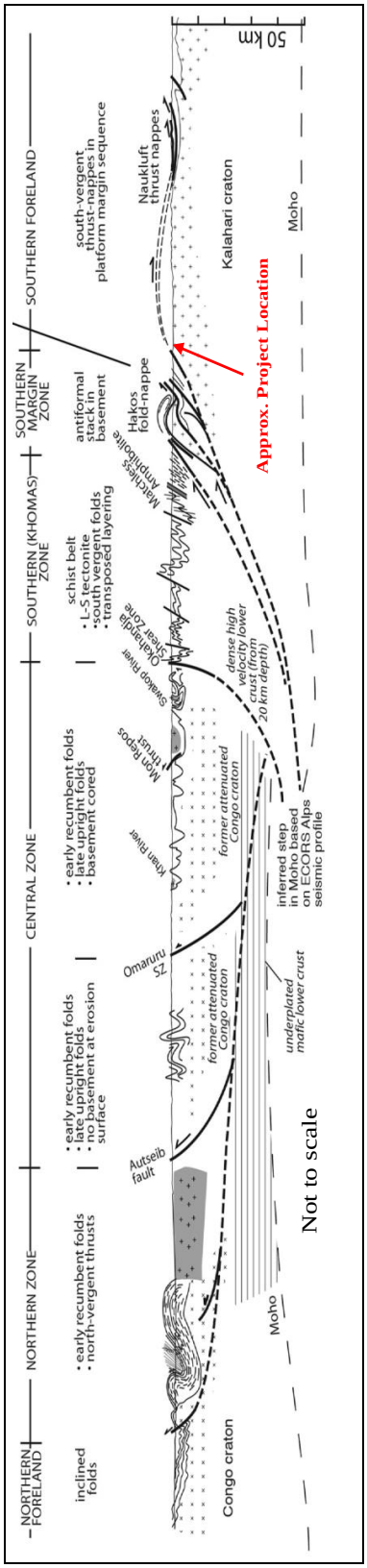


Figure 5-5. Simplified structural profile across the Damara Belt of Namibia (Goscombe, et al. 2017)

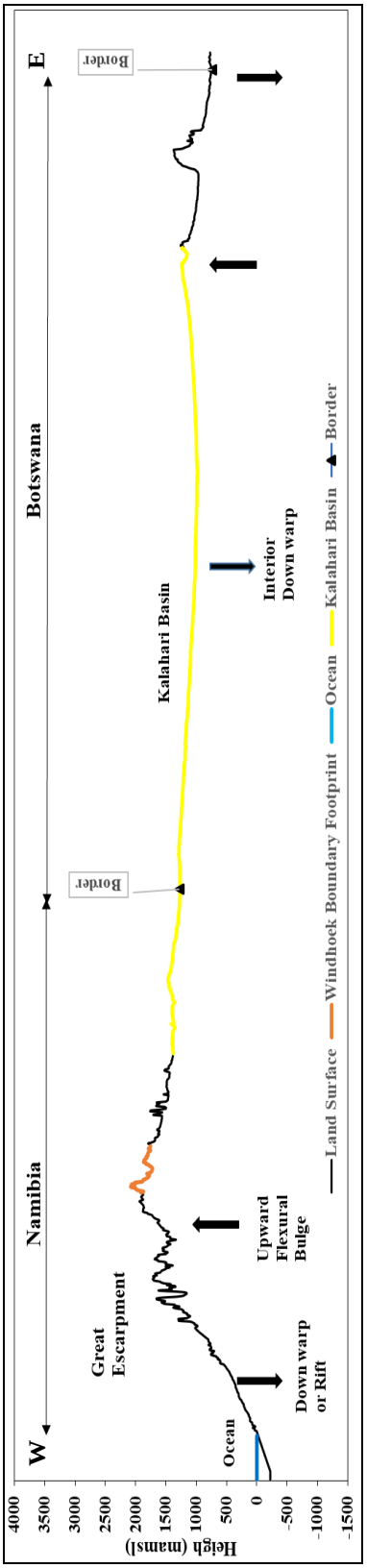


Figure 5-6. Profile across central Namibia and Botswana

The project area straddles two groundwater basins, namely the Okwa Transboundary Aquifer and the South Eastern Kalahari groundwater basin. About 70 km south of the South Eastern Kalahari basin, the Stampriet Transboundary Aquifer occurs. Both the Okwa- and Stampriet Transboundary Aquifer extends from Namibia into Botswana. The thickness of the aquifers tend to increase toward the down gradient area of the basins. Figure 5-7 depicts the project area relative to the larger extent of the groundwater basins together with inferred groundwater flow for each transboundary aquifer.

Within the South Eastern Kalahari groundwater basin, about 70 km downstream of the project, the well-known Stampriet Artesian Basin of the Stampriet Transboundary Aquifer occurs. Two major aquifer layers occur within the Stampriet Artesian Basin, known as the Auob and Nossob Members of the Karoo Sequence Ecca Group. Recharge of an artesian aquifer typically occur on the rim of the catchment where the aquifer layer meets the surface or a permeable layer in which recharge occur. The Auob Member is the larger aquifer and it is shallow and high yielding. No direct recharge from precipitation occur to this aquifer. Indirect recharge do however occur in areas where the Kalahari Aquifer overlay the Auob Member. The Nossob Member is the inferior aquifer and is located below the Auob Member. No form of recharge is considered to occur in this member. The Nossob Member can be thus described as fossil water.

The Okwa Transboundary Aquifer make up the western section of the larger Central Kalahari Basin. Groundwater flow in the Okwa Transboundary Aquifer was delineated by the extent of the catchments of the Okwa River and its tributary, the Rietfontein River, see Figure 5-7. The extent of the larger Central Kalahari Basin was modelled based on the catchment of the Okwa - Mmone River system that eventually drains into the Makgadikgadi Pans (Lukela et al., 2018).

Principal aquifers of the Central Kalahari Basin consist of the Karoo Sequence Lebung- and Ecca Aquifer, and the Damara-Sequence Ghanzi Aquifer. The thickness of the aquifers tend to increase toward the down gradient area of the basin. The Kamtsas Formation, which forms the subsurface geology of the project, constitute the Ghanzi Aquifer. This aquifer dominates the northwestern part of the Central Kalahari Basin and the majority of the Okwa Transboundary Aquifer. Figure 5-7 illustrates four transects across the transboundary aquifer (Cheruiyot, 2018). The west to east transect (transect C – C') is presented with the approximate project location (red arrow), indicating the resident Ghanzi Aquifer and the absent Ecca Aquifer. Note that the Lubung Aquifer is absent in the entire Okwa Transboundary Aquifer.

Figure 5-8 and Figure 5-9 depict a west to east and north to south transect for the project region. Figure 5-9 contains inferred groundwater levels and elevation based on data contained in the DWA borehole database. Although the database consists of long term data, water level data was sufficient to give an idea on the regional steady-state groundwater level conditions.

Figure 5-9 indicates that the hydraulic gradient decreases from the central part of the project area where the groundwater divide occurs. Groundwater flow of the western project footprint is projected in a south-western direction, as part of the South Eastern Kalahari Basin. The elevation is locally the lowest at the Black Nossob River about 16 km southwest of the project area. Groundwater flow of the eastern project footprint is projected toward the east as part of the Okwa Transboundary Aquifer. A considerable drop in elevation and groundwater gradient were noted to occur from the groundwater divide at the project area toward the east to the Botswana border.

Local groundwater flow is expected to take place through primary porosity in the surface cover (Kalahari Group), while it is expected to flow along fractures, faults, dykes/mineralised faults or along contact zones (secondary porosity) and other geological structures present within the underlying rock formations. As the surface cover is expected to be up to 10 m thick, a secondary porosity regime will be dominant in the project area. Note that local flow patterns may vary due to groundwater abstraction and due to geological constraints.

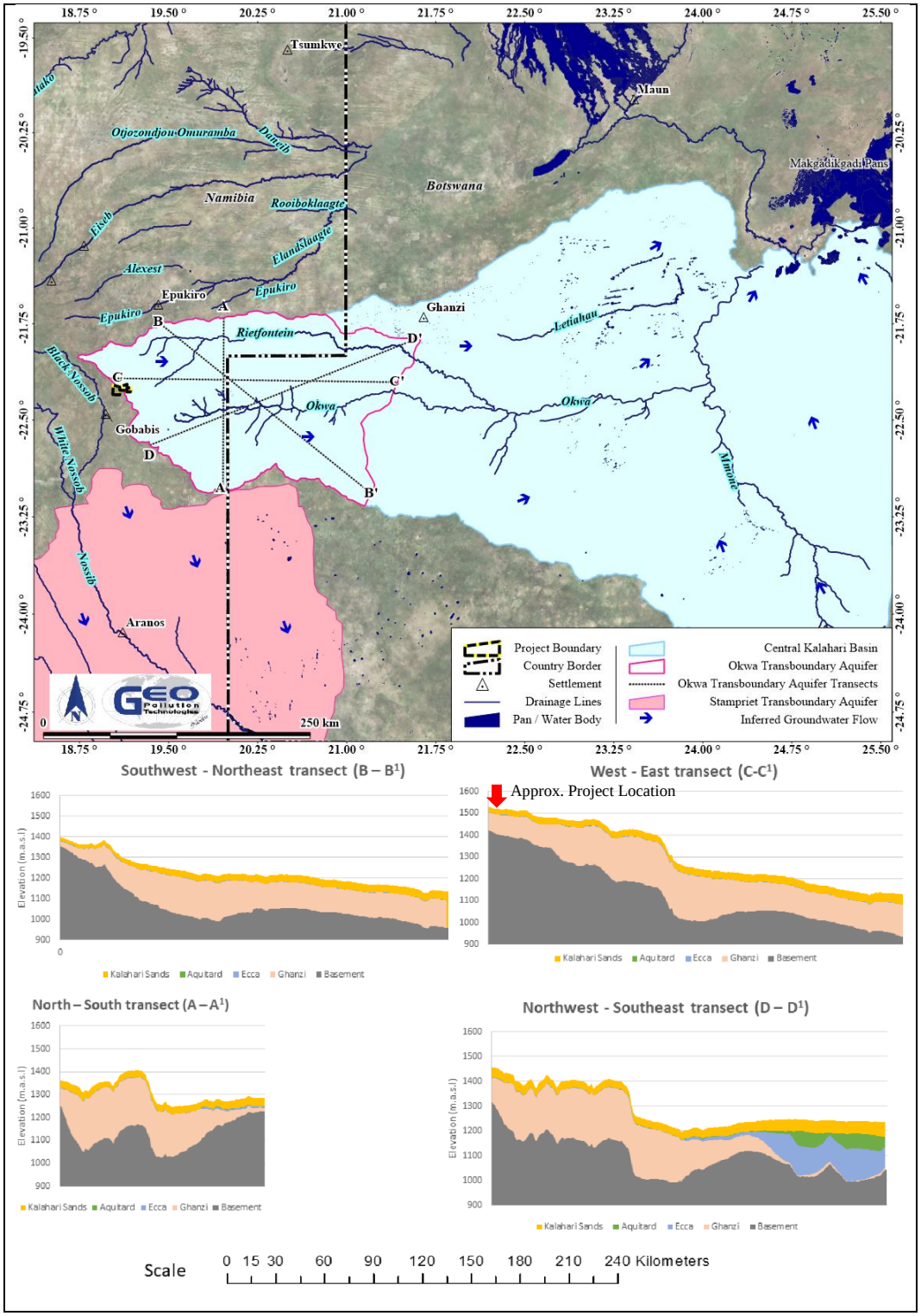


Figure 5-7. Transects of the Okwa Transboundary Aquifer (Cheruiyot, 2018) within the Central Kalahari Basin (Lukela et al., 2018) and the Stampriet Transboundary Aquifer (IGRAC & UNESCO-IHP, 2015)

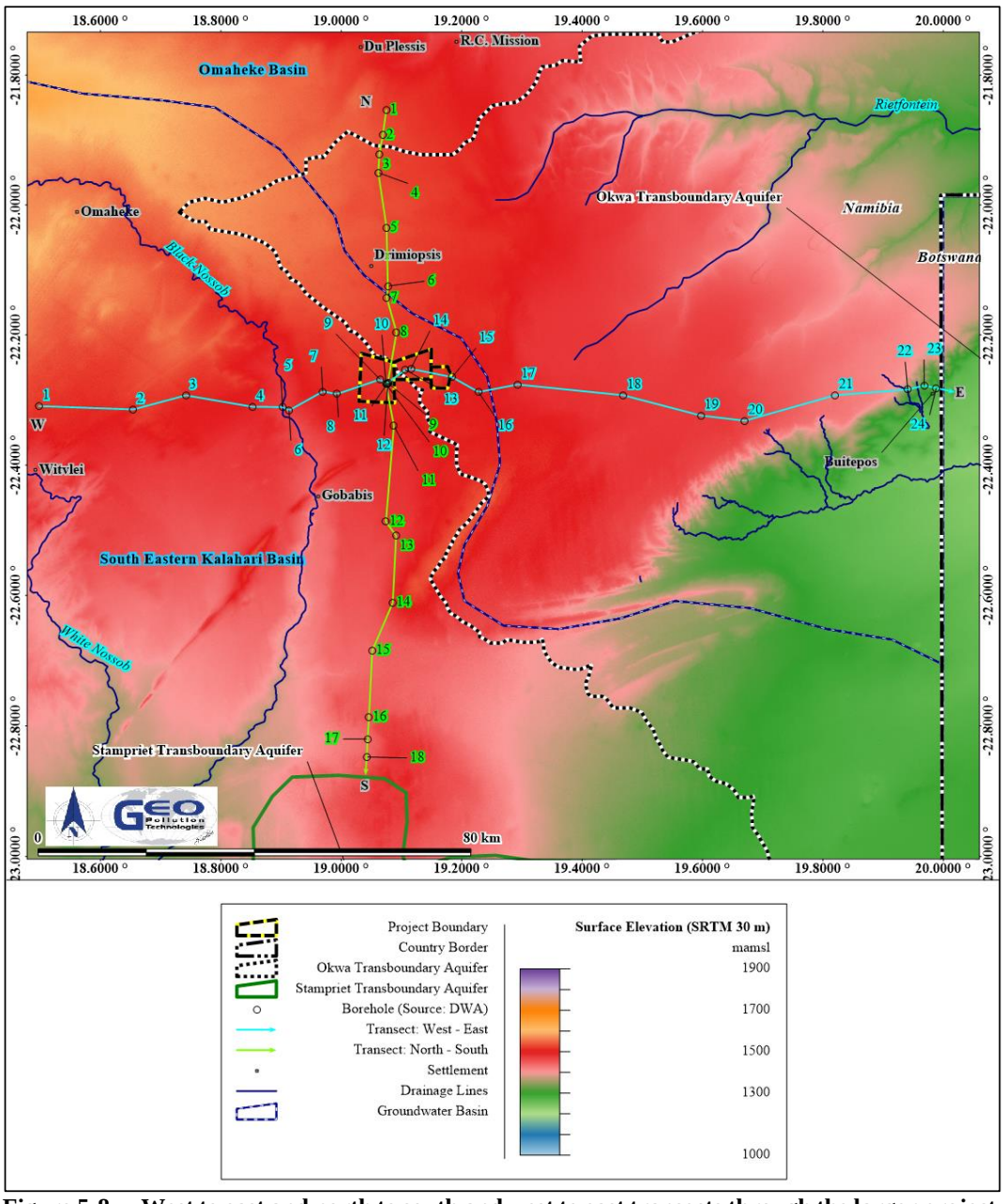


Figure 5-8. West to east and north to south and west to east transects through the larger project area with elevation

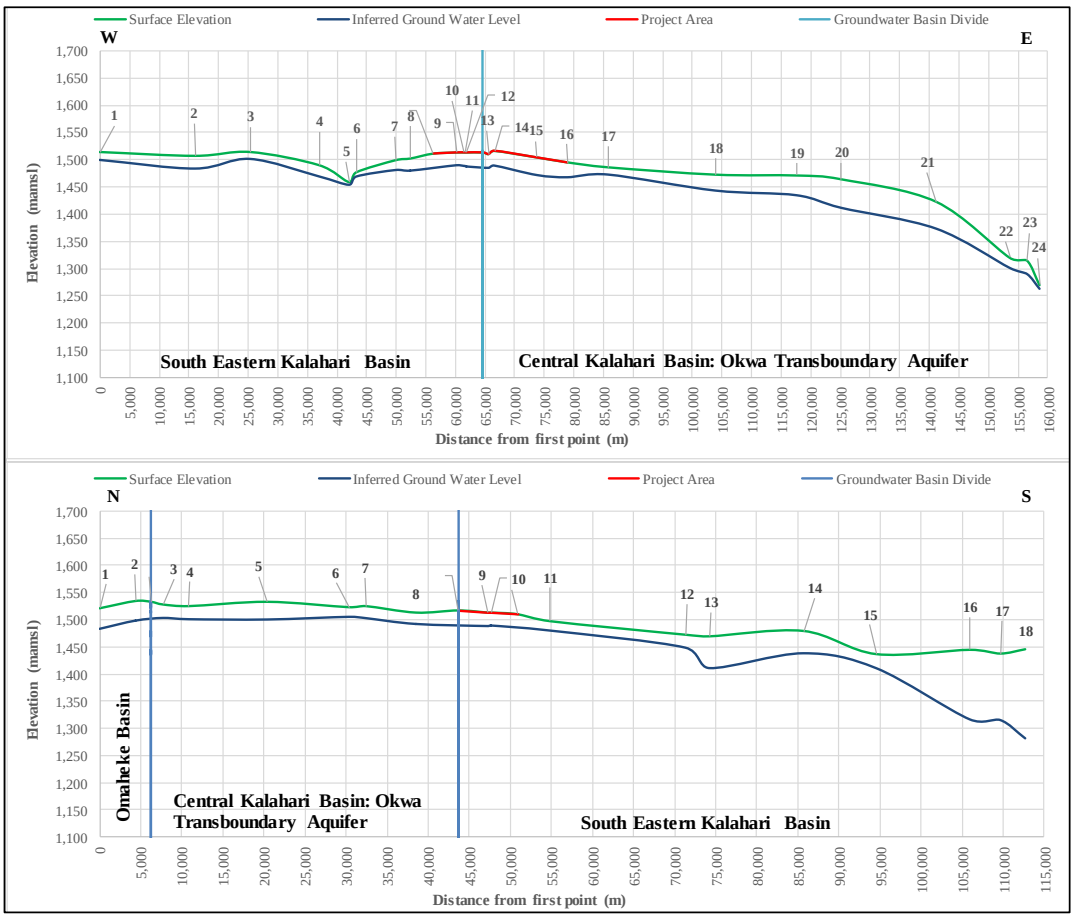


Figure 5-9. West to east and north to south transects of the larger project area

A profile was made through monitoring boreholes WW21223, WW10210, WW16919, WW9854, WW25877 and WW26674 to review the regional water level changes (Figure 5-10). The orientation of the profile is mainly directed down gradient of the Okwa Transboundary Aquifer and has a length of about 360 km (Figure 5-11). Boreholes WW21223, WW10210, WW16919, WW9854, and WW25877 are located in the South Eastern Kalahari groundwater basin, while borehole WW26674 is located in the Okwa Transboundary Aquifer.

Regional water level monitoring data, sourced from the MAWLR - DWA, is presented in Figure 5-12. Monthly and seasonal (July to June) CHIRPS-2 rainfall data (Funk et al., 2015) is also presented in Figure 5-12. The locations of the selected monitoring boreholes are presented in Figure 5-11.

Borehole WW21223 is located at the settlement of Seeis. It was drilled near the Seeis River and relies on the primary porosity from the sands in the river. Water level monitoring at borehole WW21223 started in July 1975 and ended in March 2018. The historic water level in the borehole ranges between 1.96 to 9.8 mbs. A nearby NamWater scheme may impact on water levels in this area. From Figure 5-12 it is evident that the water level in this borehole has a saw tooth pattern with a generally stable trend due to sufficient recharge from the Seeis River.

The borehole WW10210 is situated about 20 km east of the settlement of Omitara, and 500 m southwest of the White Nossob River. Data from this borehole is available from July 1985 up to June 2020, with some data gaps. The water level shows a slight downward trend, but a noticeable level increase is present during 2011, corresponding with a high rainfall season. After this, and up to the last available data, the water level generally decreased over time.

Borehole WW16919 is situated about 12 km west of the Witvlei settlement on the farm Grunental No. 151. This borehole was drilled near the Black Nossob River, the same river which eventually flows about 16 km from the project area. Data from this borehole is available from January 1974 up to June 2020, with some data gaps. The water level shows a general upward trend, with noticeable level increases during 1997, 2006 and 2011, corresponding with high rainfall seasons.

Borehole WW9854 is located at the Gobabis Power Station in Gobabis and WW25877 is located about 7 km to the south of the settlement near the Gobabis aerodrome. Borehole WW9854 and WW25877 is respectively located about 1.4 km and 2.5 km east of the Black Nossob River. The nearby Gobabis South Station water supply scheme (NamWater) may impact water levels in this area as the groundwater is used to augment water supply to Gobabis during surface water shortages (Du Plessis, 2020).

Available data for borehole WW9854 are from January 1983 up to June 2020 with some data gaps. Over the whole period of monitoring, a general upward level trend is noted, although a considerable water level drop occurred between 1994 and 1996, which may be related to water abstraction nearby. However, water levels increased rapidly in 1997 and ever since showed an increasing trend, with obvious level increments in 2006, 2009 and 2011.

Data for borehole WW25877 is available from January 1981 up to June 2020, with some data gaps. The water level at borehole WW25877 is general stable, also with a general upward trend over the entire monitoring period. Noticeable increases occurred during the rainy seasons of 1997, 2006 and 2011.

Borehole WW26674 is located at the settlement of Rietfontein, about 1.3 km west of the Rietfontein River and 10 km west of the Namibia – Botswana border. Data for this borehole is available from July 1983 up to June 2020. This borehole has a saw tooth pattern. The water levels showed a slight downward trend between 1983 and 2000, where after a general stable upward trend occurred up to June 2020. Noticeable water level increases occurred in 1997, 2000, 2003, 2006 and 2014.

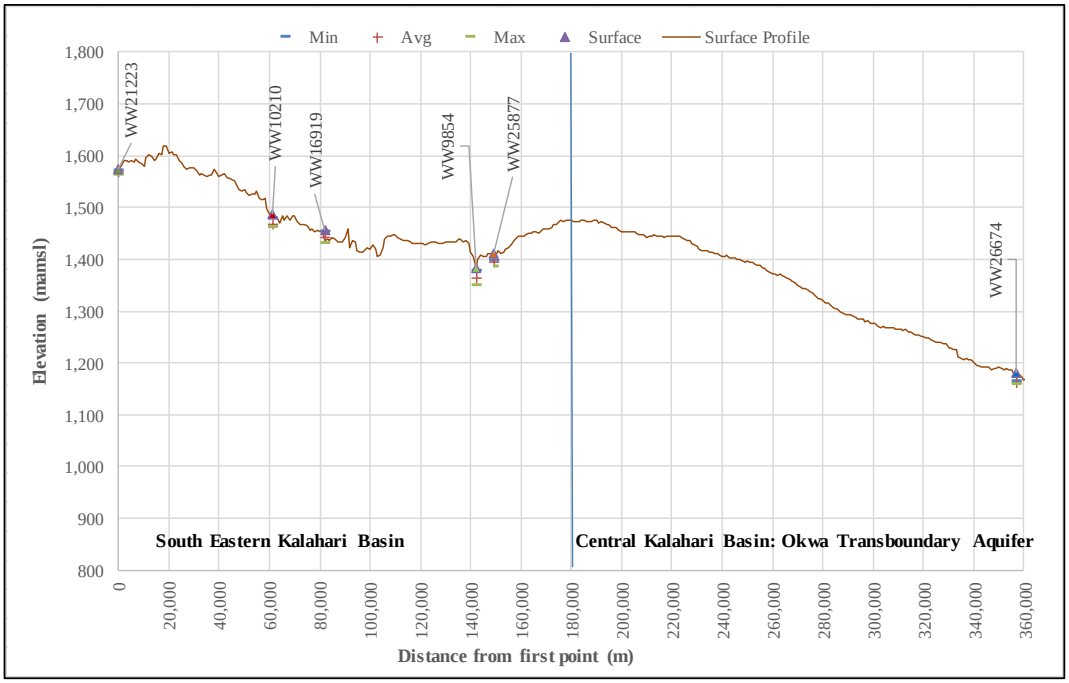


Figure 5-10. Regional surface elevation profile with water level information

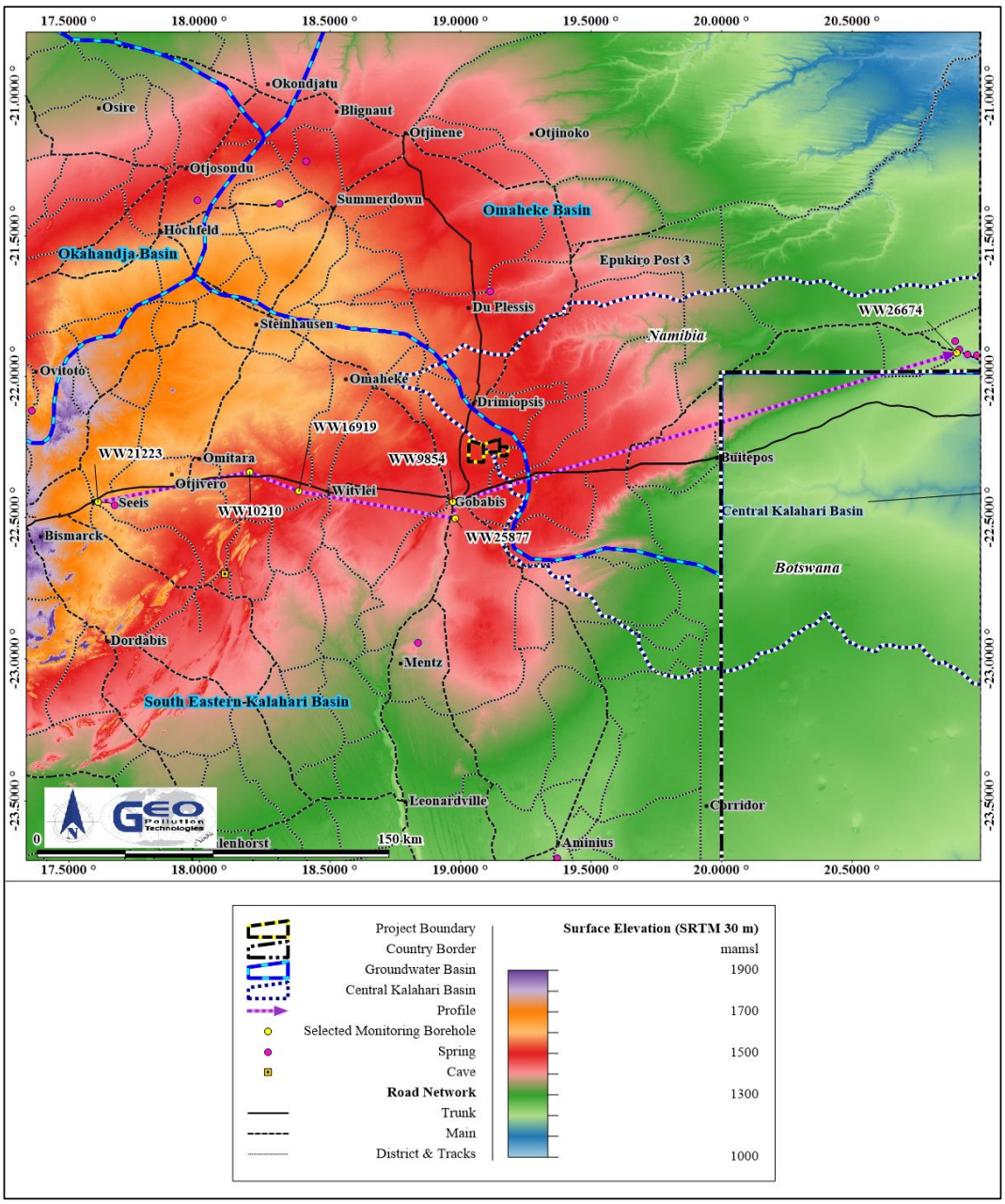


Figure 5-11. Monitor boreholes, profile, springs, groundwater basins and elevation

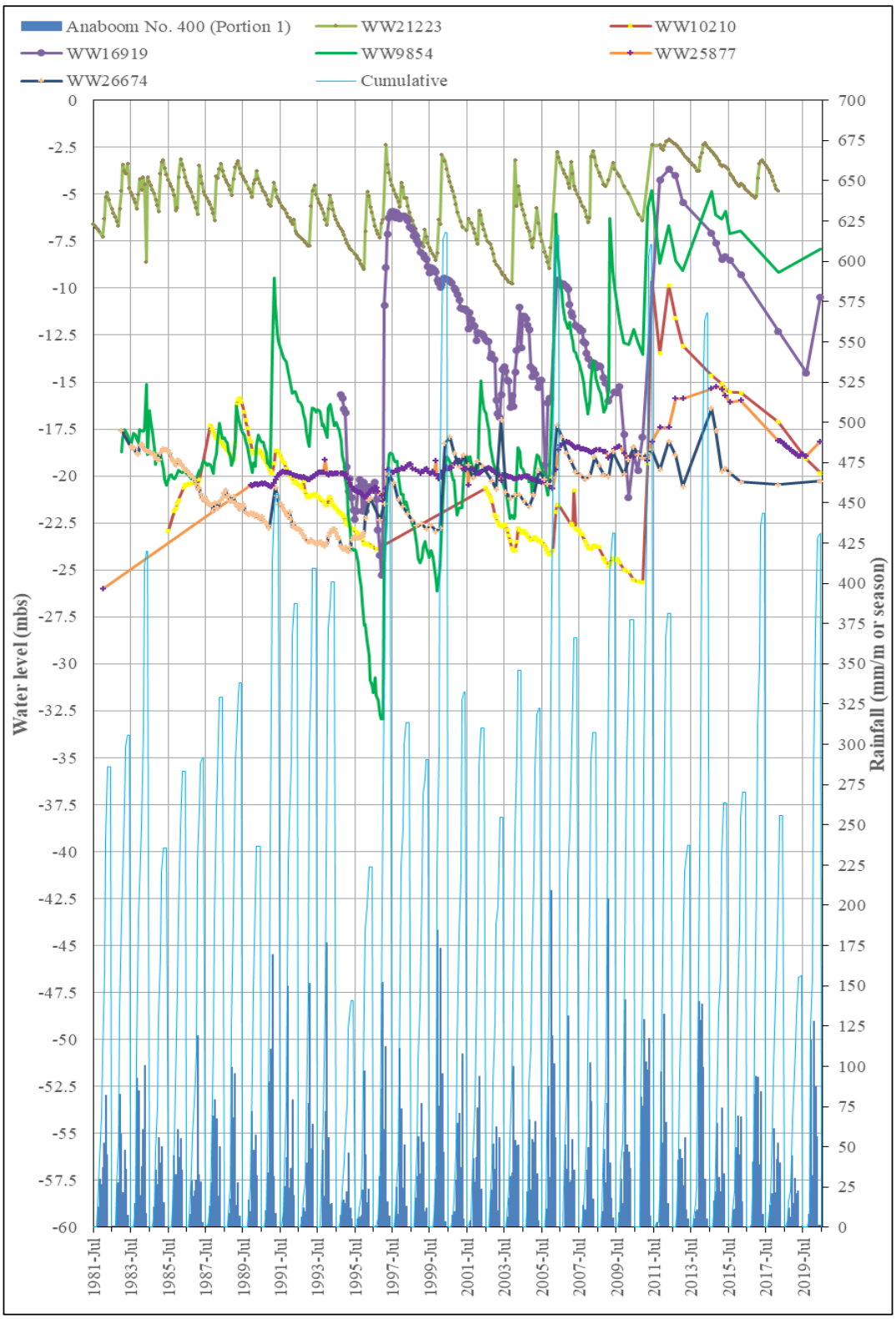


Figure 5-12. Regional water level changes (MAWLF; 2020) and monthly and seasonal cumulative rainfall (CHIRPS-2 data)

Table 5-3 indicates the groundwater statistics for a radius of 5 km around the project. The groundwater information was obtained from Department of Water Affairs (DWA) borehole database. This database is generally outdated and more boreholes might be present. Groundwater is widely utilised in the study area, with 36 boreholes within a 5 km radius. The boreholes were drilled to an average depth of 61 m below surface and average yield of 10 m³/h. Groundwater quality falls mainly under Group A category, which indicates that the water is of an excellent quality, based on the provided parameters.

Groundwater levels in the project area is generally shallow, averaging at 24 mbs.

Springs, possibly related to the contact zones between relatively impermeable formations and more permeable formations or shallow groundwater conditions (e.g., along drainage lines), occur as scattered points throughout the area. The nearest spring is present approximately 63 km north of the project area near the settlement of Du Plessis, see Figure 5-11. No caves or lakes are known of near (< 10 km radius) the project.

The project is located in the Windhoek-Gobabis Subterranean Water Control Area (Government Notice 189 of 6 February 1970), see Figure 5-1. Government thus regulates groundwater usage in this area and all other groundwater related activities like drilling, cleaning or deepening of boreholes and rates of water abstraction. All groundwater remains the property of the government of Namibia.

Table 5-3. Groundwater statistics

Query Centre:	Anaboom; -22.2508°S; 19.1112°E										Query Box Radius: 5.0km
	NUMBER OF KNOWN BOREHOLES	LATITUDE	LONGITUDE	DEPTH (mbs)	YIELD (m3/h)	WATER LEVEL (mbs)	WATER STRIKE (mbs)	TDS (ppm)	SULPHATE (ppm)	NITRATE (ppm)	FLUORIDE (ppm)
Data points	**36**			30	27	17	16	15	15	15	15
Minimum		-22.205804	19.062584	30	0	15	18	258	3	2	0
Average				61	10	24	42	409	7	3	0
Maximum		-22.295796	19.159816	138	80	40	106	914	12	8	1
Group A				56.67%	14.81%	0.00%	0.00%	100.00%	100.00%	100.00%	100.00%
Limit				50	>10	10	10	1000	200	10	1.5
Group B				30.00%	7.41%	100.00%	68.75%	0.00%	0.00%	0.00%	0.00%
Limit				100	>5	50	50	1500	600	20	2.0
Group C				13.33%	48.15%	0.00%	25.00%	0.00%	0.00%	0.00%	0.00%
Limit				200	>0.5	100	100	2000	1200	40	3.0
Group D				0.00%	29.63%	0.00%	6.25%	0.00%	0.00%	0.00%	0.00%
Limit				>200	<0.5	>100	>100	>2000	>1200	>40	>3

Statistical grouping of parameters is for ease of interpretation, except for the grouping used for sulphate, nitrate and fluoride, which follow the Namibian guidelines for the evaluation of drinking-water quality for human consumption, with regard to chemical, physical and bacteriological quality. In this case the groupings has the following meaning:
Group A: Water with an excellent quality
Group B: Water with acceptable quality
Group C: Water with low health risk
Group D: Water with a high health risk, or water unsuitable for human consumption.

Groundwater quality data is presented in Figure 5-13 as Maucha Plots and in Figure 5-14 as Piper plots. From Figure 5-13 and Figure 5-14 it is clear that the groundwater of the project location is mostly of a calcium - magnesium - bicarbonate water type which suggest the water is recently recharged. Groundwater in the immediate project area and to the west and south of the project has higher concentrations of magnesium (Mg) and less dominance in calcium (Ca). Groundwater to the northeast of the project area fall under a different groundwater basin (Omaheke groundwater basin) and has higher concentrations of calcium (Ca) and less dominance in magnesium (Mg).

Regionally, an increase of sodium (Na), sulphate (SO_4) and chloride (Cl) concentrations generally tend to correlate with the extent of the ephemeral rivers, e.g., Black Nossob River. Localised evaporite mineral deposits in pans along river courses contribute to the elevated sodium (Na) and chloride (Cl) concentrations. Elevated chloride (Cl) is thus noticed at data points 1 and 2 in

Figure 5-14 near the Black Nossob River. However, note that some areas away from river courses also indicated elevated TDS concentration.

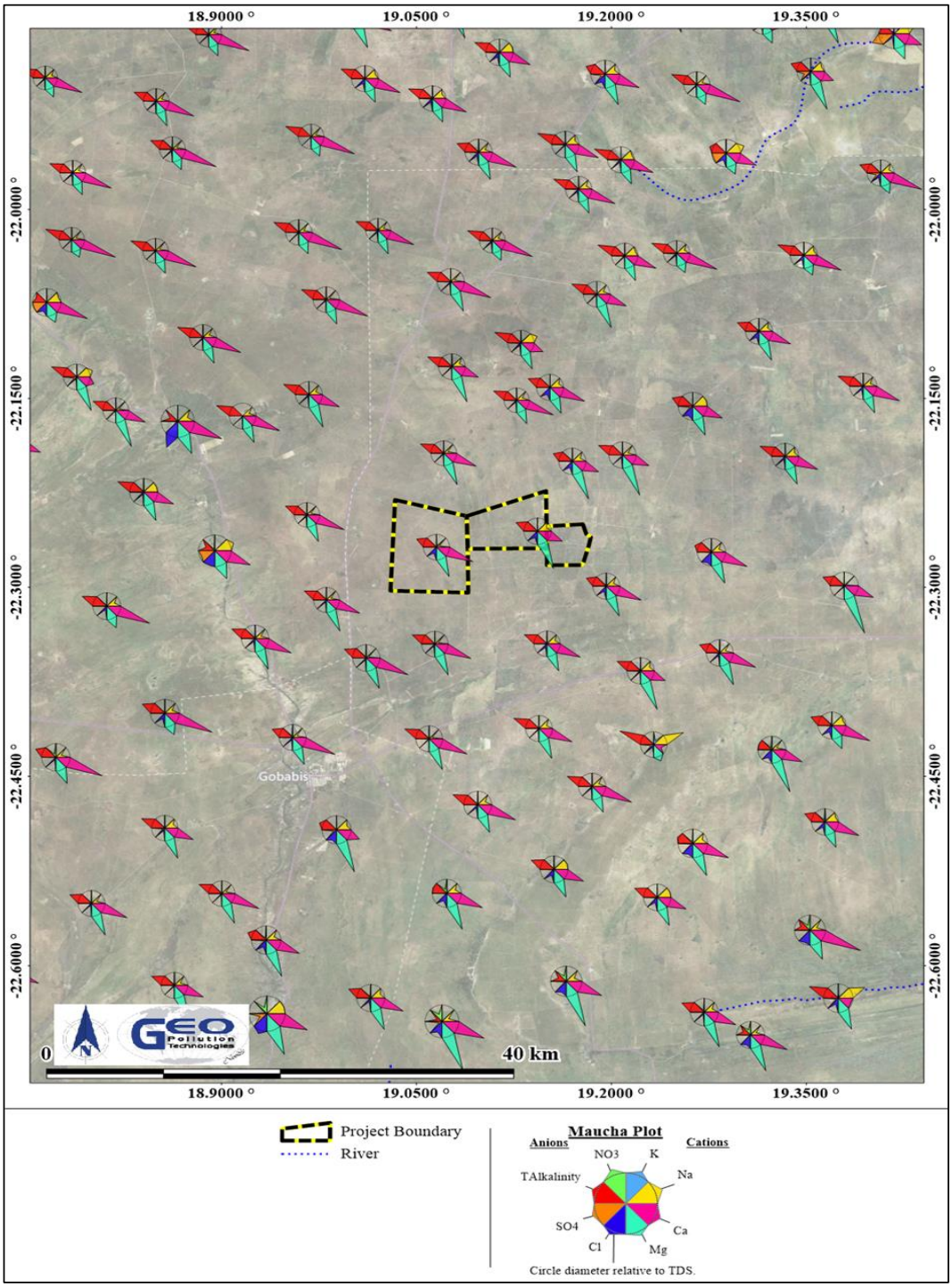


Figure 5-13. Groundwater quality (Maucha Plots)

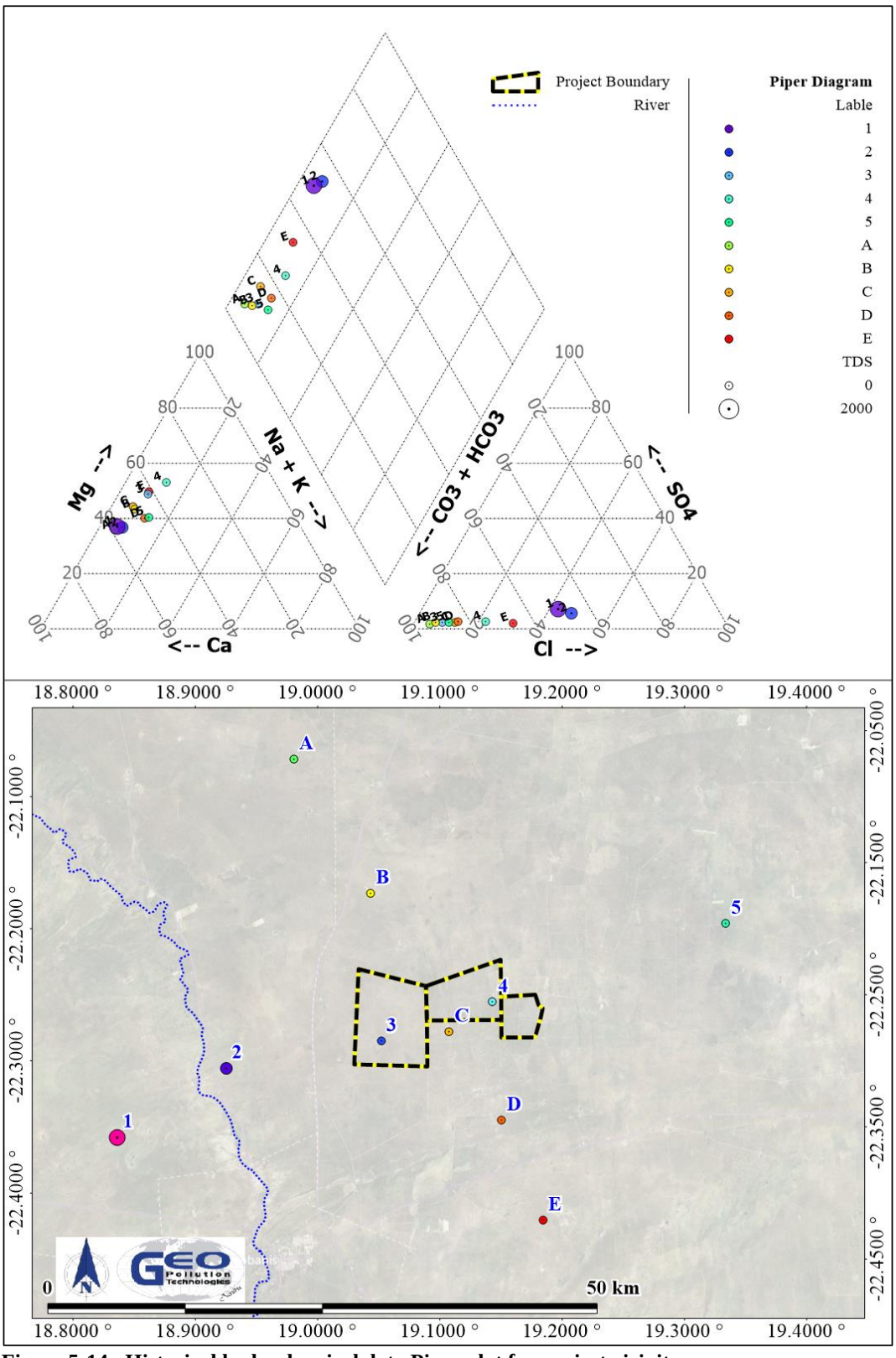


Figure 5-14. Historical hydrochemical data Piper plot for project vicinity

5.6 PROJECT GROUNDWATER USAGE

The only available water source for the project is groundwater and the farms in the project area thus rely on boreholes for water supply for potable use, irrigation and livestock.

Forty (40) boreholes are present on the three farms operated by the Proponent. Two additional boreholes are planned for the project, one on farm Ohlsenhagen No. 174 (Portion 2) and another on farm Anaboom No. 400 (Portion 1). These two boreholes will be used for irrigation purposes, should a permit be allocated to the Proponent. A summary of the available borehole data received from the Proponent is provided in Table 5-1. Figure 5-15 illustrates locations of all the boreholes as received from the Proponent as well as those contained in the DWA database on the farms and immediate vicinity. Note that the majority of the boreholes are not currently used by the Proponent. However, a number of boreholes are used for purposes of potable water supply (domestic use), irrigation and/or livestock watering.

Four boreholes are currently used as irrigation boreholes. These are boreholes WW204515 and WW204516 on farm Anaboom No. 400 (Portion 1); and boreholes WW205775 and WW205776 on farm Ohlsenhagen No. 174 (Portion 2). On farm Ohlsenhagen No. 174 (Portion 2) borehole WW205919 was previously used for irrigation purposes, but it collapsed at the end of 2019. Borehole WW204517 on farm Anaboom No. 400 (Portion 1) is also registered for irrigation purposes, but is currently employed as a stock watering borehole.

Abstracted water is used to irrigate crops via centre pivot irrigation systems. Submersible pumps are installed in the boreholes to pump water via buried pipelines to reservoirs, where, on demand, the water is mixed with fertilizer and then transferred to the irrigation systems (i.e. centre pivot systems). The irrigation boreholes are fitted with flow meters at each borehole.

Borehole WW35219 on farm Ohlsenhagen No. 174 (Portion 2) and borehole WW35234 on farm Anaboom No. 400 (Portion 1) is managed by NamWater and form part of the Gobabis - North East scheme. The scheme consist of borehole and pipeline infrastructure that supply groundwater to the Gobabis municipality during periods of surface water shortages (Du Plessis, 2020). Borehole WW35219 and WW35234 is indicated in Figure 5-15 as Map Reference No. 5 and 17 respectively.

Three boreholes on farm Ohlsenhagen No. 174 (Portion 2) are used for stock watering purposes while one borehole at a farm house is used for domestic purposes. On farm Anaboom No. 400 (Portion 1), five boreholes are used for stock watering purposes and three boreholes for domestic purposes for the farm house. On farm Escourt No. 713 (Portion 1) there are three boreholes used for stock watering purposes. There were no irrigation or domestic boreholes on farm Escourt No. 713 (Portion 1) at the time of this study.

As previously mentioned, the project area is situated in a water control area (Figure 5-1). Government thus regulates groundwater usage in this area and all other groundwater related activities like drilling, cleaning or deepening of boreholes and rates of water abstraction. All groundwater remains the property of the government of Namibia.

The Proponent has an abstraction permit for borehole WW204515, WW204516 and WW204517 on farm Anaboom No. 400 (Portion 1), dated 10 June 2016 and valid for 5 years. The permit allows for the abstraction of up to 140,000 m³ per year for irrigation purposes. Upon the renewal of this abstraction permit, an abstraction volume of 360,000 m³ per year will be applied for. An assessment of the last three years' abstraction and water level returns indicated that this abstraction amount is feasible.

The Proponent is also in possession of two abstraction permits for farm Ohlsenhagen No. 174 (Portion 2). One is for the boreholes WW205775 and WW205776 dated 21 September 2020. The other permit is for borehole WW205191 dated 18 September 2018. The permits allow for the abstraction of up to 140,000 m³ per year for irrigation purposes per permit. The second permit for the farm Ohlsenhagen No. 174 (Portion 2), which provide for the abstraction of water from borehole WW205191, will be reapplied for since there is a discrepancy with the borehole

numbering. An increase of allowable abstraction will also be requested, with an application for 360,000 m³ being planned.

Water level and abstraction data, as supplied by the Proponent, is presented in Figure 5-16. Groundwater monitoring is performed at boreholes WW204515 and WW204516 on farm Anaboom No. 400 (Portion 1); and boreholes WW205919, WW205775 and WW205776 on farm Ohlsenhagen No. 174 (Portion 2). Note that the colour of the water levels in Figure 5-16 coincides with the colour of the boreholes' representative abstraction rates.

The data comprises of monthly groundwater levels and monthly abstracted groundwater data. Data for WW204515 and WW204516 covers the period June 2018 to December 2020.

Borehole WW205919 has data from December 2018 to December 2019, WW205775 from May 2019 to December 2020, and WW205776 from January 2020 to December 2020.

Figure 5-16 shows that water levels of boreholes WW205919, WW205775 and WW205776 (farm Ohlsenhagen No. 174 (Portion 2)) generally remained stable throughout the monitoring period. Slight level decreases were however noted at WW205775 during August 2019 and November 2020, and at WW205776 in November 2020, coinciding with the months of highest abstraction volumes from these boreholes.

The water level for WW204515 had an increasing trend from June 2018 to September 2019, but then showed a declining trend up to December 2020, which was the last month of available data. In general, the water level of borehole WW204516 remained stable throughout the entire monitor period.

Water levels of the boreholes WW204515, WW204516, WW205775 and WW205776 tended to increase once abstraction volumes from the boreholes were reduced, e.g., between March 2020 to September 2020.

The highest recorded rainfall during the monitor period was December 2019 (CHIRPS-2 data: 116 mm) and February 2020 (CHIRPS-2 data: 128 mm). Water levels show a seasonal relationship with monthly rainfall figures.

Table 5-4. Summary of borehole information obtained from the Proponent

Map Ref.	Farm Name	Borehole Name(s)	Use	Borehole Depth (m)	Yield (m³/h)	Water Level (mbs)
1	Ohlsenhagen No. 174 (Portion 2)	WW205776	Irrigation	60	80	25
2	Ohlsenhagen No. 174 (Portion 2)	WW205775	Irrigation	70	150	25.15
3	Ohlsenhagen No. 174 (Portion 2)		Not Used			
4	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	15
5	Ohlsenhagen No. 174 (Portion 2)	WW35219	Not Used	102	46.2	22.75
6	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	15
7	Ohlsenhagen No. 174 (Portion 2)		Not Used	37	4.5	24
8	Ohlsenhagen No. 174 (Portion 2)	WW205919	Not Used	60	40	24.7
9	Ohlsenhagen No. 174 (Portion 2)		Not Used	30	4.5	18
10	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	34	11.4	18
11	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	34	11.4	18

Map Ref.	Farm Name	Borehole Name(s)	Use	Borehole Depth (m)	Yield (m^3/h)	Water Level (mbs)
12	Ohlsenhagen No. 174 (Portion 2)		Stock Watering	35	4.5	18
13	Ohlsenhagen No. 174 (Portion 2)	Planned Borehole	Potential Irrigation			
14	Anaboom No. 400 (Portion 1)	Huis Water	Domestic	65	10	
15	Anaboom No. 400 (Portion 1)	WW204515	Irrigation	72	110	26.3
16	Anaboom No. 400 (Portion 1)	WW204516	Irrigation	66	120	24.5
17	Anaboom No. 400 (Portion 1)	WW35234	Not Used	120	36.6	25.35
18	Anaboom No. 400 (Portion 1)		Not Used	47	2.7	40
19	Anaboom No. 400 (Portion 1)		Not Used			
20	Anaboom No. 400 (Portion 1)		Not Used			
21	Anaboom No. 400 (Portion 1)	WW31091	Not Used	84		
22	Anaboom No. 400 (Portion 1)	WW31080	Not Used	74		
23	Anaboom No. 400 (Portion 1)		Not Used			
24	Anaboom No. 400 (Portion 1)		Not Used	32	2.3	21
25	Anaboom No. 400 (Portion 1)	WW31090	Not Used	78		
26	Anaboom No. 400 (Portion 1)	WW31584	Not Used	74		
27	Anaboom No. 400 (Portion 1)		Stock Watering	30	4.5	18
28	Anaboom No. 400 (Portion 1)	WW204517	Stock Watering	37	5.4	24
29	Anaboom No. 400 (Portion 1)		Stock Watering	46	3.2	
30	Anaboom No. 400 (Portion 1)		Domestic		2.7	
31	Anaboom No. 400 (Portion 1)		Domestic		2.5	
32	Anaboom No. 400 (Portion 1)		Stock Watering	100	4.3	24
33	Anaboom No. 400 (Portion 1)		Stock Watering	30	15	
34	Anaboom No. 400 (Portion 1)	Planned Borehole	Potential Irrigation			
35	Escourt No. 713 (Portion 1)		Not Used		0.5	
36	Escourt No. 713 (Portion 1)		Not Used			
37	Escourt No. 713 (Portion 1)		Not Used	48	4.5	37
38	Escourt No. 713 (Portion 1)		Not Used			
39	Escourt No. 713 (Portion 1)		Not Used			
40	Escourt No. 713 (Portion 1)		Stock Watering	30	10	
41	Escourt No. 713 (Portion 1)		Stock Watering	100		
42	Escourt No. 713 (Portion 1)		Stock Watering	100		

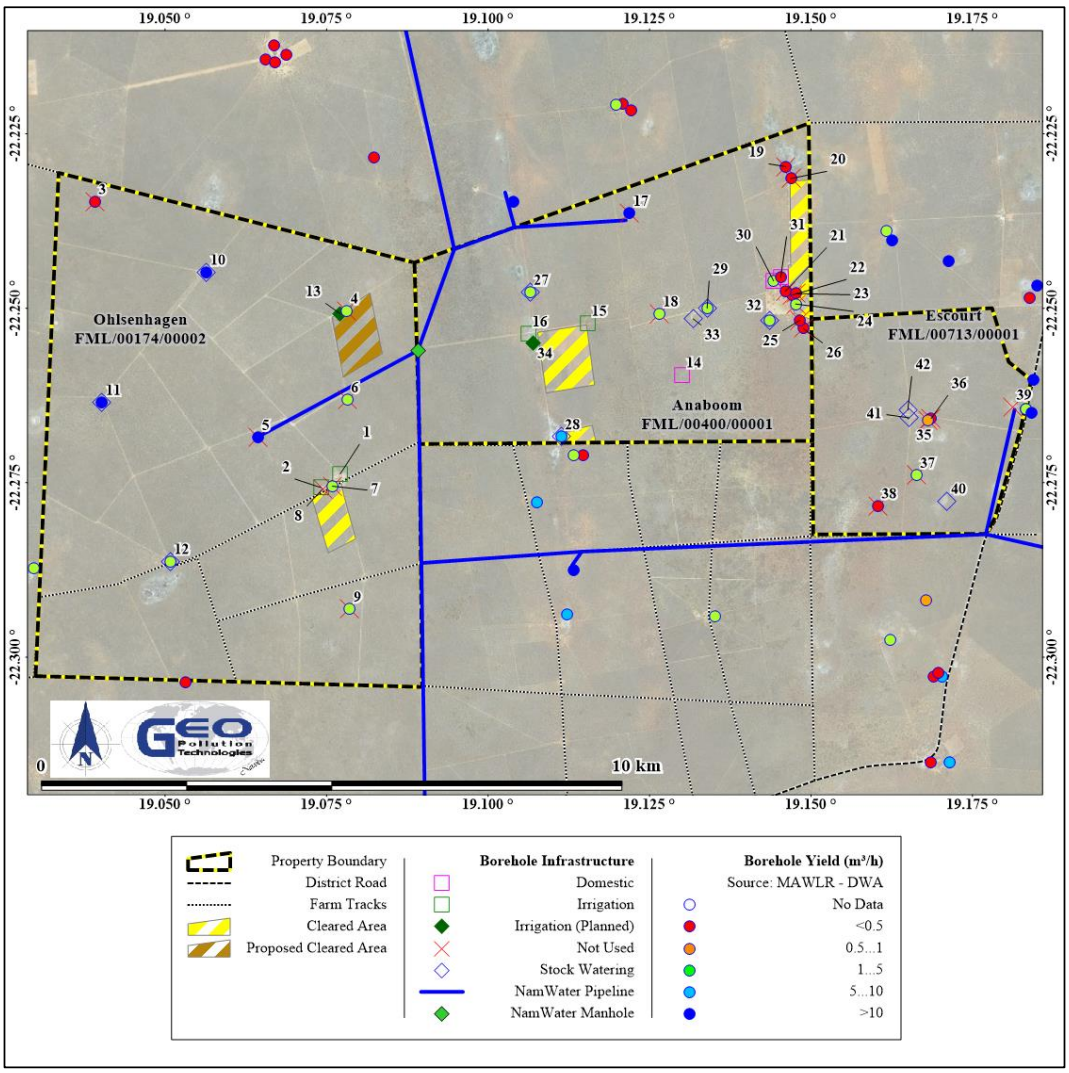


Figure 5-15. Locations of boreholes and cleared areas

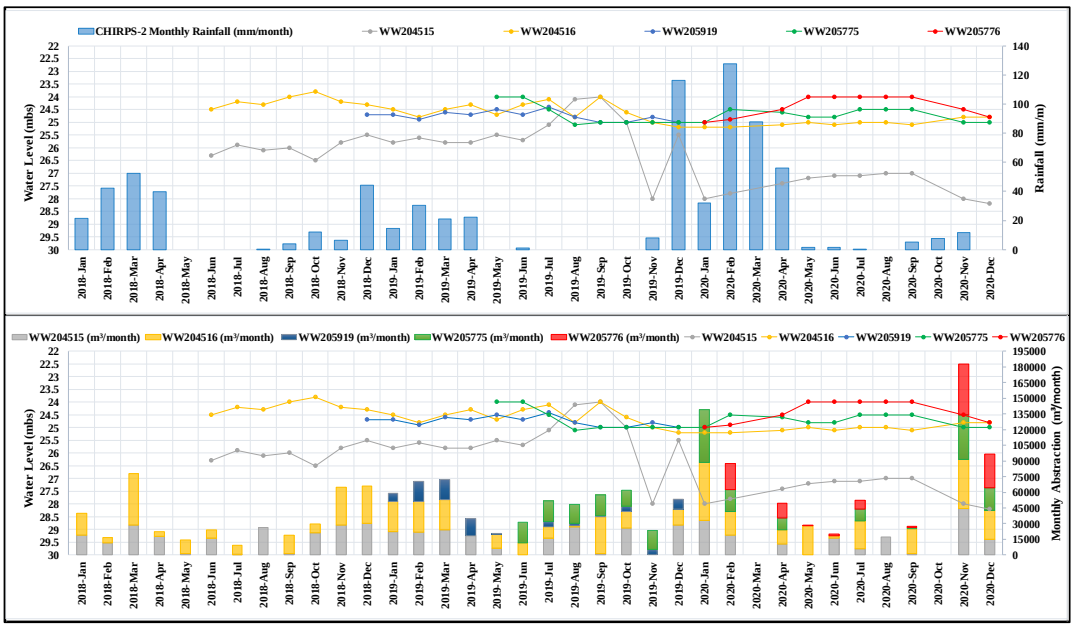


Figure 5-16. Abstraction and borehole monitoring data with CHIRPS-2 monthly rainfall data

6 ASSESSMENTOF BOREHOLE DATA

Test pumping data, consisting of constant discharge test data, was supplied by the Proponent. Test data is presented for borehole WW204515 and WW204516 of farm Anaboom No. 400 (Portion 1) and borehole WW205775, WW205919 and Small Hole of farm Ohlsenhagen No. 174 (Portion 2).

Note that some of the constant discharge tests did not contain the frequency of field measurements as normally required by a conventional constant discharge test. There are some data gaps in some of the datasets. The rate of abstraction also varied at times during test pumping. Raw data is attached in Appendix A. Analysis of the data was still conducted to obtain an indication of aquifer parameters.

Test pumping of borehole WW204515 and WW204516 of farm Anaboom No. 400 (Portion 1) took place in November 2016. The rest water levels for boreholes WW204515 and WW204516 were 26.3 mbs and 24.5 mbs respectively. Borehole WW204515 was pumped for a duration of 10 hours and recovered for 5 minutes. Borehole WW204516 was pumped for a duration of 35 minutes. No recovery data was available for borehole WW204516, however it was assumed this borehole recovered rapidly.

The water level dropped rapidly at borehole WW204515 after test pumping commenced. At this borehole, the water level stabilized at 46.3 mbs after 8 hours of pumping and it reached 99 % recovery within the 5 minutes of observation. The water level dropped gradually at borehole WW204516 and stabilized at 27.4 mbs after 35 minutes of pumping.

The Theis I drawdown analysis was applied to obtain the local aquifer parameters for the test data of boreholes WW204515 and WW204516, see Figure 6-1 and Figure 6-2 respectively. The analysis indicated a transmissivity value of 526 m^2/day for WW204515 and 560 m^2/day for WW204516. Considering the average discharge rates for WW204515 and WW204516 as 92.6 m^3/h and 105.17 m^3/h respectively, and the rapid recovery of WW204515, it is clear that the boreholes are high yielding. Based on the test pumping data, it is expected that a more permeable layer is present deeper than 46.3 mbs for WW204515 and 27.4 m below surface for WW204516.

Test pumping of boreholes WW205775, WW205919 and Small Hole of farm Ohlsenhagen No. 174 (Portion 2) took place in March 2019. The rest water levels for boreholes WW205775, WW205919 and Small Hole was 25 mbs, 26 mbs and 25 mbs respectively. Borehole WW205775 was pumped for a duration of 2 hours and 30 minutes and recovery was within 2 minutes. Borehole WW205919 was pumped for 2 hours and recovery was rapid and occurred within one minute after pumping ended. The

borehole Small Hole was pumped for a duration of 1 hour and 15 minutes and recovery was within 2 minutes.

The water level at borehole WW205775 stabilized at 29 mbs within 2 minutes and remained so for the full duration of the test and recovered rapidly back to 25 mbs, with a recovery rate of 100 %. At borehole WW205919 the water level stabilized at 33.8 mbs after 1 hour and 15 minutes of pumping with a recovery rate 100 %. Water levels dropped rapidly at borehole Small Hole and stabilized at 38 mbs after 25 minutes of pumping. The recovery rate of borehole Small Hole is also 100 %.

The Theis I drawdown analysis was applied to obtain the local aquifer parameters for boreholes WW205919 and Small Hole, see Figure 6-3 and Figure 6-4 respectively. Although borehole WW205775 proved to be high yielding (average discharge rate of 105 m³/h), test pumping data showed insufficient drawdown to provide detailed analysis. The analysis indicated a transmissivity value of 101 m^2/day for WW205919 and Small Hole. Considering the average discharge rates for WW205919 and borehole Small Hole as 38.9 m^3/h and 50.9 m^3/h respectively, and the rapid recovery of the boreholes, it is clear that the boreholes are high yielding. Based on the test pumping data, it is expected that a more permeable layer is present deeper than 33.8 mbs for WW205919 and 38 mbs for Small Hole.

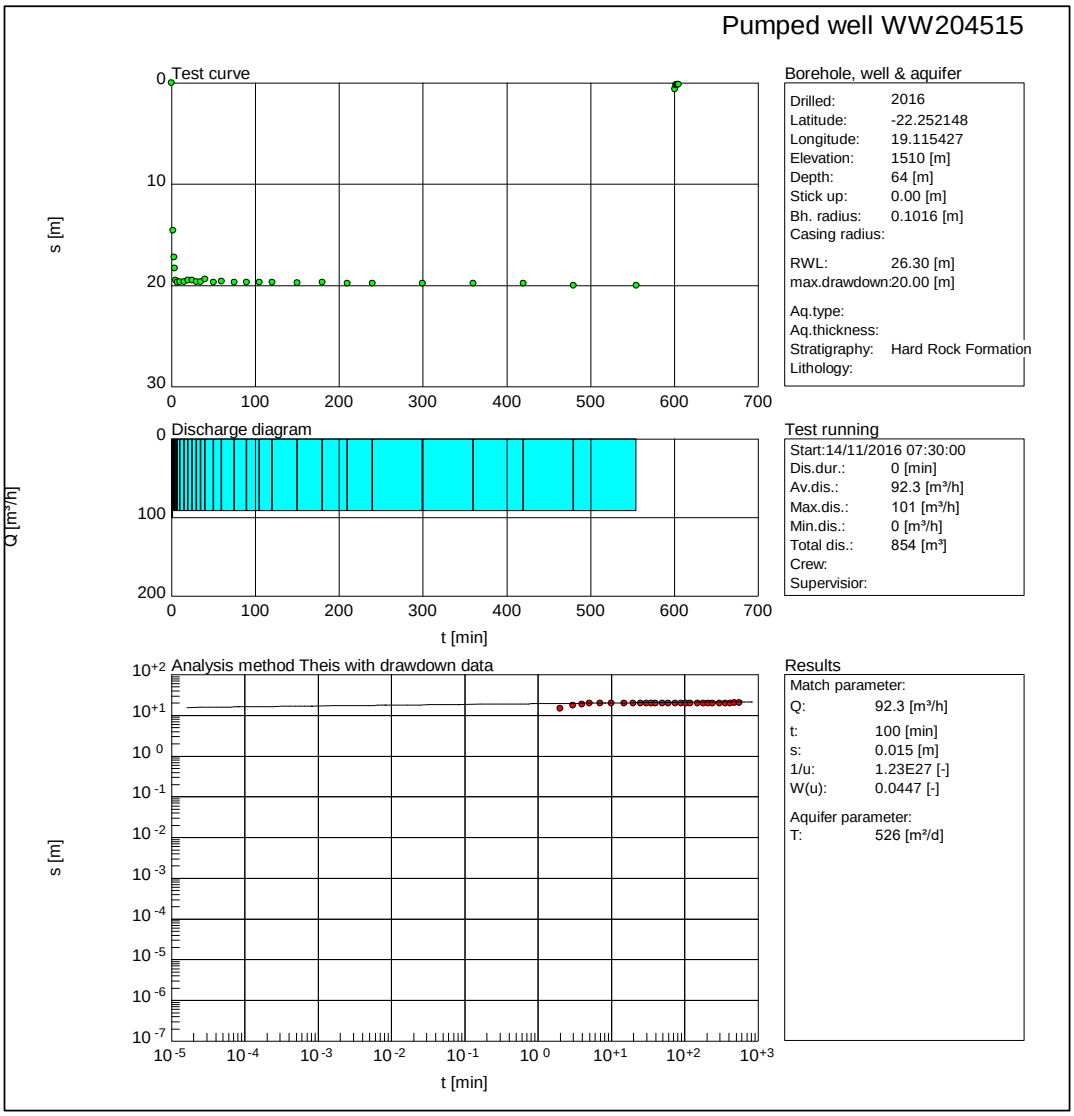


Figure 6-1. Theis I drawdown curve for borehole WW204515

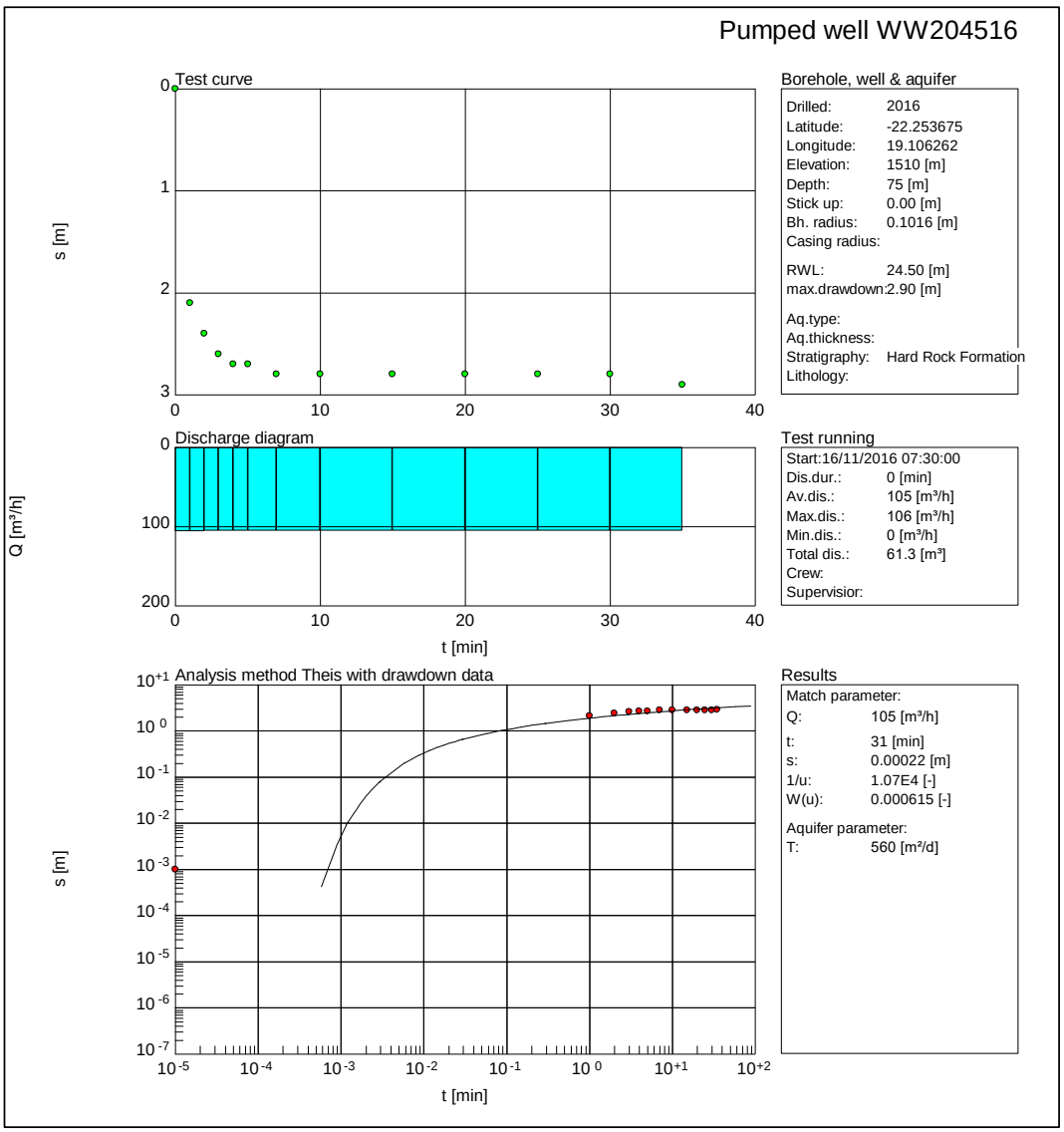


Figure 6-2. Theis I drawdown curve for borehole WW204516

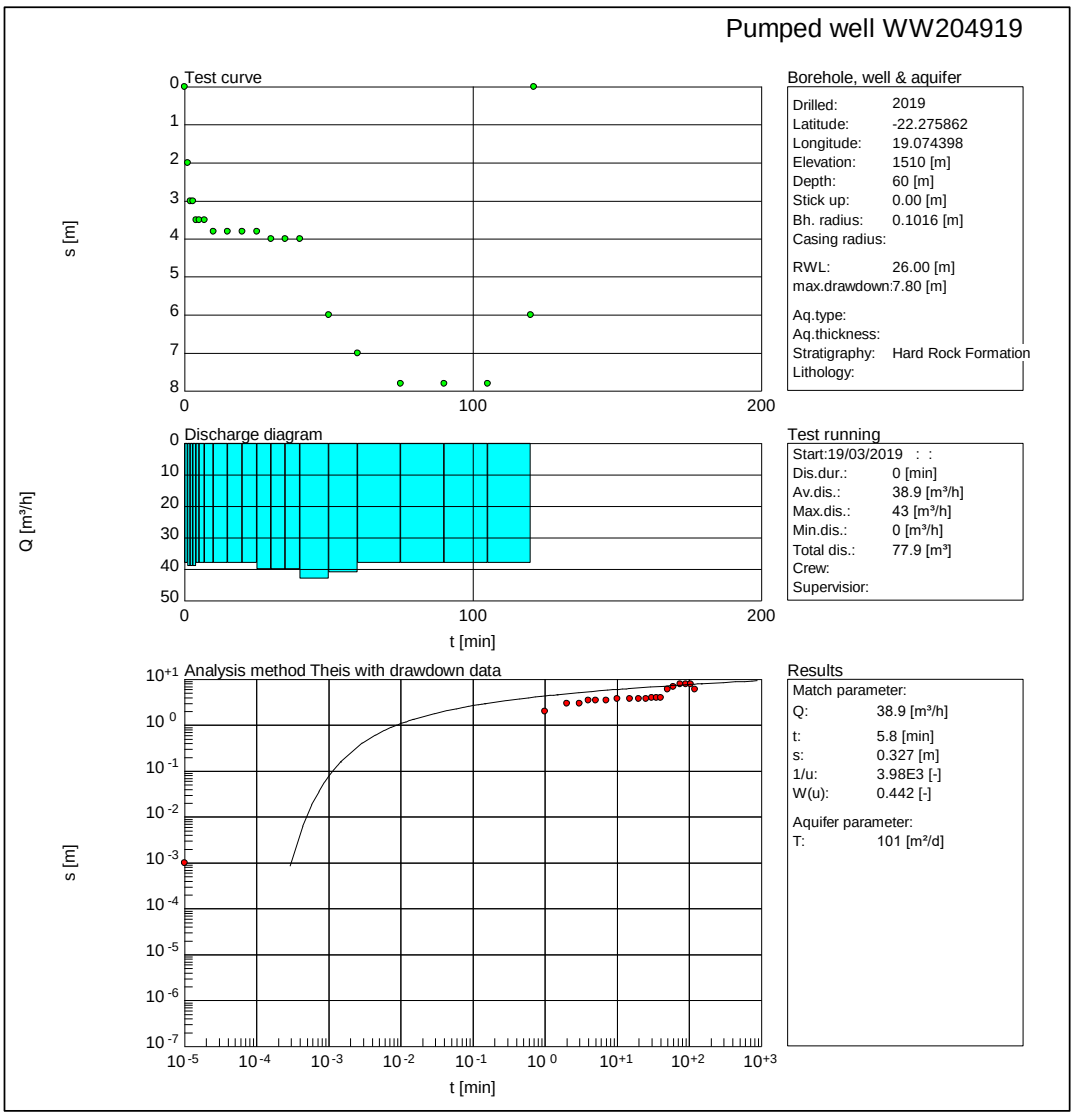


Figure 6-3. Theis I drawdown curve for borehole WW205919

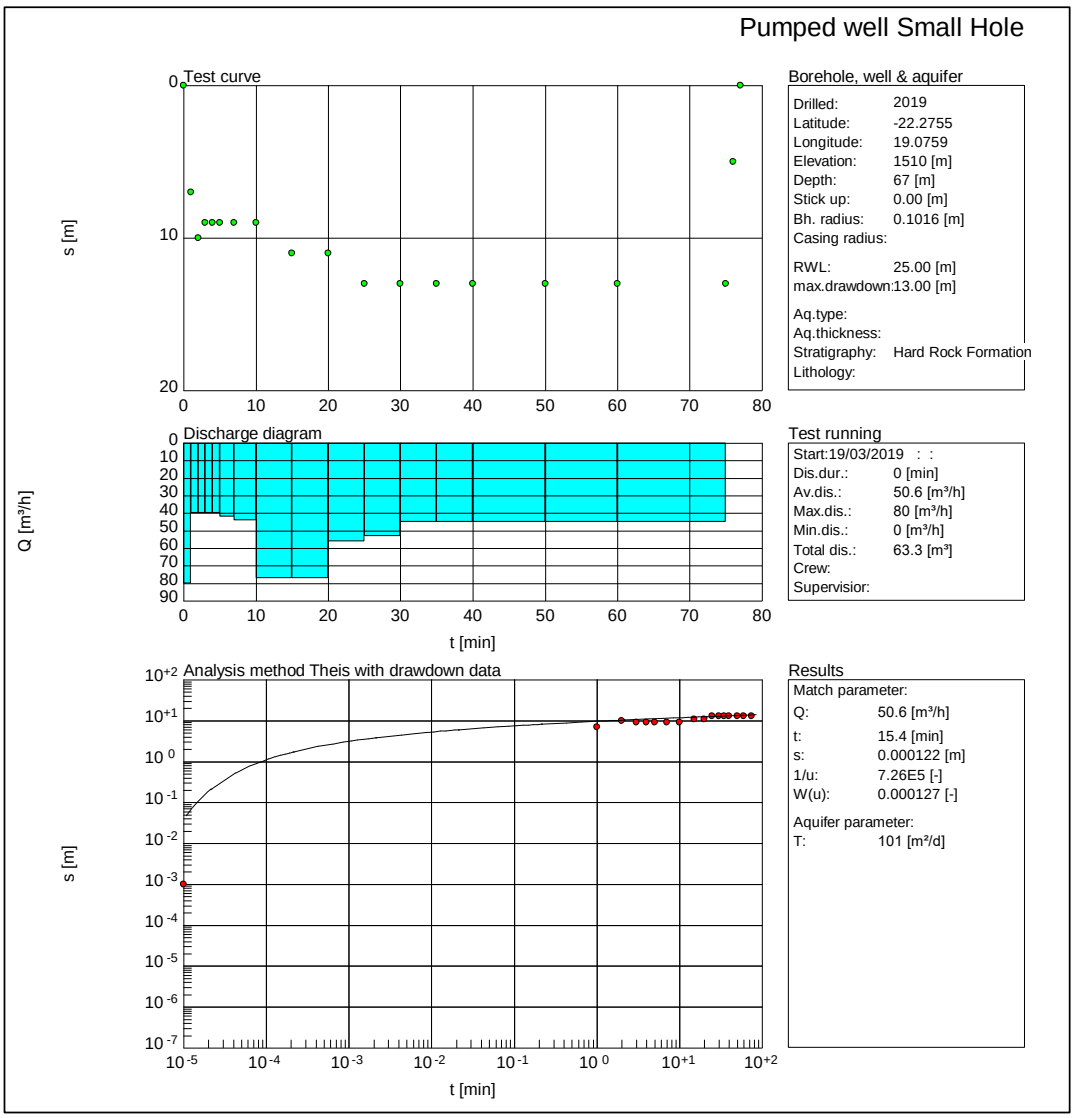


Figure 6-4. Theis I drawdown curve for the borehole Small Hole

7 WATER SUITABILITY FOR IRRIGATION PURPOSES

A total of five (5) water samples were collected from the irrigation boreholes by the Proponent. Of the samples, three (3) were collected on farm Anaboom No. 400 (Portion 1) from the irrigation boreholes WW204515, WW204516 and stock watering borehole WW204517 in February 2016, and two (2) were collected from borehole WW205775 and WW205776 from farm Ohlsenhagen No. 174 (Portion 2) in February 2021. The samples were submitted to a laboratory for chemical analysis. Chemical analysis results are contained in Appendix B.

Calculations based on the analysis results indicate that all samples from the farms had a low-sodium hazard (S1).

One of the three samples of farm Anaboom No. 400 is classified as having a low-salinity hazard (C1), while the other two samples have a medium-salinity hazard (C2). Two samples had an injurious Permeability Index (injurious to plants), but however had a suitable Magnesium Adsorption Ratio (MAR). One sample had an unsatisfactory Permeability Index and unsuitable Magnesium Adsorption Ratio, see Figure 7-1.

The samples of farm Ohlsenhagen No. 174 (Portion 2) have a medium-salinity hazard (C2). Although the Permeability Index of the samples are considered injurious (injurious to plants), the samples had a suitable Magnesium Adsorption Ratio, see Figure 7-1.

Low-salinity water (C1) can be used for irrigation of most crops on most soils with little likelihood that soil salinity will develop. Medium-salinity water (C2) can be used if a moderate amount of leaching occurs. Plants with moderate tolerance can be grown in most cases without special practices for salinity control.

Low-sodium water (S1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium.

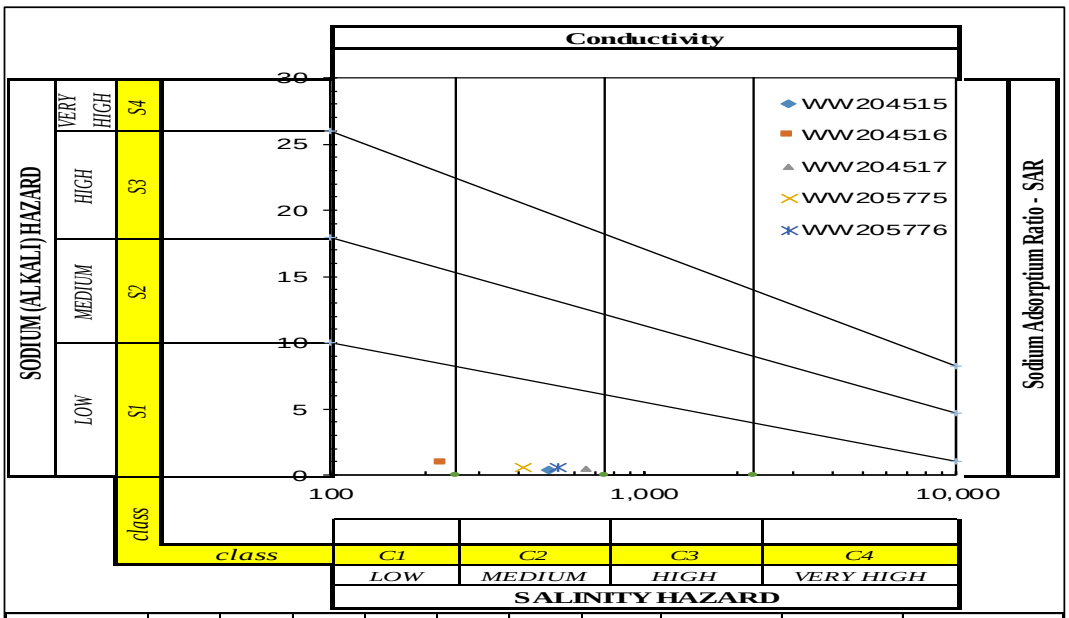
The Permeability Index of soil is affected by irrigation water with high sodium, calcium, magnesium and bicarbonate content, coupled to its long term use. High sodium in the irrigation water can cause soil permeability problems. Permeability is also affected by CO_3^{2-} and HCO^{3-} concentrations in the water. A portion of CO_3^{2-} and HCO^{3-} is precipitated as $CaCO_3$ (or) $MgCO_3$ removing Ca and Mg from irrigation water, leading to increased precipitation of these elements.

Magnesium is essential for plant growth, but too much magnesium can have a severe toxicity effect on plants. A Magnesium Adsorption Ratio exceeding 50 is considered unsuitable for plants as it may increase the salinity of soil.

The pH value adequate for irrigation range between pH of 6 to 8. Two samples are suitable for irrigation, and even when crop foliage is wetted, no foliar damage will occur. However one sample had an elevated pH value (high alkalinity) of 9.1, which may have an effect on crop production. The three samples further have safe concentrations of chloride (Cl), sodium (Na), magnesium (Mg), fluoride (F), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn) and Lead (Pb).

From Figure 7-2 it is evident that the water from the source has a calcium - magnesium - bicarbonate type composition. Water from WW204516 has an elevated concentration of magnesium (Mg) when compared with the other two samples. The quality of the water can generally be described as Group A or excellent quality, suitable for human consumption or irrigation.

Care must be exercised when long term irrigation takes place on unsuitable soil.



Sample	pH	EC	Na	Ca	Mg	K	HCO_3^-	Sodium adsorption ratio (SAR)	Permeability Index (PI)	Magnesium adsorption ratio (MAR)
		µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l			
WW204515	7.7	500	17.0	97.6	22.3	5.0	319.4	0.4	41 - Injurious	27 - Suitable
WW204516	9.1	227	20.0	4.0	17.5	4.0	95.1	1.0	84 Unsatisfactory	88 - Unsuitable
WW204517	7.9	656	18	69.2	33.5	5.0	304.8	0.4	43 - Injurious	44 - Suitable
WW205775	7.4	410	19	52.0	14.0	3.6	226.0	0.6	60 - Injurious	31 - Suitable
WW205776	7.2	534	21	64.0	24.0	6.9	323.0	0.6	53 - Injurious	38 - Suitable

Figure 7-1. Groundwater sodium adsorption ration

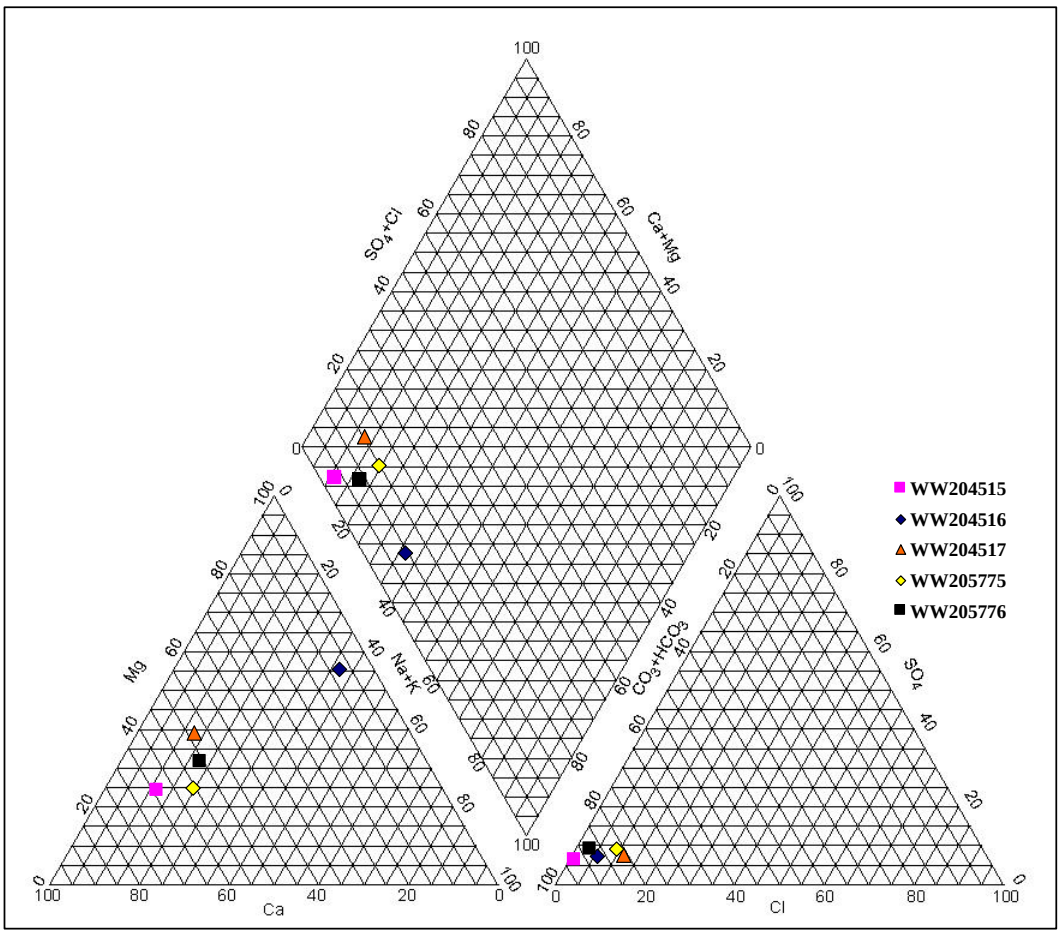


Figure 7-2. Piper diagram

8 SOIL SUITABILITY FOR IRRIGATION PURPOSES

Four (4) soil samples were collected in August 2020 by the Proponent on the project area and were submitted for chemical analyses at a laboratory. The exact locations of the sampling points are unknown, but the results give a general idea of the soil type and quality for the project area. Chemical analysis results are contained in Appendix B. The soil had a pH value ranging between 6.01 and 6.32. The soil can be described as slightly acidic soil. An increased acidity can cause deficiency of nitrogen, phosphorus, calcium and / or magnesium. Figure 8-1 below indicate the solubility of elements at different pH levels, the red square represents the pH levels present in the project area's soil.

A summary of the soil sample results is depicted in Table 8-1. All elements highlighted in blue have low concentrations of the elements as required by plants. All highlighted in orange have high concentrations of the elements that can be harmful to plants. All the elements highlighted in white are in the most efficient range as required by plants. All four samples showed optimum pH levels, best for crop production. At this level, exchange of plant nutrient cations will take place, ensuring effective plant growth.

All four samples showed sufficient concentrations of magnesium (Mg) and calcium (Ca). All samples had inefficient concentrations of potassium (K). Plant growth, root- and fruit development are usually reduced during potassium deficiency. Sodium (Na) is not a plant nutrient and therefore is not necessary for plant growth. However, high levels of sodium are detrimental to soil tilth and plant growth.

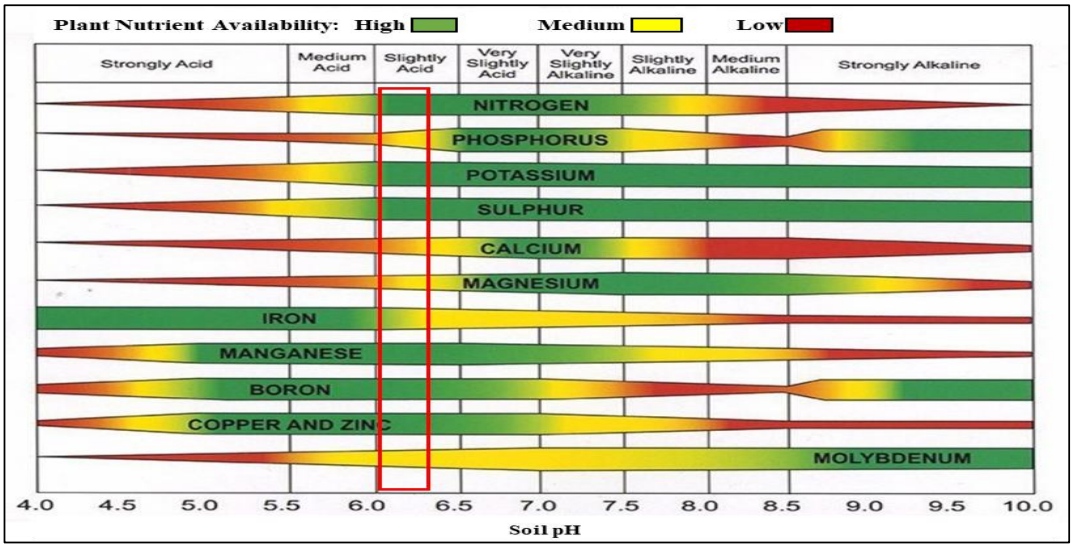


Figure 8-1. Soil pH effects on availability of elements (after University of California; 2019)

Table 8-1. Soil sample results

Type of Test:		**pH**	**Potassium (K)**	**Magnesium (Mg)**	**Calcium (Ca)**
Method details:		***(KCL)***	***(Mehlich III - WIN 074)***		
Lab No.	Sample Refrence		*mg K/kg*	*mg Mg/kg*	*mg Ca/kg*
G24-43032	Lusern	6.26	101	140	720
G24-43033	Ou Land	6.03	107	96	506
G24-43034	Nuwe Land	6.01	77	67	398
G24-43035	Hawer	6.32	55	63	391

	Low	**Medium**	**High**
pH	<5.4	5.5 - 6.7	>6.8
Organic Carbon	<0.9%	0.9% - 1.3%	>1.3%
K	<150 mg/kg	150 mg/kg - 250 mg/kg	>250 mg/kg
Mg	<60 mg/kg	60 mg/kg - 180 mg/kg	>180 mg/kg
Ca	<1000 mg/kg	1000 mg/kg - 2000mg/kg	>2000mg/kg

9 ASSESSMENT OF IMPACTS

The purpose of this section is to assess and identify the most pertinent environmental impacts and provide possible mitigation measures that are expected from the project. The Rapid Impact Assessment Method (Pastakia, 1998) will be used during the assessment. Impacts are assessed according to the following categories: Importance of condition (A1); Magnitude of Change (A2); Permanence (B1); Reversibility (B2); and Cumulative Nature (B3) (see Table 9-1).

Environmental Classification = A1 x A2 x (B1 + B2 + B3). The Environmental Classification of impacts is provided in Table 9-2.

The probability ranking refers to the probability that a specific impact will happen following a risk event. These can be improbable (low likelihood); probable (distinct possibility); highly probable (most likely); and definite (impact will occur regardless of prevention measures). See Table 9-3 and Table 9-4 for the final assessment of expected impacts.

Table 9-1. Assessment criteria

Criteria	Score
Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect	
Importance to national/international interest	4
Important to regional/national interest	3
Important to areas immediately outside the local condition	2
Important only to the local condition	1
No importance	0
Magnitude of change/effect (A2) – measure of scale in terms of benefit / detriment of an impact or condition	
Major positive benefit	3
Significant improvement in status quo	2
Improvement in status quo	1
No change in status quo	0
Negative change in status quo	-1
Significant negative detriment or change	-2
Major detriment or change	-3
Permanence (B1) – defines whether the condition is permanent or temporary	
No change/Not applicable	1
Temporary	2
Permanent	3
Reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition	
No change/Not applicable	1
Reversible	2
Irreversible	3
Cumulative (B3) – reflects whether the effect will be a single direct impact or will include cumulative impacts over time, or synergistic effect with other conditions. It is a means of judging the sustainability of the condition – not to be confused with the permanence criterion.	
Light or No Cumulative Character/Not applicable	1
Moderate Cumulative Character	2
Strong Cumulative Character	3

Table 9-2. Environmental classification of impacts according to the rapid impact assessment method of Pastakia 1998.

Environmental Classification (ES)	Class Value	Description of Class
72 to 108	5	Extremely positive impact
36 to 71	4	Significantly positive impact
19 to 35	3	Moderately positive impact
10 to 18	2	Less positive impact
1 to 9	1	Reduced positive impact
0	-0	No alteration
-1 to -9	-1	Reduced negative impact
-10 to -18	-2	Less negative impact
-19 to -35	-3	Moderately negative impact
-36 to -71	-4	Significantly negative impact
-72 to -108	-5	Extremely Negative Impact

9.1 GROUNDWATER ABSTRACTION

Groundwater abstraction is a very sensitive topic in a dry country where the value of land is drastically reduced if no or unusable groundwater is present on the land. Abstraction of groundwater must be conducted in a sensible way to prevent impacts on other groundwater users that depend on such groundwater. This includes water abstracted for human and animal use, irrigation, and also ecosystems that depend on groundwater.

In a typical groundwater environment, a water balance would consist of inflow and outflow of the groundwater system (Figure 9-1). Over time an equilibrium (or steady state) is normally reached with a rising water table following good recharge events and declining water table when recharge is below average. Inflow into the system would typically be from infiltration following rainfall in the recharge area and in upstream areas.

Outflow would be comprised of water leaving the system through springs and as outflow over the lower boundary of the groundwater system as well as evapotranspiration losses. Groundwater abstraction through boreholes is important as this is normally necessary to sustain human and animal demands where such users became dependant on the abstracted groundwater.

Although the project area is located well within the South Eastern Kalahari groundwater basin, realistically it is located on a watershed area between two actual groundwater basins. Excessive abstraction may influence upstream or downstream receptors on the long run. Typical consequences of over abstraction will include a lowering in the water table. Lowering of water table may further lead to the drying up of boreholes and springs. Vegetation will also be impacted where such vegetation has access to groundwater. It is important to note that the groundwater basin forms a transboundary aquifer that extent from Namibia into Botswana. Over abstraction in any of the countries will have a negative impact on the other country and can causes disputes. As the groundwater flows from the recharge area in Namibia, out to Botswana, care must be taken in Namibia to ensure that the quality of water is not affected as this may later on impact the neighbouring country.

Based on current water level fluctuations in the area, as presented in this report (Figure 5-12 and Figure 5-16), a short term threshold of 5 m below the average rest water level of borehole data is set from where abstraction rates should be reduced.

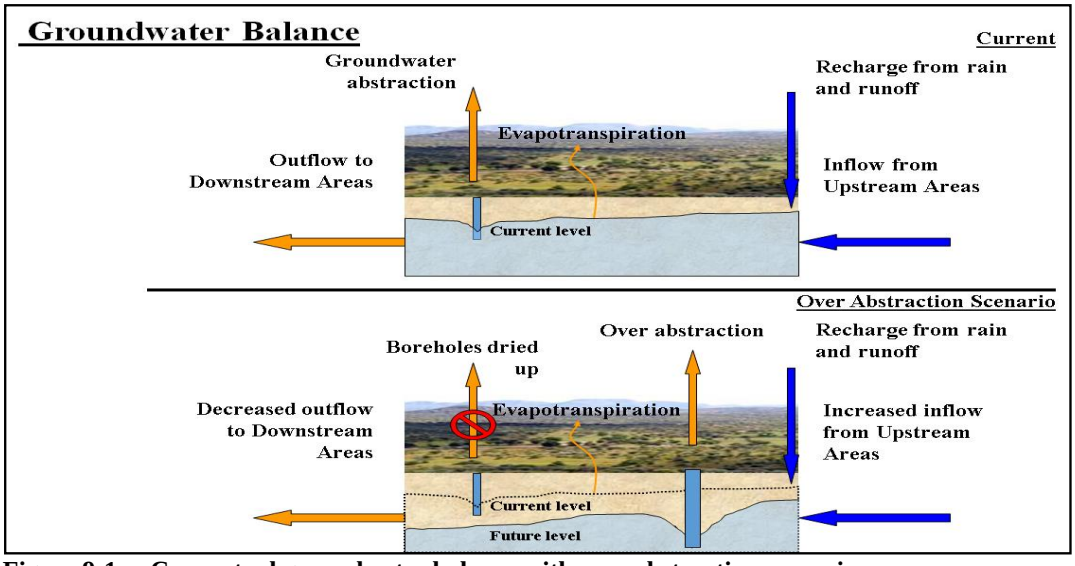


Figure 9-1. Conceptual groundwater balance with over abstraction scenario

Table 9-3. Assessment - Groundwater abstraction

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2)Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Over-abstraction of the local aquifer, decrease in the local hydraulic head.	2	-2	2	2	2	-24	-3	Probable

Desired Outcome: To utilise the groundwater on a sustainable level.

Actions

Prevention:

- Spread the water abstraction points over a larger area to diffuse the impact.
- Monthly water level monitoring.
- Maintain safe abstraction rates prescribed by test pump evaluations (an abstraction permit with prescribed rates from the MAWLR is a requirement for this project).

Mitigation:

- Reduce abstraction when the water levels nears 5 m below the average water level of each borehole.

Responsible Body:

- The proponent

Data Sources and Monitoring:

- Monthly boreholes rest water level monitoring.
- Baseline values should be reviewed every 3 years based on all historic water level data.
- A summary report on all monitoring results must be prepared.
- The Proponent supply monitoring returns to the MAWLR, as required by the permit.

9.2 GROUNDWATER, SURFACE WATER AND SOIL CONTAMINATION

Leakages and spillages of hazardous substances from vehicles and accidental fuel, oil or hydraulic fluid spills during the operational phase. Increase of nutrient levels (from over application of fertilizers) in the soil that can leach to the groundwater. Pollution due to sewerage system overflow or leakage. Overuse / incorrect application of herbicides / pesticides may also pose a risk.

Table 9-4. Assessment - Groundwater, surface water and soil contamination

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2)Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Hazardous material, spillages, hydrocarbon leakages from vehicles and machinery.	2	-1	2	2	1	-10	-2	Improbable
Daily Operations	Over application of fertilizer, herbicides / pesticides, etc. Sewerage system malfunction	2	-1	2	2	1	-10	-2	Improbable

Desired Outcome: To prevent the contamination of groundwater, surface water and soil.

Actions

Prevention:

- Appoint reputable contractors.
- Vehicles may only be serviced on a suitable spill control structure.
- Regular inspections and maintenance of all vehicles to ensure no leaks are present.
- All hazardous chemicals should be stored in a sufficiently bunded area, as per MSDS requirements.
- Follow prescribed dosage of fertilizers and pesticides / herbicides and to avoid over application.
- Maintain sewerage systems and conduct regular monitoring.
- All hazardous waste must be removed from the site and disposed of timeously at a recognised hazardous waste disposal facility, including any polluted soil or water.

Mitigation:

- All spills must be cleaned up immediately.
- Consult relevant Material Safety Data Sheet (MSDS) information and a suitably qualified specialist where needed.

Responsible Body:

- The proponent
- Contractors

Data Sources and Monitoring:

- Maintain Material Safety Data Sheets for hazardous chemicals.
- Soil should be sampled and analysed annually to ensure the correct amounts of fertilizer is applied and soil and groundwater quality is maintained.
- Groundwater should be sampled and analysed to test for nitrate concentrations from the fertilizer and for traces of chemicals used in pesticides and herbicides.
- Registers be kept by the Proponent on the type, quantities and frequency of application of fertiliser, pesticides and any other chemicals utilised in crop production.
- A register of all incidents must be maintained on a daily basis. This should include measures taken to ensure that such incidents do not repeat themselves.
- All spills or leaks must be reported on and cleaned up immediately.

10 CONCLUSION

Groundwater in the project area is high yielding and can be used for irrigation. Although groundwater monitoring data on the farms is only available for a short term (January 2018 to December 2020), the data does not indicate a declining trend of water levels over the entire period of monitoring (Figure 5-16). It was noted that excessive abstraction has an effect on the water levels, notably at WW204515. However, the water levels for all boreholes recover rapidly once abstraction is reduced or stopped completely.

Data from the long-term groundwater monitoring installations generally show stable groundwater level conditions. Based on current water level fluctuations in the region, as presented in Figure 5-12 and Figure 5-16, a short term rest water level threshold of 5 m below the average rest water level of each borehole is set from where abstraction rates should be reduced. This threshold may require adjustment during drought periods as abstraction from neighbouring farms may also influence the regional water levels.

The project is located on the groundwater divide area. Local groundwater may be susceptible to degradation (water level decrease) if excessive abstraction takes place. Excessive abstraction may also influence upstream or downstream receptors on the long run. Sustainable irrigation methods, e.g., water and soil conservation, should be practiced to minimise or prevent excessive water abstraction. Careful cooperation between farms utilising water from the aquifer, on neighbouring farms and beyond, is required to optimally utilize the groundwater resource without depleting it, as depletion will be detrimental to all. Compliance to the regulations of the abstraction permit from the MAWLR should be maintained and returns supplied thoroughly to the DWA. This should include self-monitoring and assessment of water levels. Data obtained from DWA indicates a lack of sufficient monitoring in the recent years, thus water level monitoring by the Proponent is crucial. Proper monitoring data will provide the required information to make informed decisions.

Groundwater vulnerability to contamination would be the highest around boreholes, around geological structures as well as where shallow groundwater is present. Contamination risks can be reduced through proper fertilizer, herbicide and pesticide application. Annual groundwater and soil analysis from irrigation areas will serve as early warning of contamination problems. These impacts are normally of a low magnitude and can be managed through proper housekeeping.

11 REFERENCES

Atlas of Namibia Project. (2002). Directorate of Environmental Affairs, Ministry of Environment and Tourism (www.met.gov.na). Accessed on (15/01/2021). Accessed from: http://www.uni-koeln.de/sfb389/e/e1/download/atlas_namibia/index_e.htm

Carney, J.N., Aldiss, D.T., and Lock, N.P., (1994). The geology of Botswana. Botswana Geological Survey, Bulletin, 37, 1 – 113.

Cheruiyot, S.K., (2018) Modelling groundwater resources of transboundary Okwa basin. Accessed on (21/11/2019). Accessed from:http://essay.utwente.nl/83342/

Climate Engine. (2020). Desert Research Institute and University of Idaho. Accessed on (15/01/2021). Accessed from: http://climateengine.org

Division of Agriculture and Natural Resources, University of California., (2019). Accessed:: https://ucanr.edu/sites/Salinity/Salinity_Management/Effect_of_salinity_on_soil_properties/Effect_of_pH_sodicity_and_salinity_on_soil_fertility_/. Accessed on (21/11/2019).

Du Plessis, N.P., (2020). Gobabis Water Supply Scheme. Environmental Management Plan. NamWater.

Funk, C., Peterson, P., Landsfeld, M., Pedreros, D., Verdin, J., Shukla, S., Husak, G., Rowland, J., Harrison, L., Hoell, A. and Michaelsen, J., (2015) The climate hazards group infrared precipitation with stations - A new environmental record for monitoring extremes. Scientific Data, 2, 150066. Accessed on (15/01/2021). Accessed: https://doi.org/10.1038/sdata.2015.66.

Geological Survey of Namibia; Geological Map 1:1,000,000.

Geological Survey of Namibia, (1981). Geological Map 1:250,000. Geological Series 2218 Gobabis (S.W.A/Namibia).

Goscombe, B., Foster, D.A., Gray, D., Wade, B., Marsellos, A., & Titus, J. (2017). Deformation correlations, stress field switches and evolution of an orogenic intersection: The Pan-African Kaoko-Damara orogenic junction, Namibia. Geoscience frontiers, 8, 1187-1232.

IGRAC (International Groundwater Resources Assessment Centre), UNESCO-IHP (UNESCO International Hydrological Programme), (2015). Transboundary Aquifers of the World [map]. Scale 1:50000000. Accessed on (15/01/2021). Accessed from: https://apps.geodan.nl/igrac/ggis-viewer/viewer/tbamap/public/default.

Klock, H., (2001). Hydrogeology of the Kalahari in north-eastern Namibia.

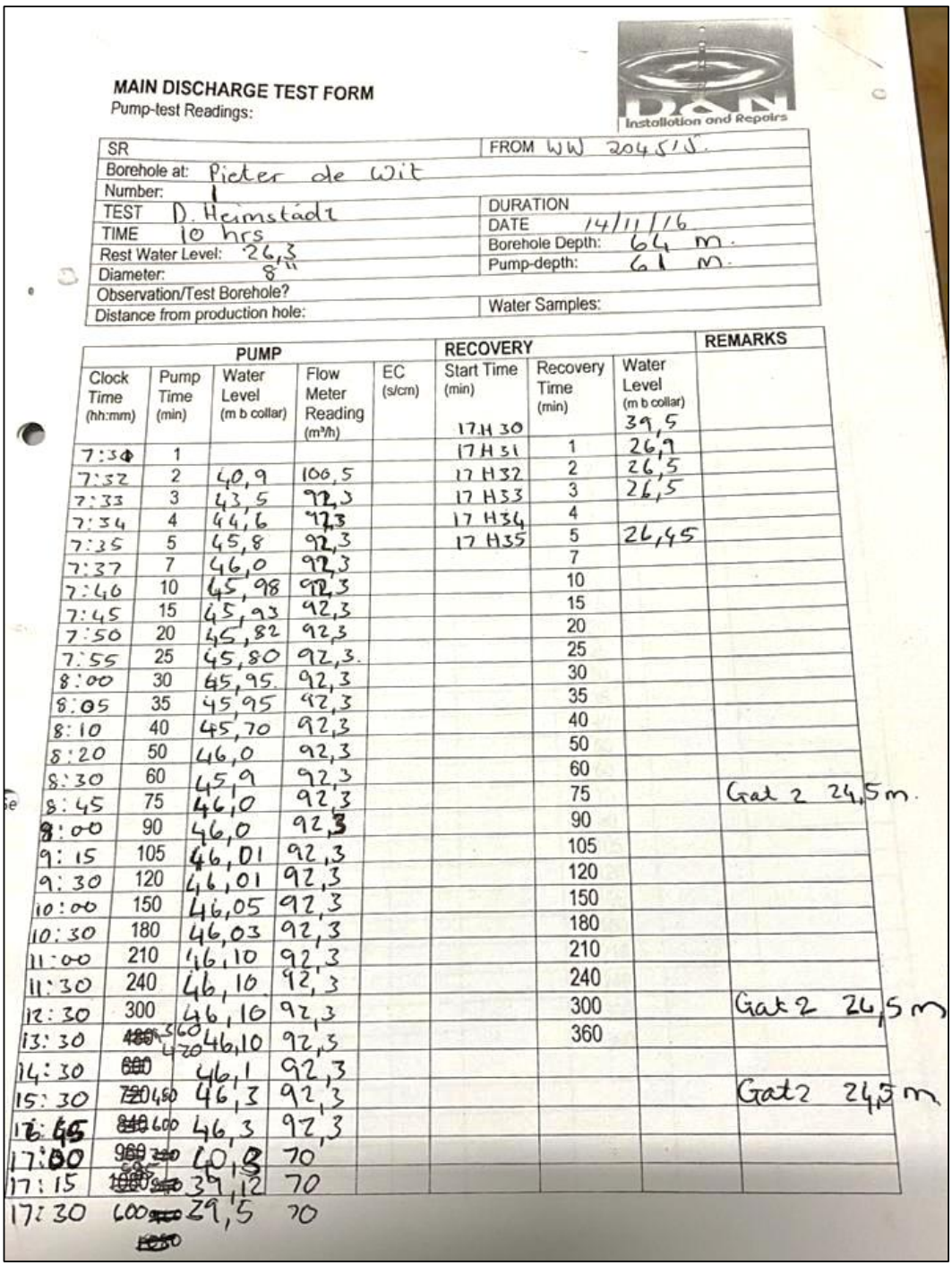
Lekula, M., Lubczynski, M., Shemang, E., (2018). Hydrogeological conceptual model of large and complex sedimentary aquifer systems – Central Kalahari Basin (Botswana). Physics and Chemistry of the Earth Parts A/B/C. 106. 10.1016/j.pce.2018.05.006. Accessed on (26/01/2021). Accessed:https://www.researchgate.net/publication/325035986_Hydrogeological_conceptual_model_of_large_and_complex_sedimentary_aquifer_systems_-_Central_Kalahari_Basin_Botswana

Miller, R.McG. (2008). The Geology of Namibia: Volume 2. Neoproterozoic to Lower Paleozoic. Geological Survey of Namibia.

Stadtler, C., Margane, A., Schildknecht, F., Schäffer, U., & Wrabel, J., (2005). Investigation of the Groundwater Resources in the Eiseb Graben in Namibia with TEM Soundings.

The Ministry of Agriculture Water and Land Reform (MAWLR)., (2020). Personal Communication.

Appendix A: Test Pumping



MAIN DISCHARGE TEST FORM
Pump-test Readings:

DAN Installation and Repairs

SR	FROM WW 20451.
Borehole at: Pieter de Wit	
Number: 1	
TEST D. Heimstadt	DURATION
TIME 10 hrs	DATE 14/11/16
Rest Water Level: 26,3	Borehole Depth: 64 m.
Diameter: 8"	Pump-depth: 61 m.
Observation/Test Borehole?	
Distance from production hole:	Water Samples:

PUMP					RECOVERY			REMARKS
Clock Time (hh:mm)	Pump Time (min)	Water Level (m b collar)	Flow Meter Reading (m³/h)	EC (s/cm)	Start Time (min)	Recovery Time (min)	Water Level (m b collar)	
					17.H 30		39,5	
7:30	1				17 H 31	1	26,9	
7:32	2	40,9	106,5		17 H 32	2	26,5	
7:33	3	43,5	92,3		17 H 33	3	26,5	
7:34	4	44,6	92,3		17 H 34	4		
7:35	5	45,8	92,3		17 H 35	5	26,45	
7:37	7	46,0	92,3			7		
7:46	10	45,98	92,3			10		
7:45	15	45,93	92,3			15		
7:50	20	45,82	92,3			20		
7:55	25	45,80	92,3.			25		
8:00	30	45,95	92,3			30		
8:05	35	45,95	92,3			35		
8:10	40	45,70	92,3			40		
8:20	50	46,0	92,3			50		
8:30	60	45,9	92,3			60		
8:45	75	46,0	92,3			75		Gat 2 24,5m.
9:00	90	46,0	92,3			90		
9:15	105	46,01	92,3			105		
9:30	120	46,01	92,3			120		
10:00	150	46,05	92,3			150		
10:30	180	46,03	92,3			180		
11:00	210	46,10	92,3			210		
11:30	240	46,10	92,3			240		
12:30	300	46,10	92,3			300		Gat 2 26,5m
13:30	~~480~~ 360 420	46,10	92,3			360		
14:30	~~600~~	46,1	92,3					
15:30	~~720~~ 480	46,3	92,3					Gat 2 24,5m
~~17:45~~	~~840~~ 600	46,3	92,3					
~~17:00~~	~~960~~ 720	40,8	70					
17:15	~~1080~~ 840	39,12	70					
17:30	600 ~~960~~	29,5	70					
	~~1080~~							

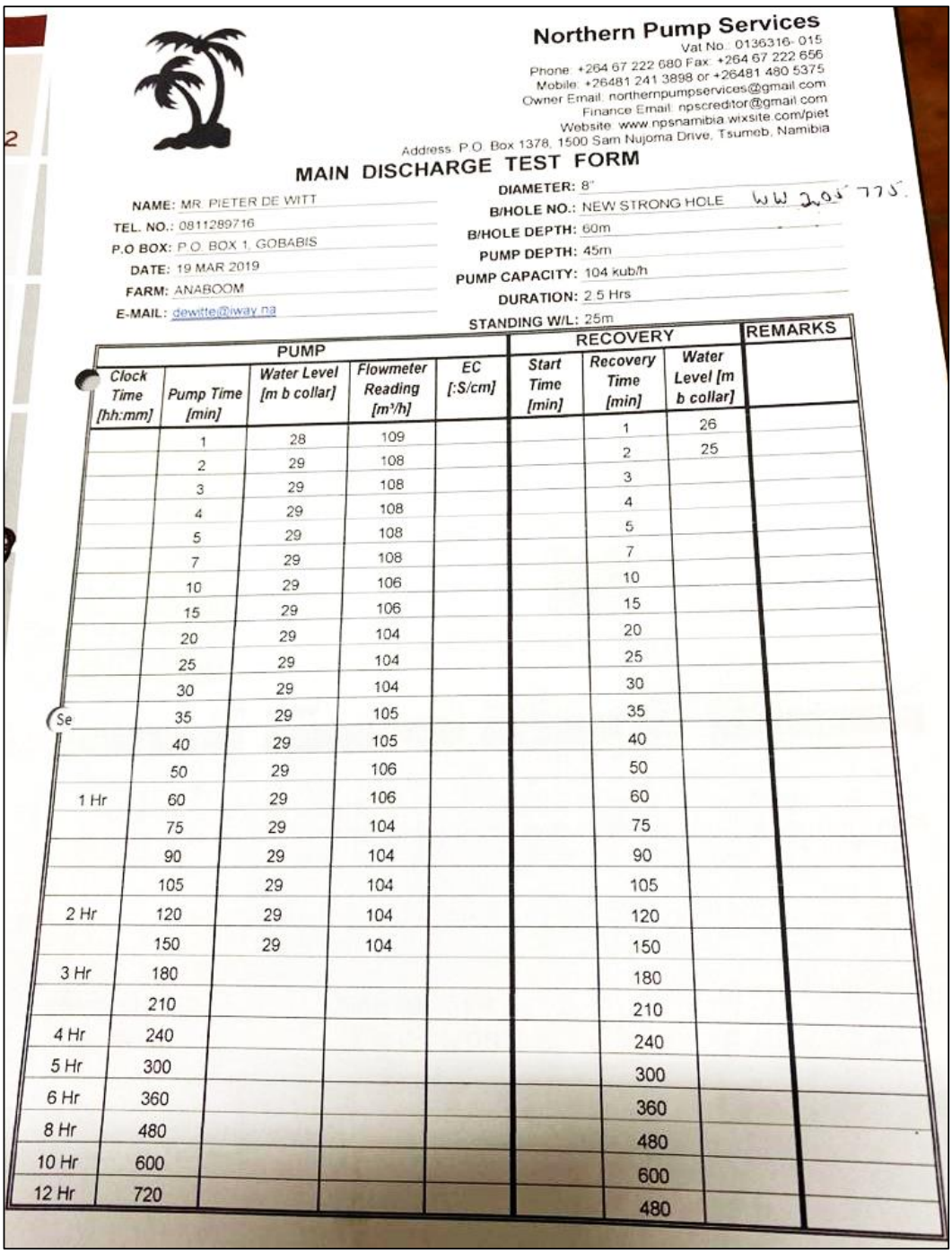
MAIN DISCHARGE TEST FORM

Pump-test Readings:

DAN Installation and Repairs

SR	FROM WW 20455/16
Borehole at: Pieter de Witt	
Number:	DURATION
TEST	DATE 16/11/16.
TIME	Borehole Depth: 75 m
Rest Water Level: 24,5 m	Pump-depth: 59 m
Diameter: 8"	
Observation/Test Borehole? Detlef Heimstadt	Water Samples:
Distance from production hole:	

PUMP					RECOVERY			REMARKS
Clock Time (hh:mm)	Pump Time (min)	Water Level (m b collar)	Flow Meter Reading (m³/h)	EC (s/cm)	Start Time (min)	Recovery Time (min)	Water Level (m b collar)	
7 H30						1		
7 H31	1	26,6	107			2		
7 H32	2	26,9	107			3		
7 H33	3	27,9	105			4		
7 H34	4	27,2	105			5		
7 H35	5	27,2	105			7		
7 H37	7	27,3	105			10		
7 H40	10	27,3	105			15		
7 H45	15	27,3	105			20		
7 H50	20	27,3	105			25		
7 H55	25	27,3	105			30		
8 H00	30	27,3	105			35		
8 H05	35	27,4	105			40		
8 H10	40					50		
8 H20	50					60		
8 H30	60					75		
8 H45	75					90		
9 H00	90					105		
9 H15	105					120		
9 H30	120					150		
	150					180		
	180					210		
	210					240		
	240					300		
	300					360		
	480							
	600							
	720							
	840							
	960							
	1080							



Northern Pump Services

Vat No. 0136316- 015
Phone: +264 67 222 680 Fax: +264 67 222 656
Mobile: +26481 241 3898 or +26481 480 5375
Owner Email: northernpumpservices@gmail.com
Finance Email: npscreditor@gmail.com
Website: www.npsnamibia.wixsite.com/piet
Address: P.O. Box 1378, 1500 Sam Nujoma Drive, Tsumeb, Namibia

MAIN DISCHARGE TEST FORM

NAME: MR. PIETER DE WITT
TEL. NO.: 0811289716
P.O BOX: P.O. BOX 1, GOBABIS
DATE: 19 MAR 2019
FARM: ANABOOM
E-MAIL: dewitte@iway.na

DIAMETER: 8"
B/HOLE NO.: NEW STRONG HOLE WW 20... 775.
B/HOLE DEPTH: 60m
PUMP DEPTH: 45m
PUMP CAPACITY: 104 kub/h
DURATION: 2.5 Hrs
STANDING W/L: 25m

PUMP					RECOVERY			REMARKS
Clock Time [hh:mm]	Pump Time [min]	Water Level [m b collar]	Flowmeter Reading [m³/h]	EC [:S/cm]	Start Time [min]	Recovery Time [min]	Water Level [m b collar]	
	1	28	109			1	26	
	2	29	108			2	25	
	3	29	108			3		
	4	29	108			4		
	5	29	108			5		
	7	29	108			7		
	10	29	106			10		
	15	29	106			15		
	20	29	104			20		
	25	29	104			25		
	30	29	104			30		
Se	35	29	105			35		
	40	29	105			40		
	50	29	106			50		
1 Hr	60	29	106			60		
	75	29	104			75		
	90	29	104			90		
	105	29	104			105		
2 Hr	120	29	104			120		
	150	29	104			150		
3 Hr	180					180		
	210					210		
4 Hr	240					240		
5 Hr	300					300		
6 Hr	360					360		
8 Hr	480					480		
10 Hr	600					600		
12 Hr	720					480		

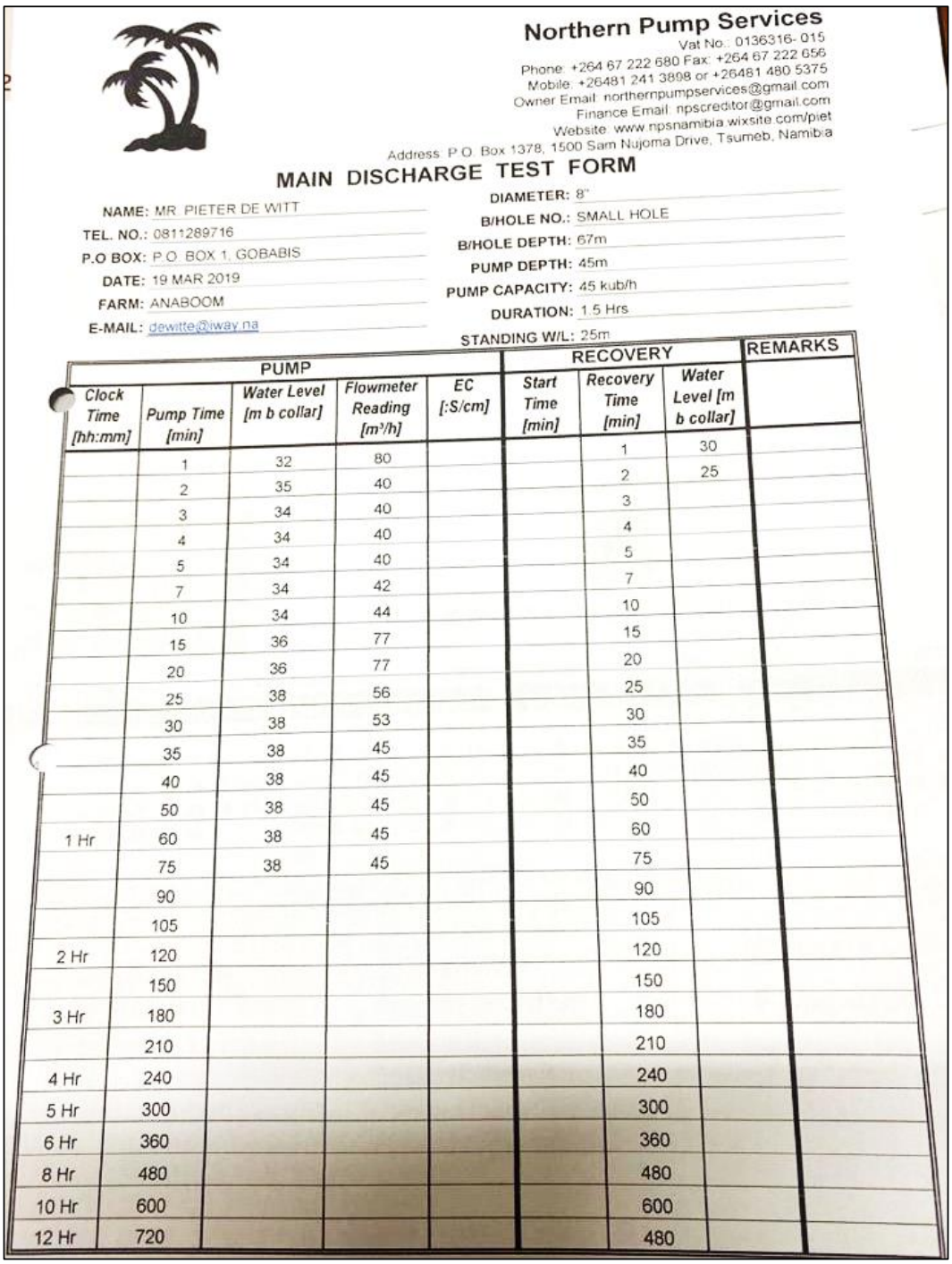
Vat No.: 0136316-015
Phone: +264 67 222 680 Fax: +264 67 222 656
Mobile: +26481 241 3898 or +26481 480 5375
Owner Email: northernpumpservices@gmail.com
Finance Email: npscreditor@gmail.com
Website: www.npsnamibia.wixsite.com/piet
Address: P.O. Box 1378, 1500 Sam Nujoma Drive, Tsumeb, Namibia

MAIN DISCHARGE TEST FORM

NAME: MR. PIETER DE WITT
TEL. NO.: 0811289716
P.O BOX: P.O. BOX 1, GOBABIS
DATE: 19 MAR 2019
FARM: ANABOOM
E-MAIL: dewitte@iway.na

DIAMETER: 8"
B/HOLE NO.: WINDGAT HOLE (Sutchelgat) Saved.
B/HOLE DEPTH: 60m
PUMP DEPTH: 45m
PUMP CAPACITY: 38 kub/h
DURATION: 2 Hrs
STANDING W/L: 26m

PUMP					RECOVERY			REMARKS
Clock Time [hh:mm]	Pump Time [min]	Water Level [m b collar]	Flowmeter Reading [m³/h]	EC [:S/cm]	Start Time [min]	Recovery Time [min]	Water Level [m b collar]	
	1	28	38			1	26	
	2	29	39			2		
	3	29	39			3		
	4	29.5	39			4		
	5	29.5	38			5		
	7	29.5	38			7		
	10	29.8	38			10		
	15	29.8	38			15		
	20	29.8	38			20		
	25	29.8	38			25		
	30	30	40			30		
	35	30	40			35		
	40	30	40			40		
	50	32	43			50		
1 Hr	60	33	41			60		
	75	33.8	38			75		
	90	33.8	38			90		
	105	33.8	38			105		
2 Hr	120	32	38			120		
	150					150		
3 Hr	180					180		
	210					210		
4 Hr	240					240		
5 Hr	300					300		
6 Hr	360					360		
8 Hr	480					480		
10 Hr	600					600		
12 Hr	720					480		



Northern Pump Services

Vat No.: 0136316- 015
Phone: +264 67 222 680 Fax: +264 67 222 656
Mobile: +26481 241 3898 or +26481 480 5375
Owner Email: northernpumpservices@gmail.com
Finance Email: npscreditor@gmail.com
Website: www.npsnamibia.wixsite.com/piet
Address: P.O. Box 1378, 1500 Sam Nujoma Drive, Tsumeb, Namibia

MAIN DISCHARGE TEST FORM

NAME: MR. PIETER DE WITT
TEL. NO.: 0811289716
P.O BOX: P.O. BOX 1, GOBABIS
DATE: 19 MAR 2019
FARM: ANABOOM
E-MAIL: dewitte@iway.na

DIAMETER: 8"
B/HOLE NO.: SMALL HOLE
B/HOLE DEPTH: 67m
PUMP DEPTH: 45m
PUMP CAPACITY: 45 kub/h
DURATION: 1.5 Hrs
STANDING W/L: 25m

PUMP					RECOVERY			REMARKS
Clock Time [hh:mm]	Pump Time [min]	Water Level [m b collar]	Flowmeter Reading [m³/h]	EC [:S/cm]	Start Time [min]	Recovery Time [min]	Water Level [m b collar]	
	1	32	80			1	30	
	2	35	40			2	25	
	3	34	40			3		
	4	34	40			4		
	5	34	40			5		
	7	34	42			7		
	10	34	44			10		
	15	36	77			15		
	20	36	77			20		
	25	38	56			25		
	30	38	53			30		
	35	38	45			35		
	40	38	45			40		
	50	38	45			50		
1 Hr	60	38	45			60		
	75	38	45			75		
	90					90		
	105					105		
2 Hr	120					120		
	150					150		
3 Hr	180					180		
	210					210		
4 Hr	240					240		
5 Hr	300					300		
6 Hr	360					360		
8 Hr	480					480		
10 Hr	600					600		
12 Hr	720					480		

Appendix B: Chemical Analyses

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43796
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 1 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	7.7		A - Excellent
Conductivity mS/m	50.0	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	335	mg/l	
Sodium as Na	17	mg/l	A - Excellent
Potassium as K	5	mg/l	A - Excellent
Sulphate as SO_4	1	mg/l	A - Excellent
Nitrate as N	1.0	mg/l	A - Excellent
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	73	mg/l	
Fluoride as F	0.8	mg/l	A - Excellent
Chloride as Cl	6.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	262	mg/l	
Total Hardness as $CaCO_3$	244	mg/l	A - Excellent
Calcium as $CaCO_3$	153	mg/l	A - Excellent
Magnesium as $CaCO_3$	92	mg/l	A - Excellent
Turbidity	25.2	NTU	Above recommended limit
Colour	12.0	mg/l Pt	Within recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class A : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43796

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43796

Stability pH : 7.25
Langelier Index : 0.45 - Scaling
Ryznar Index : 6.80 - Stable

CORROSITIVITY POTENTIAL OF WATER TOWARDS STEEL : 0.04 - Non-corrosive

IRRIGATION CLASIFICATION : C2 - S1
MEDIUM-SALINITY WATER (C2)
Can be used if a moderate amount of leaching occurs. Plants with moderate tolerance can be grown in most cases without special practices for salinity control.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43796

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43797
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 2 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	9.1		B - Good
Conductivity mS/m	22.7	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	152	mg/l	
Sodium as Na	20	mg/l	A - Excellent
Potassium as K	4	mg/l	A - Excellent
Sulphate as SO_4	<1	mg/l	A - Excellent
Nitrate as N	<0.5	mg/l	A - Excellent
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	2	mg/l	
Fluoride as F	0.5	mg/l	A - Excellent
Chloride as Cl	5.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	110	mg/l	
Phenolphthalein Alkalinity as $CaCO_3$	16.0	mg/l	
Total Hardness as $CaCO_3$	85	mg/l	A - Excellent
Calcium as $CaCO_3$	10	mg/l	A - Excellent
Magnesium as $CaCO_3$	75	mg/l	A - Excellent
Iron as Fe	0.07	mg/l	A - Excellent
Manganese as Mn	0.01	mg/l	A - Excellent
Copper as Cu	<0.01	mg/l	A - Excellent
Zinc as Zn	<0.01	mg/l	A - Excellent
Cadmium as Cd	<0.01	mg/l	A - Excellent
Lead as Pb	<0.02	mg/l	A - Excellent
Turbidity	7.4	NTU	Above recommended limit
Colour	10.0	mg/l Pt	Within recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class B : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43797

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43797

Stability pH : 8.78
Langelier Index : 0.32 - Scaling
Ryznar Index : 8.45 - Corrosive

#VALUE!

IRRIGATION CLASIFICATION : C1 - S1
LOW-SALINITY WATER (C1)
Can be used for irrigation with most crops on most soils with little likelihood that soil salinity will develop. Some leaching is required, but this occurs under irrigation practices except in soils of extremeley low permeability.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43797

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

Private Bag 13389, Windhoek Namibia
Tel (+264 - 61) 71 2257 Fax (+264 -61) 71 2097

CHEMICAL WATER ANALYSIS REPORT

DETAILS OF SAMPLE:

SAMPLE NUMBER	: DS43798
SENDER	: Early Dawn Trading
SAMPLE POINT NAME	: Farm: Anaboom No 400
AREA DESCRIPTION	: -
LOCATION DESCRIPTION	: Borehole 3 -
COMMENTS	: Full chemical analyses on lowest conductivity
DATE SAMPLE TAKEN	: 18/02/2016
TIME TAKEN	: -
DATE SAMPLE RECEIVED	: 25/02/2016
DATE SAMPLE ANALYSED	: 01/03/2016

DETERMINANT :	Value	Units	Classification
pH	7.9		A - Excellent
Conductivity mS/m	65.6	mS/m	A - Excellent
Total dissolved solids calculated from conductivity	440	mg/l	
Sodium as Na	18	mg/l	A - Excellent
Potassium as K	5	mg/l	A - Excellent
Sulphate as SO_4	4	mg/l	A - Excellent
Nitrate as N	11.3	mg/l	B - Good
Nitrite as N	<0.1	mg/l	
Silicate as SiO_2	70	mg/l	
Fluoride as F	0.7	mg/l	A - Excellent
Chloride as Cl	29.0	mg/l	A - Excellent
Total Alkalinity as $CaCO_3$	250	mg/l	
Total Hardness as $CaCO_3$	310	mg/l	B - Good
Calcium as $CaCO_3$	173	mg/l	A - Excellent
Magnesium as $CaCO_3$	138	mg/l	A - Excellent
Turbidity	13.5	NTU	Above recommended limit
Colour	60.0	mg/l Pt	Above recommended limit
Aluminium as Al	<0.01	mg/l	

REMARKS :

CLASSIFICATION FOR CHEMICAL QUALITY OF DRINKING WATER IN RESPECT OF DETERMINANTS AS ABOVE :
Class B : Suitable for human consumption
Stockwatering : Suitable

TURBIDITY : Turbidity effects the aesthetic quality of water. The amount of chlorine required for disinfection increases as the turbidity increases.
COLOUR: Colour in water is generally due to organic compounds together with colloidal iron and/or manganese.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43798

E.Honga
Senior Manager : Water Quality & Environmental Services

NAMWATER
Namibia Water Corporation Ltd

ADDITIONAL INFORMATION : DS43798

Stability pH : 7.23
Langelier Index : 0.67 - Scaling
Ryznar Index : 6.56 - Stable

CORROSITIVITY POTENTIAL OF WATER TOWARDS STEEL : 0.18 - Non-corrosive

IRRIGATION CLASIFICATION : C2 - S1
MEDIUM-SALINITY WATER (C2)
Can be used if a moderate amount of leaching occurs. Plants with moderate tolerance can be grown in most cases without special practices for salinity control.
SODIUM
The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of Sodium-sensitives plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.
LOW-SODIUM WATER (S1)
Can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and advocados may accumulate injurious concentrations of sodium.

M.Conradie **Pr.Sci.Nat.**
Senior Techician : Water Quality Services
conradiem@namwater.com.na
DS43798

E.Honga
Senior Manager : Water Quality & Environmental Services

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

Windhoek:
analab@mweb.com.na
Tel +264 61 210 132
Cell +264 81 611 8843
71 Newcastle Street

Walvis Bay:
walvisbaylab@analab.com.na
Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Geo Pollution Technologies (Pty)Ltd**
P.O. Box 11073
Windhoek

Date received: 08/Feb/21
Date analysed: 12 February - 22 February 2021
Date reported: 22/Feb/21

Attn: Mr Pierre Botha
e-mail: christian@thenamib.com
Tel: 061 257411/ 0811220082

Client Reference no.: verbal
Quotation no.: QU-5482
Lab Reference: I210346
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	GPTN 3332
Description of sampling point	Lusern
Date of sampling	2021/05/2021
Test item number	I210346/1

Parameter	Value	Units	me	Salinity/Chloride/RSC Hazard Low	Medium	High	Very High
p H	7.2			Acceptable pH range: 6.5-8.4			
Electrical Conductivity	53.4	mS/m		<25	25-75	75-225	>225
P-Alkalinity as $CaCO_3$	0	mg/l					
Total Alkalinity as $CaCO_3$	265	mg/l					
Bicarbonate as HCO_3^-	323	mg/l	5.30				
Carbonate as CO_3^{2-}	0	mg/l	0				
Total Hardness as $CaCO_3$	259	mg/l					
Chloride as Cl^-	11	mg/l		0-105	105-140	140-350	>350
Fluoride as F^-	1.0	mg/l					
Sulphate as SO_4^{2-}	9	mg/l					
Nitrate as N	2.6	mg/l					
Sodium as Na	21	mg/l	0.91				
Potassium as K	6.9	mg/l					
Magnesium as Mg	24	mg/l	1.97				
Calcium as Ca	64	mg/l	3.19				
Manganese as Mn	<0.01	mg/l					
Iron as Fe	0.01	mg/l					
Copper as Cu	0.01	mg/l					
Zinc as Zn	0.01	mg/l					
Boron as B	0.09	mg/l		0.3-1.0	1.0-2.0	2.0-4.0	>4.0
Molybdenum as Mo	<0.01	mg/l					
Quality Indices:							
Electrical Conductivity	0.53	mS/cm					
HCO_3:Ca	1.66	me/l					
Modified calcium value	1.49	me/l					
Adj. Sodium Adsorption Ratio	1.0	me/l					
Residual Sodium Carbonate	0.13	me/l		<1.25	1.25-2.50	>2.50	
Magnesium Ratio	38	me/l			Acceptable ratio: <50		
Stability pH, at 25°C	7.23						
Ryznar Index	7.26	stable		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	0.09	no corrosive properties		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Silke Rügheimer
Laboratory Manager

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

Windhoek:
analab@mweb.com.na
Tel +264 61 210 132
Cell +264 81 611 8843
71 Newcastle Street

Walvis Bay:
walvisbaylab@analab.com.na
Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Assessment of water quality and its subsequent effect on soils

pH value	:	**suitable**, even when crop foliage is wetted, this should not casue foliar damage
Salinity hazard	:	**medium**, water can be used if a moderate amount of leaching occurs. Should ensure that salt sensitive crops can be grown without yield decreases when using low frequency irrigation systems
Chloride hazard	:	**low,** should prevent the accumulation of chloride to toxic levels in all but the most sensitive plants, even when chloride uptake is through foliar absorption
Boron hazard	:	Boron, though a plant nutrient, becomes toxic if present in water beyond a particular level. **Safe**
Sodium hazard	:	**low**, water can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium Should prevent the accumulation of sodium to toxic levels in all but the most sensitive plants, even when crop foliage is wet.
RSC hazard	:	This index indicates the tendency of carbonate and bicarbonates to precipitate calcium as calcium carbonate. **Safe**
Magnesium ratio	:	Magnesium deteriorates soil structure particularly when waters are sodium-dominated and highly saline. Higher level of Mg usually promotes higher development of exchangeable Na in irrigated soils. **Safe**
Fluoride	:	Its contents beyond 1 mg/l in drinking water and 10ppm in irrigation water is harmful. It is not directly toxic to the plant but to animals feeding on plants which have been irrigated with high fluoride waters.
Nitrate	:	Nitrate generally occurs in trace quantities in surface water but can be present in higher concentrations in some groundwaters. Beneficial effect of nitrates on crop production has been widely reported. The presence of potassium and nitrate in appreciable amounts in irrigation water has been found to partially counteract the adverse effect of salinity and sodicity on plant growth.
Potassium	:	Being a plant nutrient, its presence in saline water counteracts the adverse effect of sodium on crop growth.
Manganese	:	Safe
Iron	:	Safe
Copper	:	Safe
Zinc	:	Safe
Molybdenum	:	Safe

Silke Rügheimer
Laboratory Manager

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

Windhoek:
analab@mweb.com.na
Tel +264 61 210 132
Cell +264 81 611 8843
71 Newcastle Street

Walvis Bay:
walvisbaylab@analab.com.na
Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Geo Pollution Technologies (Pty)Ltd**
P.O. Box 11073
Windhoek

Date received: 08/Feb/21
Date analysed: 12 February - 22 February 2021
Date reported: 22/Feb/21

Attn: Mr Pierre Botha
e-mail: christian@thenamib.com
Tel: 061 257411/ 0811220082

Client Reference no.: verbal
Quotation no.: QU-5482
Lab Reference: I210346
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	GPTN 3333
Description of sampling point	Hawer
Date of sampling	2021/05/2021
Test item number	I210346/2

				Salinity/Chloride/RSC Hazard			
Parameter	**Value**	**Units**	**me**	**Low**	**Medium**	**High**	**Very High**
p H	**7.4**			Acceptable pH range: 6.5-8.4			
Electrical Conductivity	**41.0**	**mS/m**		<25	25-75	75-225	>225
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**185**	**mg/l**					
Bicarbonate as HCO_3^-	**226**	**mg/l**	3.70				
Carbonate as CO_3^{2-}	**0**	**mg/l**	0				
Total Hardness as $CaCO_3$	**187**	**mg/l**					
Chloride as Cl^-	**18**	**mg/l**		0-105	105-140	140-350	>350
Fluoride as F^-	**0.3**	**mg/l**					
Sulphate as SO_4^{2-}	**6**	**mg/l**					
Nitrate as N	**2.9**	**mg/l**					
Sodium as Na	**19**	**mg/l**	0.83				
Potassium as K	**3.6**	**mg/l**					
Magnesium as Mg	**14**	**mg/l**	1.15				
Calcium as Ca	**52**	**mg/l**	2.59				
Manganese as Mn	**<0.01**	**mg/l**					
Iron as Fe	**0.01**	**mg/l**					
Copper as Cu	**0.01**	**mg/l**					
Zinc as Zn	**0.01**	**mg/l**					
Boron as B	**0.06**	**mg/l**		0.3-1.0	1.0-2.0	2.0-4.0	>4.0
Molybdenum as Mo	**<0.01**	**mg/l**					
Quality Indices:							
Electrical Conductivity	**0.41**	**mS/cm**					
HCO_3:Ca	**1.43**	**me/l**					
Modified calcium value	**1.49**	**me/l**					
Adj. Sodium Adsorption Ratio	**1.0**	**me/l**					
Residual Sodium Carbonate	**-0.05**	**me/l**		<1.25	1.25-2.50	>2.50	
Magnesium Ratio	**31**	**me/l**			Acceptable ratio: <50		
Stability pH, at 25°C	**7.46**						
Ryznar Index	**7.53**	corrosive		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**0.17**	no corrosive properties		Applies to water in the pH range 7-8			
				which also contains dissolved oxygen			
				ratios <0.2 no corrosive properties			
				ratios >0.2 increasing corrosive tendency			

Silke Rügheimer
Laboratory Manager

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

Windhoek:
analab@mweb.com.na
Tel +264 61 210 132
Cell +264 81 611 8843
71 Newcastle Street

Walvis Bay:
walvisbaylab@analab.com.na
Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Assessment of water quality and its subsequent effect on soils

pH value	:	**suitable**, even when crop foliage is wetted, this should not casue foliar damage
Salinity hazard	:	**medium**, water can be used if a moderate amount of leaching occurs. Should ensure that salt sensitive crops can be grown without yield decreases when using low frequency irrigation systems
Chloride hazard	:	**low,** should prevent the accumulation of chloride to toxic levels in all but the most sensitive plants, even when chloride uptake is through foliar absorption
Boron hazard	:	Boron, though a plant nutrient, becomes toxic if present in water beyond a particular level. **Safe**
Sodium hazard	:	**low**, water can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium Should prevent the accumulation of sodium to toxic levels in all but the most sensitive plants, even when crop foliage is wet.
RSC hazard	:	This index indicates the tendency of carbonate and bicarbonates to precipitate calcium as calcium carbonate. **Safe**
Magnesium ratio	:	Magnesium deteriorates soil structure particularly when waters are sodium-dominated and highly saline. Higher level of Mg usually promotes higher development of exchangeable Na in irrigated soils. **Safe**
Fluoride	:	Its contents beyond 1 mg/l in drinking water and 10ppm in irrigation water is harmful. It is not directly toxic to the plant but to animals feeding on plants which have been irrigated with high fluoride waters.
Nitrate	:	Nitrate generally occurs in trace quantities in surface water but can be present in higher concentrations in some groundwaters. Beneficial effect of nitrates on crop production has been widely reported. The presence of potassium and nitrate in appreciable amounts in irrigation water has been found to partially counteract the adverse effect of salinity and sodicity on plant growth.
Potassium	:	Being a plant nutrient, its presence in saline water counteracts the adverse effect of sodium on crop growth.
Manganese	:	Safe
Iron	:	Safe
Copper	:	Safe
Zinc	:	Safe
Molybdenum	:	Safe

Page 4 of 6

Silke Rügheimer
Laboratory Manager

FRM 168 version: 01, 2018-06-29 WO 77646:94528 PAGE: 1 of 2

NviroTek Labs

Verslag / Report

Grond / Soil

Nviro Business Hub unit 6, Ou Wapad road, Ifafi, Hartbeespoort, 0260 | Tel: 012 252 7588 | www.nviroteklabs.co.za

Datum Ontvang/Date Received:	2020-08-28	**Verslag nr./Report no.:**	WO 77646:94528
Datum Ontleed/Date Analysed:	2020-08-28	**Datum Gerapporteer/Date Reported:**	2020-09-04

To/Aan:
AGRO PEDO (PTY) LTD
27636909605
P.O. BOX 70031 POTCHEFSTROOM 2527

Representative/Verteenwoordiger: ELANE DE KLERK
Farm Name/Plaas Naam:
Order/Bestel#: PO 02023 PG de Wit
Email: elane@agropedo.co.za,admin@agropedo.co.za

Lab Nommer	Sample Reference	pH KCl *	P Bray1	EXCH ACID KCl	Dens. *	Ca (M3)	Mg (M3)	K (M3)	Na (M3)	Fe (M3)	Mn (M3)	Cu (M3)	Zn (M3)	B (M3)	S (M3)	P (M3)	Al (M3)	%Ca	%Mg	%K	%Na
Lab Number	Monsterverwysing	-	mg/kg	cmol(+)/kg	g/ml	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	%	%
G24-43032	Lusern	6.26	19	0.00	1.25	720	140	101	39	19.60	29.15	0.55	1.15	0.50	3.26	43	163	69.62	22.12	4.97	3.29
G24-43033	Ou Land	6.03	17	0.00	1.34	506	96	107	21	17.08	22.60	0.49	0.71	0.35	3.21	24	139	68.80	21.35	7.42	2.43
G24-43034	Nuwe Land	6.01	13	0.00	1.32	398	67	77	22	21.10	32.19	0.45	0.33	0.26	2.17	15	187	70.33	19.34	6.99	3.34
G24-43035	Hawer	6.32	4	0.00	1.29	391	63	55	22	18.05	27.58	0.53	0.29	0.27	1.90	6	175	72.23	19.01	5.16	3.61

Lab Nommer	Sample Reference	T-VALUE (M3)	ACID SAT.	Ca:Mg (M3)	(Ca+Mg)/K (M3)	Mg:K (M3)	Na:K (M3)	S-VALUE (M3)
Lab Number	Monsterverwysing	cmol(+)/kg	%	1.5-4.5	10.0-20.0	3.0-4.0	-	cmol(+)/kg
G24-43032	Lusern	5.17	0.00	3.15	18.45	4.45	0.66	5.17
G24-43033	Ou Land	3.67	0.00	3.22	12.15	2.88	0.33	3.67
G24-43034	Nuwe Land	2.83	0.00	3.64	12.83	2.77	0.48	2.83
G24-43035	Hawer	2.71	0.00	3.80	17.69	3.68	0.70	2.71

NOTAS / NOTES:

Verslag goedgekeur deur / Report approved by:

Yvette van der Merwe
yvette.vdmerwe@nviroteklabs.co.za
Data Administrator

Francois Reeders
francois.reeders@nviroteklabs.co.za
Technical Signatory - ICP-OES, pH

FRM 168 version: 01, 2018-06-29 WO 77646:94528 PAGE: 2 of 2

NviroTek Labs

Verslag / Report

Grond / Soil

Nviro Business Hub unit 6, Ou Wapad road, Ifafi, Hartbeespoort, 0260 | Tel: 012 252 7588 | www.nviroteklabs.co.za

BELANGRIK / IMPORTANT

* Results marked with * in this report are not included in the Schedule of Accreditation for this laboratory.

** Results marked with ** are Subcontracted Tests and are not included in the Schedule of Accreditation for this laboratory.

The test report shall not be reproduced except in full, without written approval of the laboratory. These results are only applicable to the tests performed on the samples received.
Die resultate gerapporteer hou verband met die monster(s) ontvang en ontleed in die laboratorium. Die verslag mag slegs in totaliteit geherproduseer word met die geskrewe toestemming van die laboratorium.

Test	Method	Test	Method
pH(KCl)*	WIN 078	P(Mehlich III)	WIN 074
P(Bray1)	WIN 073	Al(Mehlich III)	WIN 074
EXCH ACID KCl	WIN 031	%Ca(Mehl III)	CALC
Dens. - Density*	WIN 076	%Mg(Mehl III)	CALC
Ca(Mehlich III)	WIN 074	%K(Mehl III)	CALC
Mg(Mehlich III)	WIN 074	%Na(Mehlich III)	CALC
K(Mehlich III)	WIN 074	T-VALUE(Mehlich III)	CALC
Na(Mehlich III)	WIN 074	ACID SATURATION(Mehl III)	CALC
Fe(Mehlich III)	WIN 074	Ca:Mg(Mehl III)	CALC
Mn(Mehlich III)	WIN 074	(Ca+Mg)/K(Mehlich III)	CALC
Cu(Mehlich III)	WIN 074	Mg:K(Mehlich III)	CALC
Zn(Mehlich III)	WIN 074	Na:K(Mehlich III)	CALC
B(Mehlich III)	WIN 074	S-VALUE(Mehlich III)	CALC
S(Mehlich III)	WIN 074		

End of Report

Appendix C: Tree Information

Trees recorded in quarter degree squares 2219AC, and 2219AA (Curtis & Mannheimer, 2005)

Name	Common Name
Acacia ataxacantha	Flame-thorn
Acacia erioloba	Camel-thorn
Acacia erioloba	Camel-thorn
Acacia fleckii	Sand-veld Acacia
Acacia hebeclada subsp hebeclada	Candle-pod Acacia
Acacia hebeclada subsp hebeclada	Candle-pod Acacia
Acacia hereroensis	Mountain-thorn
Acacia hereroensis	Mountain-thorn
Acacia karroo	Sweet-thorn
Acacia luederitzii var luederitzii	Kalahari Acacia
Acacia mellifera subsp detinens	Blue-thorn Acacia
Acacia mellifera subsp detinens	Blue-thorn Acacia
Acacia nebrownii	Water-thorn
Bauhinia petersiana subsp macrantha	White Bauhinia
Bauhinia petersiana subsp macrantha	White Bauhinia
Boscia albitrunca	Shepherd's Tree
Boscia albitrunca	Shepherd's Tree
Catophractes alexandri	Trumpet-thorn;Rattlepod
Catophractes alexandri	Trumpet-thorn;Rattlepod
Dichrostachys cinerea subsp africana	Kalahari Christmas Tree;Sickle-bush
Dichrostachys cinerea subsp africana	Kalahari Christmas Tree;Sickle-bush
Diospyros lycioides	Bluebush
Diospyros lycioides	Bluebush
Diospyros lycioides subsp lycioides	Bluebush
Ehretia alba	White-puzzle Bush
Ehretia alba	White-puzzle Bush
Elephantorrhiza elephantina	Elands-bean
Elephantorrhiza elephantina	Elands-bean
Euclea undulata var myrtina	Common Guarri;Mountain Ebony
Grewia avellana	Mezunzunvani
Grewia flava	Velvet Raisin
Grewia flava	Velvet Raisin
Grewia flavescens	Sandpaper Raisin
Grewia flavescens	Sandpaper Raisin
Grewia retinervis	Kalahari Raisin
Gymnosporia senegalensis	Confetti Spikethorn
Gymnosporia senegalensis	Confetti Spikethorn
Lycium bosciifolium	Limpopo Honey-thorn
Nymania capensis	Chinese-lanterns
Opuntia spp	Spiny Cactus; Prickly-pear
Ozoroa insignis	Africa Resin-tree
Ozoroa paniculosa	Common Resin-bush
Ozoroa paniculosa	Common Resin-bush
Phaeoptilum spinosum	Brittle-thorn
Prosopis spp	0
Rhigozum brevispinosum	Simple-leaved Rhigozum
Rhigozum brevispinosum	Simple-leaved Rhigozum
Searsia tenuinervis var tenuinervis	Kalahari Currant

Name	Common Name
Searsia tenuinervis var tenuinervis	Kalahari Currant
Tarchonanthus camphoratus	Camphor Bush
Tarchonanthus camphoratus	Camphor Bush
Terminalia sericea	Silver Cluster-leave
Terminalia sericea	Silver Cluster-leave
Ziziphus mucronata	Buffalo-thorn
Ziziphus mucronata	Buffalo-thorn

Appendix D: Proof of Public Consultation

Registered and Notified IAPs

Name	Surname	Position	Organisation
D	Mbako	Owner	Cadillac
P	Booysen	Owner	Juliana Wes
ZP	Booysen	Owner	Juliana Wes (eastern portion)
J	Ndjou	Owner	Agarichas
W	Van der Schyff	Owner	Sonelus
B	Venter	Owner	Ged van Sonelus / Remainder of the Farm Annaboom
B	Schmidt von Wüllisch	Owner	Ohlsenhagen A
Tikkie	Van Eeden	Owner	Ohlsenhagen
Rian	Barnard	Owner	Houvas
Jolanda	Murangi/Kamburona	Environmentalist In-Training	Namibia Water Corporation
Nicolaas	Du Plessis	Environmentalist	Namibia Water Corporation
Darius	Hangero	Supervisor	NamPower Gobabis

Notification Letter

TEL.: (+264-61) 257411 ♦ FAX.: (+264) 88626368
CELL.: (+264-81) 1220082
PO BOX 11573 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

OMAHEKE REGIONAL COUNCIL
PRIVATE BAG 2277
2020 -11- 23
GOBABIS
CHIEF REGIONAL OFFICER

To: **Chief Regional Officer**
Omaheke Regional Council
Gobabis
Namibia

23 November 2020

Re: **Environmental Scoping Assessment and Environmental Management Plan for Irrigation Activities on the Farms Anaboom, Ohlsenhagen and Escourt, Gobabis District**

Dear Sir/Madam

Geo Pollution Technologies (Pty) Ltd was appointed by Mr. P de Wit to undertake an environmental assessment for the irrigation and associated activities on his farming unit in the Gobabis District. The assessment will be conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

Project: Environmental Scoping Assessment and Environmental Management Plan for Irrigation Activities on the Farms Anaboom, Ohlsenhagen and Escourt, Gobabis District

Proponent: Mr. P de Wit

Environmental Assessment Practitioner: Geo Pollution Technologies (Pty) Ltd

The farming unit consists of Portion 1 of Farm 400 (Anaboom), Portion 2 of Farm 174 (Ohlsenhagen) and Portion 1 of Farm 713 (Escourt). Collectively the Proponent has cleared 56 ha for irrigation and 60 ha for dryland cropping. At present, the main crop cultivated is maize. Irrigation is from production boreholes by means of centre pivot irrigation systems and crops are cultivated on a rotational basis. In addition to crop cultivation the Proponent also conducts cattle faming. A consumer fuel installation consisting of two 2.2 m^3 tanks is present on site to supply diesel to tractors and other vehicles. The environmental assessment will include all infrastructure and operational activities associated with the agricultural activities on the farm. This include land clearing, soil preparation, planting, pest control and fertilizer use, harvesting and support services such as electricity supply, fuel storage and use, staff accommodation and effluent disposal.

All interested and affected parties (IAPs) are invited to register with the environmental consultant to receive further documentation and communication regarding the project. By registering, IAPs will be provided with an opportunity to provide input that will be considered in the drafting of the environmental assessment report and management plan.

Please register as an IAP and provide comments by **30 November 2020** at:

Fax: 088-62-6368

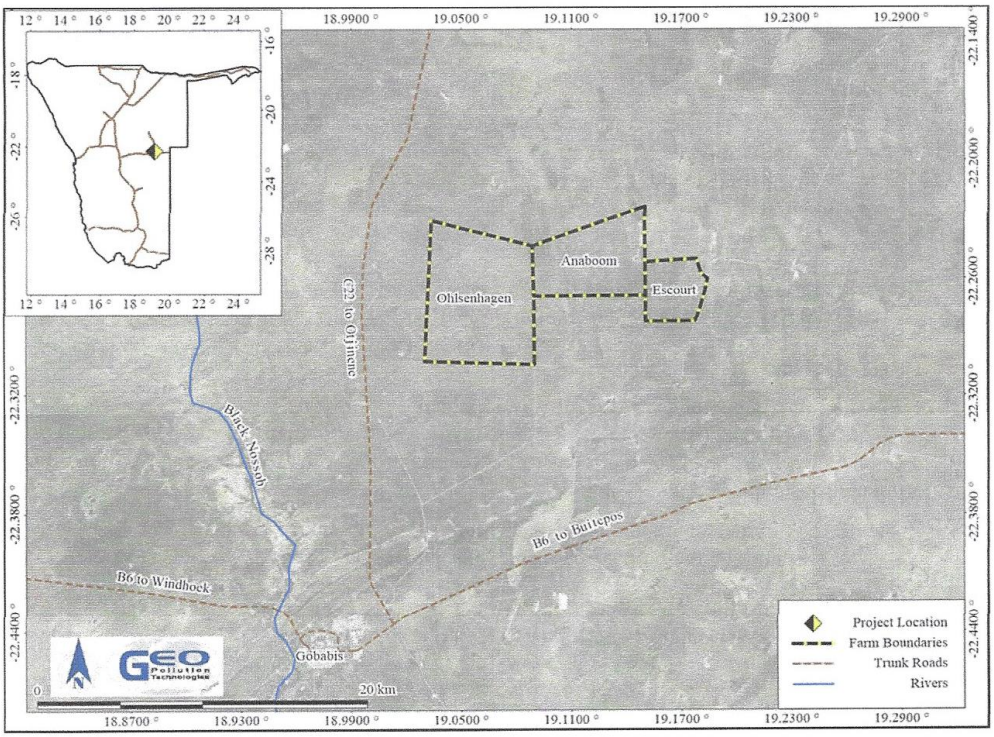
E-Mail: gpt@thenamib.com

Should you require any additional information please contact Geo Pollution Technologies at telephone 061-257411.

Thank you in advance.

Sincerely,
Geo Pollution Technologies

Quzette Bosman
Social and Environmental Assessment Practitioner


12 ° 14 ° 16 ° 18 ° 20 ° 22 ° 24 °
-16 °
-18 °
-20 °
-22 °
-24 °
-26 °
-28 °
18.9900 °
19.0500 °
19.1100 °
19.1700 °
19.2300 °
19.2900 °
-22.1400 °
-22.2000 °
-22.2600 °
-22.3200 °
-22.3800 °
-22.4400 °
Anaboom
Escourt
Ohlsenhagen
C22 to Otjimene
Black Nossob
B6 to Windhoek
B6 to Buitepos
Gobabis
Project Location
Farm Boundaries
Trunk Roads
Rivers
0
20 km
18.8700 °
18.9300 °

Background Information Document

TEL.: (+264-61) 257411 ♦ FAX.: (+264) 88626368
CELL.: (+264-81) 1220082
PO BOX 11073 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

BACKGROUND INFORMATION DOCUMENT

ENVIRONMENTAL SCOPING ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN FOR IRRIGATION ACTIVITIES ON THE FARMS ANABOOM, OHLSENHAGEN AND ESCOURT, GOBABIS DISTRICT

1. Introduction

Geo Pollution Technologies (Pty) Ltd was appointed by Mr. P de Wit (the Proponent) to undertake an environmental assessment for irrigation activities on his farming unit in the Gobabis District. The farming unit consists of Portion 1 of Farm 400 (Anaboom), Portion 2 of Farm 174 (Ohlsenhagen) and Portion 1 of Farm 713 (Escourt) (Figure 1). Collectively the Proponent has cleared 56 ha for irrigation and 60 ha for dryland cropping. At present, the main crop cultivated is maize. Irrigation is from production boreholes by means of centre pivot irrigation systems. In addition to crop cultivation the Proponent also conducts cattle faming.

The environmental assessment will include all operational activities associated with the irrigation and agricultural activities of the Proponent. It includes handling and storage of pesticides and fuel, cultivation techniques and waste disposal.

An environmental clearance certificate (ECC) for the operations is required as per the Environmental Management Act No. 7 of 2007 (EMA). A scoping environmental assessment report (SR) and an environmental management plan (EMP) are proposed to be submitted to the Ministry of Environment, Forestry and Tourism's Department of Environmental Affairs (DEA) in support of an application for an ECC.

2. The purpose of this document

With this background information document (BID), GPT aims to provide interested and affected parties (IAPs) with information about the project and interact with them regarding it. IAPs are therefore invited to register with GPT for the project in order to:

- Provide GPT with additional information which should be taken into account in the assessment of impacts;
- Share any comments, issues or concerns related to the project; and
- Review and comment on the reports (SR and an EMP).

3. Project Description

Activities associated with the project have been divided into the following phases: planning, maintenance/construction, operational and the decommissioning phase. A brief outline of expected activities for each phase is detailed below.

3.1 Planning Phase

While planning for operations, construction / maintenance activities and decommissioning of the farm, it is the responsibility of the Proponent to ensure they are and remain compliant with all legal requirements. The Proponent must also ensure that all required management measures are in place prior to and during all phases, to ensure potential impacts and risks are minimised. Typical planning activities include:

- Obtain permits and approvals from local and national authorities including a water abstraction permit from the Ministry of Agriculture, Water and Land Reform and a consumer fuel installation certificate from the Ministry of Mines and Energy.
- Make provisions to have a Health, Safety and Environmental Coordinator to implement the EMP.
- Ensure provisions for a fund to cater for environmental incidents risks/pollution and ecological restoration are made.
- Ensure all appointed contractors and employees enter into an agreement which includes the EMP.
- Establish and/or maintain a reporting system to report on aspects of construction activities, operations and decommissioning as outlined in the EMP.

3.2 Maintenance / Construction Phase

Maintenance continues on a daily basis and may include some construction activities. Maintenance include minor repairs to infrastructure, general upkeep of buildings, servicing of vehicles and farm implements, etc.

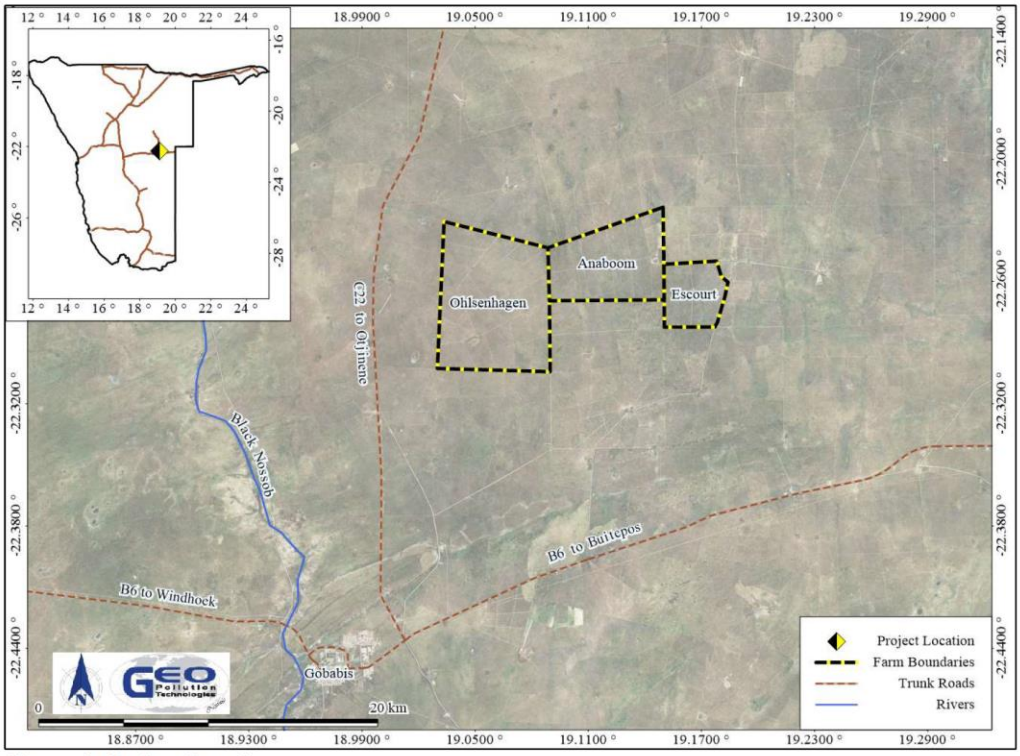


Figure 1: Project Location

3.3 Operational Phase

The main operational activities include: land clearing and preparation; planting; water abstraction and irrigation; pest control; harvesting and transport. Crops are cultivated on a rotational basis. A consumer fuel installation of two 2.2 m^3 tanks is present on site to supply diesel to tractors and other vehicles.

3.4 Decommissioning Phase

Decommissioning is not foreseen during the validity of the environmental clearance certificate. Should decommissioning occur at any stage, rehabilitation of the area may be required. Decommissioning will entail the complete removal of all infrastructure including buildings and underground infrastructure. Any pollution present on the site must be remediated.

4. Preliminary Identified Impacts

During the environmental assessment all components of the environment will be considered, however only those components which are being impacted on significantly or are deemed to be sensitive will be assessed. These include the following:

- Health and safety risks,
- Soil and groundwater pollution.
- Over abstraction of groundwater,
- Fire,
- Waste and effluent generation and disposal,
- Traffic,
- Noise,
- Visual impact,
- Ecosystem and biodiversity impacts,
- Socio-economic contributions.

5. Getting Involved

Geo Pollution Technologies invites all IAPs to provide in writing, any issues and suggestions regarding the development. This correspondence must include:

- Name and surname,
- Organization represented or private interest,
- Position in the organization,
- Contact details, and
- Any direct business, financial, personal or other interest which you may have in the approval or refusal of the application.

All contributions become public knowledge and will be circulated along with the reports as per the EMA requirements.

The comments, inputs and suggestions will also be submitted to the DEA along with how any issues have been addressed in the SR.

The public participation process will remain ongoing during the environmental assessment. However, all comments and concerns should be provided to Geo Pollution Technologies by 30 November 2020 to ensure incorporation into the final report.

The project team may be contacted at:

Geo Pollution Technologies (Pty) Ltd.
Telephone: (+264-61) 257411
Fax: (+264) 88626368
e-mail: gpt@thenamib.com

Your rights as an IAP according to the Environmental Management Act, No7 of 2007, Government Notice No 30 (Environmental Impact Assessment Regulations)

Section 23.

(1) A registered interested or affected party is entitled to comment in writing, on all written submissions made to the Environmental Commissioner by the applicant responsible for the application, and to bring to the attention of the Environmental Commissioner any issues which that party, believes may be of significance to the consideration of the application, as long as -

(a) comments are submitted within 7 days of notification of an application or receiving access to a scoping report or an assessment report;

(b) the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

(2) Before the applicant submits a report compiled in terms of these regulations to the Environmental Commissioner, the applicant must give registered interested and affected parties access to, and an opportunity to comment in writing on the report.

(3) Reports referred to in sub regulation (2) include-

(a) scoping reports;

(b) scoping reports amended and resubmitted;

(c) assessment reports; and

(d) assessment reports amended and resubmitted.

(4) Any written comments received by the applicant from a registered interested or affected party must accompany the report when the report is submitted to the Environmental Commissioner.

(5) A registered interested or affected party may comment on any final report that is submitted by a specialist reviewer for the purposes of these regulations where the report contains substantive information which has not previously been made available to a registered interested or affected party.

Section 24:

The applicant responsible for an application must ensure that the comments of interested and affected parties are recorded in reports submitted to the Environmental Commissioner in terms of these regulations, and comments by interested and affected parties on a report which is to be submitted to the Environmental Commissioner may be attached to the report without recording those comments in the report itself.

Advertisements

EDITORIAL

The seasonal blabbering has ended. And with that, the public is saved from the bizarre and silly election promises. It also means, rather sadly, that voters will only see politicians in their vicinity again five years from now. But against this background, voting is the most potent weapon any Namibian possesses in setting the national agenda. And despite the obvious weaknesses in our electoral processes, it would be absurd of any registered voter to simply look away on Election Day and not make their democratic voice heard. True, the entire political basket of Namibia is filled with rotten apples, by default in rare cases, but some apples are less rotten than others. The degree of rottenness lies in the eye of the beholder, so it is incumbent upon individuals to decide which devil they would rather have in office. Indeed, the nation is now conscious, especially its army of young people. There will be no rest for the wicked, just like the Lord commanded in the biblical book of Isaiah. Evil-doers will face eternal punishment at the ballot. Those who get voted for this week must accept, with humility, that this is a privilege to serve. Servitude and nothing else. Those who are in it for 'honourable' titles and for the dollar will be ushered through the exit door at the earliest available opportunity. May the best candidates, who genuinely want to serve, win!

CONTACT DETAILS

Tel (061) 383 400
P.O. Box 86829, Eros II
General Murtala Mohammed Road,
Eros, Windhoek

Website: www.namibiansun.com
Email: sun@namibiansun.com

Editor:
Toivo Ndjebela: toivo@namibiansun.com

Sub-Editors:
Herma Prinsloo, Cindy van Wyk

Reporters:
Ellanie Smit, Jemima Beukes, Jana-Mari Smith, Ogone Tlhage

Sport Reporters:
Jesse Jackson Kauraisa, Limba Mupetami

Entertainment Reporter:
Michael Kayunde

Designers:
Aina Mushelenga, Theonistha Kohlman

Rundu:
Kenya Kambowe, 081 7241 044

Ongwediva:
Tuyeimo Haidula, 081 339 3112

Keetmanshoop:
Elizabeth Joseph, 081 836 8036

Otjiwarongo:
Ester Kamati, 081 812 0059

Carmen Stenger/ Marketing and Sales Team Leader
081 239 7664/061 297 2102

Subscriptions:
Ettienne Kotze, ettienne@nmh.com.na
Tel (061) 297 2076

Namibian Sun is a publication of Namibia Media Holdings Pty (Ltd) and is printed by Newsprint Namibia ISSN 1997-4876

ADAMANT: Members of the Affirmative Repositioning movement held a demonstration on the street on which Chief Justice Peter Shivute resides. PHOTO: OGONE TLHAGE

Overnight

Continued from page 1

AR spokesperson Simon Amunime took issue with Shivute's refusal to accept the petition.

"We demanded for the recruitment process to be fair, to be transparent and that we don't have secret interviews. We have written letters to the JSC but to our shock, we were very disappointed [on Saturday] when we expected the Chief Justice to receive our memorandum of understanding and a security guard welcomed us, which was very shocking," Amunime said.

'A clown complains on Twitter'

AR leader Job Amupanda had also questioned why the qualifying requirements for candidates were lowered. The JSC, he said, did not offer an explanation thereto.

"A clown complains on Twitter about the recruitment, and what do they do? The JSC went to issue new requirements so that this Swapo functionary benefits from the new requirements," Amupanda, in apparent reference to the shortlisting of Herunga, said.

"No one can explain to us. How are we supposed to understand it if the JSC itself does not take us into confidence? In fact, as people who are inheriting this country, we don't want to inherit a 'skoroskoro' country," Amupanda said.

"The commission offered us no ears; we have no confidence in the process you undertook," he added.

Potential for interference

AR also questioned the potential of former justice minister Sacky Shanghala interfering in the recruitment process. Shanghala is implicated in two parallel corruption scandals, where he stands accused of having used his office for self-gratification as well as money-laundering.

"If Sacky Shanghala can manipulate Parliament which is a body of 104 people, how about a body of five people? How do we know that Shanghala is not running the JSC from jail?" Amupanda questioned.

The JSC has been given until 27 November to consider AR's new list of demands.

Zambezi

Continued from page 1

The press secretary said it was "pointless" to have these demonstrations when President Hage Geingob is already seized with the matter.

He said the demonstrations were nothing but political.

'Insensitive and inconsiderate'

On Friday, the Zambezi leadership of Swapo held a press conference at which they demanded that Hengari apologises to the nation, particularly to the people of the region, for his comments.

His utterances were deemed insensitive and inconsiderate, given the office he serves.

"We therefore in solidarity with the victims of the cruel and criminal act by the BDF demand that the press secretary in the Office of the President unequivocally withdraws his reckless statement and apologises to the nation and the residents of the Zambezi Region in particular," Swapo regional coordinator for Zambezi, Moffat Sileze, said.

"We feel that his statement was insensitive and inconsiderate towards the situation based on little to no information. It was his duty to calm the situation by assuring the nation that the matter is receiving the utmost from the presidency, as it deserved."

Unapologetic

Hengari told *Namibian Sun* on Saturday that the nation should stop pointing fingers.

"What transpired on 5 November 2020 was tragic for the Nchindo family and the Namibian nation at large.

"We should leave polemics and finger-pointing behind us and allow our two governments to complete the investigations into the killings," Hengari said.

MOFFAT SILEZE

We feel that his statement was insensitive and inconsiderate towards the situation based on little to no information.

The senseless killings

The four fishermen who were gunned down by the BDF are three brothers, Tommy, Martin and Wamunyima Nchindo, as well as their cousin, Sinvula Muyeme, a Zambian national.

The motive behind the killings is still unclear, with allegations that the men were poachers making the rounds.

Relatives and close friends of the deceased, however, have described the men as fishermen who were well respected in their community.

The Nchindo brothers were buried on 17 November at Kamabozu village on the Impalila Island in Zambezi along with their mother, Alphonsina Mubu, who died on 10 November, allegedly from shock. Last week, *Namibian Sun* reported that, according to family member Pasco Sibuko, who went to Botswana to repatriate the men's bodies, five bullets were retrieved from Martin's body, while the other three were each shot twice, mostly aimed near the heart.

kenya@namibiansun.com

'destroyed'

Continued from page 1

Deeply divided

The party went into the 2019 general deeply divided and the final results, where the party lost its two-thirds majority, were largely blamed on internal factionalism.

The ruling party has this year changed its slogan to "We have heard you". Shaningwa denied they did this because they lost votes last year. She said this move was to reiterate that they have always heard the Namibian people.

Fishrot shouts

While addressing the gathering, some party supporters in attendance chanted "Fishrot", much to Shaningwa's annoyance, who challenged those with evidence that the party benefitted from the landmark fishing quota bribery scandal to come forward.

"We don't care about Fishrot money. Some of them also ate Fishrot money. It was eaten by individuals and not the party. If anyone has seen Swapo with that money, come and take out the money you think Swapo has in its coffers," she said.

Don't vote for anarchy

Shaningwa told Namibians to make sure the ruling party does not lose its two-thirds majority in the National Council, saying they voted 'unruly' people into the National Assembly last year. She pleaded with voters to correct the 'mistake' the made.

Swapo enjoyed an overwhelming majority in the National Assembly since 1994 and reached a high of winning 77 out of 96 voting seats in the 2014 election. This changed last year when the ruling party secured only 63 seats.

Shaningwa said those voted into Parliament are frustrating the ruling party's leaders as no bills are being passed and no constructive discussions are taking place. This, she said, because of 'never-ending bickering'.

She said the 'unruly' members of the National Assembly are always busy swearing at the founding president Sam Nujoma, former president Hifikepunye Pohamba and President Hage Geingob.

"These are the people you want to vote to National Council? The mistake we made should not be repeated.

We should feel guilty that our salaries don't commensurate with the work we do. We are in parliament making noise. They just want to cause distractions and come to blame us.

"Don't allow them to get seats. They will be a distraction. We want to work but we are distracted because there is no order in the house," she said.

● PANDEMIC THREATENS ESSENTIAL HEALTH SYSTEMS

Covid undermines HIV, malaria and TB efforts

Disruptions can bring the region back **to 2011 AIDS-related mortality levels.**

JEMIMA BEUKES
WINDHOEK

Service disruptions associated with Covid-19 are impacting global efforts to end the epidemics of HIV, tuberculosis and malaria, says the latest Unaids report.

According to this report, a six-month, 50% disruption in HIV treatment could lead to 300 000 extra AIDS-related deaths in sub-Saharan Africa over a one-year period. Sub-Saharan Africa is a region where 440 000 people died of AIDS-related illnesses in 2019, and disruptions can bring the region back to 2011 AIDS-related mortality levels, Unaids warns.

The report adds that a six-month service disruption in programmes to prevent mother-to-child transmission of HIV could cause new HIV infections among children to increase by 40 to 80% in high-burden countries. On the other hand, the report points out that the HIV response offered a jumpstart to the Covid-19 fight. Lessons to learn from this fight includes the building of political commitment, engaging communities, prioritising research and accountability

CONCERN: Service disruptions associated with Covid-19 are undermining global efforts to end other epidemics. PHOTO: FILE

System disruption

The report also states that the Covid-19 pandemic is not only directly causing high morbidity and mortality, but also disrupts essential systems for health and undermines programmes to address HIV and other global health priorities.

It further points out that as the pandemic underlines the imperative of governments to respect, protect and fulfil human rights, the Covid-19 responses should be grounded in human rights.

"Communities must be at the centre of Covid-19 responses. Communities should build on their existing infrastructure, networks and relationships to expand the delivery of health services, identify vulnerable people and provide them with needed support, document human rights violations and barriers to Covid-19 prevention and healthcare and alert national decision-makers of emerging challenges that must be addressed," the report states.

jemima@namibiansun.com

Revised tourism safety protocols

ELLANIE SMIT
WINDHOEK

The Namibian Tourism Board (NTB) has issued a new version of the Toolkit on Tourism Safety Protocols and Guidelines.

The document can be downloaded from its website and has been reviewed by the United Nations World Tourism Organisation (UNWTO).

According to the revised document, NTB believes that the guidelines and protocols will provide confidence in the country's source markets to travel to Namibia. It is further aimed at allaying any reasonable fears among guests, staff and management that there is concerted awareness and action towards a safe and hygienic working space for the tourism industry. It says that due to the recommendation by UNWTO which was also endorsed by the NTB board, it does not issue any certification stating that any establishment or destination is declared a safe travel destination. Neither does it endorse any business operator or service provider who wishes to be assessed and certified.

It says certification and or endorsement would require constant monitoring of the application of protocol plans and therefore it would need to be clearly specified what is being certified and for what duration. "The responsibility for assessment and certification has been taken on by the health ministry on behalf of the government and it will continue to implement at national level the required protocols and health regulations to which all business and operators in the tourism and hospitality industry must subscribe." It is therefore recommended that establishments place signage with information at the entrance indicating the commitment to complying with coronavirus standard operating procedures to reassure guests. Among the measures further set out for establishments is that the facility may only be occupied to a capacity that would allow compliance with the required social distance between persons in all public areas. Establishments must obtain the full travel history of all customers, the document says. A variety of measures are also stipulated for restaurants, bars and cafes, which include the handling of food. One of the points made in this section is that the use of digital menus with QR codes should be promoted.

At casinos and gambling houses, the document recommends the constant cleaning of machines after every use. The handling of cash should be limited by encouraging e-payment, e-documentation and card payment. Furthermore, measures were set out for tour operators, airports and those involved in logistics, activities and transfer of tourists.

COMMUNITIES ENCOURAGED TO AVOID WILDLIFE CONFLICT

ELLANIE SMIT
WINDHOEK

Environment minister Pohamba Shifeta has encouraged communities to take steps to prevent losses because of human-wildlife conflict.

He was speaking at the inauguration of water infrastructure last week, which has been upgraded at Okonjota village in the Kunene Region to help reduce human-wildlife conflict and improve living standards.

The project was carried out by the environment ministry in collaboration with the German government, through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Shifeta said the ministry recognises that living with wildlife comes at a cost as larger wildlife populations and expanded home ranges into communal and freehold farming areas result in human-wildlife conflict.

"These conflicts are mostly caused by elephants and predators in many areas. This has resulted in livestock and crop losses, damage to infrastructure and loss of human lives."

He stressed that supporting preventive measures in all affected areas remains a priority for the ministry.

REVIEWED: Communities are being helped to avoid conflict with wildlife. PHOTO: NWR

The Kunene project consisted of the rehabilitation and upgrading of 18 boreholes, costing a total of N$7 million.

"The boreholes have been upgraded and rehabilitated for both communities and wildlife (mainly elephants) in order to mitigate the impacts of human-wildlife conflict and improve community livelihoods," Shifeta said.

The water infrastructure will be handed over to the local communities, with support from the agriculture ministry.

The 18 boreholes have been fitted with new solar pumping systems, elephant protection walls and elephant dams.

Additionally, livestock drinking troughs were built and pipelines were extended to provide water to the communities. All these interventions were done to mitigate human-wildlife conflict and contribute to social development of communities. "I would like to remind the conservancies that the human-wildlife self-reliance scheme needs to be maintained with funding generated from wildlife utilisation. This is important to ensure sustainability and continuous mitigation of human-wildlife conflict," Shifeta added.

» Vyf jaar van Geingob in oënskou

Regeringsbestuur: 'Prentjie lyk stroef'

Ondanks onderneemings om regeringsbestuur te verbeter, bestaan daar nog talle leemtes, sê die IPPR.

Denver Kisting

'n Herhaling van die Fishrot-skandaal, die beweerde grootskaalse kaping van Namibiese viskwotas wat die afgelope jaar opspraak wek en twee oudministers agter tralies het, is sonder twyfel moontlik.

Dit is een van die bevindings in 'n verslag oor regeringsbestuur wat Vrydag bekendgestel is.

"Die prentjie lyk stroef."

Só sê mnr. Graham Hopwood, die uitvoerende direkteur van die Instituut vir Openbare Beleidsnavorsing (IPPR), oor die stand van regeringsbestuur in Namibië.

'n Volgende Fishrot-saga is veral moontlik omdat die ministerie van visserye en mariene hulpbronne steeds in geheimhouding gehul is, lui die verslag.

Hy het Vrydag tydens die bekendstelling van die verslag gesê pres. Hage Geingob maak veral sedert 2017 'n groot gewag oor die regering se beweerde politieke verbintenis tot die stryd teen korrupsie toe die Wet op Hokaairoepers en dié op die Beskerming van Getuies in die parlement deurgevoer is.

Maar, maan Hopwood, albei dié wette is steeds nie in werking nie – oënskynlik vanweë begrotingsbeperkings. "Geen fondse is in die nasionale begroting toegeken nie ondanks sprake van die beskikbaarstelling van skeletpersoneel om die kantoor van hokaairoeperbeskerming en die getuiebeskermingseenheid tot stand te bring."

Hiernaas word mooi broodjies gebak oor die omvattende raamwerk wat die verklaring van bates en belange van politici en openbare ampsdraers uiteensit, sê Hopwood. "In 2020 werk die stelsels wat gemoeid is met die verklaring en openbaarmaking van bates en belange nie."

In dié stadium is dit nog net die eertydse minister van finansies en huidige minister van landbou, water en grondhervorming, mnr. Calle Schlettwein, wat reeds twee keer gehoor gegee het aan die "vrywillige stelsel wat vir ministers voorgestel is".

Hopwood sê: "Die stelsel vir LP's is steeds kwalik funksioneel, met vele LP's wat dit nie ernstig opneem nie."

TOEGANG TOT INLIGTING

Hy sê dit het twee dekades geneem vandat wetgewing oor toegang tot inligting voorgestel is totdat 'n wetsontwerp hieroor uiteindelik aan die begin van vanjaar in die Nasionale Vergadering (NV) ter tafel gelê is.

Boonop is die wet steeds nie in werking nie, sê Hopwood. "Ondanks die onlangse vordering om die wetgewing bekend te stel, bly toegang tot inligting 'n reuseprobleem en 'n versperring om 'n kennisgebaseerde samelewing te skep."

'n IPPR-studie in 2017 het bevind nagenoeg 80% van regeringsinstellings reageer nie op basiese versoeke tot inligting nie.

PARTYFINANSIERING

Hopwood sê 'n ander kwelpunt is die finansiering van politieke partye, wat deur onderregulering of géén regulering in die wiele gery word.

Hy sê die Verkiesingskommissie van Namibië (ECN) het tot dusver versuim om met regulasies vorendag te kom wat reëls rondom partypolitieke finansiering sou versterk en sou toesien dat dié liggame die wet gehoorsaam. "Dit het bygedra tot 'n ruimte van politiekepartyfinansiering gekenmerk deur 'n kultuur van nienakoming."

STELSELS, PROSESSE, INSTELLINGS

Die Teenkorrupsiekommissie (ACC) gaan steeds gebuk onder kwessies wat dié liggaam se reputasie, kapasiteit en befondsing betref, lui die verslag.

Dieselfde tekortkominge – veral kapasiteitsuitdagings – kortwiek die werksaamhede van die kantoor van die aanklaergeneraal, sê Hopwood.

Ernstige vertragings het ook 'n negatiewe impak op die werksaamhede van die land se howe, sê hy.

OMSTREDE VERKRYGING

Wat openbare verkryging betref, word dié openbare funksie belemmer deur bewerings van korrupsie, 'n gebrek aan deursigtigheid en nienakoming, sê Hopwood. Hy sê wat uitsonderings op reëls en noodverkryging betref, is gebrekkige deursigtigheid die vernaamste kommer.

HOOP

Die IPPR sê pres. Geingob het steeds die geleentheid tydens sy tweede termyn om as 'n kampioen in die stryd teen korrupsie uit die stryd te tree. Maar, sê Hopwood, korrupte LP's sal uitgeskop moet word en bate- en belangeverklaring sal verpligtend gemaak moet word.

Namibië se eerste Supra-vrou gekroon

Ná maande van intense mededinging is die 23-jarige Chanique Rabe Saterdagaand as die eerste Mej. Supranational Namibië bekroon.

Saam met dié gesogte titel stap sy weg met pryse ter waarde van N$350 000, gratis stilering vir 'n jaar en vervoerdienste wat deur BMW verskaf sal word. Sy sal Namibië volgende jaar by die internasionale Mej. Supranational-skoonheidswedstryd in Pole verteenwoordig, waar sy teen 76 ander dames sal meeding om dié titel, wat van dieselfde kaliber as die Mej. Wêreld en Mej. Heelal-titels beskou word.

Die top drie. Van links is Monique Smith (naaswenner), Chanique Rabe (wenner) en Andeline Wieland (tweede prinses). FOTO MARISELLE STOFBERG

Chanique is ook as die "vrou van substansie" aangewys. Nadja Breytenbach, wat Namibië in 2019 in Pole verteenwoordig het, het die kroon aan haar oorhandig.

Monique Smith is as die naaswenner aangewys, en sal Chanique se plek inneem indien sy om enige rede nie haar verpligtinge as Mej. Supranational Namibië kan nakom nie. Andeline Wieland was die tweede prinses en Ashleigh Kleintjies is as Mej. Debutante aangewys.

Antigeen-toetse vir reisigers na SA beskikbaar

Antigeen-toetse om die coronavirus op te spoor, is volgens die Suid-Afrikaanse regering se inligtingsdiens (GCIS) by alle grensposte na die land beskikbaar.

Dié toetse, wat van teenliggaamtoetse verskil, wys die teenwoordigheid van 'n spesifieke virale antigeen wat daarop dui dat iemand 'n virale infeksie onder lede het.

Die voordeel van sulke toetse bo dié van die polimerasekettingreaksie-(PCR) toetse, waar monsters uit iemand se keel of neus geneem word, is dat die resultate binne 15 minute beskikbaar is.

Luidens 'n verklaring deur GCIS is dié toetse by grensposte beskikbaar gestel ten einde vlak 1-reisregulasies in die buurland toe te pas.

Hiervolgens moet reisigers na Suid-Afrika wat nie 'n gesertifiseerde negatiewe PCR-toets vir Covid-19 het nie, eers getoets word voordat hulle die land mag binnekom. Die negatiewe toetsuitslag mag nie ouer as 72 uur wees nie.

Volgens die Suid-Afrikaanse regering beskik sommige van sy buurlande, onder meer Lesotho, nie oor die vermoë om PCR-toetse vir alle reisigers na Suid-Afrika te doen nie.

Antigeentoetse maak dit moontlik om die invloei van reisigers sonder gesertifiseerde PCR-toetse tydig in die buurland te bestuur. Teen R150 en R170 is antigeentoetse veel goedkoper as PCR-toetse. Die koste van die toets moet deur die reisiger gedra word. As die toets negatief is, mag die reisiger na die ingangspunt beweeg.

As die uitslag positief is, moet die reisiger onder kwarantyn geplaas word by 'n aangewese kwarantyngerief vir daardie grenspos. Reisigers sonder 'n gesertifiseerde PCR-toets wat weier om die antigeen-toets te laat doen, sal toegang tot die land geweier word en na 'n aangewese kwarantyngerief moet gaan.

Alle reisigers moet waar moontlik steeds 'n PCR-toets laat doen binne 72 uur voor hul vertrek of aankoms by 'n grenspos in Suid-Afrika.

– Sanews.gov.za; netwerk24

Biochar hou belofte vir land in

» Inligtingsdag lok boere van ver

Plaaslike navorsing oor biochar word tans deur verskeie partye gedoen oor die moontlikhede om gewasse se oeste te verbeter.

› Elvira Hattingh

'n Demonstrasie van hoe biochar in die grond ingewerk word by die Charcoal Village. FOTO VERSKAF

Biochar, wat tans internasionaal baie aandag geniet, kan boere help om by klimaatsverandering aan te pas deur die grond se eienskappe te verbeter.

So kan dit gewas-oeste verbeter en boere meer veerkragtig teen droogtes wees.

Dit was die boodskap tydens 'n biochar-inligtingsdag wat onlangs by die Charcoal Village by Otjiwarongo aangebied en wat deur boere van so ver as Kavango-Oosstreek bygewoon is.

Die dag is deur die Namibië Houtskoolvereniging (NCA) saam met sy susterverenigingdie Namibia Biomass industry Group (N-BiG) asook die Namibië Universiteit van Wetenskap en Tegnologie (Nust) aangebied.

Dit het die steun van die Duitse GIZ se Bush Control and Biomass Utilisation-projek geniet, wat die ontwikkeling van waardekettings uit die volhoubare oes van indringerbos ondersteun.

By die inligtingsdag het boere praktiese inligting oor die nodige stappe vir die produksie en gebruik van biochar ontvang, wat insluit die voorbereiding van die hout, hoe die brand- en blusproses werk, die voorbereiding van die biochar met voedingstowwe en mikro-organismes en hoe dit in die grond ingewerk moet word.

Daar is gewys biochar kan met verskillende tegnologieë en met verskillende grootte stowe gemaak word sodat dit by boere se individuele behoeftes aanpas.

Afgesien daarvan dat biochar met organiese materiaal soos hoender- of beesmis gemeng kan word, het Nust getoon meer innoverende metodes is ook gepas en dit met klei en gips gemeng.

Biochar is 'n vorm van swart koolstof wat soortgelyk, maar ook beslis verskillend van houtskool is, sê die NCA.

"Dit het 'n groot binne-oppervlak, wat dit in staat stel om water, voedingstowwe asook giftowwe soos 'n spons op te neem.

"Internasionaal word biochar oor die algemeen in beide gewas- en veeboerdery gebruik om die grond, diere se gesondheid, asook die verwydering van koolstof uit die lug te verbeter.

"Plaaslik word dit van fyn- tot mediumgrootte takke van bosse gemaak, wat gewoonlik te grof is om boskos van te maak, maar ook te klein vir houtskool is.

"Biochar word eenmalig in die grond ingewerk en kan vir honderde jare in die grond voorkom, wat beteken dit kan boere help om op kunsmis te bespaar," het die NCA verduidelik.

Navorsing oor biochar word tans deur onderskeie plaaslike verenigings, asook Nust se Bush-projek gedoen. Die strewe is om vas te stel wat die moontlikhede van biochar is om gewasse se oeste te verbeter, asook om dit in boskos te gebruik.

"Die universiteit is besig om toetsgeriewe op die been te bring waar basiese laboratoriumontleding van biochar vir die publiek gedoen kan word," sê dr. Ibo Zimmermann, hoofnavorser vir biochar in Nust se Bush-projek.

- elvira@republikein.com.na

Swart Vrydag vs. Kuber-Maandag

Die immergewilde Swart Vrydag vind eerskomende Vrydag plaas en elke ywerige koper gaan op die uitkyk wees vir reusespesiale aanbiedinge en hul voorberei op die grootste winskopies van die jaar.

Daar is egter nog 'n dag wat te midde van al die inkopiewaansin opgeduik het: Kuber-Maandag.

So, wat is Kuber-Maandag en hoekom moet ons daaraan aandag gee?

Kuber-Maandag vind op die eerste Maandag ná Swart Vrydag plaas (met ander woorde die eerste Maandag na Dankseggingsdag in Amerika) en dit is die beste tyd om aanlyn winskopies uit te snuffel.

Dit is 'n dag wat deur kleinhandelaars geskep is om mense aan te moedig om aanlyn te koop.

Die Nasionale Kleinhandelsvereniging het hierdie bemarkingsterm op 28 November 2005 begin gebruik in 'n mediaverklaring van shop.org wat verduidelik het Kuber-Maandag was vinnig besig om een van die grootste aanlyn inkopiedae van die jaar te word.

Daar is nie 'n beter manier om tuis te bly, die lang toue in die winkels te vermy en steeds die beste winskopies te kry nie.

Maar watter een is die beste keuse: Swart Vrydag of Kuber-Maandag?

Volgens *Business Insider* is Swart Vrydag 'n beter tyd om groot items te koop, terwyl Kuber-Maandag beter is vir tegnologiese winskopies en kleiner geskenke te koop.

Jy sal ook beter spesiale aanbiedinge aanlyn teëkom.

Volgens Adobe Analytics het Kuber-Maandag se transaksies in 2019 US$3,1 miljard beloop, met 'n rekord aanlyn verkope van US$9,4 miljard.

Vanjaar vind Kuber-Maandag op 30 November plaas en as jy van plan is om hierdie inkopiedag te benut, kan jy altyd jou gunstelinghandelaars op sosialemedia-platforms volg om op hoogte te bly van spesiale aanbiedinge. Jy kan selfs 'n toep – wat pryse vergelyk, gebruik om te sien watter kleinhandelaars die beste pryse op dié groot inkopiedag aanbied.

Die belangrikste aspek van Swart Vrydag of Kuber-Maandag is om altyd binne jou begroting te probeer bly en om versigtig te wees vir kredietkaart- en identiteitsbedrog.

FOTO TER ILLUSTRASIE FREEPIK

Site Notice


invited to register as an interested and affected party with Geo Pollution Technologies. Registration provides you with an opportunity to submit comments, issues or concerns related to the facility, for consideration in the environmental assessment. Please send your written registration or comments to:
Fax: 088-62-6368
E-mail: gpt@thenamib.com
Should you require any additional information please contact Geo Pollution Technologies at 061-252411.
Registration and comments should reach us by 30 November 2020.
Thank you in advance.
Yours sincerely,
Geo Pollution Technologies
GEO Pollution Technologies
PUBLIC NOTICE:
ENVIRONMENTAL ASSESSMENT FOR IRRIGATION ACTIVITIES ON THE FARMS ANABOOM, OHLSENHAGEN AND ESCOURT
GOBABIS DISTRICT
Project: Irrigation Activities on the Farms Anaboom, Ohlsenhagen and Escourt, Gobabis District
Proponent: Mr. P de Wit


Beter
mark.
waarde.
vennoot.
Kontak Pieter 081 128 9716
Beefmaster

Appendix E: Consultants' Curriculum Vitae

ENVIRONMENTAL ASSESSMENT PRACTITIONER **Quzette Bosman**

Quzette Bosman has 14 years' experience in the Impact Assessment Industry, working as an Environmental Assessment Practitioner and Social Assessment practitioner mainly as per the National Environmental Legislation sets for South Africa and Namibia. Larger projects have been completed in terms of World Bank and IFC requirements. She studied Environmental Management at the Rand Afrikaans University (RAU) and University of Johannesburg (UJ), including various Energy Technology Courses. This has fuelled a passion towards the Energy and Mining Industry with various projects being undertaken for these industries. Courses in Sociology has further enabled her to specialize in Social Impact Assessments and Public Participation. Social Assessments are conducted according to international best practise and guidelines. Work has been conducted in South Africa, Swaziland and Namibia.

CURRICULUM VITAE QUZETTE BOSMAN

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	QUZETTE BOSMAN
Profession	:	Social Impact Assessor / Environmental Assessment Practitioner
Years' Experience	:	14
Nationality	:	South African
Position	:	Senior Environmental Consultant
Specialisation	:	ESIA & ESMP; SIA
Languages	:	Afrikaans – speaking, reading, writing – excellent English – speaking, reading, writing – excellent German –speaking - fair

First Aid Class A	EMTSS, 2017
Basic Fire Fighting	EMTSS, 2017

EDUCATION AND PROFESSIONAL STATUS:

BA	Geography & Sociology	:	Rand Afrikaans University, 2003
BA	(Hons.) Environmental Management	:	University of Johannesburg, 2004

PROFESSIONAL SOCIETY AFFILIATION:

Namibian Environment and Wildlife Society
International Association of Impact Assessors South Africa (IAIA SA)
Member 2007 - 2012
Mpumalanga branch Treasurer 2008/2009

OTHER AFFILIATIONS
Mkhondo Catchment Management Forum (DWAF): Chairperson 2008-2010
Mkhondo Water Management Task Team (DWAF): Member 2009

AREAS OF EXPERTISE:

Knowledge and expertise in:

- environmental impact assessments
- project management
- social impact assessment and social management planning
- community liaison and social monitoring
- public participation / consultation, social risk management
- water use licensing
- environmental auditing and compliance
- environmental monitoring
- strategic environmental planning

EMPLOYMENT:

2015 - Present	:	Geo Pollution Technologies – Senior Environmental Practitioner
2014-2015	:	Enviro Dynamics – Senior Environmental Manager
2010 - 2012	:	GCS – Environmental Manager (Mpumalanga Office Manager)
2007 - 2009	:	KSE-uKhozi - Technical Manager: Environmental
2006 -2007	:	SEF – Environmental Manager
2004 - 2005	:	Ecosat – Environmental Manager

PUBLICATIONS:

Contract reports	: +180
Publications	: 1