



FINAL GEOHYDROLOGICAL REPORT

FOR

**REMAINING EXTENT OF PORTION 46,58,59 OF THE FARM
ELANDSHEUWEL 436 IQ**

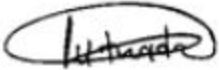
PREPARED FOR:

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TITTLE	FINAL GEOHYDROLOGICAL REPORT FOR REMAINING EXTENT OF PORTION 46,58,59 OF THE FARM ELANDSHEUWEL 436 IQ, JB MARKS LOCAL MUNICIPALITY, NORTHWEST PROVINCE		
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EXECUTIVE SUMMARY

The geohydrological assessment was undertaken by Vhuluvhi Group (Pty) Ltd on behalf of the Housing Development Agency for the proposed township development on Portions 46, 58, and 59 of the Farm Elandsheuwel 436 IQ, located within the Grimbeek Park area of JB Marks Local Municipality in the North West Province. The investigation forms part of a broader township establishment project aimed at creating integrated and sustainable human settlements. The scope of the geohydrological study included evaluating the viability of both surface and groundwater sources to support future residential development, assessing aquifer characteristics, groundwater vulnerability, contamination risks, water quality, and potential for stormwater harvesting.

The site is situated in a low-lying area characterised by flat to gently sloping topography, with slopes ranging between 0.35% and 0.48%. It is bordered by the Mooi and Loopspruit rivers and features perennial streams and surface water bodies, particularly prominent in Portion 59. The area experiences a temperate climate (Cwa classification), with hot, wet summers and cool, dry winters. Annual rainfall varies between 566 mm and 620 mm, mostly falling between October and March through high-intensity thunderstorms. The site is currently vacant but actively cultivated for maize and other crops, surrounded by existing residential townships and agricultural holdings.

A desktop study was conducted using geological and topographical maps, along with the Department of Water and Sanitation's groundwater database. A hydrocensus within a 2 km radius identified three existing boreholes (BHA, BHB, and BHC). A geophysical gravity survey was performed to locate subsurface anomalies indicative of groundwater potential, followed by proposed borehole drilling. Estimated borehole yields ranged from 2 to 6.5 litres per second, with groundwater strikes encountered between 7 m and 15 m depth, indicating sufficient yield potential to support the development.

Surface water sampling was carried out at waterlogged sections of the site and in the nearby Mooi and Loopspruit rivers. Soil analysis revealed predominantly clay-rich profiles,

which possess low permeability and thus act as a protective barrier against groundwater contamination. This significantly reduces the aquifer's vulnerability. The aquifer system beneath the site is classified as a major aquifer with high yield and good water quality, underlain by fractured and weathered rock formations associated with the Silverton Formation. The site hosts two aquifer types: a shallow intergranular aquifer within alluvial river deposits and a deeper fractured-rock aquifer within hard rock formations.

Groundwater quality tests showed compliance with SANS 241-1:2015 standards, with parameters such as pH (6.58), electrical conductivity (17.82 mS/m), total dissolved solids (136 mg/L), and various chemical and microbial indicators falling within acceptable limits. Notably, *Escherichia coli* and faecal coliforms were absent, indicating safe water quality for domestic use. The groundwater recharge rate through the vadose zone is estimated at 50 to 100 mm/year, supporting moderate aquifer replenishment. Groundwater levels range from 0 to 15.3 m below ground surface, suggesting a relatively shallow water table with low contamination risk due to protective soil layers.

Regional geology comprises transported Quaternary alluvium overlying shale, quartzite, hornfels, and limestone of the Silverton Formation within the Pretoria Group. These formations are associated with east-west trending valleys typical of the Pretoria group. Flow direction follows the regional hydraulic gradient, moving from the northern boundary toward the south, west, and southeast, ultimately discharging into adjacent river systems.

Lastly, the proximity of the site to the Mooi and Loopspruit rivers, both fed by major dams such as Klipdrift, Klerkskraal, and Boskop, presents an additional opportunity for supplementary surface water harvesting. The report concludes that both surface and groundwater resources within the Grimbeek Park area are viable for supporting the proposed township development. The overall aquifer vulnerability and susceptibility are rated low due to the protective soil cover and depth to groundwater, while water quality is considered good and suitable for various domestic and agricultural uses. Recommendations include further monitoring, borehole development, and engagement with regulatory authorities for necessary water-use licensing.

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1. INTRODUCTION

On the 12th of March 2025, Housing Development Agency appointed Vhuluvhi Group for Tender No: HDA/NW/2024/043, titled “The appointment of a service provider to undertake township establishment for the creating of the three integrated and sustainable human settlement developments in the Grimbeek Park Area, within the Jurisdiction of JB Marks Local Municipality, Northwest Province”.

As part of the scope of work, a geohydrological study to investigate the two possible water alternative sources, being either the dam/river or underground harvesting within the site, was conducted. The proposed development will comprise a residential development and associated infrastructure.

1.1. OBJECTIVES OF THE STUDY

The scope of work is to undertake investigations on the estimated water properties for the yield of dam/river/underground harvesting in the Grimbeek Park area, and include the following: -

- Assess the underground water harvesting migration direction and quality.
- Analyse water and soil samples and measure contamination levels.
- Measure the environmental impact of erosion, droughts and floods.
- Predict floods and droughts, especially droughts as a result of water demand catering for the relevant proposed yield.
- Provide pollution levels of underground harvesting.
- Provide a report of the interpretation of analytical and hydrogeologic data.
- Provide a storage method for the underground harvesting.
- Provide topographical elevation and the determination of water flow directions for underground water harvesting.
- The flow or run-off intensity of the water.
- Capacity of water on the flow into the underground harvesting basin and possible flow along the stream channel to the very basins.
- Provide the rate of evaporation.

- Propose techniques to improve the quality and quantity of water in the designated areas (Grimbeek Park area).
- Possibilities of stormwater catchment harvesting in the Grimbeek Park area
- Estimated sources contributing the water properties (e.g. volume, flow) to the dam/river/underground harvesting in the Grimbeek Park area.

This report is not intended to be an exhaustive description of the assessment, but rather serves as a specialist hydrogeological assessment to evaluate the overall hydrogeological character of the site.

1.2. DATABASE

The following information was utilised:-

- “2626-West Rand”: Geological Map
- “2627CA Potchefstroom”: Topographical Map
- Department of Water and Sanitation (DWS) Groundwater Database

1.3. GEOGRAPHICAL SETTINGS

1.3.1. TOPOGRAPHY AND DRAINAGE

The topography within the site is generally rolling with flat to gentle slopes separated by a perennial stream traversing the boundaries of the site. The proposed site is situated in a low-lying area, surrounded by permanently wet pans or surface water, particularly on Portion 59 of the site. Topographically, the site is located in a waterlogged area.

The investigated site is characterised by intermittent inland water bodies and streams that hold water during wet portions of the year. The elevations range between 1324 m and 1330 m above mean sea level (amsl).

The topography is characterised by an exceptionally gentle slope, with gradients varying between 0.35% and 0.48%, sloping generally towards the south and southwest.

1.3.2. RAINFALL AND CLIMATE

The proposed township establishment falls within both the C23H and C23K quaternary catchment, with the regional Vaal Catchment.

Potchefstroom, located in the North West Province of South Africa, experiences a temperate climate characterised by hot, wet summers and cool, dry winters. According to the Köppen-Geiger climate classification, the region falls under the Cwa Category. This denotes a temperate climate (C), with dry winters (w), and hot summers (a). The area does not qualify as arid or semi-arid due to its moderate annual rainfall, making it suitable for agriculture and human settlement.

The average annual rainfall in Potchefstroom ranges from 566mm to 620mm, with the majority of precipitation occurring during the summer months, from October to March. Rainfall typically results from short-duration, high-intensity thunderstorms that are common in the region during this period. The wet season is therefore marked by high humidity, intense heat during the day, and frequent afternoon thunderstorms, often accompanied by lightning and localised flooding.

Winters, on the other hand, are cool and dry, with minimal rainfall between May and August. During this period, Potchefstroom experiences clear skies, low humidity, and crisp mornings, often accompanied by frost. Temperatures in winter can drop close to freezing at night but generally remain mild during the day. This distinct seasonal rainfall pattern contributes to significant moisture fluctuations in the soil, which is a critical consideration for construction and agricultural activities in the area.

The region is also influenced by its inland position and elevation of approximately 1,350 meters above sea level, which moderates extreme heat and contributes to occasional temperature drops at night. Despite hot summers, extreme temperatures above 35°C are not sustained for long periods due to the elevation and regular storm activity.

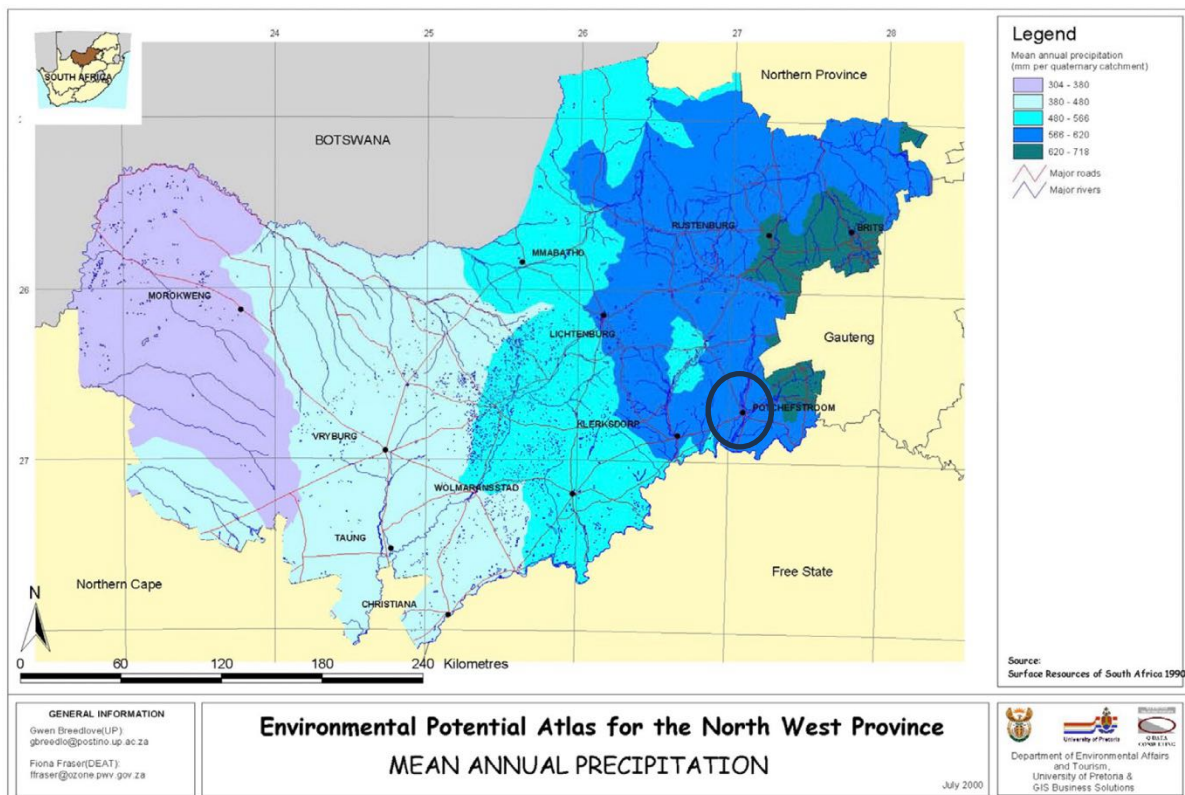


Figure 1.1: Mean Annual Precipitation

1.3.3. LAND USE

The proposed site is currently vacant with no existing infrastructure. The surrounding land uses of the proposed township establishment are mainly established residential townships and agricultural activities. The proposed site is being utilised for agricultural purposes such as maize and other commercial crops, and is actively cultivated.



Figure 1.2 Grimbeek Park Area Land-Use Map

2. FACTUAL REPORT

2.1. DESKTOP STUDIES

Before the commencement of any fieldwork, a desktop study was conducted on the data obtained from previous investigations by other consultants.

The 1:250,000 geological maps, “2626 West Rand”, were consulted in order to determine the regional and local geology. To supply information regarding the topography of the site, the 1:50,000 topographical maps, “2627CA Potchefstroom” were referenced.

2.1.1. HYDROCENSUS

Generally, a hydrocensus within a 2km radius of an area of interest is regarded as being sufficient in terms of identifying borehole users or sensitive groundwater-dependent ecosystems. The groundwater gradient and especially downgradient sensitive areas should, however, also be considered when determining a hydrocensus area. A secondary catchment was delineated for the project area during this assessment; the hydrocensus focused mainly within the boundaries of this catchment. Concerning the above, a hydrocensus was carried out on 11 June 2025.

The proposed township establishment was located with Portion 46, 58 and 59 of the Elandsheuwel 436IQ, within the JB Marks Local Municipality in the Northwest Province. The site is directly bounded by the following:-

North : Established Grimbeek Park Township

South: Other Agricultural Holdings (Portion 0 and 1 of Erf 457 Wilgeboom)

West: The Mooi River at the boundary of Portion 58 of the Farm 436IQ

East: The Loopspruit River at the boundary of Portion 59 of the Farm 436IQ

A hydrocensus was conducted within the vicinity of 2km radius of the site, and identified three boreholes, namely BHA, BHB and BHC.



Figure 2.1: Hydrocensus Site Plan showing previously drilled boreholes

The proposed township establishment falls within both the C23H and C23K quaternary catchment, with the regional Vaal Catchment.

2.1.2. GEOPHYSICAL SURVEY AND RESULTS

The Geophysical survey was conducted on site on the 6th of June 2025 across the whole site of Portion 46, 58 and 59 of the Farm Elandsheuwel 436IQ, within the JB Marks Local Municipality, North West province.

The survey aimed to identify geophysical anomalies associated with possible localised geological structures (fractured zones in the underlying rock, weathered zones, geological contacts, etc.). The gravity geophysical method was used to conduct the survey. This method is used to ultimately determine the relative density distribution of the subsurface over a survey or project area. Lower subsurface densities are usually associated with fractured and weathered rock conditions.

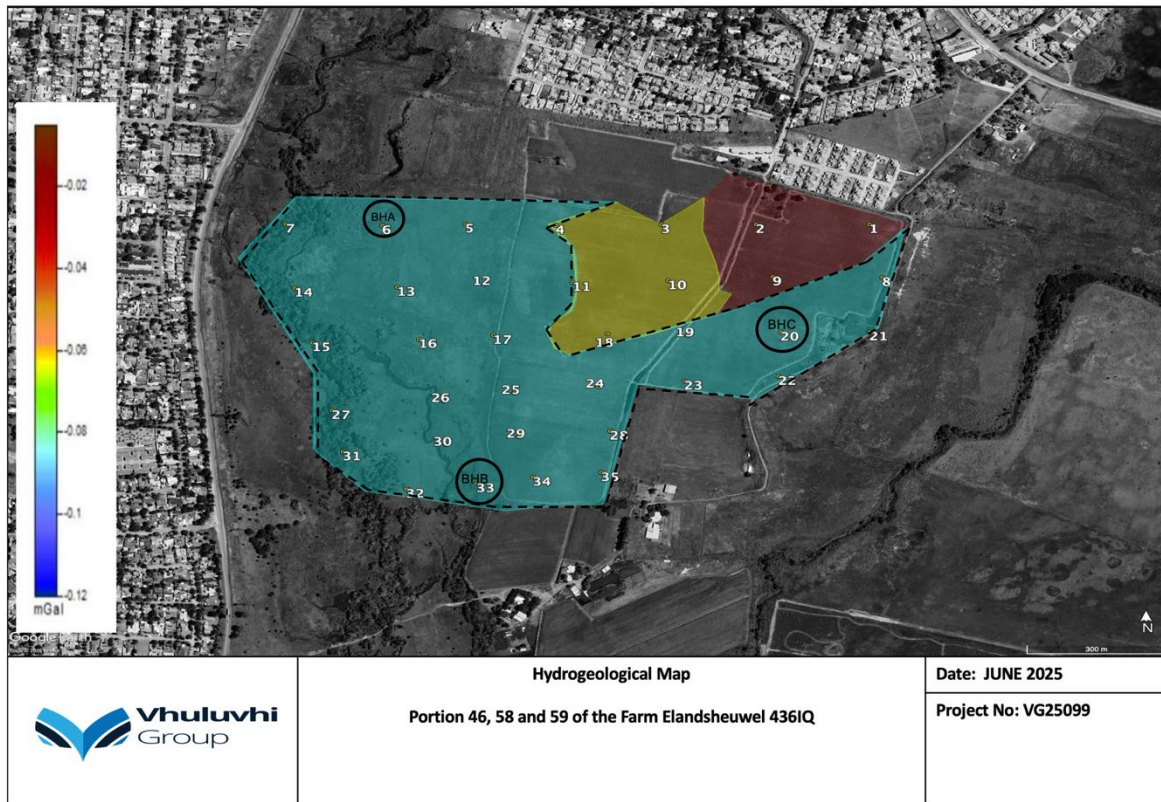


Figure 2.2: Gravity survey for groundwater borehole exploration

2.1.3. DRILLING AND SITING OF BOREHOLES

Boreholes should be drilled based on the gravity survey results conducted, and the strongest borehole with maximum yield at an estimated average groundwater strike of 11.6m below the current level.

Borehole No	Estimated Groundwater Strike (m)	Estimated Groundwater Yield l/sec
BHA	10m	2l/sec
BHB	7m	5l/sec
BHC	15m	6.5l/sec

The proposed boreholes will need an average of 4.5l/sec, and are considered sufficient to be utilised for groundwater harvesting to support the proposed township establishment within Portion 46, 58 and 59 of the Farm Elandsheuwel 436 IQ.

2.1.4. SAMPLING AND CHEMICAL ANALYSIS

Water sampling was undertaken on surface water located within Portion 59 of the farm Elandsheuwel 436 IQ, which constitutes the waterlogged section of the site. Additional

surface water samples were also collected from both the Mooi River and Loopspruit River to assess the potential for surface water harvesting.

2.1.5. SOIL MEDIA AND IMPACT OF THE VADOSE ZONE

The soil composition plays a critical role in influencing both the rate of groundwater recharge and the potential for contaminant transport. Soils with a high clay content are typically characterised by low permeability, which restricts the downward movement of water and limits the infiltration of potential contaminants. In contrast, sandy soils, with their larger particle sizes and higher permeability, allow for more rapid infiltration, thereby increasing the risk of groundwater contamination.

In the area under investigation, the subsurface profile is predominantly composed of clay soils, with higher proportions of clay relative to silt and sand. This clay-rich composition implies that the soil matrix exhibits low permeability, acting as a natural barrier to the migration of surface contaminants toward the water table. As a result, the groundwater vulnerability potential in this region is considered to be low, which is favourable from a groundwater protection standpoint.



Figure 2.3. Soil Type Of the Grimbeek Park Area

3. AQUIFER CHARACTERISTIC

3.1. AQUIFER CLASSIFICATION

DWA's Aquifer Classification Map of South Africa indicates the area to be underlain by a major Aquifer – a highly yielding system of good water quality.

3.2. AQUIFER VULNERABILITY

The vulnerability of an aquifer refers to the tendency or likelihood for contamination to reach a specified position within the groundwater system after being introduced at a point above the uppermost aquifer. It considers factors such as the permeability of overlying soils, depth to the water table, and the presence of protective layers. In the context of the site under investigation, this vulnerability is classified as low. This is primarily due to the presence of clay-rich soils with low permeability, which act as a natural barrier to the vertical migration of contaminants. Consequently, the likelihood of pollutants reaching the groundwater from surface sources is minimal under current site conditions.

3.3. AQUIFER SUSCEPTIBILITY

Groundwater is contaminated due to anthropogenic (human) activities. It encompasses both the vulnerability of the aquifer based on factors such as soil permeability, depth to groundwater, and recharge potential and the relative importance or classification of the aquifer in terms of its role in water supply and ecological support.

In the context of the investigated area, the aquifer susceptibility is classified as low. This classification is primarily attributed to the predominance of clay-rich soils with low permeability, which act as a protective barrier against contaminant infiltration. Additionally, the relatively shallow and less productive nature of the underlying aquifer further contributes to its lower susceptibility rating. As a result, the potential for contamination of the groundwater resource from surface activities is minimal under current land use conditions.

3.4. GROUNDWATER QUALITY MANAGEMENT

The ratings for the Aquifer System Management Classification and Aquifer Vulnerability Classification yield a Groundwater Quality Management (GQM) Index of 1 for the subject area. This index was determined using the method proposed by Parsons (1995), where a minor aquifer system is assigned a value of 2 points, and an aquifer vulnerability classified as medium also contributes 2 points. Based on the matrix provided by Parsons, the combination of these two ratings results in a GQM Index of 1, which indicates that the area requires low-level protection in terms of groundwater quality management.

3.5. RIVER CAPACITY STORAGE

The site is found in between the Mooi river (within the site) and the Loopspruit river (50m away on the east), and both the river can be utilised to support the township establishment provided the water user application can be applied for within the department of water affairs and forestry.

The table below consist of major dams which feed in the rivers which has the possibility of supporting the township establishment with the Grimbeek Park Area.

Table 1: Major Dams				
Name of Dam	Number in figure 3.1	Drainage Basin	River	Storage Capacity (x10 ³ m ³)
Klipdrift	25	C2	Loopspruit	13.6
Klerkskraal	26	C2	Moorriver	8.3
Boskop	27	C2	Moorriver	20.6

The two rivers within the vicinity of the site are the Moorriver and Loopspruit river, which feed from the three dams, with Klipdrift dam feeding the Loopspruit river, and both the Klerkskraal and Boskop dams feeding the Moorriver.

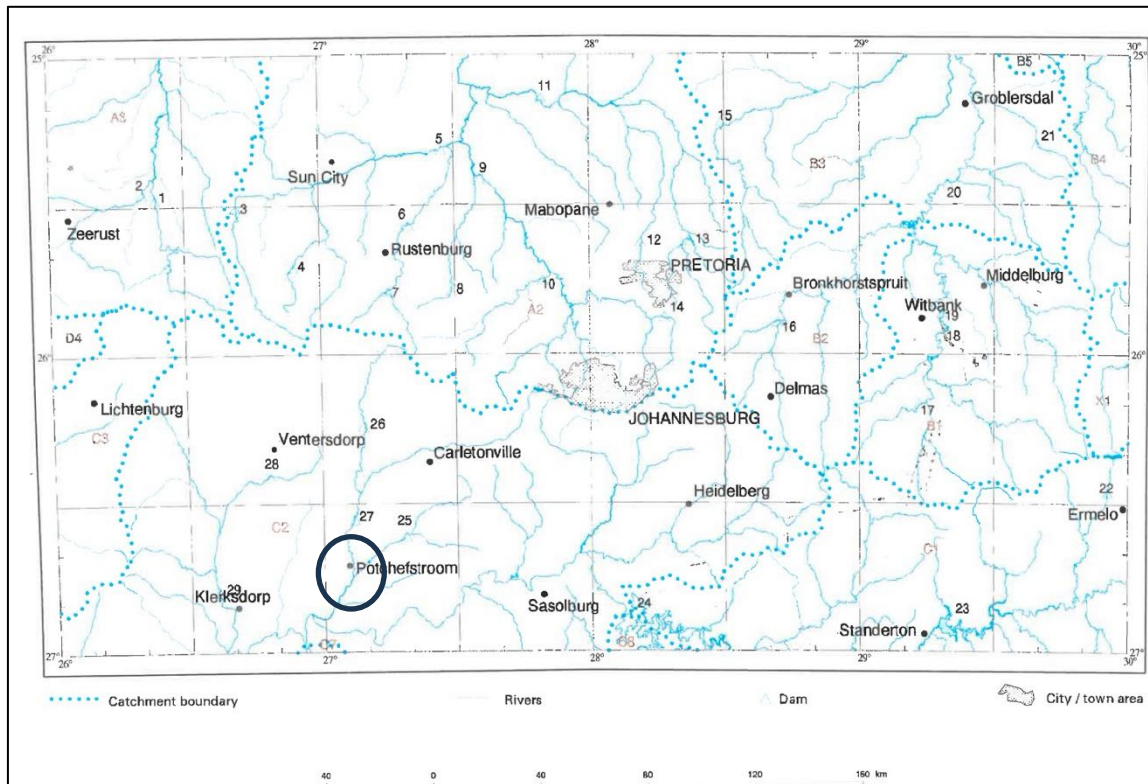


Figure 3.1: Drainage regions, major dams and rivers

4. PREVAILING GROUNDWATER CONDITIONS

4.1. GENERAL GROUNDWATER UNDERSTANDING

Groundwater can be defined as water found within the zone of saturation, which lies beneath the unsaturated (aeration) zone. The unsaturated zone acts like a sponge, allowing water from the surface to percolate downward until it reaches the saturated zone, where all the pore spaces between soil or rock particles are fully filled with water (Kruseman & de Ridder, 1991).

An aquifer is a geological formation that holds sufficient quantities of groundwater to be extracted for practical and economical use, such as domestic, agricultural, or industrial purposes (van Tonder et al., 2001).

There are two main types of aquifers: porous shallow weathered aquifers and deep fractured rock aquifers. Porous aquifers consist of unconsolidated materials such as sand, gravel, and silt, where groundwater moves through the interconnected pores between individual grains. In contrast, fractured rock aquifers are typically found in consolidated rock formations where groundwater flows along fractures, joints, and other discontinuities in the rock mass (Kruseman & de Ridder, 1991).

4.1.1. GROUNDWATER RECHARGE

Recharge can be described as the process by which water is added to the zone of saturation of an aquifer, serving as the primary mechanism for transporting contaminants to the groundwater table.

In the study area, groundwater recharge through the vadose (unsaturated) zone is high, ranging from 50 mm to 100 mm per year. This rate suggests an increase in recharge of the groundwater to contamination, as higher recharge rates the higher borehole groundwater yields.

4.1.2. REGIONAL GEOLOGY

A desktop geological review indicates that the site is overlain by transported soil, which is alluvium in nature of Quaternary age, and underlain by shales interbedded with quartzites, hornfels and limestones of the Silverton Formation in the Pretoria Group within the Transvaal Supergroup.

Although the regional geology includes dolerite and syenite dykes of varying ages that commonly crosscut the granite suite, no such intrusions were observed on site. Based on regional experience, the depth of weathering in the shale rocks is highly variable, often marked by the presence of cornerstone remnants. Patches of highly kaolinised residual soils are also known to occur.

Field observations suggest that the in situ residual shales have been recently blanketed by a layer of transported soils, which is alluvium in nature.

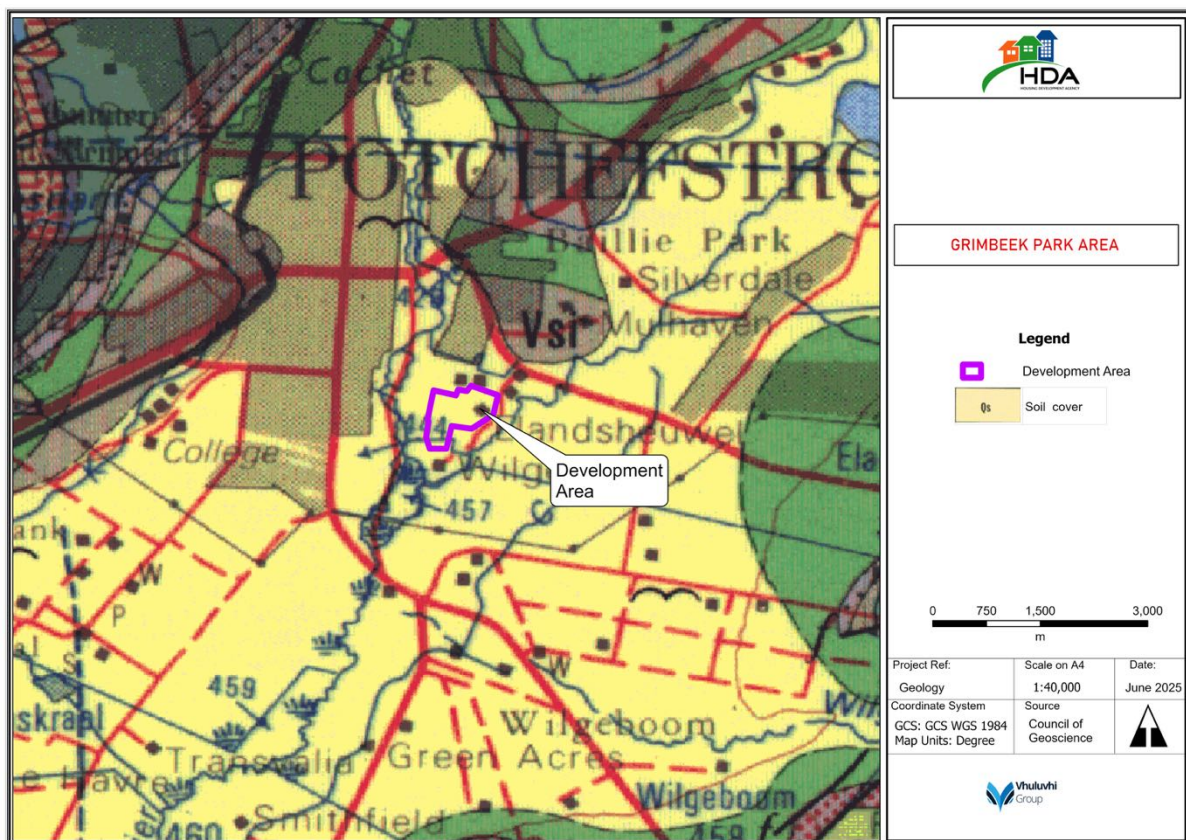


Figure 4.1 Geological Map Of the Proposed Site

4.1.3. CHEMISTRY OF GROUNDWATER FROM SILVERTON FORMATION

As per regional geology, the site is overlain by transported soil, which is alluvium in nature of Quaternary age, and underlain by shales interbedded with quartzites, hornfels and limestones of the Silverton Formation in the Pretoria Group within the Transvaal Supergroup. The east-west trending valleys near the Pretoria Group are a distinct topographic expression of the Silverton Formation, which is predominantly composed of shale.

Groundwater within this formation tends to occur in weathered shale zones, fractured or jointed areas, and most notably along the contact zones where diabase sheets intrude into the shale. The groundwater yield potential is considered good, as data indicates that 40% of recorded boreholes yield over 2 litres per second, with 22% exceeding 5 litres per second. High-yielding boreholes are typically found near surface water drainage systems, particularly in the wide valley bottoms. The static water level usually ranges between 10 and 25 meters below the ground surface, though it can reach depths of up to 80 meters near the base of the Magaliesberg mountains.

The groundwater level fluctuations within boreholes have been correlated with rainfall, leading to an estimated average recharge rate of approximately 8% for the Silverton Formation, as calculated by Bredenkamp (1978). From a quality perspective, the groundwater is generally suitable for various uses, including irrigation, as indicated by an average electrical conductivity (EC) of 58 mS/m and a mean pH of 7.6. However, some variability exists in the concentrations of chloride and sulphate, which show significant coefficients of variation.

ELEMENT / PARAMETER	STATISTICS DRAWN FROM A POPULATION OF 43 SAMPLES				
	Minimum Value	Mean Value	Maximum Value	Standard Deviation	Coefficient of Variation
pH	5.5	7.6	8.8	0.6	8 %
Electrical Conductivity (mS/m)	5.6	58.0	340.0	56.0	97 %
Total Dissolved Salts (mg/l)	39.0	428.0	2118.0	383.0	89 %
Calcium (mg/l Ca)	2.0	44.0	304.0	54.0	123 %
Magnesium (mg/l Mg)	2.0	32.0	148.0	32.0	100 %
Sodium (mg/l Na)	2.0	30.0	200.0	37.0	123 %
Potassium (mg/l K)	0.2	2.8	28.0	5.0	179 %
Chloride (mg/l Cl)	1.0	39.0	824.0	124.0	318 %
Sulphate (mg/l SO ₄)	1.0	56.0	953.0	162.0	289 %
Total Alkalinity (mg/l CaCO ₃)	14.0	181.0	480.0	121.0	67 %
Nitrate (mg/l N)	0.1	3.9	39.0	6.7	172 %
Fluoride (mg/l F)	0.1	0.3	3.1	0.5	167 %
Langelier Saturation Index (LSI)	-4.7	-0.6	0.9	1.1	
Sodium Adsorption Ratio (SAR)	0.1	0.9	8.1	1.3	144 %

Figure 4.2: Chemistry of Groundwater from the Silverton Formation

4.1.4. REGIONAL AQUIFER TYPE AND BOREHOLE YIELD

Groundwater vulnerability is significantly influenced by the type and characteristics of the aquifer, particularly in relation to its geohydrological properties. Fractured and weathered aquifers typically exhibit higher permeability, which increases their susceptibility to contamination due to the enhanced movement of pollutants along fractures. In the proposed study area, groundwater occurrence and flow are closely governed by the underlying geological formations, comprising an intergranular and fractured aquifer system. Borehole yields range from 1.00 to 2.0 litres per second, with a transmissivity of about 25 m²/day, indicating moderate groundwater movement facilitated by interconnected fractures.

This system is designated as a Major Aquifer region, known for its relatively high yield and “class I” water quality. Two aquifer types are present: a shallow intergranular aquifer associated with alluvial deposits along riverbeds, and a deeper fractured aquifer occurring within the underlying hard rock formations.

4.1.5. REGIONAL GROUNDWATER QUALITY

Groundwater quality is a critical parameter in assessing water suitability and is often represented by Electrical Conductivity (EC). EC measures the ability of groundwater to conduct electricity, which is directly related to the concentration of dissolved ions in the water. As such, EC serves as an effective indicator of groundwater quality. The conductivity of water depends on the presence of inorganic dissolved solids, including chloride, nitrate, phosphate anions, and cations such as sodium, calcium, magnesium,

and iron. Lower EC values generally indicate better water quality, while elevated EC values suggest brackish or saline conditions. In the regional context, groundwater quality is commonly expressed in terms of Electrical Conductivity measured in millisiemens per meter (mS/m).

In the study area, the EC values of groundwater range between 70 and 300 mS/m, indicating good water quality that is generally suitable for use with only rare instances of adverse effects. However, groundwater quality can be compromised if leaks in the sewage system occur and are not promptly addressed, potentially leading to contamination.

4.1.6. REGIONAL GROUNDWATER FLOW

Groundwater moves from areas of higher hydraulic pressure to areas of lower pressure, following the hydraulic gradient—that is, it flows from recharge zones toward discharge areas, typically moving downslope toward streams and rivers. At the proposed site, groundwater is expected to flow predominantly toward the nearby stream and the south, west and east portions of the area. Elevated groundwater levels are anticipated along the northern boundary of the site, resulting in groundwater flow generally directed from north to south and from northwest to southeast (see figure below).

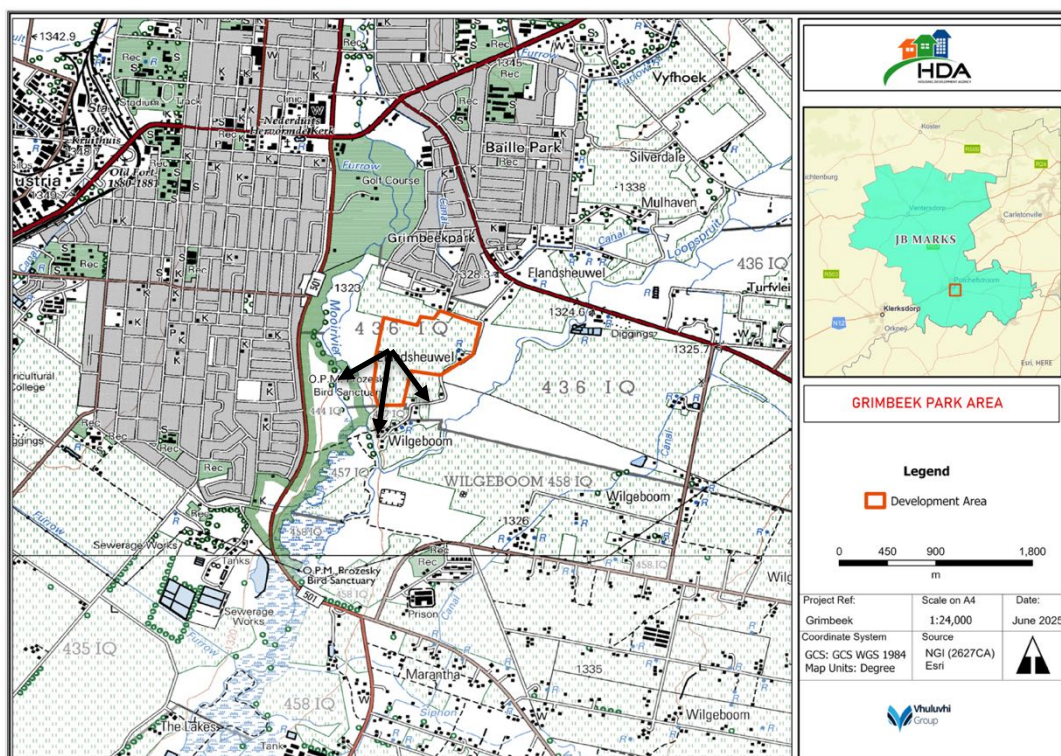


Figure 4.3: Grimbeek Park Area Groundwater Flow Direction

4.1.7. REGIONAL GROUNDWATER LEVEL/ DEPTH TO GROUNDWATER TABLE

The depth of the groundwater table is the relative distance that a potential contaminant travels to reach the saturated zone. Therefore, the shallower the groundwater table, the shorter the flow path for the contaminant to reach the aquifer, thus increasing the vulnerability of the groundwater to be contaminated.

An important parameter influencing groundwater vulnerability to contamination is the depth of the water level below the surface. This level, coupled with soil type, lithology, presence of structural lineament, and permeability characteristics, controls the movement of potential contaminants from the surface into the aquifer zone. Available static water level data ranges from 0 to 15.30 m, indicating that the groundwater pollution probability with respect to the depth of the groundwater table is low.

5. CONCLUSION AND RECOMMENDATIONS

The geohydrological investigation undertaken for the proposed township development on Portions 46, 58, and 59 of the Farm Elandsheuwel 436 IQ has provided a robust understanding of the groundwater resources, aquifer characteristics, and overall hydro-environmental suitability of the site. The area is underlain by a dual aquifer system comprising shallow intergranular and deeper fractured aquifers classified as a Major Aquifer with high yield potential and good water quality. Borehole yields ranging between 2 and 6.5 litres per second, along with favourable transmissivity and recharge rates, indicate that groundwater harvesting is a feasible and sustainable option for supporting the water demands of the planned residential development.

The site also benefits from its proximity to perennial rivers (Mooi and Loopspruit), which are fed by significant upstream dams. These surface water sources present viable supplementary options for water supply, provided regulatory approvals and water use licenses are obtained. Soil conditions, dominated by clay-rich profiles with low permeability, act as a natural safeguard against contaminant migration, resulting in low aquifer vulnerability and susceptibility. Furthermore, laboratory analysis confirms that groundwater quality falls within acceptable limits as per SANS 241-1:2015, making it suitable for domestic, irrigation, and construction purposes.

Topographical and climatic analyses also support the feasibility of the development, with modest gradients facilitating stormwater management and rainfall patterns conducive to recharge and surface water availability. Overall, the site presents favourable geohydrological conditions for the establishment of an integrated and sustainable township. The following recommendations should be adhered to:-

- **Borehole Development and Licensing:** Proceed with the drilling and equipping of boreholes at the identified high-yield targets (BHA, BHB, BHC). A water use license application should be submitted to the Department of Water and Sanitation for both groundwater abstraction and potential use of surface water from the Mooi and Loopspruit rivers.
- **Groundwater Monitoring Programme:** Implement a routine groundwater monitoring programme to track water levels, abstraction rates, and quality

parameters over time. This will help assess the sustainability of groundwater use and detect any early signs of contamination.

- **Surface Water Harvesting Integration:** Explore the integration of surface water harvesting systems, particularly stormwater catchment during the rainy season, to supplement groundwater use and reduce pressure on aquifers.
- **Water Quality Safeguards:** Establish sanitary protection zones around boreholes and ensure proper wellhead protection and sealing to prevent contamination from surface runoff and nearby land uses.
- **Stormwater and Flood Management:** Given the gentle slopes and waterlogged conditions in parts of the site, design effective drainage infrastructure to manage stormwater and prevent localised flooding, particularly in Portion 59.
- **Aquifer Protection Measures:** Maintain existing land use controls that limit potentially contaminating activities such as unregulated waste disposal or intensive agriculture near recharge zones or borehole locations.
- **Infrastructure Planning:** Align infrastructure development (pipelines, roads, sewage systems) with groundwater protection zones to avoid accidental contamination during and after construction.
- **Public Engagement and Education:** Engage local communities and stakeholders to promote water conservation practices and foster awareness on the importance of groundwater protection, particularly in light of future urban growth.
- **Long-Term Sustainability:** Consider integrated water resource management strategies that balance surface and subsurface water use, ensure equitable allocation, and prepare the township to adapt to climate variability or periods of drought.

6. REFERENCE

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