Project Name:

Helderberg Centre WULA: Geohydrological Report



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1 Introduction and Scope

1.1 Appointment

H_2 cOnsulting (Pty) Ltd was appointed by Thibault Investments to undertake a geohydrological study for Portion 77 of Farm 794, known as Helderberg Centre, in Somerset West. The scope of work comprised the following:

- Report review;
- Site visit and hydrocensus;
- Sampling of hydrocensus boreholes and selected surface water features (if required); and
- Geohydrological report to support the Water Use License Application (this report).

1.2 Background

Helderberg Centre intends to utilise groundwater for landscape irrigation and operational use within the shopping centre. **Table 1** and **Table 2** present the General Authorisation applicable to Catchment G22J and the projected water demand, respectively. The information indicates that the projected demand exceeds the General Authorisation volume; therefore, a water use licence is required. The available groundwater supply has been determined based on the yield testing conducted on borehole HBC_BH1. Maximum monthly abstraction is expected to occur during the summer months at a rate of approximately 73 m^3/day. The average daily abstraction over a one-year period would be 46 m^3/day.

Table 1: General Authorization for Catchment G22J

Property Size (Ha)	General Authorization (m^3/ha/a)	Available Supply (m^3 /a)
6.01	400	2 404

Table 2: Calculated water demand

Peak Monthly (m^3/month)	Yearly demand from borehole (m^3/a)
2 200	16 810

2 Geographical Setting

2.1 Site Description

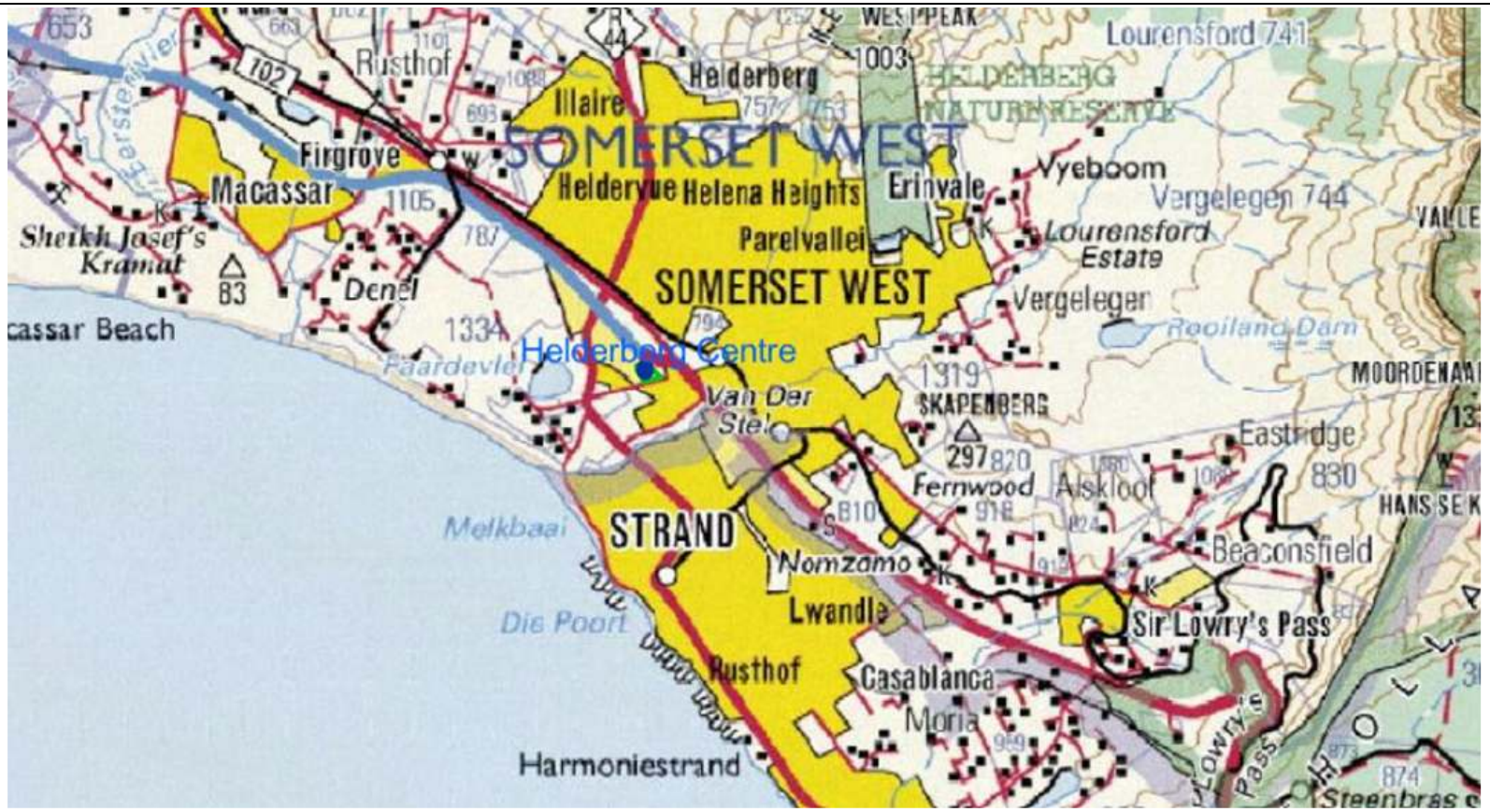
Helderberg Centre is situated on the south-western outskirts of Somerset West (**Figure 1**), within Quaternary Catchment G22J. The property covers approximately 6 ha. The site slopes gently, at an estimated gradient of 1%, from north-east to south-west, with the highest elevation occurring in the eastern corner at approximately 18 mamsl.

The following rivers/streams flow close to the centre:

- Melksloot stream flow in a north westerly direction draining from the Lourens River into the Paardevlei wetland;
- Geelsloot Stream flows along the south-eastern and southern boundaries of the Centre; and

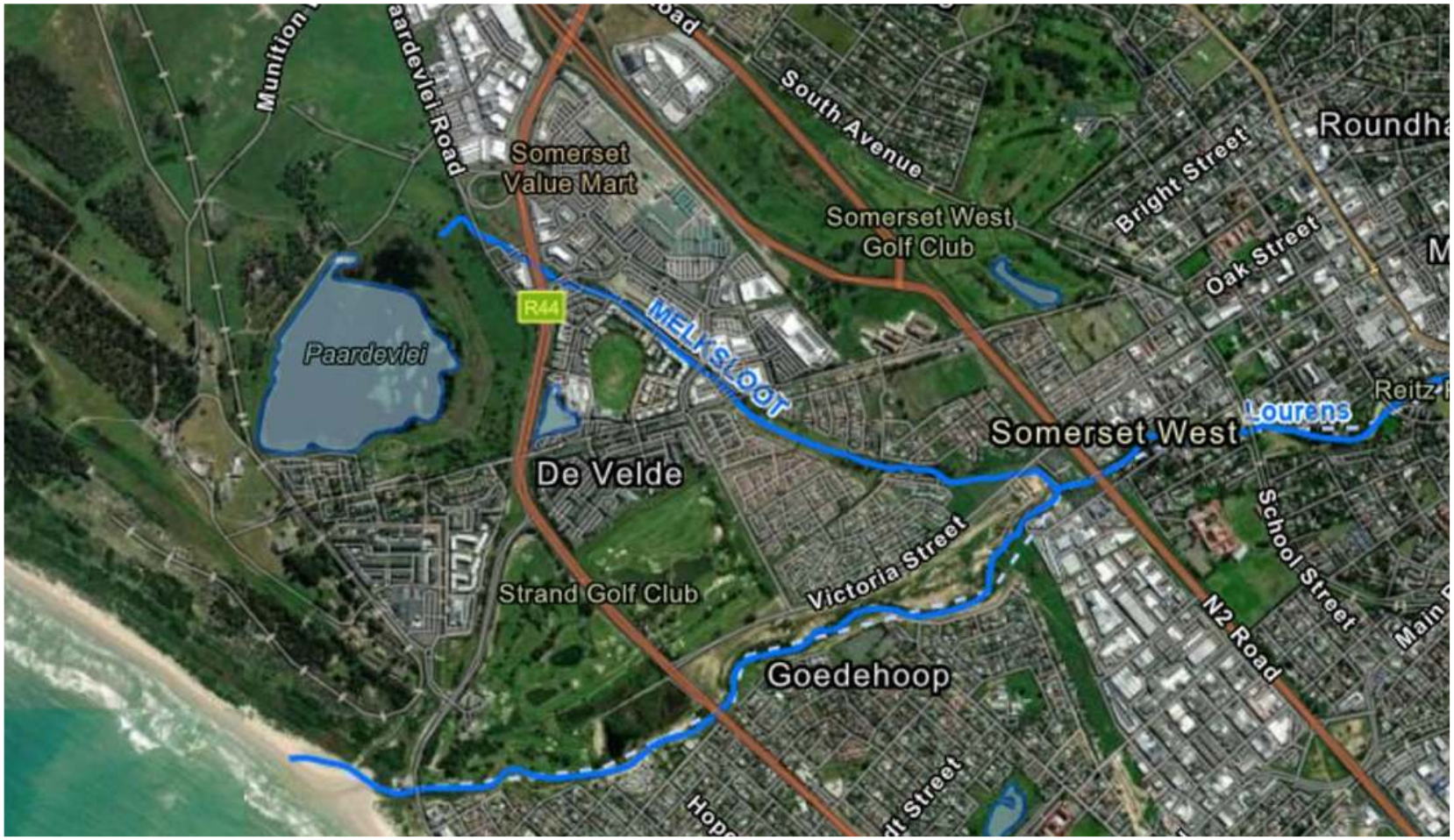
- Lourens River draining into a south westerly direction.

Several wetlands also occur in proximity to the centre, most notably the Paardevlei wetland, located approximately 1.4 km west of Helderberg Centre.



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Figure 1	**Locality map**

Figure 1: Locality map



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Figure 2	**Surface water features**

Figure 2: Surface water features

2.2 Climate

The site is located within the winter-rainfall region of the Western Cape, which is characterised by a Mediterranean climate with warm, dry summers and mild, wet winters.

The mean annual precipitation (MAP), based on the GRA-2 dataset, is 1 002.1 mm/a. The average monthly rainfall distribution is presented in **Figure 3**.

Rainfall occurs predominantly between April and September, corresponding with the autumn and winter months. Mean annual evaporation is approximately 1 410 mm/a (DWAF GRA-2, 2005).

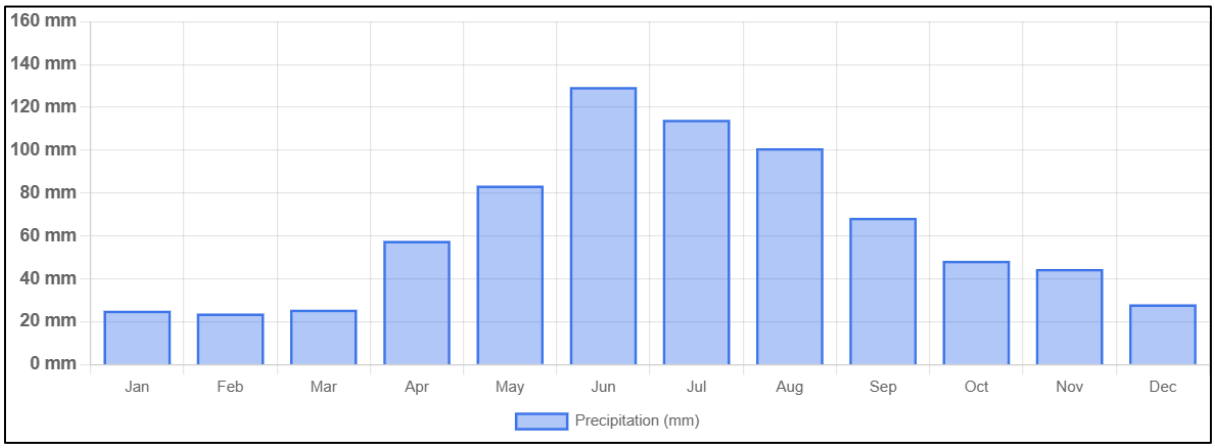


Figure 3: Rainfall (https://weather-and-climate.com)



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Figure 4	**Catchment G22J**

Figure 4: Catchment G22J

3 Methodology

3.1 Desk Study

For the hydrogeological desk study of the site the following reports and information were collated and assessed:

- The Department of Water and Sanitation's National Groundwater Archive (NGA);
- The Department of Water and Sanitation's WARMS borehole data:
- DWAF's 2005 National Groundwater Resource Assessment Phase 2 database;
- JG Africa PAARDEVLEI SOLAR PHOTO-VOLTAIC FARM GEOTECHNICAL INVESTIGATION. Report Number 6047
- JG Africa, GEOHYDROLOGICAL ASSESSMENT FOR THE PAARDEVLEI SOLAR PV FACILITY CLOSE TO SOMERSET WEST, WESTERN CAPE, Report Number 6064
- The DWAF's 2002 1:500 000 Hydrogeological Map Sheet Cape Town 3317;

The following datasets were sourced from the DWS' NGA:

- Borehole ID;
- Co-ordinates;
- Water use;
- Borehole depth;
- Field measurements, i.e. Electrical Conductivity (EC) and pH;
- Water level measurements; and
- Yield and discharge data.

The borehole positions are displayed in **Figure 5**. Borehole (**Table 3**) yields for the area range between 0.05 and 2.2 L/s. Salinity values range from 14 to 69 mS/m for boreholes located closer to the recharge zone. Near the Centre, salinity values are higher, typically ranging between 300 and 400 mS/m.

Borehole depths range between 13.34 and 90 m. The average borehole depth is 41 m. Boreholes are mainly drilled into the semi-weathered shales and are in general less than 60 m deep.

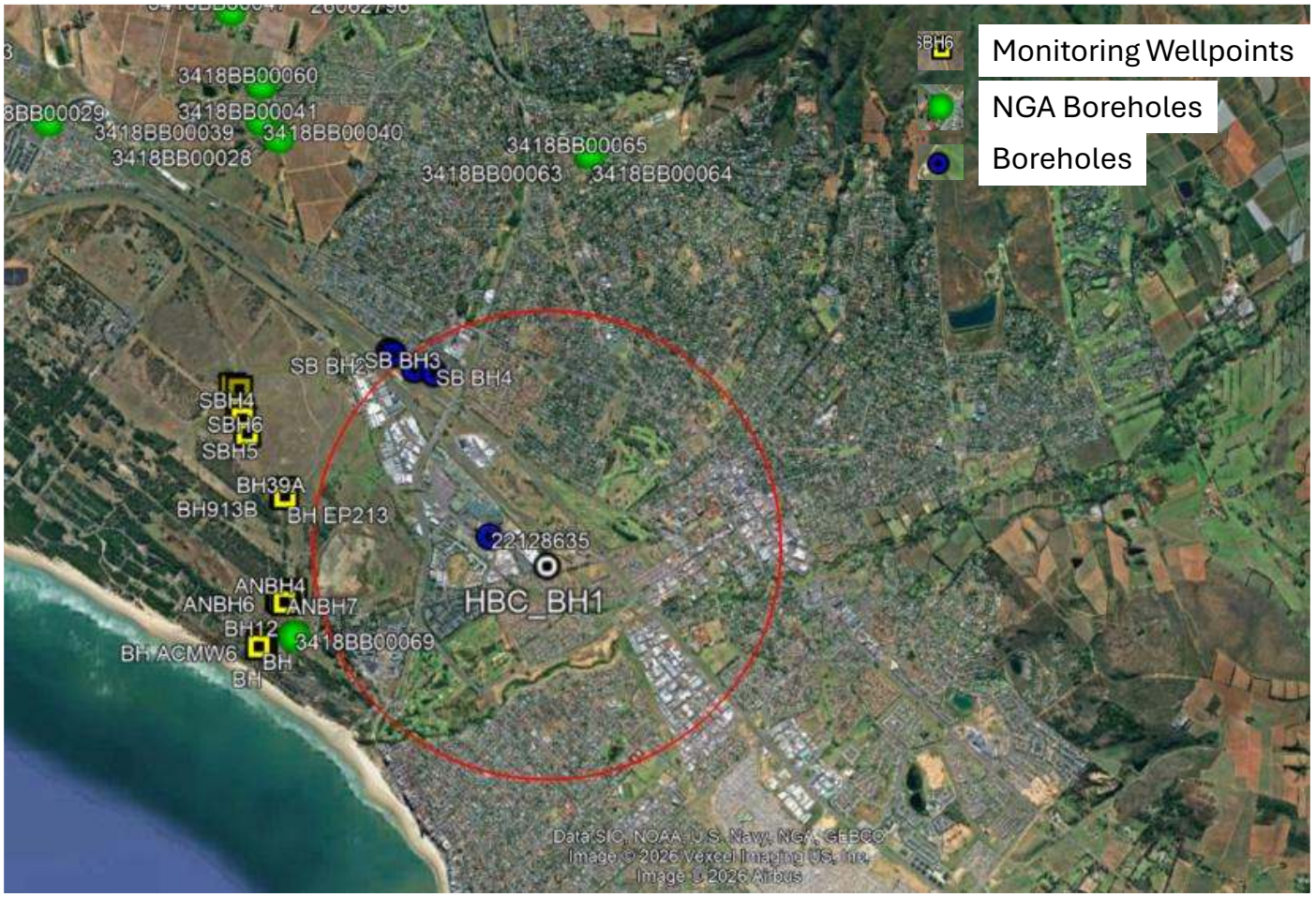
Table 3: Borehole details

	Water Level (mbgl)	Abstraction Rate (L/s)	EC (mS/m)	Borehole Depth (m)
AVG	10.34	0.91	41.00	41.38
MAX	25.91	2.27	69.00	90.00
MIN	1.52	0.05	14.00	13.34

Presented in **Table 4** are details of boreholes located within a 2 km radius of the Centre. These boreholes are slightly deeper than boreholes from the NGA but has similar yields to the borehole at the Centre.

Table 4: Details of boreholes close to the Centre

BH ID	Latitude	Longitude	Water Level (mbgl)	EC (mS/m)	Blow Yield (L/s)
SB BH1	-34.07062	18.81667	0.99	106	1.7
SB BH2	-34.07085	18.81703	0.94	91.7	7.2
SB BH3	-34.07203	18.81898	1.47	101	6.1
SB BH4	-34.07234	18.82079	4.09	97.8	5.56
22128635	-34.08490	18.82590	-	-	-



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Figure 5	**Borehole positions**

Figure 5: Borehole positions

3.2 Geophysical Survey and Results

No geophysical surveys were conducted.

3.3 Drilling of Borehole

The borehole log and construction details are not available. During the yield test the borehole depth was measured to be 40.2 m and fitted with 110 mm u-PVC casing. It is inferred that the borehole penetrated sand and clay before intersecting the semi-weathered shale. The sand and clay sequence is expected to have been cased off with steel casing; therefore, abstraction is interpreted to occur from the secondary aquifer only.

3.4 Aquifer Yield Testing

The borehole was yield tested from 4th to 7th June 2026 by GEOSS. Yield testing was carried out in accordance with SANS 10299.

Summaries of the yield test results for HBC_BH1 are given in **Table 5** (step tests) and **Table 6** (CDTs). The test pumping data report by GEOSS are included in **Appendix A**.

Four step tests were conducted on HBC_BH1. Constant Discharge Tests (CDT) were conducted for a period of 24 hours, to gain an understanding of the “safe” yield of the borehole.

Step tests on HBC_BH1 were conducted at discharge rates of 0.56, 1.06, 2.08 and 4.66 L/s. The drawdown at the end of the final step was 9.09 m. After the test the water level recovered to 0.6 m after 4 hours of recovery. Following water-level recovery, HBC_BH1 was pumped for 24 h at a constant discharge rate of 4.1 L/s. By the end of the constant discharge test, the borehole had reached a final drawdown of 13.32 m. The water level recovered to 1.35 m after 24 h.

Table 5: Step test yields

Borehole No.	Borehole Depth	Pre-Pumping Water Level	60 min Step Discharge Rates L/s					Max. Drawdown at Last Step
	mbgl	mbgl	Step 1	Step 2	Step 3	Step 4	Step 5	m
HBC_BH1	40.2	3.56	0.56	1.06	2.08	4.66	-	9.09

Table 6: Constant discharge tests HBC_BH1

Borehole No.	Borehole Depth	Pre-Pumping Water Level	24 hr Constant Discharge Test	
	mbgl	mbgl	Pump Rate L/s	Final Drawdown m
HBC_BH1	40.2	3.56	4.1	13.32

To estimate the maximum long-term pumping rate the test pumping data were analysed using an Excel based software package developed by Van Tonder et al (2002). In the FC-Analysis the following aquifer input parameters were used:

- Effective recharge of 137 mm/a (average) (GRA-2 data for G22J, DWAF, 2005);
- Available drawdown of 21.75 m; and
- Based on a Drought Index of 3.88 year (GRA-2 data for G22J, DWAF, 2005).

Presented in the tables below are the aquifer parameters and calculated safe abstraction rates.

Table 7: Aquifer parameters for HBC_BH1

Method	Transmissivity	Storativity
Basic FC	11.8 m^2/d	0.0033
Cooper-Jacob	11.3 m^2/d	
Barker	46.01 m^2/d	

Table 8: Calculated 24-hour abstraction rates for HBC_BH1

Method	Abstraction Rate (24 hour)
Basic FC	1.65 l/s
Cooper-Jacob	1.56 l/s
Barker	1.46 l/s
Average Managed Yield	1.56 l/s

The proposed pumping rates and daily abstraction volumes are presented in **Table 9**. For borehole HBC_BH1 it is recommended that abstraction can occur at a rate of up to 2.20 L/s for 12 hours per day (95 m^3/day). This recommended safe abstraction rates is therefore more than the peak daily demand.

Table 9: Sustainable abstraction rates

Pumping Rate (L/s)	Daily Pump Hours (h)	Daily Volume(kl/day)
2.7	8	77
2.2	12	95
1.56	24	134

3.5 Chemical Analysis

A summary of the laboratory analysis results for groundwater from borehole HBC_BH1 is presented in **Table 10**. The results indicate that the groundwater has elevated salinity and chloride concentrations. The laboratory test certificates are included in **Appendix A**.

No *E. coli* was detected in HBC_BH1, but the heterotrophic plate count of 4 600 cfu/mL exceeds limits of SANS 241, and the groundwater must therefore be disinfected before use. Several analysed parameters exceed the SANS 241 limits. The following water treatment measures, among others, are required before the groundwater can be used:

- Metal removal;
- Desalination; and
- Disinfection.

Table 10: Chemical results

Parameter	HBC_BH1	SANS 241 Limit
EC (mS/m)	358	<170
pH	6.6	5-9.7
Cl (mg/L)	1049	<300
Fe (mg/L)	0.273	0.3
NH_4-N	<0.15	<1.5
N (mg/L)	<0.7	<11
F	1.06	1.5
E.coli	0	0

3.6 Groundwater Recharge

The groundwater recharge of 176.58 mm/a (wet season) was obtained for G22J from the GRA-2 dataset (DWAF, 2005). The dry season recharge is 137.72 mm/a.

3.7 Groundwater Modelling

No groundwater modelling required.

3.8 Groundwater Availability Assessment

Presented in **Table 11** is the recommended production pumping rates, schedules and management details for HBC_BH1. **Table 12** provide the summarised groundwater information for Quaternary Catchment G22J**.** GRAII data indicate that groundwater use is 0 m^3/a. This is an outdated number, and groundwater abstraction has increased since the drought in 2017**.**

From **Table 11** it can be seen that the safe groundwater abstraction volumes are higher than the demand and that the borehole will be pumped at lower rates.

Table 11: Recommended production pumping rates, schedules and management details

Borehole ID	Borehole Depth	Rest Water Level	Recommended Pump Intake Depth	Available Drawdown	Recommended 24h/d Safe Pumping Rate		Recommended 12h/d Safe Pumping Rate		Minimum/Maximum Water Demand	Max. Pumping Water Level Not to Exceed
	mbgl	mbgl	mbgl	m	L/s	m^3/d	L/s	m^3/d	m^3/d	mbgl
HBC_BH1	40.2	3.56	35	21.75	1.56	134	2.2	95	46/73	25.34

Table 12: Summary of groundwater information for Quaternary Catchment G22J

Information Piece	Unit	Amount
Extent	km^2	129
Estimated Groundwater Storage of Aquifers	m^3/km^2	81 734
Mean Recharge to Groundwater	$m^3/km^2/a$	157 152
Drought Index	Years	3.88
Mean Groundwater River Baseflow Contribution	$m^3/km^2/a$	1 585 550
Estimated Groundwater Abstraction	m^3/a	0
Utilisable Groundwater Exploitation Potential	$m^3/km^2/a$	49 863

4 Prevailing Groundwater Conditions

4.1 Geology

Quaternary-age sediments overlie basement rocks of the Malmesbury Group within the wider study area. A brief description of the geology of the site and surrounding area is provided in **Figure 6** and **Table 13**.

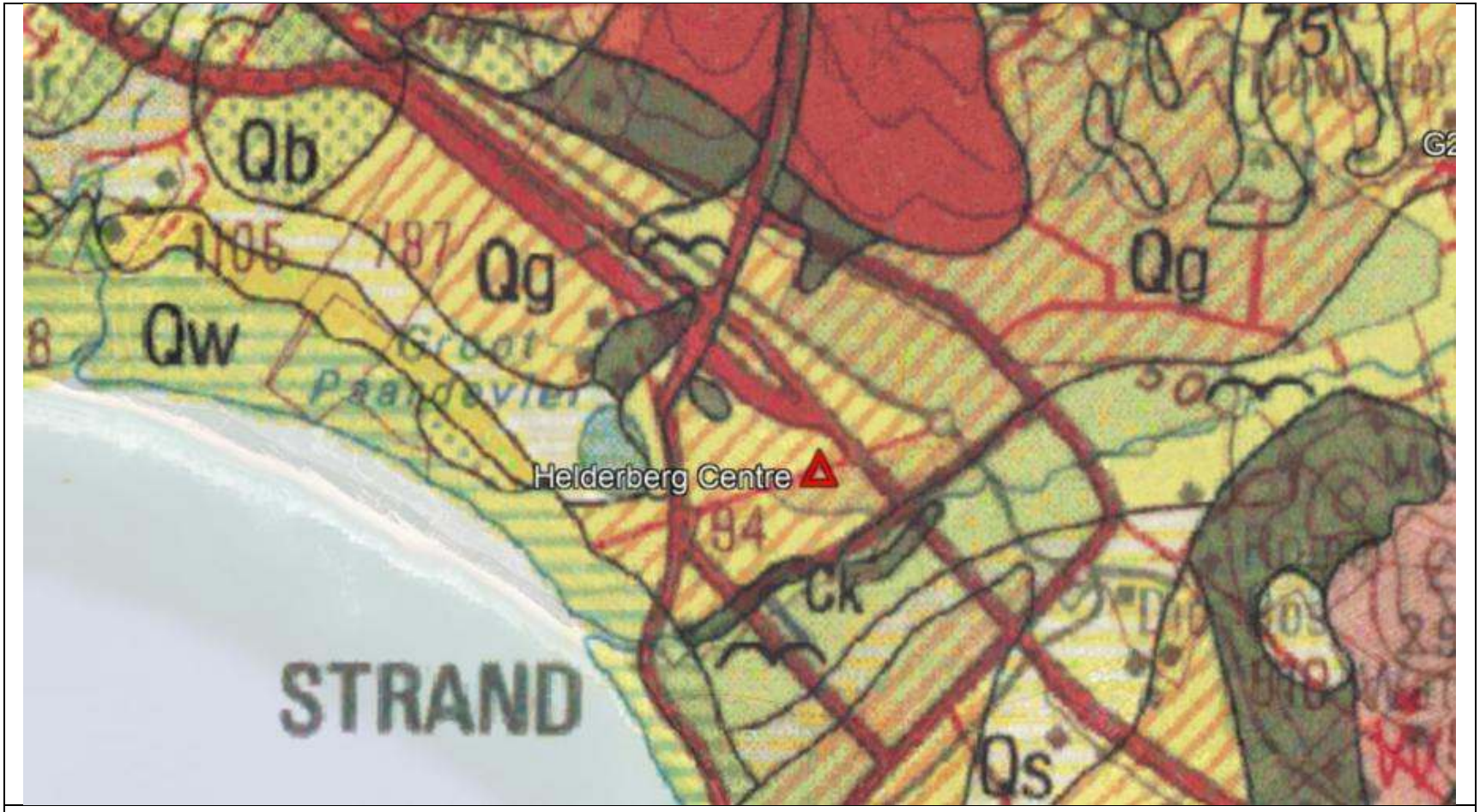
Table 13: Stratigraphy and Lithology of the Area Surrounding In2Food (after Council for Geoscience's 1:250 000 Geological Series sheet 3318 Cape Town)

Group	Formation	Lithology
	Quaternary Sediments (Qg)	Sandy loam soil
	Intrusion (Ck)	Quartz porphyry
Malmesbury Group	Tygerberg (Nt)	Greywacke, phyllite and quartzitic sandstone with volcanic intercalations

Tertiary to Recent deposits underlie the area surrounding the property and consist mainly of sandy loam soil, which is underlain by rocks of the Malmesbury Group. The sand thickness at the site is expected to be less than 5 m.

The basement rocks comprise the Tygerberg Formation of the Malmesbury Group, which consists mainly of alternating layers of grey to green phyllitic shale, siltstone and medium- to fine-grained impure sandstone (greywacke). The transition between the sands and the Malmesbury Group rocks is characterised by a clay layer formed through shale weathering. The degree and depth of weathering may vary over relatively short distances.

The area surrounding the Centre is therefore underlain by two aquifer systems: a primary sand aquifer and a secondary bedrock aquifer. These aquifers are separated by a clay layer of variable thickness.



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Figure 6	**Regional geology**

Figure 6*:* Regional geology (after 1:250 000 Geological Series sheet 3318 Cape Town)

4.2 Hydrogeology

According to the DWAF 1:500 000 hydrogeological map (**Figure 7**), expected borehole yields for both the primary sand aquifer and the secondary Tygerberg Formation aquifer range between 0.5 and 2 L/s. This range is generally consistent with the yield recorded for HBC_BH1.

The DWAF 1:500 000 hydrogeological map (**Figure 8**) indicates that groundwater salinity in the area ranges between 70 and 150 mS/m. This EC range is lower than the values measured in the existing boreholes; therefore, newly drilled boreholes in the area are expected to have similarly elevated EC values. Surrounding groundwater data also indicate elevated salinity values.

According to **Figure 9** the aquifer is classified as a major aquifer. Ground water vulnerability was considered in terms of the 'DRASTIC' method of assessment of the intrinsic vulnerability of an aquifer to contamination from the surface (Aller *et. al*., 1987) and is shown in **Figure 10** . The method considers the following factors, which control the vulnerability of an aquifer to contamination from surface:

- Depth to water table (D)
- Recharge (R)
- Aquifer material (A)
- Soils (S)
- Topography and slope (T)
- Impact of the vadose (unsaturated) zone (I)
- Hydraulic conductivity (C)

Aquifer vulnerability is defined as the likelihood for contamination to reach a specified position in the groundwater system after being introduced at some point above the uppermost aquifer.

According the DWAF's aquifer vulnerability map (DWAF, 2013), the site's vulnerability rating is 'Most'.

The aquifer vulnerability for the secondary aquifer (into which HBC_BH1 was drilled into) has a rating of Moderate.



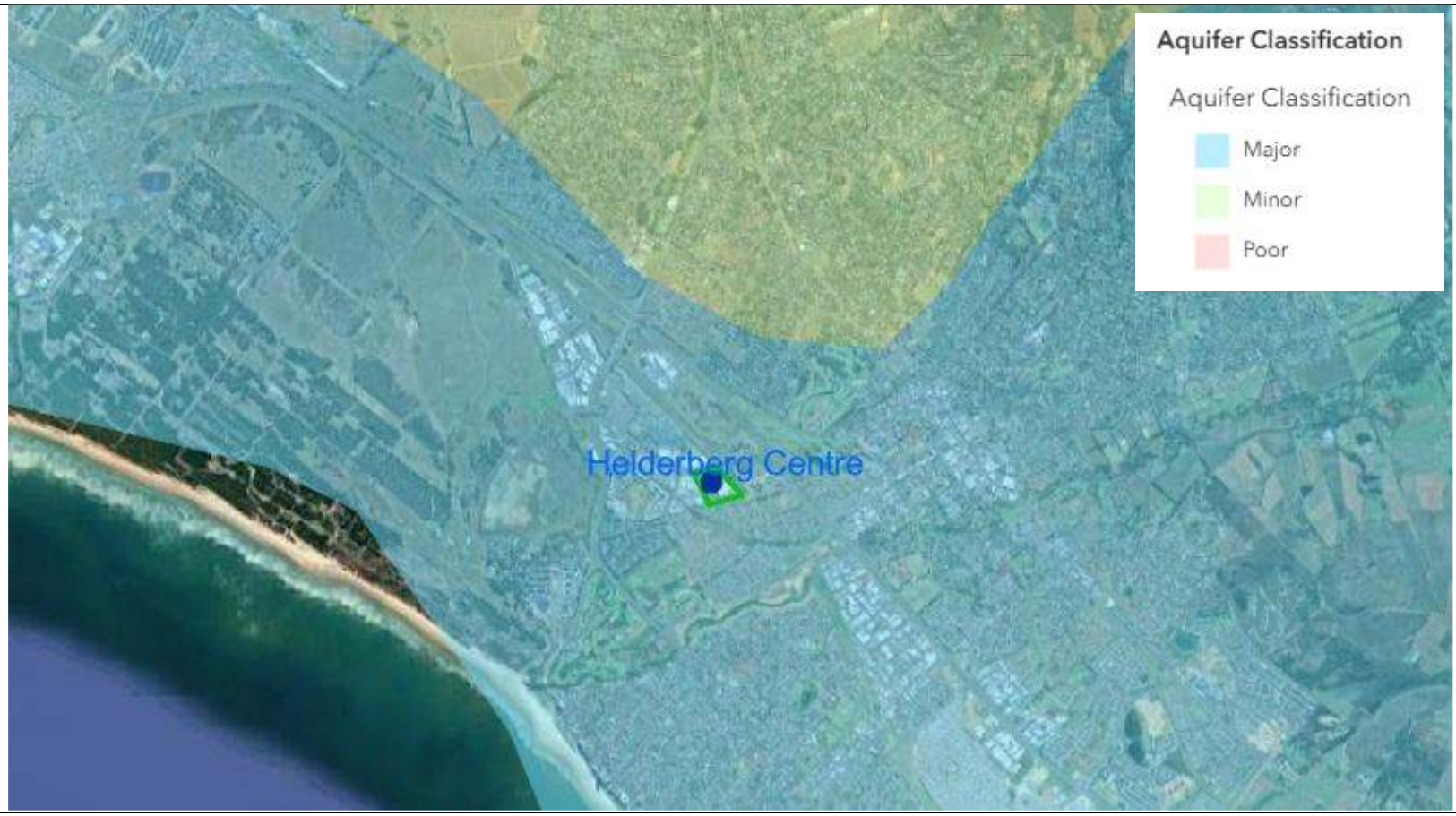
Helderberg Centre WUL Application	
Figure 7	**Borehole Yields**

Figure 7: Expected Borehole yields



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Figure 8	**Expected Quality**

Figure 8: Expected Quality



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Figure 9	**Aquifer Classification**

Figure 9: Aquifer classification



Helderberg Centre WUL Application	
Figure 10	**Aquifer Vulnerability**

Figure 10: Aquifer vulnerability

4.3 Groundwater Levels

Groundwater levels in the area surrounding Helderberg Centre range from 1.56 to 25.9 mbgl (**Table 14**). The water level at HBC_BH1 was measured to be 3.56 mbgl. Groundwater flow is expected to broadly follow the local topography, with flow directed towards the south-west.

Table 14: Summary of groundwater levels

Parameter	Water level (mbgl)
Min	1.52
Max	25.91
Avg	10.34

The influence of pumping both HBC_BH1 on the surrounding aquifer can be calculated using Cooper-Jacob modelling of radius of influence. The equation is:

$s = 2.3Q / (4\pi T) * \log10(2.25Tt / R^2S)$, where

Q = Daily abstraction (73 m^3)

T = Transmissivity (11.8 m^2/d)

t = 730 days (2 years)

R = Distance (1000 m)

S = Storativity of 0.0033

The above values were determined from the yield tests.

Based on the above calculation the impact of pumping at HBC_BH1 would be an additional 0.87 m drawdown over two years 1 km from the borehole.

The closest known borehole is some 560 m west of the Centre. Based on the above equation the water level in the borehole will drop by an additional 1.4 m if the borehole is pumped at the maximum rate of 73 m^3/day. Using the average daily abstraction rate of 46 m3/day the influence will be 0.9 m.

This impact is seen as minimal due to:

- The aquifer is not homogenous, and impact should be less; and
- The borehole will not be pumped for 24 h per day over the two years.

It is recommended that the borehole be included in the monitor network.

4.4 Groundwater Surface Water Interaction

Several wetlands and other surface water features are located close to the Centre. As discussed in previous sections, the area has two aquifers. A shallow Primary aquifer and a deeper Secondary aquifer. The two aquifers are separated by a clay layer acting as an aquitard therefore blocking groundwater flow between the aquifers. Borehole HBC_BH1 is 40 m deep and targeted the secondary aquifer. Typical borehole construction is to seal off the sand and clay with steel casing and therefore groundwater will be abstracted from the deeper secondary aquifer only.

Based on the above assessment, groundwater abstraction from HBC_BH1 is not expected to adversely affect the wetlands in the surrounding area.

5 Groundwater Modelling

Not Applicable.

6 Assessment of Potential Geohydrological Impacts

6.1 Construction Phase

Not applicable for this study

6.2 Operational Phase

6.2.1 Impacts on Groundwater Quantity

The following impacts have been identified that could potentially impact on the groundwater quantity:

- Abstracting groundwater from the borehole might result in drawdown in the local fractured-rock aquifer and possibly influence other users; and
- Any abstraction from the borehole results in a water level decline in the abstraction borehole.

Too limit such impact the proposed pumping rates and times are kept to the minimum. Such as reduced pumping hours will allow the water level to recover and is likely to reduce the significance of the impact to very low. See impact rating below in **Table 15**.

Table 15: Impact rating assessment Groundwater Quantity – Operational Phase

Mitigation	Impact no	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without	1	Local 1	Medium 2	Long-term 3	**Medium** 6	Possible	**Low**	**–**	Low
Essential mitigation measures: • Implement proposed pumping rates and regimes. • Pumping rates are below the sustainable pumping rates. **Best practise measures:** • Implement a groundwater monitoring system to monitor groundwater quality, volumes abstracted and water levels. **Natural mitigation:** • High annual recharge and high storage potential of the aquifers naturally mitigate the negative effects of abstraction on the aquifers of this area.									
With	1	Local 1	Low 1	Long-term 3	**Low** 5	Improbable	**Very Low**	**–**	Low

6.3 Impacts on Groundwater Quality

Not applicable

6.4 Groundwater Management

The following groundwater management measures are recommended:

- Install the production pumps at recommended depths;
- Limit abstraction to recommended volumes;
- Include known surrounding boreholes in the monitoring network;
- Include the borehole in a groundwater monitoring programme to include:
    - The borehole must be equipped with a slotted conduit pipe (35 mm ID class 6 HDPE pipe) attached to the pump's rising pipes and installed to *c.*1 m above the pump inlet.
    - The water level and volumes abstracted must be recorded on at least a monthly basis. Best results are obtained if automatic flow meters and water level recorders set to take hourly readings are installed; and
    - A SACNASP registered hydrogeologist should evaluate the monitoring data on an quarterly basis and compile a monitoring report.

Implement all the essential mitigation measures included in ***Table 15***

6.5 Decommissioning Phase

Not applicable

6.6 Post-Operational Phase

Not applicable

7 Groundwater Monitoring System

7.1 Introduction

A groundwater monitoring plan as indicated in previous sections must be implemented as early as possible. This information will inform the ongoing implementation and development of a water management strategy and management of impacts within the site area and on downstream or down gradient water users.

The results of monitoring, and any changes to the water management strategies, must be reported to management and DWS as per the WUL for specific items, and a detailed monitoring report submitted to the DWS on an quarterly basis. The report serves to notify DWS of areas of reduction in water supply and the actions implemented, in progress or planned to address the identified impacts including source identification and control.

7.2 Groundwater Monitoring Network

Install monitoring equipment in the borehole. And surrounding boreholes.

7.3 Source Plume, Impact and Background Monitoring

Not applicable

7.4 Monitoring Frequency

- Monitoring frequency should be weekly and reviewed every three months;
- Monitoring must commence as soon as possible; and
- Water levels in the borehole should be measured on a weekly basis, preferably daily. Best practise is to install an automatic recorder (logger) in the borehole to measure the water level, temperature and electrical conductivity (salinity) hourly.

8 Groundwater Environmental Management Programme

8.1 Current Groundwater Conditions

These are summarised in the Sections above.

8.2 Predicted Impacts of Facility

As per previous sections.

8.3 Mitigation Measures

As per previous sections.

9 Post Closure Management Plan

Not applicable to this application.

10 Conclusions and Recommendations

Based on the data and information discussed in this report, the following is recommended regarding the groundwater resources at Helderberg Centre:

- The report supports a Water Use Licence Application for Helderberg Centre in Somerset West, focusing on groundwater use from borehole HBC_BH1.;
- Helderberg Centre intends to use groundwater for landscape irrigation and operational purposes;
- The annual groundwater demand is estimated at 16,810 m³/a, which exceeds the General Authorisation volume of 2,404 m³/a for Catchment G22J, requiring a water use licence;

- The site lies within Quaternary Catchment G22J and covers approximately 6 ha;
- Nearby surface water features include the Melksloot, Geelsloot, Lourens River, and Paardevlei wetland;
- The area has a Mediterranean climate with winter rainfall, mean annual precipitation of about 1,002 mm/a, and mean annual evaporation of about 1,410 mm/a;
- Borehole HBC_BH1 was yield tested in June 2026 and is drilled into the secondary aquifer of the Malmesbury Group;
- Step tests and a 24-hour constant discharge test showed that the borehole can sustainably supply more water than the estimated peak demand;
- Recommended abstraction is up to 2.2 L/s for 12 hours per day, equivalent to approximately 95 m^3/day which exceeds the maximum demand of 73 m^3/day. The average water demand is 46 m^3/day:
- Groundwater quality is marginal, with elevated salinity and chloride concentrations;
- Several groundwater quality parameters exceed SANS 241 limits, and treatment is required before use;
- Required treatment measures include metal removal, desalination, and disinfection;
- No E. coli was detected, but the heterotrophic plate count exceeds acceptable limits, requiring disinfection;
- The site is underlain by two aquifer systems: a shallow primary sand aquifer and a deeper secondary bedrock aquifer;
- A clay layer separates the shallow and deeper aquifers, limiting hydraulic connection between them;
- HBC_BH1 abstracts from the deeper secondary aquifer, so abstraction is not expected to adversely affect nearby wetlands;
- Groundwater levels in the area range from about 1.52 to 25.91 mbgl, with HBC_BH1 measured at 3.56 mbgl;
- Modelling indicates that pumping could cause approximately 1.1 m additional drawdown over two years in a 1 km radius. It is expected that a borehole 560 m away will be impacted by less than 0,9 m drop in water level over a two-year period. This impact is seen as minimal due to that the aquifer is not homogenous, and impact should be less and the borehole will not be pumped for 24 h per day over the two years;
- Operational-phase groundwater quantity impacts are rated as low without mitigation and very low with mitigation;
- Groundwater quality impacts are considered not applicable for this study;
- A groundwater monitoring and management programme is recommended;
- Monitoring should include groundwater levels, abstraction volumes, water quality, temperature, and electrical conductivity;
- Monitoring should begin as soon as possible, ideally with automatic flow meters and water-level loggers;

- A SACNASP-registered hydrogeologist should review monitoring data quarterly and compile monitoring reports;
- Essential mitigation includes implementing recommended pumping rates, limiting abstraction volumes, and maintaining a monitoring programme;
- The report concludes that groundwater use from HBC_BH1 is feasible, provided treatment, monitoring, and mitigation measures are implemented.

11 References

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12 Appendices

Appendix A Yield test results and Water Quality

Appendix B: Impact Assessment Methodology

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GEOSS Project No: 5682_AV
17 June 2026

SANS 10299-4:2003 accredited yield testing of HBC_BH1, Helderberg Centre, Helderberg

This report specifies that borehole HBC_BH1, located on Helderberg Centre, Helderberg, was yield tested according to the South African National Standards (SANS 10299-4:2003, Part 4 - Test pumping of water boreholes). The yield test consisted of a Step Test, Constant Discharge Test (CDT) and recovery monitoring. A SACNASP-accredited professional hydrogeologist analysed the data, and abstraction from this resource is recommended to occur according to the stipulated rates below.

Table 1: Helderberg Centre Borehole Details

HBC_BH1 Borehole Details				
Borehole Name	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Borehole Depth (m)	Inner Diameter (mm)
HBC_BH1	-34.08724	18.83125	40.20	110
Abstraction Recommendations				
Borehole Name	Abstraction rate (L/s)	Abstraction Duration (hrs)	Recovery Duration (hrs)	Possible Volume Abstracted (L/d)
HBC_BH1	2.70	8	16	77 760
	2.20	12	12	95 040
	1.56	24	0	134 784
Pump Installation Details				
Borehole Name	Recommended Pump Installation Depth (mbgl)	Critical Water Level (mbgl)	Dynamic Water Level (mbgl)*	Rest Water Level (mbgl)
HBC_BH1	35.00	25.34	19.59	3.56

**Typical water level expected during long-term production (pump duty point)*



Figure 1: HBC_BH1 before (left) and after (right) testing.

1. Testing Methodology

The yield testing was carried out according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This included a Step Test, Constant Discharge Test and recovery monitoring of the borehole. For the Step Test, a borehole is pumped at a constant rate for one-hour intervals and the flow rates are incrementally increased for each step. This test is followed by a Constant Discharge Test where the borehole is pumped at a constant rate for an extended period of time, followed by recovery monitoring. The water level drawdown is monitored at pre-determined intervals during these tests (drawdown refers to the difference in water level from the rest water level (RWL) measured before commencement of the yield test).

The yield test data were analysed using the Excel-based FC program, developed by the IGS (Institute for Groundwater Studies) in Bloemfontein. The sustainable yield of the borehole was calculated based upon long-term extrapolations of the Constant Discharge Test data according to (1) the Cooper-Jacob (1946) approximation of the Theis solution for confined aquifers, (2) the Barker (1988) Generalised Radial Flow Model (GRF) for hydraulic tests in fractured rock and (3) the Flow Characteristic (FC) method(s) (Van Tonder et al.,2001) using first and second derivative calculations. Boundary conditions are accounted for in multiplication factors to the rate of drawdown (derivatives), according to each of the above three methods.

2. Testing

2.1 Yield Testing HBC_BH1

The yield testing was conducted between 4 and 7 June 2026. The borehole was measured to a depth of 40.20 meters below ground level (mbgl). The test pump was installed at a depth of 39.20 mbgl. The rest water level (RWL) at the start of the step test was 3.56 mbgl and 3.59 mbgl before the start of the CDT. During the CDT, the water level had drawn down 13.32 meters below the rest water level (16.88 mbgl) after the 24-hour test period. **The data from the tests are graphically presented in Figure 2, which also indicates the available drawdown and critical water level as the red line at 21.75 meters (25.34 mbgl) as per the geomean of the water level reached during the CDT and the available drawdown to the borehole depth.**

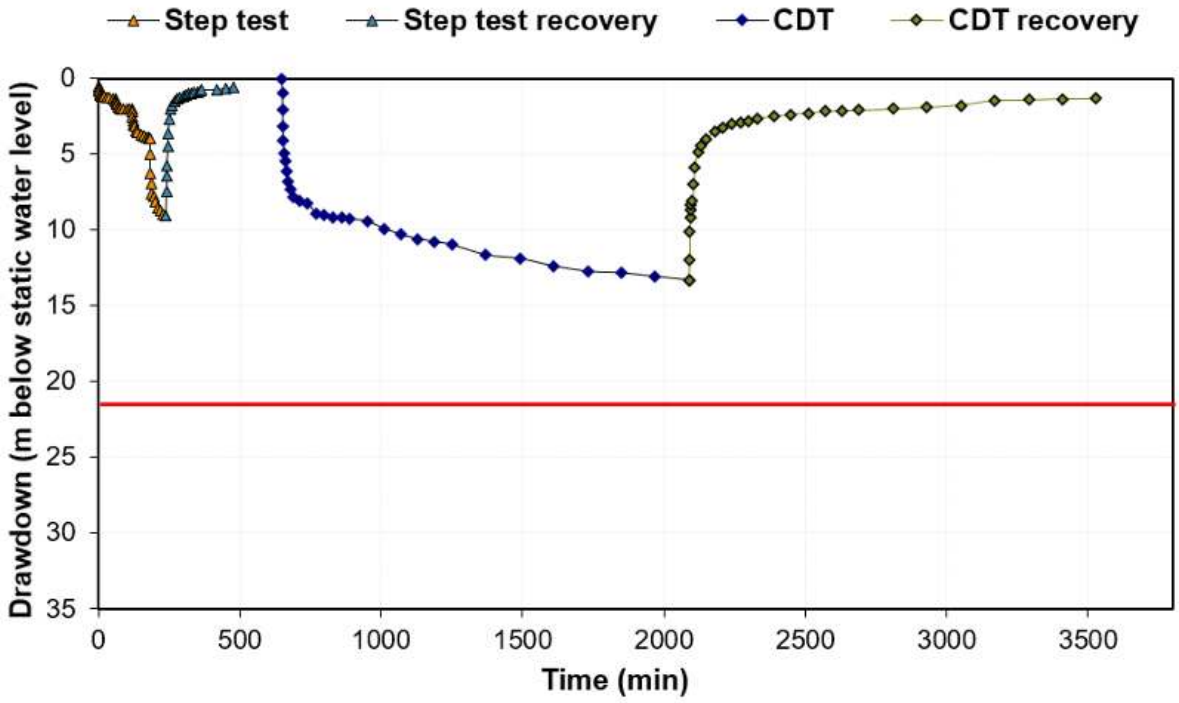


Figure 2: Drawdown vs time graph of the testing at HBC_BH1.

Several methods were used to assess the yield test data as presented in the table below. It is recommended that groundwater be abstracted at a rate of up to 2.20 L/s (7 920 L/h) for up to 12 hours per day. The assessments were based on an available drawdown (AD) of 21.75 meters below the RWL, which equates to 11.84 mbgl.

Table 2: Yield Determination – HBC_BH1

HBC_BH1			
Method	**Sustainable Yield (L/s)**	**Late *T (m^2/d)**	****AD used (m)**
Basic FC	1.65	11.8	21.75
Cooper-Jacob	1.56	11.3	21.75
Barker	1.46		21.75
Average Q_sust (L/s)	**1.56**		
Recommended Abstraction			
Abstraction Rate (L/s)	**Abstraction Duration (hours)**		**Recovery Duration (hours)**
2.70	**8**		**16**
2.20	**12**		**12**
1.56	**24**		**0**

***AD- Available Drawdown*

** T – Transmissivity*

3. Groundwater quality

A groundwater sample was collected from the borehole at the end of the yield test and submitted to a SANAS accredited laboratory (Vinlab H20) in Stellenbosch for inorganic and microbial chemical analyses. The chemistry results obtained for the borehole have been classified according to the SANS241-1: 2015 standards for drinking water (**Table 3**). **Table 4** presents the water chemistry analysis results, colour coded according to the SANS241-1: 2015 drinking water assessment standards.

Table 3: Classification table for the specific limits.

Acute Health	Aesthetic	Chronic Health	Operational	Acceptable

The limits and associated risks for drinking water as determined by the South African National Standard (SANS) 241:2015 are as follows, where:

- Health risks: parameters falling outside these limits may cause acute or chronic health problems in individuals.
- Aesthetic risks: parameters falling outside these limits indicate that water is visually, aromatically or palatably unacceptable.
- Operational risks: parameters falling outside these limits may indicate that operational procedures to ensure water quality standards are met may have failed.

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Table 4: Production borehole results classified according to SANS241-1:2015.

Analyses	HBC_BH1	SANS 241-1:2015
Date and Time Sampled	6-June-2026 08:00	
pH (at 25 °C)	6.60	5.0 ≤ Operational ≤ 9.7
Conductivity (mS/m) (at 25 °C)	358.00	Aesthetic ≤170
Total Dissolved Solids (mg/L)	2427.24	Aesthetic ≤1200
Turbidity (NTU)	8.06	Operational ≤1 Aesthetic ≤5
Colour (mg/L as Pt)	<15	Aesthetic ≤15
Sodium (mg/L as Na)	519.00	Aesthetic ≤200
Potassium (mg/L as K)	11.00	N/A
Magnesium (mg/L as Mg)	68.00	N/A
Calcium (mg/L as Ca)	105.00	N/A
Chloride (mg/L as Cl)	1049.81	Aesthetic ≤300
Sulphate (mg/L as SO_4)	69.92	Aesthetic ≤250 Acute ≤500
Combined Nitrate & Nitrite Nitrogen (as a ratio)	0.08	≤1 Acute Health
Nitrate Nitrogen (mg/L as N)	<0.70	Acute Health ≤11
Nitrite Nitrogen (mg/L as N)	<0.05	Acute Health ≤0.9
Ammonia Nitrogen (mg/L as N)	<0.15	Aesthetic ≤1.5
Total Hardness (mg/L as $CaCO_3$)	541.30	N/A
Fluoride (mg/L as F)	1.06	Chronic Health ≤1.5
Aluminium (mg/L as Al)	<0.05	Operational ≤0.3
Total Chromium (mg/L as Cr)	<0.01	Chronic Health ≤0.05
Manganese (mg/L as Mn)	0.294	Aesthetic ≤0.1 Chronic ≤0.4
Iron (mg/L as Fe)	0.273	Aesthetic ≤0.3 Chronic ≤2
Nickel (mg/L as Ni)	<0.05	Chronic Health ≤0.07
Copper (mg/L as Cu)	<0.05	Chronic Health ≤2
Zinc (mg/L as Zn)	<0.05	Aesthetic ≤5
Arsenic (mg/L as As)	<0.01	Chronic Health ≤0.01
Selenium (mg/L as Se)	<0.01	Chronic Health ≤0.04
Cadmium (mg/L as Cd)	<0.003	Chronic Health ≤0.003
Antimony (mg/L as Sb)	<0.013	Chronic Health ≤0.02
Mercury (mg/L as Hg)	<0.001	Chronic Health ≤0.006
Lead (mg/L as Pb)	<0.01	Chronic Health ≤0.01
Uranium (mg/L as U)	<0.028	Chronic Health ≤0.03
Cyanide (mg/L as CN-)	<0.01	Acute Health ≤0.2
Total Organic Carbon (mg/L as C)	1.10	N/A
E.coli (count per 100 ml)	0	Not Det. Acute Health-1
Total Coliform Bacteria (count per 100 ml)	1	Not Det.≤10 Operational
Heterotrophic Plate Count (count per ml)	4600	≤1000 Operational
Charge Balance Error %	0.50	≥-5 - ≤5 Acceptable

Based on the chemical results presented in **Table 4**, groundwater from HBC_BH1 is of poor quality for potable use and does not fully comply with the SANS 241-1:2015 drinking water standards.

The electrical conductivity (358.00 mS/m) and total dissolved solids (2 427.24 mg/L) exceed their aesthetic limit of 170 mS/m and 1 200 mg/L, respectively. This is likely caused by elevated concentrations of sodium (519.00 mg/L) and chloride (1 049.81 mg/L), which exceeds their respective aesthetic limits of 200 mg/L and 300 mg/L. These exceedances pose no direct health risk, but may result in a salty taste of the water from HBC_BH1. Additionally, turbidity (8.06 NTU) and manganese (0.294 mg/L) exceed their operational and aesthetic limit, which will cause a cloudy appearance in the water.

Microbiological results show an elevated heterotrophic plate count of 4 600 cfu/mL, exceeding the operational limits of SANS 241. Although E. coli was not detected, the high microbial count indicates possible ingress of contaminated water and underlines the need for disinfection prior to use. In its current condition, the groundwater is not suitable for human consumption without appropriate treatment.

For irrigation use, the water presents restrictions due to an elevated salinity hazard. With an electrical conductivity of 358.00 mS/m and a TDS of 2 427.24 mg/L, the water is considered brackish and generally unsuitable for irrigation under normal conditions. It poses a high risk of soil salinization and crop toxicity, meaning it can only be used for highly salt-tolerant crops on well-drained soils, paired with intensive leaching, specialized management, and continuous soil monitoring.

4. Results and Recommendations

For borehole HBC_BH1 it is recommended that abstraction can occur at a rate of up to 2.20 L/s for 12 hours per day. A pump suitable to deliver the recommended rate should be installed at a depth of 35.00 mbgl. It is anticipated that abstraction at the recommended rate will cause the water level to drop to a depth of approximately 19.59 mbgl – this is referred to as the dynamic water level. During abstraction, a maximum level cut-off switch should be installed at 25.34 mbgl to ensure the groundwater level does not drop to below the critical water level.

Groundwater from HBC_BH1 is of poor quality for potable use due to elevated EC, TDS, turbidity, sodium, chloride, manganese as well as a high heterotrophic plate count of 4 600 cfu/mL, all of which exceed SANS 241-1:2015 limits. While E. coli was not detected, the results indicate the need for disinfection and treatment before use. For irrigation, the water is suitable for high salt-tolerant crops, however, soil salinity should be monitored over time.

To facilitate monitoring and informed management of the borehole, it is recommended to equip the borehole with the following monitoring infrastructure and equipment:

- Install a 32 mm (inner diameter, class 10) observation pipe from the pump depth to the surface, closed at the bottom and slotted for the bottom 5 – 10 m.
- Install an electronic water level logger (for automated water level monitoring).
- Install a sampling tap (to monitor water quality).
- Install a flow volume meter (to monitor abstraction rates and volumes).

GEOSS South Africa (PTY) LTD cannot be held liable for the over-abstraction or misuse of this resource. The resource should only be utilised once the appropriate authorisation has been acquired from the Department of Water and Sanitation and if the resource is correctly monitored (including water level, abstraction and water quality).



Ajay Larey
Hydrogeologist

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Abbreviations	
ec	Electrical conductivity
mbgl	Meters below ground level
mbch	Meters below casing height
mbd	Meters below datum level
mags	Meters above ground level
l/s	Litres per second
RPM	Revs per minute
SWL	Static water level
µS/cm	Microsiemens per centimeter

BOREHOLE TEST RECORD

Ground water solutions t/a AB Pumps CC

CONSULTANT:	Michael Bekker
DISTRICT:	Helderberg
PROVINCE:	Western Cape
FARM / VILLAGE NAME :	Helderberg Shopping Centre
DATE TESTED:	2026-06-04

PROJECT #	P3305
TEAM MEMBERS	Eddie
	Thabang
	Luthando
	Phillip
	Joseph

BOREHOLE LOCATION & ACCESS INFORMATION:

BOREHOLE COORDINATES	
LATITUDE (SOUTH):	34.087246
LONGITUDE (EAST):	018.831255

COMMENTS ON ACCESS IF ANY:

BOREHOLE NO:	HBC-BH01
TRANSMISSIVITY VALUE:	
TYPE INSTALLATION:	Submersble
BOREHOLE DEPTH: (mbgl)	40.2

MAINTENANCE RECORD:		**REHABILITATION RECORD:**		**DIGITAL CAMERA LOGGING:**		**EQUIPMENT FISHING RECORD**	
Labour hours:		**Jetting hours:**		**Camera logged once:**		**Hours spent:**	
Cost of material:		**Brushing hours:**		**Camera logged twice:**			
Travelling (km):		**Airlifting hours:**		**Camera logged three times:**		**OTHER COSTS ON PROJECT:**	
		Sulphamic Acid KG's		**Camera work sent to client:**		**Courier of samples:**	
		Boresaver KG's				**Km's for delivery:**	
		Soda Ash KG's				**Cost of packaging:**	

COMMENTS:	**RECOMMENDATIONS / CORRECTIVE ACTIONS:**
Existing Pump was reinstalled	

SAMPLE INSTRUCTIONS :

Water sample taken	Yes	No	If consultant took sample, give name:		**DATA CAPTURED BY:**	IH
Date sample taken	2026-06-06		If sample courier, to where:		**DATA CHECKED BY:**	AVN
Time sample taken	08:00					

DESCRIPTION:	**UNIT**	**QTY**		**UNIT**	**QTY**
STRAIGHTNESS TEST:	**NO**	0	BOREHOLE DEPTH AFTER TEST:	**M**	40.20
VERTICALLY TEST:	**NO**	0	BOREHOLE WATER LEVEL AFTER TEST: (mbch)	**M**	4.82
CASING DETECTION:	**NO**	UPVC	SAND/GRAVEL/SILT PUMPED?	**YES/NO**	0
SUPPLIED NEW STEEL BOREHOLE COVER:	**NO**	0	DATA REPORTING AND RECORDING	**NO**	1
BOREHOLE MARKING	**NO**	0	SLUG TEST:	**NO**	0
SITE CLEANING & FINISHING	**NO**	1	LAYFLAT (M):	**M**	10
LOGGERS FOR WATERLEVEL MONITORING	**NO**	0	LOGGERS FOR pH AND EC:	**NO**	0

It is hereby acknowledged that upon leaving the site, all existing equipment is in an acceptable condition.

NAME: _____ **SIGNATURE:** _____

DESIGNATION: _____ **DATE:** _____

FORM 5 E

STEPPED DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3305	Coordinates:	SOUTH: 34.087246	PROVINCE:	Western Cape
BOREHOLE NO:	HBC-BH01		EAST: 018.831255	DISTRICT:	Helderberg
ALT BH NO:	0			SITE NAME:	Helderberg Shopping Centre
ALT BH NO:	0				

BOREHOLE DEPTH (m)	40.20	DATUM LEVEL ABOVE CASING (m):	0.65	EXISTING PUMP:	Submersible
WATER LEVEL (mbdl):	4.21	CASING HEIGHT: (magl):	Ground Level	CONTRACTOR:	AB PUMPS
DEPTH OF PUMP (m):	39.20	DIAM PUMP INLET (mm):	110.00	PUMP TYPE:	WA22-2

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM 229		DISCHARGE RATE 2			RPM 280		DISCHARGE RATE 3			RPM 483	
DATE:	2026-06-04	TIME:	12:00		DATE:	2026-06-04	TIME:	13:00		DATE:	2026-06-04	TIME:	14:00	
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	0.50		**1**		**1**	1.45	0.97	**1**		**1**	2.19		**1**	
2	0.69		**2**		**2**	1.50	1.05	**2**		**2**	2.56	2.08	**2**	
3	0.84		**3**		**3**	1.54	1.04	**3**		**3**	2.80		**3**	
5	1.00		**5**		**5**	1.59		**5**		**5**	3.02	2.08	**5**	
7	1.09	0.58	**7**		**7**	1.73	1.05	**7**		**7**	3.10		**7**	
10	1.16		**10**		**10**	1.87		**10**		**10**	3.17	2.07	**10**	
15	1.19	0.58	**15**		**15**	1.98	1.07	**15**		**15**	3.49		**15**	
20	1.21		**20**		**20**	2.01		**20**		**20**	3.59	2.08	**20**	
30	1.25	0.57	**30**		**30**	2.03	1.06	**30**		**30**	3.70		**30**	
40	1.29		**40**		**40**	2.04		**40**		**40**	3.81	2.08	**40**	
50	1.32	0.56	**50**		**50**	2.05	1.06	**50**		**50**	3.86		**50**	
60	1.36		**60**		**60**	2.07		**60**		**60**	3.92		**60**	
70			**70**		**70**			**70**		**70**			**70**	
80			**80**		**80**			**80**		**80**			**80**	
90			**90**		**90**			**90**		**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP	19.30	°C	**180**		**TEMP**	19.60	°C	**180**		**TEMP**	18.00	°C	**180**	
EC	1971	µS/cm	**210**		**EC**	1831	µS/cm	**210**		**EC**	1836	µS/cm	**210**	

DISCHARGE RATE 4			RPM 1004		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE:	2026-06-04	TIME:	15:00		DATE:		TIME:			DATE:		TIME:		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	3.95		**1**	7.46	**1**			**1**		**1**			**1**	
2	4.01	2.70	**2**	6.47	**2**			**2**		**2**			**2**	
3	5.03	4.06	**3**	5.74	**3**			**3**		**3**			**3**	
5	6.30		**5**	4.50	**5**			**5**		**5**			**5**	
7	6.98	4.66	**7**	3.62	**7**			**7**		**7**			**7**	
10	7.62		**10**	2.71	**10**			**10**		**10**			**10**	
15	7.80	4.66	**15**	1.99	**15**			**15**		**15**			**15**	
20	8.14		**20**	1.78	**20**			**20**		**20**			**20**	
30	8.53	4.66	**30**	1.50	**30**			**30**		**30**			**30**	
40	8.74		**40**	1.35	**40**			**40**		**40**			**40**	
50	9.00	4.66	**50**	1.26	**50**			**50**		**50**			**50**	
60	9.09		**60**	1.17	**60**			**60**		**60**			**60**	
70			**70**	1.11	**70**			**70**		**70**			**70**	
80			**80**	1.04	**80**			**80**		**80**			**80**	
90			**90**	1.00	**90**			**90**		**90**			**90**	
100			**100**	0.96	**100**			**100**		**100**			**100**	
110			**110**	0.91	**110**			**110**		**110**			**110**	
120			**120**	0.87	**120**			**120**		**120**			**120**	
pH			**150**	0.80	**pH**			**150**		**pH**			**150**	
TEMP	17.80	°C	**180**	0.72	**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC	1821	µS/cm	**210**	0.66	**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	
			240	0.60				**240**					**240**	
			300					**300**					**300**	
			360					**360**					**360**	

S/W/L:(mbch) 3.56

FORM 5 F

CONSTANT DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3305	Coordinates: SOUTH:	34.087246	PROVINCE:	Western Cape
BOREHOLE NO:	HBC-BH01	EAST:	018.831255	DISTRICT:	Helderberg
ALT BH NO:	0			SITE NAME:	Helderberg Shopping Centre
ALT BH NO:	0				
BOREHOLE DEPTH:	40.20	DATUM LEVEL ABOVE CASING (m):	0.65	EXISTING PUMP:	Submersible
WATER LEVEL (mbdl):	4.24	CASING HEIGHT: (magl):	Ground Le	CONTRACTOR:	AB PUMPS
DEPTH OF PUMP (m):	39.20	DIAM PUMP INLET(mm):	110	PUMP TYPE:	WA22-2

CONSTANT DISCHARGE TEST & RECOVERY

TEST STARTED				TEST COMPLETED								
DATE:	2026-06-05	TIME:	08:10	DATE:	2026-06-07	TIME:	08:10	TYPE OF PUMP:				
				OBSERVATION HOLE 1			OBSERVATION HOLE 2			OBSERVATION HOLE 3		
				NR:			NR:			NR:		
DISCHARGE BOREHOLE				Distance(m			Distance(m)			Distance(m		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME:	Drawdown	Recovery	TIME:	Drawdown	Recovery	TIME:	Drawdown
(MIN)	DOWN (M)	(L/S)	MIN	(M)	(min)	m	(m)	(min)	(m)		(min)	(m)
1	0.96		1	12.02	1			1			1	
2	2.07	3.51	2	10.08	2			2			2	
3	3.15	3.80	3	9.20	3			3			3	
5	4.10	4.08	5	8.72	5			5			5	
7	4.96		7	8.32	7			7			7	
10	5.47	4.06	10	8.05	10			10			10	
15	6.18		15	6.97	15			15			15	
20	6.79	4.04	20	5.92	20			20			20	
30	7.34		30	4.84	30			30			30	
40	7.86	4.08	40	4.45	40			40			40	
60	8.06		60	4.02	60			60			60	
90	8.25	4.10	90	3.50	90			90			90	
120	8.90		120	3.28	120			120			120	
150	9.03	4.09	150	3.03	150			150			150	
180	9.15		180	2.96	180			180			180	
210	9.22	4.11	210	2.84	210			210			210	
240	9.30		240	2.65	240			240			240	
300	9.44	4.09	300	2.52	300			300			300	
360	9.91		360	2.38	360			360			360	
420	10.31	4.08	420	2.29	420			420			420	
480	10.59		480	2.20	480			480			480	
540	10.81	4.07	540	2.13	540			540			540	
600	10.98		600	2.11	600			600			600	
720	11.66	4.10	720	2.01	720			720			720	
840	11.90		840	1.94	840			840			840	
960	12,39,	4.08	960	1.78	960			960			960	
1080	12.75		1080	1.47	1080			1080			1080	
1200	12.85	4.10	1200	1.43	1200			1200			1200	
1320	13,09,	4.10	1320	1.37	1320			1320			1320	
1440	13.32		1440	1.35	1440			1440			1440	
1560			1560		1560			1560			1560	
1680			1680		1680			1680			1680	
1800			1800		1800			1800			1800	
1920			1920		1920			1920			1920	
2040			2040		2040			2040			2040	
2160			2160		2160			2160			2160	
2280			2280		2280			2280			2280	
2400			2400		2400			2400			2400	
2520			2520		2520			2520			2520	
2640			2640		2640			2640			2640	
2760			2760		2760			2760			2760	
2880			2880		2880			2880			2880	
3000			3000		3000			3000			3000	
3120			3120		3120			3120			3120	
3240			3240		3240			3240			3240	
3360			3360		3360			3360			3360	
3480			3480		3480			3480			3480	
3600			3600		3600			3600			3600	
3720			3720		3720			3720			3720	
3840			3840		3840			3840			3840	
3960			3960		3960			3960			3960	
4080			4080		4080			4080			4080	
4200			4200		4200			4200			4200	
4320			4320		4320			4320			4320	
Total time pumped(min):				1440		W/L			W/L			W/L
Average yield (l/s):				4.10								

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866
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2026-06-15

TEST REPORT

Water

Groundwater Solutions cc t/a AB Pumps

Attn: Ailene Van Niekerk

East London
+27828397258

@VinlabSA

Sample Details					
SampleID	W77824				
Water Type	Drinking Water				
Water Source	Borehole				
Sample Temperature					
Description	P3305 Helderberg HBC-BH01				
Batch Number					
PO Number	P3305				
Date Received	2026-06-09				
Condition	Cold				

Water - Routine	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C (Water)		VIN-05-MW01	^^^	>= 5 to <= 9.7	6.60				
Conductivity@25C (Water)	mS/m	VIN-05-MW02	^	<= 170	358				
Turbidity (Water)*	ntu			<= 5	8.06				
Total dissolved solids (Water)*	mg/L			<= 1200	2427.24				
Free Chlorine (Water)*	mg/L			<= 5	<0.02				
Ammonia (NH4) as N (Water)	mg/L	VIN-05-MW08	8.90%	<= 1.5	<0.15				
Nitrate as N (Water)	mg/L	VIN-05-MW08	11.00%	<= 11	<0.70				
Nitrite as N (Water)	mg/L	VIN-05-MW08	4.50%	<= 0.9	<0.05				
Chloride (Cl-) - Water	mg/L	VIN-05-MW08	10.12%	<= 300	1049.81				
Sulphates (SO4) - Water	mg/L	VIN-05-MW08	7.56%	<= 500	69.92				
Fluoride (F) - Water	mg/L	VIN-05-MW08	12.30%	<= 1.5	1.06				
Alkalinity as CaCO3 (Water)*	mg/L				135.50				
Colour (Water)*	mg/L Pt-Co			<= 15	<15				
Total Organic Carbon (Water)*	mg/L			<=10	1.10				
Date Tested					2026-06-09				

Water - Metals	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium (Ca) - Water	mg/L	VIN-05-MW43	13.35%		105				
Magnesium (Mg) - Water	mg/L	VIN-05-MW43	15.85%		68				
Sodium (Na) - Water	mg/L	VIN-05-MW43	13.31%	<= 200	519				

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^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±5mS/m
^^ - COD LR = ±16mg/L MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

sanas Testing Laboratory T1131

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TEST REPORT

Water

Groundwater Solutions cc t/a AB Pumps

Attn: Ailene Van Niekerk

East London
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Potassium (K) - Water	mg/L	VIN-05-MW43	6.80%		11				
Zinc (Zn) - Water	mg/L	VIN-05-MW43	13.22%	<= 5	<0.05				
Antimony (Sb) - Water*	µg/L			<=20	<13.0				
Arsenic (As) - Water*	µg/L			<= 10	<10.0				
Boron (B) Water	µg/L	VIN-05-MW43	19.29%	<= 2400	129				
Cadmium (Cd) Water	µg/L	VIN-05-MW43	14.10%	<= 3	<3				
Chromium (Cr) - Water	µg/L	VIN-05-MW43	11.39%	<= 50	<10				
Copper (Cu) - Water	µg/L	VIN-05-MW43	11.07%	<= 2000	<50				
Iron (Fe) - Water	µg/L	VIN-05-MW43	7.63%	<= 2000	273				
Lead (Pb) - Water	µg/L	VIN-05-MW43	9.38%	<= 10	<10				
Manganese (Mn) - Water	µg/L	VIN-05-MW43	10.54%	<= 400	294				
Nickel (Ni) - Water	µg/L	VIN-05-MW43	10.61%	<= 70	<50				
Selenium (Se) - Water*	µg/L			<= 40	<10.0				
Aluminium (Al) - Water	µg/L	VIN-05-MW43	13.90%	<= 300	<50				
Cyanide (CN) - Water*	µg/L			<= 200	<10.0				
Mercury (Hg) - Water*	µg/L			<= 6	<1.0				
Barium (Ba) Water	µg/L	VIN-05-MW43	12.56%	<= 700	13				
Uranium (U) - Water*	µg/L			<= 30	<28				
Date Tested					2026-06-09				

Water - Micro

	Unit	Method	Uncertainty	Limits	Results	Results	Results	Results	Results
Total Coliforms (Water)	cfu/100mL	VIN-05-MW09		<= 10	1				
E-Coli (Water)	cfu/100mL	VIN-05-MW09		not detected	nd				
Heterotrophic plate count*	cfu/mL			<= 1000	4600				
Date Tested					2026-06-09				

Comments

W77824
Two Samples received,

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^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±5mS/m
^^ - COD. LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

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TEST REPORT

Water

Groundwater Solutions cc t/a AB Pumps

Attn: Ailene Van Niekerk

East London
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@VinlabSA

Mistral Page
Senior Analyst
VIN-05-MW01, MW02, MW03, MW04, MW06, MW09, MW10, MW12, MW13, MW14, MW43

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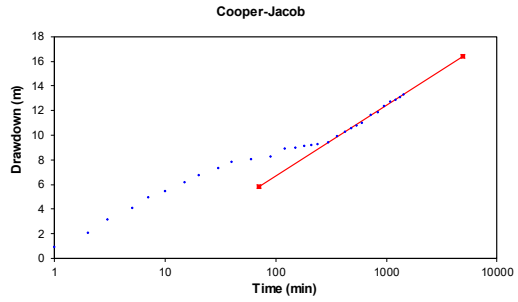
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^^^ - pH ± 0.1

sanas Testing Laboratory T1101

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HBC_BH1

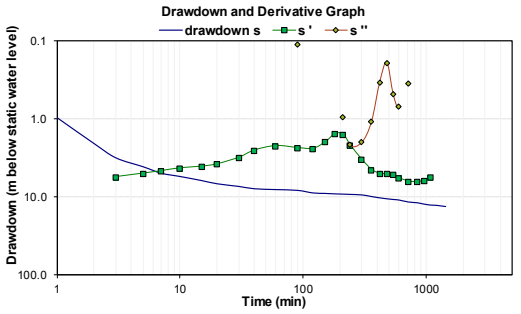


Cooper-Jacob method

T(m²/d) =	11.3	r_e (m)=	0.1
S =	1.21E+01	Q (l/s) =	4.10

	No boundaries	1 no-flow	2 no-flow	Closed
Q_sust	3.00	1.50	0.99	0.75
Avg. Q_sust =		1.56	std. dev =	1.01

Boundaries selected	0 - closed

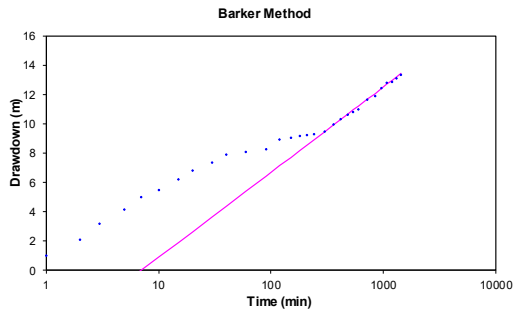


FC method

Extrapolation time in years	2	1051200	Extrapol.time in minutes	
Effective borehole radius (r_e)	49.9003717	49.90037171	Est. r_e	From r(e) sheet
Q (l/s) from pumping test	4.1	7.53472E-05	S-late	Change r_e
s_a (available drawdown), sigma_s	**21.75**	0	Sigma_s from risk	
Annual effective recharge (mm)	0	21.75	s_available w orking draw dow n(m)	
t(end) and s(end) of pumping test	1440	13.32	End time and draw dow n of test	
Average maximum derivative	**5.51**	6.379904195	Estimate of average of max deriv	
Average second derivative	**0**	0.054674237	Estimate of average second deriv	
Derivative at radial flow period	3.73151435	3.731514345	Read from derivative graph	
T-early[m²/d]		17.37255012	Aqui. thick (m)	60
T and S estimates	**T-late [m²/d]**	**11.76513975**	Est. S-late	0.0033
	S-late	0.0033		

BASIC SOLUTION

	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	29.10	44.87	60.65	107.98
Q_sust (l/s) =	3.06	1.99	1.47	0.83
Average Q_sust (l/s) =	1.65			
w ith standard deviation=	0.95			
Boundaries selected	0 - closed			

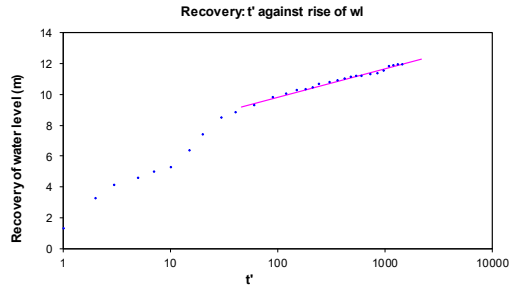


Barker method

	K_f [m/d]	S_f [1/m]	b	n	N
Fit Parameters	0.60	2.00E-03	18.62	1.99	0.0050

	No boundaries	1 no-flow	2 no-flow	Closed
sWell(Extrapol.time)	30.57	62.12	77.90	93.68
Q_sust	2.92	1.44	1.14	0.95

Fractal n = 1.99	Average Q-sust (l/s)=	1.46	std. dev = 0.89
	Boundaries selected	0 - closed	



Recovery

T [m2/d]	35.1
CDT Duration	1440
Recovery Duration	1440
Max % Recovery	89.9

The significance of potential impacts that may result from the proposed project was determined in order to assist decision-makers (typically by a designated competent authority or state agency, but in some instances, the applicant).

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in the table below.

Rating	Definition of Rating	Score
A. *Extent* *– the area (distance) over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g. the development site and immediate surrounds)	1
Regional	The region (e.g. Municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the extent of the impact and sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. ***Duration*** *– the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years and reversible	1
Medium-term	2 to 15 years and reversible	2
Long-term	More than 15 years and irreversible	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

Probability *– the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally, the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity/development.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity/development.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity/development.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity/development.
- **HIGH**: the potential impact **will** affect the decision regarding the proposed activity/development.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended, and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; and
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the applicant if not implemented.