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Report 2020 / 01 / 07 / GWSE

Sterkspruit to Mlamli Hospital Groundwater Potential Desktop Study

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Sterkspruit to Mlamli Hospital Groundwater Potential Desktop Study

16 January 2020

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LIST OF ABBREVIATIONS

Abbreviation	Description
DWS	Department of Water and Sanitation
DLG	Department of Local Government
MAP	Mean Annual Precipitation
MBGL	Meter Below Ground Level
MAMSL	Meters Above Mean Sea Level
NGA	National Groundwater Archive

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1 INTRODUCTION

1.1 General

AGES Omega (Pty) LTD hereafter referred to as AGES, was appointed by Masilakhe Consulting Engineers, here after referred to as the client, to investigate the groundwater potential of the area between Sterkspruit town and Mlamli Hospital.

1.2 Scope of the investigation

The methodology for the requested inputs relate to the following items:

- Source and review hydrogeological maps
- Source and review NGA and AGES historical data
- Remote sensing and structural geological mapping
- Groundwater reserve and yield potential assessment
- Groundwater quality assessment
- Identify potential target areas for exploration geophysics and drilling
- Data processing and report compilation indicating estimated available groundwater volumes and borehole required to meet demand.
- Define implementation budget

The above-mentioned scope was addressed by combining all of the background information available and the information made available by the client.

1.3 Location of the project area

The area of investigation is situated along the road leading from Sterkspruit town to Mlamli Hospital south east of Sterkspruit town within the Joe Gqabi District Municipality.

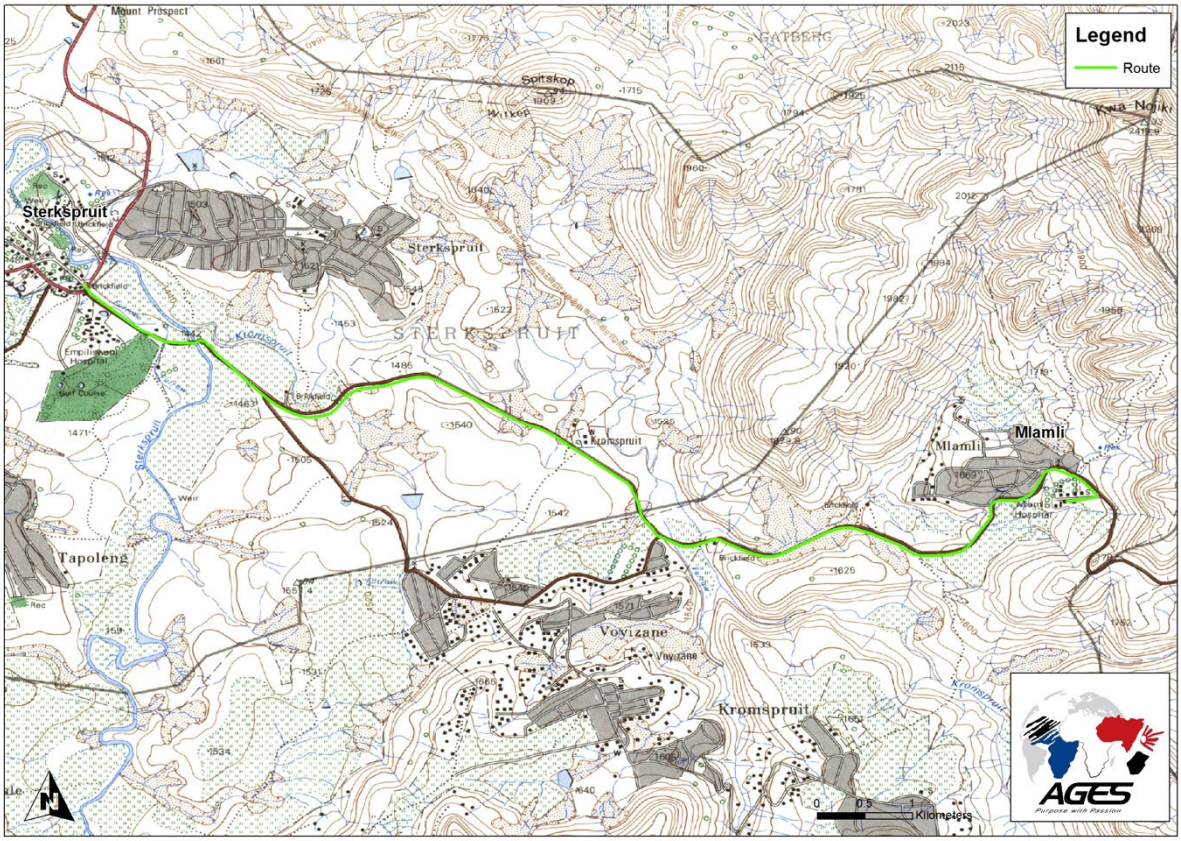

Figure 1: Project Locality

2 HYDROGEOLOGICAL SETTING

2.1 Geology

According to the 1: 250 000 Geological Map of Aliwal North, the project area is underlain by the Elliot Formation that consists of brownish red and grey mudstone that is in turn underlain by the Molteno Formation that consists of grey mudstone, shale and gritty sandstone. The project area is also intersected by various dolerite dykes that strike in a primary north west to south east direction.

The local geological setting is indicated on the inset map on Figure 7 in Section 5 of this report.

2.2 Hydrogeology and Water Quality

According to the 1:500 000 scale hydrogeological map of Bloemfontein, the project area is underlain by intergranular and fractured aquifers. The expected yield of a successful borehole drilled into the underlying aquifers can range between 0.5 and 2.0 l/s.

The 1:500 000 scale hydrogeological map of Bloemfontein indicates that GOOD groundwater quality conditions may be expected on the project area, with EC range of 0-70 mS/m possibly being found. This is however a regional estimation. From projects conducted in the area of Sterkspruit, groundwater strikes along dolerite dykes have had high Fluoride concentrations.

Overall good water quality is expected for the area though elevated fluoride concentrations can be expected.

2.3 NGA and AGES Geosite Data

In total 11 geosites were identified from the National Groundwater Archive (NGA) Database and AGES internal Database that fall within a 500m radius of Route between Sterkspruit and Mlamli Hospital. The available information is summarised in Table 1 below and the location of the sites are indicated on Figure 2.

Table 1: NGA and AGES Data Summary

Geosite Name	Latitude	Longitude	Date Surveyed	Water Level (mbgl)	EC (mS/m)	Equipment	Comments
EC-D12-277	-30.55578	27.43082		6.27	39.00		
EC-D12-279	-30.55232	27.44499		Dry	-		
EC-D12-280	-30.55229	27.44501		11.78	35.00		
EC-D12-235	-30.55089	27.46205		-	-		Drilled for Mlamli School
EC-D12-278	-30.55044	27.42681		10.01	23.00		
EC-D12-234	-30.5503	27.46898		-	-		Drilled for Mlamli School
EC-D12-233A	-30.54822	27.46729		-	-		Drilled for Mlamli School
EC-D12-233B	-30.54817	27.46721		-	-		Drilled for Mlamli School
EC-D12-057	-30.52717	27.37556	2007/11/21			No Equipment	The Borehole is blocked
EC-D12-063	-30.53422	27.38213	2007/11/02			No Equipment	The Borehole is blocked
EC-D12-064	-30.53085	27.37393	2007/11/21	0.01	88	Handpump	Borehole Destroyed though water level is visible

Based on the limited available data pulled from the databases it can be seen that shallow general groundwater target conditions occur as water levels are shallower than 12 mbgl, though the data is outdated and due to the recent drought conditions it is expected to have deeper groundwater levels. From previous projects in the Sterkspruit area boreholes are generally not drilled deeper than 120m.

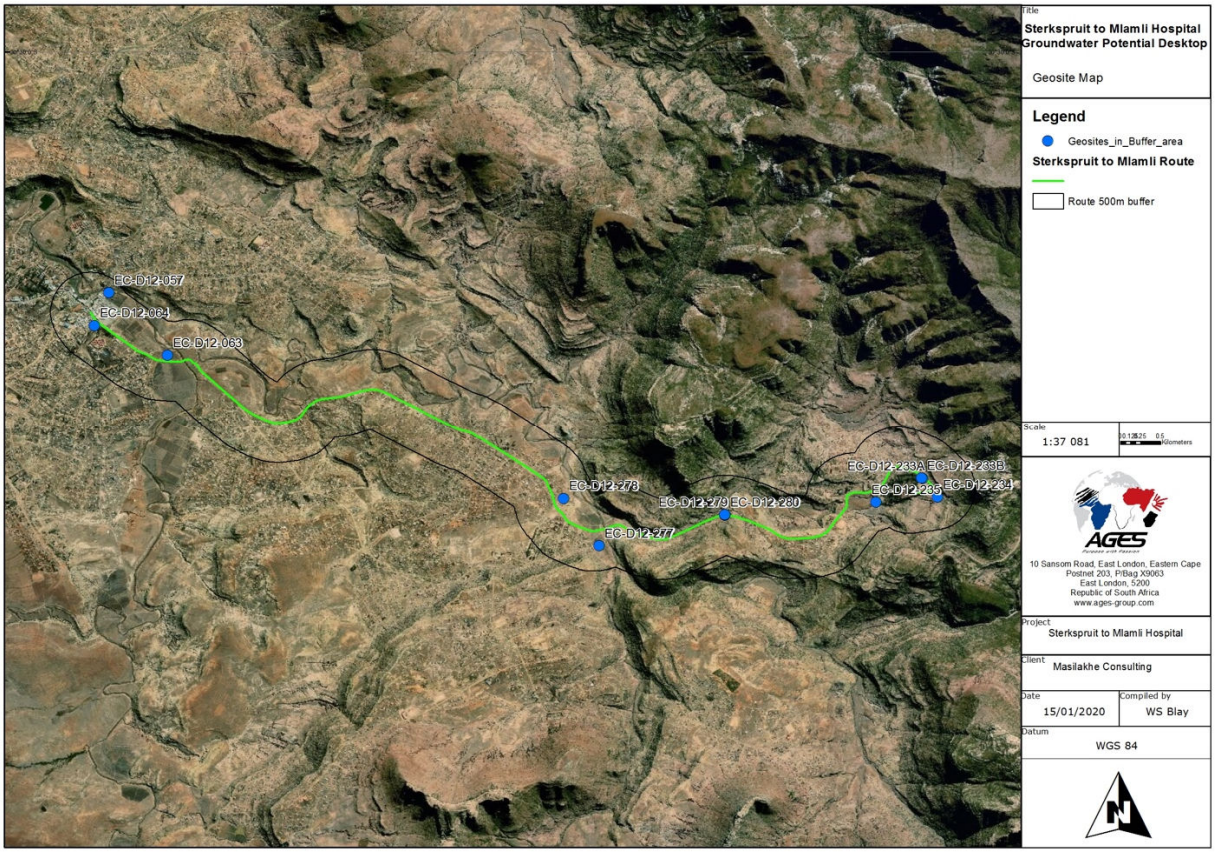

Figure 2: Geosites within 500m of the Route

2.4 Groundwater Potential and Target Zone Identification

The project area is located within the quaternary catchment D12B that has a mean annual rainfall of 720 mm and a recharge of 45.68 mm/a with a current groundwater use of 0.16 Mm^3/a according to the GRDM database.

Two groundwater target zones were identified as indicated in Figure 3 for geophysical exploration based on the access to drill, topography and dolerite dykes in the Elliot and Molteno Formations. The target zone located to the north west that is the closest to Sterkspruit is expected to have a higher groundwater potential due to the small dolerite dykes located in the area.

The groundwater potential for the target areas north west is are expected to be Medium to High and the target area closer to Mlamli is also expected to be Medium.

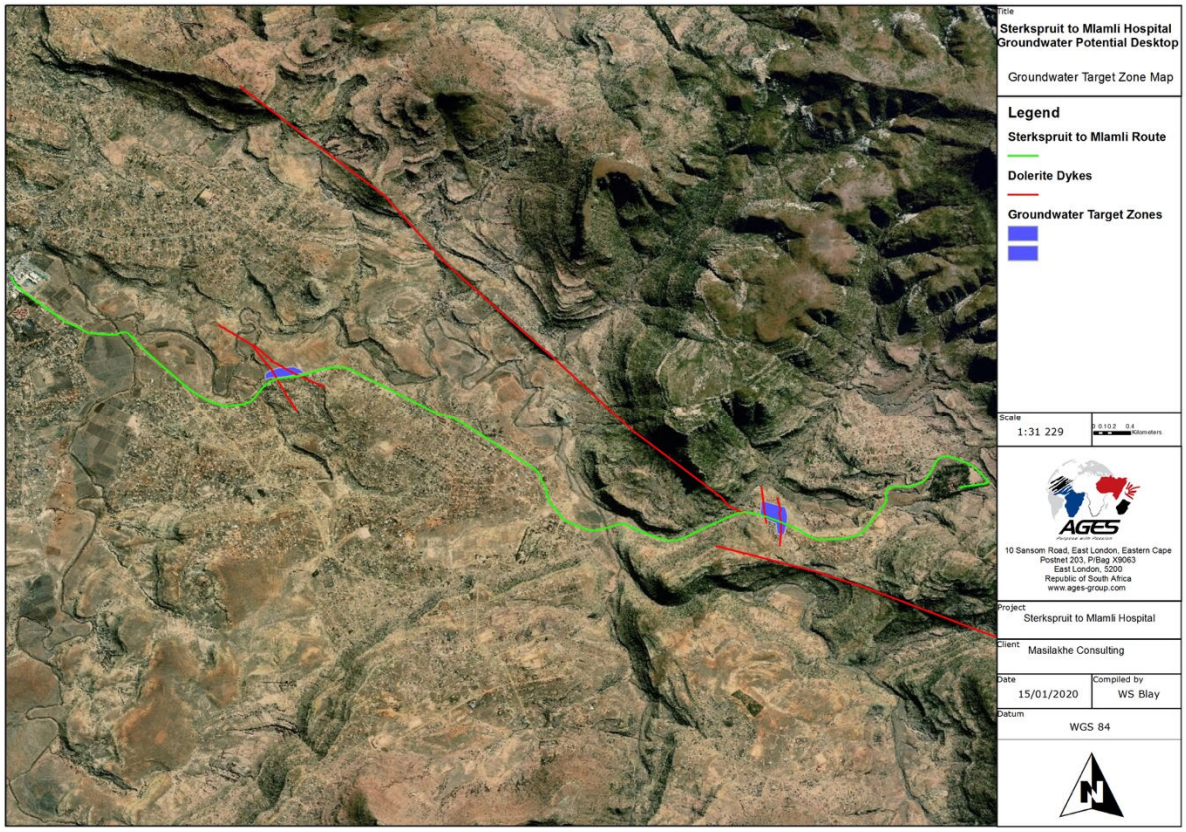

Figure 3: Groundwater Target Zones and Geological Structures

2.5 GRDM – Reserve Determination

As part of the investigation a rapid groundwater reserve was completed, using the DWA GRDM software, with quaternary catchment D12B delineated as a groundwater resource unit, as indicated on Figure 4. A 500m buffer was created of the Route between Sterkspruit and Mlamli as indicated in the resource unit below.

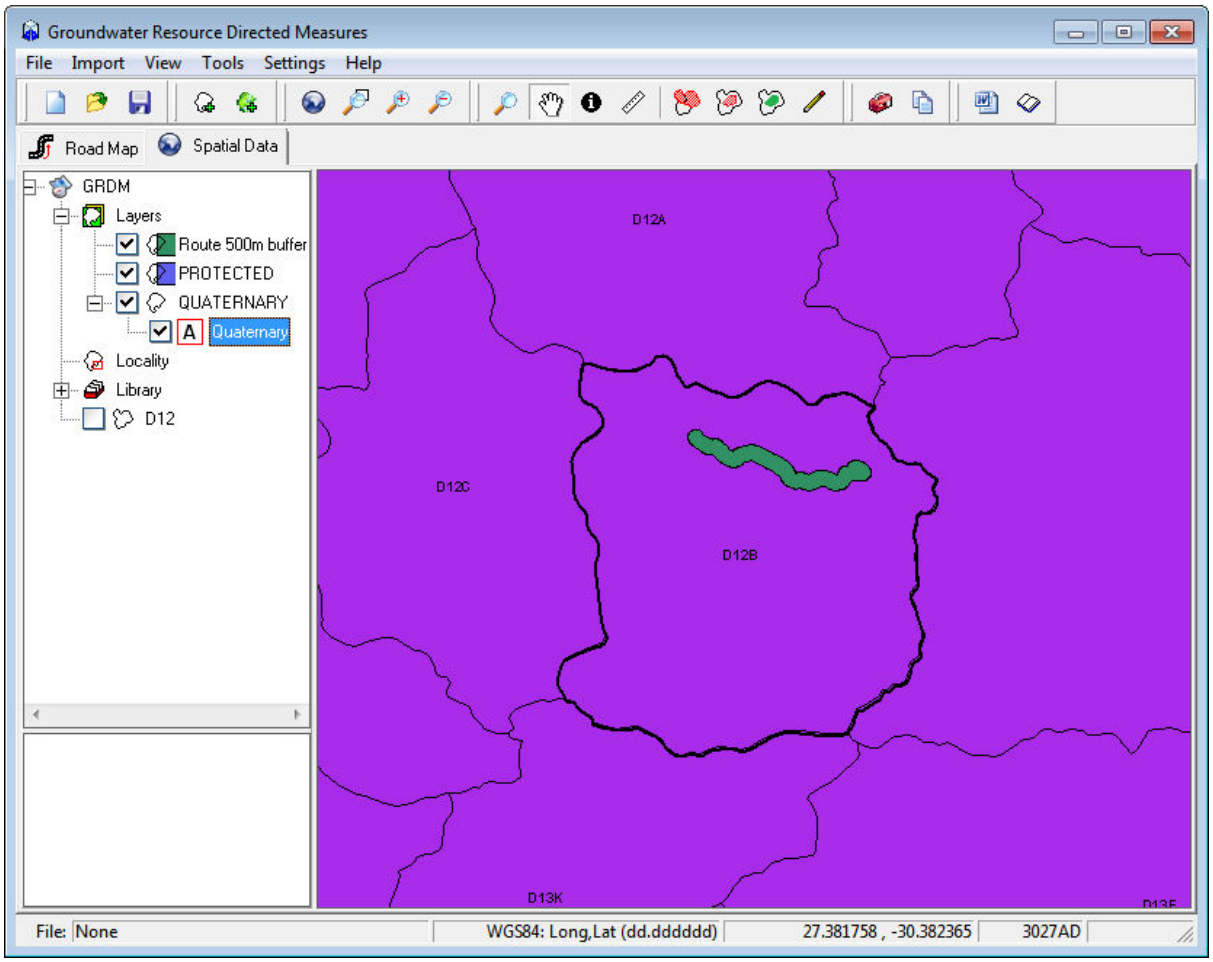

Figure 4 Groundwater Resource Unit

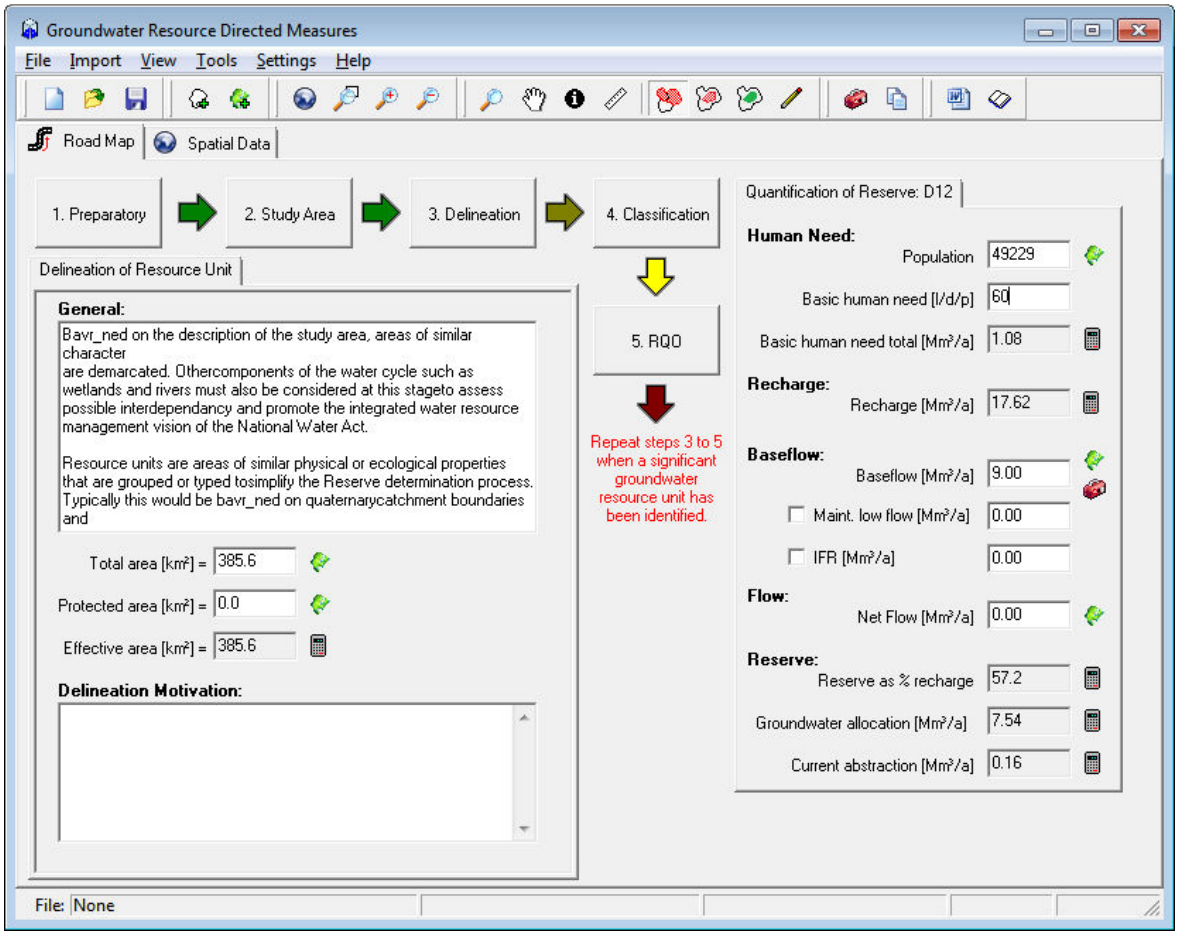

Figure 5. The Reserve

The underlying aquifer classifies as category A according to the GRDM software, this infers that the underlying aquifer is viewed as being in unmodified, pristine conditions.

Figure 5 indicates that there is an estimated minimum total allocable volume of 7.54 Mm^3/a within the quaternary catchment. This can be more simply be quantified as 239.09 l/s over a 24-hour duty cycle or 20657 m^3/day.

It is important to note that the allocable yield is what is available for the whole catchment area.

3 SUMMARY

AGES Omega (Pty) LTD hereafter referred to as AGES, was appointed by Masilakhe Consulting Engineers, here after referred to as the client, to investigate the groundwater potential of the area between Sterkspruit town and Mlamli Hospital.

The area of investigation is situated along the road leading from Sterkspruit town to Mlamli Hospital south east of Sterkspruit town within the Joe Gqabi District Municipality as indicated in Figure 1.

The project area is underlain by the Elliot Formation that consists of brownish red and grey mudstone that is in turn underlain by the Molteno Formation that consists of grey mudstone, shale and gritty sandstone. The project area is also intersected by various dolerite dykes that strike in a primary north west to south east direction.

The expected yield of a successful borehole drilled into the underlying aquifers can range between 0.5 and 2.0 l/s. Good water quality is expected from boreholes drilled in the underlying aquifer, though elevated fluoride concentrations can be expected in places. The electrical conductivity of the groundwater in this area is expected to be between 0 and 70 mS/m.

In total 11 geosites were identified from the National Groundwater Archive (NGA) Database and AGES internal Database that fall within a 500m radius of Route between Sterkspruit and Mlamli Hospital. Borehole water levels are expected to be above 12 mbgl though due to the drought conditions the water levels can be deeper.

The project area is located within the quaternary catchment D12B that has a mean annual rainfall of 720 mm and a recharge of 45.68 mm/a. Two groundwater target zones were identified as indicated in Figure 3 for geophysical exploration based on the access to drill, topography and dolerite dykes in the Elliot and Molteno Formations. The target areas have a **Medium to High** groundwater potential.

A rapid desktop groundwater reserve was conducted on the quaternary catchment D12B in order to quantify the allocable groundwater. The GRDM software indicates that there is a total allocable volume of 7.54 Mm^3/a within the quaternary catchment. This can be more simply be quantified as 239.09 l/s over a 24-hour duty cycle. It is important to note that the allocable yield is for the whole catchment. The reserve will be updated with a smaller project specific area should the client wish to continue with the exploration drilling.

4 RECOMMENDATIONS

- Conduct a detailed hydrocensus to verify the existing borehole information and identify any additional borehole available for utilisation.
- Conduct geophysical surveys in the identified groundwater target zones in order to site exploration boreholes.
- It is recommended to continue with geophysical surveys and exploration drilling, however a water demand is required to provide the implementation budget.

5 MAPS

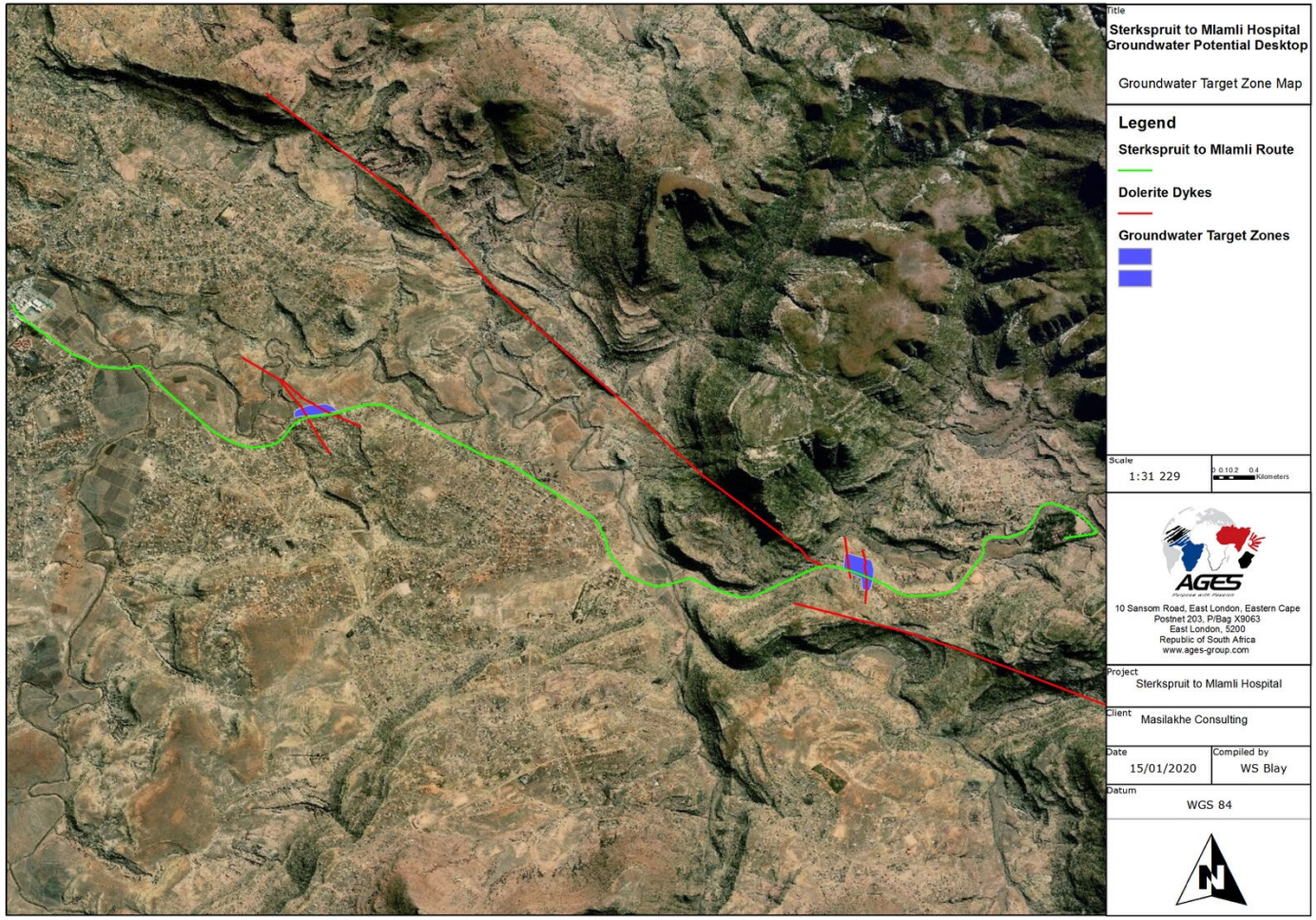

Figure 6: Target Area Map

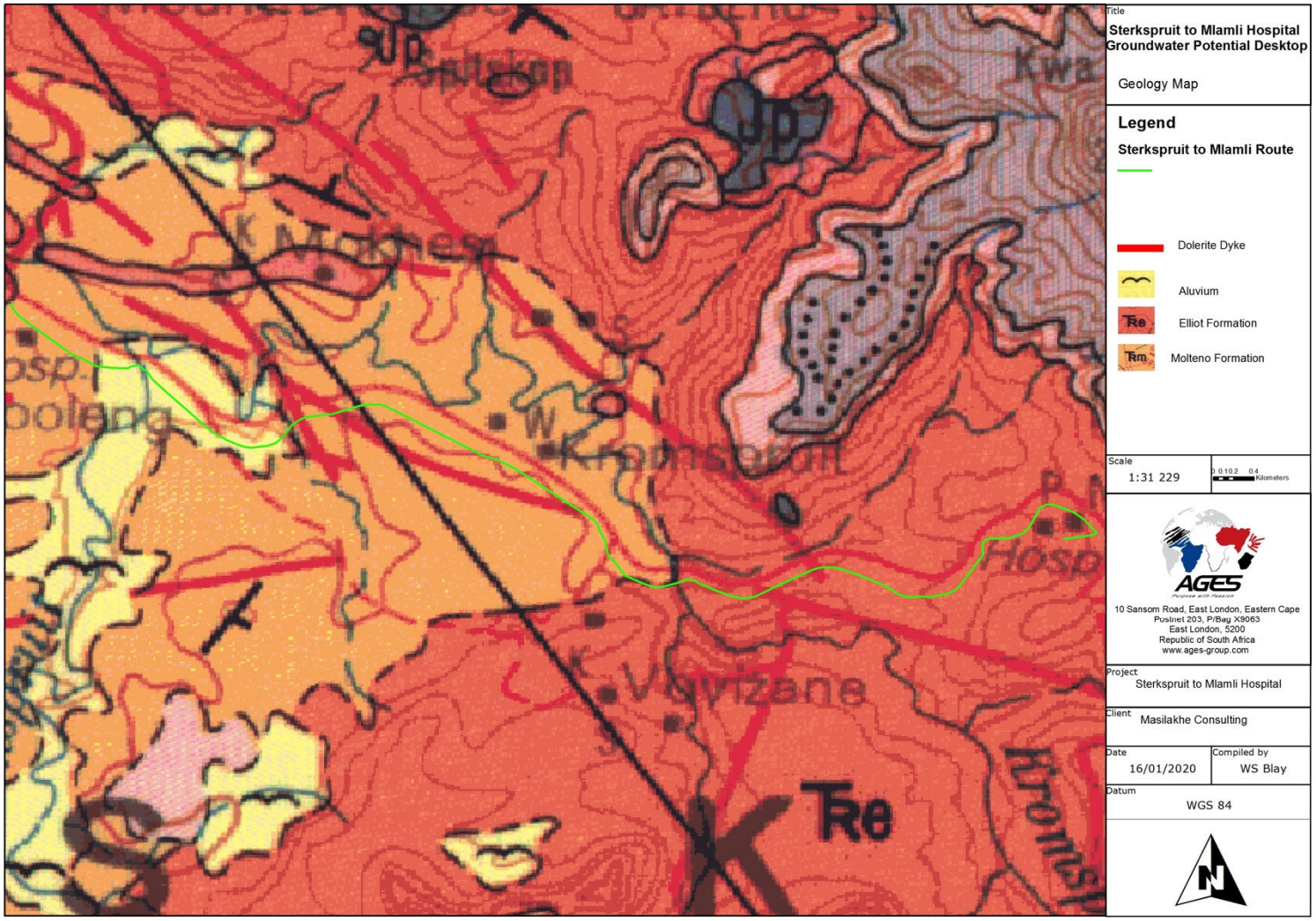

Figure 7: Geological Map