Black Mountain Mining Prospecting Rights Application:

Geohydrological Specialist Study:

JAAGERS PLAAT AREA

Report Prepared for

EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

Report Number 549553/JAAGERS PLAAT

Report Prepared by

srk consulting

July 2019

Black Mountain Mining Prospecting Rights Application:

Geohydrological Specialist Study:

JAAGERS PLAAT AREA

EIMS

SRK Consulting (South Africa) (Pty) Ltd.
38 Bonza Bay Road
Beacon Bay
East London 5241
South Africa

e-mail: eastlondon@srk.co.za
website: www.srk.co.za

Tel: +27 (0) 43 748 6292
Fax:+27 (0) 43 748 1811

SRK Project Number 549553/JAAGERS PLAAT

July 2019

Compiled by:

Gert Nel (Pr. Sci. Nat.)
Partner

Email: egoossens@srk.co.za

Peer Reviewed by:

Eunice Goossens (Pr. Sci. Nat.)
Principal Hydrogeologist

Authors:

Gert Nel; Eunice Goossens
Connan Hempel (contributor)

Executive Summary

Environmental Impact Management Services (Proprietary) Limited (EIMS) appointed SRK Consulting (South Africa) (Pty) Ltd (SRK) to undertake a Geohydrological Desktop Specialist study as part of a basic assessment report (BAR) in support of a Mining Prospecting Rights Application.

Summary of principal objectives

The aim of this assessment is to assess the baseline groundwater conditions for the aquifer system/s within the Jaagers Plaat Area and to highlight possible risks to the groundwater environment accordingly (from a desktop perspective). The scope of work comprises a desk study in which potentially sensitive geohydrological features are highlighted, to investigate the potential impact on these (if any) and to develop management plans to prevent / mitigate any potential impacts.

Outline of work programme

EIMS appointed SRK on 12 June 2019 to conduct a desktop geohydrological assessment on five areas where exploration drilling is planned. The Jaagers Plaat Area, the focus of this report, is one of the five areas.

Focus on results

From the desktop study and information provided to SRK, by EIMS, the following are concluded for the Jaagers Plaat Area:

- Although the majority of the area is classed as a minor aquifer system with potentially poor water quality and low expected yields, there are existing groundwater users for which boreholes could be the only water source. It is therefore critical that existing groundwater users be taken into account and that their boreholes are not negatively affected in any way.
- Any negative impact on groundwater and/or groundwater users, whether factual or perceived (complaints from surrounding borehole users) can have a significant financial and reputational impact on the exploration programme and subsequent mining.
- It is not possible to accurately predict the aquifers that will be penetrated when drilling 400 m or more and it is therefore important that support by a geohydrologist is provided before and during the drilling activities.
- Due to the lack of available information, such as hydrocensus information, exact drilling positions, drilling depths and drilling processes, only a basic sensitivity map could be compiled at this stage, incorporating areas covered by quaternary deposits (e.g. sands) and surface water / pans. This information was taken from available geological and topographical maps.

Potential impacts have been identified as:

- Degradation of aquifers;
- Impacts on existing groundwater users; and
- Impacts on surface water features (e.g. streams, rivers, wetlands, saltpans) – which may be recharged by groundwater.

Proposed mitigation measures include:

- Detailed hydrocensus (to include surface water features);

- Once the exact drilling positions are known and the hydrocensus completed, the geohydrological report must be updated and must include an assessment of potential aquifers that could be penetrated by the drilling and whether mixing the water of these aquifers can lead to degradation of any of the aquifers penetrated.

Assumptions, uncertainties and gaps in knowledge

Assumptions: SRK assumes that the main purpose of this desktop study is to provide a broad overview of what has been documented for this specific area in terms of the geohydrology. SRK further assumed that the planned exploration has not yet been publicised or discussed with the local municipalities, local farming unions, or any other private or public sector body. SRK therefore did not make contact with any private or public body in terms of the gathering of site specific data. SRK further assumes that a public participation process will be followed whereby existing groundwater users will be consulted.

Limitations: The potential impacts of any drilling activity on the groundwater regime will vary from site to site, even over short distances due to changes in geology and receptors. As no recent hydrocensus across the entire exploration area has been conducted, SRK did not have access to, for example, positions of existing boreholes, dependency on groundwater, specific water quality, depth to groundwater levels and borehole depths. The sensitivity map and groundwater management plan, as presented in this report, must be seen as working documents that must be improved as more information becomes available.

Gaps: Based on the information presented to SRK, by EIMS, the following information gaps have been identified:

- Exact drilling positions and drilling depths;
- On-site storage and handling of any potentially hazardous materials / substances on the drilling site, e.g. fuels (diesel, petrol, paraffin, etc.), oils and cleaning chemicals;
- Detailed hydrocensus within the areas where exploration drilling will take place – the hydrocensus must be completed by a geohydrologist / geohydrological technician who has experience in the collection of geosite data, as prescribed by the Department of Human Settlement, Water and Sanitation (DHSWS).
- Detailed scientific reports (geological and geohydrological) of the exploration area (if any) – sourcing these reports will require open conversations with private and public bodies, in which the purpose of the exploration programme and exploration areas will have to be revealed.

Table of Contents

Executive Summary ii
Disclaimer vi
List of Abbreviations vi
1 Introduction 1
1.1 Scope of Work and Terms of Reference 1
1.2 Legislative and Policy Framework 1
1.3 Statement of SRK Independence 1
1.4 Summary of Specialist Expertise 1
2 Project Work 2
2.1 Topographical Information 2
2.2 Geology 2
2.3 Hydrogeology 3
2.3.1 Groundwater Flow Directions 3
2.4 Receiving Environment 5
2.4.1 Existing Groundwater Users 7
2.4.2 Future Groundwater Users 10
2.4.3 Groundwater as Natural Resource 10
2.5 Consideration of related/significant aspect management plans in the area 10
2.6 Spatial Sensitivity Mapping 10
2.7 Identification, description and assessment of potential impacts 13
3 Possible Impacts and Mitigation Measures 14
3.1 Potential Impact 1: Degradation of Aquifers 15
3.2 Potential Impact 2: Impact on Local Groundwater Users 16
3.3 Potential Impact 3: Degradation of Surface Water (linked to groundwater) 17
4 Geohydrological Management Plan 18
5 Conclusions 19
6 Assumptions, uncertainties and gaps in knowledge 20
6.1 Assumptions 20
6.2 Limitations 20
6.3 Gaps 20
8 References 22
Appendix 1: Maps 23

List of Tables

Table 2-1: List of Properties that form part of the planned Exploration 6
Table 2-2: NGA Dataset 7
Table 2-3: Planned Activities for the Exploration 12
Table 3-1: Potential Impact 1 - Degradation of Aquifers 15
Table 3-2: Potential Impact 2: Impact on Local Groundwater Users 16
Table 3-3: Potential Impact on Surface Water Sources 17

List of Figures

Figure 2-1: Project Locality 2
Figure 2-2: Water Management Areas (as per the DWS classification) – Quaternary Catchments inclusion ... 4

Disclaimer

The opinions expressed in this Report have been based on the information obtained by SRK Consulting (South Africa) (Pty) Ltd (SRK) from various sources such as the Department of Human Settlement, Water and Sanitation (DHSWS), the National Groundwater Archive (NGA) and others listed under References. SRK has exercised due care in reviewing the obtained information. Whilst SRK has compared the available data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the available data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

DWS	-	Department of Water and Sanitation (before 30 May 2019)
DHSWS	-	Department of Human Settlement, Water and Sanitation (after 30 May 2019)
NEMA	–	National Environmental Management Act
NWA	–	National Water Act
MPRDA		Mineral and Petroleum Resources Development Act
WMA		Water Management Area
EWR	-	Ecological Water Requirements
GRU	-	Groundwater Resource Units
GIA	-	Groundwater Impact Assessment
BAR	-	Basic Assessment Report
EMPR	-	Environmental Management Program
EIA	-	Environmental Impact Assessment
GRA2	-	Groundwater Resource Assessment Phase 2
AGEP	-	Average Groundwater Exploitation Potential
SANS	-	South African National Standard
NGA	-	National Groundwater Archive
m amsl	-	metres above mean sea level
m bgl	-	metres below ground level
L/s	-	litres per second
mg/L	-	milligrams per litre
EC	-	Electrical Conductivity
GPS	-	Global Positioning System
GIS	-	Geographic Information Systems

1 Introduction

Environmental Impact Management Services (Proprietary) Limited (EIMS) appointed SRK Consulting (South Africa) (Pty) Ltd (SRK) to undertake a Geohydrological Desktop Specialist study as part of a basic assessment report (BAR) in support of a Mining Prospecting Rights Application, JAAGERS PLAAT AREA.

1.1 Scope of Work and Terms of Reference

The aim of this assessment was to assess the baseline groundwater conditions for the aquifer system/s within the Jaagers Plaat Area and to supply an indication of possible risks to the groundwater environment accordingly. The scope of work comprises a desk study in which potentially sensitive geohydrological features are highlighted, to investigate the potential impact on these (if any) and to develop management plans to prevent / mitigate any potential impacts. No fieldwork or site visit(s) were to be undertaken.

1.2 Legislative and Policy Framework

As per EIMS's request, the geohydrological desktop study is to satisfy the requirements of the NEMA EIA Regulations and the NWA WUL Applications, as well as the relevant MPRDA regulations. The **NWA**, Chapter 3, Part 4 states the following "*The person who owns, controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources*". This includes groundwater. The **MPRDA**, Part IV: Pollution Control and Waste Management Regulation states that the groundwater investigations may include an assessment of "(*iv) the vulnerability and existing potential use of the groundwater resource within the zone that could potentially be affected by the residue facility".* In terms of this report (focussing only on exploration and not mining itself) SRK will replace the term "residue facility" with "exploration activities".

1.3 Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK. SRK has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

1.4 Summary of Specialist Expertise

Gert Nel is a partner in SRK, qualified **Principal Geohydrologist** and registered Professional Natural Scientist **(Pr. Sci. Nat.)** with over 26 years' of experience in the water and waste fields. Gert started off the first eight years of his career with the South African Department of Water Affairs (DWA) and was involved in geohydrological mapping, water supply and the permitting of solid waste facilities. He then joined the private sector where he continued his involvement in the water and waste fields, but also became involved in geohydrological risk assessments for private industries, including the fuel industry and mines.

Eunice Goossens is a **Principal Hydrogeologist**, registered as a Professional Natural Scientist **(Pr. Sci. Nat.)**. Eunice has 20 years' experience in geohydrological investigations, and started her career at Department of Water Affairs (DWA) and was involved in groundwater supply investigation as well as geohydrological research projects. She joined the private sector and continued her career in Groundwater Management, Groundwater resource development and evaluation, Geophysical investigations, Sanitation Groundwater Protocol Application, Groundwater database management and processing, GIS applications / mapping and Landsat & Aerial photo Interpretation.

Connan Hempel is a **Senior Geologist** and registered Professional Natural Scientist (**Pr. Sci. Nat**.) with over 20 years' experience in academic training, mining and exploration. Connan started the first ten years of his career as a Geology Lecturer at the Nelson Mandela Metropolitan University Department of Geosciences. He later joined Anglo American where he worked as a Senior Production Geologist. Prior to joining SRK Consulting, he also worked for Elitheni Coal as a Senior Exploration & Mining Geologist.

2 Project Work

2.1 Topographical Information

The topography of the Jaagers Plaat Area is depicted in **Map 1**, **Appendix 1**. The area is located approximately 100 kilometres South of the town of Pofadder, Northern Cape, South Africa. It covers 42 farms, over an area of 129 407 Ha (1274 km$^{2)}$. Topographically, the north-eastern parts of the Jaagers Plaat Area are the highest with altitudes in the order of 1000 m amsl. The area then drops towards the south and southeast to elevations around 900 m amsl. Minor, non-perennial drainages can also be seen in the middle central parts of the area. The area is also characterised by several salt pans, the largest of these occurring in the south-western area.

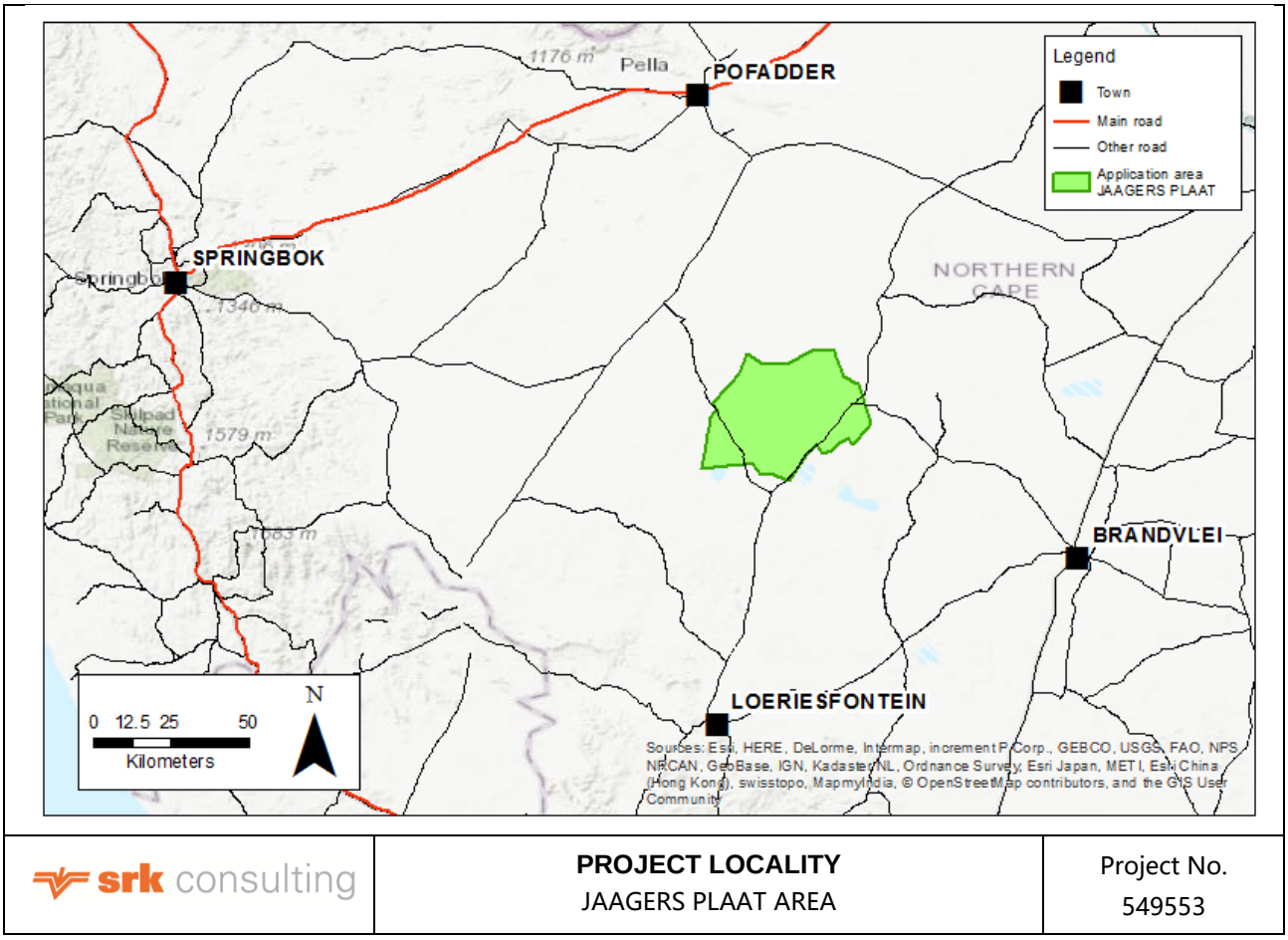

Figure 2-1: Project Locality

2.2 Geology

The terrain consists of flat lying plains with Cenozoic and Karoo-aged sediments overlying Namaquan granite gneiss and meta sediments. The north-eastern and eastern parts are further characterised by large dolerite intrusions. The majority of the area comprises the Prince Albert Formation

(carbonaceous shale), with the Vaalputs Formation (aeolian sands) forming the southern boundary. Refer to **Map 2** in **Appendix 1**.

2.3 Hydrogeology

The following key information sources were consulted:

- Vegter, J.R., Seymour A., 1995. Groundwater Resources of the Republic of South Africa – Two Map sheets and explanatory brochure. DWAF).
- Parsons, R., Conrad, J., WRC Report No KV 116/98, "Explanatory Notes for the Aquifer Classification Map of South Africa".
- Groundwater Resource Assessment Phase 2 (GRA 2), DWS, 2003
- Department of Water and Sanitation, South Africa, October 2016. Determination of Ecological Water Requirements for Surface water and Groundwater in the Lower Orange WMA. Groundwater EWR report.
- Department of Water Affairs and Forestry. Hydrogeological Map Series of the Republic of South Africa. Completed in 2002".

According to Vegter and Seymore (1995), the majority of the area (eastern half of the area) can be considered having a low groundwater potential of <10 %. The eastern parts of the area have a groundwater potential of 10 – 20%. These percentages indicate the probability of drilling a successful borehole (yield > 2 L/s). DWS initiated a project in 2003, referred to as the Groundwater Resource Assessment Phase 2 (GRA 2) and focussed on the quantification of the groundwater resources of South Africa on a national scale. The project included the quantification of recharge, storage and sustainable yield of the aquifer systems throughout South Africa. The expected average groundwater exploitation potential (AGEP) in the Jaagers Plaat area is < 2500 m^3/km^2/annum.

Based on the Aquifer Classification Map (Vegter), the aquifer is classified as a poor aquifer region – therefore being a low to negligible yielding aquifer system of moderate to poor water quality. These aquifers can be fractured or potentially fractured rocks which do not have a high permeability, or other formations with variable permeability.

The Jaagers Plaat Area falls entirely within the Lower Orange WMA (see Figure 2-2). The EWR report of 2016 covers the Lower Orange WMA and from this report the following information is deemed relevant to the Jaagers Plaat Area:

- The Jaagers Plaat Area have an estimated 30 – 60 % dependency of groundwater (i.e. domestic use, irrigation, stock watering, bulk supply, mining).
- Jaagers Plaat Area falls entirely with the D53F Quaternary Catchment and can, according to the EWR report, described as "poor groundwater quality from marine sediments".

Refer to Figure 2-2 (the insert) for the positioning of the Jaagers Plaat Area relevant to the quaternary catchments. The expected electrical conductivity (EC) for the southern half of the area is 300 – 1000 mSm. For most of the northern half of the area the expected ECs are 70 – 300 mSm. **Map 3a** in **Appendix 1** shows the expected EC's for the area.

2.3.1 Groundwater Flow Directions

In the absence of field measurements (water level data) and accurate elevations of boreholes, no accurate groundwater contour map can be compiled. If one assumes that the groundwater table will follow the topography and surface drainage directions, then the inferred groundwater flow is depicted in **Map 3b**, **Appendix 1**.

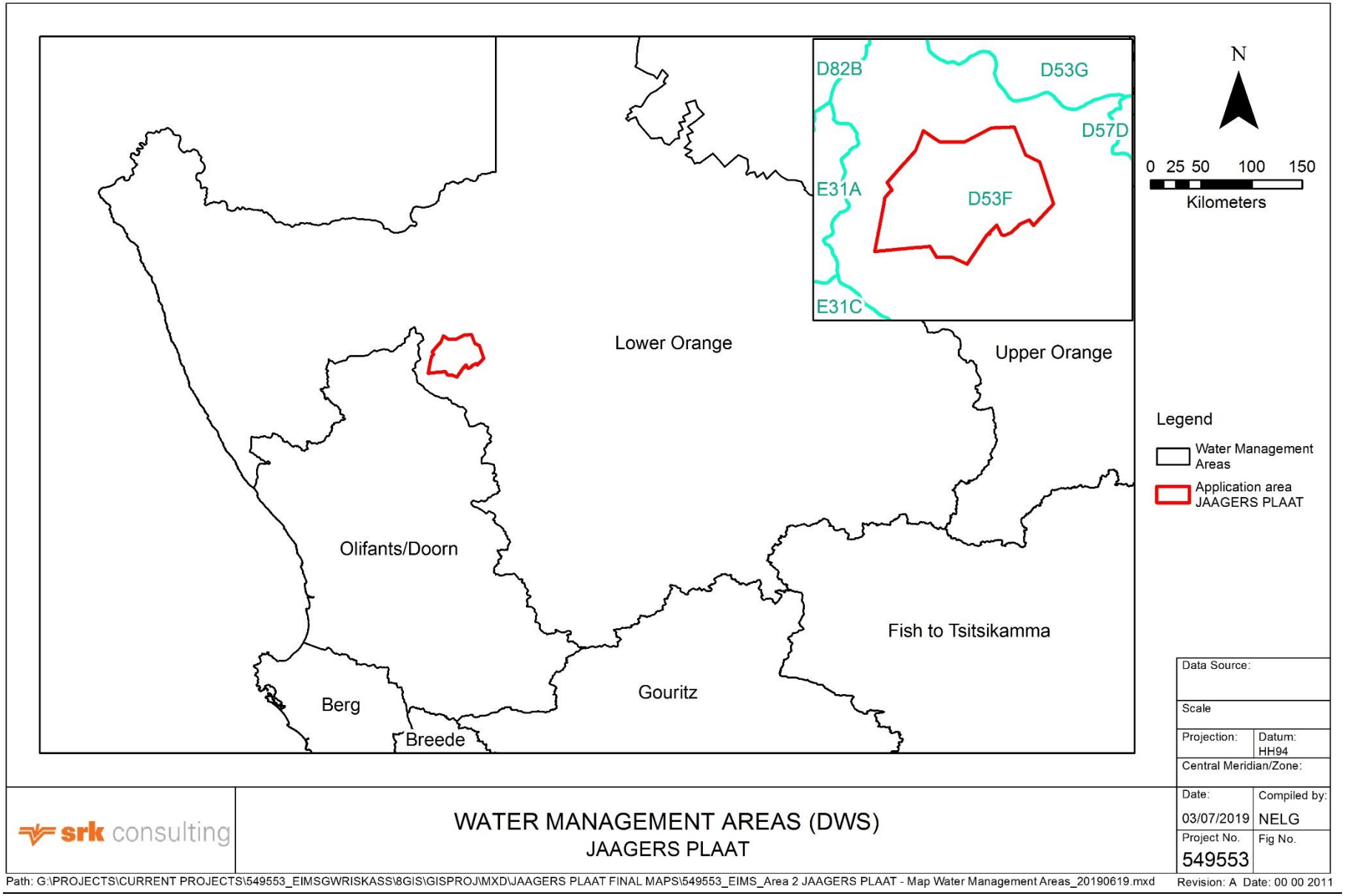

Figure 2-2: Water Management Areas (as per the DWS classification) – Quaternary Catchments inclusion

2.4 Receiving Environment

For the purpose of the geohydrological desktop assessment, and considering that no fieldwork has been conducted, the receiving environment of the Jaagers Plaat Area is considered to be:

- Existing groundwater users (via boreholes and springs, where applicable);
- Future groundwater users (via boreholes and springs, where applicable); and
- Groundwater, as a natural resource that falls under the protection of the National Water Act.

In the absence of sufficient data, aspects relating to groundwater recharge have not been taken into account. These include:

- Natural groundwater recharge areas (groundwater catchments); and
- Areas where managed aquifer recharge (artificial recharge) could be considered.

Due to insufficient data, the following receiving environments have also been excluded:

- Wetlands (if there are any in the area) that are groundwater fed - not all wetlands are partially or fully dependent on groundwater for sustainability, but due consideration must be given when boreholes are drilled within 500 m of a wetland, regardless whether the boreholes are for exploration, monitoring or water supply.
- Streams or rivers that are dependent on groundwater inflow – in many cases the base of streams and rivers sits below the groundwater table and are therefore experiencing lateral recharge from groundwater. Groundwater can therefore sustain the baseflow of a river or stream in cases where the water table (or perched water level) is located higher (in terms of elevation, i.e. metres above sea level) than the base of the river or stream.

Information provided to SRK, by EIMS, indicates that the farms listed in **Table 2-1** will be targeted for the exploration programme (Ref: Black Mountain Prospecting Work Programme).

Table 2-1: List of Properties that form part of the planned Exploration

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm Weltevreden 146 Portion 0 RE	Calvinia Rd	1299,453691	T31987/2014CTN	C01500000000014600000
2	Farm Weltevreden 146 Portion 2	Calvinia Rd	3926,586066	T104436/1999	C01500000000014600002
3	Farm Weltevreden 146 Portion 3	Calvinia Rd	3762,126742	T54118/1989CTN	C01500000000014600003
4	Farm Klein Brand Pens 147 Portion 0 RE	Calvinia Rd	1390,743997	T55777/1988CTN	C01500000000014700000
5	Farm Klein Brand Pens 147 Portion 1 RE	Calvinia Rd	2715,210142	T86919/1998CTN	C01500000000014700001
6	Farm Klein Brand Pens 147 Portion 4	Calvinia Rd	2702,072374	T21212/1978	C01500000000014700004
7	Farm Lemoendoorn 148 Portion 0 RE	Calvinia Rd	4514,496053	T1252/1981	C01500000000014800000
8	Farm Lemoendoorn 148 Portion 1	Calvinia Rd	905,693438	T1252/1981	C01500000000014800001
9	Farm Blouputs 149 Portion 0	Calvinia Rd	2573,096312	T56673/2002CTN	C01500000000014900000
10	Farm Groot Brand Pens 150 Portion 1 RE	Calvinia Rd	1493,3018	T55777/1988CTN	C01500000000015000001
11	Farm Granaat Bosch Kolk 151 Portion 0 RE	Calvinia Rd	4453,884349	T25921/1986	C01500000000015100000
12	Farm Granaat Bosch Kolk 151 Portion 1	Calvinia Rd	4327,719526	T51250/2009CTN	C01500000000015100001
13	Farm Abrahams Kop 152 Portion 1	Calvinia Rd	4220,008433	T51251/2009	C01500000000015200001
14	Farm Abrahams Kop 152 Portion 2	Calvinia Rd	263,05238	T82745/2001CTN	C01500000000015200002
15	Farm Abrahams Kop 152 Portion 2	Calvinia Rd	2528,160884	T82745/2001CTN	C01500000000015200002
16	Farm Abrahams Kop 152 Portion 4	Calvinia Rd	2384,544464	T105180/2000CTN	C01500000000015200004
17	Farm Nutiep 153 Portion 1	Calvinia Rd	4808,37246	T105180/2000CTN	C01500000000015300001
18	Farm Nutiep 153 Portion 2	Calvinia Rd	6106,832579	T11972/2002	C01500000000015300002
19	Farm Jaagers Plaat 154 Portion 0 RE	Calvinia Rd	3346,950002	T409/2003CTN	C01500000000015400000
20	Farm Jaagers Plaat 154 Portion 1	Calvinia Rd	5577,4439	T11977/2002	C01500000000015400001
21	Farm Groot Zevenfontein East 155 Portion 1	Calvinia Rd	53,010402	T17706/1951	C01500000000015500001
22	Farm Groot Zevenfontein East 155 Portion 2	Calvinia Rd	5449,897835	T9372/1985CTN	C01500000000015500002
23	Farm Abiquas Kolk Oost 156 Portion 3 RE	Calvinia Rd	4581,880721	T85701/1999	C01500000000015600003
24	Farm Abiquas Kolk Oost 156 Portion 4	Calvinia Rd	4546,483651	T74859/1990	C01500000000015600004

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
25	Farm Dik Pens 182 Portion 0 RE	Calvinia Rd	3991,96617	T34187/1996	C01500000000018200000
26	Farm Dik Pens 182 Portion 2 RE	Calvinia Rd	2567,8786	T15673/1956	C01500000000018200002
27	Farm Dik Pens 182 Portion 3	Calvinia Rd	50,124671	T16948/1977CTN	C01500000000018200003
28	Farm Dik Pens 182 Portion 4	Calvinia Rd	1842,300209	T16948/1977CTN	C01500000000018200004
29	Farm Dik Pens 182 Portion 5	Calvinia Rd	46,339945	Unknown	C01500000000018200005
30	Farm Dik Pens 182 Portion 6	Calvinia Rd	51,269516	Unknown	C01500000000018200006
31	Farm Dik Pens 182 Portion 7	Calvinia Rd	3,786603	Unknown	C01500000000018200007
32	Farm Dik Pens 182 Portion 8	Calvinia Rd	3436,687791	T46045/1990	C01500000000018200008
33	Farm Dik Pens 182 Portion 9	Calvinia Rd	1801,0099	T7468/1962	C01500000000018200009
34	Farm Dik Pens 182 Portion 10	Calvinia Rd	2101,832234	T46045/1990	C01500000000018200010
35	Farm Dik Pens 182 Portion 11	Calvinia Rd	2104,318691	T99592/1997CTN	C01500000000018200011
36	Farm Dik Pens 182 Portion 12	Calvinia Rd	95,217776	T16948/1977CTN	C01500000000018200012
37	Farm Water Kuil 185 Portion 0 RE	Calvinia Rd	5256,948423	T17521/2004	C01500000000018500000
38	Farm Water Kuil 185 Portion 1	Calvinia Rd	5209,377283	T98195/2002	C01500000000018500001
39	Farm Dwaggas West 186 Portion 0	Calvinia Rd	9854,817947	T15138/2005CTN	C01500000000018600000
40	Farm Dwaggas Oost 190 Portion 1	Calvinia Rd	7,15319	T19413/1960	C01500000000019000001
41	Farm Hyes 191 Portion 1	Calvinia Rd	5034,154349	T74929/2003CTN	C01500000000019100001
42	Farm Blouvlei 1155 Portion 0	Calvinia Rd	8083,847178	T14596/1988CTN	C01500000000115500000
	TOTAL AREA (HA)		129 407		

2.4.1 Existing Groundwater Users

To capture all existing groundwater users a hydrocensus[1] will be required. The National Groundwater Archive (NGA) data for this specific area is outdated and the data can therefore not be used to accurately determine how many existing groundwater users there are, and what the water is used for.

Existing borehole information

A data search on the NGA[2] revealed 80 existing boreholes, of which:

- 34 boreholes had water level data – the average groundwater level was 20.37 m bgl[3];
- 21 boreholes had recorded yields - the average yield being 1.17 L/s and the maximum recorded yield 7.5 L/s;
- 80 boreholes had recorded boreholes depths – the average depth being 61 m bgl and the deepest 141 m bgl (refer to **Map 4a** for a plot of the NGA-derived **borehole depths**); and

[1] Hydrocensus – field survey to capture all existing boreholes, springs and dugholes.
[2] Maintained by the DHSWS
[3] Bgl = below ground level

- 31 boreholes had recorded water strike depths – the average strike depth being 47 m bgl and the maximum strike depth 131 m bgl.

The data that was obtained from the NGA however dates back to 1953, with the most recent data being from 1999. Although this data provides some information on the use of groundwater at the time, it does not necessarily reflect the current number of boreholes and current use. As GPS (Global Positioning System) technology was not readily available in the 1940's – 1980's the coordinates of the boreholes are not deemed very accurate and would have to be field-verified. This information will have to be obtained by means of a hydrocensus across the entire area. Error! Not a valid bookmark self-reference. provides the borehole information as recorded on the NGA. A plot of the **NGA data** is presented by **Map 4b**, **Appendix 1**.

Table 2-2: NGA Dataset

Site ID No.	Other No.	Latitude	Longitude	Date established	Depth [m bgl]	Groundwater level [m bgl]	Reported Yield [L/s]	Waterstrike depth [m bgl]
3019BA00035		-30.19863	19.61145	08-Dec-99	30	19.61		
3019BA00012	79066	-30.18366	19.66590	21-Aug-61	60.65	29.87	0.10	39.01 and 60.65
3019BA00013	80268	-30.18366	19.66591	13-Sep-61	18.9	8.53	2.30	10.06
3019BA00013		-30.18366	19.66591	13-Sep-61	18.9	8.53	2.30	10.06
3019BA00033	55963	-30.15923	19.50395	18-Oct-54	74.37	45.72		62.18
3019BA00034	56186	-30.15922	19.50395	28-Oct-54	30.48	26.82	0.85	27.74
3019BA00017	156743	-30.14338	19.50756	15-Nov-90	60			
3019AB00029	118182/5	-30.14089	19.45451	12-Nov-74	71.6	42.00	0.15	44.2
3019BA00015	156715	-30.13366	19.52701	25-Oct-90	60			
3019BA00014	156716	-30.12533	19.51201	26-Oct-90	60			
3019BA00036		-30.12473	19.60090	08-Dec-99	30	17.79		
3019BA00037		-30.12393	19.74506	15-Nov-99	35			
3019BA00019	156717	-30.09894	19.51090	29-Oct-90	66	16.00	0.18	42
3019BA00016	156718	-30.09477	19.51034	30-Oct-90	72			
3019BB00027		-30.08744	19.88381	03-Nov-99	80	7.15		
3019BB00029		-30.08719	19.86437		80			
3019BA00031		-30.08116	19.64529	03-Nov-99	80	19.28		
3019BB00020	149468/4	-30.07954	19.82586	13-Aug-86	60			60
3019BB00019	149470/7	-30.07953	19.82587	18-Aug-86	90			90
3019BB00018	149472/3	-30.07952	19.82588	19-Aug-86	66			66
3019BB00022	149469/2	-30.07951	19.82589	14-Aug-86	61			61
3019BB00021	52132	-30.07950	19.82590	16-Sep-53	29.26	8.23	0.40	14.63 and 19.51
3019BA00032		-30.06350	19.68867	03-Nov-99	80	7.46		
3019BA00011	139359/5	-30.05869	19.58256	05-Jul-82	114			
3019BA00009	140841/3	-30.05868	19.58256	29-Jun-82	102			
3019BA00007	115888	-30.05867	19.58256	18-Mar-74	141	36.00	0.06	131.1
3019BA00005	111473	-30.05866	19.58256	26-Jan-72	46.33			
3019BA00006	111474	-30.05866	19.58257	10-Feb-72	137.77			
3019BA00008	111475	-30.05866	19.58258	16-Mar-72	94.49			
3019BA00010	140842/1	-30.05866	19.58259	02-Jul-82	66			
3019BA00023	139358/7	-30.05477	19.58256	23-Mar-82	78		7.50	75

Site ID No.	Other No.	Latitude	Longitude	Date established	Depth [m bgl]	Groundwater level [m bgl]	Reported Yield [L/s]	Waterstrike depth [m bgl]
3019BB00026		-30.05136	19.87245		80			
3019BA00038		-30.05105	19.73790	03-Nov-99	35	10.15		
3019BB00003	166984	-30.04200	19.81756	08-Mar-96	24			24
3019BA00028		-30.03730	19.54670		80			
3019BA00029		-30.03644	19.64092		80			
3019BA00020	145044/4	-30.03616	19.53895	03-Apr-84	66			66
3019BA00021	145046/0	-30.03616	19.53895	04-Apr-84	24	9.20	0.24	12.5
3019BA00022	145043/6	-30.03616	19.53895	30-Mar-84	30			30
3019BA00026		-30.03305	19.57381		80			
3019BB00023		-30.03086	19.84148		80			
3019BA00003	113923	-30.02534	19.61590	03-Oct-72	32			
3019BA00001	111456	-30.02533	19.61590	02-Dec-71	74.98	30.17	0.19	70.1
3019BA00002	111457	-30.02533	19.61591	08-Dec-71	76.81	35.05	0.25	44.19 and 69.49
3019BA00004	113924	-30.02533	19.61592	20-Oct-72	132.3	36.57	1.99	120
3019BB00025		-30.02514	19.81470	03-Nov-99	80	15.26		
3019BA00030		-30.01900	19.66209		80			
3019BA00027		-30.00733	19.59345	04-Nov-99	80	27.23		
3019BA00018	156744	-30.00283	19.51312	22-Nov-90	60	30.00	0.29	54
2919DD00025		-29.99905	19.84302	03-Nov-99	80	16.80		
2919DC00007	78941	-29.99260	19.66588	29-May-61	40.54			
2919DC00005	78300	-29.99259	19.66588	27-Mar-61	68.27	27.74	0.06	40.84
2919DC00004	76601	-29.99258	19.66588	27-Feb-61	124.66			
2919DC00006	78735	-29.99258	19.66589	04-May-61	111.86			
2919DC00008	79068	-29.99258	19.66590	20-Jun-61	30.48			
2919CD00034	150446	-29.99204	19.48254	27-Feb-87	18			
2919CD00032	111483	-29.99203	19.48254	22-Jun-72	64.62	37.80	4.47	61.26
2919CD00031	17755	-29.99202	19.48254	19-Apr-32	40.23	24.69	0.08	24.69
2919CD00033	150445	-29.99202	19.48255	27-Feb-87	18			
2919CD00035	150447	-29.99202	19.48256	02-Mar-87	18			
2919DD00011	111476	-29.98371	19.76588	21-Mar-72	28.04	6.40	0.25	18.9 and 21.94
2919DD00009	110760	-29.98370	19.76588	02-Jul-71	38.1			
2919DD00008	110759	-29.98369	19.76588	24-Jun-71	61.57			
2919DD00010	110761	-29.98369	19.76589	06-Jul-71	15.85			
2919DD00006	110757	-29.98369	19.81588	02-Jun-71	65.84			
2919DD00007	110758	-29.98369	19.81589	08-Jun-71	57.91	16.76	2.69	51.82
2919DD00029		-29.97839	19.81121	04-Nov-99	80	24.89		
2919DC00035		-29.96750	19.68924		80			
2919DC00042		-29.95717	19.73277	03-Nov-99	35			
2919DC00034		-29.95500	19.71060	03-Nov-99	80	2.50		
2919DC00029	133512/3	-29.95286	19.65532	18-Jul-79	35	8.20		21.9
2919DC00030	133511/5	-29.95286	19.65532	16-Jul-79	24.3			24.3
2919DC00003	145048/6	-29.95037	19.68254	05-Apr-84	16	10.10	0.20	13.2
2919DC00002	145047/8	-29.95036	19.68254	05-Apr-84	33			

Site ID No.	Other No.	Latitude	Longitude	Date established	Depth [m bgl]	Groundwater level [m bgl]	Reported Yield [L/s]	Waterstrike depth [m bgl]
2919DC00027	136305/3	-29.93369	19.73254	07-Aug-80	17			
2919DC00028	136306/1	-29.93369	19.73255	08-Aug-80	16			
2919DC00033		-29.93330	19.70496	03-Nov-99	80	16.04		
2919DC00032		-29.92536	19.69018		80			
2919DC00031		-29.89350	19.72496		80			
2919DC00001	138359/0	-29.88369	19.73254	12-Oct-81	60	14.00	0.02	39

2.4.2 Future Groundwater Users

The drivers for future groundwater development usually include the following:

- Existing boreholes that dry up;
- Increase in groundwater demand (e.g. population growth, economic growth, agricultural growth);
- Insecurity of bulk water supplies;
- Surface water shortages (as result of global warming, increased demand); and
- Prolonged droughts.

From a desktop study it is not possible to determine the future demand on groundwater, as the existing use and growth factors have to be taken into account.

2.4.3 Groundwater as Natural Resource

Groundwater falls under the protection of the National Water Act, and may not be polluted.

2.5 Consideration of related/significant aspect management plans in the area

SRK is not aware of any specific aspect management plans in the Jaagers Plaat Area, besides the regulations previously discussed.

2.6 Spatial Sensitivity Mapping

According to UNEP-WCMC. (2018),

Sensitivity mapping provides a visual representation of risks, and assets which may be exposed to them. Multiple environmental sensitivity mapping approaches exist, with methods and uses varying based on stakeholders' values, drivers of change, data availability, and the technical capacity of the users. Sensitivity mapping is often carried out using geographic information systems (GIS) technology. The amount and/or type of data used to produce a sensitivity map will affect and limit its potential uses. Nevertheless, environmental sensitivity mapping can have a wide variety of applications. These include but are not limited to:

- *Helping decision-makers understand where protection of valuable environmental assets is needed, which could aid the development of protected area networks;*
- *Informing governmental and private sector spatial planning at the project level, targeting activities to the locations where they will have the lowest impact;*
- *Supporting all stages of impact management, including prevention, mitigation, preparedness, operations, relief, recovery and integration of lessons learned;*
- *Aiding situational awareness and response strategy development for responders and decision makers during an incident.*

In the case of the Jaagers Plaat Area and in order to create a spatial sensitive map, the following are deemed of key importance:

- Exploration methods:
  - Drilling positions and drilling methods;
  - The processes that will be followed during the exploration phase; and
  - Implementation and auditing of the groundwater management plan.
- Receiving environment (for the purpose of this report, specifically groundwater):
  - Areas overlain with sand / alluvial deposits (quarternary deposits) – these are highly permeable and contamination may migrate rapidly[4] towards groundwater and surface water; and
  - Proximity of surface water features such as wetlands, streams, rivers and earth dams.

Drilling Positions, Drilling depths and Exploration Processes

Exact drilling positions: According to Black Mountain: "*it is not possible to give details of the drilling program before the surveys and surface work phase 1 is completed. The targeting of all drilling activities will be dependent on the results obtained during the preceding phases of prospecting, namely the geological mapping and geophysical surveying and as such it is currently not possible to include a finalized surface plan showing the intended location, extent and depth of boreholes to be completed."*

Drilling depths and drilling methods: According to Black Mountain*: The initial planned invasive exploration activities will consist of diamond drill boreholes drilled to appropriate depths to target any anomalies identified during Phases 2 & 3 of the non-invasive portion of the prospecting work plan. Percussion Rotary Air Blast (RAB) or Reverse Circulation (RC) drilling may be carried out for pre-collaring of diamond drill boreholes or for obtaining samples if significant depth of cover is encountered over particular targets. No bulk sampling work is to be carried out during this prospecting program.*

According to Black Mountain, the planned phases detailed in **Table 2-3** below will be used to investigate the prospecting area.

[4] The migration of a pollution plume is dependent on (1) the viscosity of the pollutant, (2) pathway medium, (3) the volume of pollutant and (4) hydraulic head.

Table 2-3: Planned Activities for the Exploration

Phase	Activity (what are the activities that are planned to achieve optimal prospecting)	Skill(s) required (refers to the competent personnel that will be employed to achieve the required results)	Timeframe (in months) for the activity)
1	**Non-Invasive Prospecting** Desktop Study: Literature Survey / Review	Geologist	Month 1-12
2	**Non-Invasive Prospecting** Regional Airborne Geophysical Survey	Geophysicist / Geologist / field crew	Month 6-12
3	**Non-Invasive Prospecting** Ground Geophysical Survey and Geological Field Mapping	Geologist & field crew	Month 12-24
4	**Invasive Prospecting** Exploration Boreholes (6 RAB holes – 2400m; 4 DD holes – 2000m)	Geologist / drill rig team / field crew / laboratory technicians	Month 24-34
5	**Non-Invasive Prospecting** Compilation, interpretation and modeling of data	Geologist / Geophysicist	Month 34-36
6	**Non-Invasive Prospecting** Detailed Ground Geophysical Survey on individual positively mineralized targets to define possible extent	Geophysicist / Geologist / field crew	Month 36-42
7	**Invasive Prospecting** Boreholes to confirm continuity of mineralization & potential deposit size (20 DD holes – 8000m)	Geologist / drill rig team / field crew / laboratory technicians	Month 42-48
8	**Invasive Prospecting** Resource definition drilling (40 DD holes – 16000m)	Geologist / drill rig team / field crew / laboratory technicians	Month 48-60
9	**Non-Invasive Prospecting** Analytical Desktop Pre-Feasibility Study	Economic Geologist / Mining Geologist	Month 54-60

From the available information gathered during SRK's desktop assessment of the geology, geohydrology, NGA data and information provided by EIMS, the potentially **groundwater sensitive** areas have been restricted to:

- Areas covered by quaternary deposits (e.g. alluvial sands); and
- Existing boreholes.

Other sensitive areas that can be linked to groundwater include:

- Surface water features (e.g. rivers); and
- Salt Pans

The sensitivity map for the Jaagers Plaat Area is shown in **Appendix 1**, **Map 5** and shows the areas that have been mapped on the geological map series as quaternary deposits. Mapped rivers and saltpans are also shown. A buffer zone of 150 m from mapped rivers / streams is also drawn. The distance of 150 m has been taken from the DWS document "Groundwater Protocol for the Protection of Aquifers from On-site Sanitation". Although the current exploration activities do not involve the installation of on-site sanitation systems, in SRK's professional opinion, the protocol guidelines can be applied for this project[5].

A hydrocensus of the targeted areas (farms) will provide key information pertaining to specific areas where existing boreholes, springs, rivers, streams and wetlands (groundwater fed) are situated. The spatial sensitivity map can then be updated.

2.7 Identification, description and assessment of potential impacts

From Table 2-3, the "invasive Prospecting" works (Phases 4, 7 and 8) will include Diamond Drilling with possible Percussion Rotary Air Blast (RAB) or Reverse Circulation (RC) for pre-collaring of diamond drill boreholes.

Aquifers are vulnerable to degradation during and following exploration drilling in the following ways:

- Exploration boreholes left open may lead to the inflow of contaminated run-off from the surface;
- Aquifers of good water quality may be connected to aquifers with poor and/or unacceptable water quality via the drilling processes;
- Aquifers with useable quantities of water may be connected to leakage zones / unsaturated zones; and
- Groundwater wastage can occur during drilling, negatively affecting nearby boreholes (groundwater users).

Waterways, such as streams, springs and rivers are also vulnerable to negative impact from exploration drilling activities. These negative impacts may manifest via contaminated groundwater, where the groundwater table is present at a higher altitude than the base of the river or stream and groundwater therefore feeds the stream or river. Drainage of contaminated water from the drilling processes may enter rivers, streams or springs directly. Contaminated drilling spoils that are left on the surface may be washed into rivers, streams or springs during rains.

[5] The "safe distance" between any exploration borehole and the relevant (nearest) receptors will have to be determined and adjusted once the exact drilling positions are known

3 Possible Impacts and Mitigation Measures

The aim of this section is to make a preliminary assessment of any potential groundwater impacts that are likely to arise as a result of the proposed **prospecting activities**. It must be kept in mind that no details of the prospecting / exploration activities were available at the time of writing this report. Where reference is made to possible pollution / contamination, it refers to any contamination that can result from the invasive work, i.e. drilling. This may include, but is not limited to, on-site spills (e.g. fuels and oils), sanitation, litter and mixing of poor water quality with good water quality.

EIMS provided SRK with an evaluation format to be used in the reporting of possible impacts, the severity of the impacts and mitigation measures during the exploration phases. Based on the various evaluation criteria, the following potential impacts have been identified:

- **Potential Impact 1**: **Degradation of aquifers** (see Table 3-1)
- **Potential Impact 2:** **Impact on existing groundwater users** (see Table 3-2)
- **Potential Impact 3**: **Degradation of surface water** (that could be linked to groundwater) (see Table 3-3)

In assessing the potential impacts, and considering mitigation measures, SRK assumed that the drilling positions cannot be moved by a distance > 1 km as the drilling will be target specific and not random.

3.1 Potential Impact 1: Degradation of Aquifers

Terms used:

- **Mitigation:** To reduce the risk of the drilling activities having a negative impact on the aquifer system or various aquifer systems (to be determined) a detailed geohydrological assessment would be required for the exploration area, and could have to be adapted for every drilling position. A qualified geohydrologist must form part of the exploration project team, to provide the necessary input and scientific support in terms of preventing / mitigating degradation of aquifers.
- **Pre-mitigation**: Refers to drilling in the absence of a detailed geohydrological impact assessment and no on-site geohydrological drilling control.
- **Post Mitigation**: Assumes that the proposed mitigation measures have been put in place.
- **Alternative 1**: In this case there is no alternative to drilling and therefore Alternative 1 = No Alternative.

Table 3-1: Potential Impact 1 - Degradation of Aquifers

Impact Name	**Degradation of aquifers**				
Alternative	**Alternative 1**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	4	2
Extent	3	3	Reversibility	3	2
Duration	4	2	Probability	3	3
Environmental Risk (Pre-mitigation)					-10.50
Mitigation Measures					
Detailed geohydrological assessment of expected aquifers and support during drilling phases – input to the EMP					
Environmental Risk (Post-mitigation)					-6.75
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					3
High: Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Medium: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
High: Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1.83
Final Significance					-12.38

3.2 Potential Impact 2: Impact on Local Groundwater Users

Terms used:

- **Mitigation:** To reduce the risk of the drilling activities having a negative impact on any existing groundwater user (i.e. boreholes) a detailed hydrocensus, followed by a geohydrological assessment would be required for the exploration area. The geohydrological report must include a risk assessment (source-pathway-receptor) of every drill site with nearby boreholes / springs in mind. A qualified geohydrologist must form part of the exploration project team, to provide the necessary input and scientific support in terms of preventing / mitigating impacts on nearby groundwater users.
- **Pre-mitigation**: Refers to drilling in the absence of a hydrocensus, absence of a detailed geohydrological report and no on-site geohydrological drilling control.
- **Post Mitigation**: Assumes that the proposed mitigation measures have been put in place.
- **Alternative 1**: In this case there is no alternative to drilling and therefore Alternative 1 = No Alternative.

Table 3-2: Potential Impact 2: Impact on Local Groundwater Users

Impact Name	**Impact on local GW users**				
Alternative	**Alternative 1**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	4	2
Extent	3	3	Reversibility	3	2
Duration	2	2	Probability	3	2
Environmental Risk (Pre-mitigation)					-9.00
Mitigation Measures					
Detailed hydrocensus, detailed geohydrological assessment and geohydrological support during drilling phases – input to the EMP					
Environmental Risk (Post-mitigation)					-4.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					3
High: Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Medium: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
High: Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1.83
Final Significance					-8.25

3.3 Potential Impact 3: Degradation of Surface Water (linked to groundwater)

Terms used:

- **Mitigation:** To reduce the risk of the drilling activities having a negative impact on any nearby surface water that may be linked to groundwater (e.g. wetlands that are sustained by groundwater, streams / rivers that are partly recharged by groundwater), the detailed geohydrological report must include a risk assessment (source-pathway-receptor) of every drill site with nearby surface water features in mind. The drilling must also be overseen by a qualified geohydrologist, who will also brief the drilling contractor on the possible risks to the receptors so that the drilling contractor can have a contingency plan in place
- **Pre-mitigation**: Refers to drilling in the absence of a hydrocensus (which must also detect surface water features), absence of a detailed geohydrological impact assessment and no on-site geohydrological drilling control.
- **Post Mitigation**: Assumes that the proposed mitigation measures have been put in place.
- **Alternative 1**: In this case there is no alternative to drilling and therefore Alternative 1 = No Alternative.

Table 3-3: Potential Impact on Surface Water Sources

Impact Name	**Degredation of surface water**				
Alternative	**Alternative 1**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature	-1	-1	Magnitude	4	2
Extent	3	3	Reversibility	3	2
Duration	3	2	Probability	2	2
Environmental Risk (Pre-mitigation)					-6.50
Mitigation Measures					
Detailed hydrocensus, including capturing surface water and risk assessment report – as input to EMP					
Environmental Risk (Post-mitigation)					-4.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					3
High: Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Medium: Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					1
Low: Where the impact is unlikely to result in irreplaceable loss of resources.					
Prioritisation Factor					1.50
Final Significance					-6.75

4 Geohydrological Management Plan

The desktop study has highlighted potential risks and impacts that the invasive phases of the exploration (i.e. drilling) could cause. As the details of the drilling processes, drilling depths and drilling positions are not known at this stage, the potential risks that have been highlighted in this report is generic of nature and applies to exploration drilling in general.

The geohydrological management plan (GMP) cannot be finalised at a desk study phase as the identified risks and potential impacts are site specific and currently the final drilling positions have not been finalised yet. A GMP can be compiled for the Jaagers Plaat Area once a hydrocensus has been completed, also taking cognisance of the specific drilling positions and potential receptors.

Site specific information / instructions that will ultimately have to be included in the final GMP and overseen by an experienced and qualified geohydrologist (Pr. Sci. Nat. registered) must include:

- A description of the expected geological formations that will be penetrated and the expected aquifer characteristics associated with each geological formation – depth of the borehole will dictate the potential risks;
- Expected water qualities of each aquifer (associated with the different geological formations) that will be penetrated – depth of the exploration borehole will dictate the potential risks;
- An assessment of the potential degradation of the aquifers should variable water qualities mix;
- Surrounding groundwater users and the protection thereof: positions of boreholes, depths, abstraction rates, water quality and dependency of the owner of his/her borehole.

The following mitigation measures should be implemented as standard during the prospecting phase in order to limit the impact on groundwater resources:

- Ensure vehicles and equipment are in good working order.
- Place oil traps under stationary machinery, only re-fuel machines at fuelling station, construct structures to trap fuel spills at a fuelling station, immediately clean oil and fuel spills and dispose contaminated material (soil, etc.) at licensed sites only.
- Ensure that good housekeeping rules are applied.
- A procedure for the storage, handling and transport of different hazardous materials must be drawn up and strictly enforced.
- Implement and follow water saving procedures and methodologies.
- If boreholes are to be drilled to supply water for the staff or drilling processes;
    - Ensure the location of the borehole/s is selected to prevent a negative effect on the groundwater levels of existing boreholes.
    - Ensure the abstraction from the borehole/s is determined scientifically to prevent over abstraction.
    - Liaise with potentially affected groundwater water users and monitor any potential impact.
    - The distance between a planned exploration drill hole and a privately owned borehole is important to note, as it also affects the distance (pathway) that any potential pollutant must migrate to reach the borehole
- Monitoring of the groundwater quality during and after activities are completed.

- Portable chemical toilets must be used during the exploration phase.
- Mud pits (if to be used) must be lined and properly covered with impermeable material after completion of exploration boreholes
- Cap and seal all exploration boreholes to prevent surface water from entering the borehole.

It is not currently known whether groundwater from boreholes is considered to be utilised during the prospecting phase. It is anticipated that water will be brought onto site and trucked to the identified drill sites.

During exploration drilling the following information must be recorded and reported on:

a) Aquifer type;

b) Depths to first water strike;

c) Depths to deeper water zones;

d) Salinity of water strike zones (EC measurement with field probe);

e) Strike yields;

f) Standing water level (allow several hours after completion); and

g) Hole completion details (e.g. cement / bentonite plug, backfill material, bore cap, bore number and coordinates).

5 Conclusions

From the desktop study and information provided to SRK by EIMS, the following are concluded for the Jaagers Plaat Area:

- Although the majority of the area is being classed as a poor aquifer system with potentially poor water quality and low expected yields, there are existing groundwater users for which boreholes could be their only water source. It is therefore critical that existing groundwater users be taken into account and that their boreholes are not negatively affected in any way.
- Any negative impact on groundwater and/or groundwater users, whether factual or perceived (complaints from surrounding borehole users) can have a significant financial and reputational impact on the exploration programme and subsequent mining.
- It is not possible to accurately predict the aquifers that will be penetrated when drilling 400 m or more and it is therefore important that support by a geohydrologist is provided before and during the drilling activities.
- Due to the lack of information, such as hydrocensus information, exact drilling positions and drilling depths, a very basic sensitivity map could be compiled at this stage, incorporating areas covered by quaternary deposits (e.g. sands) and surface water / pans. This information was taken from available geological and topographical maps.

6 Assumptions, uncertainties and gaps in knowledge

6.1 Assumptions

SRK assumes that the main purpose of this desktop study is to provide a broad overview of what has been documented for this specific area in terms of the geohydrology. SRK further assumed that the planned exploration has not yet been publicised or discussed with the local municipalities, local farming unions, or any other private or public sector body. SRK did therefore not make contact with any private or public body in terms of the gathering of site specific data. The information on which the desktop study is based, is therefore mainly the available information from the Department of Human Settlement, Water and Sanitation, on a national scale, and published reports that we could source. SRK further assumes that a public participation process will be followed whereby existing groundwater users will be included.

6.2 Limitations

The potential impacts of any drilling activity on the groundwater regime will vary from site to site, even over short distances due to changes in geology and receptors. As no recent hydrocensus across the entire exploration area has been conducted, SRK did not have access to, for example, positions of existing boreholes, dependency on groundwater, specific water quality, depth to groundwater levels and borehole depths. The sensitivity map and groundwater management plan, as presented in this report, must be seen as working documents that must be improved as more information becomes available.

6.3 Gaps

Based on the information presented to SRK, by EIMS, the following information gaps have been identified:

- Exact drilling positions and drilling depths;
- Storage and handling of any potentially hazardous materials / substances on the drilling site, e.g. fuels (diesel, petrol, paraffin, etc.), oils and cleaning chemicals;
- Detailed hydrocensus within the areas where exploration drilling will take place – the hydrocensus must be completed by a geohydrologist / geohydrological technician who has experience in the collection of geosite data, as prescribed by the DWS.
- Detailed scientific reports (geological and geohydrological) of the exploration area (if any) – sourcing these reports will require open conversations with private and public bodies, in which the purpose of the exploration programme and exploration areas will have to be revealed.

A **detailed geohydrological assessment** is required prior to any invasive exploration work (e.g. drilling).

Prepared by

Gert Nel (Pr. Sci. Nat.)

Partner

Reviewed by

Eunice Goossens (Pr. Sci. Nat.)

Principal Hydrogeologist

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

8 References

Department of Water Affairs. (February 2006). *Groundwater Resources Assessment Phase II, Project No. 3003-150.*

Department of Water Affairs. (March 2003). *A Protocol to manage the potential of groundwater contamination from on site sanitation, 2nd Ed.*

Department of Water Affairs. (March 2006). *A guideline for the assessment, planning and management of groundwater resources in South Africa.*

Directorate Catchment Management, DWA, GIS and Cartographic: Helena Fourie. (n.d.). *1: 2 000 000 Water Management areas of the Republic of South Africa.*

P.H. Macey, H. S. (2011). *The Geology of the Loeriesfontein Area, Explanation Sheet 3018.*

Appendix 1: Maps

Map 1 - Topography

Map 2 – Geology

Map 3a – EC

Map 3b – Groundwater Flow Directions

Map 4a – Boreholes Depths

Map 4b – NGA Data

Map 5 – Sensitivity Map

SRK Report Distribution Record

Report No. 549553/JAAGERS PLAAT

Name/Title	Company	Copy	File Type	Date	Authorised by
Mr. GP Kriel	EIMS	1	Electronic	5 July 2019	E. Goossens
SRK Electronic	SRK Consulting	2	Electronic	5 July 2019	E. Goossens

Approval Signature: