Heldervue – Clearing their “vue” to ensure sustainable water resource management

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“There is a real and urgent need to deal with water losses due to invasive alien trees in our catchments in a consistent and long-term manner.” – Richard Bugan, Hydrogeologist for The Nature Conservancy in South Africa.

The Fruit Farm Group

The Fruit Farm Group (TFFG), established at the end of 2014, has farms distributed over four countries and three continents. Its farmers produce a variety of sought-after fruits by implementing sustainable and regenerative agriculture practices. They strive towards healthy soils, saving water, and vibrant ecosystems. In doing so, their plants receive the nutrients they require to produce healthy fruit. The company is especially well known for producing, packaging, distributing, and marketing fruit in Southern Africa.

Heldervue

Heldervue is one of five South African farms part of TFFG. The farm is located on top of the Piketberg Mountain in the Western Cape, an area well known for cultivating deciduous fruits including apples and pears. This region has a typical Mediterranean climate, with warm, dry summers and cold, wet winters. During summer, they rely on boreholes and storage dams for irrigation. The area forms part of the Breede-Olifants Water Management Area (WMA), according to the 2023 classification. Previously, Heldervue was situated on the border between the Berg and Olifants-Doorn WMA’s. In 2010, the Berg and Olifants-Doorn WMA’s were classified by the Department of Water and Sanitation as those having the lowest volume of available groundwater per year (DWS, 2010).

The Geohydrology of Heldervue

There are 17 boreholes located on the Heldervue farm, of which 9 have been monitored since 2017. These boreholes are drilled into the quartzitic Peninsula Formation of the Table Mountain Group, which is a fractured super-aquifer (Blake *et al*., 2010). Considering that the farm is situated on top of a mountain, the geology is complex (**Figure** 1). The locations of the boreholes are plotted with yellow dots in **Figure 1** and the locations of the monitoring boreholes are displayed in **Figure 2**. The boreholes are fairly deep (80+ meters) and low yielding (2-5 L/s).

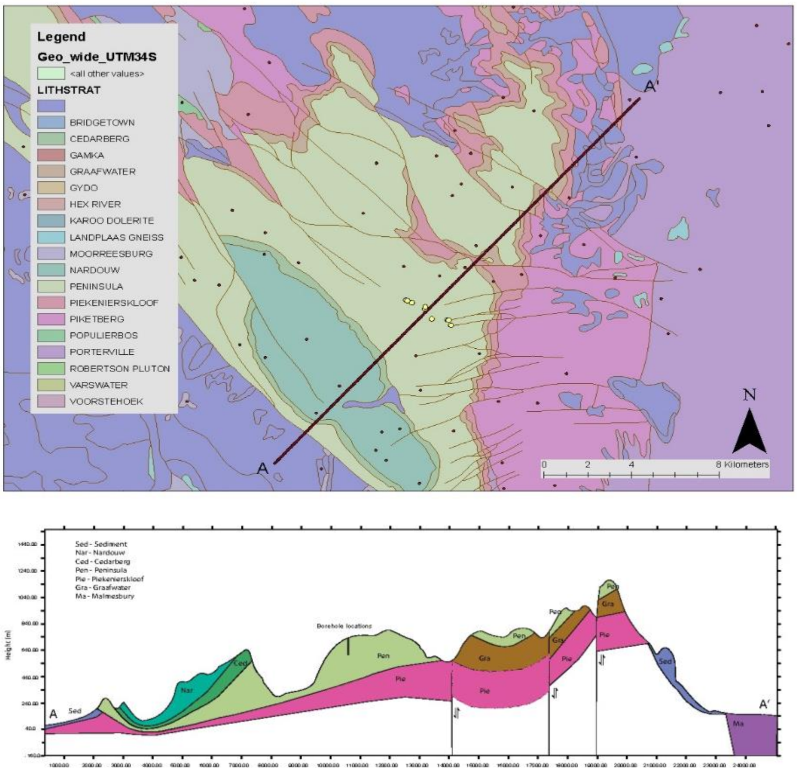

Figure 1 The Geology of Heldervue on the Piketberg Mountain

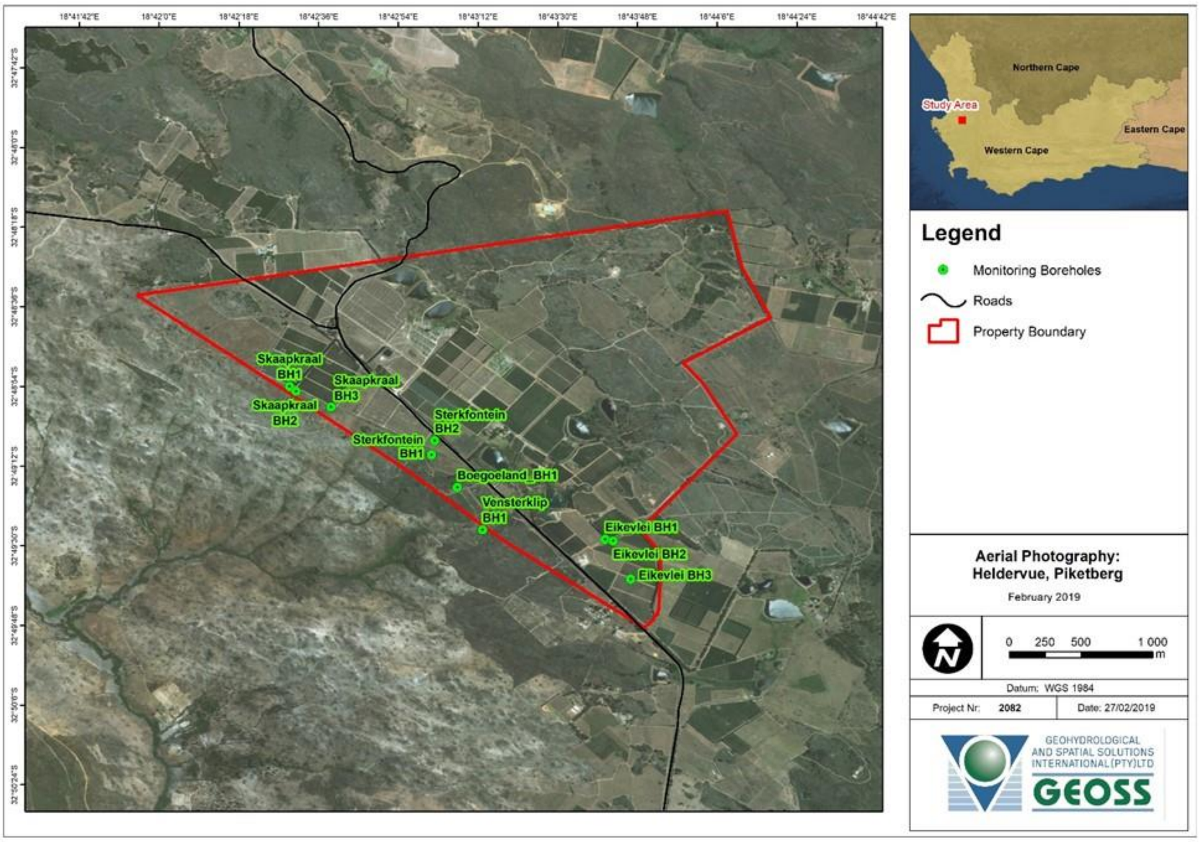

Figure 2 Monitoring Borehole Locations on the Heldervue Farm

The Hydrology of Heldervue

There are 9 dams located on the main farm portion of Heldervue, spread across six catchment areas (Grobler & Barrow, 2021). Only 54.35% of the total surface area of the farm drains into the dams (Grobler & Barrow, 2021). Additionally, groundwater is used to fill the dams. A drought hit the Western Cape of South Africa from 2016-2018. Rainfall was low and the draw down of the borehole water levels were as low as the pump inlet. In Table 1, the effect of the drought is clear in 2017, when the farm only received 61% of the 10-year average yearly rainfall.

Table 1 Heldervue Rainfall Data (2013–2023)

Month	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
Jan	10	42.2	6.7	30.4	13	12	37	6	7	0	5	15
Feb	33.4	3.6	4.8	10	3	14	11	12	9	5	45	14
Mar	14.4	20	2.9	43.1	5	38	14	18	117	37	97	37
Apr	133.6	7.4	4.9	75.5	23	64	18	55	23	14	74	45
May	45.8	12.6	31.9	22.3	6	101	58	69	191	54	107	64
Jun	199	214.8	150.4	153.2	167	159	160	149	170	182	471	198
Jul	98.8	155.2	125.3	139.4	48	86	169	170	124	69	96	116
Aug	211	126.8	50.1	70.3	70	89	55	149	129	128	112	108
Sep	5.8	28.2	31.4	75.7	33	117	22	61	27	30	121	50
Oct	17	8.8	10.2	20.9	43	41	58	9	88	0	10	28
Nov	23.8	59.4	27.8	7.4	33	21	11	58	65	30	0	31
Dec	0.4	0.6	11.9	9.3	0	49	35	5	53	75	2	22
Total	**793**	**679.6**	**458.3**	**657.5**	**444**	**791**	**648**	**761**	**1003**	**624**	**1140**	**727.2**

**Data is displayed in millimeters and collected from a rain gauge at Heldervue (32°48'47.14"S, 18°43'18.83"E).*

The Drought and Invasive Plant Species

Groundwater's resilience to drought is well-known and many would respond by drilling more boreholes (DWS, 2010). However, TFFG had a different approach to the multi-year drought. In South Africa, invasive plant species pose a serious threat to the ecosystem because they increase evapotranspiration and above-ground biomass, which reduce surface water runoff and groundwater recharge (Chamier *et al*., 2012). About 5% of our priceless water resources are consumed by invasive plant species, which also lowers the carrying capacity of our natural rangelands (Bonthuys, 2021). According to CapeFarmMapper 3 (2023), the potential evapotranspiration loss on the Piketberg Mountain is 1 100–1 200 mm/year. Increases in evapotranspiration brought on by invasive plants result in lower dilution and higher concentrations of nutrients, contaminants, and suspended particles in water as well as reductions in streamflow and groundwater recharge rates (Chamier *et al*., 2012). Where evapotranspiration exceeds rainfall, irrigation is needed to ensure a healthy crop.

Heldervue's Adaptation Strategy

The farm's alien plant species lowered the amount of water that drained into the storage dams on the property and lessened the potential discharge from the watershed. To assure continuity in irrigation water supplies and to alleviate water stress, TFFG partnered with BlueScience to evaluate the costs of removing and controlling the invasive species, as well as the potential benefits. BlueScience identified Black Wattle, Eucalyptus, and Port Jackson as the most common alien species found on the Heldervue farm (Grobler & Barrow, 2021). Densely infested areas covered 14.93 ha and moderately infested areas covered 11.06 ha (Grobler & Barrow, 2021). Under a moderate rainfall scenario, an 8.11% increase in surface runoff was predicted upon the completion of the alien vegetation clearing (Grobler & Barrow, 2021).

Outcomes

Heldervue started the alien clearing process in August 2021, and by August 2022 most of the aliens were cleared. They started from the northern farm boundary and worked to the south. In **Figure 3**, the area where the alien clearing took place is indicated in yellow. During January 2024, the shallowest (best recovered) groundwater levels were measured since monitoring commenced in 2017. Significant groundwater recharge was observed at all of the monitoring boreholes and can be attributed to the alien clearing. Surface runoff increased and resulted in increased groundwater recharge and drainage into storage dams. The triple La Niña of the past three years (2021-2023) also resulted in reduced abstraction from the boreholes. The Eikevlei boreholes are located at the southern border of the farm. Eikevlei BH3 (**Figure 4**) and Eikevlei BH2 (**Figure 5**) were used as case studies.

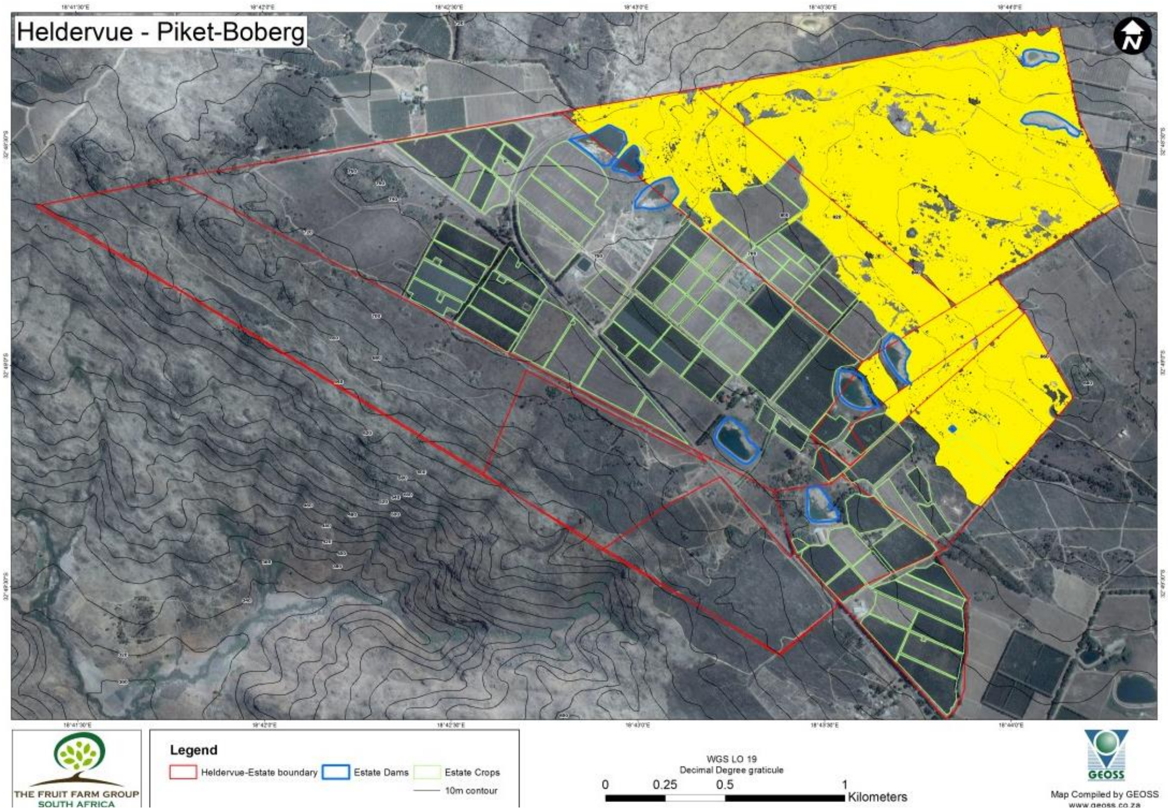

Figure 3 Alien Clearing Area on Heldervue

Case Studies

In **Figure 4**, the consequence of the drought can be observed from 2018 to 2021, when pumped water levels were running at the pump inlet. This poses a risk of burning out the pump and dewatering the aquifer and is a result of insufficient recharge and increased abstraction due to below-average rainfall. Eikevlei BH3 is one of the main production boreholes on the farm and could not be left to rest. The period when alien clearing occurred is marked with a red band on the graph in **Figure 4**. It is evident that since alien clearing started in August 2021, water levels have begun to rise. The recharge potential on the farm increased and the good rainfall of 2023 resulted in reduced abstraction. Before alien clearing, the static water level was 80 meters below ground level (mbgl). After the good rainfall of 2023, and the completion of the alien clearing in August 2022, static water levels were 20 mbgl. **The static groundwater level recovered by an astonishing 60 meters**. The water level has since dropped during the 2023-2024 summer period, as abstraction increased and rainfall reduced but still demonstrates significant improvement.

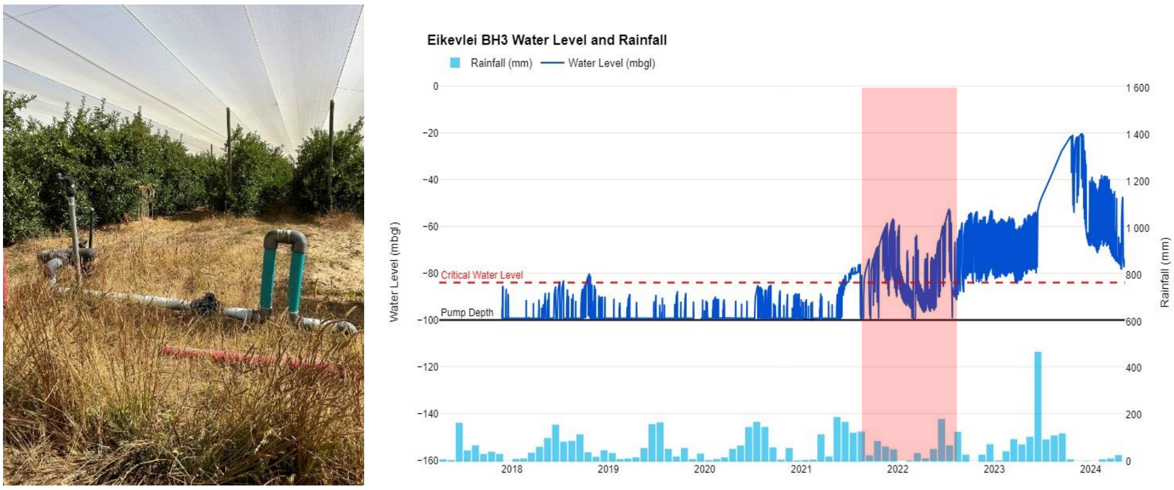

Figure 4 Eikevlei BH3 Water Level and Monthly Rainfall (2017 – 2024 YTD)

In **Figure 5**, a decommissioned borehole, Eikevlei BH2, is shown. This borehole can be considered a proper monitoring borehole, as no abstraction has been taking place since the end of 2021, when water levels dropped below the pump inlet. The period when alien clearing took place (August 2021 – August 2022) is also marked with a red band on the graph in **Figure 5**. Since abstraction ceased, and the alien vegetation cleared, water levels continued to rise. Static water levels were 70 mbgl before 2022. Manual water level measurements obtained in January 2024 showed that the static water level was ~10 mbgl, **also indicating a 60 m rise in the groundwater levels**. During May 2024, the water level was still at ~20 mbgl, according to manual measurements.

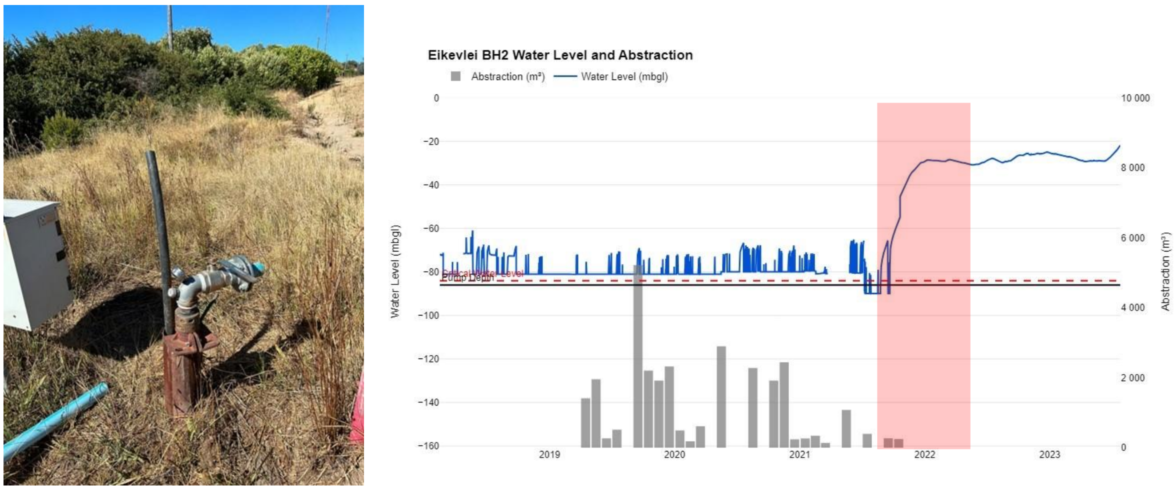

Figure 5 Eikevlei BH2 Water Level and Monthly Abstraction (2018 – 2023)

Discussion and Conclusion

Maclear already identified the significance of saving water in South Africa in 1995 due to rising demands on limited water resources (Maclear, 1995). With a sustainability mindset, Heldervue placed itself in a very good situation. The early implementation of a groundwater monitoring and management plan helped them understand their drought resilience. Due to its value in the agricultural sector, groundwater is directly related to food security and must be treated as a limited resource in land-use planning (DWS, 2010). All essential precautions must be taken to protect the resource and its recharge processes (DWS, 2010) and even though very few studies have quantified the impacts of invasive alien plants on stream flow, runoff, or groundwater recharge (Chamier *et al*., 2012) Heldervue took a leap of faith and is now "picking the fruit". The conjunctive use of surface water and groundwater, in addition to the removal of alien vegetation, will ensure long-term water security on the farm.

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