# SWARTLAND

# SPATIAL DEVELOPMENT FRAMEWORK

# ADDENDUM B

HYDROLOGY


**APRIL 2014**

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## 1. Introduction

As part of Status Quo report for the Swartland SDF the Bio-Physical environment was addressed, this included a section on the Water Resources in the Swartland contained in Chapter 9 of this report. The following provide additional information to this report and will focus specifically on groundwater and locality of aquifers within the Swartland.

Swartland Municipality contracted GEOSS (Geohydrological and Spatial Solutions International Pty Ltd) to do a study regarding the Hydrology, and specifically the occurrence of groundwater in Swartland Municipal area. This study will provide the relevant background information on groundwater in the region as well as identify sensitive areas to allow the municipality to make informed decisions. Part of the study also included the identification of aquifers and in particular the Grootwater aquifer at Yzerfontein. Groundwater plays a crucial role in the area from a socio-economic and ecological perspective and it therefore needs to be managed and protected in an appropriate manner by informed decisions making.

The study undertaken by GEOSS included:

- The location of the aquifers in the region;
- The yield of these aquifers, and
- The sensitivity of these aquifers with regards to urban development i.e. to propose some buffer areas or sterilization areas.

The study included a total of four (4) maps which form part of this document:

- Map 1 – Catchment areas and Government Water Control Area Map
- Map 2 – Aquifer type and yield
- Map 3 – Groundwater quality
- Map 4 – Groundwater vulnerability to surface based contamination sources

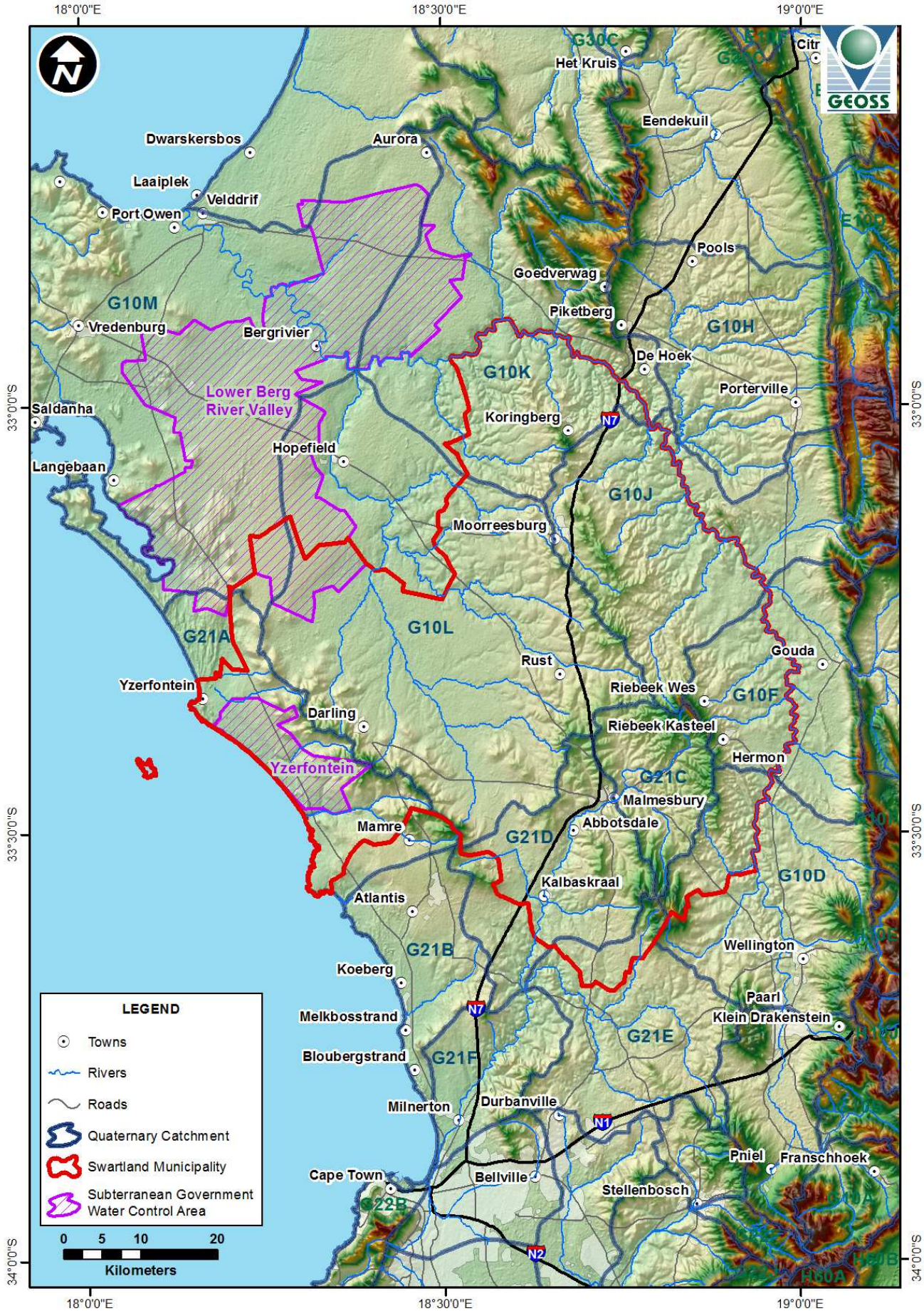
The following maps and descriptions summarise their findings and provide support information as compiled by GEOSS.

## 2. Catchment areas and Government Control Areas

This map was compiled to outline the Swartland Municipal area in terms of the different catchment areas and also indicate the “Subterranean Government Water Control Areas” within the Swartland region. The different “Subterranean Government Water Control Areas” was declared where the control of the use of the water was deemed by the Minister to be desirable in the “public interest” or “national interest”.

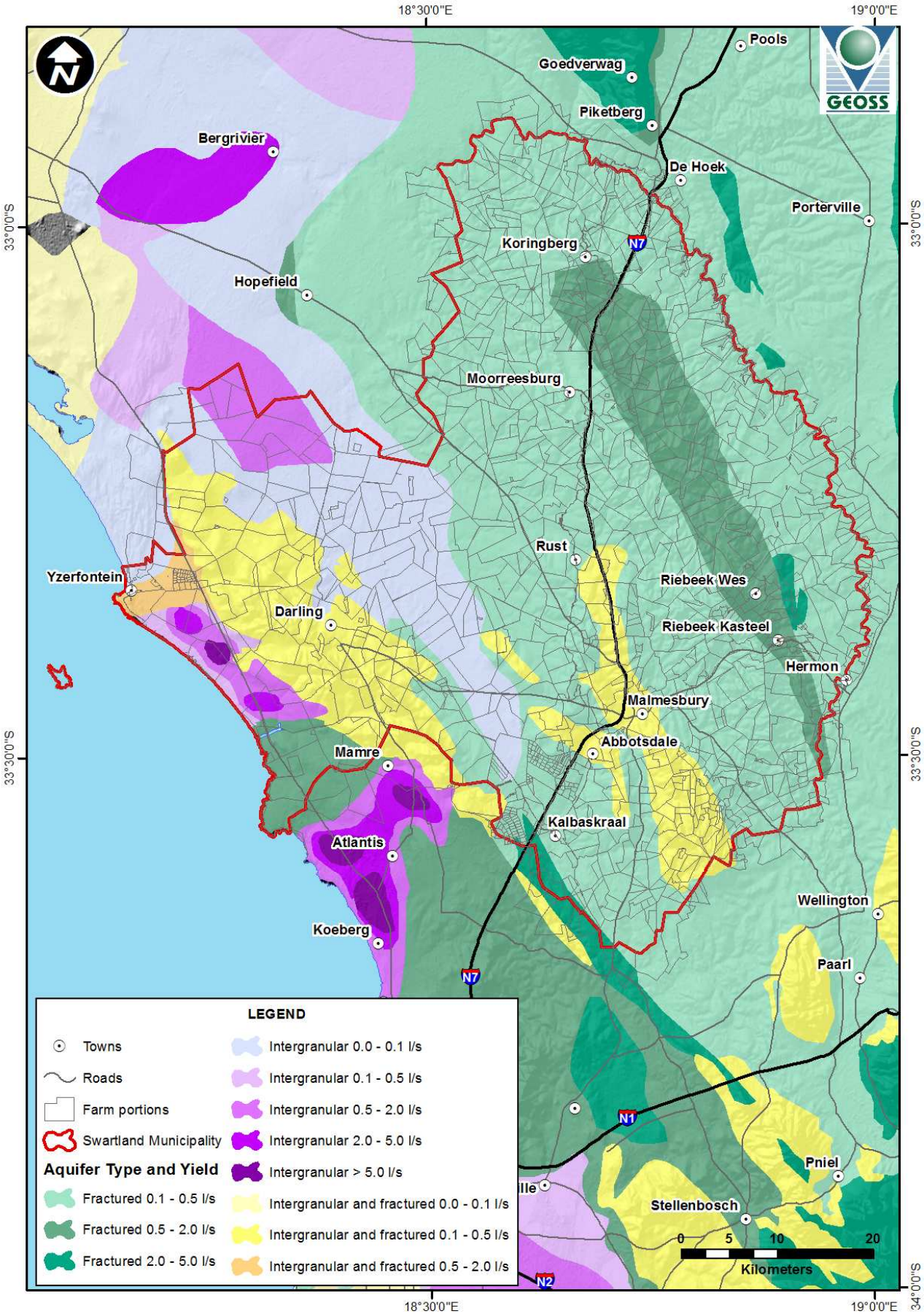
The Water Control Areas in the Swartland Municipal area are as follows:

- The **Yzerfontein Subterranean Government Water Control Area** was declared on the 2nd of February 1990. It is within the Tertiary/Quaternary drainage region G20. This area is excluded from any General Authorization for groundwater abstraction.
- The lower part of the **Lower Berg River Valley Subterranean Government Water Control Area** also occurs within the Swartland municipal area. This area was declared on the 10th of September 1976 within the Tertiary/Quaternary drainage region G10 and G30.




**Map 1: Catchments and Subterranean Government Water Control Area**

## 3. Aquifer type and yield




**Map 2: Aquifer type and yield**

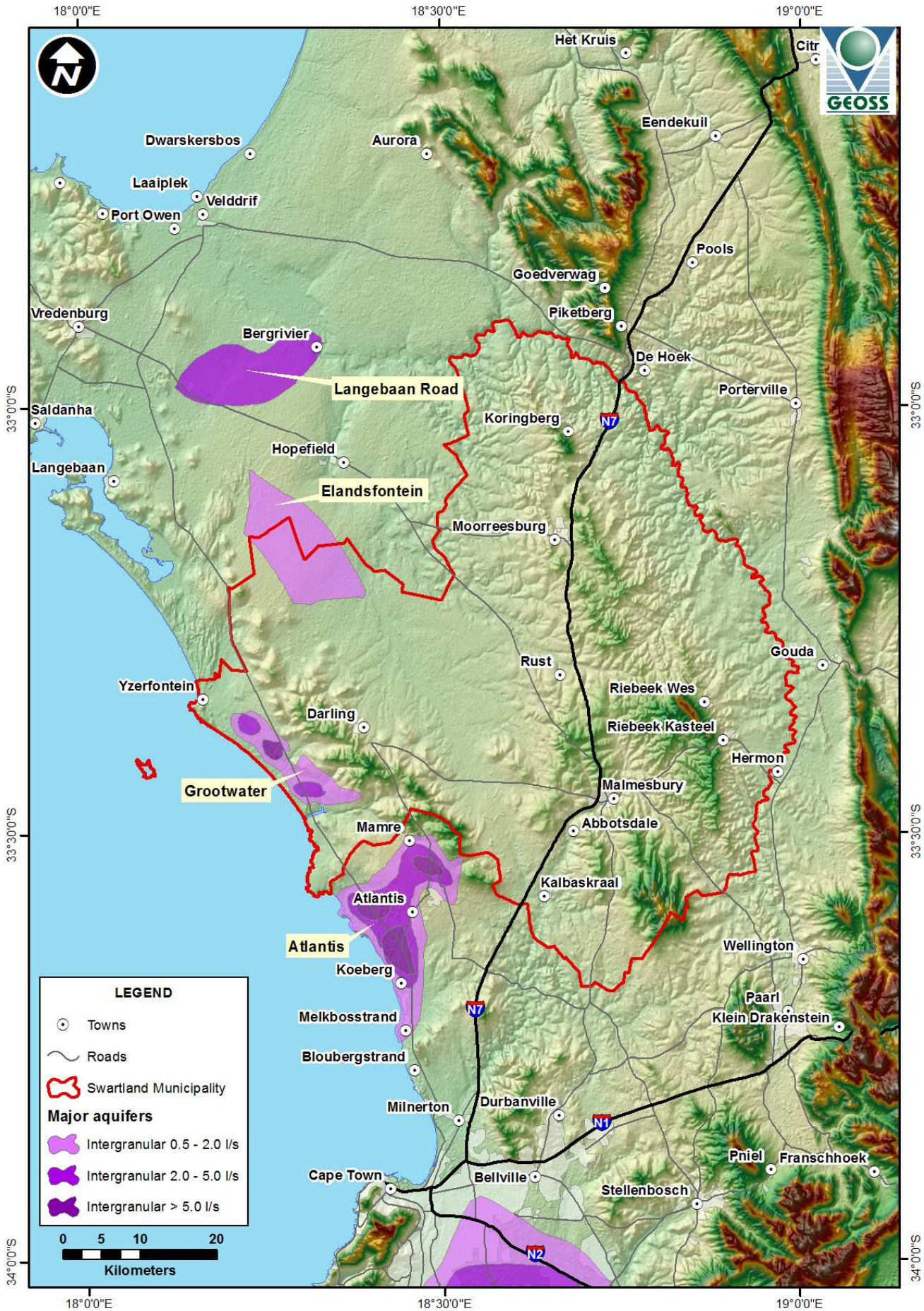
Map 2 indicates the three different types of aquifers that occur within the Swartland region as well as their yield in terms of water, measured in litres per second. The cadastral map is

The different aquifers are as follows:

- **Intergranular aquifers**: Generally unconsolidated but occasionally semi-consolidated aquifers. The groundwater occurs within intergranular interstices in a porous medium. Typically occurs as alluvial deposits along river terraces.
- **Intergranular and fractured aquifers**: Largely medium to coarse grained granite, weathered to varying thicknesses, with groundwater contained in intergranular interstices in the saturated zone, and in jointed and occasionally fractured bedrock.
- **Fractured aquifers**: Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.

The yield of the different identified aquifers means that if a borehole is drilled (correctly sited and constructed) it will yield groundwater at the indicated rate measured in litres per second. This is however not a guarantee for the success of a borehole, only a mere indication of what the potential yield could be. The map clearly indicate the occurrence of aquifers with a higher yield through the darker shadings of the colours with the dark purple indicating the potential highest yield from an aquifer of around 5 litres per second. This occurs in sections of the identified Grootwater aquifer south of Yzerfontein.

The major aquifers in and around the Swartland is identified in Map 3, The localint of the Grootwater Aquifer is clearly indicated along the West Coast with the Elandsfontein Aquifer also identified in the north western corner of the Swartland. This aquifer is also shared with Saldanha Municipality.




**Map 3: Location of Major Aquifers**

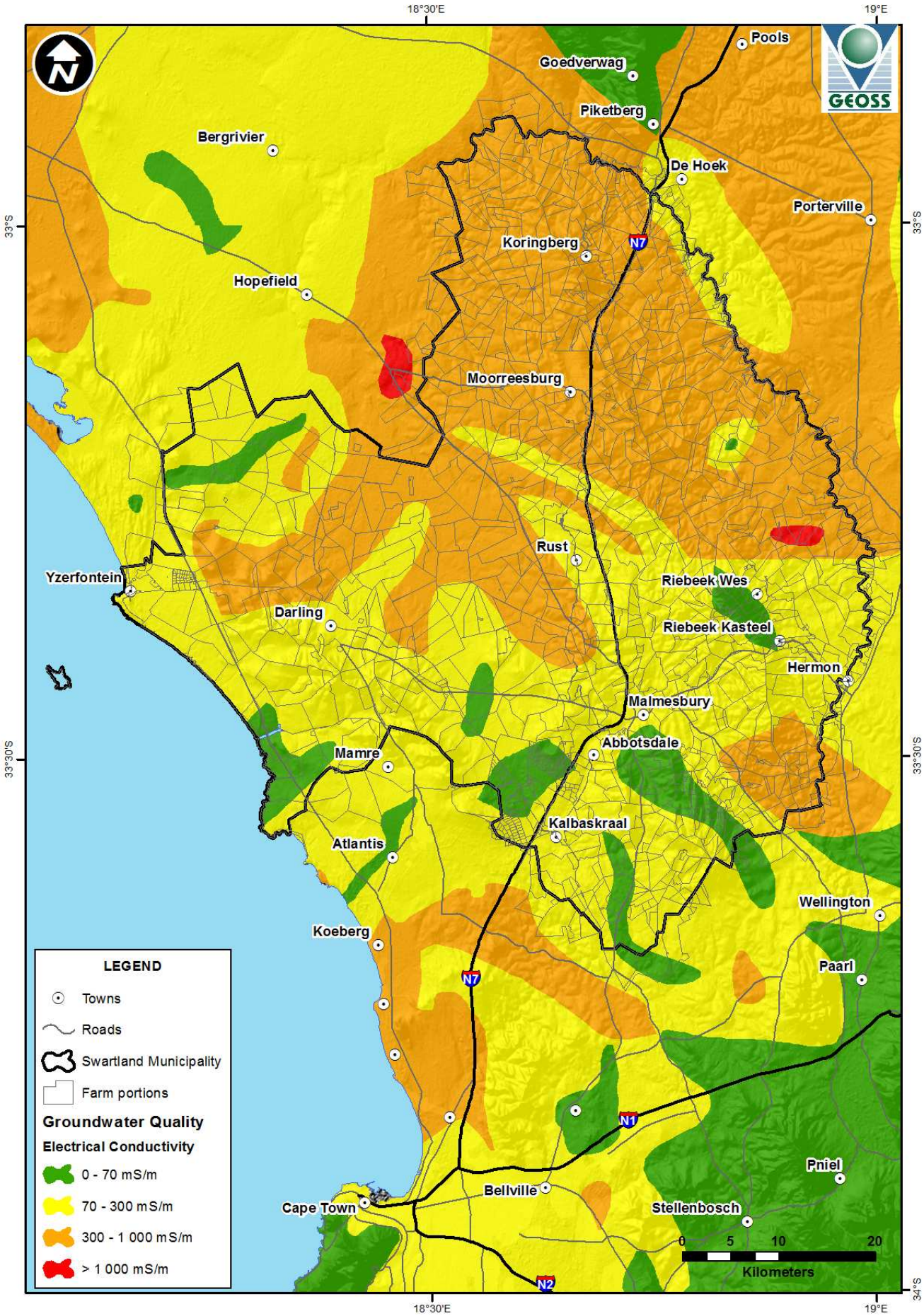
## 4. Groundwater quality

The map below identified as Map 4 indicated groundwater quality in the Swartland municipal area, as represented by Electrical Conductivity (EC). Electrical Conductivity is just a general measure (indicator) of groundwater quality, which does not indicate what minerals are present in the water. The lower the EC count the purer the water. The units for EC are numerous, however most commonly used is milliSiemens per metre (mS/m). The table below classifies the different EC levels and define the quality within each classified class:

| | DWA (1998) Drinking Water Assessment Guide | | | | |
|---|---|---|---|---|---|
| | **Class 0** | **Class I** | **Class II** | **Class III** | **Class IV** |
| Conductivity (mS/m) | <70 | 70-150 | 150-370 | 370-520 | >520 |

| | |
|---|---|
| **Class 0** | **Ideal water quality** – suitable for lifetime use |
| **Class I** | **Good water quality** – suitable for use, rare instances of negative effects |
| **Class II** | **Marginal water quality** – conditions acceptable. Negative effects may occur. |
| **Class III** | **Poor water quality** – unsuitable for use without treatment. Chronic effects may occur. |
| **Class IV** | **Dangerous water quality** – totally unsuitable for use. Acute effects may occur. |

The table above should be read in conjunction with Map 4.




**Map 4: Groundwater Quality**

## 5. Groundwater vulnerability

This section identify the vulnerability of groundwater to surface based contamination ( for example agricultural activity etc.). Groundwater vulnerability can be defined as the "*tendency for contaminant to reach a specific position in the groundwater system after introduction at some location"* (NRC, 1993 in Vrba and Zaporozec, 1994). The key parameters which determine groundwater vulnerability include lithology, thickness, effective porosity, groundwater flow direction, age and residence time of water. Generally, the residence time of a contaminant in groundwater and the distance that it travels in the aquifer area considered important measures of vulnerability.

The most well known "index or subjective rating method" for measuring the vulnerability of groundwater is the "DRASTIC" method (Aller et al., 1987). The DRASTIC method of Aller et al. (1987) uses the typical overlay technique often applied in subjective rating methods. The DRASTIC approach is based on four major assumptions:

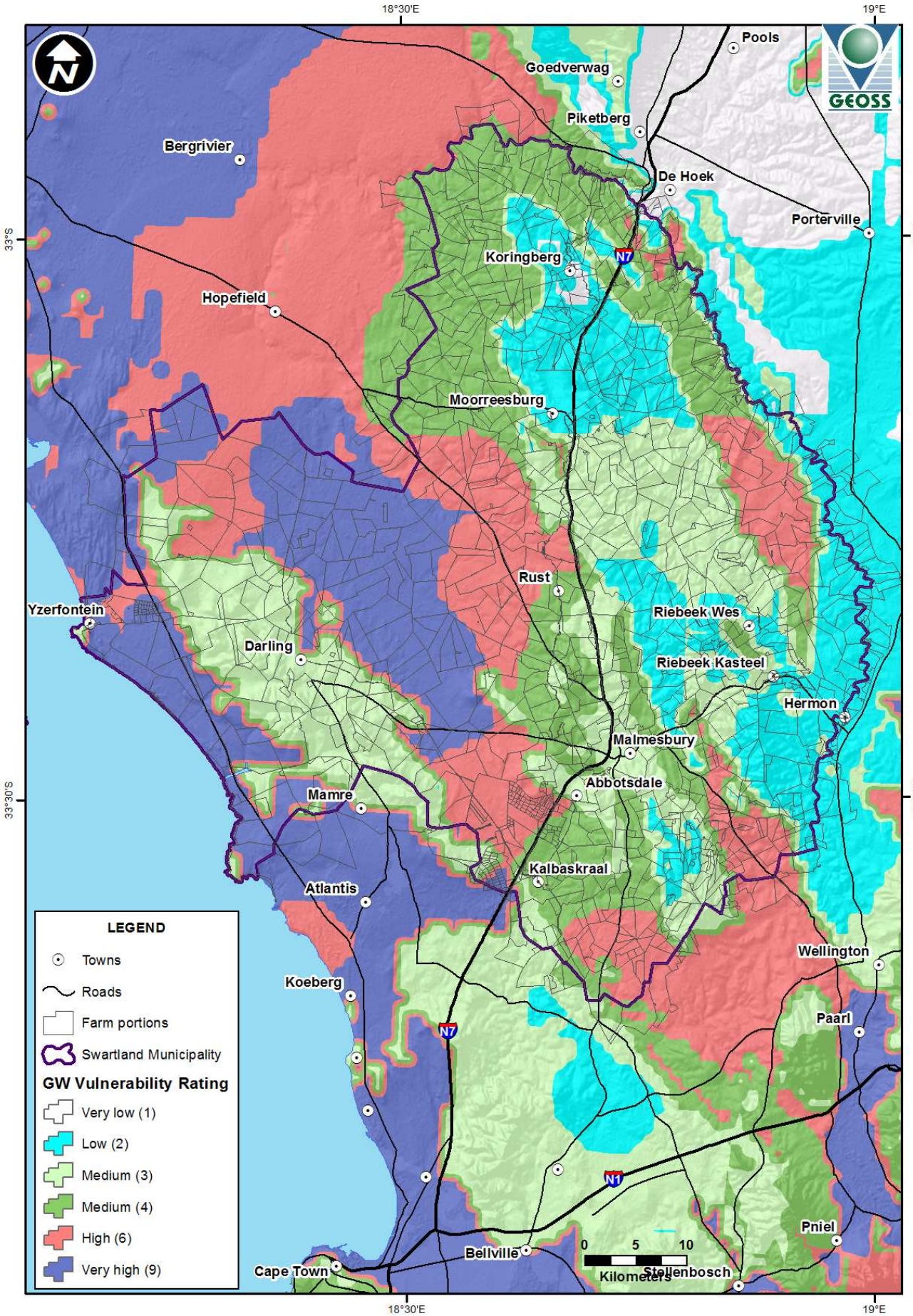
- The contaminant is introduced at ground surface;
- The contaminant is flushed into the groundwater by precipitation;
- The contaminant has the mobility of water;
- The area evaluated using DRASTIC is 40.5ha or larger.

The implication of these assumptions is that DRASTIC should not be used for contaminants that do not have mobility of water or for point assessment (such as storage tanks). In addition, groundwater conditions in South Africa are dominated by secondary and fracture controlled flow conditions. DRASTIC does not take into account preferential flow paths or fractured systems particularly well.

The DRASTIC method takes into account the following factors:

- D = depth to groundwater (5)
- R = recharge (4)
- A = aquifer media (3)
- S = soil type (2)
- T = topography (1)
- I = impact of the vadose zone (5)
- C = conductivity (hydraulic) (3)

The number indicated in parenthesis at the end of each factor description is the weighting or relative importance of that factor.




**Map 5: Groundwater vulnerability**