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Production Borehole Hydrocensus Report: Ditsobotla Local Municipality

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Compiled: Valli Yantolo

Sub-directorate: Geohydrology – North West

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Executive Summary

Department of Water and Sanitation, Geohydrology Section received data for North West production (Municipal) boreholes from Provincial Disaster Management and a request to verify the data. The data was organised on a local municipal basis. For the verification of the data a hydro census was in order. This is a report on the hydro census carried out on Ditsobotla Local Municipality in Ngaka Modiri Molema District Municipality (NMMDM) which had 150 production boreholes pending site visitation. Following, a hydro census was planned for immediate execution, on the abovementioned production boreholes. The hydro census was carried out over two weeks by the author and Mr Meshack Garegae, Department of Water and Sanitation's experienced auxiliary office on groundwater monitoring in the North West. Field work was completed over a span of two weeks during the weeks of 19-23 June 2017 and 21-25 August 2017.

The purpose of the hydro census was to collect recent data on the production boreholes for a rough water supply analysis, to assess any risk to water resource pollution, and for the general purpose of data collection. Data was collected using a modified version of the NGA form (DWS, NGA). Data collected was subject to instant availability and related to NGA identifier, Borehole ownership, Geosite status, Equipment installed, Quaternary catchment etc.

According to a Drought Status Report (2016) by the Department of Water and Sanitation the study area is currently experiencing a mild drought at best and a moderate drought at worse; and there seems to be no end in sight.

The geological setting mostly comprises of cherty dolomites from the Malmani Sub-group in the Chuniespoort group from the greater Transvall SupergroupThe hydrogeology in the study area is immensely diverse, inclusive of karsts aquifers, fractured, weathered and alluvial aquifers. Nevertheless, sites visited are only drilled into karst aquifer, weathered and fractured aquifers, thus excluding alluvial aquifers.

In total 148 boreholes were visited, out of the total only 33 production boreholes were operation; less than 23%. A total of 28 Production boreholes had been block as a consequence of vandalism to a large part. Vandalism may indicate knowledge or frustrations on the part of the communities cited in this report. Twenty (20) production boreholes did not have pumps. There are 46 production boreholes that were reported as inaccessible; this simply means that a route to borehole was not immediately available; there was a locked

gate or entry denied by property owner. These inaccessible points increase the uncertainty in the analysis by increasing points of no data.

The high rate of vandalism, poor maintenance and drought threat incline the author to conclude that there is a high risk for water supply in the Local Municipality of Ditsibotla. A further risk assessment study would be beneficial to the understanding and quantification of the risk to aid the management of the groundwater resource and water supply.

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Abbreviations

WMA	Water Management Area
NMMDM	Ngaka Modiri Molema District Municipality
NGA	National Groundwater Archive
DWS	Department of Water and Sanitation

1. Introduction

Department of Water and Sanitation, Geohydrology Section received data for North West production (Municipal) boreholes from Provincial Disaster Management and a request to verify the data. The data was organised on a local municipal basis. For the verification of the data a hydro census was in order. This is a report on the hydro census carried out on Ditsobotla Local Municipality **(Figure 1)** in Ngaka Modiri Molema District Municipality (NMMDM) which had 150 production boreholes pending site visitation. Following, a hydro census was planned for immediate execution, on the abovementioned production boreholes. The hydro census was carried out over two weeks by the author and Mr Meshack Garegae, Department of Water and Sanitation's experienced auxiliary office on groundwater monitoring in the North West. Field work was completed over a span of two weeks during the weeks of 19-23 June 2017 and 21-25 August 2017.

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This report will summarise and discuss the results from the abovementioned hydro census results. A rough estimate of water supply analyse will be performed based on principles such as operational borehole availability in the wake of unavailable abstraction data.

Figure 1: Local Municipalities within Ngaka Modiri Molema District Municipality (Municipalities, n.d.)

2. Study area

The study area is located in Ditsobotla Local Municipality within Ngaka Modiri Molema District Municipality (NMMDM, n.d.) in North West Province **(Figure 1)**. Boreholes to be visited were to a large extent situated in villages and farms around the towns Lichtenburg and Coligny. Ditsibotla Local Municipality covers an area of 6,465 km^2. The places incorporated in the hydro census are Bodibe, Sheila, Itsoseng, Welverdiend/Meetmekaar, Matile 2, Coligny, Iketeng, Lichtenburg Game Breeding Centre and Springbokpan. D41A, D41B, C31D, C24F, C31B are the Quaternary Catchments within the study area from two separate Water Management Areas (WMA), namely; the Vaal WMA and Limpopo WMA.

According to a Drought Status Report (2016) by the Department of Water and Sanitation the study area is currently experiencing a mild drought at best and a moderate drought at worse; and there seems to be no end in sight. The study area is situated in a semi-arid area and is one of the driest provinces in the country with rainfall as low as 38 mm in February 2016 and low as 5mm in February 2015 (DWS, 2016).

3. Geology

The geological setting **(Figure 2)** mostly comprises of cherty dolomites from the Malmani Sub-group in the Chuniespoort group from the greater Transvall Supergroup. The Malmani-subgroup is dated at 2.64-2.5 Ga and consists of 4 dolomitic formations of varying chert content (Molokomme, 2014). Malmani Dolomites have undergone a complex tectonic history resulting in tilting and inclusive of diabase sills and dykes (Barnard, 200). The dolomites are often overlain by younger sediments unconsolidated deposits and soils.

Sandstones and conglomerates in the Bothaville fm and andesitic lavas from the Allanridge fm. underlie the remainder of the study area. Both formations belong to the Ventersdorp Supergroup and are of Archaean age, predating the abovementioned Trasnvaal Supergroup. Bothaville fm. is found in Coligny. A few sites are underlain by granodiorite, pigmitite and gneiss for the Halfway Granites. These are intrusive rocks are old craton rocks that predate all of the above formations.

Aquifer properties are derived from rock types and history of rocks formations therefore it is of interest to understand the regional geology of the study area for a better geohydrological understanding.

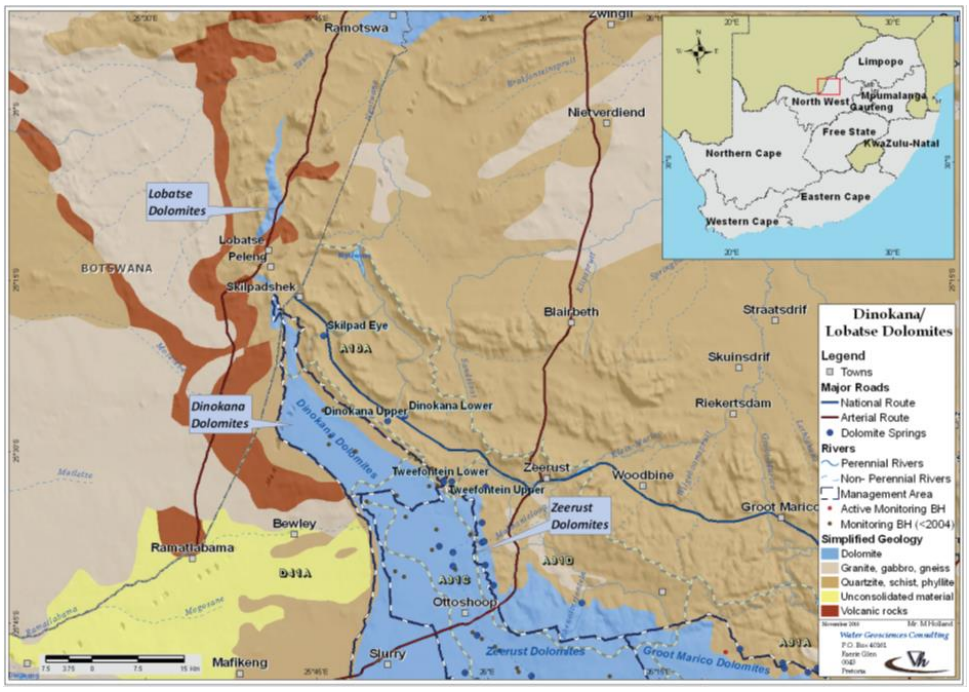

Figure 2: Geological Setting (Pietersen, Beekman and Holland, 2011)

4. Hydrogeology

The hydrogeology in the study area is immensely diverse, inclusive of karsts aquifers, fractured, weathered and alluvial aquifers. Nevertheless, sites visited are only drilled into karst aquifer, weathered and fractured aquifers, thus excluding alluvial aquifers.

Karst aquifers develop only within dolomitic formations. A vast amount of the sites visited are drilled into Karst aquifers, this is no coincidence because Karst aquifers are known for delivering yields of water with a max of 126 (l/s)(Barnard, 2000). It is of no surprise that the groundwater yield potential in these aquifers is also higher than average. The internal cave structure of the Karst aquifers enables high values of transmissivity and storage co-efficient. Barnard, 2000 writes that the dykes and sills intruded into Malmani Dolomites have created semi-permeable boundaries within the aquifers, effectively creating Dolomitic Compartments. Compartments that fall with the study area are Molopo/Grootfontien, Dudfield and Itsoseng Compartment (Meyer, 2014). The dykes and sills also introduce hydraulic conditions that contribute to high abstraction yields, particularly in proximity to the boundaries themselves.

Rocks of the Allanrigde and Bathoville formations do not have primary porosity but have developed porosity via deep weathering, structural features such as faults, fracture zones and lithological contacts (Barnard, 2000). Thus these rocks produce Fractured and weathered aquifers. These rocks can both have good groundwater yield potential but may be highly variable owing to the depth of weathering, topography, hydraulic factors and degree of fracturing. Halfway granites have the majority of their porosity attributed to deep weathering over billions of years and fracturing. The Halfway granites produce fractured aquifer s that are of good yield potential.

5. Hydro Census Results

The study area is reliant solely on groundwater as surface water is very scarce in the area; with only the Molopo River as the closest surface water body (Google, 2017).

From the data collected, it was noted that; the geomorphology is flat grassy land throughout the study area with the occasional scattered bushes. Vast portions of land are predominantly rural settlement and agriculture in land-use (NGA form, 2017). It was gathered from site investigation that agricultural activity is dominated by commercial maze and sunflower. The water from the production boreholes are used for Domestic use (including human consumption), livestock and irrigation.

A hydrocensus was conducted to primarily verify the status and type equipment installed of Production boreholes in Ditsobotla LM. **Table 1**, indicates the places visited the number of sites visited and the results.

Place	Boreholes visited	In-use	Not in-use	No Pump	Blocked	Inaccessible
Bodibe	13	1	12	1	4	4
Itsoseng	27	6	21	6	2	11
Matile 2	17		17	3	6	3
Sheila	6	3	3	0	1	0
Springbokpan	13	4	9	0	2	4
Weldverdiend	12	2	10	1	4	2
Itekeng	13	1	12	3	1	7
Coligny	26	7	19	5		13
Litchtenburg Game Breeding Centre(LGBC)	21	9	12	1	8	2
Total	**148**	**33**	**115**	**20**	**28**	**46**

Table 1: Ditsobotla Hydrocensus Results

In total 148 boreholes were visited, out of the total only 33 production boreholes were operation; less than 23% **(as seen in Table 1)**. A total of 28 Production boreholes had been block as a consequence of vandalism to a large part. Vandalism may indicate knowledge or

frustrations on the part of the communities cited in this report. Twenty (20) production boreholes did not have pumps. Therefore, water cannot be abstraction from such boreholes at the moment. A significant portion of the sites visited are situated in Itsoseng, Litchtenburg and Coligny. This is a result of the large number of people residing in these areas and the economic activities currently undergoing such as agriculture and industry. The rest of the places excluding Itsoseng, Lichtenburg and Coligny are at a high risk of water shortage the few number of operating production wells **(Table 1)**.

There are 46 production boreholes that were reported as inaccessible; this simply means that a route to borehole was not immediately available; there was a locked gate or entry denied by property owner. These inaccessible points increase the uncertainty in the analysis by increasing points of no data.

None of the visited boreholes were confirmed as dry. Water supply shortages are likely not have attributed to the over abstraction and deteriorating resources but rather poor maintenance of water supply infrastructure and vandalism from uninformed/disgruntled community members. This is evident in the enormous number of non-operational blocked, vandalised and abandoned sites.

Water Supply in the study area may be considered unreliable because of issues such as vandalism and poor maintenance. Nevertheless the Karst aquifers in this region are one of the most important aquifers in South Africa being able to supply cities and enormous agriculture and industries. Yet the impressive resilience of the aquifers is meaningless without proper infrastructure and sound management.

6. Conclusion

It is in the interest of the Department of Water and Sanitation that data of sufficient quality on the water resources of South Africa is produced and made available to the public. Sufficient data means that the data is accurate, timeless, credible, accessible and secured data (DAM strategy, 2016). Therefore, the data collected has been uploaded and/or updated on National Groundwater Archive (NGA). Water Quality data was not collected although desirable it was desirable for a water quality analysis and compliance checking with SANS Drinking Water Standards. Data on the NGA is freely available for public use and any persons interested. Such data may be utilised for future projects in the realm Geohydrology; may it be groundwater resource assessment, water supply assessment/refurbishment or research.

20-00043 in Iketeng is situated on a Dumpsite, despite the borehole being inaccessible; nevertheless a risk of groundwater pollution persists for groundwater beneath dumpsites.

The high rate of vandalism, poor maintenance and drought threat incline the author to conclude that there is a high risk for water supply in the Local Municipality of Ditsibotla. A further risk assessment study would be beneficial to the understanding and quantification of the risk to aid the management of the groundwater resource and water supply.

7. Recommendations

Based on the hydrocensus results, groundwater supply infrastructure has deteriorating and an immediate refurbishment is required.

Municipal boreholes, meaning boreholes are supplying water to the communities may not be limited to the data supplied in this report. Therefore, it is recommended that further data be source from the municipality and contractors from Ditsobotla LM so as to ascertain the status quoi of municipal production boreholes as a whole.

Water metering is a critical monitoring tool than assists in revenue recovery and resource assessment for both licensing procedures and also water supply refurbishment projects. It is recommended that meters are installed where groundwater abstraction is occurring.

There are 46 production boreholes that were reported as inaccessible; this simply means that a route to borehole was not immediately available; there was a locked gate or entry denied by property owner. These inaccessible points increase the uncertainty in the analysis by increasing points of no data. In the future it is recommended that the involvement of the affected land-owners done prior to fieldwork, in order to arrange site visits and avoid this matter.

It is therefore imperative that the status of water supply be monitored closely and measures for water supply emergencies are in place in case of a more severe drought or any factor that and compromise the provision of save drinking water to the public at all times.

There needs to be a closer/better working relationship between spheres of government and all stakeholders to ensure a the data is effectively shared for analysis and quick management responses thus ensuring meticulous management of South African Groundwater Resources.

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