



*Geohydrological comparison – Louw's Bos
proposed south and north memorial park
sites. Stellenbosch Municipality*

REPORT:

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EXECUTIVE SUMMARY

Stellenbosch Municipality requires additional burial sites (also known as Memorial Parks) to service the larger Stellenbosch Municipal area. GEOSS was previously tasked to complete a preliminary geohydrological study of potential sites. Through a process of elimination, the number of sites was narrowed down. CK Rumboll & Partners have asked that GEOSS complete a comparison between two of the previously investigated sites (Louw’s Bos south and north Memorial Parks).

The two proposed memorial park sites are located on the Kuils River – Helderberg pluton of the Cape Granite Suite. The regions surficial cover is comprised of in-situ weathered parent rock. The surficial cover comprises of loam and sandy loam material. Weathered granite underlies these residual soils with a gradual transition into competent granite bedrock. The granite bedrock in the region has a porphyritic texture with large distinct crystal in coarse grained matrix. Crystals include large feldspars which generally weather into clays.

Groundwater occurs in intergranular and fractured aquifers at depths of >17 m. No groundwater was intersected above the clay layer on sites which provided borehole drill records.

There are a number of groundwater users in the area. Drill records indicate that the boreholes have above average yield, with groundwater quality been classified as “good” according to drinking water guidelines, (with the exception of elevated iron concentrations).

The sites have a “low/medium” groundwater vulnerability rating, due to the presence of a clay layer which acts as a barrier above the main aquifer and the relative depth to the groundwater level.

From a groundwater perspective, due to the relatively thick clay layer above the main aquifer the proposed sites can be considered for the development of a Memorial Park. The Louws Bos south is more suited to the development of a memorial park due to its location away from major existing groundwater users.

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ABBREVIATIONS

| | |
|------|------------------------------|
| ha | hectare |
| L/s | litres per second |
| m | metres |
| mS/m | milliSiemens per meter |
| NGA | National Groundwater Archive |

GLOSSARY OF TERMS

- Aquifer:** a geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)].
- Borehole:** includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
- Fractured aquifer:** Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
- Groundwater:** water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
- Intergranular Aquifer:** Generally unconsolidated but occasionally semi-consolidated aquifers. Groundwater occurs within intergranular interstices in porous medium. Typically occur 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.

Suggested reference for this report:

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GEOSS - Geohydrological & Spatial Solutions International (Pty) Ltd.
Stellenbosch, South Africa.

Cover photo:

On site photo of preliminary cemetery site

GEOSS project number:

2015_07-1490

1. INTRODUCTION

Stellenbosch Municipality requires additional burial sites (also known as Memorial Parks) to service the larger Stellenbosch Municipal area. GEOSS was previously tasked to complete a preliminary geohydrological study of potential site. Through a process of elimination, the number of sites was narrowed down. CK Rumboll & Partners have asked that GEOSS complete a comparison between two of the previously investigated sites (Louw's Bos south and north Memorial Park).

2. TERMS OF REFERENCE

The prime objective of the project is to determine the geohydrological setting of the proposed Memorial Parks by means of a desktop site characterization using available GIS data as well as on-site assessments.

3. REGIONAL SETTING

The two sites are located south-west of central Stellenbosch just to the west of the R44 (**Map 1, Appendix A**). The site is just south of the Annandale Road.

3.1 Geology

The two proposed memorial park sites are located on the Kuils River – Helderberg pluton of the Cape Granite Suite. The regions surficial cover is comprised of in-situ weathered parent rock. The surficial cover comprises of loam and sandy loam material. Weathered granite underlies these residual soils with a gradual transition into competent granite bedrock. The granite bedrock in the region has a porphyritic texture with large distinct crystal in coarse grained matrix. Crystals include large feldspars which generally weather into clays.

Drill reports collected indicate that the surficial cover can range from 1 – 10 m thick and the underlying clay layer thickness can range from 10 – 60 m (**Map 3, Appendix A**).

3.2 Hydrogeology

The two proposed Memorial Park are located on an aquifer which is classified as an “intergranular and fractured” aquifer i.e. fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly between gravel and sand grains as well as within fissures and fractures. If a borehole was drilled within this site, the borehole yield may be in the region of 0.1 to 0.5 L/s. However, there are high yielding boreholes west and north of the Louws Bos south site and south of the Louws Bos north site. The high yielding boreholes have a yield range of 2 – 5 L/s (**Map 4, Appendix A**).

Communication with a local driller indicated that groundwater is ideally found within a weathered zone just above the competent bedrock granite. A small percentage of groundwater is located within deeper fractures/joints located in the granite.

The estimated groundwater quality of the site is good, with expected electrical conductivity values of < 70 mS/m. Groundwater also does occur to the north of the site and the abstracted groundwater is of good quality ($EC < 70$ mS/m) (**Map 5, Appendix A**).

3.3 Hydrology

For the Louw's Bos south site, a small north-west / south-east drainage channel, a tributary to the Eerste River, flows to the north of the proposed site. Flow within this watercourse will only occur during heavy rainfall events.

For the Louw's Bos north site, there are several dams to the south-south-east of the proposed memorial park. The dams contain water throughout the year and are mainly used for agricultural purposes.

3.4 Groundwater vulnerability and use

A national groundwater vulnerability map was developed using the DRASTIC methodology. The DRASTIC system is the most widely method used to evaluate intrinsic vulnerability for a wide range of potential contaminants. It is an overlay and index model designed to produce vulnerability scores by combining several thematic maps. It was originally developed in USA under cooperative agreement between the National Water Well Association (NWWA) and the US Environmental Protection Agency (EPA) for detail hydrogeological evaluation of pollution potential (Aller et al. 1987). The word DRASTIC is acronym for most important factors within the hydrogeological settings which control groundwater pollution. Hydrogeological setting is a composite description of all major geologic and hydrogeological factors which affect the groundwater movement into, though, and out of the area. These factors are:

- depth to water,
- net recharge,
- aquifer media,
- soil media,
- topography (slope),
- impact of vadose zone, and
- hydraulic conductivity.

The DRASTIC numerical ranking system contains three major parts: weights, ranges, and ratings.

The Louws Bos south study site is on an area classified as having a “low/medium” whereas the Louws Bos north sites has been classified as having a “medium-high” groundwater vulnerability rating. (**Map 6, Appendix A**).

Below is a table summarising the site geological and hydrogeological condition of both proposed memorial parks.

Table 1: Site summary table

| Site | Geology | Hydrogeology | Groundwater quality | Groundwater vulnerability | Groundwater uses with 1 km search radius |
|-----------------|--|--|---------------------|---------------------------|--|
| Louws Bos North | Thick clay layer grading into hard granite | Intergranular and fractured aquifer 0.1 – 0.5 L/s | 0 – 70 mS/m | Low/ Medium | Yes |
| Louws Bos South | | | | | Yes |

3.5 Groundwater use

The proposed Memorial Parks are located within a mostly agricultural region. Based on the number of agricultural dams in the region the agricultural sector utilized mostly surface water to supply their needs. Four sites were identified as potentially groundwater uses (**Map 2, Appendix A**). Attempts to contact owners for detail was met with no response or a response GEOSS is still awaiting response. Information within the report for sites was either collected via previous GEOSS reports in the area and information obtained from drill companies.

Site 1:

The site is known to have four boreholes with above average yields. The groundwater is intended to be used for bottling. Borehole depth range from 60 – 132 m deep. Groundwater was located within the intergranular and fractured aquifer with water strikes ranging from 17 – 112 m.

Site 2:

The Farm belongs to a Mr Zetler. Telephonic communication was made- however with no response. A drill company provide basic information pertaining to recent drilling activities. Numerous boreholes were drilled on site with mixed results. The majority of boreholes were either too low yielding or just “usable”. Intended use of the boreholes is unknown at this stage.

Site 3:

The Farm belongs to the Spier Wine farm. Electronic communication was made with the farm estate. A response was then forwarded to the estate manager. GEOSS knows of one borehole within the area. the borehole is in use. The borehole has high iron and is low yielding.

Site 4:

No site access was gained as the area is under road construction and telephonic communication was made with no response. The NGA indicated one borehole on site. No information pertaining to the borehole construction or use was attached.

4. DISCUSSION

The Louw's Bos south and north sites are located south-west of Stellenbosch. The surficial cover of the sites comprises of ferricrete and alluvial material (sandy) which grades into an argillaceous material (clayey). Bedrock in the area comprises of granite. Groundwater occurs in the weathered zone above the fresh granite and within fractures/joints in the granite.

Groundwater users exist both north and north-east of the Louws Bos south proposed memorial park. Groundwater users exist both north and south of Louws Bos north site. Drill reports indicate that the groundwater user's abstract groundwater from the "deep" underlying aquifer below the clay layer. Groundwater quality is classified as good based on results from north-east of the site.

The Louws Bos south site is down gradient of the major water uses in the area and unlikely to impact users due to both the thick clay layer and inferred groundwater flow direction to the west. The Louws Bos north site is located on a topographic high relative to the area and is up gradient from the major groundwater users. The inferred groundwater flow direction (based on the assumption that groundwater mimics surface water flow directions) would indicate that any seepage or shallow groundwater located in/above the clays would flow naturally towards major groundwater users.

The Louws Bos south and north study sites are both on an area classified as having a "low/medium" groundwater vulnerability rating, due to the argillaceous material and clay layer present above the bedrock.

From a groundwater perspective, due to the relatively thick clay layer above the main aquifer, the proposed sites can be considered for the development of a Memorial Park. The Louws Bos south is more suited to the development of a memorial park due to its location further away from the major groundwater users.

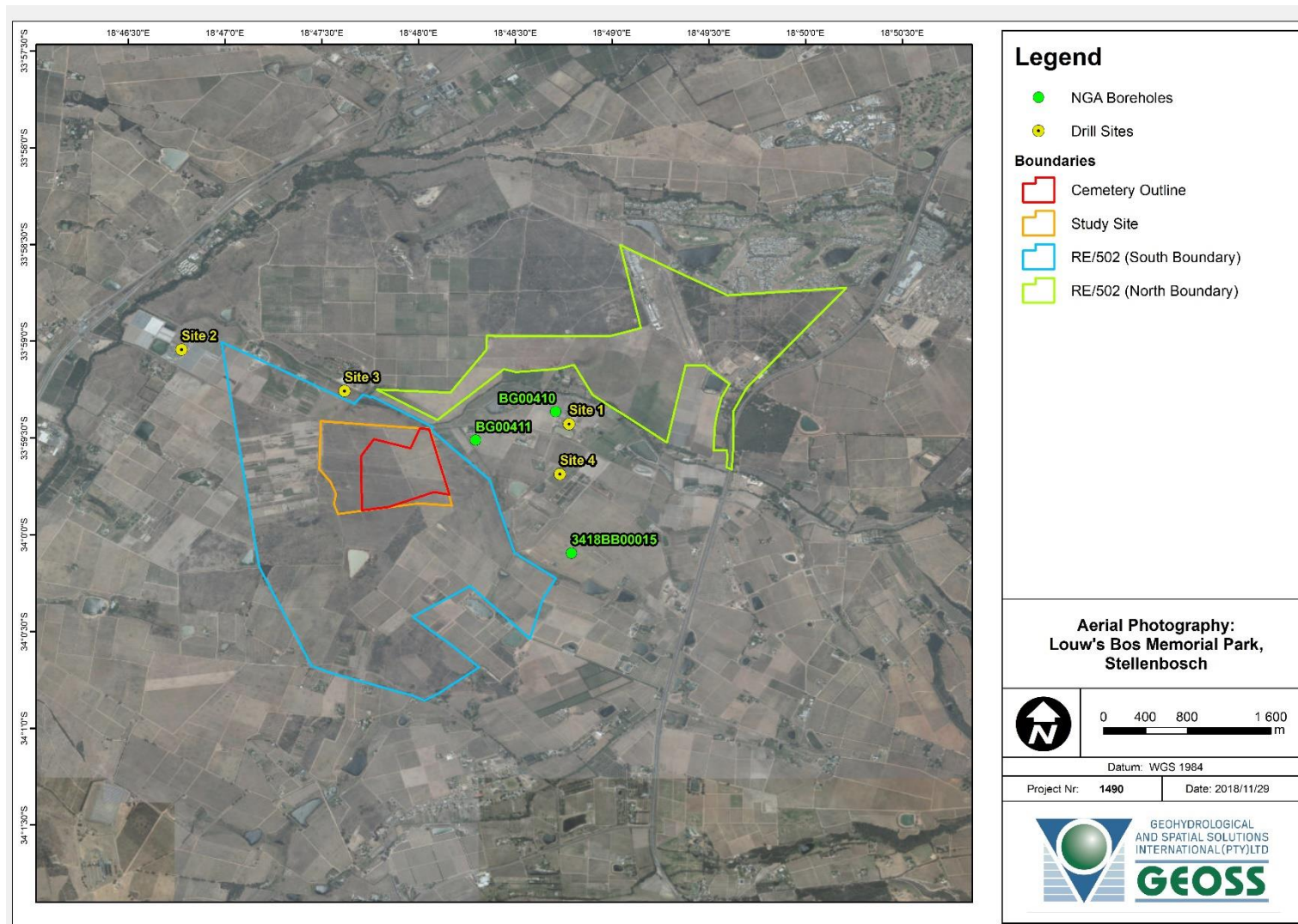
5. REFERENCES

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- DWS, (2000). National scale mapping of groundwater conditions. Department of Water and Sanitation, Pretoria.
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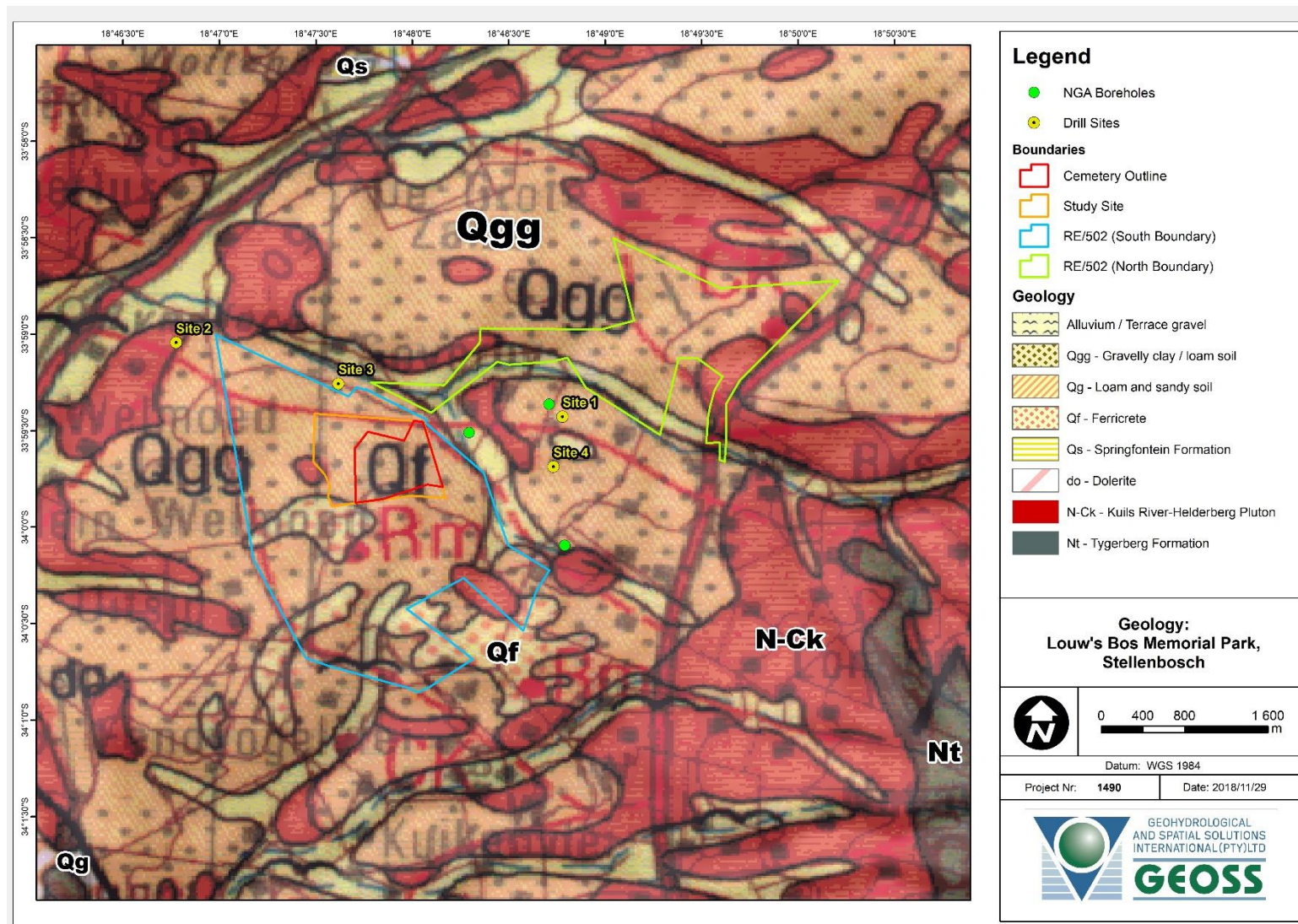
6. APPENDIX A: MAPS –LOUW'S BOS SOUTH AND NORTH



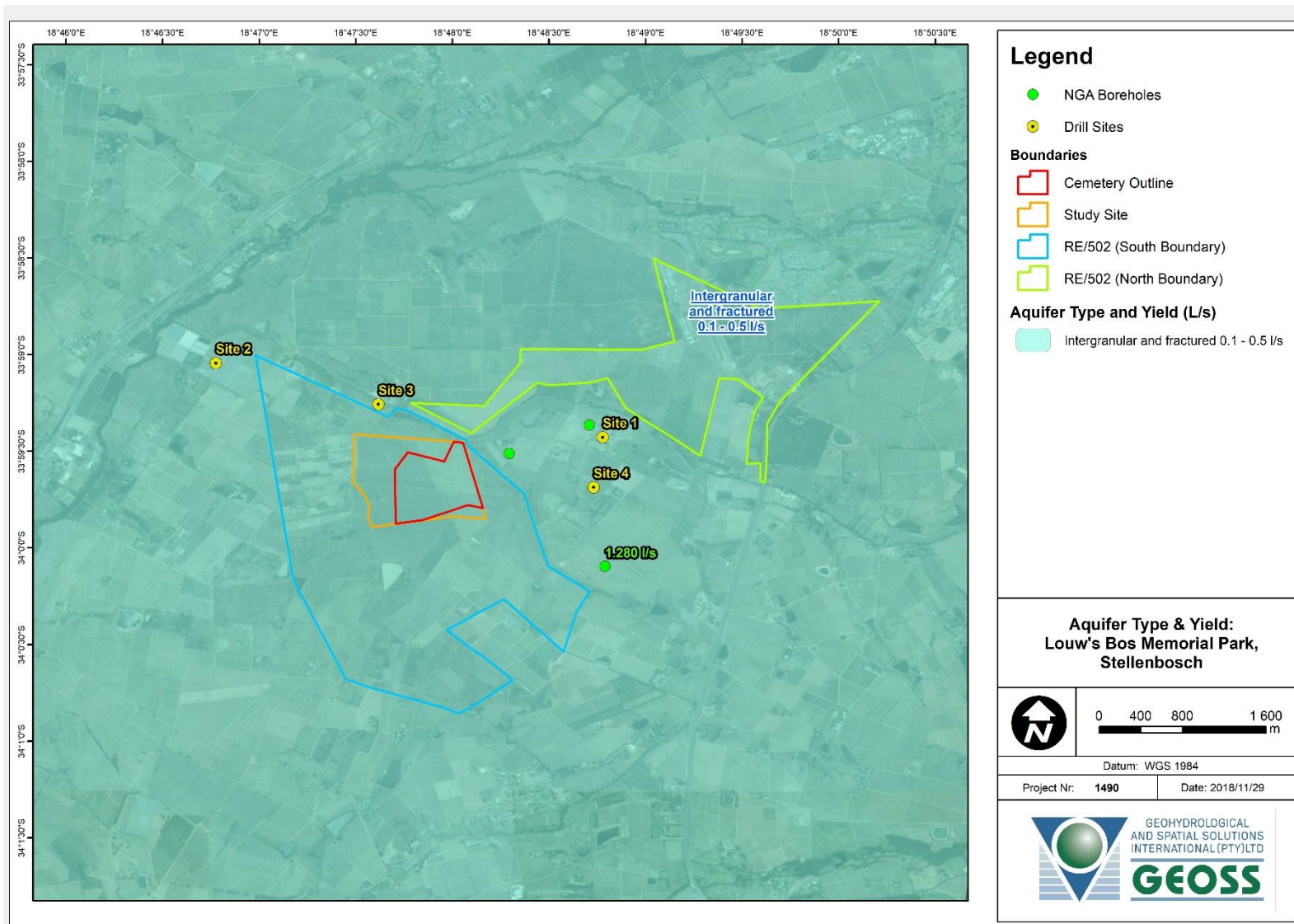
Map 1: Location of the Nuwe Louw's Bos South study area within a regional setting



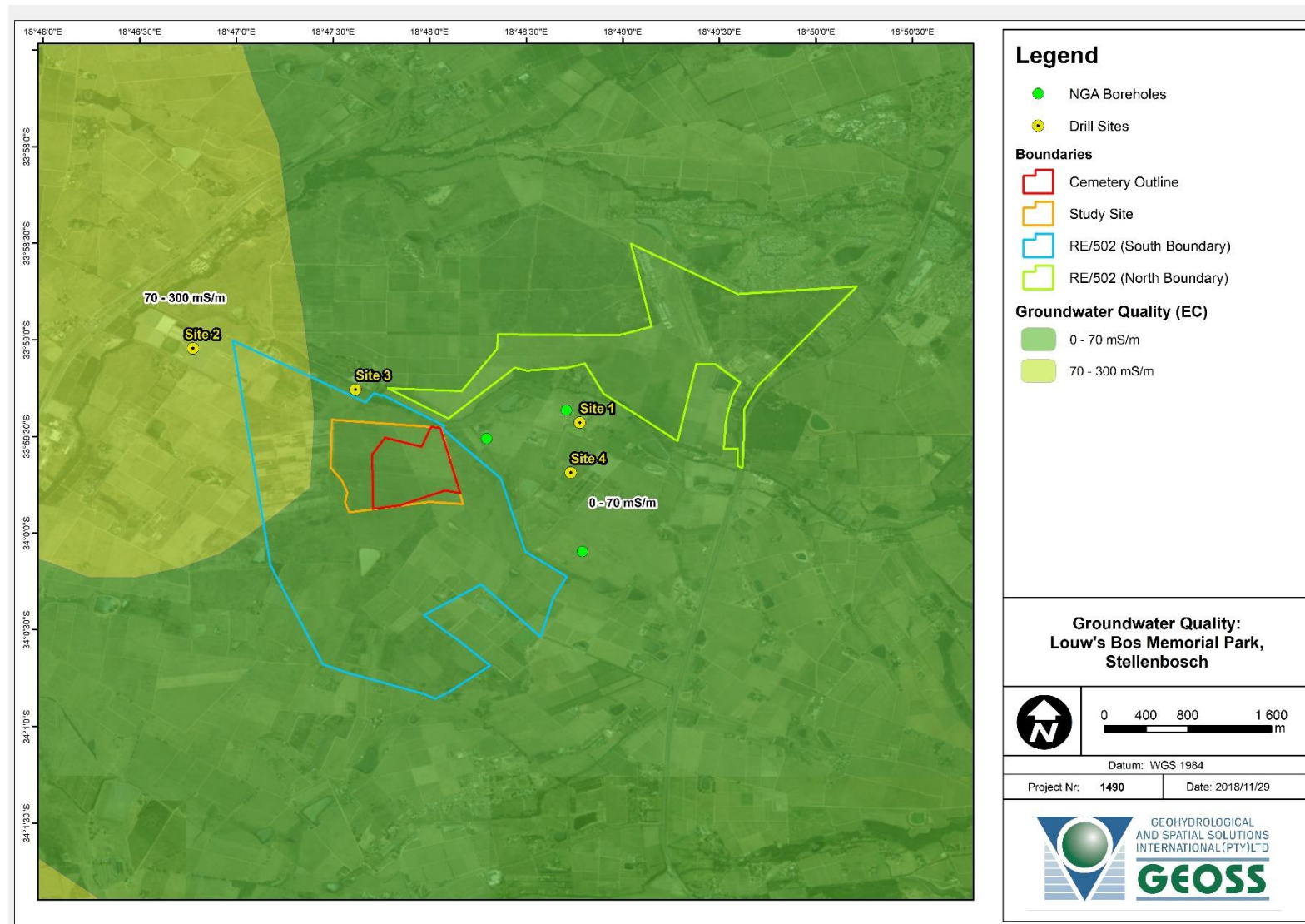
Map 2: The Louw's Bos South and North study sites superimposed on an aerial photograph



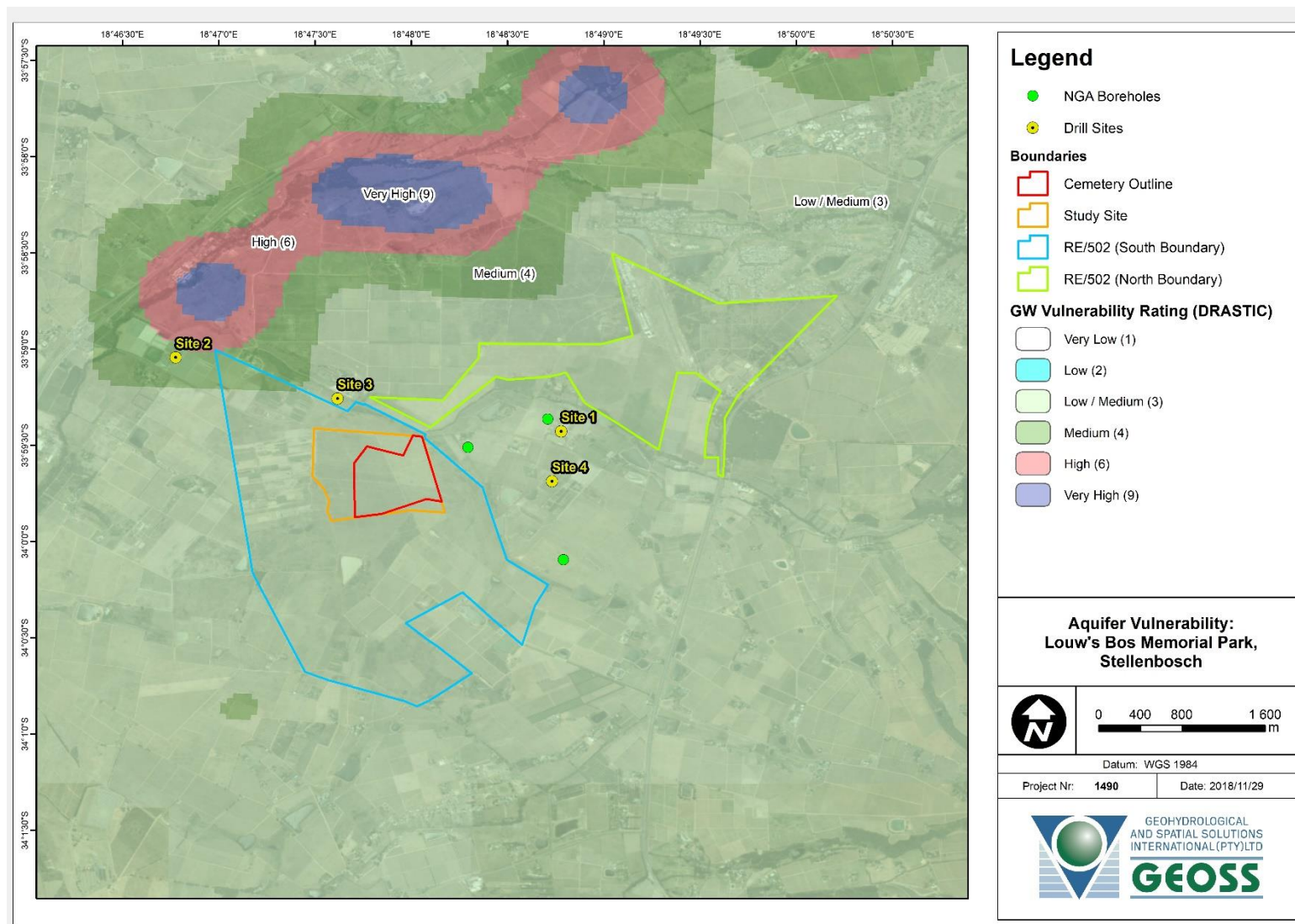
Map 3: The Louw's Bos South and North study sites and superimposed on a 1:250 000 scale geological map (3318 Cape Town).



Map 4: Aquifer types of the Louw's Bos South and North study sites (1:500 000 scale DWS, 2000)



Map 5: Groundwater quality within the Louw's Bos South and North study sites (Electrical Conductivity in mS/m), (DWS, 2000).



Map 6: Groundwater vulnerability at the Louw's Bos South and North study sites (DWS, 2005).