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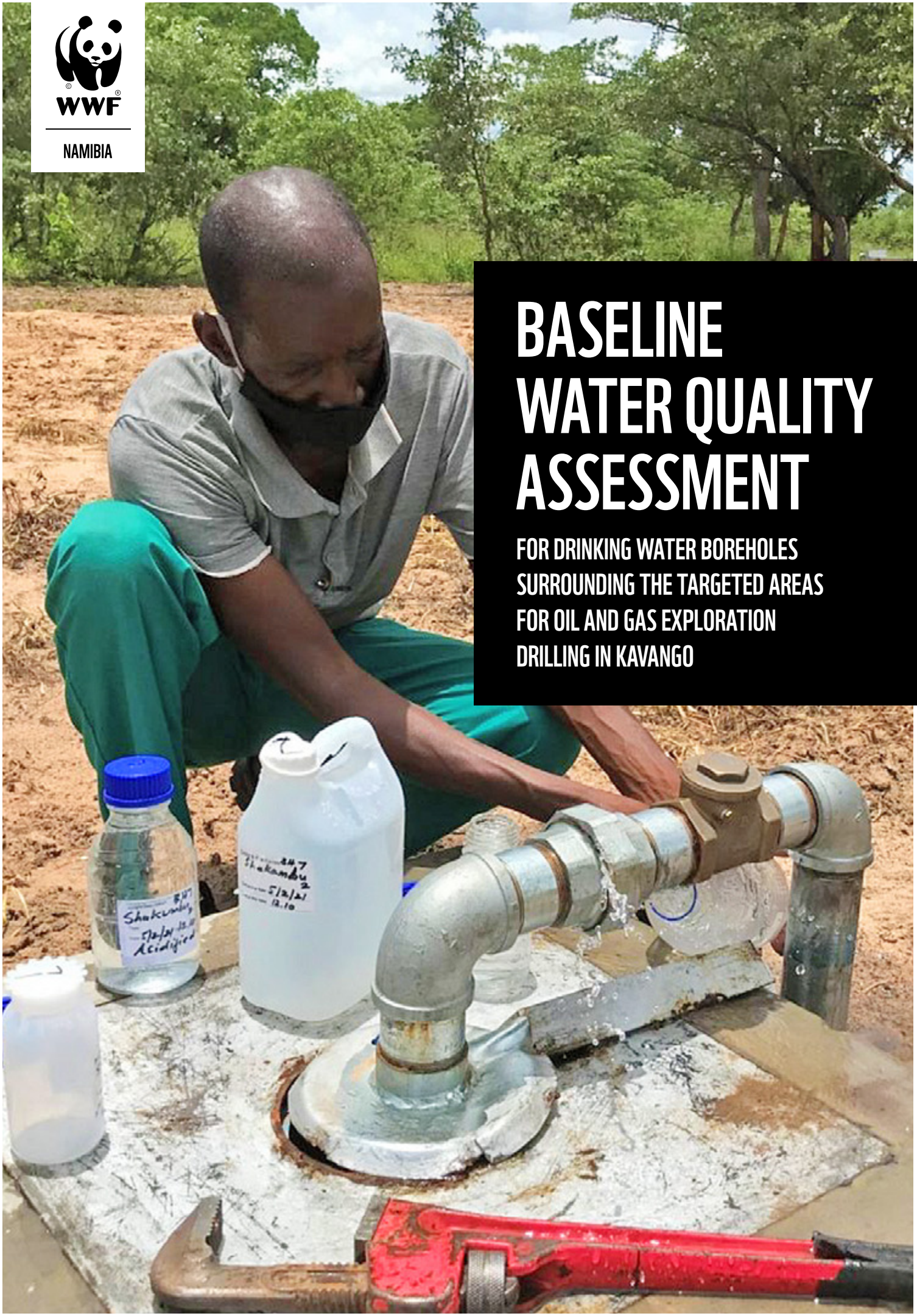

BASELINE WATER QUALITY ASSESSMENT

FOR DRINKING WATER BOREHOLES SURROUNDING THE TARGETED AREAS FOR OIL AND GAS EXPLORATION DRILLING IN KAVANGO

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CONTENTS

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EXECUTIVE SUMMARY

The Canadian based company, Reconnaissance Africa (ReconAfrica) holds licences for oil and gas exploration in a large part of north-east Namibia, an area that overlaps with the Southern African Development Community (SADC) Region's Kavango-Zambezi (KAZA) Transfrontier Conservation Area. In January 2021, ReconAfrica started drilling the first of two permitted stratigraphic holes. Both exploration sites are surrounded by local farmers, who are completely reliant on groundwater for their livelihoods. Maintaining groundwater levels and the original groundwater quality is thus essential for the health and wellbeing of residents in this area.

WATER QUALITY RESULTS SHOW THAT NONE OF THE COMPOUNDS TYPICALLY ASSOCIATED WITH CONTAMINATION FROM OIL AND GAS EXPLORATION ACTIVITIES WERE PRESENT PRIOR TO DRILLING ACTIVITIES.

This report provides an independent pre-drilling assessment of groundwater quality in used boreholes surrounding the drill sites, so as to establish a baseline that can act as a reference for future studies and monitoring. Should any contamination occur from the stratigraphic holes or a fully developed well-field in the future, results in this report can also be used as evidence to hold the company accountable.

Oil and gas stratigraphic holes 6-1 and 6-2 are found within the Omatako river basin, but slightly out of the active zone of the Omatako River. They are, therefore, drilled in areas where rain will pool on the surface, filter into the ground and flow into the aquifer below. Groundwater in this region is tapped from depths of 40 to 60 metres or less from porous aquifers associated with the Kalahari Sequence.

Both the scientific literature and the ReconAfrica Environmental Impact Assessment (EIA) point to groundwater contamination risks from oil and gas exploration as well as later extraction processes. The ReconAfrica EIA clearly lists thirteen potential negative impacts on surface and groundwater – with aquifer pollution risks, negative impacts due to contaminated water discharge, oil tank bursts and/or pipe breaks, and the impacts from backwash water considered to be of medium to high risk. Hence mitigation measures against these risks are included in the Environmental Management Plan (EMP), which includes a recommendation to monitor groundwater levels and quality on a bi-annual basis and make results available to surrounding residents.

Furthermore, the EIA does state that "A detailed assessment of the surface and groundwater situation within the project area is highly recommended."

WWF strongly agrees with both the EIA recommendation and the EMP requirement to regularly sample groundwater quality around exploration and extraction sites. This report forms the baseline for future monitoring and more detailed assessments.

The authors of this report believe that the risks of increased salinization, impacts due to disrupted groundwater flow/pathways, and impacts due to elevated or reduced groundwater levels should have received a higher risk rating, which would have resulted in mitigation measures being included in the EMP.

It needs to be noted with concern that ReconAfrica drilling practices do not appear to be adhering to some of the mitigation recommendations in their own EMP that would minimize groundwater contamination risk. This makes regular groundwater quality monitoring crucial.

Beginning in February 2021, while drilling activities had halted at Drill Site 6-2, WWF commissioned Water Associates Namibia to sample water quality at eight boreholes surrounding the two drill sites. Sampling was done according to strict protocol and with the cooperation of the Directorate of Water Supply and Sanitation Coordination (DWSSC) within the Ministry of Agriculture, Water and Land Reform (MAWLR).

A water quality and health risk expert analysed the water quality results. All boreholes sampled were below detection limits for Gasoline Range Organics and Total Petroleum Hydrocarbons, Polycyclic aromatic hydrocarbons, chlorinated compounds and phthalates as well as Polar Compounds. It proves that none of the compounds typically associated with contamination from oil and gas exploration activities were present prior to drilling activities.

Forty-five dissolved metals were included in the analyses and three metals – namely, calcium, sodium and vanadium – were found naturally to be over drinking water limits in some boreholes, although not by significant amounts. These have no relation to oil and gas drilling.

A standard physico-chemical water quality analysis was also conducted in order to characterize the groundwater, giving it the equivalent of a cation-anion fingerprint, against which changes over time can be monitored.

The physico-chemical analysis also allowed the groundwater sampled from the boreholes to be classified. Water from six of the eight boreholes had calcium bicarbonate waters, typical of shallow fresh ground water. It means that the boreholes immediately surrounding the drill sites 6-1 and 6-2 are tapping into groundwater that infiltrates from the surface during rainfall events.

The report contains an information section that explains the typical health impacts that could be expected if any groundwater contamination were to occur from gas exploration and oil recovery. People may be exposed to gas or oil in the environment through inhalation of volatile compounds, ingestion of contaminated water, food and dust, and through dermal absorption while washing and bathing.

THE FOLLOWING RECOMMENDATIONS ARE PROPOSED:

1. **Independent biannual or triannual water quality and water level sampling should continue at the eight boreholes.** The sampling network should be expanded in line with drilling activities. This should include the monitoring of the mud pit activities and any other point source contamination or pollution incidents.
2. **ReconAfrica are obliged to carry out its own monitoring**, in accordance with the Environmental Management Plan.
3. **In line with EIA recommendations, a detailed assessment of the surface and groundwater situation is essential.** This includes transmissivity assessments to estimate the length of travel time of any possible pollutants arising from the exploration activities, which may affect existing groundwater sources.
4. **The process of plugging all exploration holes and sealing any aquifers should be monitored** to ensure that standard industry procedures have been followed where appropriate. This review should be undertaken by independent, technically qualified experts so that the possible impact on the groundwater resources can be assessed.
5. **New boreholes drilled by ReconAfrica will be handed over to the community upon the conclusion of the exploration**. This process should be carried out through official channels after demonstration that the boreholes meet the national physical and micro-biological potable water quality standards. ReconAfrica should fully fund equipment and operating expenses for a minimum two-year regular sampling programme post exploration to ensure that post drilling pollutants are not evident.
6. **Independent institutions with a watchdog function should keep in regular contact with the Ministry of Environment, Forestry and Tourism** as the leading regulatory body, supported by the Ministry of Mines and Energy and the Ministry of Agriculture, Water and Land Reform as part of their regulatory responsibilities. Independent watchdog institutions should contribute expertise and information to any technical committee, which will be formed to coordinate the review and monitoring of activities, especially for the compliance actions identified in the EIAs and incorporated in the EMPs.

1. BACKGROUND TO THE GROUNDWATER QUALITY BASELINE ASSESSMENT

MANY OF NAMIBIA'S INHABITANTS FULLY DEPEND ON GROUNDWATER FOR DRINKING AND ECONOMIC ACTIVITIES, INCLUDING AGRICULTURE.

1.1 OIL AND GAS EXPLORATION IN NAMIBIA

There has been significant, renewed interest in Namibia's oil and gas industry in recent years, including the entrance of international oil companies, such as BP, Repsol, Petrobras and HRT. The number of exploration licences has increased noticeably from 11 in 2007 to over 30 in 2018. A press release from ReconAfrica and the Namibian Ministry of Mines and Energy on 15 April 2021 announced a potential working petroleum system onshore in the Okavango basin and as such increased exploration activities can be expected in that area going forward.

Reconnaissance Energy Namibia (Pty) Ltd a subsidiary of Reconnaissance Energy Africa Ltd (ReconAfrica) has obtained an exploration licence for oil and gas in Kavango East and West in north-eastern Namibia. The area where the exploration activities are taking place has numerous conservation areas, including national parks, conservancies, and community forests. The area is inhabited by rural communities most of which are subsistence farmers relying on cropping and livestock production. The exploration area also overlaps with the KAZA Transfrontier Conservation Area, undersigned by the governments of Angola, Botswana, Namibia, Zambia and Zimbabwe.

The present oil and gas exploration activities of ReconAfrica includes the drilling of two permitted stratigraphic holes to a depth of approximately 2.5 to 4 km underground. The diameter of the holes is basically 18 inches (45 cm) with steel casings in an attempt to minimize groundwater contamination.

Given the public announcements since 15 April 2021, it can be expected that both the Namibian government and ReconAfrica will motivate for exploration to increase.

1.2 EXPLORATION IN AN ARID AND ECOLOGICALLY SENSITIVE AREA

Namibia is the most arid country south of the Sahara and many of its inhabitants fully depend on groundwater for drinking and economic activities, including agriculture. This is also true for the local inhabitants within the licenced exploration area.

Groundwater is found in porous, permeable rocks (aquifers) that often lie close to the Earth's surface. In contrast, most of the largest oil and gas deposits are found many thousands of metres below the surface. As a result, oil and gas production involves drilling through aquifers to access the oil and gas further down. Oil and gas exploration activities can lead to contamination of groundwater from leaks due to well-casing blowouts, corrosion, or deterioration with age. Surface spills usually occur from pipelines, operations lines, and transmission piping where the oil, produced water or other chemicals seep into the ground and impact groundwater (Jackson et al., 2013).

Groundwater protection methods and emerging technologies play an important role in protecting human health and the environment at oil and natural gas production sites and they need to be applied by ReconAfrica to safeguard against the contamination of the scarce and essential groundwater resources in the Kavango region.

If indeed oil and gas resources are found, it is important that a detailed geohydrological and water quality assessment study be undertaken in the areas currently under exploration in Kavango.

1.3 WATER QUALITY BASELINE STUDY OBJECTIVE

Within the KAZA TFCA water is an important ecosystem service relevant to the extractive industries sector. The challenge is that the extractive industry sector may have severe impacts on biodiversity and ecosystem services at different temporal and spatial levels. These activities may compromise vital ecosystem services and have far-reaching impacts on other major economic activities such as tourism and agriculture, especially in the vicinity of Protected Areas and other key biodiversity areas.

The objective of this study is to provide a brief and independent pre-drilling assessment of the current groundwater quality of used boreholes in the vicinity of the drill sites, so as to provide a baseline that can act as a reference for future studies and monitoring. Should any contamination occur from the stratigraphic wells or a fully developed well-field, this information can also be used as evidence and should be able to hold the company liable. Having this information at hand aims to increase the pressure on the company to adhere to appropriate practices and take water related risks seriously.

The scope of the work included:

- **Basic desktop assessment of existing community production boreholes** and, where possible, estimate the water use in the vicinity of the drilling well-field;
- **Identification and Hydrocensus** (taking water quality samples and recording of borehole details of nearby boreholes in use around the well fields); and
- **Sampling of at least four boreholes** where possible within about a 30km radius around each drill site and analysis of the standard national drinking water quality parameters as well as components that may be associated with oil and gas extraction processes.

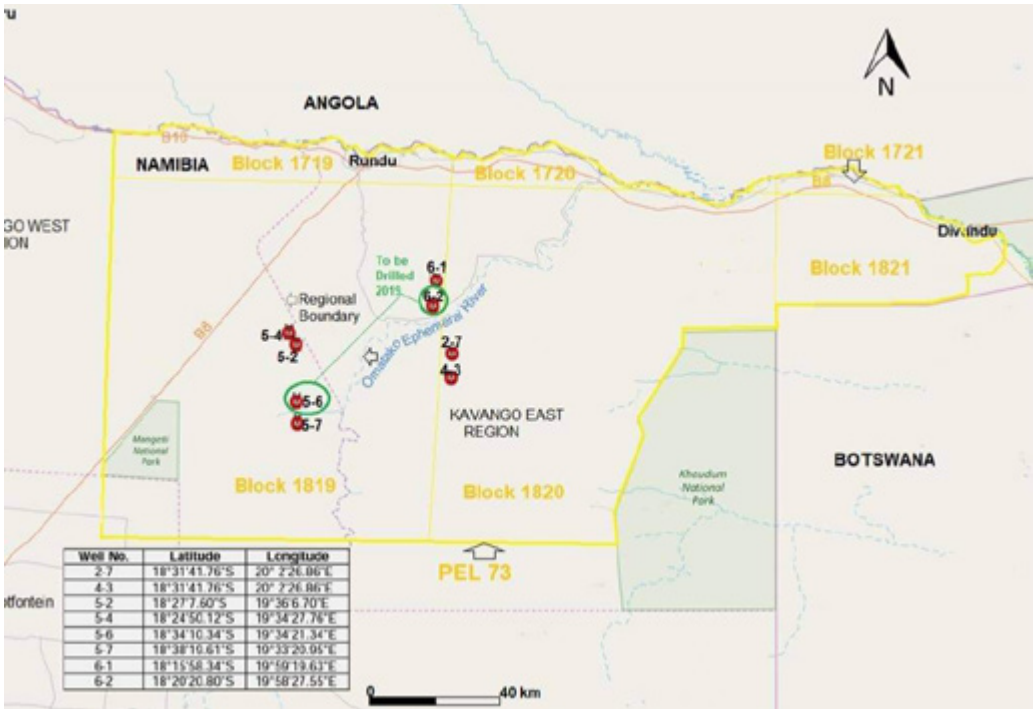
2. RECONNAISSANCE AFRICA: ENVIRONMENTAL IMPACT ASSESSMENT

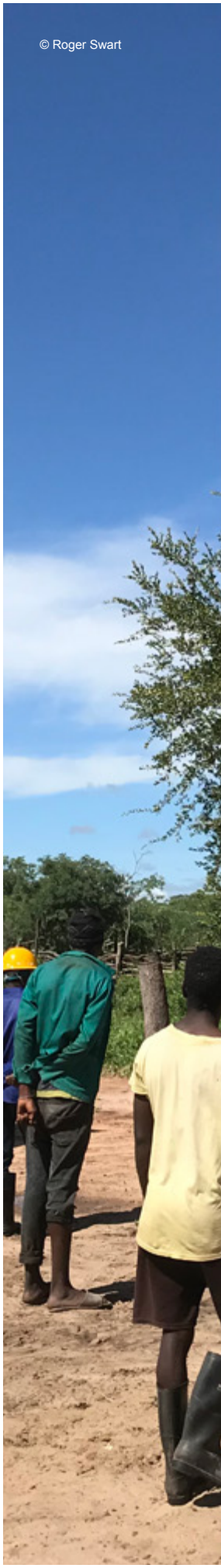
ReconAfrica published a commissioned final Environmental Impact Assessment (EIA) report in June 2019. The three-volume assessment was submitted to apply for an Environmental Clearance Certificate with the Ministry of Environment, Forestry and Tourism in support of an existing petroleum exploration licence (No. 73) issued by the Ministry of Mines and Energy.

A total of eight potential drill sites are demarcated in the EIA, and two (Site 5-6 and site 6-2) are demarcated in the EIA as the two chosen drill sites. ReconAfrica's original intention was to commence the drilling at Site 5-6 as shown on Figure 1 but it is understood that they moved to Site 6-2 due to access difficulties and drilling activities now continue at 6-1.

Annex 4 of the EIA explains that drill sites 6-1 and 6-2 fall into the Omatako basin, but slightly out of the active zone of the Omatako River. They are thus in areas of potential surface water ponding, infiltration, and groundwater through flow into the unconfined aquifer below. The two ReconAfrica drill sites are surrounded by human settlements and their water supply is tapped from porous aquifers associated with the Kalahari Sequence (Christelis and Struckmeier, 2001).

Figure 1 - Sites of ReconAfrica Exploration Wells





Annex 4 of the EIA gives a detailed description of the possible negative impacts of the surface and groundwater resources. The main report draws on Annex 4 and identifies thirteen impacts that are summarized below:

1. Aquifer pollution vulnerability.
2. Increased risk of flooding.
3. Impacts due to contaminated water discharge.
4. Impacts due to oil tank bursts and/or pipe breaks.
5. Impacts due to vehicle fuel leaks.
6. Impacts due to backwash water.
7. Impacts due to loss of drainage area.
8. Impacts due to increased or reduced runoff.
9. Impacts due to drainage pattern disturbances.
10. Impacts due to increased suspended loads.
11. Impacts due to increased risk of salinization.
12. Impacts due to disrupted groundwater flow/pathways.
13. Impacts due to elevated or reduced groundwater levels.

The EIA report concluded that most of the risks of impact were moderate to negligible so long as the proposed mitigation measures were adhered to. However, the report also acknowledged that impacts 1, 3, 4 and 6 above should be included in the associated Environmental Management Plan (EMP) due to the possible high to moderate impacts.

The report considered that long-term and cumulative impacts of the exploration activities are limited but recommended that each stratigraphic hole should be properly controlled at the top or totally plugged once the site work is completed, depending on the outcome of the exploration results. The plugging recommendation (and the sealing of aquifers) is in keeping with the industry practice (Allison and Mandler, 2018), which ReconAfrica must follow for each exploration hole.

The EIA itself recommends an assessment of surface and groundwater situation in the targeted sites:

"Project falls within the rural, communal areas where water supply is provided by the Directorate of Water Supply and Sanitation Coordination within the Department of Water Affairs (DWA) in the Ministry of Agriculture, Water and Land Reform (MAWLR). In private commercial farmland, individual farm owners provide for all their water needs through the application for abstraction permits from the Department of Water Affairs. **A detailed assessment of the surface and groundwater situation within the project area is highly recommended.**" Reconnaissance Energy Namibia Final EIA report Volume 2 of 3.

3. ENVIRONMENTAL MANAGEMENT PLAN

As part of the Environmental Impact Assessment (EIA) report from 2019, ReconAfrica included an Environmental Management Plan (EMP) as the third volume. The EMP describes the mitigation measures that should take place to provide an effective management/protection of the surface and groundwater resources, including the general water resources usage during the exploration phase (Table 3.11 in EMP report, here displayed as Table 1).

Many of the mitigation measures are designed to minimize the water usage on the drill sites. The report identifies that wastewater discharges to any ephemeral river channel (public stream) are prohibited.

Where water boreholes should be drilled to supply the drill sites, permission (abstraction licences) is required from the appropriate authorities such as the Ministry of Agriculture, Water and Land Reform (MAWLR) and from land owners (communities).

Finally, a groundwater monitoring system is recommended to be established during and after exploration activities take place, and full access to the results must be shared with the affected communities and landowners. Recommendations 4, 10, 11 and 12 do not appear to have been followed to date.

Table 1 – Mitigation measures for surface and groundwater protection as well as general usage

OBJECTIVE	MITIGATION MEASURES	SCHEDULE	RESPONSIBILITY
Effective management / protection of surface and groundwater resources and general water resources usage	1. Always use as little water as possible. Reduce, reuse and re-cycle water where possible. 2. All leaking pipes / taps must be repaired immediately they are noticed. 3. Never leave taps running. Close taps after you have finished using them. 4. Never allow any hazardous substance to soak into the soil. 5. Immediately tell your Contractor or Environmental Control Officer / Site Manager when you spill, or notice any hazardous substance being spilled during the fieldbased exploration activities or around the camp site. 6. Report to your Contractor or Environmental Control Officer / Site Manager when you notice any container, which may hold a hazardous substance, overflow, leak or drip. 7. Immediately report to your Contractor or Environmental Control Officer / Site Manager when you notice overflowing problems or unhygienic conditions at the ablution facilities. 8. No washing of vehicles, equipment and machinery, containers and other surfaces. 9. Limit the operation to a specific site and avoid sensitive areas and in particular the Ephemeral River Channel. This would sacrifice the actual area for other adjacent Ephemeral River areas and thus minimise any likely negative effect on water resources. 10. Disposal of wastewater into any public stream is prohibited. 11. The Proponent must obtained permission of the land owners before utilising any water resources or any associated infrastructure. 12. If there is a need to drilling a water borehole to support the exploration programme the proponent (Proponent) must obtain permission form the land owner and Department of Water Affairs in the Ministry of Agriculture and Forestry. In an event of discovery of economic minerals resources, the sources of water supply for the mining related operations will be supplied by NamWater. 13. If there are any further (larger scale) exploration/drilling activities and/or mining activities to follow from the initial planned drill holes, groundwater monitoring must be implemented to include water level monitoring and also water sampling on a bi-annual basis. In order to have greater transparency on the water monitoring activities, the affected landowners / farmers must be given full access to the results of the water monitoring analyses.	(i) Regional reconnaissance field-based mapping and sampling activities. (ii) Initial local fieldbased mapping and sampling activities. (iii) Detailed local field-based activities such as local geological mapping, geochemical mapping and sampling, trenching and drilling of closely spaced boreholes and bulk sampling. (iv) Prefeasibility and feasibility studies.	(i) Proponent's Representative (PR) (ii) Project Manager (PM) (iii) Project HSE (iv) Contractor (v) Subcontractors

4. DETERMINATION OF THE FIELD WATER QUALITY SAMPLING NETWORK

Water Associates Namibia (Pty) Ltd (WAN) were appointed on 1 February 2021 to carry out a baseline water quality assessment for drinking water boreholes surrounding the targeted areas for oil and gas exploration drilling in Kavango, Namibia.

The first drilling site (known as Drill Site 6-2) was not operational (i.e. drilling taking place) during the field visit that commenced on 3 February 2021. It is believed that the drilling had reached 900m below ground at that time, with the intention of drilling to a target depth of 3810 metres. The location of Drill Site 6-2 can be found in Figures 1 and 4.

A second drilling site (known as Drill Site 6-1) was being prepared during the field visit and this site was located nearby and to the northeast of Drill Site 6-2 (see Figure 4). The determination of the water quality sampling network needed to take account of the exploration activities that were already in progress at Drill Site 6-2 and the future Drill Site 6-1.

Figure 2 – Unlined mud Pit at Drill Site 6-2

Figure 3 – Unlined Mud Pit at Drill Site 6-1

Therefore, a number of observations were made concerning the EIA and EMP before the water quality sampling network size and location could be determined. These were as follows:

- **Impacts 1, 3, 4 and 6 were still of particular concern** but impacts 11,12 and 13 should also have been escalated to higher levels of impact;
- **The unlined mud pit adjacent to Exploration Hole 1 and the future Exploration Hole 2 sites and their impact on the unconfined groundwater aquifer, which is currently used for water supplies, are of particular concern** (see Figures 2 and 3);
- **There is no evidence of the containment of any wastewater effluents** arising from the exploration sites;
- **It is understood that two water supply boreholes have been drilled** on each of the two exploration sites and it is confirmed by the Minister of MAWLR on 26 May 2021 that no permits for drilling boreholes for exploration and abstraction had been granted to date. Unregulated abstractions could lower the groundwater table in the surrounding areas of the two exploration sites;
- **There was no evidence that a groundwater monitoring network has been established** around the exploration sites, which should have been put in place before any exploration activities began; and
- **The process of plugging and sealing any aquifers did not yet apply** at the time of sampling, since ReconAfrica was still drilling at site 6-2. ReconAfrica confirms the hole is now capped, but no specifications are given. Standard industry procedures should be followed where appropriate.

Considering the risks identified in the EIA and the mitigation measures contained in the EMP, the WAN field team developed the following approach to determine the establishment of the field water quality sampling network.

- **The sampling protocols** provided by Analytical Laboratory Services in Windhoek were followed by the Field Team, including the specified conditions of sample shipment to the laboratory from Rundu, Kavango East (Annex 1);
- **The sampling methods and protocols** given in the publication by Weaver et. al. (2007) were also followed by the Field Team where applicable. This was done in addition to completing Field Testing Forms (Annex 2), Sample Submission Forms (Annex 3) and the signed Chain of Custody Record (see Annex 4);
- **A total of eight borehole sites were monitored** and the locations are shown on Figure 4. The sampling of eight sites was based on the proximity of the existing boreholes identified during the site visit, and included both community borehole sites supported by DWSSC where historical data was available and private sites at farmsteads;
- **Sampling was carried out** at each borehole at the head discharge pipe;
- **The Field Team consulted** with the Directorate of Water Supply and Sanitation Coordination (DWSSC) within MAWLR at all levels of the organisation and particularly with the Kavango East Regional office. The regional office seconded Bonifatius Kasher, who has invaluable local experience particularly of the location of all the public and private borehole sites in the area of interest, to the Field team; and
- The Field Team also visited the local NamWater office in Rundu to inform them of the sampling activities.

Once the Field Team had returned to Windhoek, a briefing meeting was held with the Director of DWSSC, who indicated interest in the results of the study and requested that a briefing meeting be held once the report was ready with key stakeholders, including the Ministry of Mines and Energy, the Environmental Commissioner's office, and NamWater Corporation. Further details are given in the conclusions and recommendations.

Figure 4 – Boreholes around Recon drill sites for Water Quality Sampling

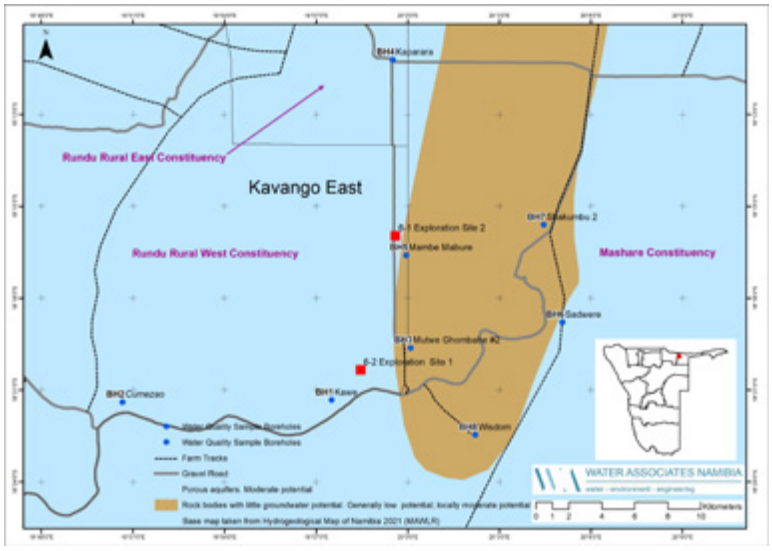


Table 2 – GPS Coordinates for the sampled boreholes and two exploration drill sites

	NAMES	WGS84_X	WGS84_Y
1	Kawe	19.95843314800	-18.35554122800
2	Cumezao	19.84431075700	-18.35667228600
3	Mutwe Ghombahe #2	20.00144004400	-18.32715797300
4	Kaparara	19.9903869200	-18.17016410700
5	Mbambe Mabure	19.99903869200	-18.27670288000
6	Sadwere	20.08437347000	-18.31317710800
7	Shakumbu 2	20.07414245200	-18.26012611300
8	Wisdom	20.3679847300	-18.37459182600
	Drill Site 6-2	19.97431945400	-18.33910942000
	Drill Site 6-1	19.99330160800	-18.26613046300

5. WATER QUALITY CHARACTERISATION

A detailed baseline water quality assessment on each of the eight boreholes was conducted in February 2021. Along with the summaries below, detailed results of all the specified water quality tests are included in Annex 6.

WATER FROM ALL BOREHOLES SAMPLED WERE BELOW DETECTION LIMITS FOR:

- Gasoline Range Organics and Total Petroleum Hydrocarbons (Table 3);
- Polycyclic aromatic hydrocarbons, chlorinated compounds and phthalates (Table 4); and
- Polar Compounds (Table 5).

Table 3 – Gasoline Range Organics and Total Petroleum Hydrocarbons (Detailed results in Annex 6)

PARAMETER	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
GRO-C6-C10	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l	<10ug/l
TPH C-10-C28	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l
THP C28- C40	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l	<382ug/l

Table 4 – Polycyclic aromatic hydrocarbons, chlorinated compounds and phthalate results for monitoring boreholes (Detailed results in Annex 6)

PARAMETER	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Polycyclic aromatic hydrocarbons-#	BDL*	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chlorinated compounds -$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phthalates - ~	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

*BDL = below detection level

= Polycyclic aromatic hydrocarbons include the following chemicals: naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b+k)fluoranthene, benzo(a)pyrene, benzo(g,h,i) perylene, dibenz(a,h)anthracene, indo(1,2,3-cd)pyrene

$ = chlorinated compounds include:1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-chloronaphthalene, hexachlorobenzene, hexachloroethane, 1,2,4-trichlorobenzene, 4-chlorophenylphenyl ether, 4-bromophenylphenyl ether

~ = phthalates include di-n-butyl phthalate, butyl benzyl phthalate, bis(2ethylhexyl) phthalate

Table 5 – Polar Compounds results for monitoring boreholes (Detailed results in Annex 6)

PARAMETER	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Acetone	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Methanol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Ethanol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Acetaldehyde	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Methyl acetate	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Ethyl acetate	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Propyl acetate	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Butyl acetate	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
n-propanol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
n-butanol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
Isopropyl alcohol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l
2-butoxyethanol	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l	<10mg/l

ALTHOUGH THESE COMPOUNDS ARE FOUND AT OVER THE RECOMMENDED LIMITS, THEY DO NOT POSE A SIGNIFICANT HEALTH IMPACT.

Dissolved metals (45 metals were included in the analyses – Annex 6) were also analysed and three metals – namely, calcium, sodium and vanadium – were over drinking water limits, although not by significant amounts (Table 6). These have no relation to oil and gas drilling but are rather present naturally.

Table 6 – Summary results of dissolved metals over the drinking water quality guidelines (Detailed results can be found in Annex 6)

BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Calcium	-	Vanadium	Sodium, vanadium	Vanadium	-	Sodium, vanadium	Sodium, vanadium

As described by the Irish Environmental Protection Agency (2001, Parameters of Water Quality Interpretation and Standards), although these compounds are found at over the recommended limits, they do not pose a significant health impact.

Calcium is essential for normal growth and health with a maximum daily requirement of 1-2 grams. Evidence exists to show that the incidence of heart disease is reduced in areas with drinking water with a high degree of hardness, the primary constituent of which is calcium, so that the presence of the element in a water supply is beneficial to health. Despite the potential health benefits of calcium abundance, there may be problems associated with water hardness.

Vanadium is not generally considered a hazard of significance in water from a health or sanitary perspective, but it may cause undesirable physiological effects, such as, for example, ear, nose and throat irritations.

Sodium is also an essential dietary requirement, and the normal intake is as common salt (sodium chloride) in food; daily consumption may amount to 5 grams or more. The main reason for limiting it is the joint effect which it exercises with sulphate with too excessive an intake (the latter normally being 2-3 times the dietary threshold) can cause hypertension.

Table 7 – Additional chemical-physical parameters analysed with detailed results in Annex 6

PARAMETERS		
Total Organic Carbon,	Nitrate Nitrogen	pH
Ammonium Nitrate,	Sulphate	Conductivity
Chloride,	Calcium	Total Alkalinity
Conductivity,	Iron	Total Dissolved Solids
Fluoride,	Potassium	Turbidity
Nitrate Nitrogen,	Magnesium	

Lastly, a standard physico-chemical water quality set of analyses were conducted on each of the eight borehole samples to characterise the groundwater. Parameters included in this analysis are in Table 7 and were used to construct Piper (Piper, 1944) and Stiff (Stiff, 1951) diagrams.

The cation-anion values were used to plot Stiff and Piper diagrams for water from each of the eight borehole sampled, to provide an indication of differences in water types. An example of a Piper diagram is shown in Figure 5 below.

Samples in the top quadrant are calcium sulphate waters, which are typical of gypsum ground water and mine drainage. Samples in the left quadrant are calcium bicarbonate waters, which are typical of shallow fresh ground water. Samples in the right quadrant are sodium chloride waters, which are typical of marine and deep ancient ground water. Samples in the bottom quadrant are sodium bicarbonate waters, which are typical of deep ground water influenced by ion exchange.

The majority of the eight boreholes (BH1, 2, 3, 5, 6 & 8) (Figure 6) are classified as calcium bicarbonate waters, typical of shallow fresh ground water, whereas BH7 can be described as a sodium chloride water, typical of deep ancient ground water, and BH4 a sodium bicarbonate water, typical of deep ground water influenced by ion exchange.

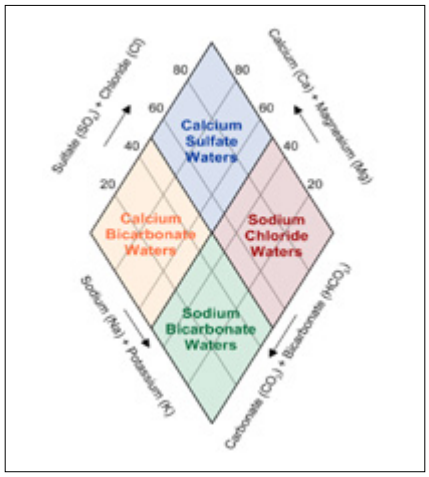


Figure 5 – Groundwater types in a Piper diagram

From (http://inside.mines.edu/~epoeter/_GW/18WaterChem2)

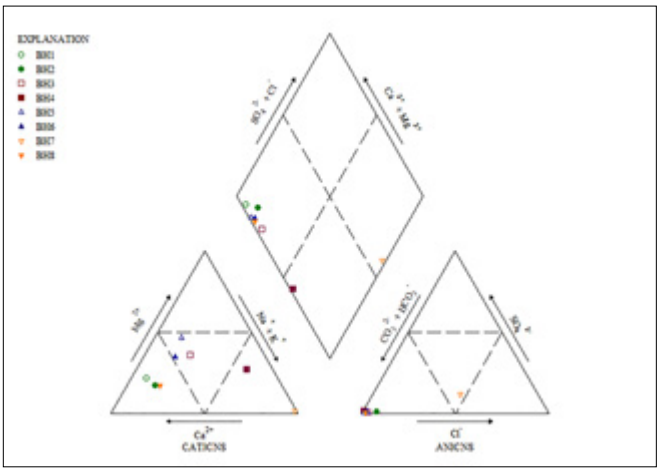
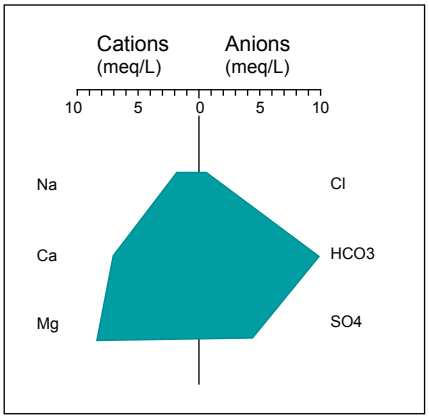


Figure 6 – Piper diagram of the 8 monitoring boreholes

Figure 7 – Example of a Stiff diagram



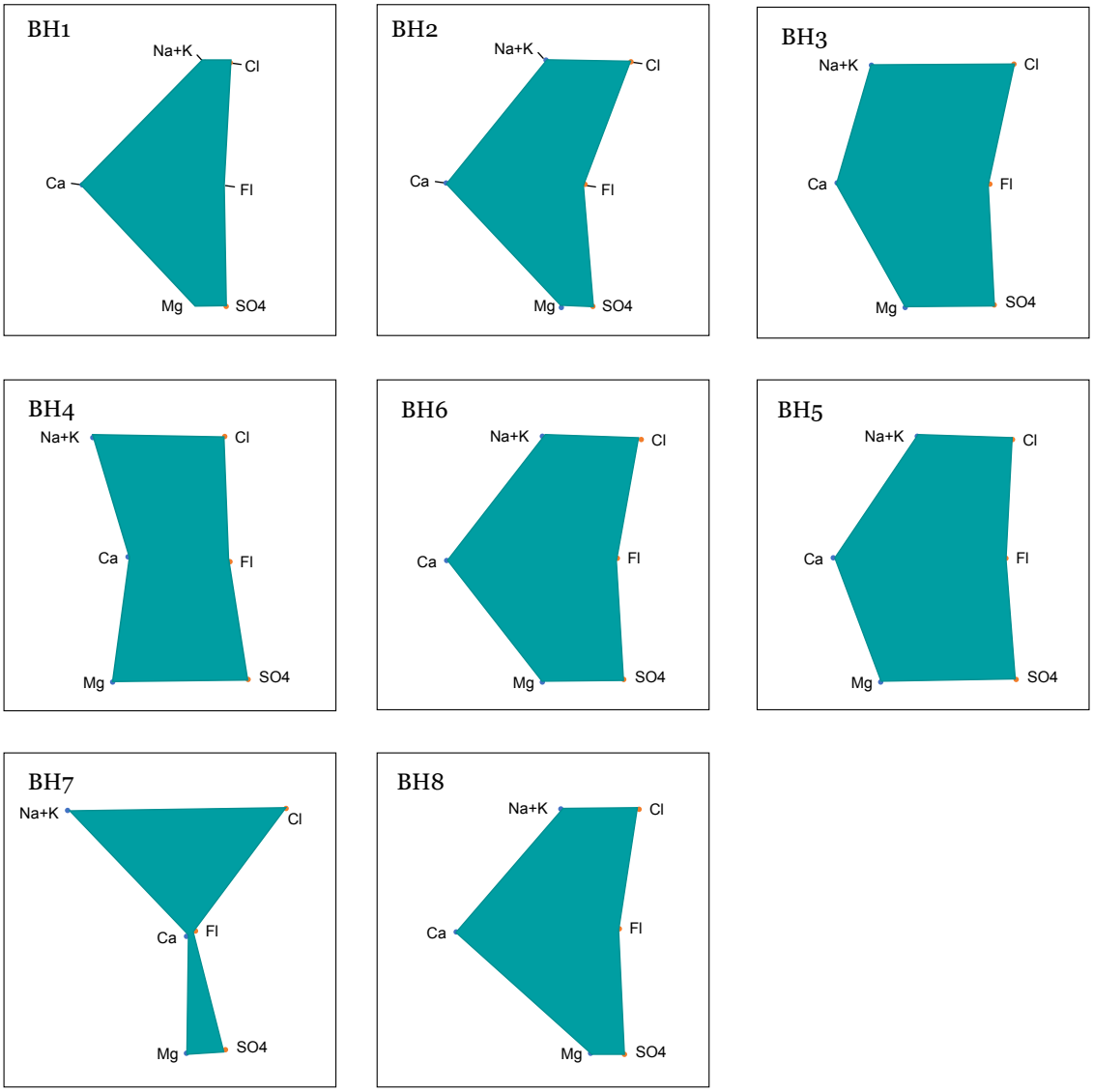
from https://en.wikipedia.org/wiki/Stiff_diagram

Stiff diagrams display the major ion composition of a water sample. Stiff diagrams plot milli-equivalent concentrations of cations on the left side of the diagram and of anions on the right (example in Figure 7).

The Stiff diagrams for the eight boreholes are shown in Figure 8.

The boreholes generally have a similar characteristic water quality with the exception of boreholes 4 and 7 as was also seen in the earlier Piper diagram (Figure 6). These results provide a water quality baseline for borehole water around the vicinity of the ReconAfrica drill sites 6-1 and 6-2. These results can be used to compare any future samples collected to assess whether changes in water quality have taken place.

Figure 8 – Stiff diagrams of the 8 monitoring boreholes



6. HEALTH IMPACTS OF CHEMICALS USED IN SHALE GAS EXPLORATION AND OIL RECOVERY

The following section is an information piece, explaining the typical health impacts that could be expected, if any groundwater contamination were to occur from gas exploration and oil recovery.

6.1 SHALE GAS EXPLORATION

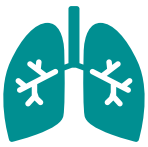
The health impacts associated with shale gas exploration and production (especially longer-term community health impacts) are largely unknown and have not been assessed. However, individual chemicals used in fracking have been shown to cause long-term and transgenerational effects. In addition to the potential long-term effects, the majority of the 1100 plus chemicals associated with the fracking process have been shown to cause short to longer term health impacts, such as eye, skin, respiratory, brain, nervous system, gastrointestinal or liver effects.

The human health impacts associated with shale gas exploration are described in detail in Genthe et. al, (2016). International experience and scientific evidence were used to predict the potential health impacts. Chemical information was obtained using international databases of the chemicals that are most used, most detected, most toxic to human health and most likely to be transported in the environment. If one considers only exploration (excluding a production phase), community health is expected to range between a moderate to a very low risk (with water as the exposure pathway) and worker health ranging from high risk (via the air pathway) to low risk, depending on the exposure pathway. Of the 1173 reportedly used chemicals (according to the database of United States Environmental Protection Agency (US EPA, 2015)), chronic health effects data are available for only 8.4 per cent of these compounds. In addition, each drilling and hydraulic fracturing ("fracking") event is unique depending on the geology, depth and resources available, with the chemicals and products used and the amounts or volumes used, differing from well to well. Information on individual chemicals used has been shown to cause long-term and transgenerational effects.

6.2 CRUDE OIL RECOVERY

Crude oils and their refined petroleum products consist largely of hydrocarbons. Crude oils also contain other organic and inorganic substances, such as sulphur, nitrogen and oxygen, and metals, such as iron, vanadium, nickel and chromium. Crude oil and semi-refined products may contain cancer-causing polycyclic aromatic hydrocarbons and other toxic substances.

Table 8 provides a summary of the known health impacts of some the chemicals in crude oil. Dose response assessment characterizes the relationship between the dose of a hazardous agent and incidence of an adverse effect in the exposed population. A chemical may be either carcinogenic (cancer causing) or toxic, or both.



THE MAJORITY OF THE 1100 PLUS CHEMICALS ASSOCIATED WITH THE FRACKING PROCESS HAVE BEEN SHOWN TO CAUSE SHORT TO LONGER TERM HEALTH IMPACTS.

Table 8 – Health impacts of chemicals present in crude oil and their refined petroleum products (Source IRIS1 and ATSDR2)

CHEMICAL	HEALTH IMPACT	
	CARCINOGENIC IMPACTS	NON-CARCINOGENIC IMPACTS (I.E. TOXICITY)
Methane	No available data.	No available data.
Ethane	Tumours in spleen, pancreas, kidney, abdomen etc. (rats).	Dizziness, loss of balance and co-ordination, unconsciousness (humans). Depressed humoral immune system (rats). Systemic tissue damage (rats).
Ethylbenzene	Not classifiable as to human carcinogenicity.	Liver and kidney toxicity (rats). Dizziness and throat and eye irritation (humans).
Heptane	Not carcinogenic.	No available data.
Hexane	No available data.	Neurotoxic.
Benzene	Known carcinogen (Category A in WHO classification system). Causes leukemia.	Headaches, drowsiness, dizziness, anemia – known to cause harmful effects on the blood.
Naphthalene	No available data.	Damage to red blood cells, fatigue, lack of appetite, nausea, vomiting, diarrhoea.
Xylenes	Not carcinogenic, but evidence is not conclusive.	Affects the brain. High levels can cause headaches, lack of muscle coordination and dizziness.
Toluene	Not carcinogenic.	Affects the brain. Tiredness, confusion, weakness, nausea.
Hydrogen sulphide	Hydrogen sulphide has not been shown to cause cancer in humans.	Eye irritations, odour discomfort and neurological effects.
Sulphur dioxide	No studies that clearly show carcinogenic effects.	Affects respiratory system.
Nitrogen oxides	No available data.	Respiratory system and eye irritant.

(Source IRIS[1] and ATSDR[2])

When assessing possible human health impacts resulting from exposure to shale gas or crude oil in the environment, a number of different routes of exposure must be considered. People may be exposed to gas or oil in the environment through inhalation of volatile compounds, ingestion of contaminated water, food, and dust, and through dermal absorption while washing and bathing.

1 IRIS is the US EPA's Integrated Risk Information System http://www.epa.gov/IRIS/

2 ATSDR is the US CDC's Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/

7. CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are proposed based on this field assessment:

1. **The gas and oil exploration programme is a flexible and ever changing process. It is, therefore, necessary to keep a watching brief by technically qualified and independent experts** on whether or not further sites are prepared for drilling (which does require a short lead time before drilling commences). If drill sites are added, it should be considered to expand the sampling network beyond the current eight boreholes around 6-1 and 6-2. The watching brief should include the monitoring of the mud pit activities and any other point source contamination or pollution incidents.

2. **Within a 4-to-6-month time frame, another water quality monitoring survey should be carried out at the eight current boreholes,** which may also be extended to include point groundwater water level measurements and new monitoring boreholes at new drill sites. This sampling should be recurrent and adapted, in scale and frequency, based on the future activities of ReconAfrica. These independent survey results would be separate to the monitoring sampling that ReconAfrica should be carrying out in accordance with the Environmental Management Plan.

3. **In line with the EIA recommendations, a detailed assessment of the surface and groundwater situation in the area is essential.** Transmissivity assessments should be made within the unconfined aquifer based on existing pump test data to determine the normal flow rates that may be expected within the aquifer. These will provide an estimate of the length of travel time of any possible pollutants arising from the exploration activities, which may affect existing groundwater sources.

4. **The process of plugging all exploration holes and sealing any aquifers should be monitored to ensure that standard industry procedures have been followed where appropriate.** This review should be undertaken by independent technically qualified experts so that the possible impact on the groundwater resources can be assessed.

5. **It is understood that any new borehole that is drilled by ReconAfrica will be handed over to the community when the exploration drilling has been concluded.** This process must be carried out through the official channels and ReconAfrica must demonstrate that the borehole meets national physical and micro-biological potable water quality standards. In addition, ReconAfrica should undertake to continue to fully fund equipment and operating expenses for a minimum of two-year regular sampling programme to ensure that post drilling pollutants are not evident in this particular borehole.

6. **Independent institutions with a watchdog function should keep in regular contact with the Ministry of Mines and Energy as the leading regulatory body** supported by the Ministry of Environment, Forestry and Tourism and the Ministry of Agriculture, Water and Land Reform as part of their regulatory responsibilities. It is understood that a technical committee of representatives from each of these bodies has been, or will be, formed to coordinate the review and monitoring activities. Independent watchdog institutions should contribute expertise and information to this committee, particularly for the compliance actions identified in the EIAs and incorporated in the EMPs.

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ANNEX 1: ANALAB SAMPLING AND STORAGE PROTOCOL

Analab specified the type of bottle to be used for each type of analysis, noting the specific laboratory that was used for each of the five samples taken at each borehole.

1. 2 L plastic bottle for general chemical analysis (anion/cation analysis by SetPoint)
2. 250ml Schott glass bottle for TOC (SetPoint)
3. 250 ml acidified (nitric acid) Kartell bottle for ICP-MS analysis (Labolink)
4. 1 L Schott glass bottle for TPH/GRO, VOC, SVOC (UisOL)
5. 500ml acidified (hydrochloric acid) Schott glass bottle for polar compounds (UisOL)

Each sample bottle was filled to the rim. Each was kept refrigerated at 4-10°C, without being allowed to freeze.

ANNEX 2: FIELD RECORD SHEET

Windhoek, Namibia

Sampler name (signature)			Project: baseline water quality assessment of community boreholes				Take photos and/or videos of sampling processes such as purging and bottle filling	
Date of sampling	Sample ID – as on sample bottle and Chain of Custody form	GPS Coordinates	Borehole data. Depth to water surface	Sampling pump details (type, purging time)	Weather conditions on the day of sampling	Water temp and other determinants e.g. pH, EC	Observations/ remarks e.g., colour change, odours	Sample handling. Filtered? Preserved? Sample bottle type? (Glass?)
						T^0 pH EC DO		
						T^0 pH EC DO		
						T^0 pH EC DO		
						T^0 pH EC DO		
						T^0 pH EC DO		
						T^0 pH EC DO		

ANNEX 3: SAMPLE SUBMISSION FORM

SAMPLE SUBMISSION FORM: WATER CHEMISTRY TESTING

Enquiries: Ms. Manuela Mayer | Section Head Water Quality

Customer Contact Information:		**FOR OFFICIAL USE**
Customer /Company Name		**Laboratory Reference No:**
Primary contact person		**Sample Condition upon Arrival at the Laboratory**
Samples submitted by		Acceptance criteria: . Cooler box temperature tolerance: 0 ˚C – 10 ˚C (Applicable for effluent water and selected tests only)
Postal Address		
Town		
Country		Sample(s) received & inspected by First Name_____ Signature: _____ Date: _____ Time: _____
Telephone Number		
Mobile Number		
Email Address		

Financial Information:	Sample container (appropriate/not appropriate)	
Customer / Company Name responsible for payment: _____ Purchase Order No: _____ Quotation No (if any): _____	Cooler box temp (without CF)	
	Cooler box temp (with CF)	
	Thermometer number (used)	
	Thermometer correction factor (CF)	

Customer Account type (tick the appropriate box)		Sample(s) accepted (tick) Sample(s) accepted with exception (tick) Sample(s) rejected (tick)
Credit Account	**Note:** Payment to be done within 30 days	
Cash Customer	**Note:** Payment to be done prior to testing	

Test Report

- Test Report(s) will be emailed to primary contact by default
- Additional Test Report(s) will be emailed as specified below: Email primary contact (tick)

Other email address (tick & specify below)

_____

If rejected, was the customer informed (tick)
Yes No Reason for rejection:
.....
.....
.....

Additional information/known hazards (if any)
.....
.....
.....
.....
.....
.....

Samples accepted with exception: I the customer agree that the sample(s) should be tested even though not in compliance with the acceptance criteria

Customer Signature: _____

Date: _____

Customer Authorisation (compulsory)

By signing below, you agree to Analytical Laboratory Services Terms & Conditions and authorise Analytical Laboratory Services to perform the requested tests to the best of their knowledge and in accordance with specified Test Methods.

Customer Signature: _____

Date: _____

Sample receipt stamp

FM 7.1-1 Version 000 Page 1 of 5
Effective Date: 06 .07. 2020

As per ISO 17025, this Sample Submittal Form serves as a Contract between the Customer and Analytical Laboratory Services (Pty) Ltd for services being rendered.

Note: Information provided on this Submittal Form will be transferred to the Test Report, therefore, ensure that the relevant information is correct.

Sample Information					FOR OFFICIAL USE
No.	Sample Description	Sampling Date	Sampling Time	Sample Matrix*	Lab Sample No.
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					

Sample Type Abbreviation Key
Water = W Dust samples = D Salt = S Chemicals = C

Please specify:
Water: potable / surface / ground / RO / seawater / brine
Domestic effluent: raw sewage / treated sewage / final effluent
Industrial effluent: raw / treated

Sampling done by: _____

Signature: _____

Reference of the sampling method (if available): _____

Sampling Location/Vessel/Factory name: _____

Special Instructions (when applicable):

CHEMICAL TESTING OF WATER SAMPLES			
Note: The laboratory will select the test parameters on behalf of the client, when a signed quotation is attached to this request form.			
No.	Test Parameters	Reference Method	Tick
1.	Absorbed oxygen	METH W 001 based on SANS 5220:2005	
2.	Acidity	METH W 002 based on AWWA 2310 B	
3.	Alkalinity	METH W 003 based on AWWA 2320 B	
4.	Ammonium	METH W 004/046 based on AWWA 4500-NH3 F / modified Berthelot	
5.	Bicarbonate & Carbonate	calculated	
6.	Biological oxygen demand, 5-day	METH W 005 based on AWWA 5210 B	
7.	Biological oxygen demand, carbonaceous	METH W 006 based on AWWA 5210 B	
8.	Bromide & Iodide	METH W 007 based on P. Höfer	
9.	Chloride	METH W 008 based on AWWA 4500-Cl- B	
10.	Chlorine, free and total	METH W 009 based on AWWA 4500-Cl G	
11.	Chlorophyll a	METH W 010 based on ISO 10260:1992 E	
12.	Chemical oxygen demand	METH W 011/012/013 based on AWWA 5220 D	
13.	Colour	METH W 014 based on AWWA Pt-Co-2120 B	
14.	Cyanide	METH W 015 based on AWWA 4500-CN E	
15.	Density	METH W 016	
16.	Dissolved oxygen	METH W 017 based on AWWA 4550-O G	
17.	Electrical conductivity	METH W 018 based on AWWA 2510 B	
18.	Fat, oil & grease	METH W 019 based on AWWA 5520 B	
19.	Fixed and volatile solids, ignited at 550°C	METH W 020 based on AWWA 2540 E	
20.	Fluoride	METH W 021 based on AWWA 4500-F C	
21.	Hardness	calculated, AWWA 2340 B	
22.	Hexavalent chromium	METH W 022 based on AWWA 3500-Cr B	
23.	Hydrolysable phosphates	METH W 023 based on AWWA 4500-P B.2 + E	
24.	Kjeldahl nitrogen	calculated	
25.	Molybdosilicate	METH W 024 based on AWWA 4500-Si C	
26.	Nitrate	METH W 025/026/044 based on Spectroquant / AWWA 4500-NO3 E	
27.	Nitrite	METH W 0027/028/045 based on AWWA 4500-NO2 B	
28.	Oxidation reduction potential (Redox)	METH W 029 based on AWWA 2580 B	
29.	pH	METH W 030 based on AWWA 4500-H+ B	

CHEMICAL TESTING OF WATER SAMPLES			
No.	Test Parameters	Reference Method	Tick
30.	Phenols	METH W 031 based on ASTM D1783-01, B	
31.	Reactive phosphorous	METH W 032/047 based on AWWA 4500-P E	
32.	Settable solids	METH W 033 based on AWWA 2540 F	
33.	Sulfide	METH W 034 based on AWWA 4500-S2- D	
34.	Sulfite	METH W 035 based on AWWA 4500-SO32- B	
35.	Sulphate	METH W 036/048 based on AWWA 4500-SO4 E / F	
36.	Total dissolved solids	METH W 037 based on AWWA 2540 C	
37.	Total nitrogen	METH W 038 based on EN ISO 11905-1:1997	
38.	Total phosphorous	METH W 039 based on AWWA 4500-P B.5 + E	
39.	Total solids	METH W 040 based on AWWA 2540 B	
40.	Total suspended solids	METH W 041 based on AWWA 2540 D	
41.	Turbidity	METH W 042 based on AWWA 2130 B	
42.	UV absorbing organic constituents at 254nm	METH W 043 based on AWWA 5910 B	

CHEMICAL TESTING OF SALT SAMPLES			
Note: The laboratory will select the test parameters on behalf of the client, when a signed quotation is attached to this request form.			
No.	Test Parameters	Reference Method	Tick
1.	Sample preparation & preparation of aqueous extract	METH GN 002 based on SP-2.3	
2.	Moisture	METH GN 002 based on SP-2.4	
3.	Insoluble impurities	METH GN 003 based on SP-2.3	
4.	Chloride	METH GN 003 based on AWWA 4500-Cl- B	
5.	Sulphate	METH GN 003 based on SP-2.5	
6.	Carbonate	BS method 1377 part 3	
7.	Iodine as KIO3	METH GN 004	
8.	Iodine as KI	METH GN 005	
9.	Screen analysis	METH GN 006	
10.	Sodium	AWWA ICP-3500-Na C	
11.	Potassium	AWWA ICP-3500-K C	
12.	Magnesium	AWWA ICP-3500-Mg C	
13.	Calcium	AWWA ICP-3500-Ca C	

TESTING OF REAGENTS AND CHEMICALS			
No.	Test Parameters	Reference Method	Tick
1.	Sodium hypochlorite – assay	METH GN 001 Powell	
2.	Scale – qualitative tests	METH GN 007	

ELEMENTAL ANALYSIS BY ICP-OES			
No.	Test Parameters	Reference Method	Tick
1.	Aluminium	AWWA ICP-3500-Al C	
2.	Antimony	AWWA ICP-3500-Sb C	
3.	Arsenic	AWWA ICP-3500-As D	
4.	Barium	AWWA ICP-3500-Ba C	
5.	Beryllium	AWWA ICP-3500-Be	
6.	Bismuth	AWWA ICP-3500-Bi	
7.	Boron	AWWA ICP-3500-B D	
8.	Cadmium	AWWA ICP-3500-Cd C	
9.	Calcium	AWWA ICP-3500-Ca C	
10.	Chromium (total)	AWWA ICP-3500-Cr C	
11.	Cobalt	AWWA ICP-3500-Co C	
12.	Copper	AWWA ICP-3500-Cu C	
13.	Gold	AWWA ICP-3500-Au	
14.	Iron	AWWA ICP-3500-Fe C	
15.	Lead	AWWA ICP-3500-Pb C	
16.	Lithium	AWWA ICP-3500-Li C	
17.	Magnesium	AWWA ICP-3500-Mg C	
18.	Manganese	AWWA ICP-3500-Mn C	
19.	Mercury	AWWA ICP-3500-Hg	
20.	Molybdenum	AWWA ICP-3500-Mo C	
21.	Nickel	AWWA ICP-3500-Ni C	
22.	Potassium	AWWA ICP-3500-K C	
23.	Rubidium	ICP-OES	
24.	Selenium	AWWA ICP-3500-Se I	
25.	Silica	ICP-OES	
26.	Silver	AWWA ICP-3500-Ag	

ELEMENTAL ANALYSIS BY ICP-OES			
No.	Test Parameters	Reference Method	Tick
27.	Sodium	AWWA ICP-3500-Na C	
28.	Strontium	AWWA ICP-3500-Sr C	
29.	Thallium	AWWA ICP-3500-Tl C	
30.	Tellurium	AWWA ICP-3500-Te	
31.	Tin	AWWA ICP-3500-Sn	
32.	Titanium	AWWA ICP-3500-Ti	
33.	Uranium	AWWA ICP-3500-U	
34.	Vanadium	AWWA ICP-3500-V C	
35.	Zinc	AWWA ICP-3500-Zn C	

GROUP TESTS			
No.	Test Parameters	Interpretation of results based on:	Tick
1.	Standard water test, including: pH, conductivity, turbidity, total dissolved solids, alkalinity, total-, calcium- and magnesium-hardness, chloride, fluoride, sulphate, nitrate, nitrite, Na, K, Mg, Ca, Mn, Fe, stability index, corrosivity index	Guidelines for the evaluation of drinking water quality for human consumption, DWA Namibia, April 1988 and South African Water Quality Guidelines, Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996	
2.	Irrigation water test, including: pH, conductivity, alkalinity, total-hardness, chloride, fluoride, sulphate, nitrate, Na, K, Mg, Ca, Mn, Fe, Cu, Zn, B, Mo, stability index, corrosivity index, sodium absorption ratio, residual sodium carbonate, magnesium ratio	South African Water Quality Guidelines, Volume 4: Agricultural water use: Irrigation, Second Edition, 1996	
3.	Concrete mixing test (Fulton), including: pH, conductivity, TDS, alkalinity, chloride, sulphate	South African National Standard, SANS 51008:2006	
4.	Corrosion water test, including: pH, conductivity, TDS, alkalinity, chloride, sulphate, Mg, Ca, Mn, Fe		
5.	Annual water test (SANS 241), including: Standard water test + colour, cyanide, phenolic compounds, Cu, Zn, As, Se, Cd, Cr, Pb, Hg, Ni, Co	Guidelines for the evaluation of drinking water quality for human consumption, DWA Namibia, April 1988 and SANS 241-1:2015	
6.	Bottled water test (SANS 1657), including: Standard water test + As, Se, Cd, Cr, Pb	Guidelines for the evaluation of drinking water quality for human consumption, DWA Namibia, April 1988 and SANS 1657:2014 (ED 2.03)	
7.	Wastewater test, including: pH, conductivity, oxidation reduction potential, dissolved oxygen, total dissolved solids (det.), total suspended solids, COD, BOD, total nitrogen, nitrate, nitrite, ammonium, o-phosphate, chloride, sulphate, sodium	General standard limits for Article 21 permits (effluents), as per regulation R553 of 5 April 1962	

GROUP TESTS			
No.	Test Parameters	Interpretation of results based on:	Tick
ICP group tests:			
8.	SW: Na, K, Mg, Ca, Mn, Fe		
9.	TW: Cr, Cd, Pb, As, Se		
10.	Gr5: U, V, Co, Ni, Li, Rb		
11.	RO: Al, Si, Ba, Sr, B		
12.	IW: Cu, Zn, Mo, B		
13.	M1: Be, Sb, Sn, Th, Ti		

Note: Unless otherwise requested by the client, expression of opinion and interpretation of results will be based on guidelines / standards as per above table.

Note: Prices are specified on FM 7.1-8 Version 000

ANNEX 4: CHAIN OF CUSTODY RECORD

PROJECT: BASELINE WATER QUALITY ASSESSMENT OF COMMUNITY BOREHOLES					
SAMPLERS: NAME (SIGNATURE)					
LOCAL ID	DATE	TIME	SITE ID: GPS	NUMBER OF CONTAINERS	REMARKS

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	**RECEIVED BY: (SIGNATURE)**	DATE	TIME
RELINQUISHED BY: (SIGNATURE)	DATE	TIME	**RECEIVED BY: (SIGNATURE)**	DATE	TIME
RELINQUISHED BY: (SIGNATURE)	DATE	TIME	**RECEIVED BY: (SIGNATURE)**	DATE	TIME

ANNEX 5: SAMPLING PICTURES

KAWE

CUMEZAO

KAPARARA

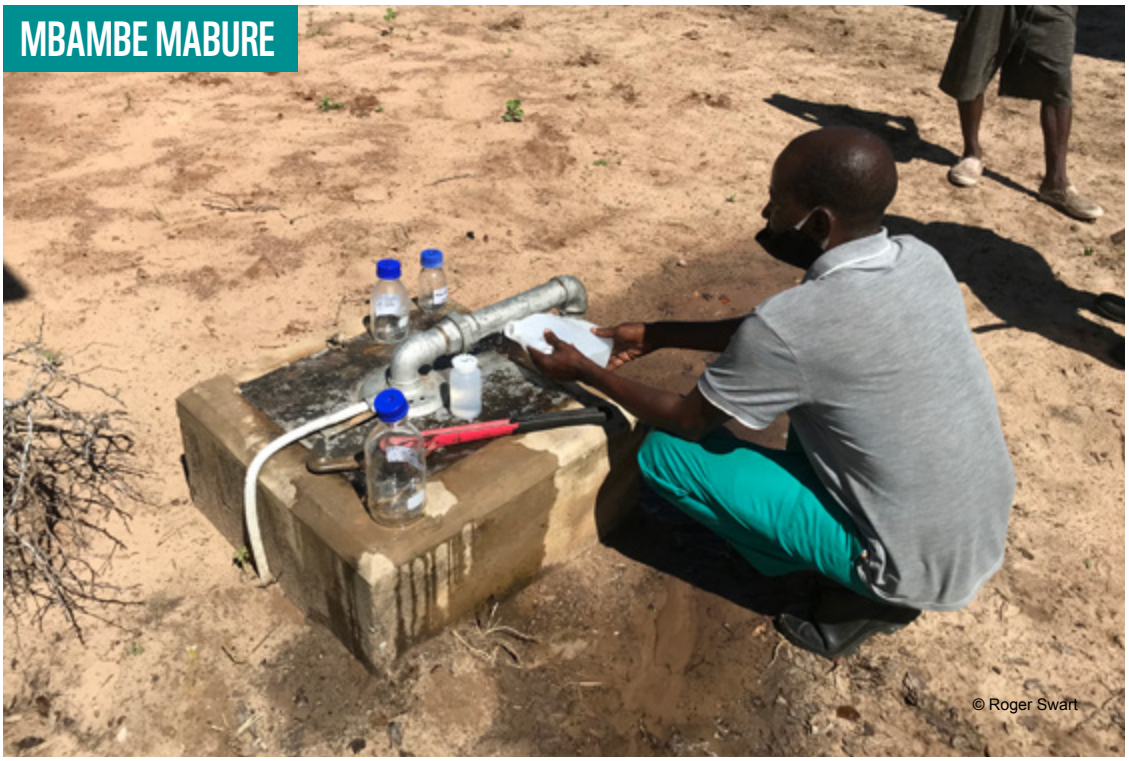
SHAKUMBU 2

MUTWE GHOMBAHE #2

SADWERE

WISDOM

MBAMBE MABURE



ANNEX 6: LABORATORY RESULTS

Analytical Laboratory Services
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Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 05/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH1 - Kawe
Date of sampling	2021/02/04; 12:06
Test item number	I210338/1

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	8.7	µg/l	Magnesium as Mg	17974	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	8.5	µg/l
Boron as B	395	µg/l	Silicon as Si	26900	µg/l
Strontium as Sr	870	µg/l	Phosphorous as P	4.5	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	803	µg/l
Molybdenum as Mo	< 0.163	µg/l	Calcium as Ca	100775	µg/l
Cadmium as Cd	< 0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	47	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	1.9	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	2.3	µg/l
Barium as Ba	1487	µg/l	Iron as Fe	109	µg/l
Lanthanum as La	0.08	µg/l	Cobalt as Co	< 0.028	µg/l
Tungsten as W	0.03	µg/l	Nickel as Ni	0.7	µg/l
Iridium as Ir	0.03	µg/l	Copper as Cu	2.9	µg/l
Platinum as Pt	0.03	µg/l	Zinc as Zn	153	µg/l
Gold as Au	0.08	µg/l	Potassium as K	3303	µg/l
Mercury as Hg	1.3	µg/l	Arsenic as As	1.5	µg/l
Thallium as Tl	0.15	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.49	µg/l	Ruthenium as Ru	0.14	µg/l
Bismuth as Bi	0.03	µg/l	Rhodium as Rh	< 0.031	µg/l
Thorium as Th	0.02	µg/l	Palladium as Pd	0.77	µg/l
Uranium as U	3.9	µg/l	Silver as Ag	0.2	µg/l
Sodium as Na	11407	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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Approved Technical Signatory
Ms. Manuela Mayer

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 05/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH2 - Cumezoa
Date of sampling	2021/02/04; 12:36
Test item number	I210338/2

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	3.6	µg/l	Magnesium as Mg	6944	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	6.8	µg/l
Boron as B	322	µg/l	Silicon as Si	25073	µg/l
Strontium as Sr	245	µg/l	Phosphorous as P	2.1	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	1035	µg/l
Molybdenum as Mo	< 0.163	µg/l	Calcium as Ca	48272	µg/l
Cadmium as Cd	< 0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	1.2	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	< 1.345	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	136	µg/l
Barium as Ba	821	µg/l	Iron as Fe	1551	µg/l
Lanthanum as La	0.13	µg/l	Cobalt as Co	0.88	µg/l
Tungsten as W	0.03	µg/l	Nickel as Ni	1	µg/l
Iridium as Ir	0.02	µg/l	Copper as Cu	0.69	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	92	µg/l
Gold as Au	0.07	µg/l	Potassium as K	2733	µg/l
Mercury as Hg	0.49	µg/l	Arsenic as As	0.96	µg/l
Thallium as Tl	0.13	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.19	µg/l	Ruthenium as Ru	0.07	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	< 0.031	µg/l
Thorium as Th	0.01	µg/l	Palladium as Pd	< 0.517	µg/l
Uranium as U	0.47	µg/l	Silver as Ag	< 0.1	µg/l
Sodium as Na	10765	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 05/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH3 - Mutwe Ghombaha No 2
Date of sampling	2021/02/04; 13:39
Test item number	I210338/3

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	19	µg/l	Magnesium as Mg	43948	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	11	µg/l
Boron as B	355	µg/l	Silicon as Si	18583	µg/l
Strontium as Sr	2568	µg/l	Phosphorous as P	13	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	1473	µg/l
Molybdenum as Mo	0.69	µg/l	Calcium as Ca	85514	µg/l
Cadmium as Cd	0.08	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	57	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	2.3	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	156	µg/l
Barium as Ba	1136	µg/l	Iron as Fe	620	µg/l
Lanthanum as La	0.22	µg/l	Cobalt as Co	1.4	µg/l
Tungsten as W	0.04	µg/l	Nickel as Ni	1.2	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	0.69	µg/l
Platinum as Pt	0.04	µg/l	Zinc as Zn	7.5	µg/l
Gold as Au	0.06	µg/l	Potassium as K	12478	µg/l
Mercury as Hg	0.39	µg/l	Arsenic as As	0.73	µg/l
Thallium as Tl	0.05	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.17	µg/l	Ruthenium as Ru	0.44	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	0.08	µg/l
Thorium as Th	0.01	µg/l	Palladium as Pd	1.9	µg/l
Uranium as U	6.8	µg/l	Silver as Ag	0.21	µg/l
Sodium as Na	51082	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 05/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH4 - Kaparara
Date of sampling	2021/02/04; 14:40
Test item number	I210338/4

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	44	µg/l	Magnesium as Mg	30667	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	7.5	µg/l
Boron as B	413	µg/l	Silicon as Si	25139	µg/l
Strontium as Sr	2248	µg/l	Phosphorous as P	14	µg/l
Zirconium as Zr	0.05	µg/l	Sulphur as S	2765	µg/l
Molybdenum as Mo	4.5	µg/l	Calcium as Ca	27839	µg/l
Cadmium as Cd	0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	210	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	20	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	0.53	µg/l
Barium as Ba	515	µg/l	Iron as Fe	6	µg/l
Lanthanum as La	0.02	µg/l	Cobalt as Co	< 0.028	µg/l
Tungsten as W	0.21	µg/l	Nickel as Ni	< 0.25	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	1.8	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	24	µg/l
Gold as Au	0.03	µg/l	Potassium as K	24054	µg/l
Mercury as Hg	1.3	µg/l	Arsenic as As	3.1	µg/l
Thallium as Tl	0.03	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.33	µg/l	Ruthenium as Ru	0.54	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	0.12	µg/l
Thorium as Th	0.01	µg/l	Palladium as Pd	2.2	µg/l
Uranium as U	43	µg/l	Silver as Ag	< 0.1	µg/l
Sodium as Na	119207	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 08/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH5 - Mbambe Mabure
Date of sampling	2021/02/05; 10:15
Test item number	I210338/5

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	19	µg/l	Magnesium as Mg	34261	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	7.9	µg/l
Boron as B	319	µg/l	Silicon as Si	28363	µg/l
Strontium as Sr	2439	µg/l	Phosphorous as P	7.9	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	1210	µg/l
Molybdenum as Mo	0.51	µg/l	Calcium as Ca	62706	µg/l
Cadmium as Cd	< 0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	125	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	7	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	0.75	µg/l
Barium as Ba	1127	µg/l	Iron as Fe	27	µg/l
Lanthanum as La	0.04	µg/l	Cobalt as Co	< 0.028	µg/l
Tungsten as W	0.03	µg/l	Nickel as Ni	0.43	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	0.61	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	8.7	µg/l
Gold as Au	0.03	µg/l	Potassium as K	11235	µg/l
Mercury as Hg	0.66	µg/l	Arsenic as As	1.6	µg/l
Thallium as Tl	0.02	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.12	µg/l	Ruthenium as Ru	0.52	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	0.12	µg/l
Thorium as Th	< 0.002	µg/l	Palladium as Pd	3	µg/l
Uranium as U	6.3	µg/l	Silver as Ag	< 0.1	µg/l
Sodium as Na	13942	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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Date received: 08/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH6 - Sadwere
Date of sampling	2021/02/05; 11:10
Test item number	I210338/6

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	9	µg/l	Magnesium as Mg	28332	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	50	µg/l
Boron as B	284	µg/l	Silicon as Si	25099	µg/l
Strontium as Sr	1157	µg/l	Phosphorous as P	3.9	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	1237	µg/l
Molybdenum as Mo	< 0.163	µg/l	Calcium as Ca	89688	µg/l
Cadmium as Cd	< 0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	33	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	5.2	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	0.74	µg/l
Barium as Ba	1135	µg/l	Iron as Fe	2.4	µg/l
Lanthanum as La	0.05	µg/l	Cobalt as Co	< 0.028	µg/l
Tungsten as W	< 0.01	µg/l	Nickel as Ni	0.67	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	0.58	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	0.74	µg/l
Gold as Au	0.04	µg/l	Potassium as K	3739	µg/l
Mercury as Hg	0.52	µg/l	Arsenic as As	0.45	µg/l
Thallium as Tl	0.02	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	0.08	µg/l	Ruthenium as Ru	0.19	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	0.09	µg/l
Thorium as Th	0	µg/l	Palladium as Pd	0.92	µg/l
Uranium as U	5.5	µg/l	Silver as Ag	< 0.1	µg/l
Sodium as Na	27902	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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TEST REPORT

To: **Water Associates Namibia (Pty) Ltd.**

Date received: 08/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH7 - Shakumbu 2
Date of sampling	2021/02/05; 12:10
Test item number	I210338/7

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	16	µg/l	Magnesium as Mg	1931	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	16	µg/l
Boron as B	585	µg/l	Silicon as Si	19049	µg/l
Strontium as Sr	118	µg/l	Phosphorous as P	19	µg/l
Zirconium as Zr	0.06	µg/l	Sulphur as S	28934	µg/l
Molybdenum as Mo	3.4	µg/l	Calcium as Ca	2757	µg/l
Cadmium as Cd	< 0.04	µg/l	Titanium as Ti	< 0.442	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	246	µg/l
Antimony as Sb	< 0.051	µg/l	Chromium as Cr	8.7	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	1.8	µg/l
Barium as Ba	20	µg/l	Iron as Fe	24	µg/l
Lanthanum as La	0.02	µg/l	Cobalt as Co	< 0.028	µg/l
Tungsten as W	0.21	µg/l	Nickel as Ni	< 0.25	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	1.6	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	8.3	µg/l
Gold as Au	0.04	µg/l	Potassium as K	7769	µg/l
Mercury as Hg	0.04	µg/l	Arsenic as As	9.2	µg/l
Thallium as Tl	0.02	µg/l	Selenium as Se	9.3	µg/l
Lead as Pb	0.6	µg/l	Ruthenium as Ru	0.06	µg/l
Bismuth as Bi	0.02	µg/l	Rhodium as Rh	< 0.031	µg/l
Thorium as Th	0	µg/l	Palladium as Pd	< 0.517	µg/l
Uranium as U	32	µg/l	Silver as Ag	< 0.1	µg/l
Sodium as Na	323618	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

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Date received: 08/Feb/21
Date analysed: 14 February 2021
Date reported: 16/Feb/21

Attn: Mr Rodney Amster
e-mail: waterassociates@iway.na
Tel: 081-475 3300

Client Reference no.: WWF
Quotation no.: QU-5294
Lab Reference: I201338
Enquiries: Ms Manuela Mayer

Sample details	water sample
Location of sampling point	-
Description of sampling point	BH8 - Wisdom Farm
Date of sampling	2021/02/05; 13:30
Test item number	I210338/8

Parameter	Dissolved Metals* Value	Units	Parameter	Dissolved Metals* Value	Units
Lithium as Li	10	µg/l	Magnesium as Mg	15087	µg/l
Beryllium as Be	< 0.329	µg/l	Aluminium as Al	25	µg/l
Boron as B	285	µg/l	Silicon as Si	39074	µg/l
Strontium as Sr	679	µg/l	Phosphorous as P	7.5	µg/l
Zirconium as Zr	< 0.045	µg/l	Sulphur as S	891	µg/l
Molybdenum as Mo	< 0.163	µg/l	Calcium as Ca	130375	µg/l
Cadmium as Cd	0.3	µg/l	Titanium as Ti	0.79	µg/l
Tin as Sn	< 0.223	µg/l	Vanadium as V	14	µg/l
Antimony as Sb	0.07	µg/l	Chromium as Cr	5.9	µg/l
Tellurium as Te	< 0.273	µg/l	Manganese as Mn	11	µg/l
Barium as Ba	1256	µg/l	Iron as Fe	1517	µg/l
Lanthanum as La	0.14	µg/l	Cobalt as Co	0.23	µg/l
Tungsten as W	0.01	µg/l	Nickel as Ni	2.1	µg/l
Iridium as Ir	< 0.012	µg/l	Copper as Cu	6	µg/l
Platinum as Pt	< 0.019	µg/l	Zinc as Zn	294	µg/l
Gold as Au	0.02	µg/l	Potassium as K	2192	µg/l
Mercury as Hg	0.56	µg/l	Arsenic as As	0.25	µg/l
Thallium as Tl	0.03	µg/l	Selenium as Se	< 0.932	µg/l
Lead as Pb	1.9	µg/l	Ruthenium as Ru	0.17	µg/l
Bismuth as Bi	0.03	µg/l	Rhodium as Rh	< 0.031	µg/l
Thorium as Th	0.01	µg/l	Palladium as Pd	0.74	µg/l
Uranium as U	23	µg/l	Silver as Ag	0.11	µg/l
Sodium as Na	30208	µg/l			

Remark: * = outsourced to Lab'O'Link, South Africa

<LOD
>LOD <HighStd
>HighStd <1Order
>1Order

Approved Technical Signatory
Ms. Manuela Mayer

SETPOINT LABORATORIES

For Attention:	Manuela		
Customer:	Analytical Laboratory Services	**Report number:**	WAT/21/0828-1
Postal address:	P.O. Box 86782, Windhoek	**Report issue date:**	2021/06/28
Tel number:	+264 61 201 132	**Date Completed:**	2021/06/28
Fax Number:		**Order no:**	PO-1267

Amended Water Analysis Report

Sample name			I210338/1 BH 1-KAWE 12H06	I210338/2 BH 2-CUMEZAO 12H36	I210338/3 BH 3-MUTWE GHOMBAH E #2 13H39	I210338/4 BH 4-KAPARARA 14H40	I210338/5 BH 5-MBAMBE MABURE 10H15	I210338/6 BH 6-SADWERE 11H10	I210338/7 BH 7-SHAKUMBU 2 12H10	I210338/8 BH 8-WISDOM FARM 13H30
Sample date			2021/02/04	2021/02/04	2021/02/04	2021/02/04	2021/02/05	2021/02/05	2021/02/05	2021/02/05
Sample container description			1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle	1L Plastic Bottle
Submission date			2021/02/12	2021/02/12	2021/02/12	2021/02/12	2021/02/12	2021/02/12	2021/02/12	2021/02/12
Sample type			Water	Water	Water	Water	Water	Water	Water	Water
Set Point ID			WAT/21/0828-0001	WAT/21/0828-0002	WAT/21/0828-0003	WAT/21/0828-0004	WAT/21/0828-0005	WAT/21/0828-0006	WAT/21/0828-0007	WAT/21/0828-0008
Visual inspection			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Method no	Determinand	Unit								
Chemical Properties and Parameters										
#	*Total Organic Carbon	mg/L C	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
M464	Ammonia Nitrogen	mg/L N	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
M469	Chloride	mg/L	5.00	16.6	15.0	<3.00	<3.00	12.4	275	8.90
M461	Conductivity	mS/m @ 25°C	57.2	31.3	79.0	84.5	55.0	78.0	156	77.2
M475	Fluoride	mg/L	<0.10	<0.10	<0.10	3.44	0.17	0.21	1.67	0.53
M465	Nitrate Nitrogen	mg/L N	4.76	<0.10	0.72	0.74	0.18	3.06	2.97	3.31
M466	Nitrite Nitrogen	mg/L N	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10
M460	pH	-	8.05	8.08	7.67	8.20	7.81	7.67	7.50	8.00
M476	Sulphate	mg/L	4.80	<3.00	<3.00	9.00	3.20	4.70	92.1	<3.00
M463	Total Alkalinity	mg/L CaCO3	275	130	409	451	298	409	225	385

Head office (Johannesburg)
(A Part of Synerlytic Services (Pty) Ltd Reg. No. 2018/589825/07 - Vat No. 4830285658)
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P: PO Box 856, Isando, 1600, Gauteng, South Africa
T: +27 (0) 11 923 7100 W: www.setpointlabs.co.za

M473	Total Dissolved Solids	mg/L @ 180°C	407	210	477	590	360	493	923	527
#	Turbidity	NTU	<0.10	4.39	<0.10	0.14	<0.10	0.38	0.24	<0.10
M474	Calcium (Ca)	mg/L	98	49.5	81.5	29.5	53.2	89.2	3.06	109
M474	Iron (Fe)	mg/L	<0.10	<0.10	0.48	<0.10	<0.10	<0.10	<0.10	<0.10
M474	Potassium (K)	mg/L	3.59	3.02	13.0	29.0	11.8	4.45	9.49	2.37
M474	Magnesium (Mg)	mg/L	18.5	7.63	44.0	34.9	38.3	39.4	2.35	17.3
M474	Sodium (Na)	mg/L	11.1	11.1	49.8	128	13.6	33.6	347	32.7

Please Note: **N/A: Not applicable** **RTF : Result to follow** ***Sub-contracted Analysis**

This report replaces FINAL ANALYSIS REPORT (WAT/21/0828) dated 04/03/2021. The reason for this amended report is:
A)Sample IDs were incorectly captured on initial report.

 # Non SANAS Accredited methods.
Results only relate to the samples tested and are reported on an "as received" basis, unless otherwise specified.
This report may not be reproduced, except in full, without the written approval of Set Point Laboratories;
Results are subject to uncertainty of measurement, which are indicated on the enclosed information sheet.
While every effort is made to provide analysis of the highest accuracy, the liability of Set Point Laboratories is restricted to the cost of the analysis.

 # Comment:

Nthudzeni Mabidi
(Report Compiler)

Moses Lelaka
Technical Signatory

 # Tests marked "Non SANAS Accredited methods", as well as any comments, opinions or interpretations expressed in this report are not included in the SANAS Schedule of Accreditation for this laboratory.

INFORMATION SHEET TO ANALYSIS REPORT

Methods used, tests subcontracted and accredited ranges:

DETERMINAND	Method code	Accredited	Avg. Uncertainty	Technique	Limit of Detection	Analytical range
pH	M450 / M850	Yes	1.3%	Electrometric	0.2	1-13
Conductivity	M451 / M851	Yes	6.7%	Electrometric	1 mS/m	1-1300 mS/m
Alkalinity	M473 / M583	Yes	4.2%	Titration	10mg/L CaCO3	10 - 1300 mg/L CaCO3
Ammonia Nitrogen	M484	Yes	[illegible]	Automated Photometric	0.1 mg/L NH3-N	0.1 - 77.8 mg/L NH3-N
Ammonia Nitrogen	M484	Yes	1.8%	Automated Photometric	0.1 mg/L NH3-N	0.1 - 2.0 mg/L NH3-N
Nitrate Nitrogen	M483 / M883	Yes	Calculated from M487 and M486 or M887 and M886	Automated Photometric	0.1 mg/L NO3-N	Calculated from M487 and M486 / M887 and M886
Nitrite Nitrogen	M486 / M886	Yes	11.4%	Automated Photometric	0.1 mg/L NO2-N	0.1 - 2 mg/L NO2-N
Nitrate and Nitrite Nitrogen	M487 / M887	Yes	12.5%	Automated Photometric	0.1 mg/L NO3+NO2-N	0.1 - 10 mg/L NO3+NO2-N
Ortho Phosphate	M485 / M889	Yes	7.2%	Automated Photometric	0.1 mg/L PO4-P	0.1 - 5 mg/L PO4-P
Chloride	M489 / M889	Yes	4.8%	Automated Photometric	3 mg/L Cl	3 - 30 mg/L Cl
Fluoride	M475 / M875	Yes	5.4%	Automated Photometric	0.1 mg/L F	0.1 - 2 mg/L F
Sulphate	M478 / M878	Yes	5.8%	Automated Photometric	3 mg/L SO4	3 - 100 mg/L SO4
Hexavalent Chromium	M471 / M871	Yes	3.0%	Automated Photometric	0.006 mg/L Cr6+	0.006 - 0.2 mg/L Cr6+
COD	M480 / M885	Yes	1.3%	Closed reflux/[illegible]	10mg/L O2	10-1500mg/L O2
Total Suspended Solids	M472 / M872	Yes	6.4%	Gravimetric	10mg/L TSS	10-1500mg/L TSS
Total Dissolved Solids	M475 / M875	Yes	1.8%	Gravimetric	10mg/L TDS	10-1500mg/L TDS
Al	M474 / M874	Yes	3.3%	ICP-OES	0.15 mg/L	0.15 - 15 mg/L
Ag	M474	Yes	0.30 ug/L	ICP-MS	0.50 ug/L	0.50 - 50 ug/L
As	M474 / M874	Yes	3.7 %	ICP-OES	0.10 mg/L	0.10 - 15 mg/L
As	M474	Yes	0.35 ug/L	ICP-MS	0.50 ug/L	0.50 - 50 ug/L
B	M474 / M874	Yes	4.4%	ICP-OES	0.35 mg/L	0.35 - 15 mg/L
Ba	M474 / M874	Yes	3.6 %	ICP-OES	0.01 mg/L	0.01 - 15 mg/L
Ba	M474	Yes	0.30 ug/L	ICP-MS	0.20 ug/L	0.20 - 100 ug/L
Be	M474 / M874	Yes	4.6 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Be	M474	Yes	0.37 ug/L	ICP-MS	0.10 ug/L	0.10 - 50 ug/L

Page 3 of 4
WAT-21-0626-1
Record: Analysis report revision status: 2021-03-01
Designed and approved by T.Swanepoel

Ca	M474 / M874	Yes	7.7 %	ICP-OES	2.00 mg/L	2.00 - 15 mg/L
Cd	M474 / M874	Yes	4.6 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Cd	M474	Yes	0.36 ug/L	ICP-MS	0.10 ug/L	0.10 - 50 ug/L
Co	M474 / M874	Yes	3.0 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Co	M474	Yes	0.56 ug/L	ICP-MS	0.20 ug/L	0.20 - 50 ug/L
Cr	M474 / M874	Yes	3.0 %	ICP-OES	0.03 mg/L	0.03 - 15 mg/L
Cr	M474	Yes	0.50 ug/L	ICP-MS	3.0 ug/L	3 - 100 ug/L
Cu	M474 / M874	Yes	3.1 %	ICP-OES	0.10 mg/L	0.10 - 15 mg/L
Cu	M474	Yes	0.90 ug/L	ICP-MS	1.0 ug/L	1 - 100 ug/L
Fe	M474 / M874	Yes	3.7 %	ICP-OES	0.10 mg/L	0.10 - 15 mg/L
Hg	M474	Yes	0.04 ug/L	ICP-MS	0.50 ug/L	0.50 - 5 ug/L
K	M474 / M874	Yes	4.7 %	ICP-OES	0.34 mg/L	0.04 - 15 mg/L
Mg	M474 / M874	Yes	3.3 %	ICP-OES	0.35 mg/L	0.05 - 15 mg/L
Mn	M474 / M874	Yes	3.8 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Mn	M474	Yes	0.45 ug/L	ICP-MS	0.35 ug/L	0.35 - 50 ug/L
Mo	M474 / M874	Yes	3.3 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Mo	M474	Yes	0.36 ug/L	ICP-MS	1.0 ug/L	1.0 - 50 ug/L
Na	M474 / M874	Yes	7.7 %	ICP-OES	0.30 mg/L	0.30 - 15 mg/L
Ni	M474 / M874	Yes	3.0 %	ICP-OES	0.02 mg/L	0.02 - 15 mg/L
Ni	M474	Yes	0.33 ug/L	ICP-MS	1.0 ug/L	1.0 - 100 ug/L
Pb	M474 / M874	Yes	5.0 %	ICP-OES	0.05 mg/L	0.05 - 15 mg/L
Pb	M474	Yes	0.37 ug/L	ICP-MS	1.0 ug/L	1.0 - 100 ug/L
Se	M474 / M874	Yes	6.8 %	ICP-OES	0.25 mg/L	0.25 - 15 mg/L
Sb	M474	Yes	0.35 ug/L	ICP-MS	0.50 ug/L	0.50 - 50 ug/L
Se	M474	Yes	0.35 ug/L	ICP-MS	2.0 ug/L	2.0 - 50 ug/L
Sn	M474	Yes	0.41 ug/L	ICP-MS	0.20 ug/L	0.20 - 50 ug/L
Sr	M474 / M874	Yes	3.6 %	ICP-OES	0.01 mg/L	0.01 - 15 mg/L
Sr	M474	Yes	0.58 ug/L	ICP-MS	0.50 ug/L	0.50 - 50 ug/L
Th	M474	Yes	0.35 ug/L	ICP-MS	0.30 ug/L	0.30 - 50 ug/L
Tl	M474	Yes	0.25 ug/L	ICP-MS	0.10 ug/L	0.10 - 50 ug/L
U	M474	Yes	0.30 ug/L	ICP-MS	0.20 ug/L	0.20 - 50 ug/L
V	M474 / M874	Yes	2.8 %	ICP-OES	0.10 mg/L	0.10 - 15 mg/L
V	M474	Yes	0.38 ug/L	ICP-MS	0.20 ug/L	0.20 - 50 ug/L
Zn	M474 / M874	Yes	4.0 %	ICP-OES	0.06 mg/L	0.06 - 15 mg/L

Note: All other tests or elements reported are not accredited unless specified otherwise.
Record: Analysis report information sheet, revision status: 2020-02-28
Compiled and approved by: T Horsfield

Page 4 of 4
WAT-21-0626 1
Record: Analysis report revision status: 2021-02-01
Designed and approved by T.Swanepoel

UIS ORGANIC LABORATORY

sanas Testing Laboratory

TEST REPORT
31515A

Test Description Gasoline Range Organics and Total Petroleum Hydrocarbons
Test Method: UISOL-T-012 (GRO) and UISOL-T-011 (TPH)

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Matrix: Water
Storage: Fridge at 0-6°C
Container: Glass
Date Received: 2021/02/11
Date Analysed: 2021/02/11
Date Issued: 2021/06/28

SAMPLE ID	GRO C6-C10	TPH C10-C28	TPH C28-C40	DILUTIONS
I210338/1 BH1-Kawe 2021/02/04; 12:06	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/2 BH2-Cumezao 2021/02/04; 12:36	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/3 BH3-Mutwe Ghombahe #2 2021/02/04; 13:39	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/4 BH4-Kaparara 2021/02/04; 14:40	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/5 BH5-Mbambe Mabure 2021/02/05; 10:15	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/6 BH6-Sadwere 2021/02/05; 11:10	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1

Disclaimers

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4) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.
5) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.

Reinardt Cromhout
Authorised Signatory

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UIS ORGANIC LABORATORY

sanas Testing Laboratory

AMENDMENT TO TEST REPORT 31515A

Test Description Gasoline Range Organics and Total Petroleum Hydrocarbons
Test Method: UISOL-T-012 (GRO) and UISOL-T-011 (TPH)

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Matrix: Water
Storage: Fridge at 0-6°C
Container: Glass
Date Received: 2021/02/11
Date Analysed: 2021/02/11
Date Issued: 2021/06/28

SAMPLE ID	GRO C6-C10	TPH C10-C28	TPH C28-C40	DILUTIONS
I210338/7 BH7-Shakumbu 2 2021/02/05; 12:10	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1
I210338/8 BH8-Wisdom Farm 2021/02/05; 13:30	<10 µg/liter	<382 µg/liter	<382 µg/liter	GRO=1, TPH=1

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UIS ORGANIC LABORATORY

TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/1 BH1-Kawe 2021/02/04; 12:06
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

Disclaimers

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Authorised Signatory

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UIS ORGANIC LABORATORY

AMENDMENT TO TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/2 BH2-Cumezao 2021/02/04; 12:36
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

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UIS ORGANIC LABORATORY

AMENDMENT TO TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/3 BH3-Mutwe Ghombahe #2 2021/0
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

Disclaimers

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Authorised Signatory

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UIS ORGANIC LABORATORY

AMENDMENT TO TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/4 BH4-Kaparara 2021/02/04; 14:40
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

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Reinardt Cromhout
Authorised Signatory

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UIS ORGANIC LABORATORY

AMENDMENT TO TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/5 BH5-Mbambe Mabure 2021/02/05;
Dilution: No Dilution
Container: Glass
Matrix: Water
Storage: Fridge at 0-6°C
Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

Disclaimers

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UIS ORGANIC LABORATORY

TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client:	Analytical Laboratory Services cc				
Address:	P.O. Box 86782 Eros Windhoek	**Attention:** **Tel:** **Email:**	Silke Rügheimer (061) 210 132 info@analab.com.na	**Project number:** **Project name:**	I210338/1-8 N/A

Sample Information

Sample ID:	**I210338/6 BH6-Sadwere 2021/02/05; 11:10**	**Matrix:**	Water	**Date Received:**	2021/02/11
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2021/02/16
Container:	Glass			**Date Issued:**	2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

Disclaimers

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UIS ORGANIC LABORATORY

AMENDMENT TO TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/7 BH7-Shakumbu 2 2021/02/05; 12:1
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

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UIS ORGANIC LABORATORY

TEST REPORT 31515A

Test Description Polars by Direct Injection
Test Method: UISOL-T-018

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/8 BH8-Wisdom Farm 2021/02/05; 13
Dilution: No Dilution
Container: Glass
Matrix: Water
Storage: Fridge at 0-6°C
Date Received: 2021/02/11
Date Analysed: 2021/02/16
Date Issued: 2021/06/28

PARAMETER	RESULT
Acetone	<10 mg/liter
Methanol	<10 mg/liter
Ethanol	<10 mg/liter
Acetaldehyde	<10 mg/liter
Methyl Acetate	<10 mg/liter
Ethyl Acetate	<10 mg/liter
Propyl Acetate	<10 mg/liter
Butyl Acetate	<10 mg/liter
n-Propanol	<10 mg/liter
n-Butanol	<10 mg/liter
Isopropyl Alcohol	<10 mg/liter
2-Butoxyethanol	<10 mg/liter

Disclaimers

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UIS ORGANIC LABORATORY

sanas Testing Laboratory

TEST REPORT
31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/1 BH1-Kawe 2021/02/04;12:06
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

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UIS ORGANIC LABORATORY

sanas Testing Laboratory

AMENDMENT TO TEST REPORT 31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/2 BH2-Cumezao 2021/02/04;12:36
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

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UIS ORGANIC LABORATORY

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AMENDMENT TO TEST REPORT 31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/3 BH3-Mutwe Ghombahe #2 2021/02/04; **Matrix:** Water
Dilution: No Dilution **Storage:** Fridge at 0-6°C
Container: Glass
Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

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UIS ORGANIC LABORATORY

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AMENDMENT TO TEST REPORT 31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/4 BH4-Kaparara 2021/02/04;14:40
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

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UIS ORGANIC LABORATORY

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AMENDMENT TO TEST REPORT 31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/5 BH5-Mbambe Mabure 2021/02/05;10:1
Dilution: No Dilution
Container: Glass
Matrix: Water
Storage: Fridge at 0-6°C
Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

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UIS ORGANIC LABORATORY

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TEST REPORT
31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek

Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na

Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/6 BH6-Sadwere 2021/02/05;11:10
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

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Reinardt Cromhout
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UIS ORGANIC LABORATORY

sanas Testing Laboratory

AMENDMENT TO TEST REPORT 31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/7 BH7-Shakumbu 2 2021/02/05;12:10
Dilution: No Dilution
Container: Glass
Matrix: Water
Storage: Fridge at 0-6°C
Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
Bis(2-ethylhexyl) phthalate*	<20 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.
2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
4) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.
5) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.

Reinardt Cromhout
Authorised Signatory

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UIS ORGANIC LABORATORY

sanas Testing Laboratory

TEST REPORT
31515A

Test Description Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client: Analytical Laboratory Services cc
Address: P.O. Box 86782 Eros, Windhoek
Attention: Silke Rügheimer
Tel: (061) 210 132
Email: info@analab.com.na
Project number: I210338/1-8
Project name: N/A

Sample Information

Sample ID: I210338/8 BH8-Wisdom Farm 2021/02/05;13:30
Dilution: No Dilution
Container: Glass
Matrix: Water
Storage: Fridge at 0-6°C
Date Received: 2021/02/11
Date Analysed: 2021/02/13
Date Issued: 2021/06/28

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<0.1 µg/liter
Acenaphthene	<0.1 µg/liter
Acenaphthylene	<0.1 µg/liter
Fluorene	<0.1 µg/liter
Phenanthrene	<0.1 µg/liter
Anthracene	<0.1 µg/liter
Fluoranthene	<0.1 µg/liter
Pyrene	<0.1 µg/liter
Benzo(a)anthracene	<0.1 µg/liter
Chrysene	<0.1 µg/liter
Benzo(b+k)fluoranthene	<0.2 µg/liter
Benzo(a)pyrene	<0.1 µg/liter
Benzo(g,h,i)perylene	<0.2 µg/liter
Dibenz(a,h)anthracene	<0.2 µg/liter
Indeno(123-cd)pyrene	<0.2 µg/liter

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<0.2 µg/liter
1,3-Dichlorobenzene*	<0.2 µg/liter
1,4-Dichlorobenzene*	<0.2 µg/liter
2-Chloronaphthalene*	<0.2 µg/liter
Hexachlorobenzene*	<0.2 µg/liter
Hexachloroethane*	<0.2 µg/liter
1,2,4-Trichlorobenzene*	<0.2 µg/liter
4-Chlorophenylphenyl ether*	<0.2 µg/liter
4-Bromophenylphenyl ether*	<0.2 µg/liter

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<20 µg/liter
Butyl benzyl phthalate*	<20 µg/liter
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