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**Groundwater level status
assessment for the Hydrogeological
regions in the Gauteng, Northwest,
Limpopo and Mpumalanga Provinces
-Volume 3-**

REPORT STATUS

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1. Introduction

The Department of Water and Sanitation is mandated to protect develop and conserve water resources of the country. This is acknowledged by the National Water Act (Act 36 of 1998). The act further states that monitoring of the water resources is required and further outlines the number of required monitoring programmes to be established are outlined. Groundwater resources form part of these monitoring programmes to be established. Strides have been made over the years with monitoring of groundwater resources for the country, with datasets (albeit having monitoring gaps) dating back more than 40years. Several information products which are the conversion of these datasets into information have been produced, aiding the public, the scholars and groundwater consultants with understanding of basic groundwater information (quality and quantity) at national scale.

As with any data gathering programme, there will always be areas for development needed when it comes to analysis and interpretation of the datasets gathered to expand the audience benefiting from the information. This starts with internal stakeholders (whom are the data gatherers so that they get to understand the latest information about groundwater resources and where active effort on management is required. This report aims to interpret groundwater trends over identified periods to ascertain whether any active management efforts or interventions are required.

South Africa is subdivided into sixty-four (64) hydrogeological regions, which define the groundwater units based on unique hydrogeological characteristics. These have been utilized to interpret the groundwater datasets. They crosscut the catchment and provincial boundaries, as geology or groundwater knows no catchment or provincial boundaries. These hydrogeological units, however, give a better understanding of the groundwater performance for those regions.

1.1 Report Objectives

The object of this report is to outline both the historic and the latest groundwater trends, give status quo of national groundwater resources and zoom-in into areas where impacts are observed, discuss them further and offer recommendations on management steps to take. Its primary focus is to alert the management to imminent impacts that might affect groundwater resources. This is in line with the mandate of protection of water resources.

2. Methodology

The existing datasets from the groundwater database (the National Groundwater Archive) were extracted with the purpose of analyzing water level trends of the monitoring boreholes from the various hydrogeological regions alluded to earlier. The processing of datasets was primarily done on MS Excel. The initial plan was to utilize data dating back to 2015. However, this was not possible with other hydrogeological regions. Some of the shortcomings included a delayed comprehensive monitoring programme which commenced recently. In some

instances, the gaps were too big to close them using both the forward and backward data patching method that MS Excel offers. A summary of step by step into ensuring completeness and accuracy of datasets involved:

- Assessing the data gaps and how best they could be closed.
- Gap closure/ data patching utilizing the forecasting method to obtain consistent trends. This was limited to small gaps using linear regression to project future data points along a line that best fits the historical data.
- Data smoothing, utilizing the exponential method to define clearly the trends. This forecasting technique for time-series data assigns exponentially decreasing weights to past observations, placing more importance on recent data than older datasets. The utilized statistical formula is as follows:

$$s(t) = \alpha x(t) + (1-\alpha)s_{t-1}$$

Where:

$s(t)$ is the smoothed value (or forecast) for the current period.

α is the smoothing factor.

$x(t)$ is the actual observed value for the current period.

s_{t-1} is the smoothed value (or forecast) from the previous period.

Subsequently, hydrographs could be generated. The water level elevations were chosen as these have a better-defined reference point i.e. the mean sea level. These hydrographs were coupled with zoom-in analysis of level fluctuations, setting the initial water level where dataset starts (as the reference point) to determine the gains or losses, indicated as a declining or a rising trend, over the assessment period.

Because the emphasis was on hydrogeological regions, the individual borehole trends were aggregated and an average water level trend for the hydrogeological region was determined using the formula:

$$\text{Average GWL} = \sum (\text{GWL of individual wells}) / \text{Number of wells}$$

This allowed for determination of the groundwater level trends with reference to the selected background point, determining whether there is a general water level decline or a rise and how steep or gradual it is.

3. The results

The results outline the outcomes of the water level assessments conducted for the hydrogeological regions in the provinces of the Gauteng, the Northwest, the Limpopo and Mpumalanga. Thirty-eight hydrogeological regions make up the three provinces mentioned above. The extent and coverage of these hydrogeological regions is shown in Figure 1.

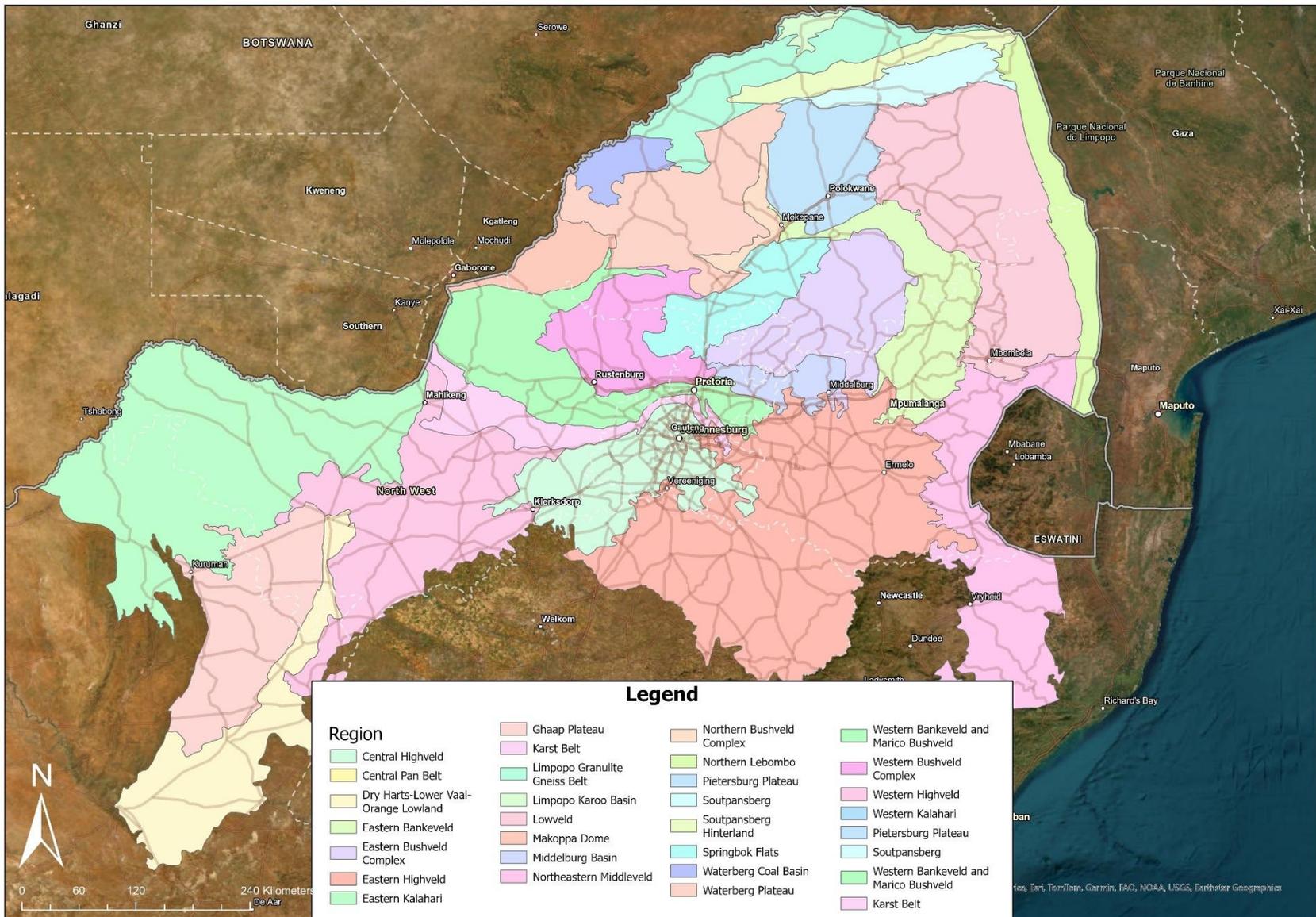


Figure 1: Hydrogeological region for the Gauteng, Northwest, Limpopo and Mpumalanga Provinces

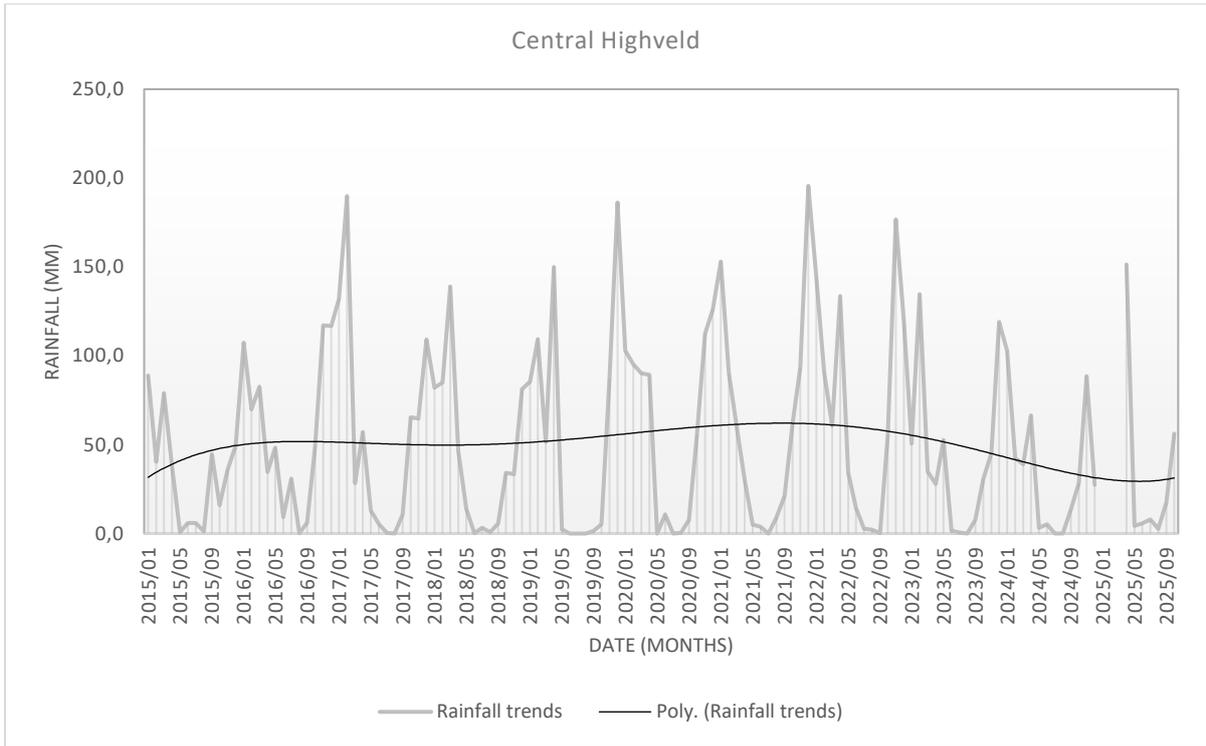


Figure 3: Monthly rainfall trends for the Central Highveld hydrogeological region

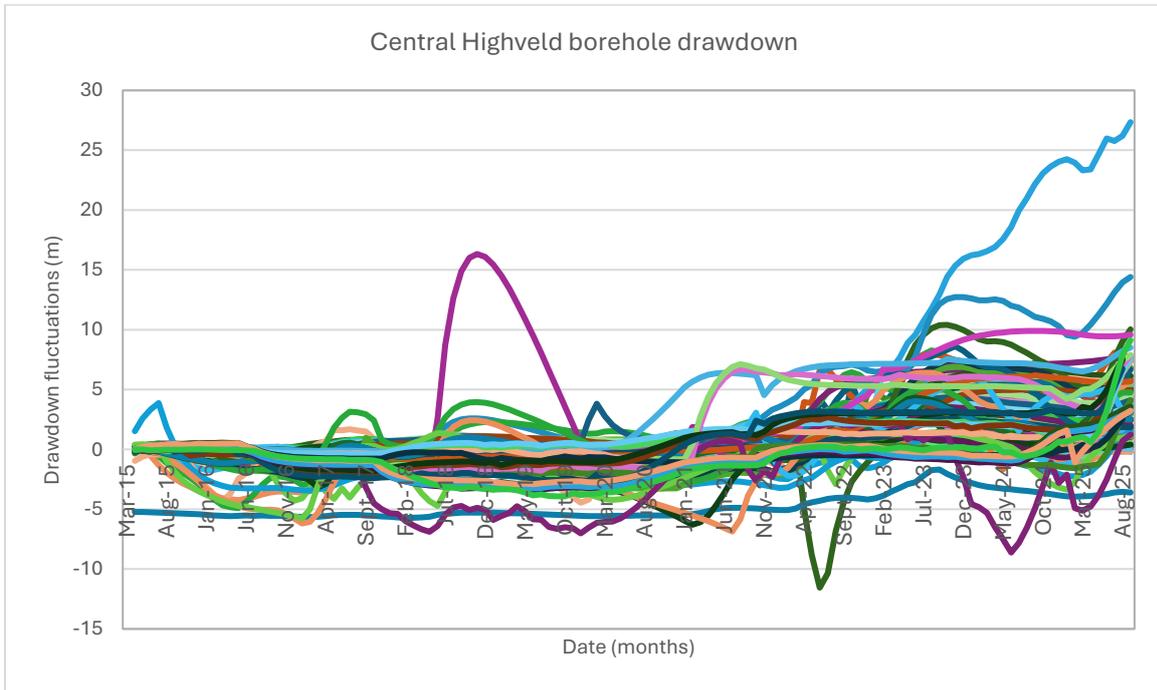


Figure 4: Groundwater level drawdown fluctuation trends for the boreholes in the Central Highveld hydrogeological region

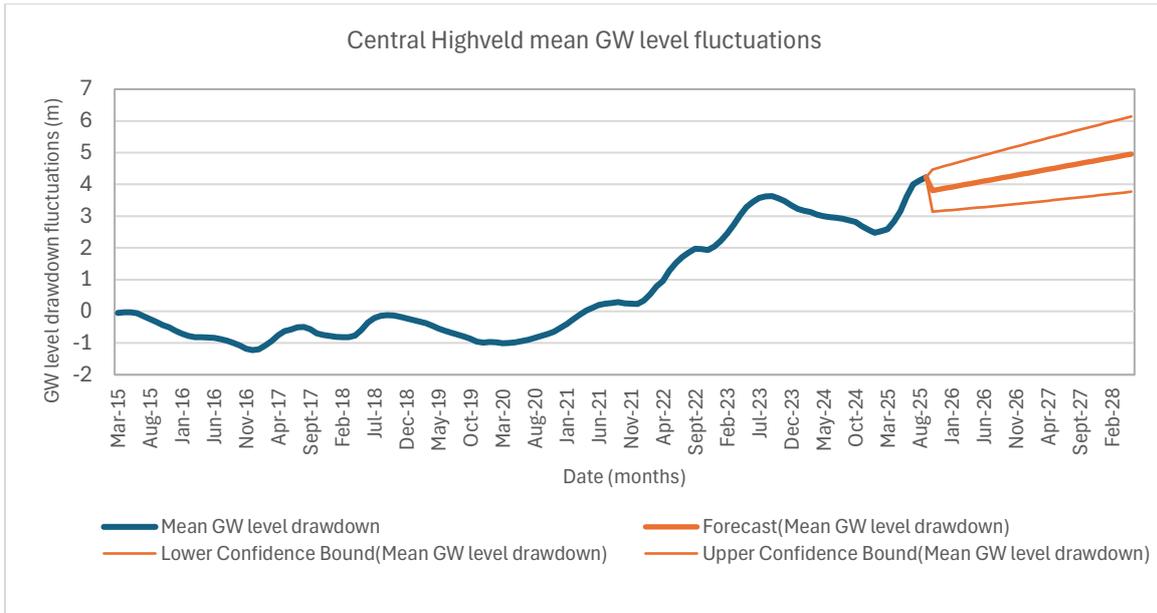


Figure 5: Mean groundwater level drawdown for the Central Highveld hydrogeological region

3.2 The Middelburg Basin Hydrogeological Region

The Middelburg Basin Hydrogeological Region, as the name suggests, encompasses the town of Middelburg to the east, and to the southeast, the town of Emalahleni. To the far west, Pretoria and its surroundings lie (Figure 6). The extent hydrogeological region crosscuts both the Mpumalanga and Gauteng Provinces. The region has limited monitoring boreholes and therefore no assessment of water levels will be made. The monitoring programme for this region needs to be expanded.

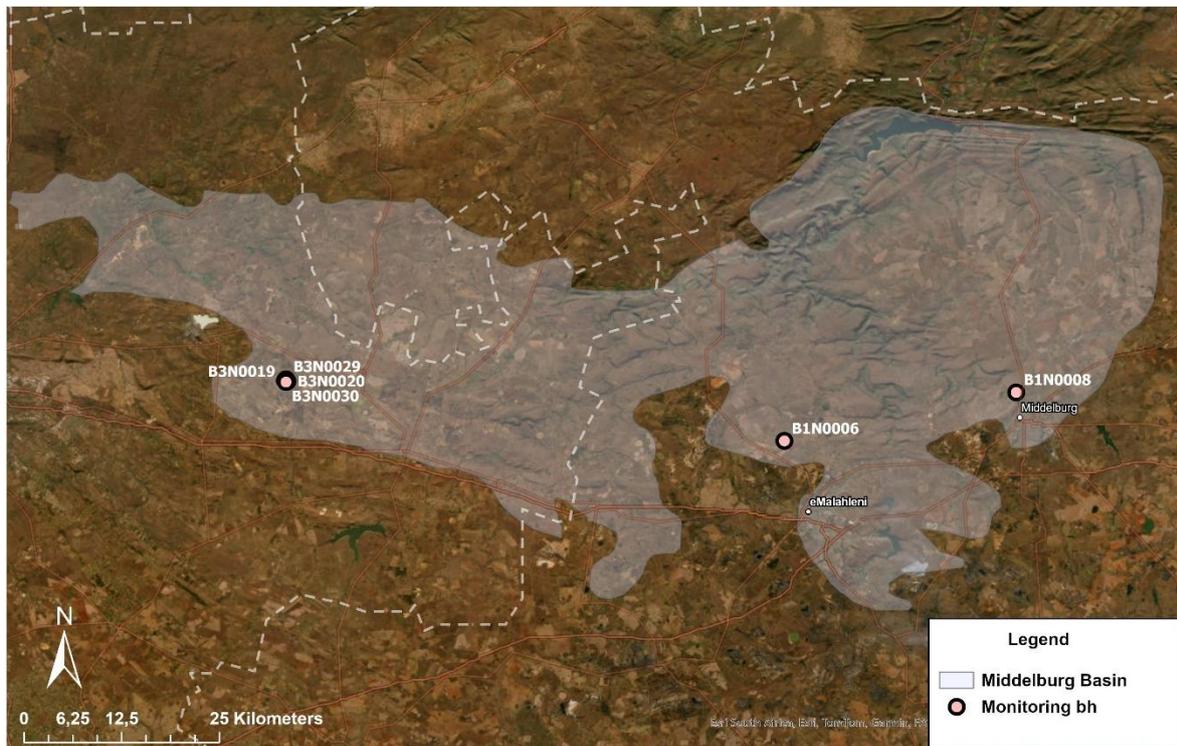


Figure 6: an extent and locality of the Middelburg Basin Hydrogeological region and its monitoring boreholes

3.3 The Western Bankeveld and Marico Bushveld Hydrogeological Region

The Western Bankeveld and Marico Bushveld hydrogeological region lies slightly north of Johannesburg, on the eastern side, and to the west, it lies north of Mahikeng stretching up north towards Gaborone and Thabazimbi. The towns of Rustenburg and Brits serve as the uppermost border on the eastern side (Figure 7). The monitoring borehole distribution for this region is concentrated along the the platinum belt, with limited boreholes to the west (Figure 7).

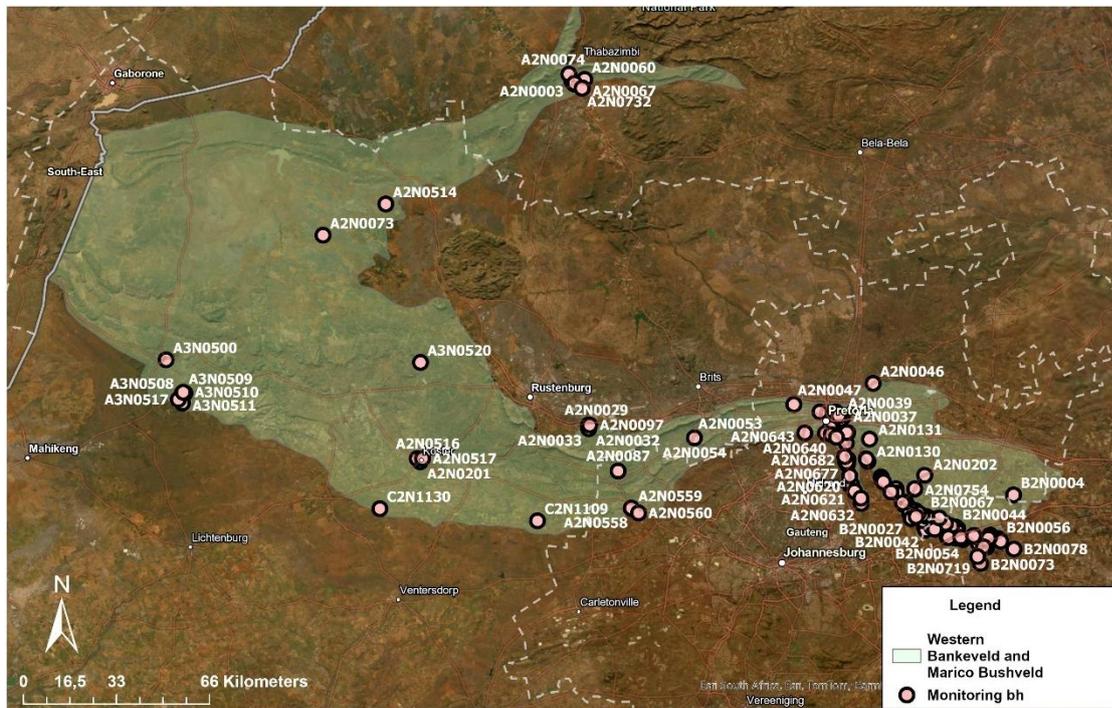


Figure 7: The extent of the Western Bankeveld and Marico Bushveld Hydrogeological region and its boreholes

The assessment of rainfall patterns for the region was made possible by averaging the monthly rainfall for SAWS Districts 74, 84, 85 and 96 rainfall stations (Figure 8). Generally, above average rainfall was observed between 2016 to early 2023 and thereafter, a decline was observed going into 2025. These rainfall patterns influence groundwater response in the form of replenishment or depletion depending on the rainfall cycle observed and its delayed response to recharge the aquifers. According to Figure 9, the groundwater level drawdown maintained horizontal trends until 2022. When new boreholes were introduced (around October 2021), fluctuating rising trends were noticed. A pronounced water level drawdown decline was noticed in early 2025, responding to lower-than-average rainfall observed since 2023 (Figure 9). This decline is a lot clearer in Figure 10 where average groundwater level drawdown for the region is depicted. The latest records indicate a rise suggesting a groundwater system which is replenished. Given this, there are no management actions required for this region.

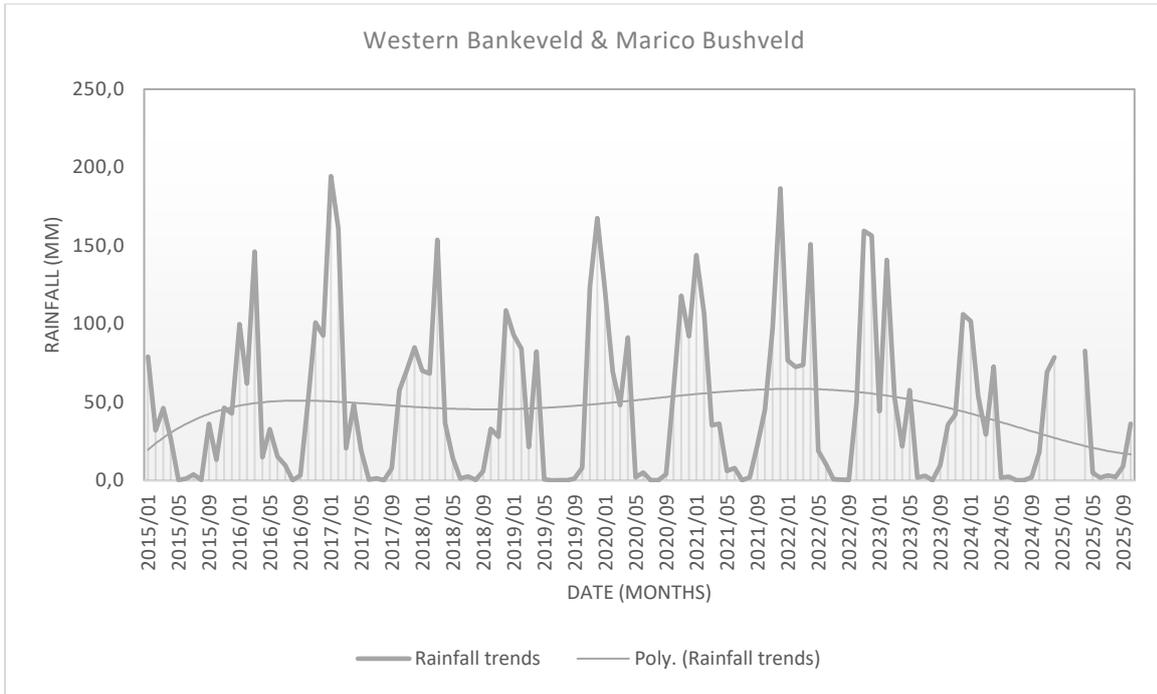


Figure 8: Monthly rainfall trends for the Western Bankeveld and Marico Bushveld hydrogeological region

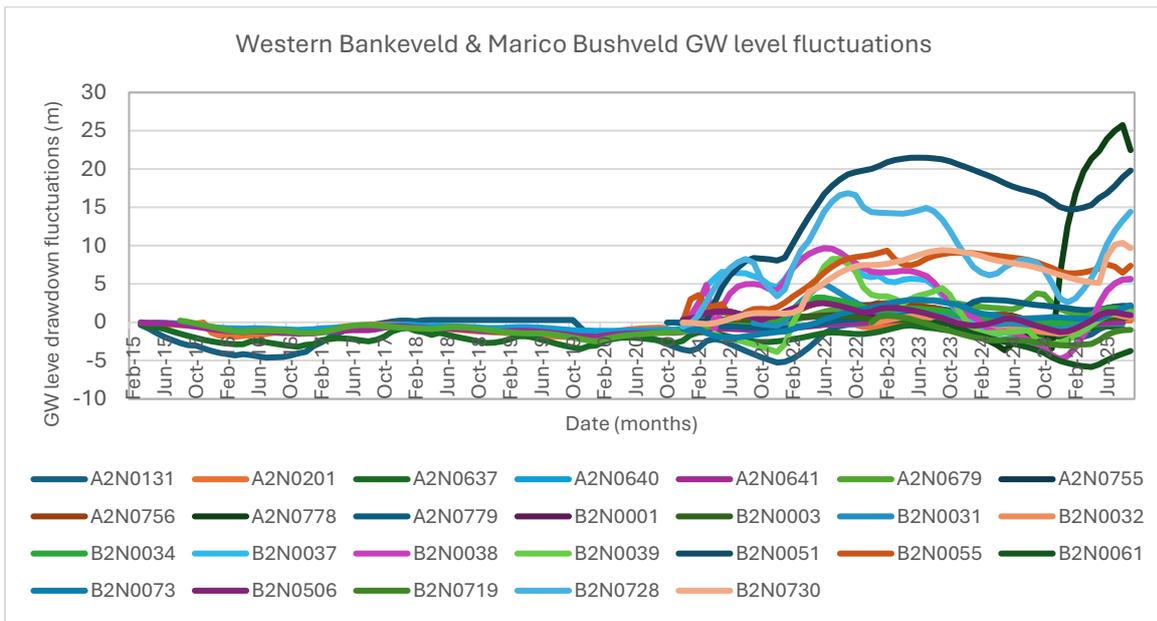


Figure 9: Groundwater level drawdown fluctuation trends for the boreholes in the Western Bankeveld and Marico Bushveld hydrogeological region

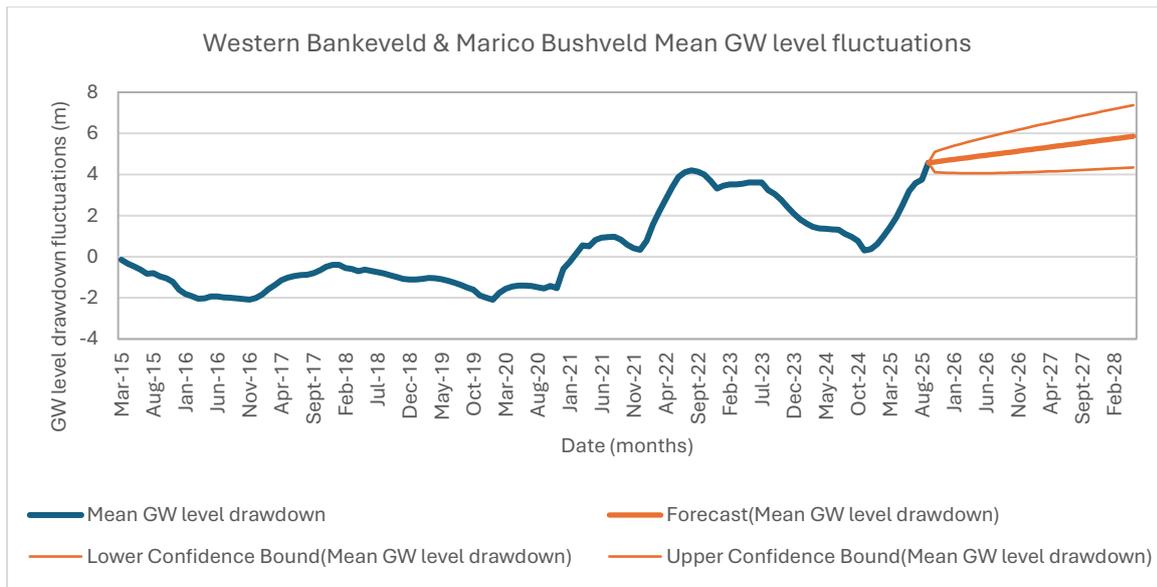


Figure 10: Mean groundwater level drawdown for the Western Bankeveld and Marico Bushveld hydrogeological region

3.4 The Karst Belt Hydrogeological Region

The Karst Belt hydrogeological region stretches from the western side slightly east of Mahikeng to the east of Johannesburg. To the north, the region lies south of route R509 in the Northwest Province and route R104 in Gauteng (Figure 11).

The groundwater monitoring is overly represented for this region (Figure 11). The region could benefit from optimization of the monitoring programme.

The rainfall patterns for the region were assessed using monthly rainfall records from the rainfall stations in SAWS District 74, 84 and 92. According to Figure 12, the rainfall for the Karst Belt region progressively increased from 2015, (with a slight decline between 2017 and 2018), to early 2023. From 2023, a decline was noted which prevailed to date. Groundwater level trends are likely to mimic these trends with delayed respond, though. Figure 13 shows the groundwater level drawdown observed from the monitoring boreholes for the Karst Belt region. Because of the number of boreholes existing in this region, the legend is not shown, but the fluctuations only. From May 2022 the aquifers indicated to be replenished, marked by rise in groundwater level (drawdown) to date. A slight decline was observed in February 2025 but quickly recovered. This is accurately depicted in Figure 14 where the mean groundwater level drawdown for the region is presented. Given the upward trend and positive groundwater level drawdown, no immediate management actions are required.

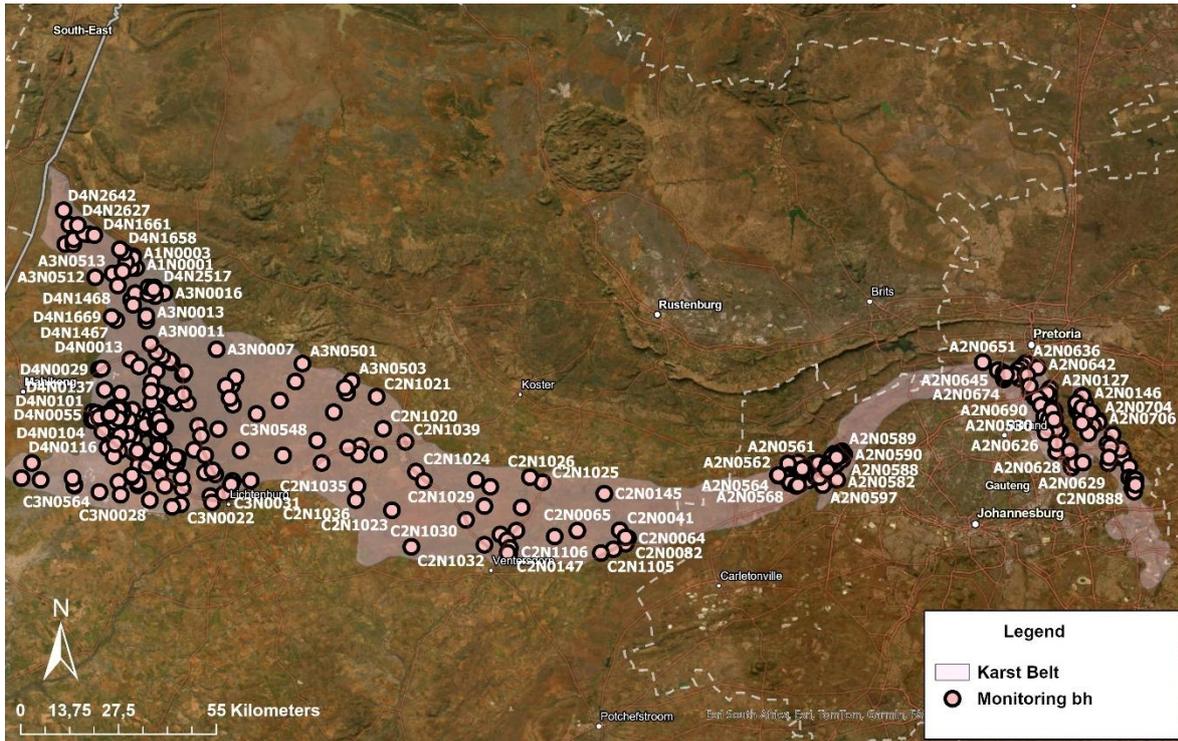


Figure 11: The Karst Belt Hydrogeological region and its boreholes

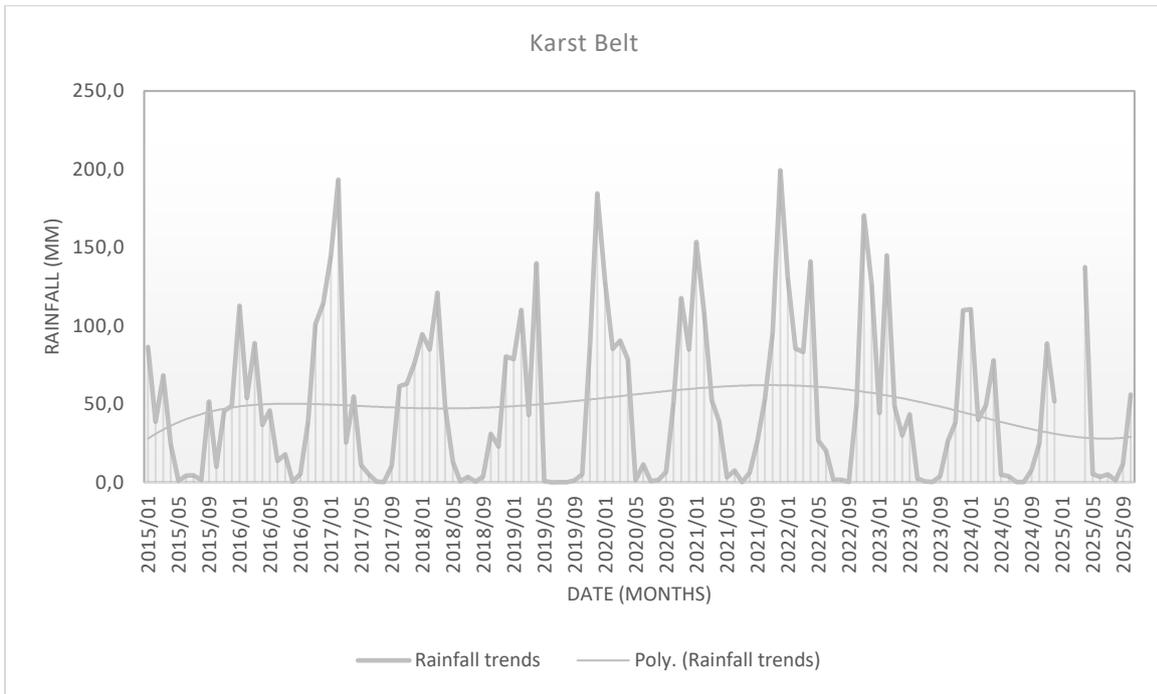


Figure 12: Rainfall trends for the Karst Belt Hydrogeological Region

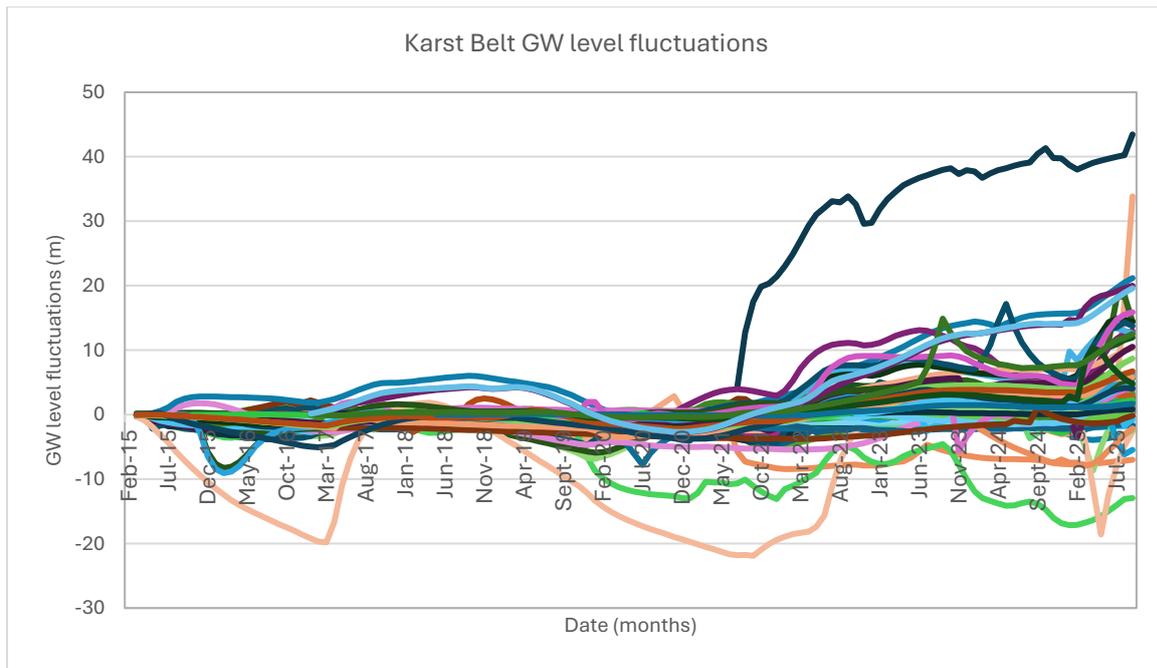


Figure 13: Groundwater level drawdown fluctuation trends for the boreholes in the Karst Belt hydrogeological region

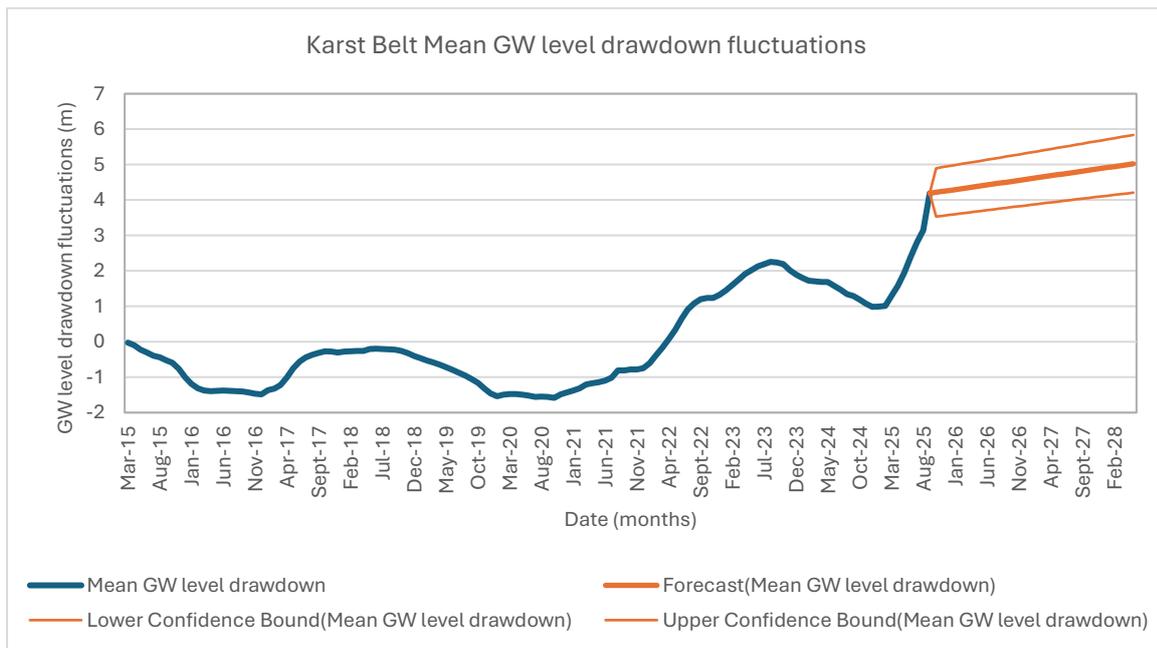


Figure 14: Mean groundwater level drawdown for the Western Bankeveld and Marico Bushveld hydrogeological region

3.5 The Western Highveld Hydrogeological Region

The Western Highveld Hydrogeological Region stretches from Mahikeng in the north to Kimberly in the south, and from Orkney in the west to Vryburg to the west (Figure 15). The boreholes monitored for this region (also indicated in Figure 15) could be optimized so that the areas near Bloemhof Dam and Orkney and Klerksdorp could have representation.

The rainfall patterns for the region were derived from the average rainfall records of the SAWS District 90 and 91 rainfall stations (Figure 16). Minimal rain was observed around 2015 and gradually increased from 2016 to mid-2023 and narrowed off towards 2025.

The groundwater level drawdown for the various boreholes in the Western highveld region is shown in Figure 17. The replenishment of the aquifers is evident from March 20217 in response to rainfall. However, some boreholes indicated negative fluctuations possibly depicting the influence of abstractions. The decline was once again noted around 2024 to early 2025 in response to lower rainfall. The latest shows a rise in groundwater level drawdown, though. Figure 18 which depicts the mean groundwater level drawdown for the region shows these changes well.

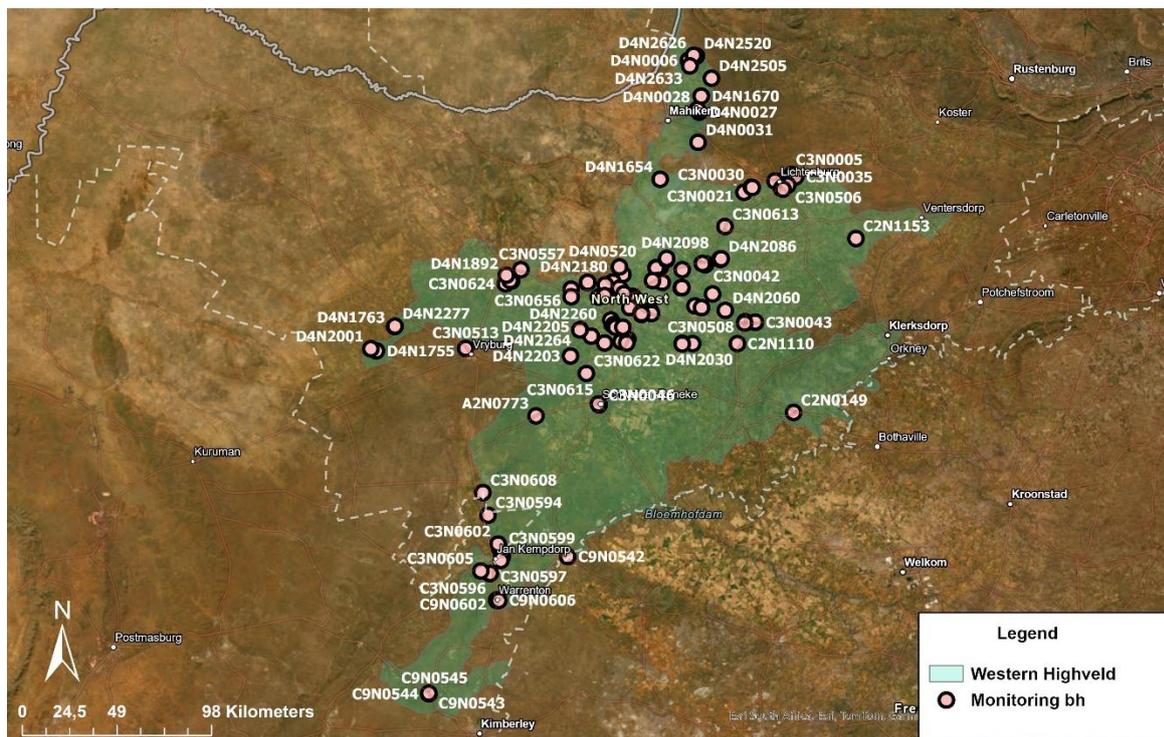


Figure 15: The Western Highveld hydrogeological region and its monitoring boreholes

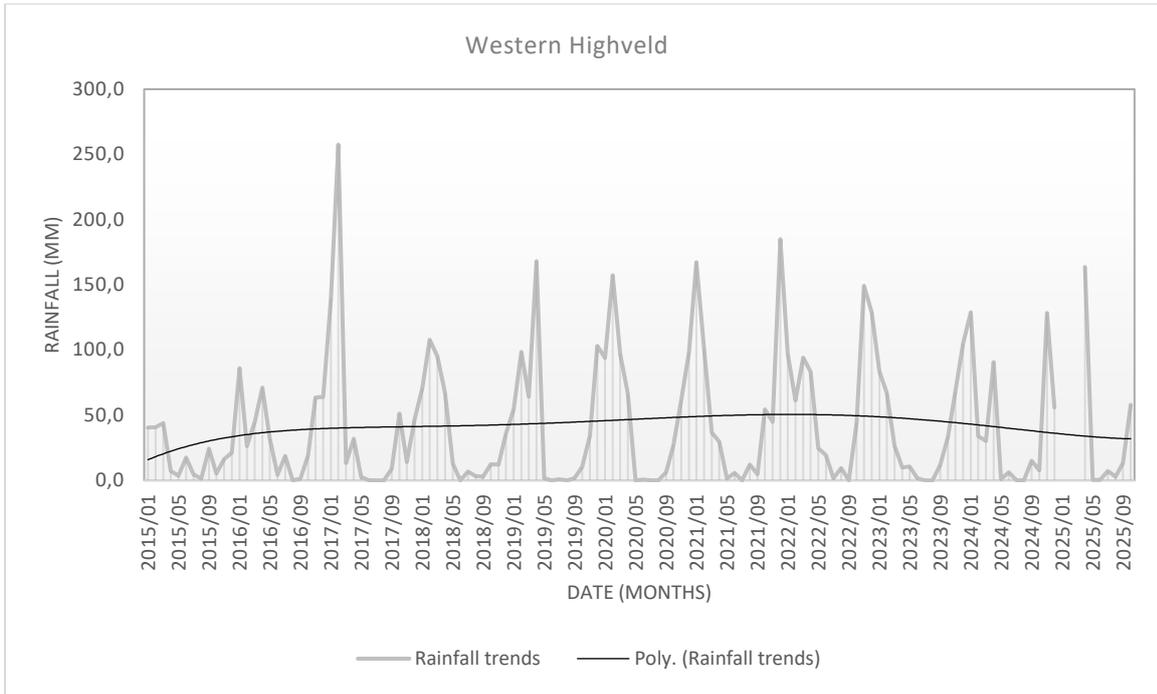


Figure 16: Rainfall patterns for the Western Highveld hydrogeological region

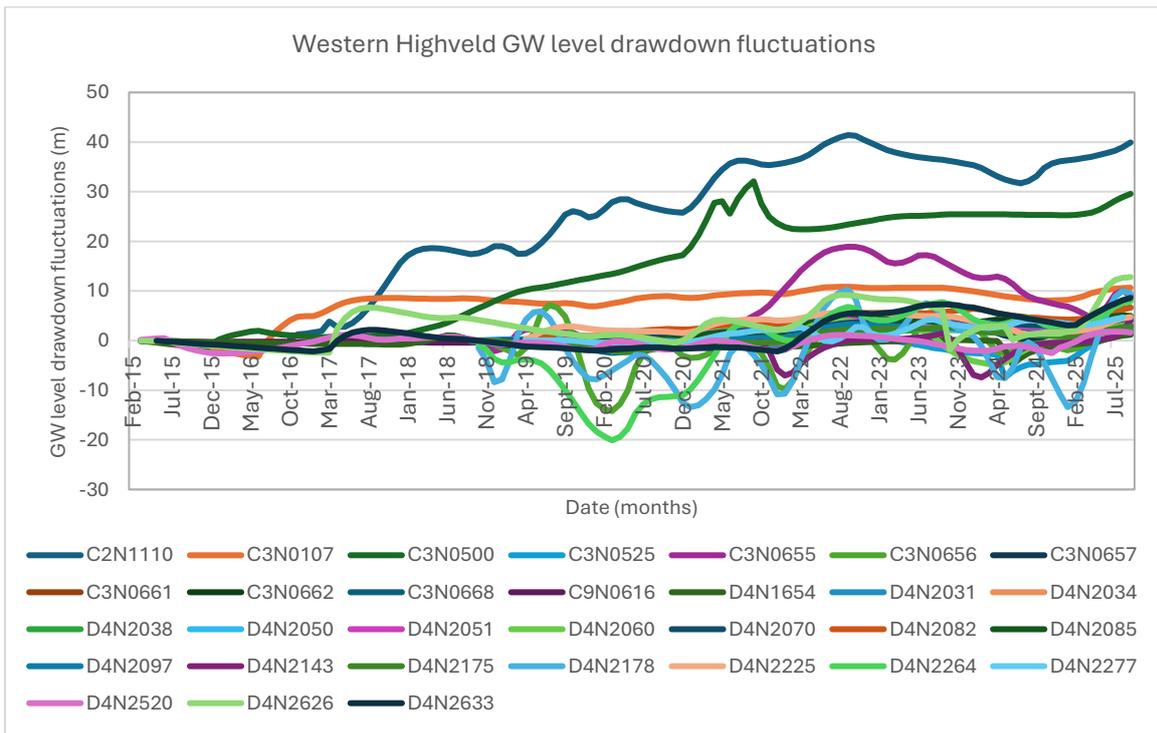


Figure 17: Groundwater level drawdown fluctuations for the Western Highveld boreholes

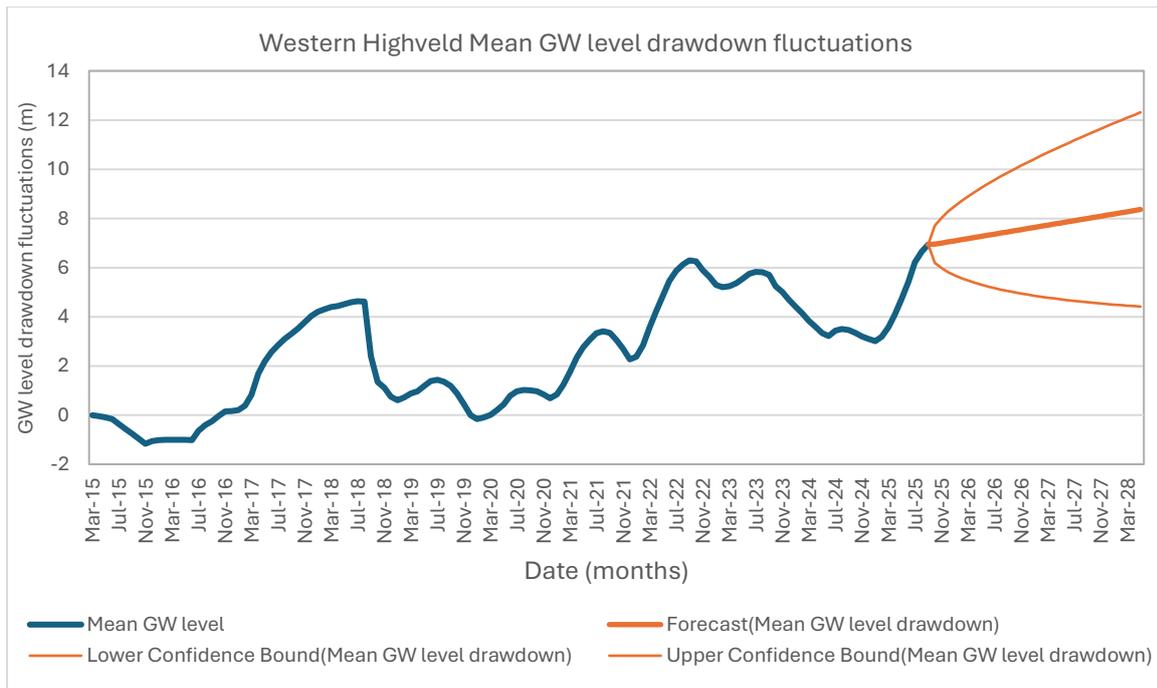


Figure 18: Mean groundwater level drawdown fluctuations for the Western highveld Hydrogeological region

3.6 The Eastern Kalahari Hydrogeological Region

The Eastern Kalahari Hydrogeological Region is bordered from the west and north by Molopo River. To the northeast, the town of Mahikeng serves as the boundary while to the south, the region stretches to Kuruman, Olifantshoek and its mountain range to the west (Figure 19).

The monitoring boreholes are more than enough but clustered to the southeast and north leaving the western and central side without representation (Figure 19). The monitoring boreholes where they are clustered (in the south, east and north) should be reduced and introduce groundwater monitoring in areas without representation.

The rainfall patterns revealed a gradually increasing rainfall trend from the beginning of 2019, peaking in 2022 and gradually declining from 2023 onwards (Figure 20).

The increased rainfall between 2019 and 2023 saw a positive groundwater level response from July 2019 to September 2024, where most boreholes indicated a positive fluctuation in water level drawdown (Figure 21). Some boreholes responded later though, especially those that were already below the initial water levels. This was followed by a short-lived decline, and a water level rise marking the latest level of groundwater in this region. This gradual rise and decline in water level drawdown in response to rainfall recharge is clearly shown in Figure 22. The latest trends for the region are indicative of a rise, clearly shown in Figure 22. Given the current water level status (i.e. positive water level drawdown fluctuations above initial water levels), no immediate interventions to the groundwater resource are recommended.

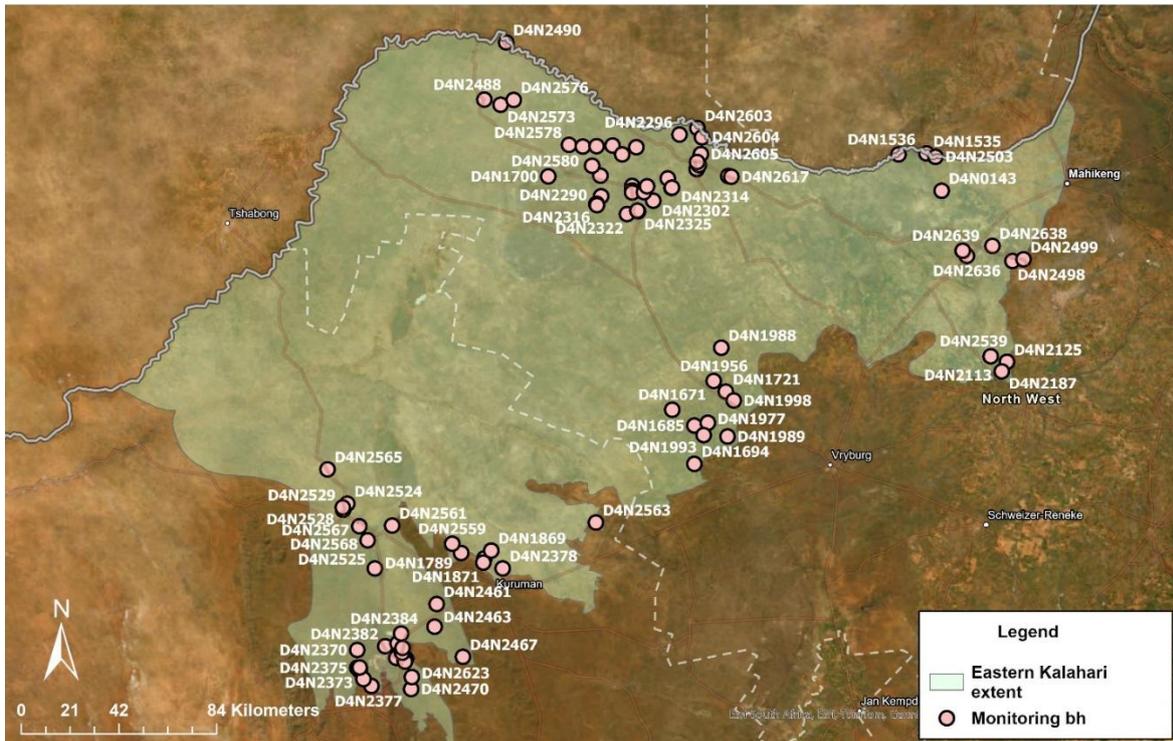


Figure 19: The Eastern Kalahari Hydrogeological Region extent and its monitoring boreholes

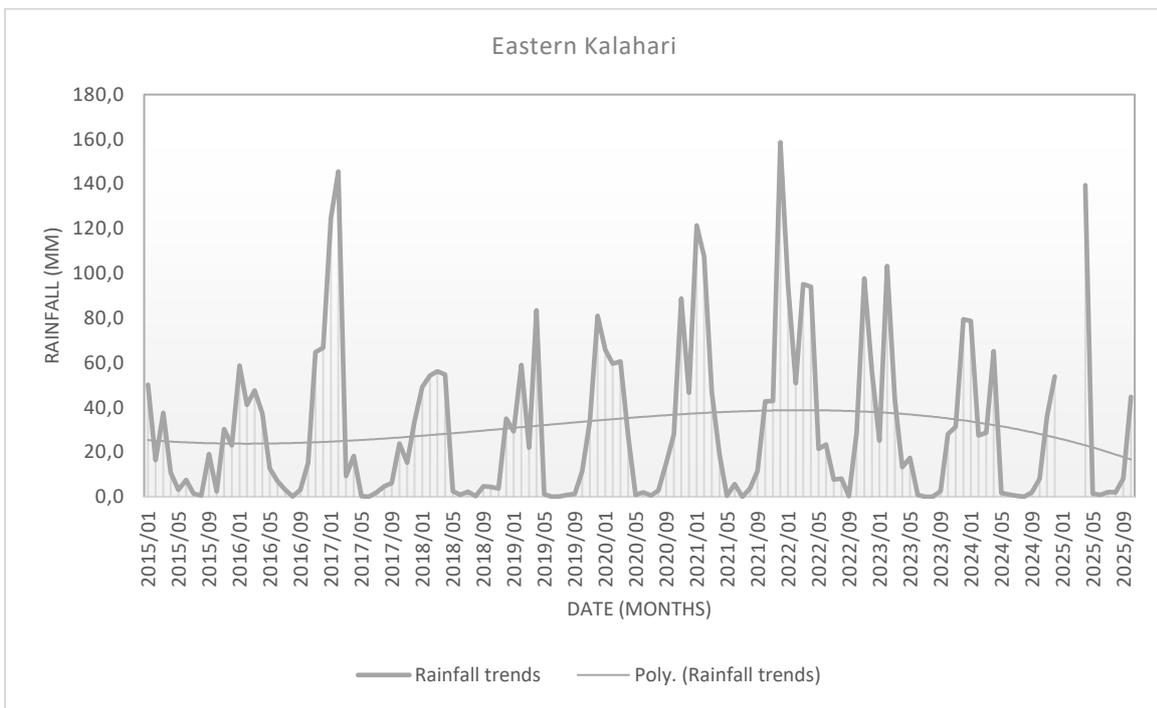


Figure 20: Rainfall trends for the Eastern Kalahari Hydrogeological Region

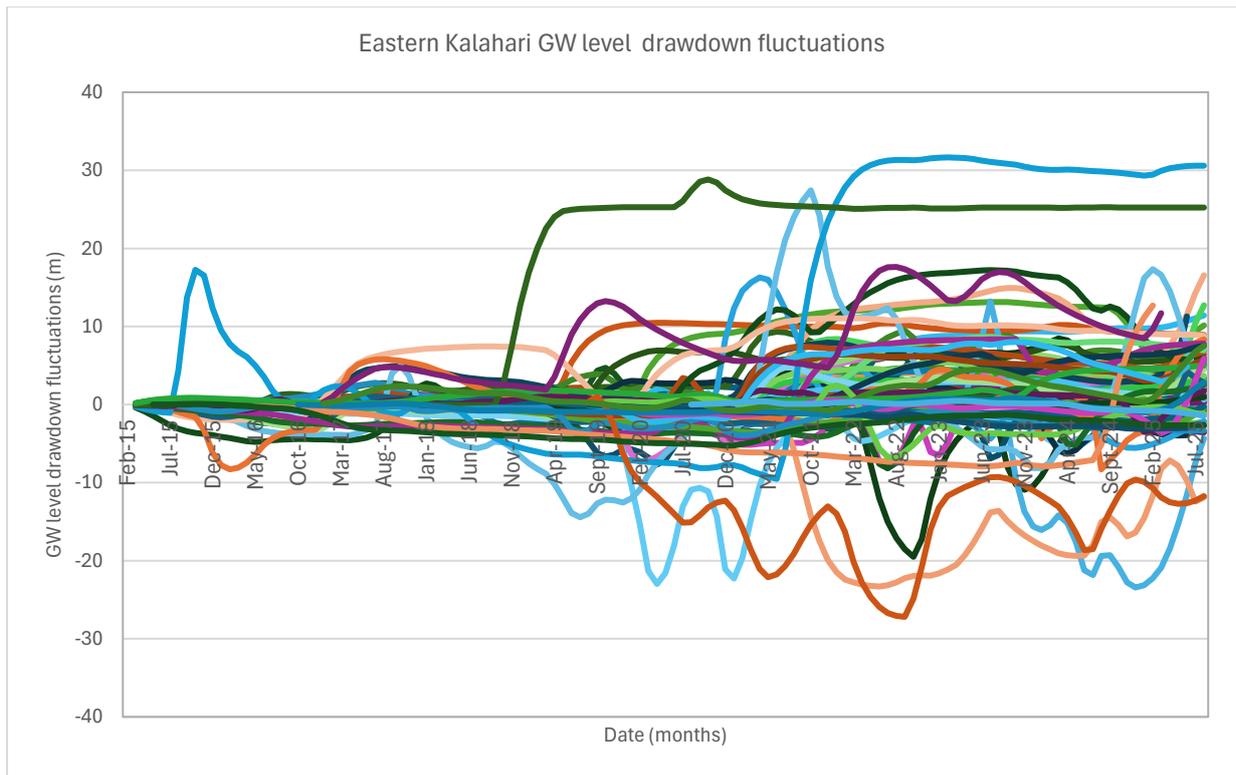


Figure 21: Groundwater level drawdown fluctuation for the Eastern Kalahari boreholes

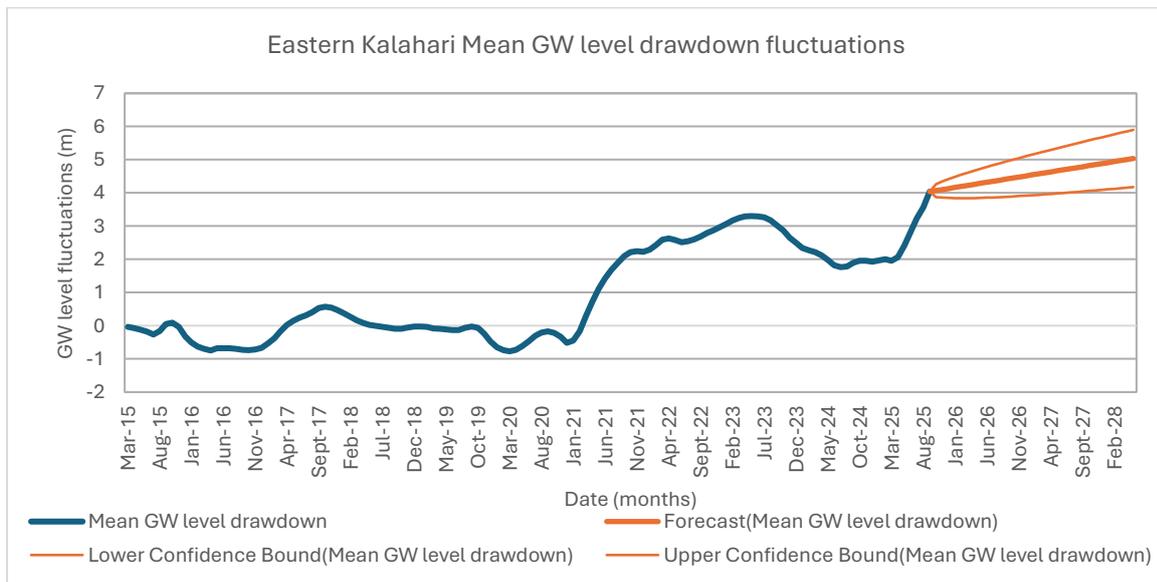


Figure 22: The Eastern Kalahari Hydrogeological Region mean groundwater level drawdown

3.7 The Ghaap Plateau Hydrogeological Region

The Ghaap Plateau Hydrogeological Region covers the area from Vryburg in the north to Campbell and its surroundings, to the south. The hydrogeological region is bisected by the Northern Cape/ Northwest provincial border. The Vall River flows on the eastern side of the region, and in some instances overlaps with the region (Figure 23).

The monitoring borehole distribution shows that the boreholes are scanty in the eastern and southern side of the hydrogeological region, while the northern section is well represented

(Figure 23). Given this, a review and optimization of the monitoring programme might benefit this region.

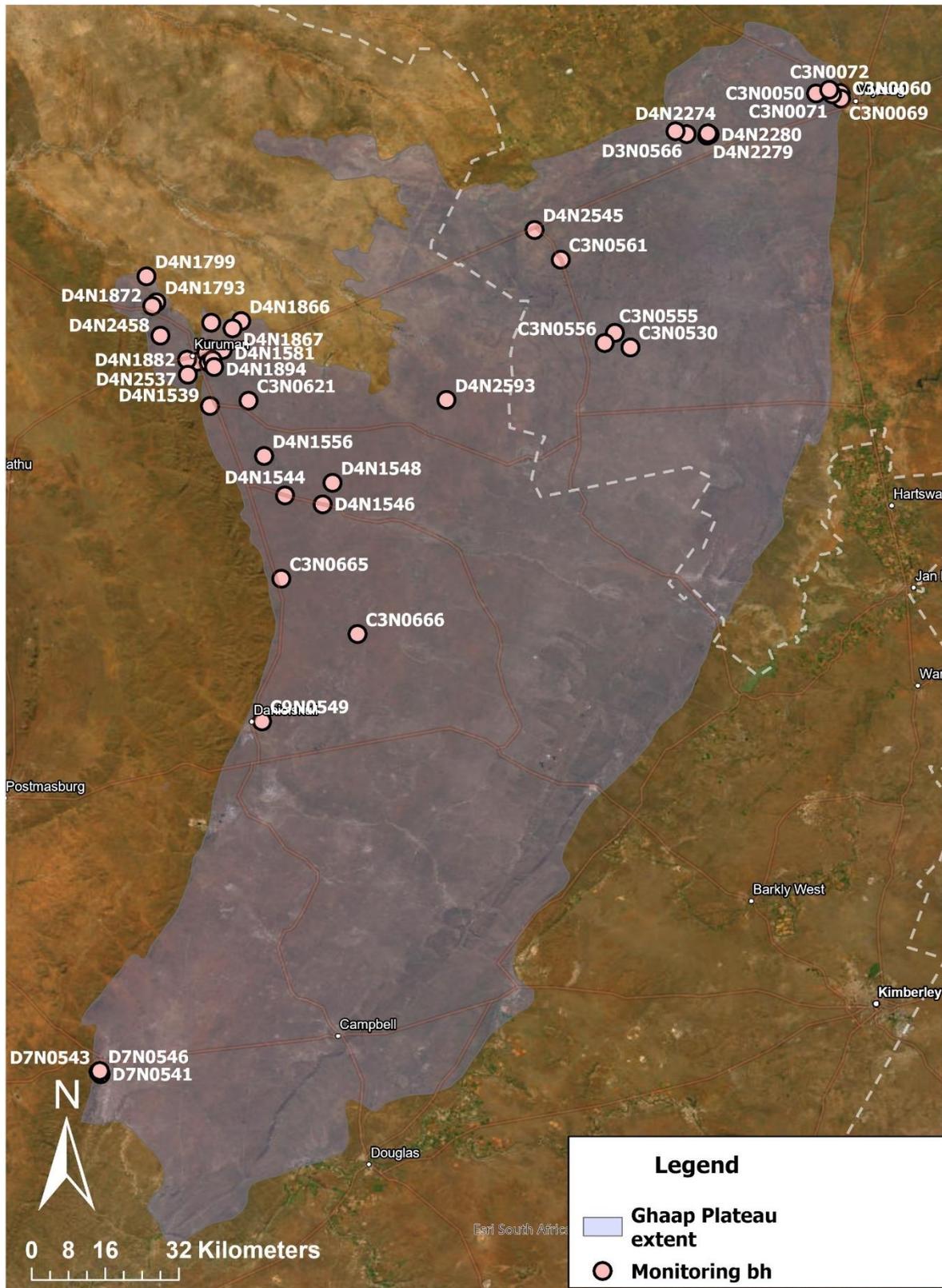


Figure 23: The extent of the Ghaap Plateau and its monitoring boreholes

The rainfall trends showed 2-yearly to 2,5- yearly cycles of low and relatively high rainfall (Figure 24). This is clear from the graph from 2015-2017, then 2020- 2022 where higher rains were recorded.

The impact of the significant rains observed in 2020 is noticed with rise in water level drawdown in October/ November 2020 (Figure 25). These groundwater drawdown levels have remained with positive horizontal trends but showing gradual decline until February 2025 where an upward rise has been recorded to date. This is clearly shown in Figure 26. Generally, the groundwater for this region is in its viable state, way above the initial water levels.

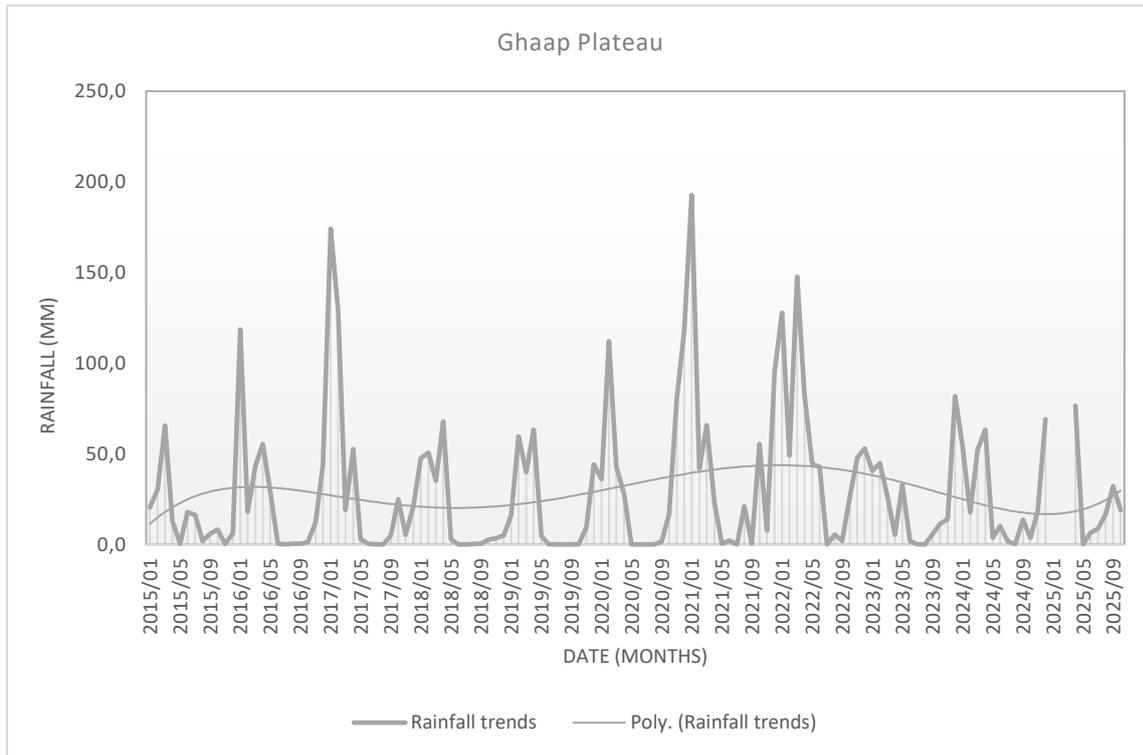


Figure 24: Rainfall trends for the Ghaap Plateau hydrogeological Region

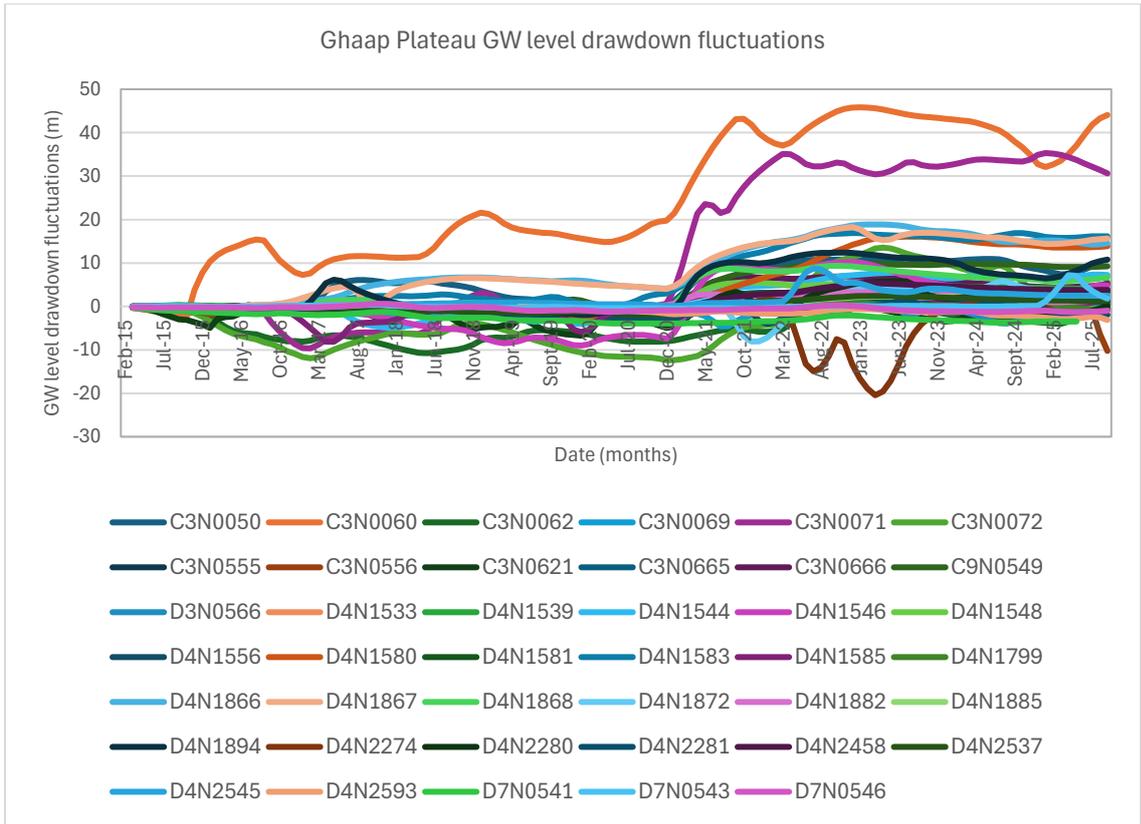


Figure 25: Groundwater level drawdown trends for the Ghaap Plateau boreholes

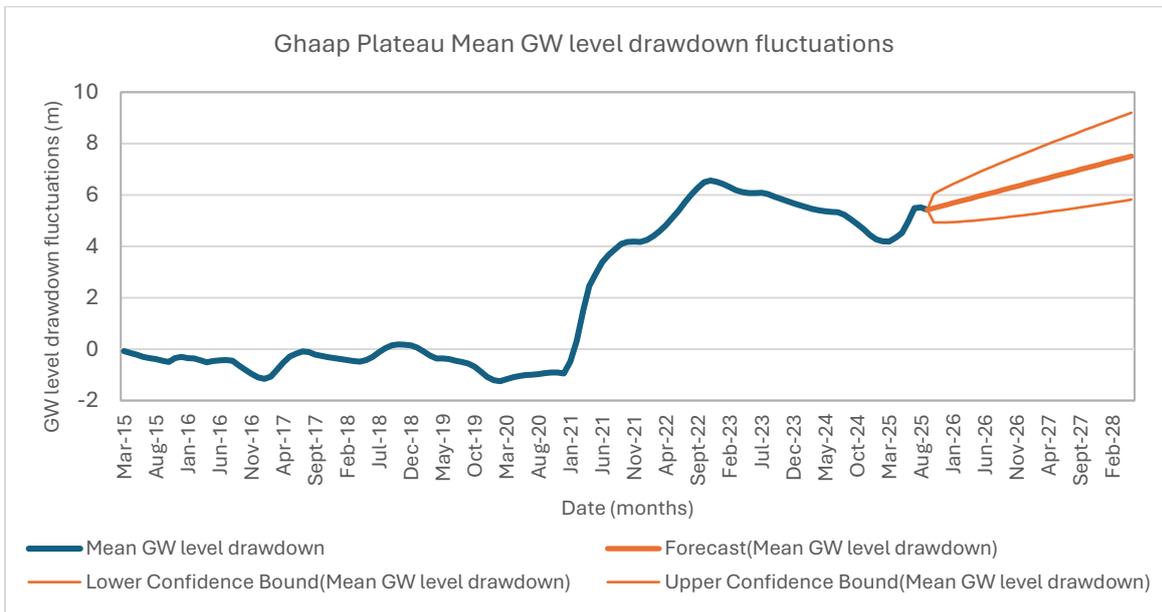


Figure 26: Mean groundwater level drawdown for the Ghaap Plateau Hydrogeological Region

3.8 The Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region

The Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region stretches from Vryburg down to Prieska in a linear direction along the N18 route. The eastern extent is bordered by Hopetown southwards and Jan Kempdorp in the northeast (Figure 27). The borehole representation isn't spectacular, with most boreholes clustered to the south and a few in Vryburg. The monitoring programme for this region needs to be reviewed and optimized.

Incremental rain over the 10-year observation period (2015-2025) has been experienced in the region since the beginning of time (Figure 28). However, since 2024, a downward trend has been noted, marking a period of lower rainfall going into 2025.

The groundwater level drawdown for the region has responded well to the rains mentioned (albeit the delayed response), with positive groundwater fluctuation trends recorded since 2017. Even borehole C3N0064 finally climbed to the initial water level mark after 7yrs of reporting negative fluctuations. This is almost the same time that C3N0075 showed a downward trend. Given the proximity of these boreholes, it is suspected that they are used interchangeably. The overall gradual rise in groundwater level drawdown is depicted clearly in Figure 30, which shows the mean groundwater levels of the region.

Generally, the groundwater availability in this region is in an intact state with insignificant environmental stressors or human induced impacts.

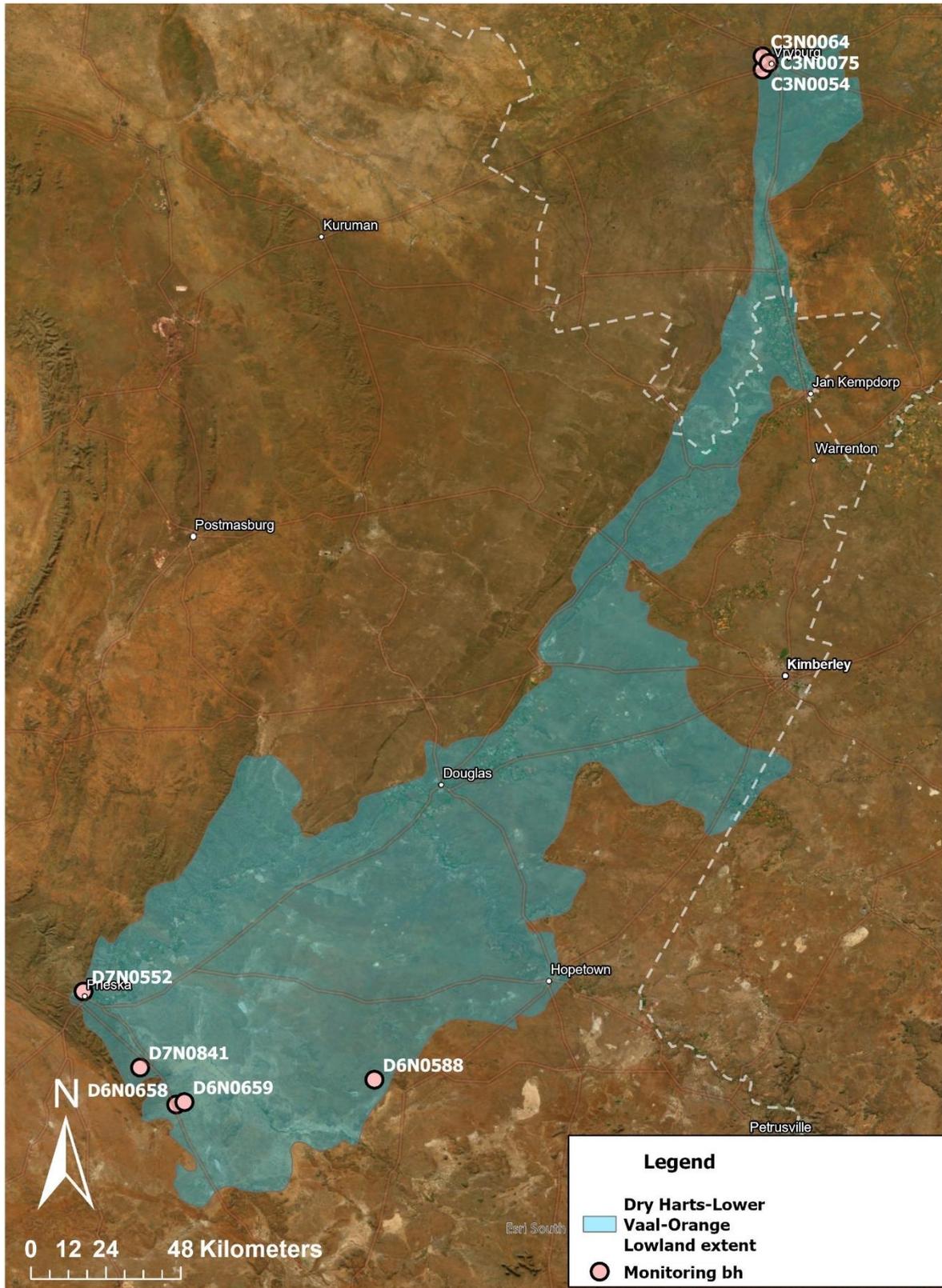


Figure 27: The extent of Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region and its monitoring boreholes

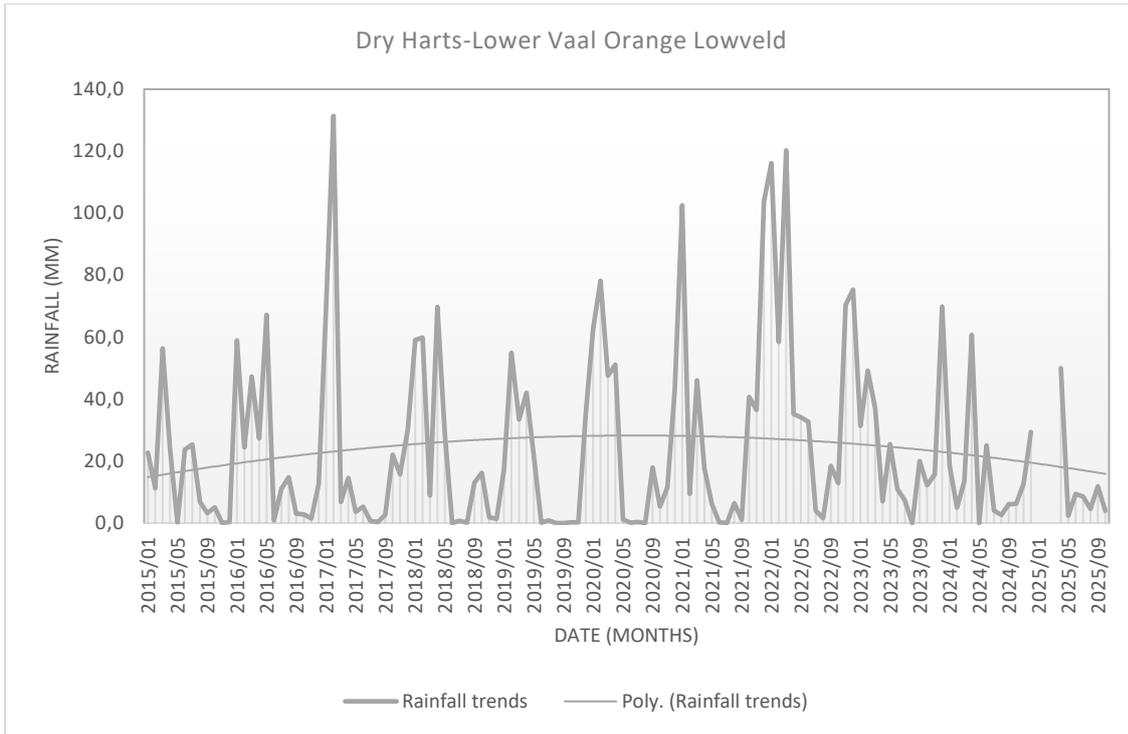


Figure 28: Rainfall trends for the Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region

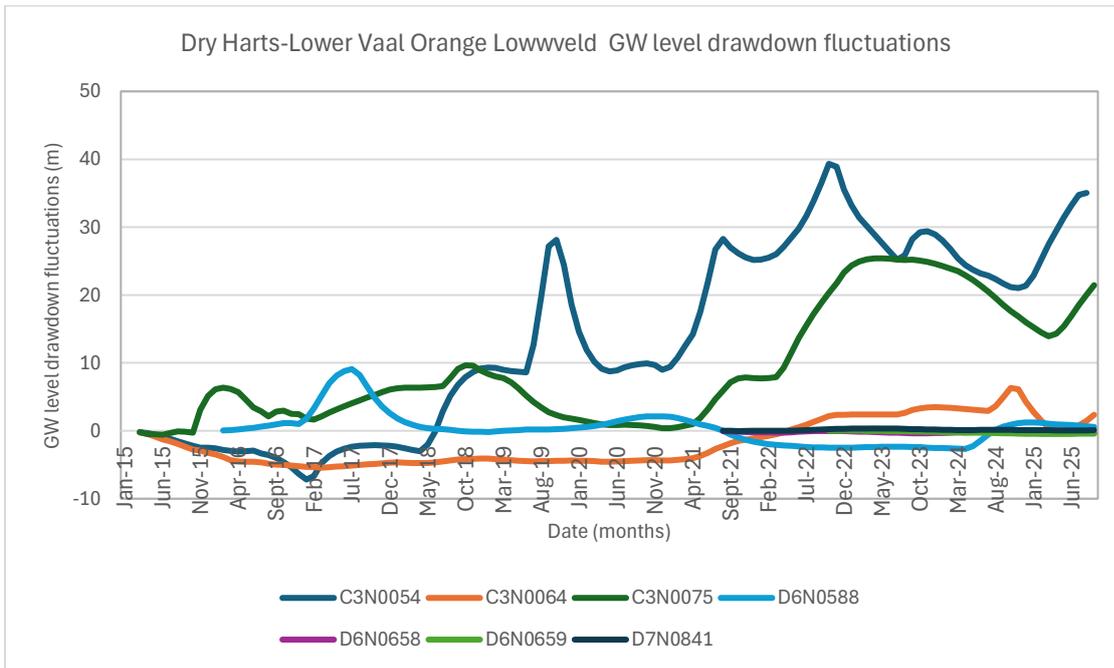


Figure 29: Groundwater level drawdown fluctuations for the Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region boreholes

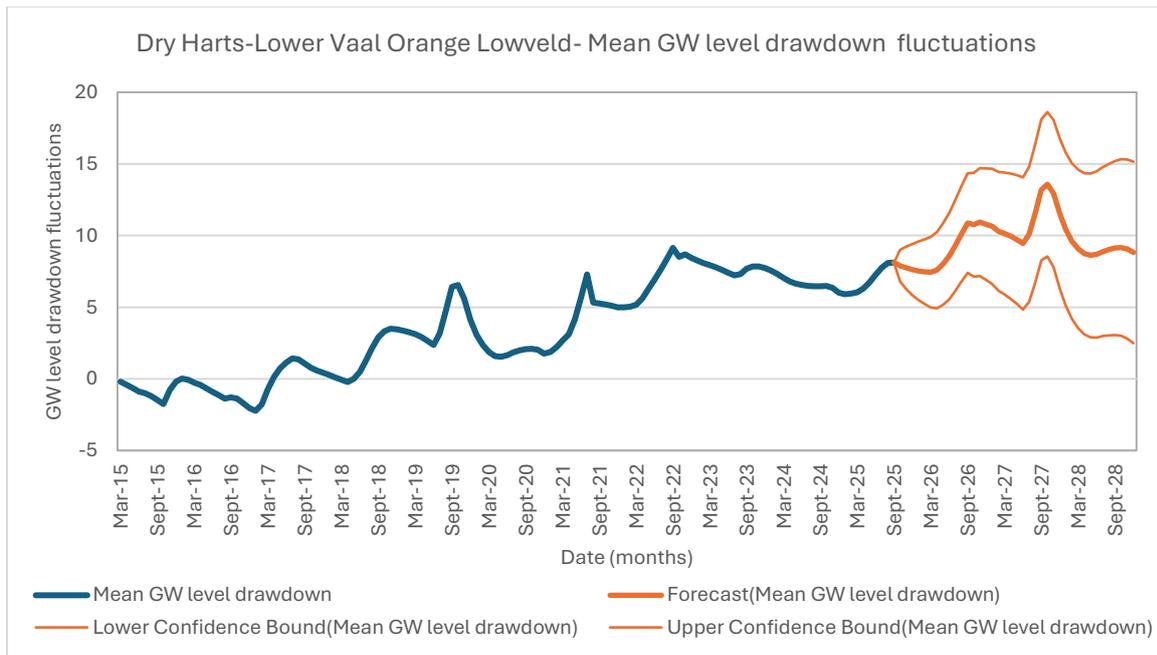


Figure 30: Mean groundwater level drawdown for the Dry Harts-Lower Vaal Orange Lowveld Hydrogeological Region

3.9 The Eastern Bankeveld Hydrogeological Region

The extent of Eastern Bankeveld Hydrogeological Region crosscuts the Mpumalanga and Limpopo Provinces. Its narrow strip northwestern border is formed by Mokopane to the north and Lebogakomo to the south. Further south, in the Mpumalanga Province, the region stretches north of route R38, slightly bypassing Mbombela to the east and stretches just south of Tzaneen in the north (Figure 31). The monitoring borehole distribution isn't fully representing the region but forms clusters to the northwest and the eastern edge of the region. Review and optimization of the monitoring programme is therefore recommended.

The rainfall trend was generated as average of SAWS District 33 and 47 rainfall stations records (Figure 32). Generally the region experienced higher rainfall between September 2016 and February 2024. Thereafter, a decline in rainfall going into 2025 was noted (Figure 32). This is likely to translate into decline in groundwater level drawn, even if delayed.

The borehole level drawdown trends for all the actively monitored boreholes for the Eastern Bankeveld hydrogeological are depicted in Figure 33. Due to large number of monitored boreholes, the legend isn't shown but just an indication of how the drawdown fluctuated in the past years to present for these boreholes. What is evident from the hydrograph is that the aquifers experienced a decline in water availability for a significantly longer period (2015-2023). Thereafter, a fluctuating rise was noted. Fewer boreholes during this time maintained horizontal trends though to a slight rise. The latest trends indicated a groundwater level drawdown dip in early 2025, but quickly recovered. This is indicated clearly in Figure 34 which shows the average groundwater level drawdown for the entire region.

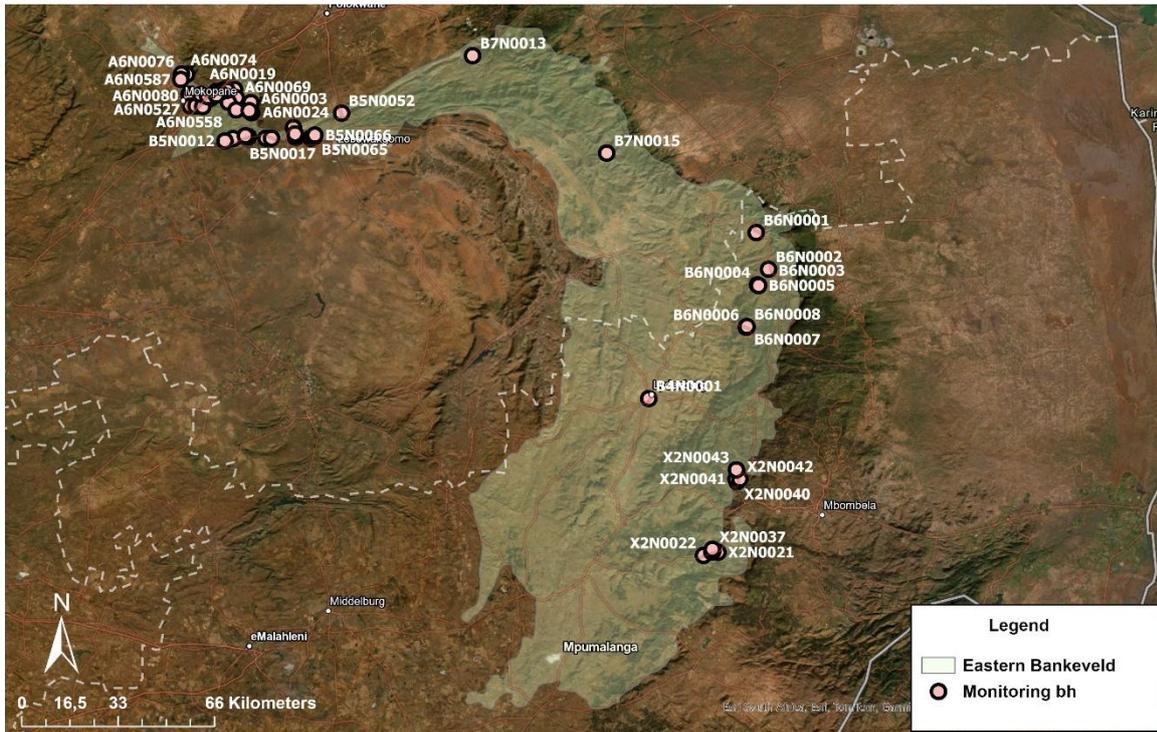


Figure 31: An extent of the Eastern Bankeveld Hydrogeological region and its monitoring boreholes

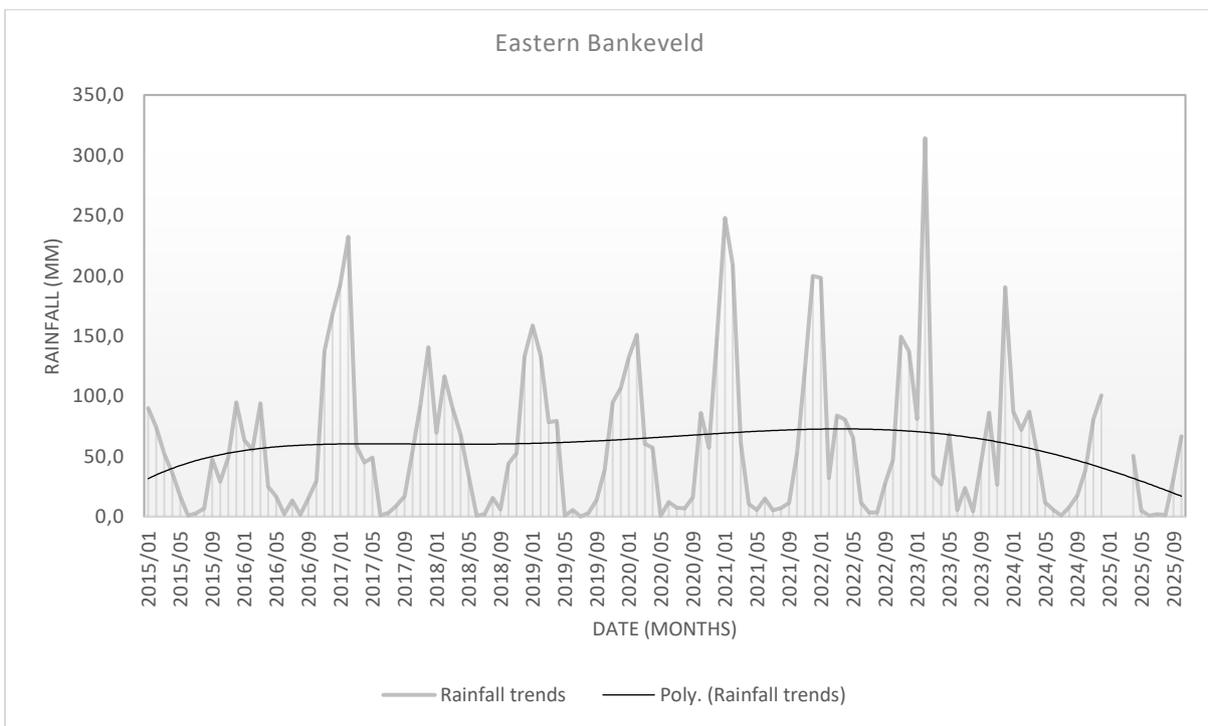


Figure 32: Rainfall trends for the Eastern Bankeveld hydrogeological region

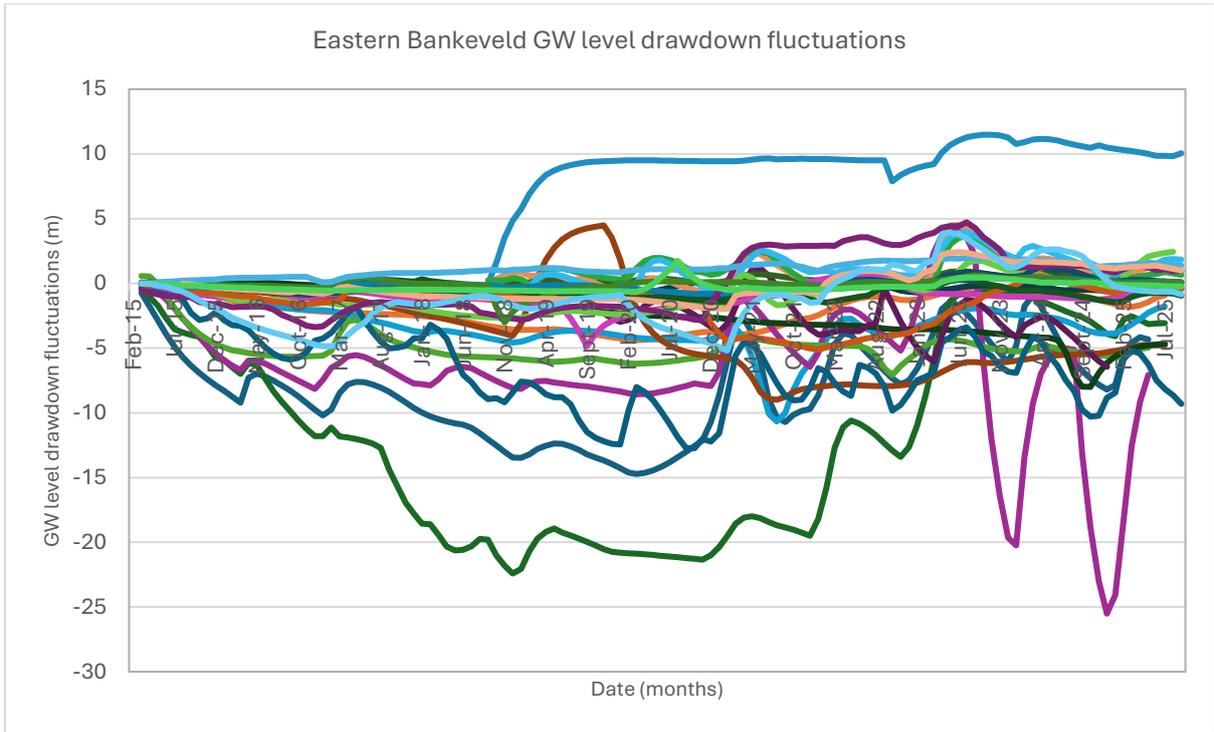


Figure 33: Groundwater level drawdown fluctuation for the Eastern Bankeveld boreholes

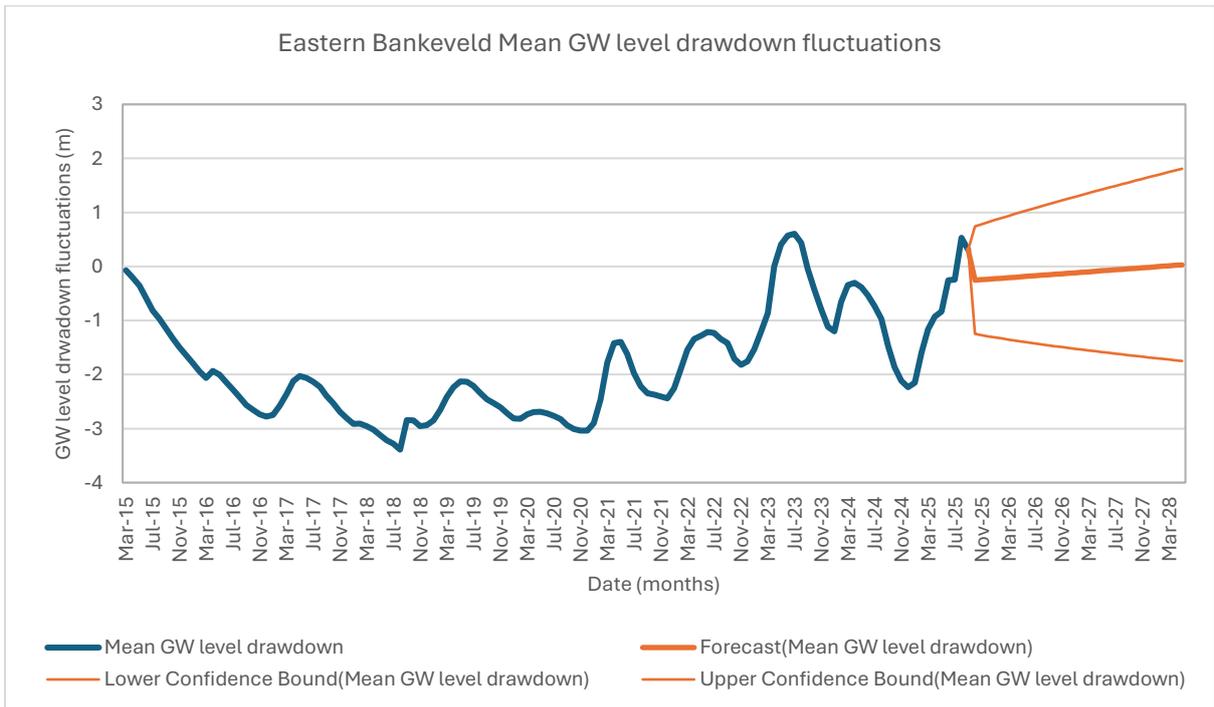


Figure 34: Mean groundwater level drawdown fluctuations for the Eastern Bankeveld Hydrogeological Region

3.10 The Lowveld Hydrogeological Region

The Lowveld hydrogeological region stretches from Mbombela in the south to Thoyandou/ Louis Trichardt in the north. To the east, the region lies slightly off the Mozambican border whilst on the western side the outskirts of LebowaKomo and Polokwane serve as the border (Figure 35). The region is well represented with monitoring boreholes (Figure 35).

The lowveld region is one of the areas that generally receive higher rainfall. Figure 36 is a testament to this where good rains were observed between September 2015 and April 2024. From mid-2024 to date the region experienced lower than average rainfall.

The Groundwater level drawdown from the monitored boreholes indicated consistent horizontal negative trends (showing a drawdown of approximately 3m compared to the initial water level) (Figure 37). Fewer boreholes have maintained positive horizontal trends though. The latest trends to date are dominated by the fluctuating downward trends. This is clearly shown by Figure 38 where a steady downward trend is more visible. Closer monitoring needs to be conducted for this region as the rainfall trends suggest that aquifers should be replenished.

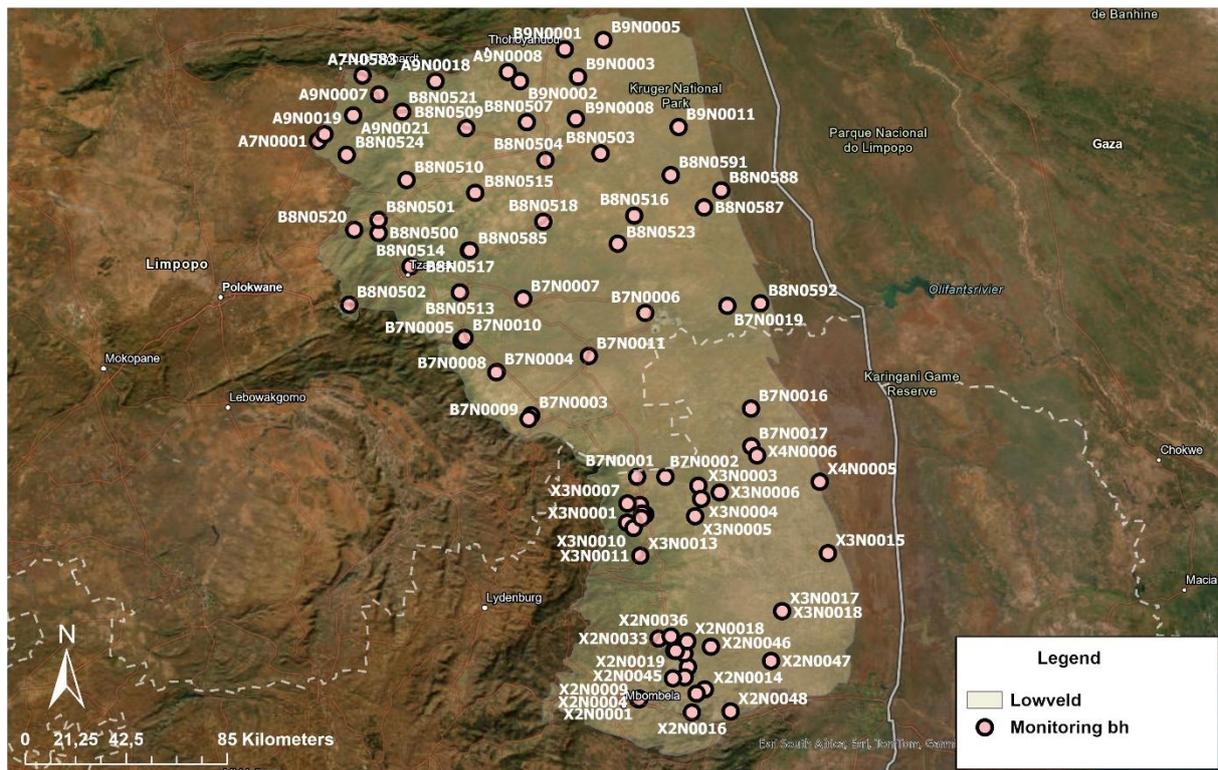


Figure 35: An extent of the Lowveld Hydrogeological region and its monitoring boreholes.

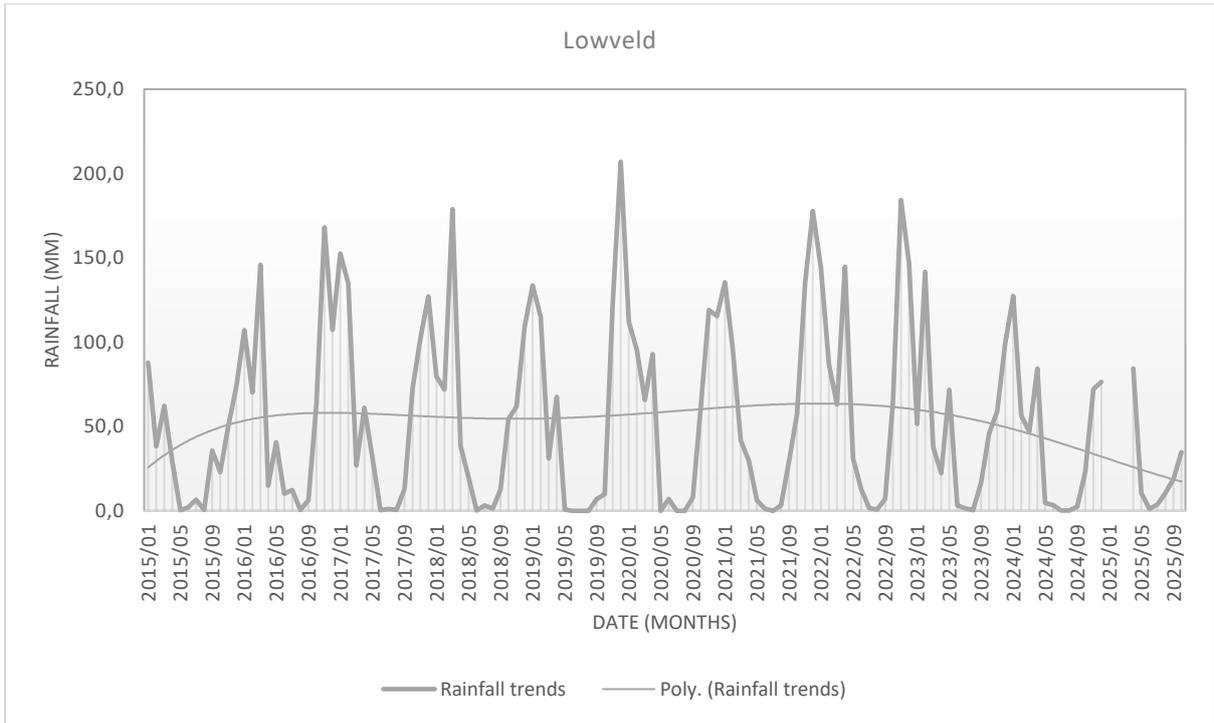


Figure 36: Rainfall trends for the Lowveld Hydrogeological Region

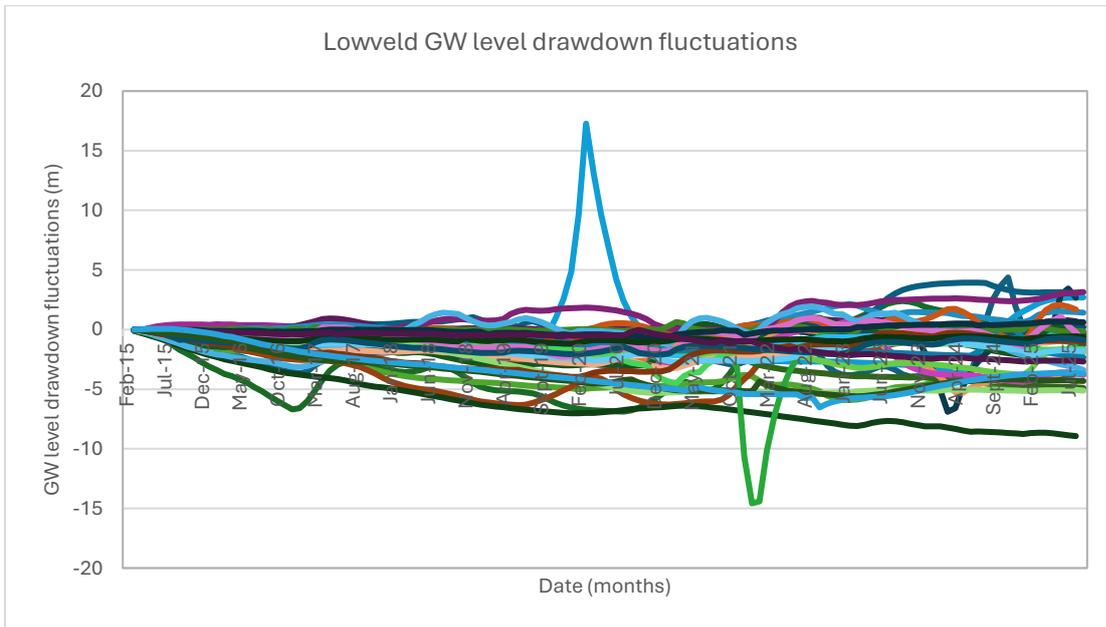


Figure 37: The Lowveld groundwater level drawdown fluctuations

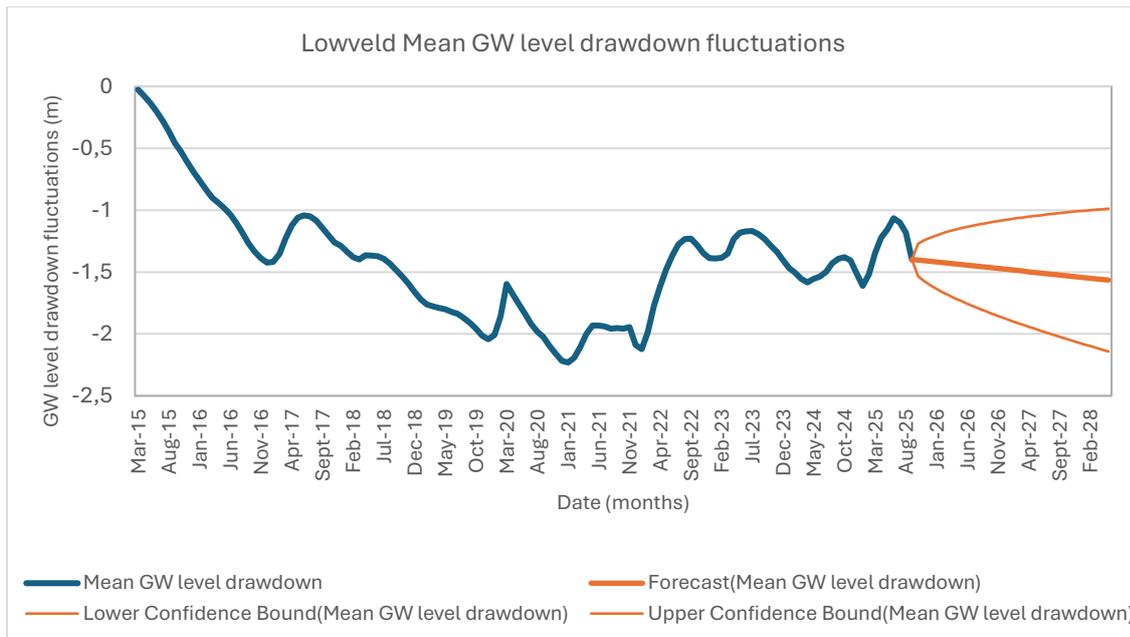


Figure 38: The Lowveld mean groundwater level drawdown fluctuation trends

3.11 The Eastern Highveld Hydrogeological Region

The Eastern Highveld Hydrogeological Region is bisected in half by the provincial border of Free State and Mpumalanga. To the north, the bordering towns include Middleburg and Carolina, to the west, Johannesburg. To the southwest and south Kroonstad and Bethlehem, respectively, exist. On the eastern side Volksrust serves as the border (Figure 39).

Regarding groundwater monitoring, only the northern half falling in Mpumalanga is monitored. There are no monitoring boreholes in the Free State portion (Figure 39). This needs to be rectified as soon as possible. At this stage the water level assessment for the region is rather focused on a portion of the hydrogeological region and purports to be for the entire region.

The Eastern Highveld Hydrogeological Region has enjoyed good rains for almost the entire observation period (2015-2025). A bit of lower rainfall was noticed though between 2015 and mid-2016 and late 2023 to date (Figure 40).

The rains have maintained positive groundwater level drawdown fluctuations for most of the observation period, save for the period from early 2024 to early 2025, where negative trends were recorded for some boreholes (Figure 41). Anthropogenic activities are attributed to the decline in water levels for some of these boreholes. The decline in rainfall was not severe to cause a change that could not be observed prior to mid-2016 rains. The prevailing trends are of rising water levels from the observed boreholes. These changes are depicted clearly in Figure 42, including the latest upward level rise. Given the status of groundwater in this region, no groundwater management immediate interventions are recommended for this region.

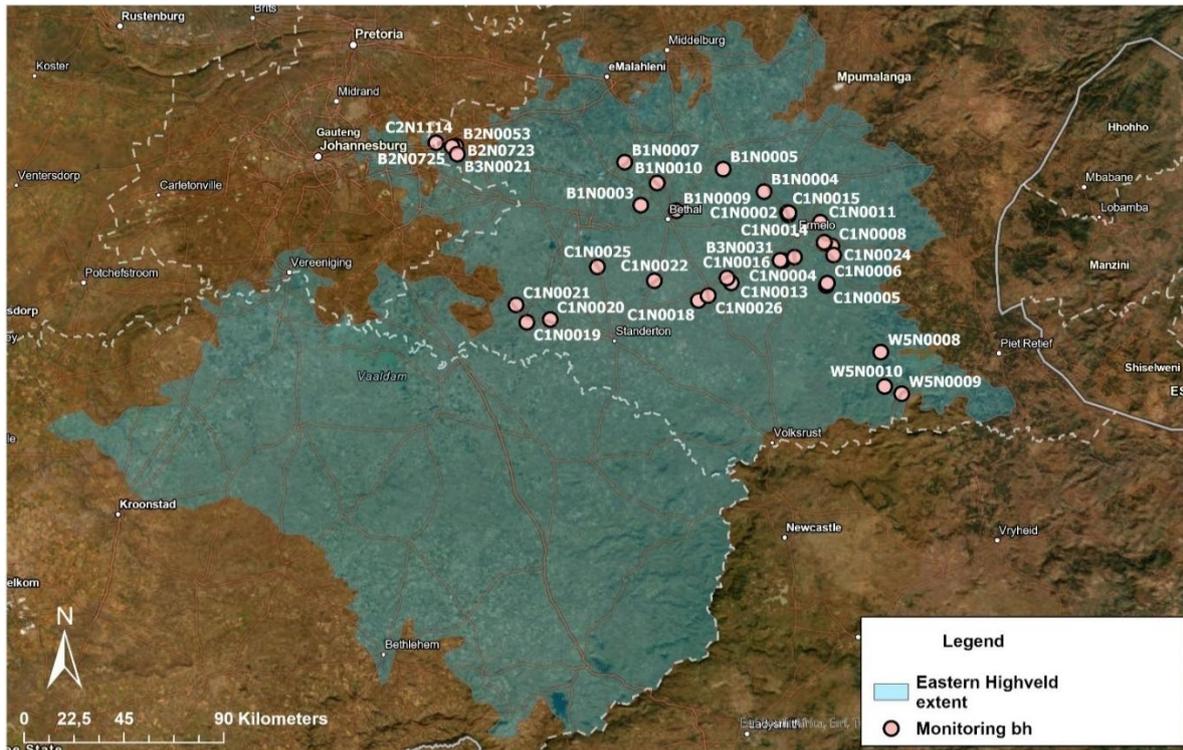


Figure 39: Layout of the Eastern Highveld Hydrogeological Region and its monitoring boreholes

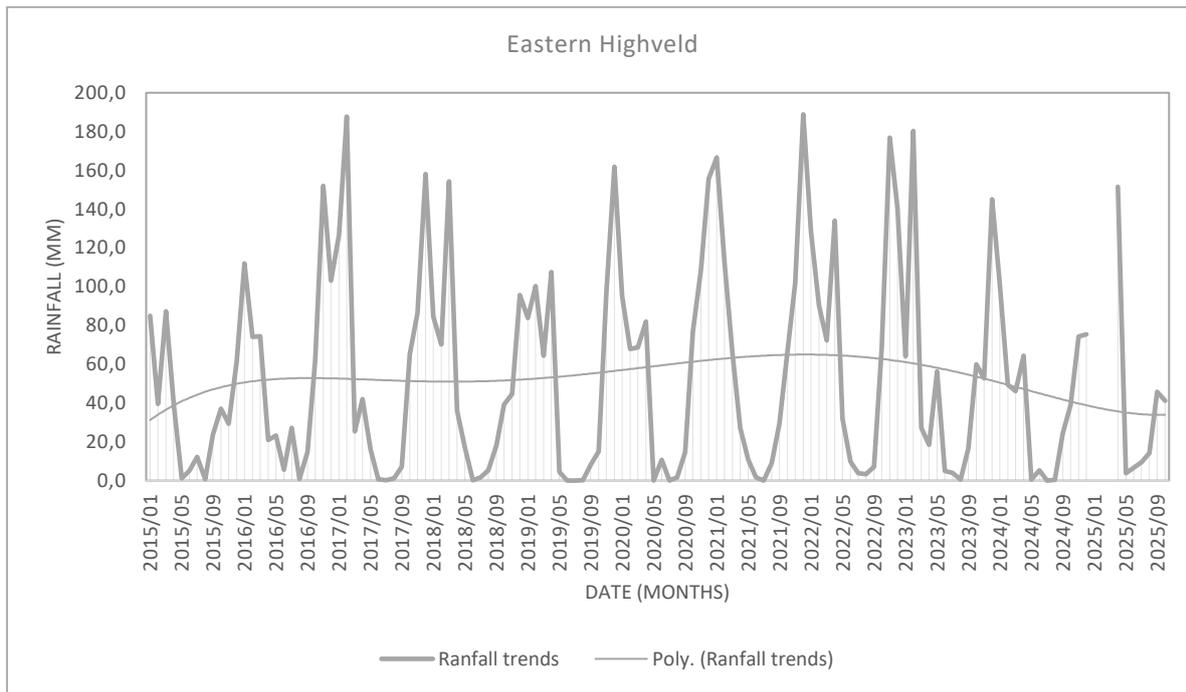


Figure 40: Rainfall trends for the Eastern Highveld.

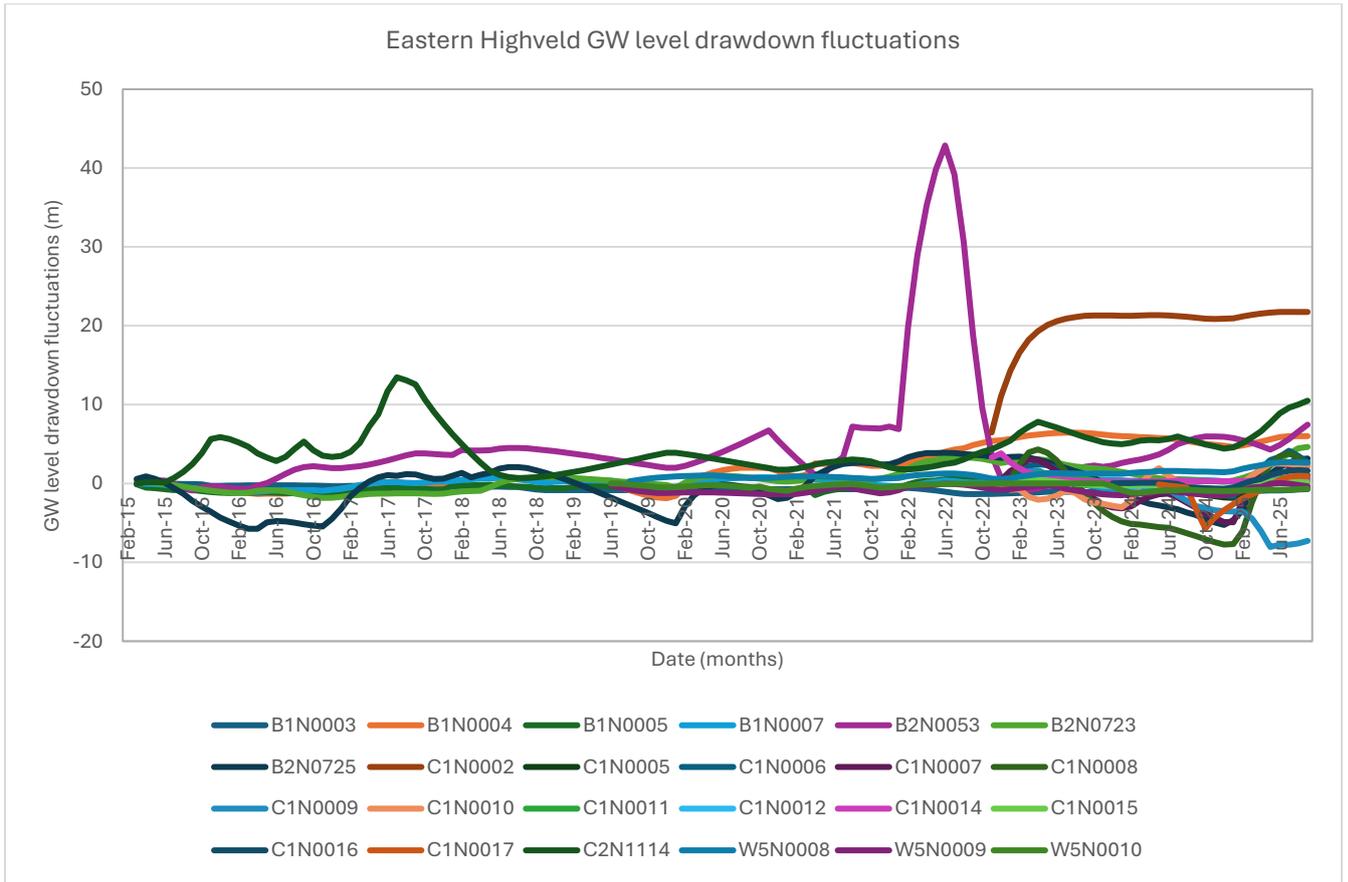


Figure 41: Groundwater level drawdown fluctuations for the Eastern Highveld boreholes.

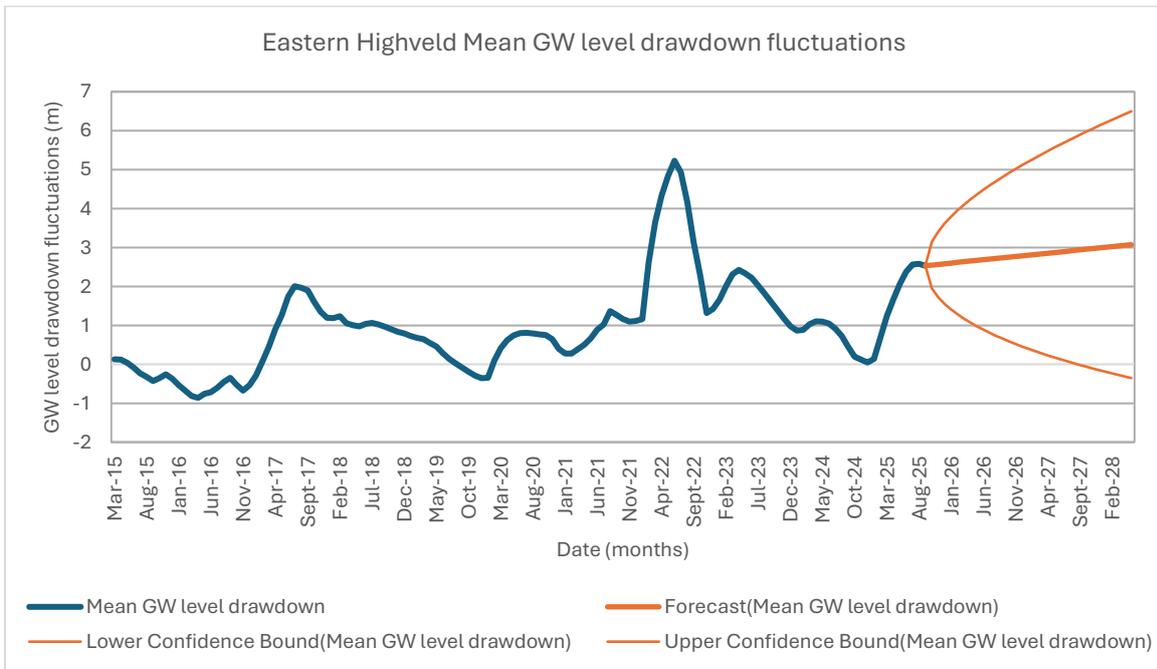


Figure 42: Mean Groundwater level drawdown fluctuations for the Eastern Highveld Hydrogeological Region

3.12 The Northeastern Middleveld Hydrogeological Region

The Northeastern Middleveld Hydrogeological Region surrounds the southern, western and northern borders of Eswatini, with its far northern border formed by the town of Mbombela.

Twenty-two (22) boreholes were utilized for assessment of water level trends for the Northeastern Middleveld Hydrogeological Region (Figure 43). The distribution of these boreholes is in the north, leaving the southern portion of the region unrepresented. ***The monitoring network needs to be expanded to cover the entire region.***

The rainfall trends for the Northeastern Middleveld Hydrogeological Region revealed a slight rise at the beginning of the observation period, plateaued for a while (mid-2016 until mid-2021) before an increase was recorded until mid-2024 and later took a downward trend with the latest rainfall records (Figure 44).

A zoom-in into groundwater level drawdown fluctuations suggest that this region has been enjoying positive trends throughout the assessment period (Figure 45). This holds true for all boreholes but X1N0013 and W5N0007, which showed a water level decline of up to 3.5m between February 2015 to June 2018 and August 2016 to May 2022 respectively. This borehole (W5N0007) has since recovered and showed a water level rise, while X1N0017 has maintained a horizontal negative trend throughout the observation period. Generally, seasonal fluctuations are demonstrated by most of the observed boreholes with positive peaks ranging between 2m and 6m common.

From an overview point, the groundwater levels for this region are indicating sustenance as a resource without showing negative climatic effects or negative anthropogenic impacts. Figure 46 serves as a testament to this, with mean groundwater level drawdown fluctuations showing positive trends.

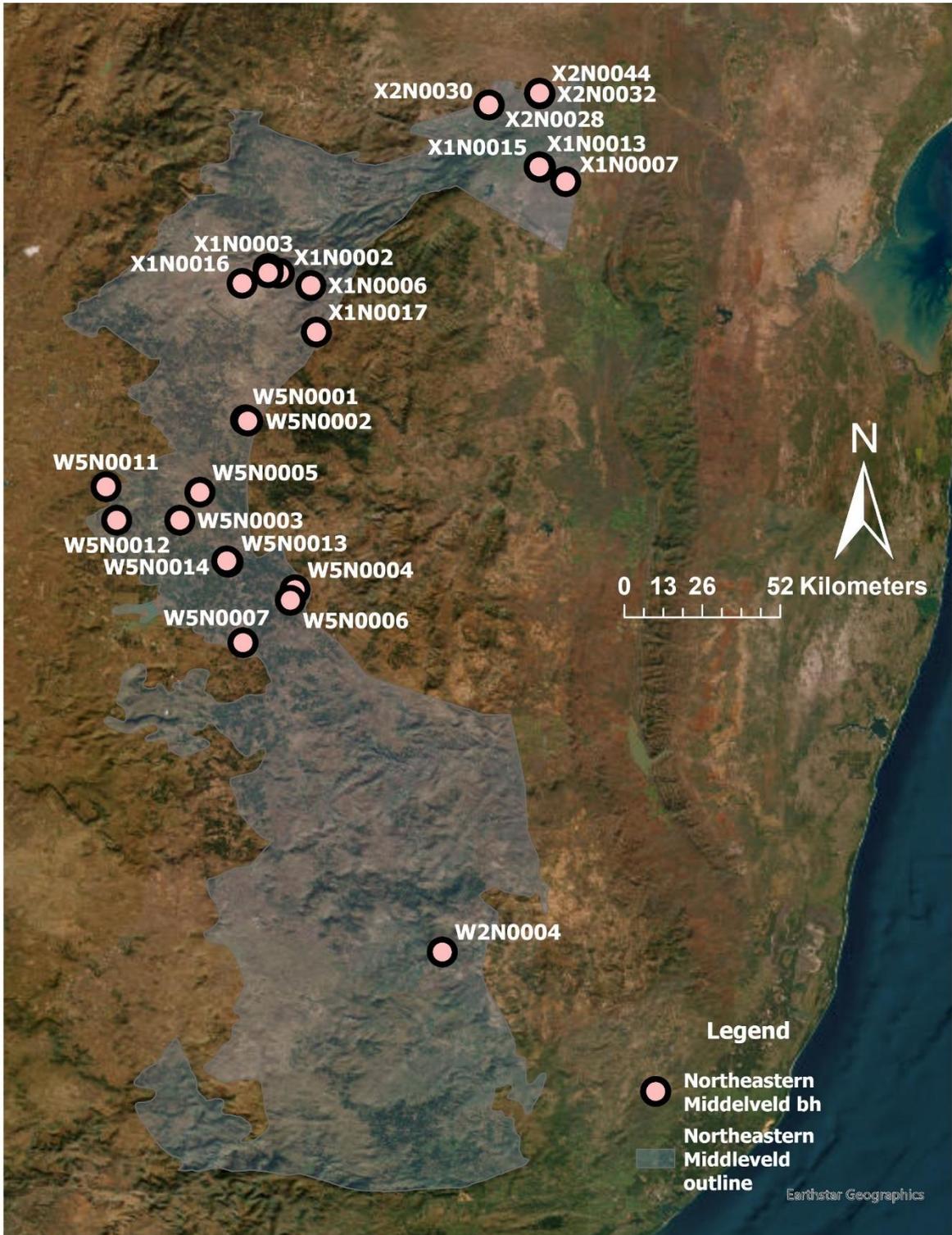


Figure 43: Borehole locality and the extent of the Northeastern Middleveld Hydrogeological region

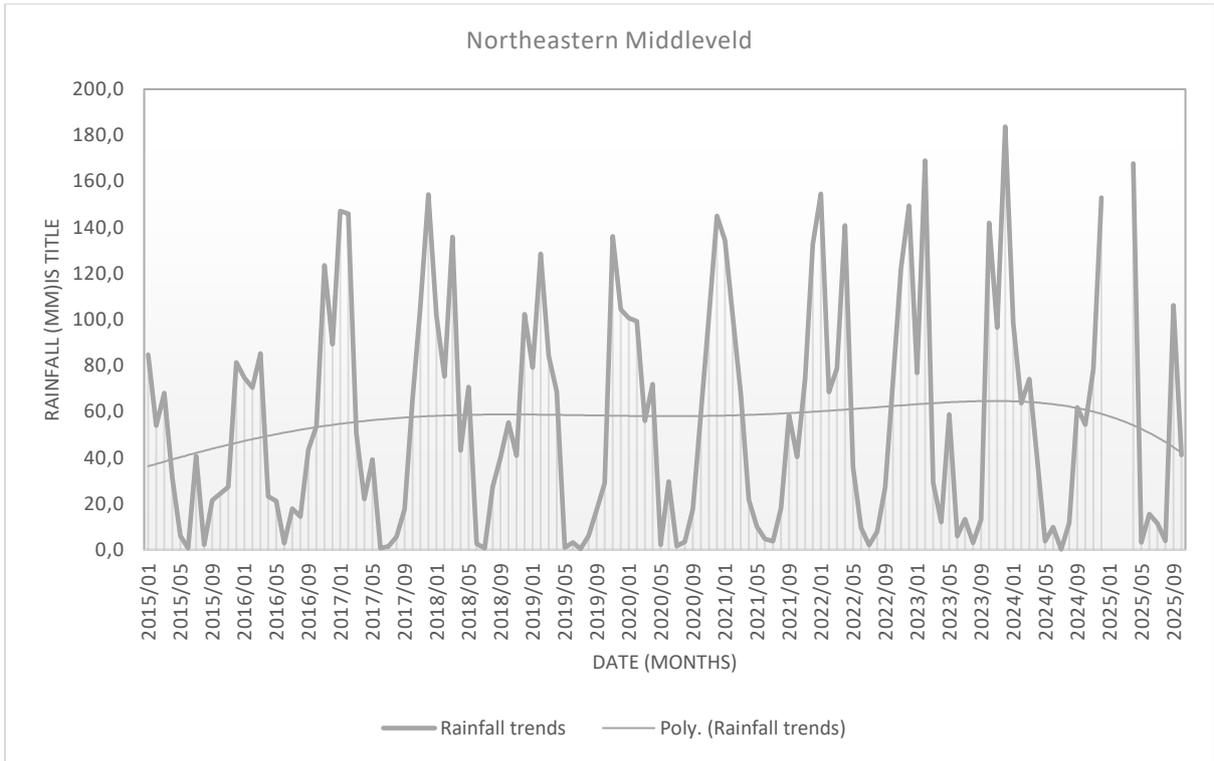


Figure 44: Rainfall trends for the Northeastern Middleveld hydrogeological Region

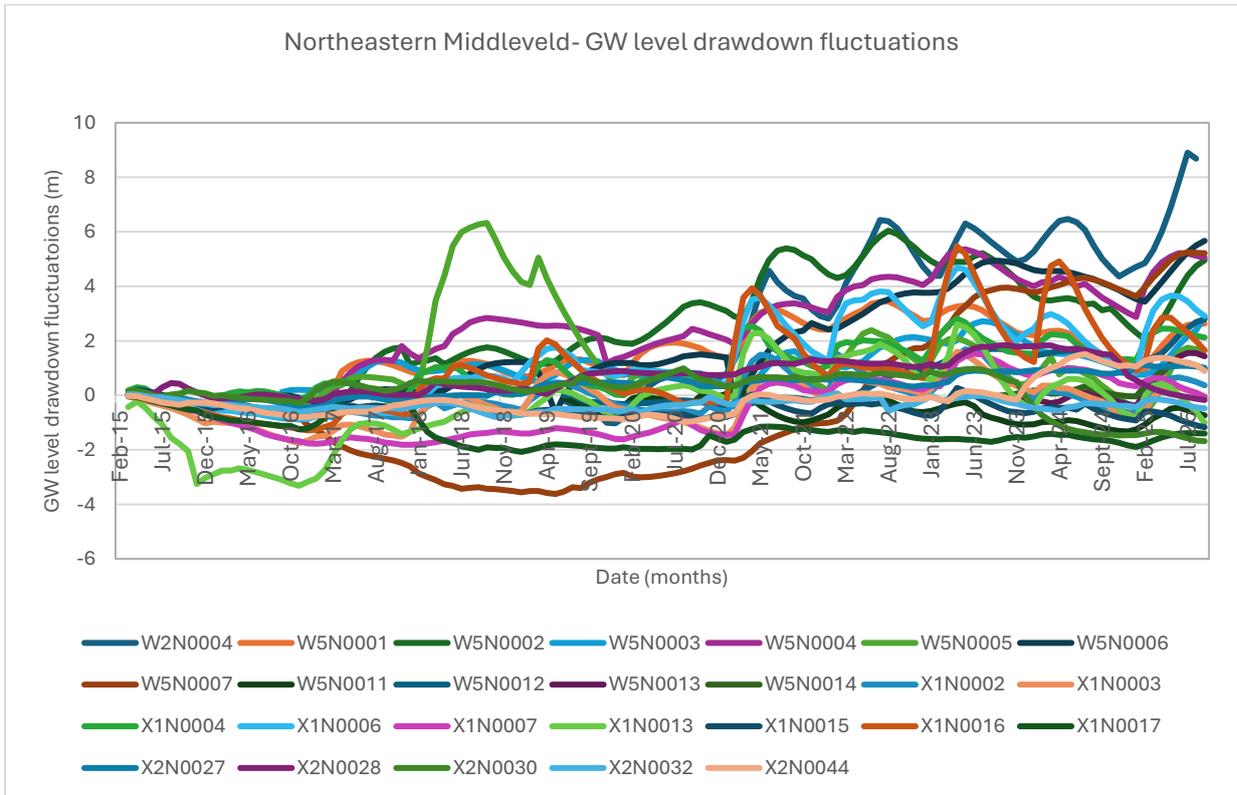


Figure 45: Groundwater level drawdown fluctuations for the Northeastern Middleveld Hydrological Region

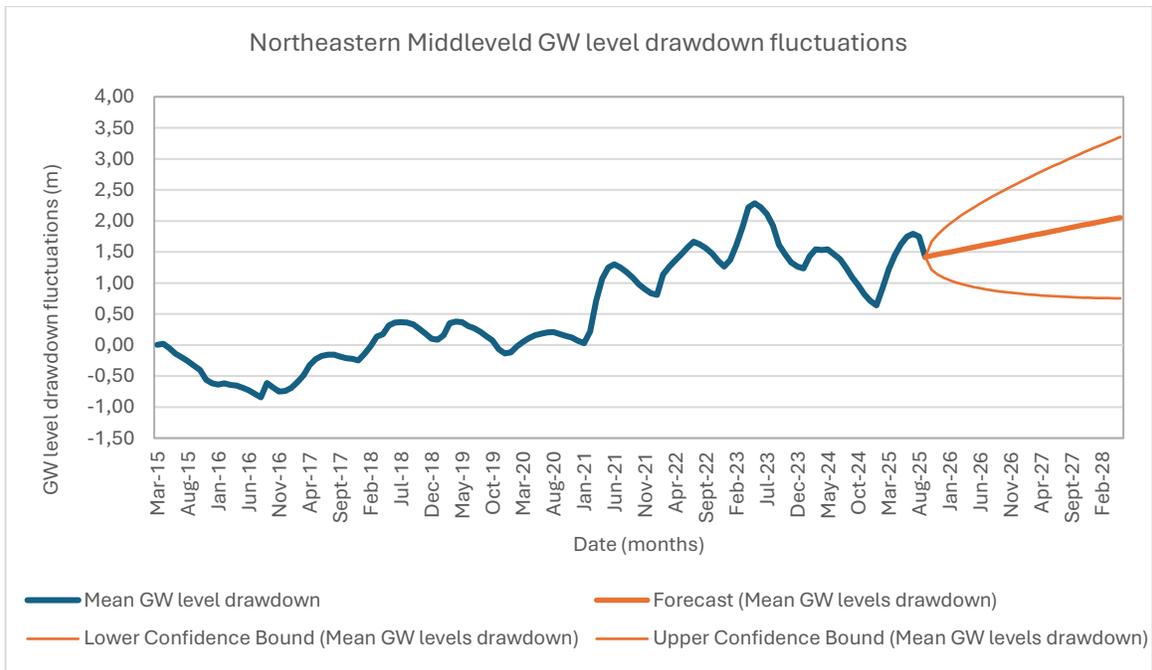


Figure 46: Mean groundwater level drawdown fluctuations for the Northeastern Middleveld Hydrogeological region

3.13 The Soutpansberg Hydrogeological Region

The Soutpansberg Hydrogeological Region extends from Louis Trichardt/ Thoyandou in the south and bordered by route R523 in the northwestern side. On the eastern side, it lies south of route R525 (Figure 47). The monitoring borehole distribution for this region is adequate (Figure 47).

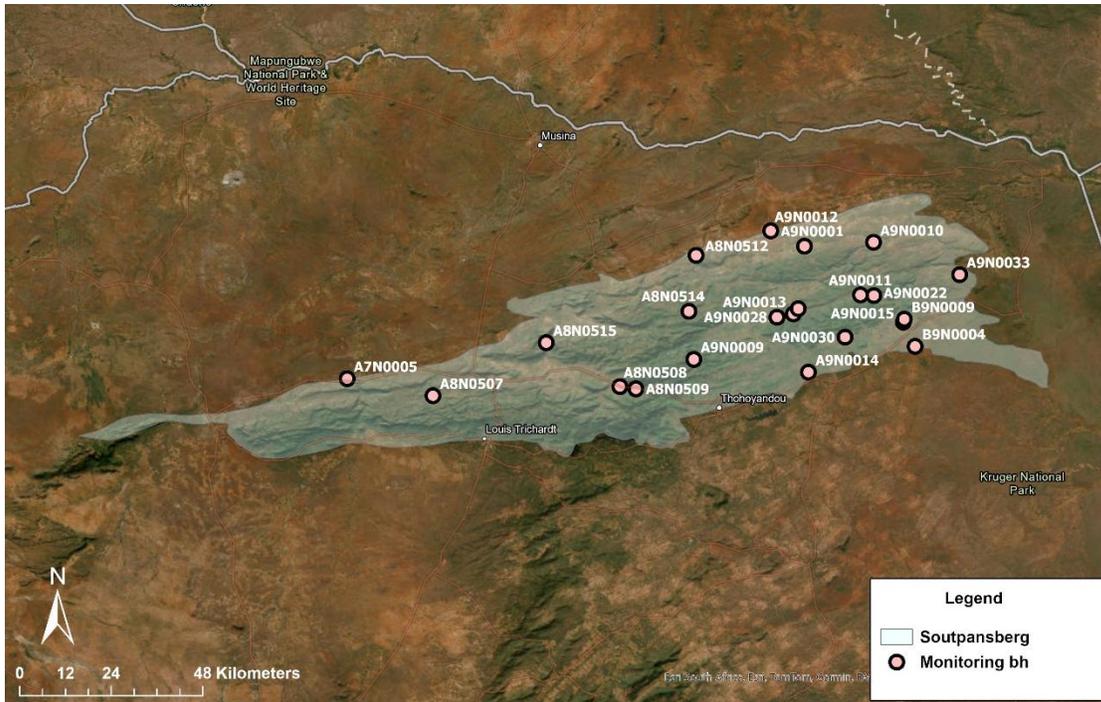


Figure 47: An extent of the Soutpansberg hydrogeological region and its monitoring boreholes

The rainfall for the region has remained average for the greater part of the observation period. Above average rains were observed for the period September 2029 to May 2023 (Figure 48). The period post May 2023 to date saw a decline in rainfall for the region (Figure 48).

The groundwater level drawdown for the boreholes for this region showed negative horizontal trends until February 2021 where a rise in water level drawdown (mostly to positive levels/ above initial water level) was seen, in response to groundwater recharge. This lasted until October 2023, thereafter the prevailing downward trends were observed (Figure 49). This is the same period that borehole A9N0012 showed prominent downward trend which could be associated with dewatering. The explained trends are depicted clearly in Figure 50. A close monitoring eye needs to be kept on the groundwater levels for this region.

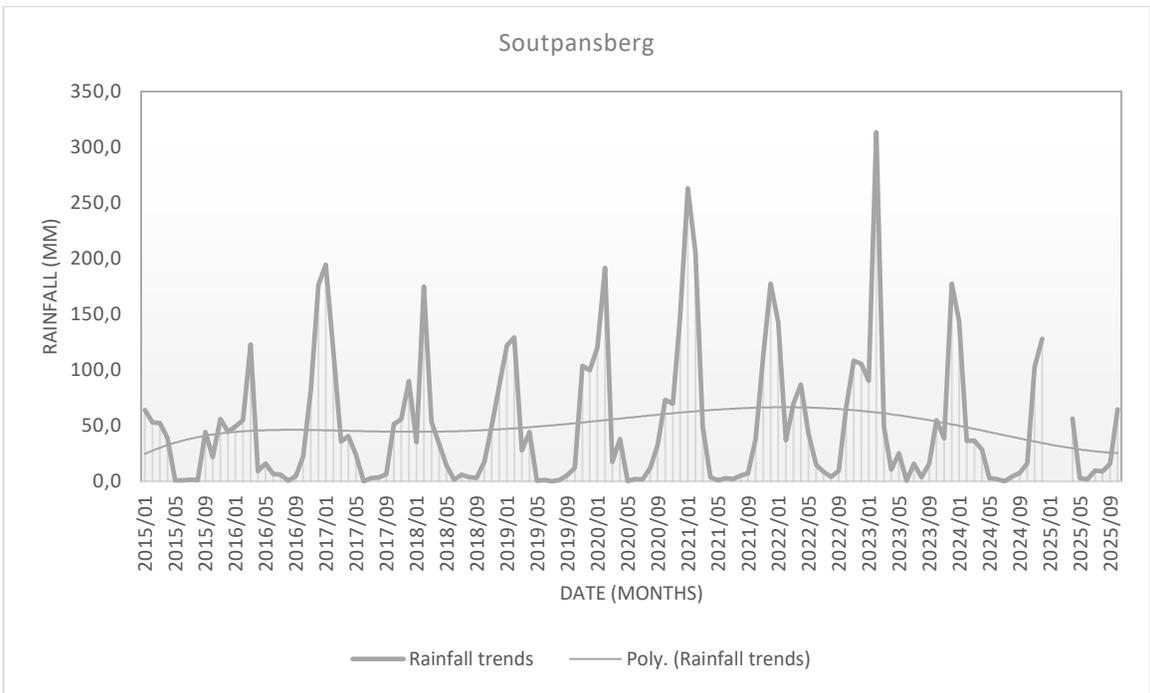


Figure 48: Rainfall trends for the Soutpansberg hydrogeological region

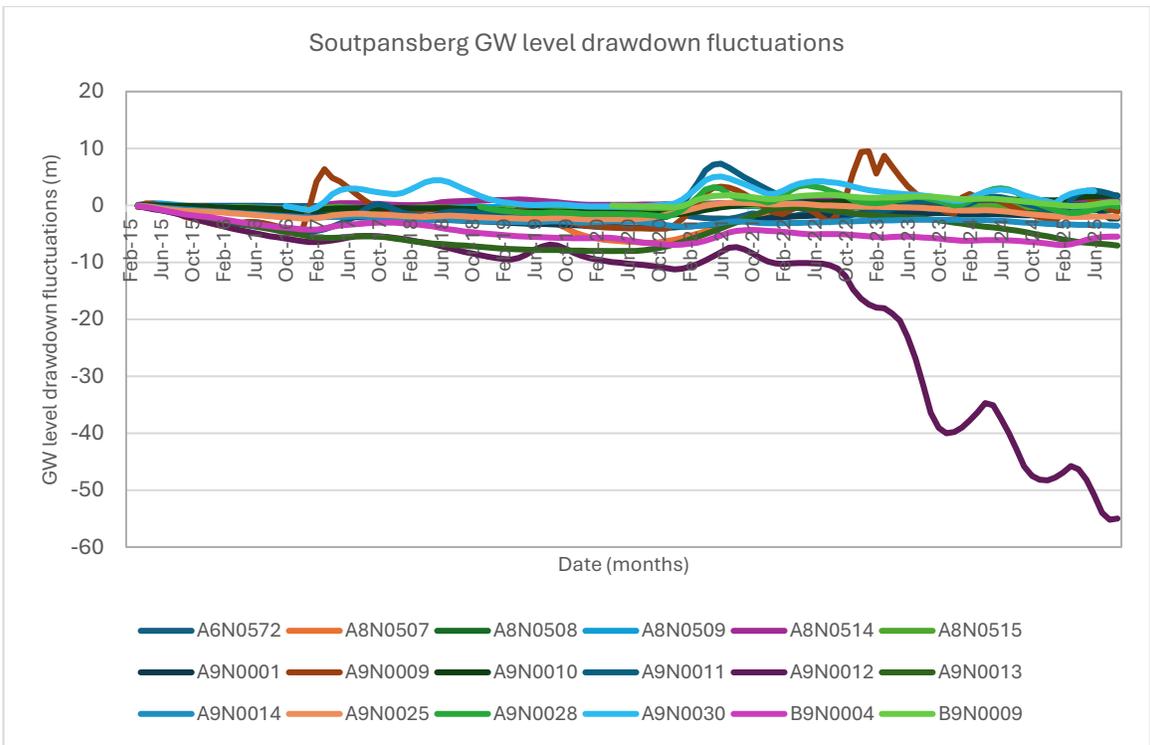


Figure 49: The Soutpansberg groundwater level drawdown fluctuations

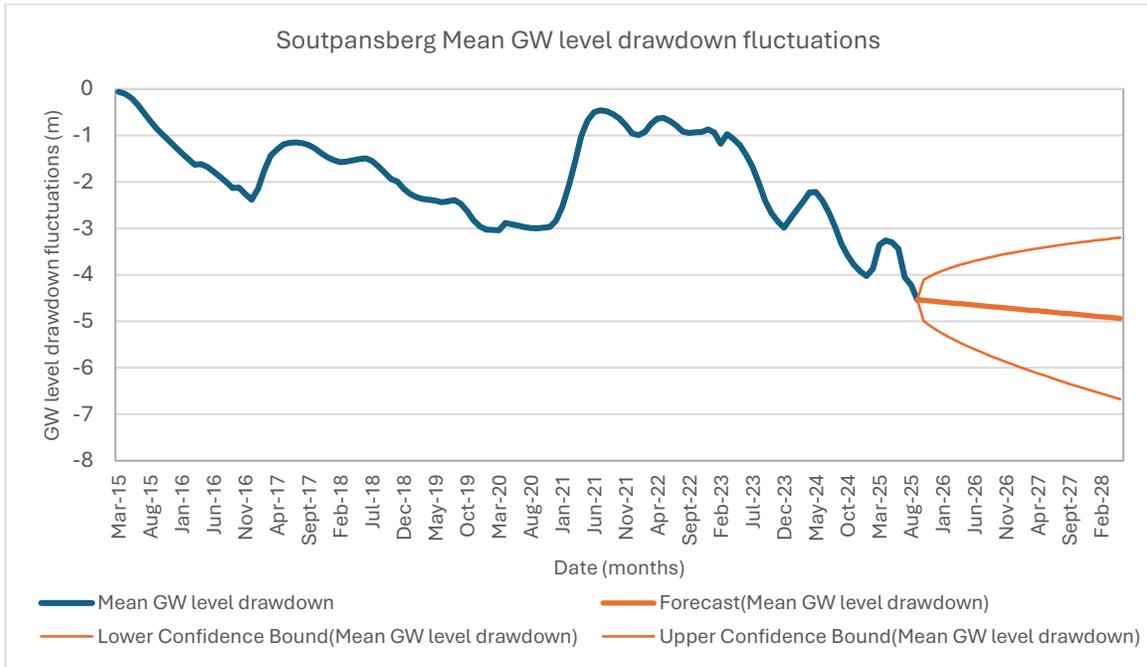


Figure 50: Mean groundwater levels for the Soutpansberg Hydrogeological Region

3.14 The Soutpansberg Hinterland Hydrogeological Region

The Soutpansberg Hinterland Hydrogeological Region forms a narrow strip bounded by the Limpopo River on the eastern side and route R561 on the western side. To the north, it lies south of Musina whilst on the south it lies north of Louis Trichardt (Figure 51). The monitoring boreholes for this region are well distributed across, offering the necessary groundwater data for this region (Figure 51).

The rainfall trends for the Soutpansberg Hinterland Hydrogeological Region were derived from the average rainfall of SAWS rainfall monitoring stations in Districts 35, 50 and 65. Figure 52 indicates the rainfall trends with a gradual increase between September 2016 and early 2023, then followed by a steady decline towards mid-2025.

The groundwater fluctuations for the monitoring boreholes in Soutpansberg Hinterland Hydrogeological Region maintained horizontal negative drawdown trends for the larger period of the observation period (Figure 53). It was until early 2021 that a positive trend was noted, marking a rise in water level drawdown while some boreholes maintained a downward trend over this period (Figure 53). This prevailed as horizontal trends until another upward episode of water level drawdown was seen in early 2025. This prevailed until today. This is captured clearly in Figure 54 which depicts the average groundwater level drawdown for the region.

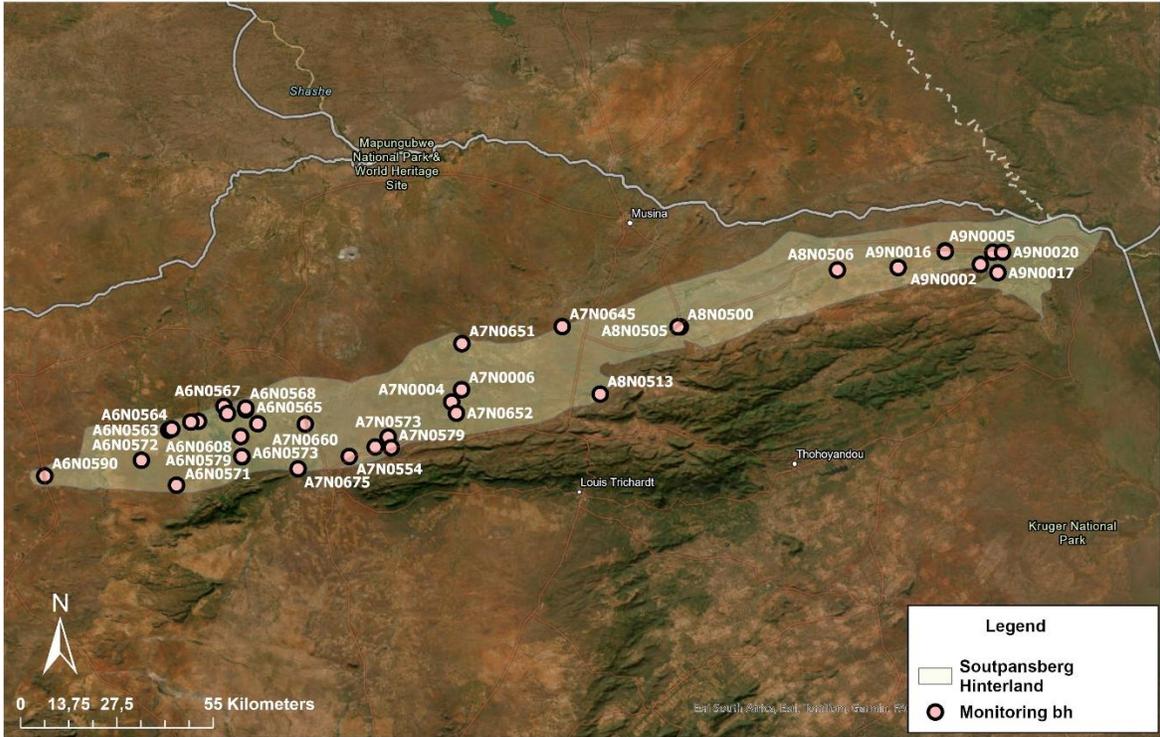


Figure 51: The extent of the Soutpansberg Hydrogeological Region and its monitoring boreholes

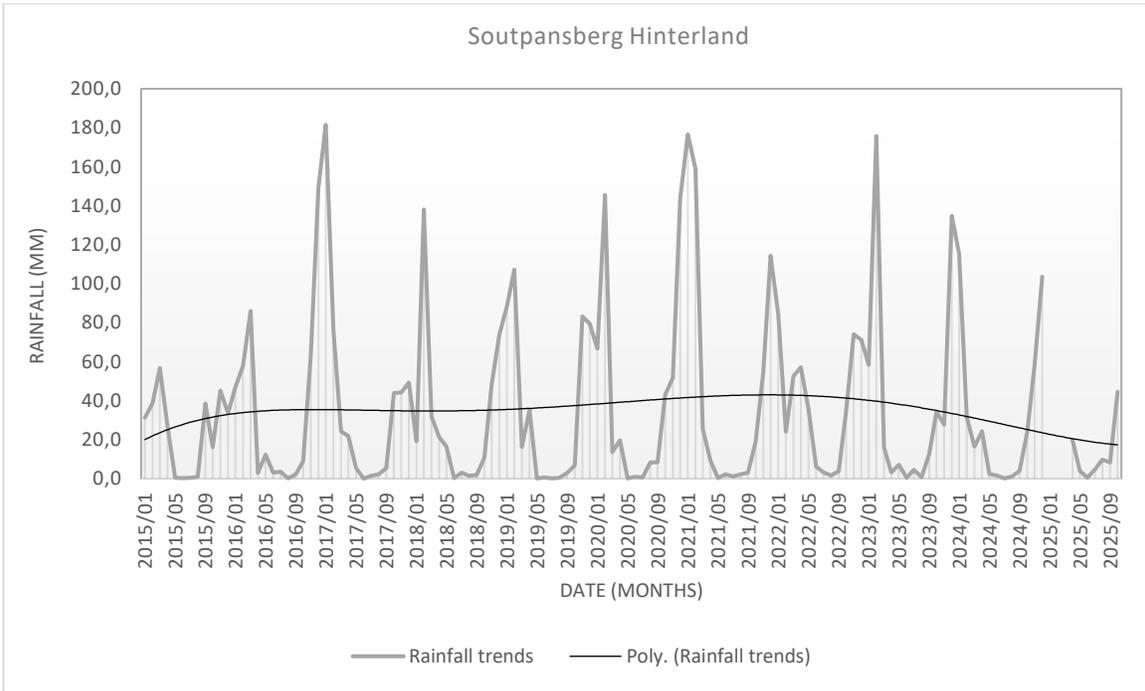


Figure 52: Rainfall trends for the Intermontane Soutpansberg Hinterland Hydrogeological Region

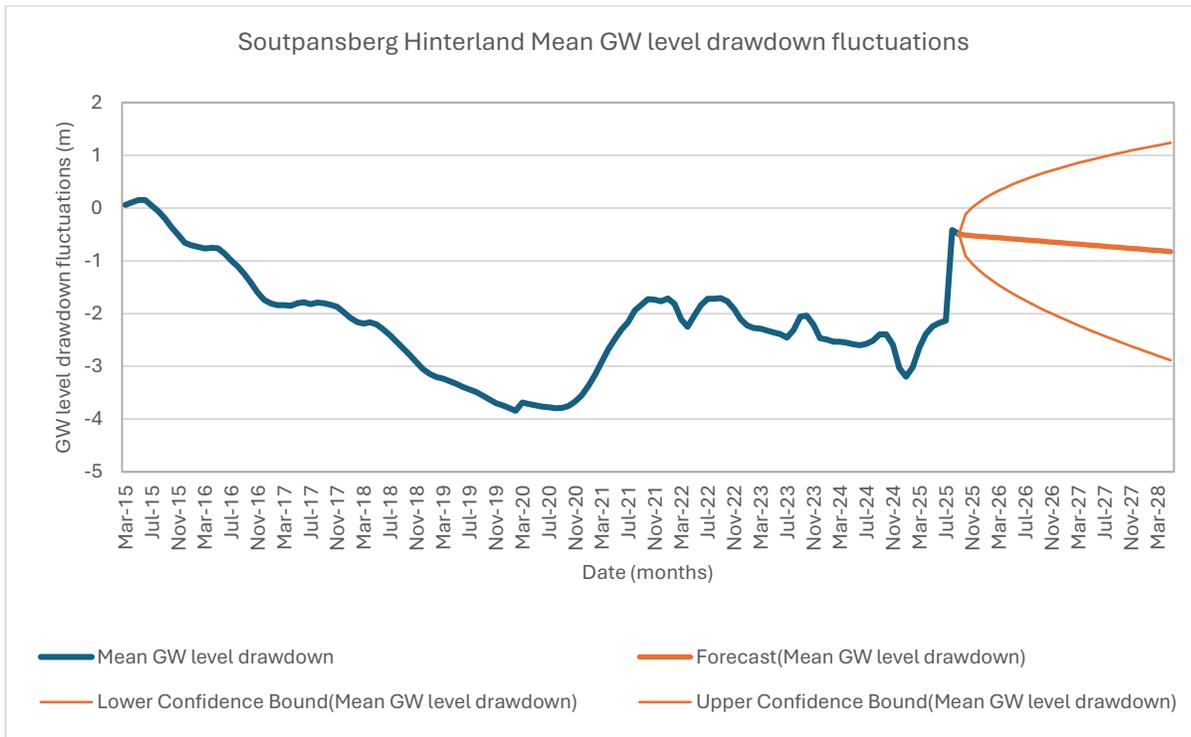


Figure 54: Mean groundwater level drawdown fluctuations for the Soutpansberg Hinterland Hydrogeological Region

3.15 The Limpopo Granulite Gneiss Hydrogeological Region

The Limpopo Granulite Gneiss Hydrogeological Region lies north of Lephalale. To the western side its border coincides with the South Africa/ Botswana national border while the northern parts are bounded by the South Africa/ Zimbabwe national border. To the east, it is bounded by Baltimore and Alldays (Figure 55). The region is well represented with monitoring boreholes (Figure 55).

The rainfall trends for the Limpopo Granulite Gneiss Hydrogeological Region were derived as an average from the rainfall station in SAWS Districts 35, 50, 65 and 77. An incremental rain was recorded from 2015 plateauing later in the year until 2019, whereafter an increase was noted until early 2023. The latter part of the observation period (mid 2023-2025) was marked by a declining rainfall trend (Figure 56).

The groundwater level drawdown corresponded with the rainfall patterns for this region. A declining trend was noted until 2021, followed by a fluctuating upward water level drawdown trend. The latest is marked by a suggested downward curvature, though. This was not the case for borehole A6N0580 which maintained a downward trend throughout the observation period (Figure 57). The above is clearly summarized by Figure 58 which depicts the mean groundwater level drawdown for the region, with water levels below the initial water levels (marking a downward trend).

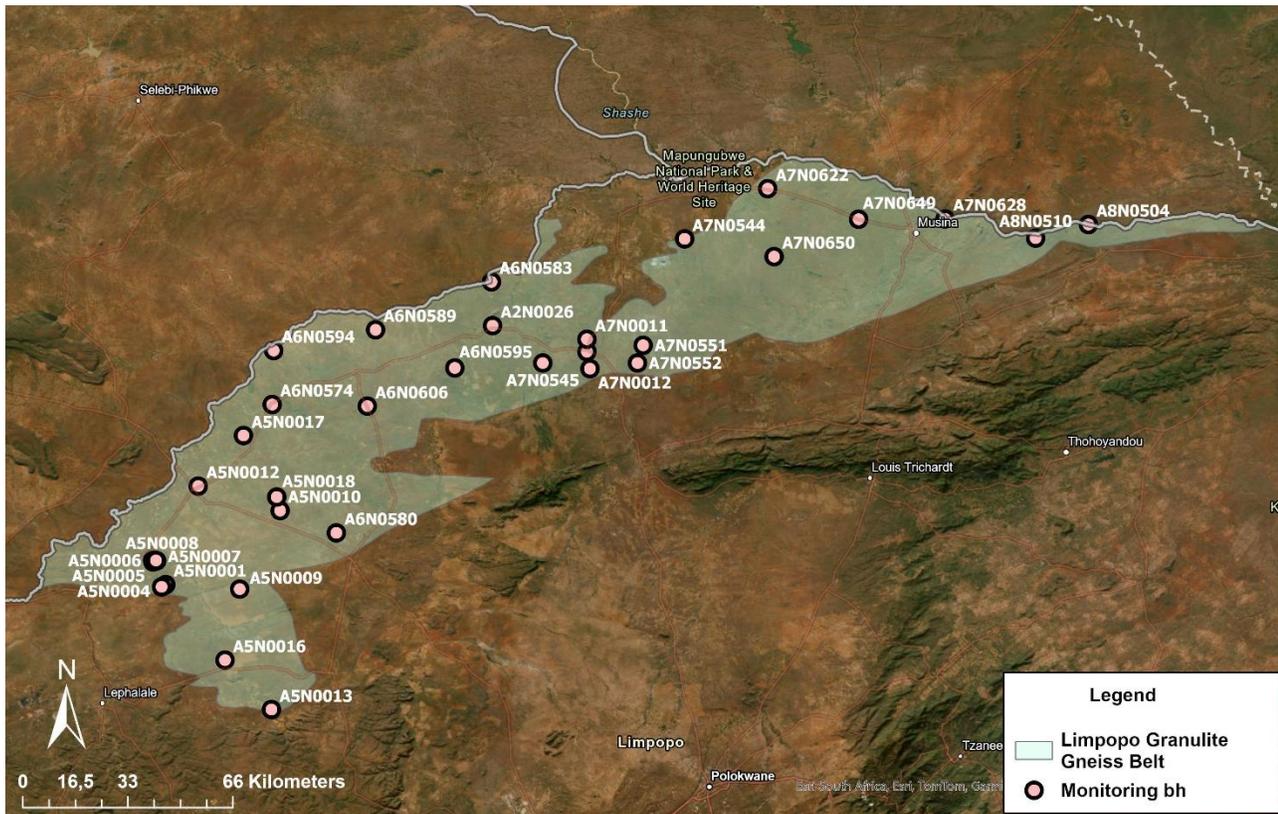


Figure 55: Locality of the Limpopo Granulite Gneiss Hydrogeological Region and its monitoring boreholes

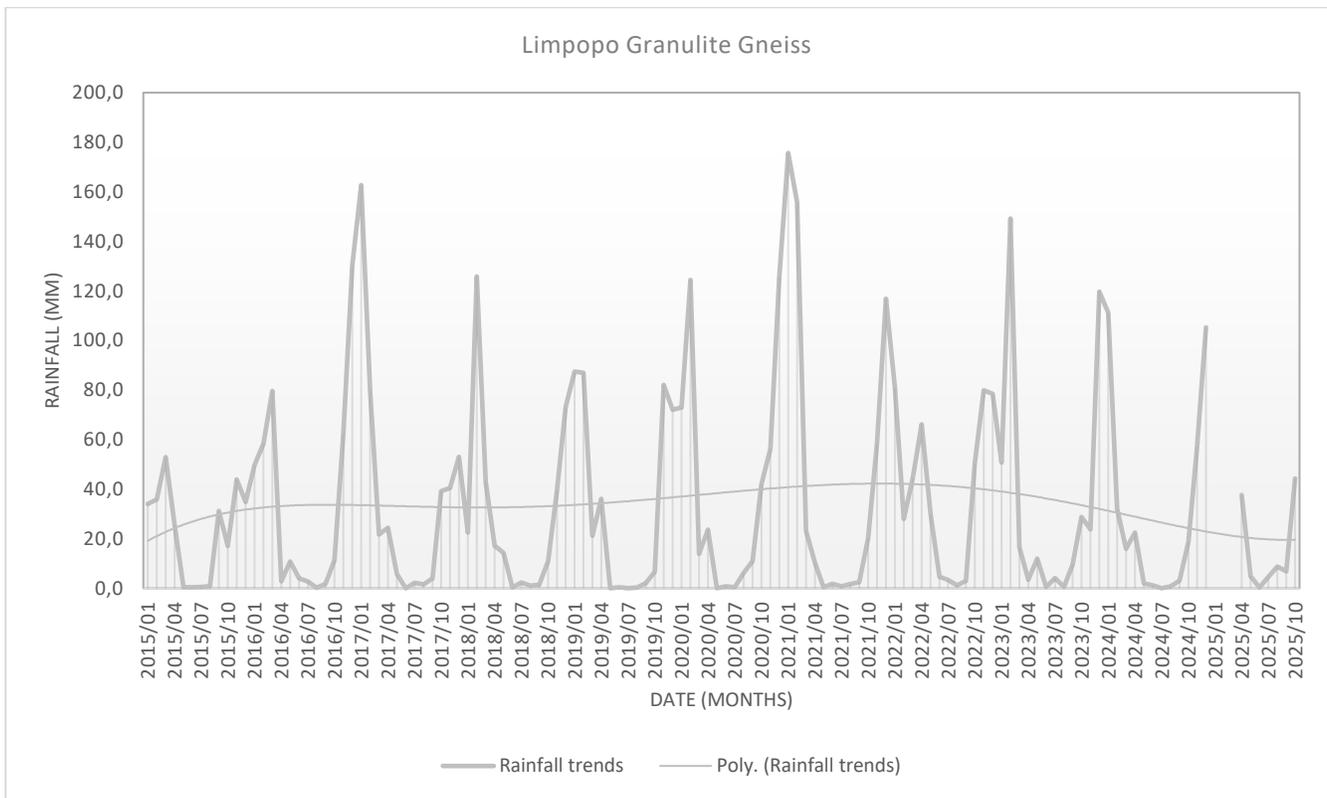


Figure 56: Rainfall trends for the Limpopo Granulite Gneiss Hydrogeological Region

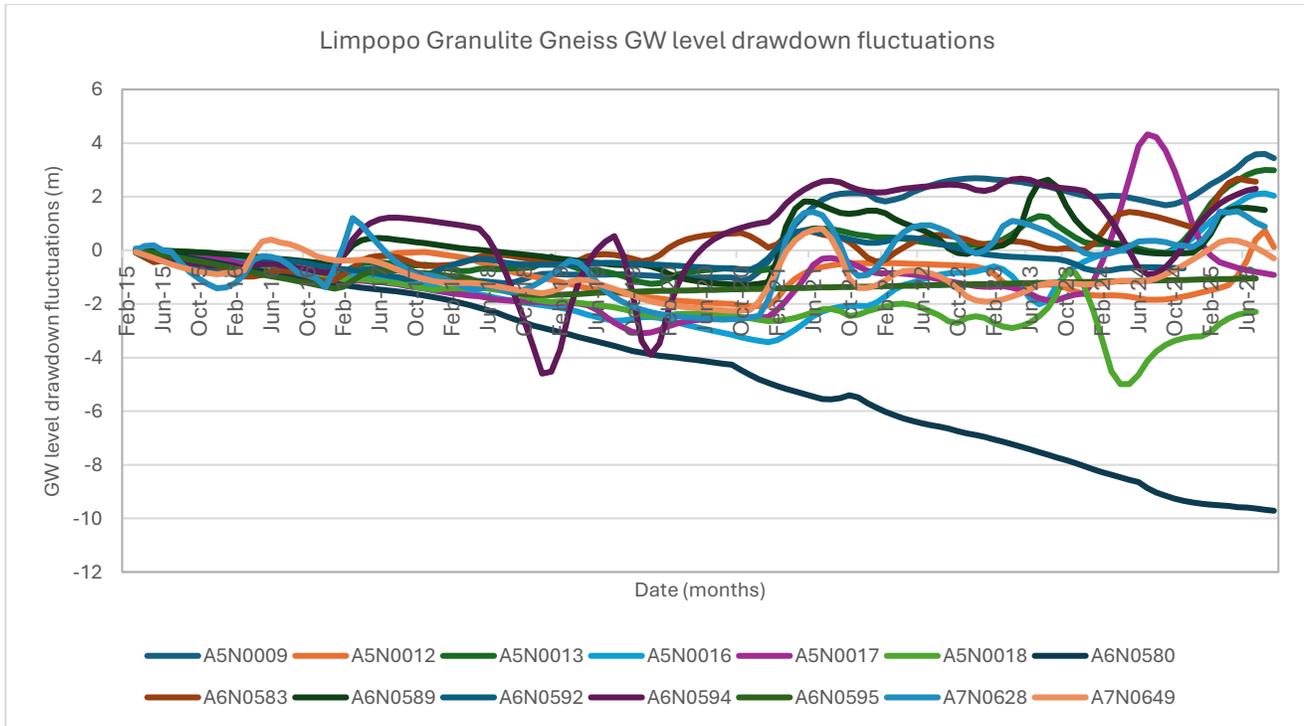


Figure 57: Groundwater level drawdown fluctuations for the Limpopo Granulite Gneiss Hydrogeological Region monitoring boreholes

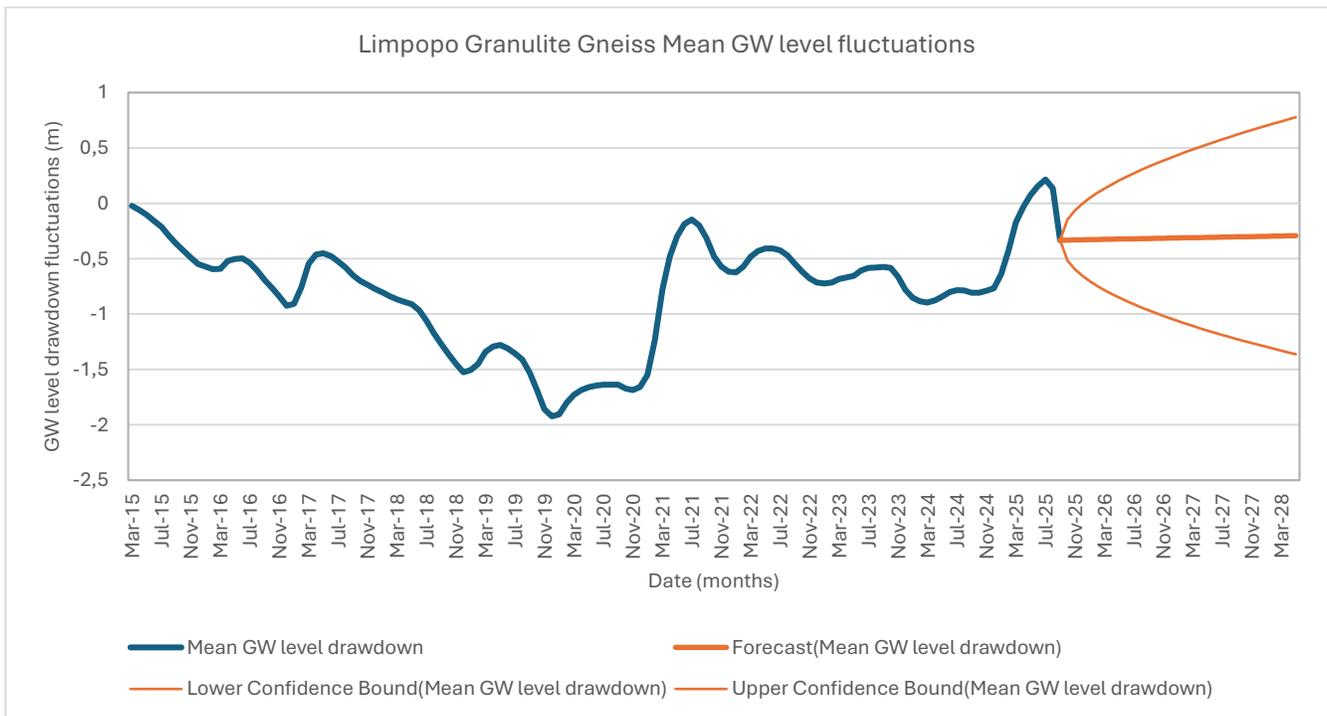


Figure 58: Mean groundwater level drawdown fluctuations for the Limpopo Granulite Gneiss Hydrogeological Region

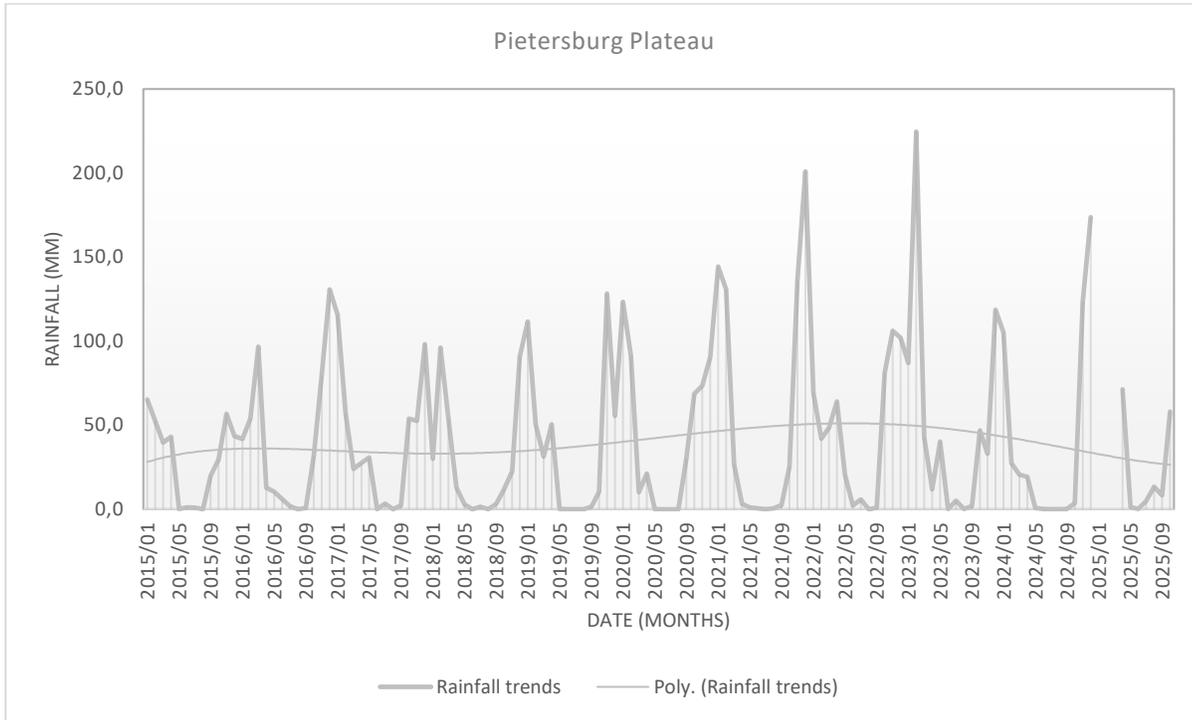


Figure 60: Rainfall trends for the Pietersburg Plateau Hydrogeological Region

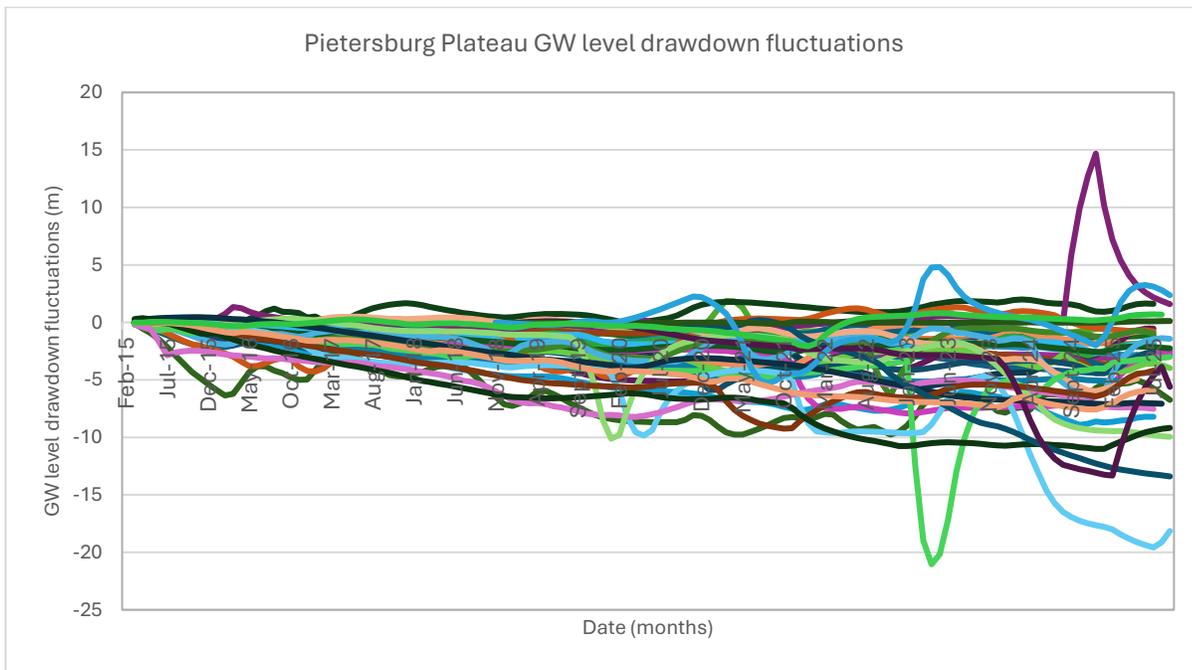


Figure 61: Groundwater level drawdown fluctuation trends for the Pietersburg Plateau Hydrogeological Region

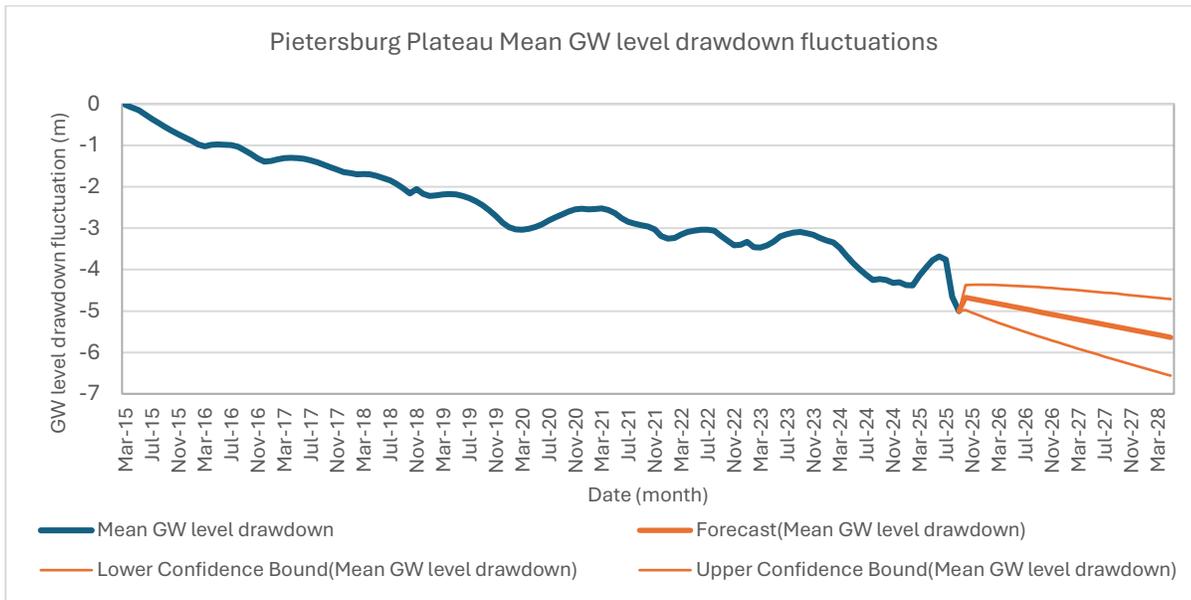


Figure 62: Mean groundwater level drawdown fluctuations for the Pietersburg Plateau Hydrogeological Region

3.17 The Waterberg Plateau Hydrogeological Region

The Waterberg Plateau Hydrogeological Region is bordered by the towns of Bela-Bela and Thabazimbi in the south and west respectively. To the north, the town of Lephalele exists whilst to the east, the outskirts of the town of Mokopane exist (Figure 63). The region is well represented with monitoring boreholes (Figure 63).

The rainfall for the Waterberg Plateau region is represented by records from SAWS Districts 76, 77, 86 and 87 rainfall stations. Figure 64 depicts the rainfall trends. According to the trend graph, the rainfall increased from 2015 reaching a peak around 2022. Thereafter, a decline was observed until early 2025 where another peak till to date was noted.

With regards to groundwater level drawdown, horizontal to downward trends were recorded by the boreholes monitoring the groundwater conditions of this region (Figure 65). The downward trends (limited to about 5m decline) prevailed until March 2022 thereafter an upward rise was noted, in response to rainfall patterns and recharge. This also was noted once again in early 2025 when the peak in rainfall was recorded. Figure 66 which represents the mean groundwater level drawdown for the region indicates clearly the episodes of water level drawdown rise/ decline over the observation period. Given the latest upward trends of groundwater level drawdown for this region, there are no immediate management steps recommended for this groundwater resource.

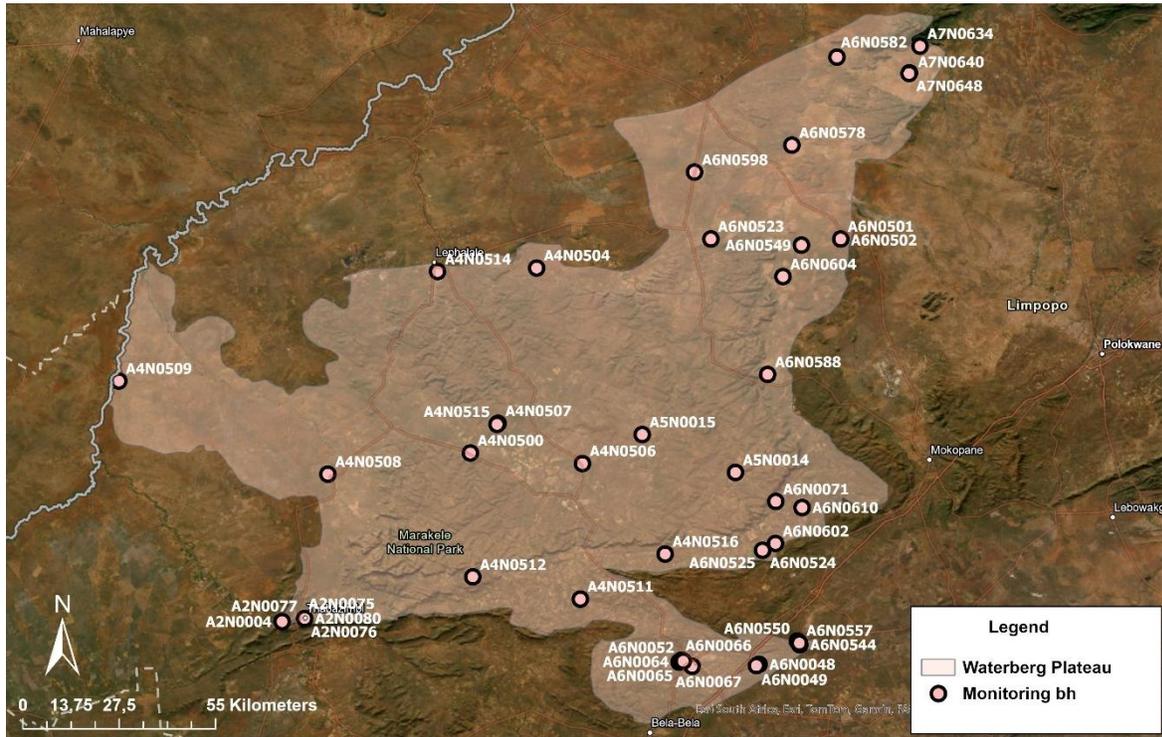


Figure 63: Locality of the Waterberg Plateau Hydrogeological Region

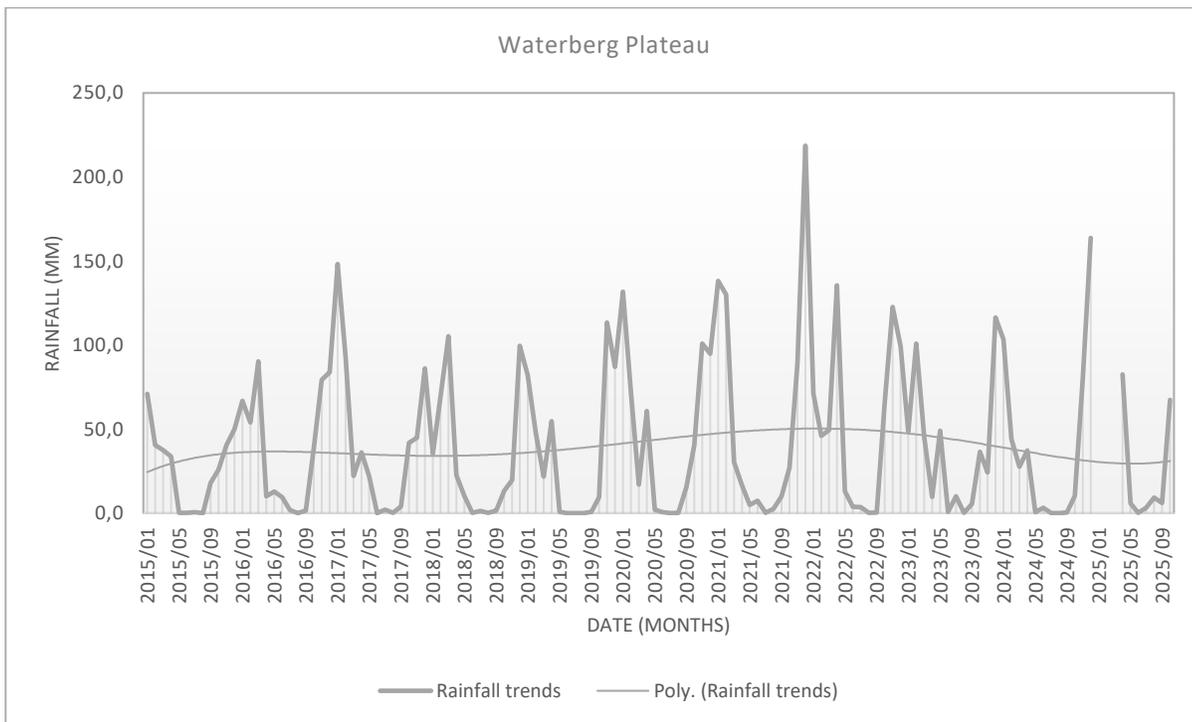


Figure 64: Rainfall trends for the Waterberg Plateau Hydrogeological Region

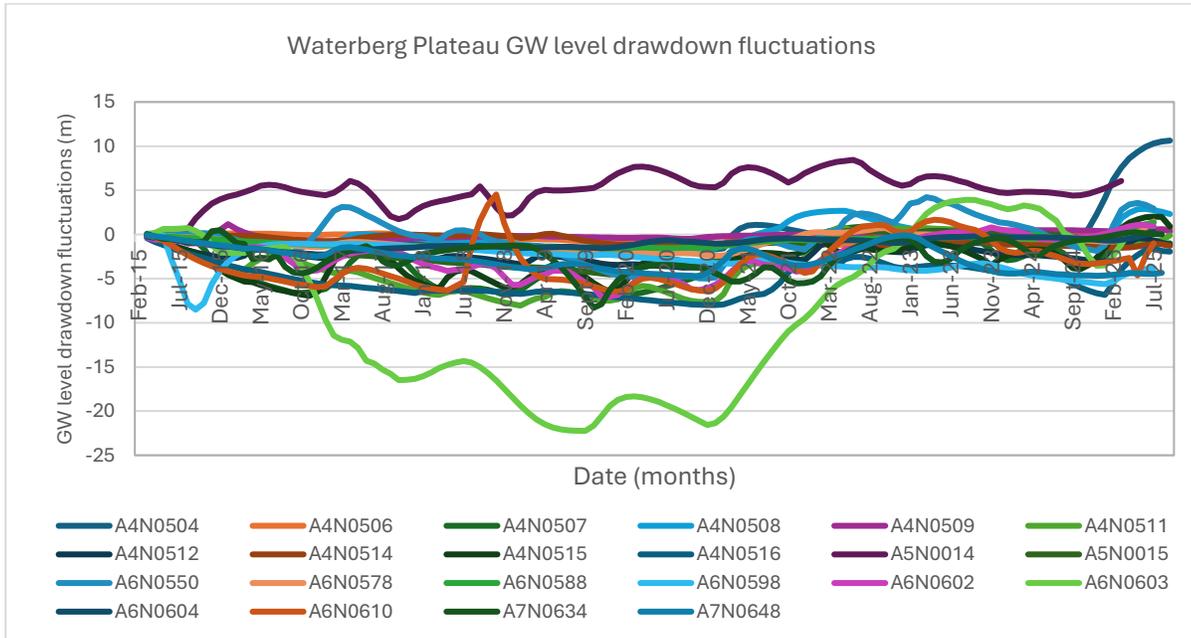


Figure 65: Groundwater level drawdown fluctuations for the Waterberg Plateau boreholes

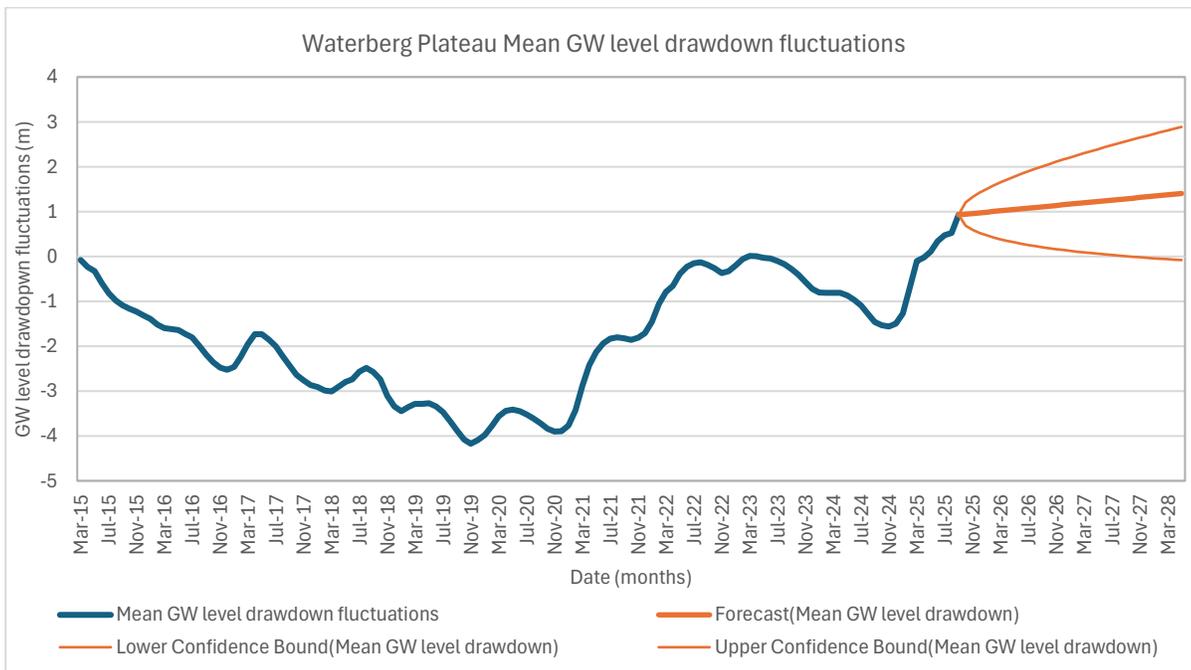


Figure 66: The mean groundwater level drawdown fluctuations for the Waterberg Plateau Region

3.18 The Northern Bushveld Hydrogeological Region

The Northern Bushveld Complex Hydrogeological Region lies west of Mokopane and stretches to the north along the N11 route. To the south, it stretches past the small town of Mookgophong and stops just at intersection of route R33 and D2748 on the western side (Figure 67). The monitoring borehole distribution is also indicated in the same Figure 67. The region could benefit from small adjustments to the programme so that there is better representation throughout the region.

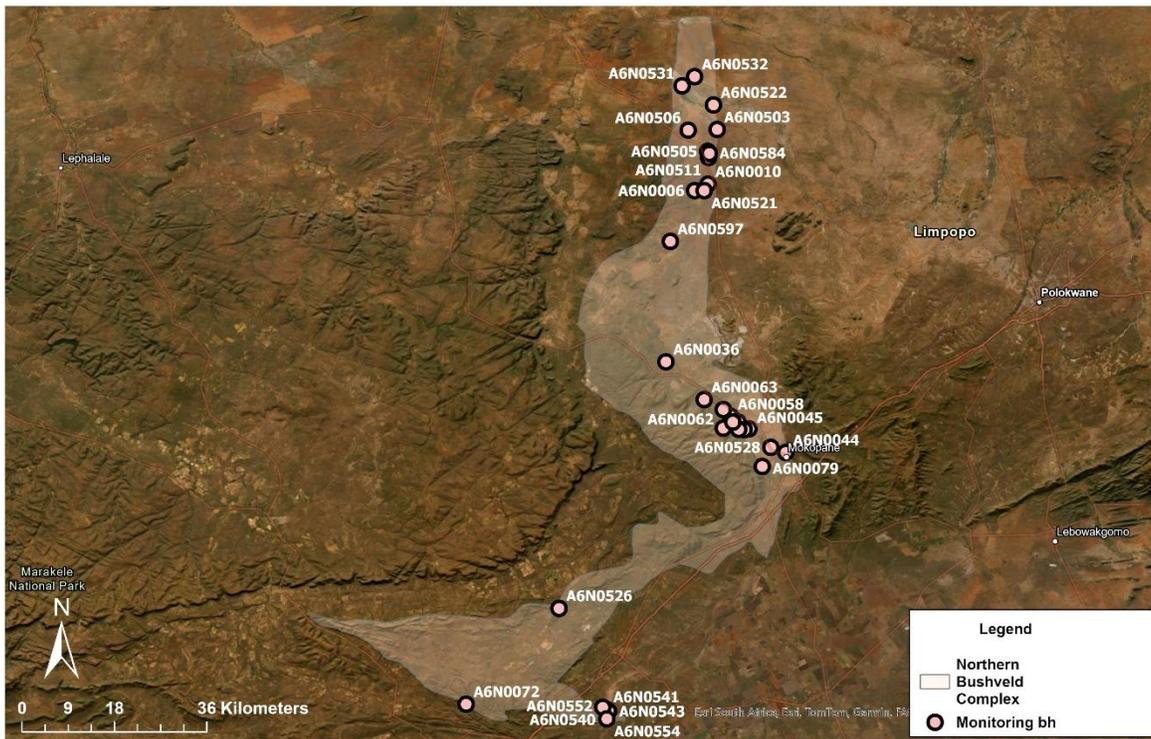


Figure 67: Monitoring borehole distribution and the extent of the Northern Bushveld Complex Hydrogeological Region

The rainfall records for this region were obtained from the SAWS District 76 rainfall stations. The rainfall data from year 2015 is indicated in Figure 68. The rainfall records declining trends from the region enjoyed an evenly distributed average rainfall throughout the observation period, save for the peaks noted in 2022 and 2025 respectively.

The groundwater level drawdown trends were dominated by downward trends from 2015 to mid-2021 where an inflection point was noted (Figure 69). This is when a fluctuating rise in most boreholes was recorded till to date. Figure 70 summarizes the groundwater level drawdown trends for the region, depicting clearly the periods of fluctuating downward and upward trends, The latest information suggests an upward rise in groundwater level drawdown therefore no immediate actions are recommended for the region but continued monitoring.

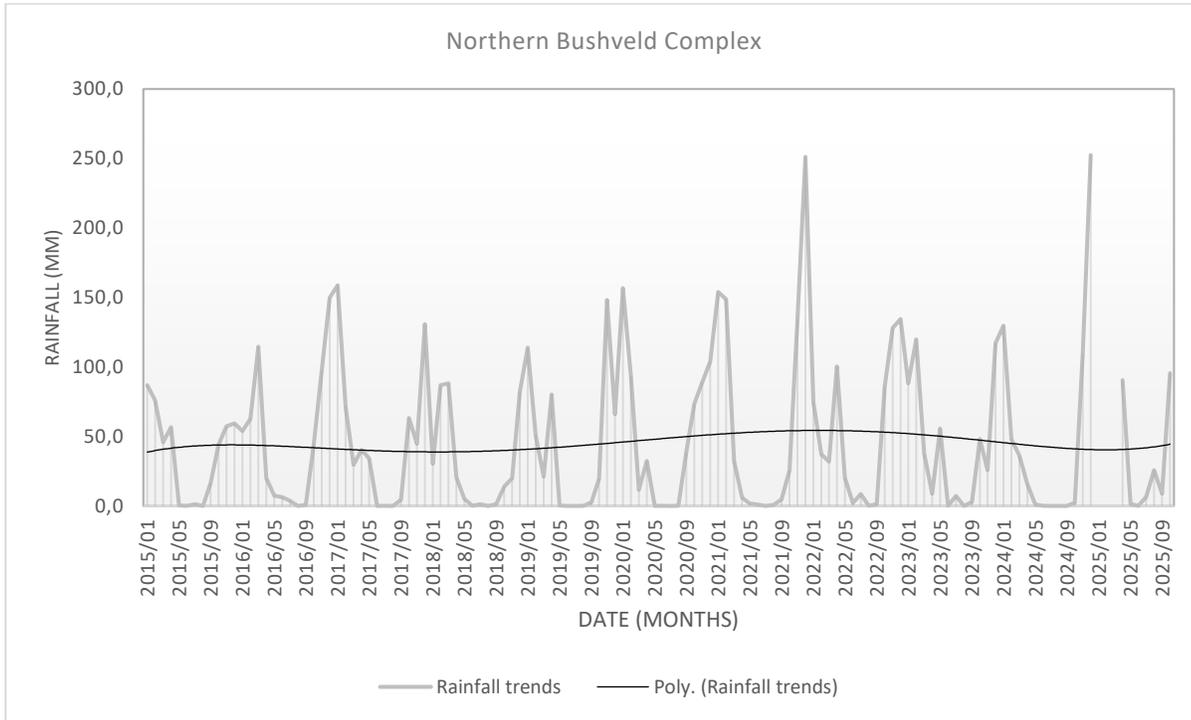


Figure 68: Rainfall trends for the Northern Bushveld Complex

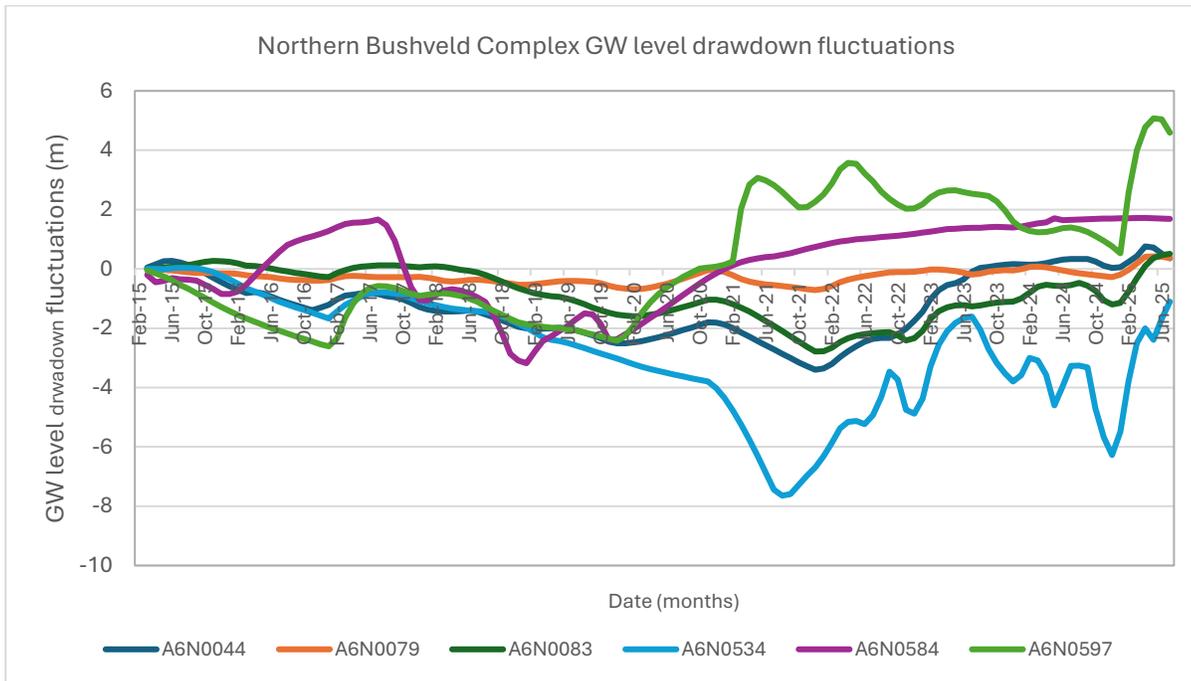


Figure 69: Groundwater level drawdown fluctuations for the Northern Bushveld Complex boreholes

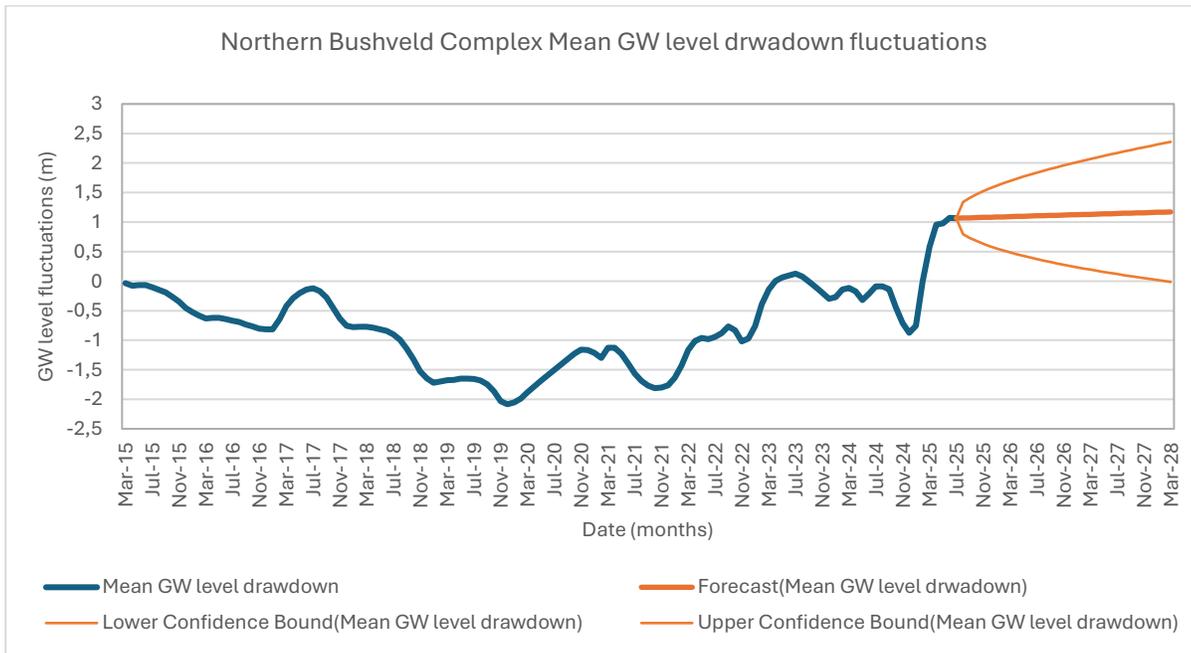


Figure 70: The mean groundwater level drawdown fluctuations for the Northern Bushveld Complex

3.19 The Waterberg Coal Basin Hydrogeological Region

The Waterberg Coal Basin lies on the upper reaches of the country, with its northern border formed by the South Africa- Botswana national border while its southern reaches are made up of Lephalale (Figure 71). The region is way underrepresented with borehole monitoring. The few that exist are located along the northwestern periphery of the region and to the south. As such, no interpretation will be done for this region.

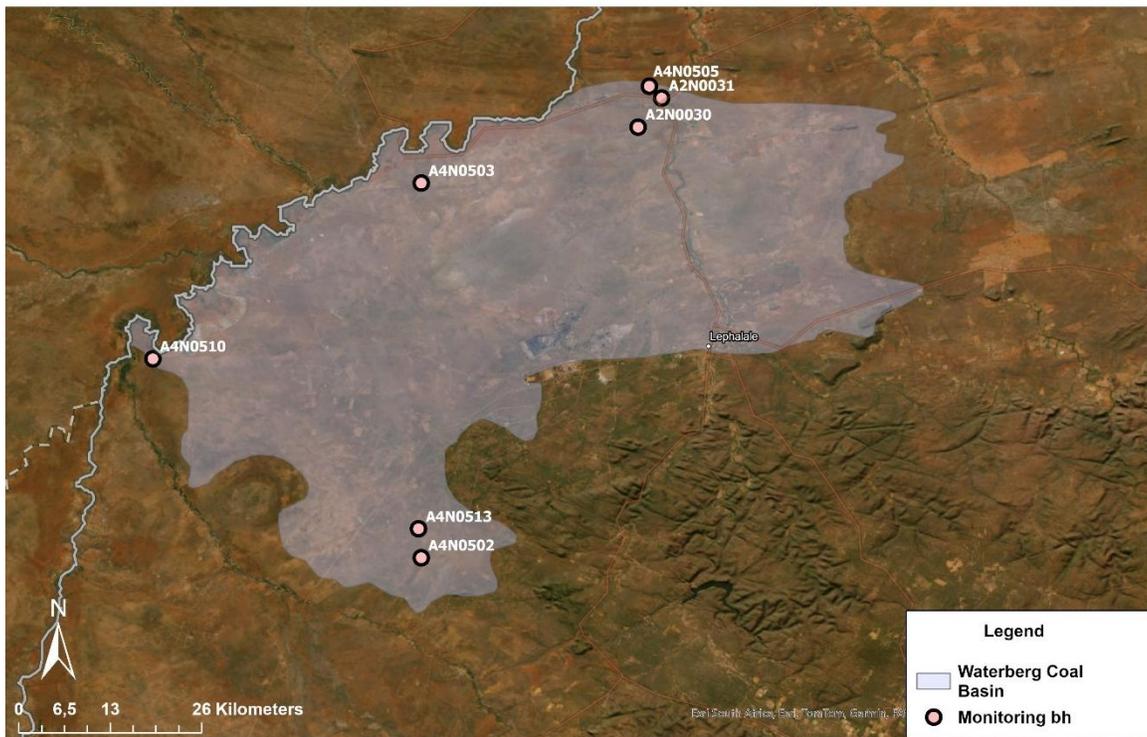


Figure 71: An extent of the Waterberg Coal Basin Hydrogeological Region and its monitoring boreholes

3.20 The Springbok Flats Hydrogeological Region

The Springbok Flats Hydrogeological region is bounded by Lebowakgomo to the north and stretches in a southwesterly direction bisecting the Gauteng, (close to Hammanskraal) and the Northwest Provinces covering parts of the Borakalalo National Park (Figure 72). The monitoring boreholes are well distributed across the region (Figure 72).

The rainfall trends in Springbok Flats Hydrogeological region have been dominated by lower-than-average rainfall between 2017 and 2021 (Figure 73). In early 2022, average to higher-than-average rainfall was observed lasting until early 2023 when a downward trend was recorded until today.

The water level drawdown for the boreholes in the Springbok Flats Hydrogeological region mimicked, to some extent, rainfall trends with boreholes having shown strong water level drawdown over a lengthy period 2015 to 2023 (Figure 74). The period was extended for borehole B5N0055 with its late recovery starting in late 2024. A fair number of boreholes responded positively to the higher rainfall observed between 2022 and 2023 though, leading to a better water level status of the region. Figure 75 indicates succinctly the water level drawdown fluctuations observed for the region. The latest trends are upward, requiring no urgent management interventions.

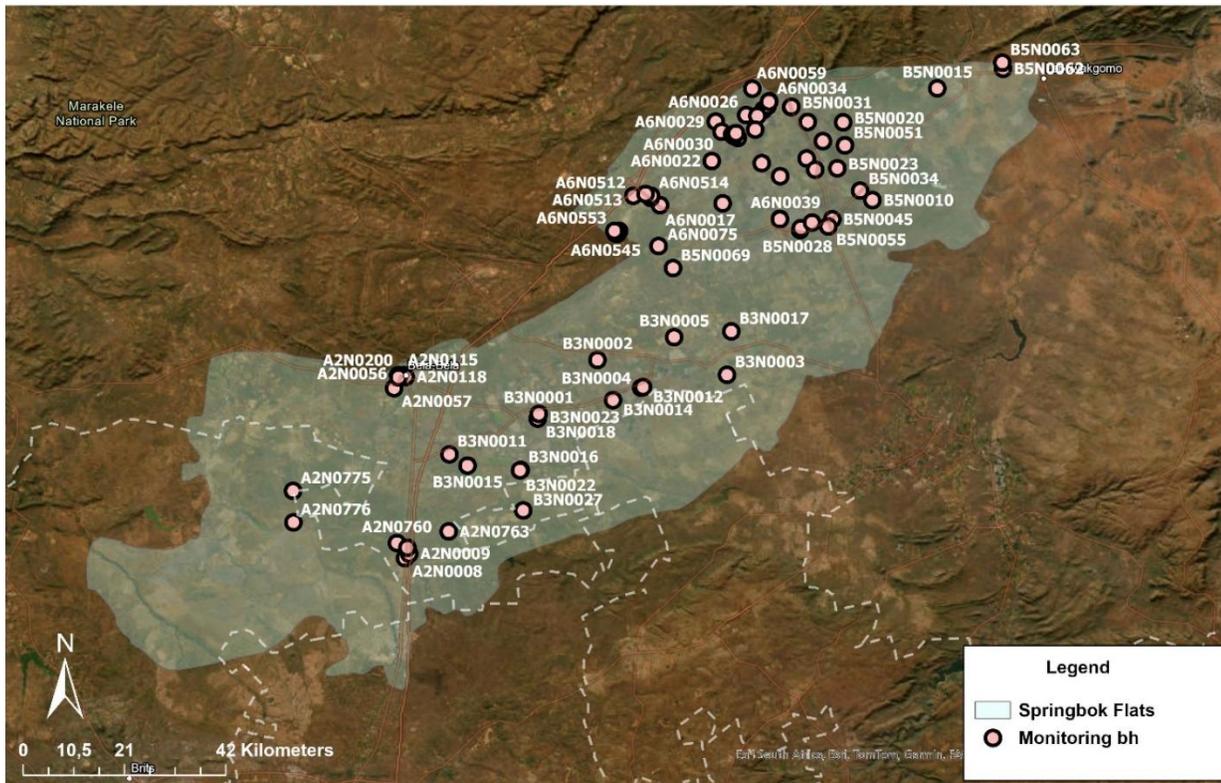


Figure 72: The Springbok Flats Hydrogeological Region and its monitoring boreholes

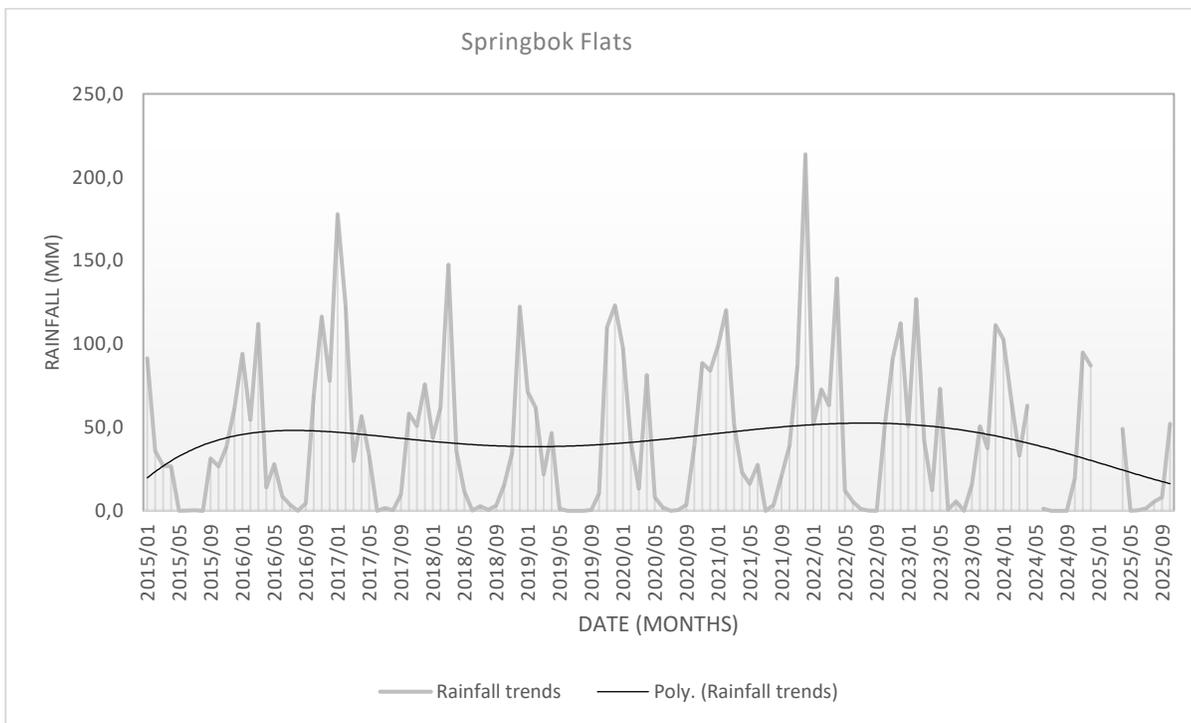


Figure 73: Rainfall trends for the Namaqualand Region

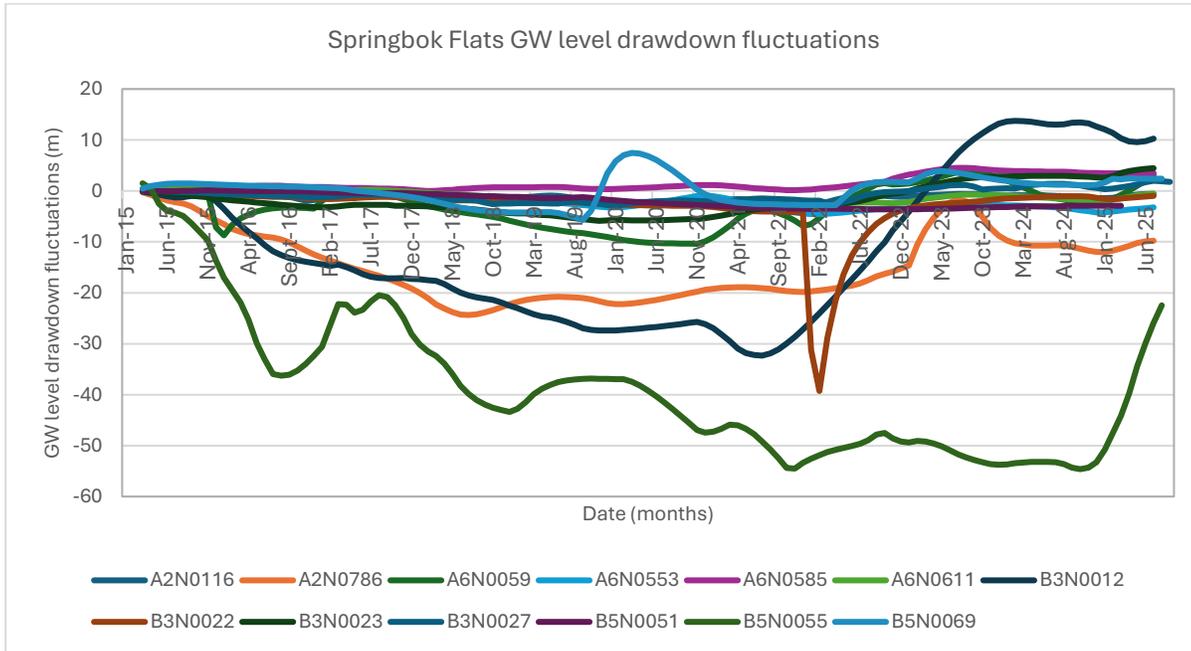


Figure 74: Groundwater level fluctuations for the Springbok Flats hydrogeological region

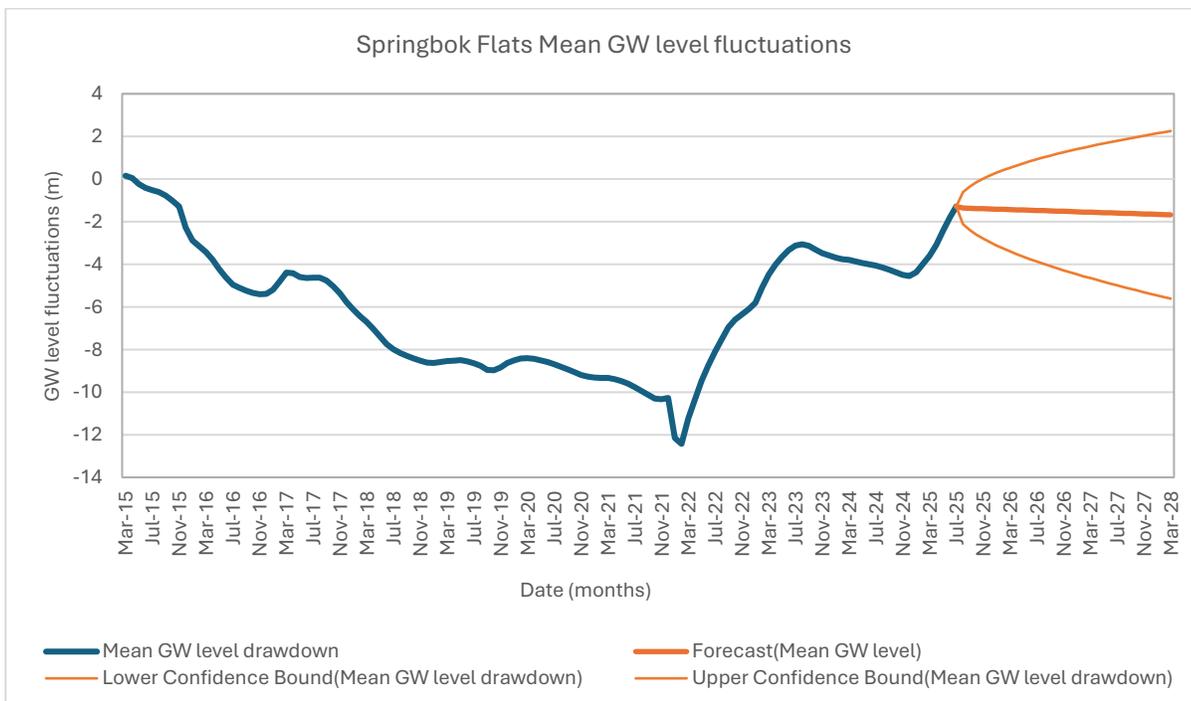


Figure 75: The mean groundwater level drawdown fluctuations for the Springbok Flats Hydrogeological Region

3.21 The Eastern Bushveld Hydrogeological Region

The extent of Eastern Bushveld hydrogeological region stretches from Lebowakgomo in the northwest. The eastern side is bordered by Burgersfort (more north) and Belfast to the south, while the southwestern side lies just north of Mabopane (Figure 76). Monitoring borehole distribution is relatively good, nicely spread across the region (Figure 76).

The rainfall trends increased from 2015 to 2016 and plateaued at an average of about 50mm per month until mid-2024 when a downward trend was registered to date (Figure 77).

The groundwater level drawdown of most boreholes monitoring the Eastern Bushveld Complex groundwater indicated a steady decline from the onset of the observation period. This has been persistent throughout the observation period (Figure 78). However, two boreholes, B3N0026 and B3N0028, have maintained strong upward trends since June 2017 and remained so until February 2021 when more boreholes followed the upward trend. Figure 79 portray this with mean groundwater level drawdown for the region, indicating an upward rise with the latest trends. Given the upward trends observed, there are no immediate interventions recommended for management of this hydrogeological region.

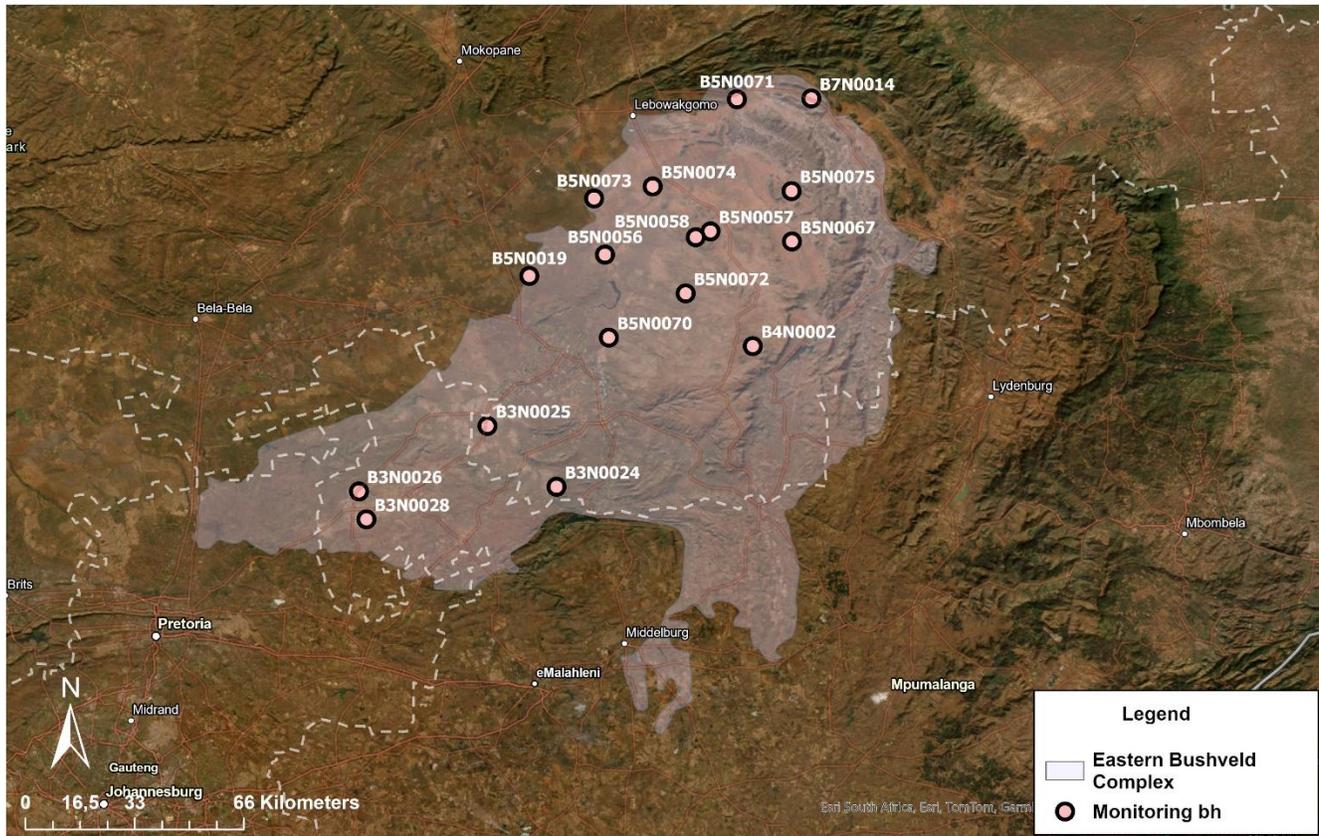


Figure 76: The extent of the Eastern Bushveld Complex Hydrogeological Regions and its monitoring boreholes.

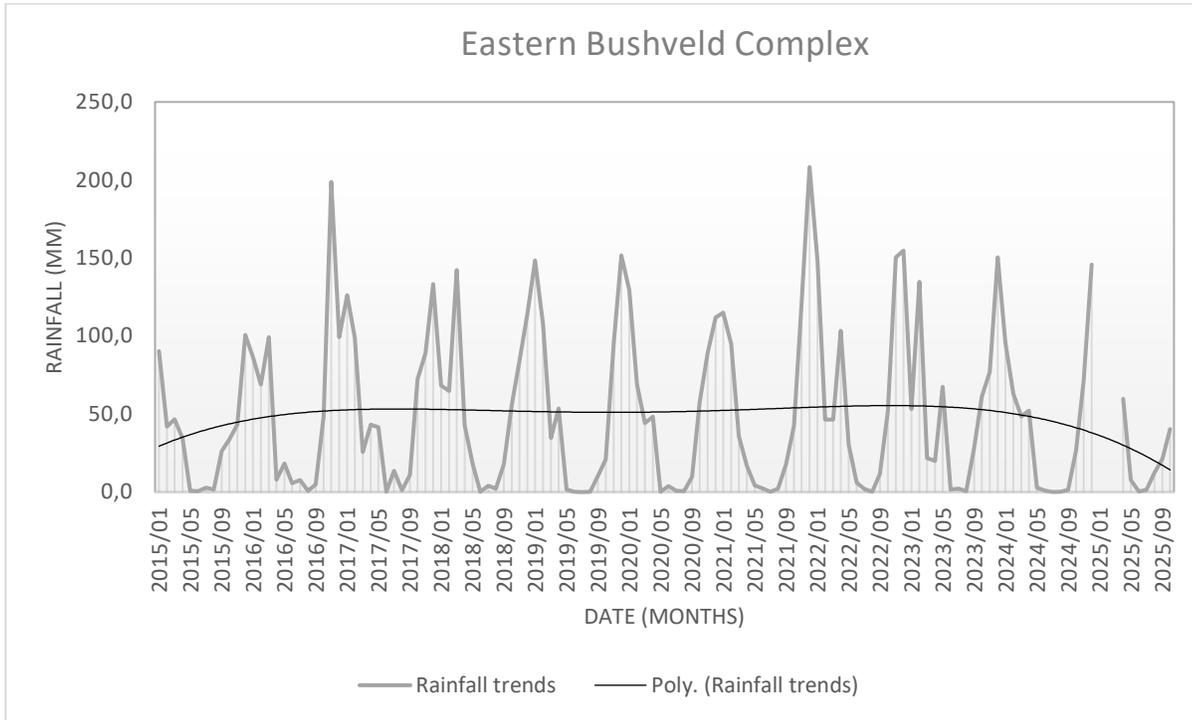


Figure 77: Rainfall trends for the Eastern Bushveld Complex Hydrogeological Region

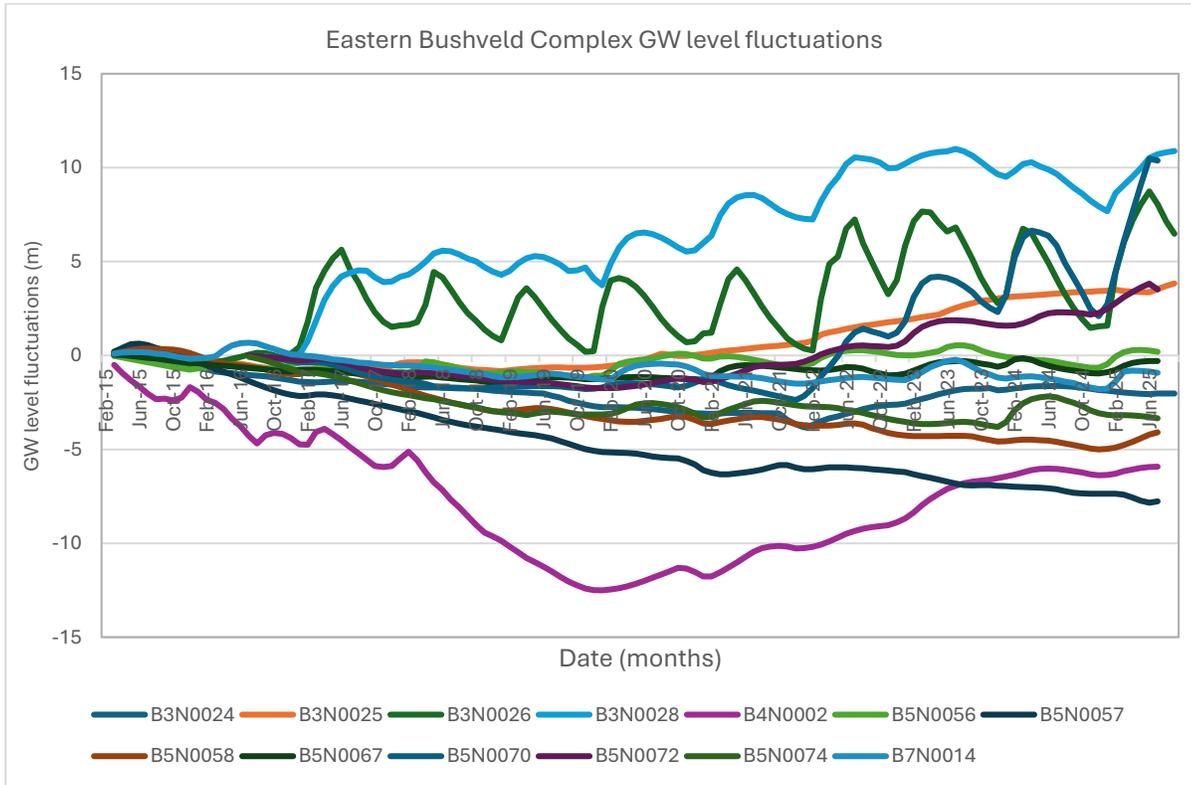


Figure 78: Groundwater level fluctuations for the Eastern Bushveld Complex Region boreholes

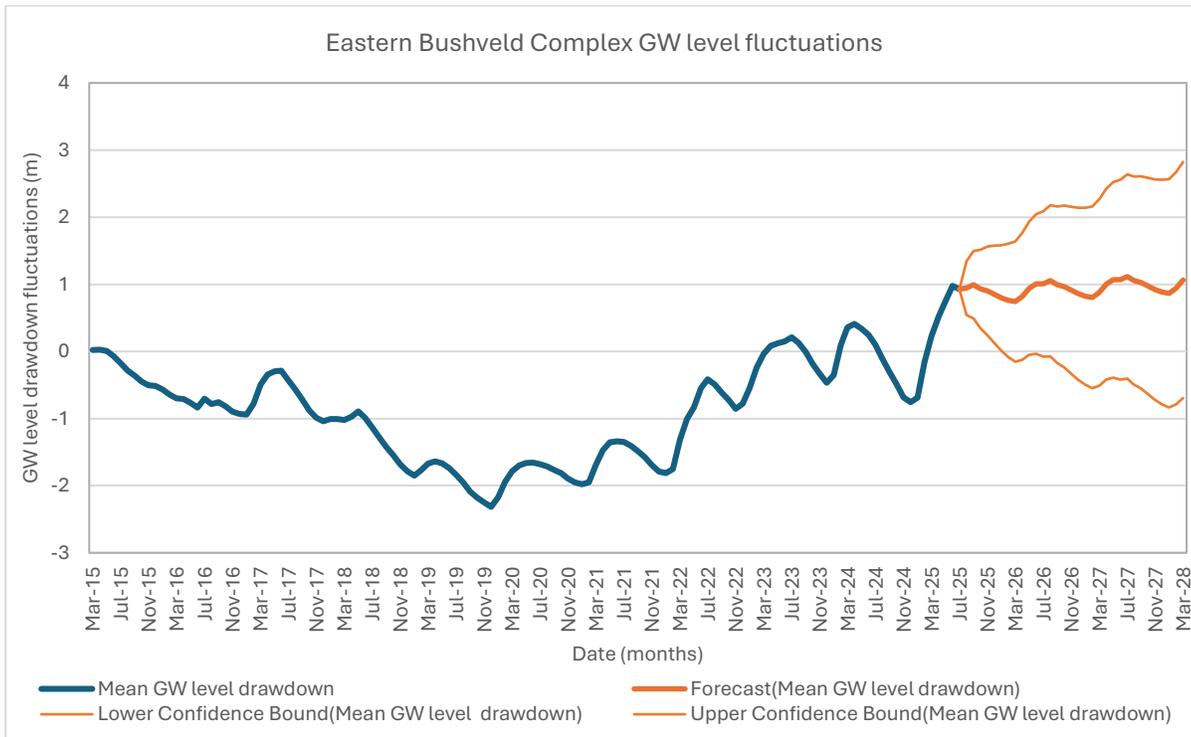


Figure 79: The mean groundwater levels for the Eastern Bushveld Complex Hydrogeological Region

4. Summary

The graphs for these provinces were split so that they could be legible. The Gauteng and Northwest Provinces hydrogeological regions are shown in Figure 80. Generally, the groundwater levels for these hydrogeological regions have maintained positive trends with rising water levels with time. The latest is indicating the healthy status of groundwater with climbing groundwater levels after a slight decline in 2024- possibly responding to rainfall recharge.

The Limpopo and Mpumalanga hydrogeological regions generally maintained horizontal trends with latest data indicating rising water levels (Figure 81). An exception holds for the Springbok Flats hydrogeological region where, for the longest period, its water levels declined by about 12m. Nevertheless, the latest status for this region indicates rising water levels, albeit still below the initial water levels. The latest trends for Soutpansberg and Pietersburg Plateau hydrogeological regions showed a downward leaning since 2023 while the Pietersburg has maintained a downward trend since 2025. These two regions need an investigation into impacts associated with these downward trends. . This is the only region that registered a decline from all the observed regions. A closer observation/ monitoring needs to be implemented for this region.

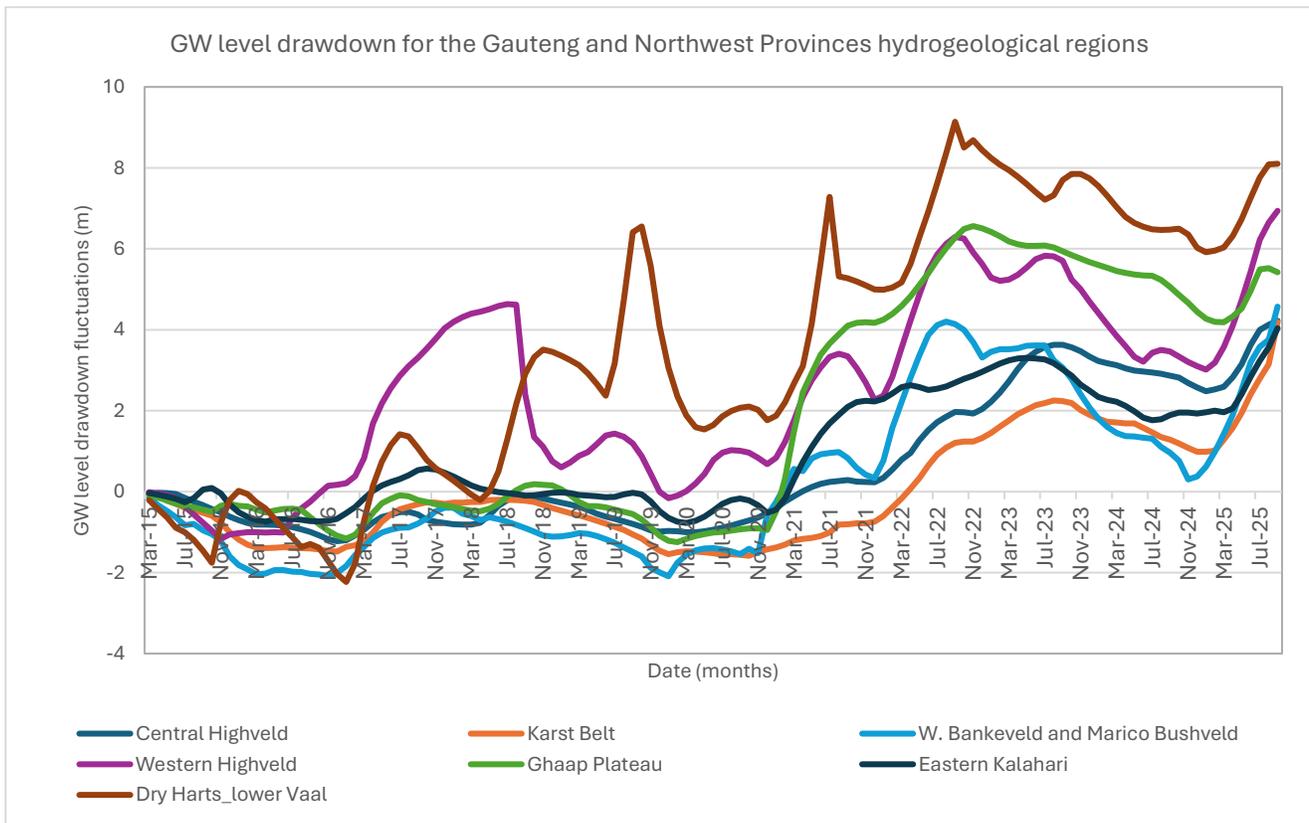


Figure 80: Groundwater level drawdown fluctuations for the hydrogeological regions in the Gauteng, and Northwest Provinces

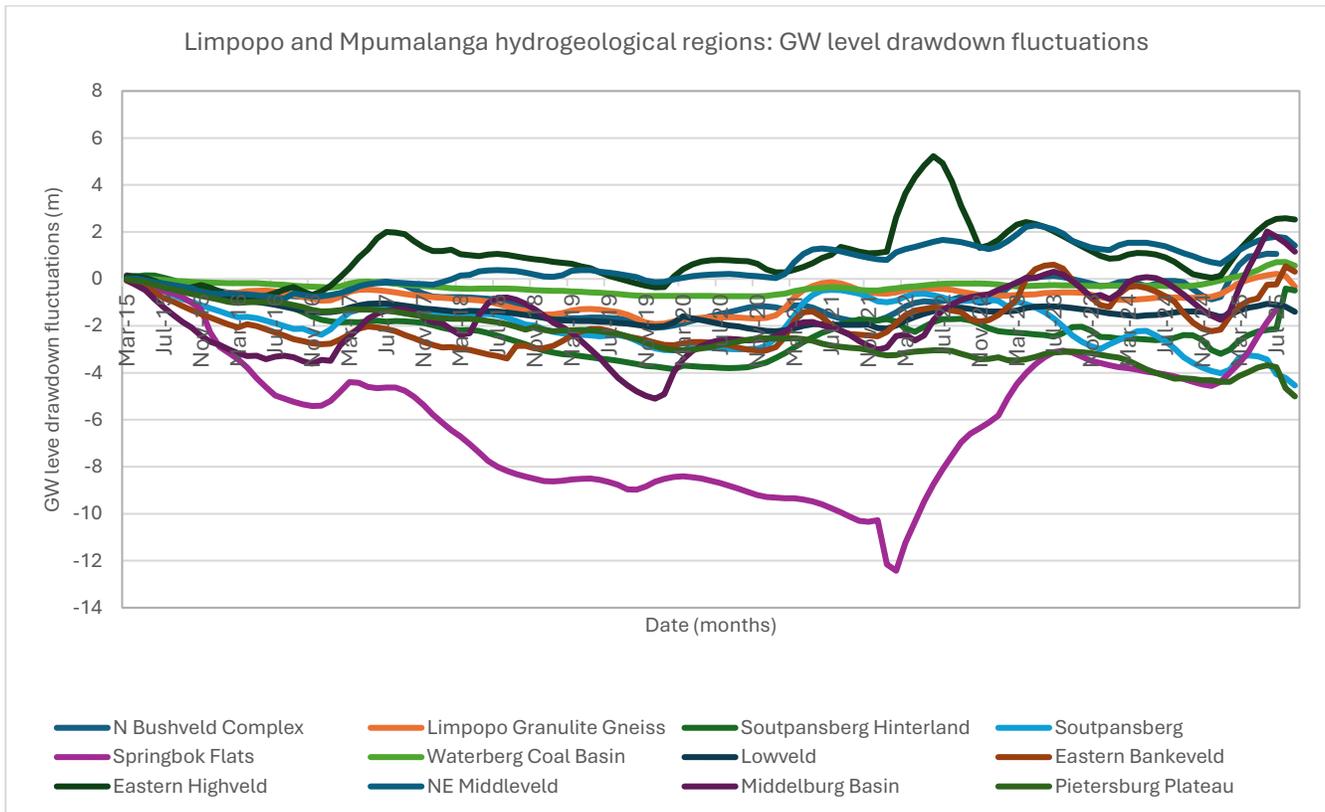


Figure 81: Groundwater level drawdown fluctuations for the hydrogeological regions in the Limpopo and Mpumalanga Provinces

5. Conclusions

About 29 hydrogeological regions falling in the Gauteng, North, Mpumalanga and Limpopo were assessed to ascertain latest status of groundwater. The aim was to assess whether the groundwater resource for these regions and provinces could be under threat from natural or anthropogenic impacts. Historic datasets recorded between 2015 to 2025 were utilized. The assessment was not possible for certain regions due to limited available datasets. These regions include:

- The Middelburg Basin
- The Western Bushveld Complex
- The Northern Lebombo
- Limpopo Karoo Basin
- The Waterberg Coal Basin and
- The Mokoppa Dome

The monitoring programme needs to be improved in these regions so that groundwater conditions can be known with higher level of certainty. Other regions that could benefit from optimization of the monitoring programme include Karst Belt, Lowveld (reduce); the Central Highveld (reduce and expand) and the following for expansion: the Northern Bushveld, the Northeastern Middleveld, the Eastern Highveld, the Eastern Bankeveld, the Dry Harts-Lower Vaal Orange, the Ghaap Plateau, the Eastern Kalahari, and the Western Bankeveld and Marico Bushveld.

With regards to groundwater level status the Soutpansberg and Pietersburg Plateau indicated alarming declining trends over a long period. Closer monitoring and investigation would benefit these regions to understand the underlying impacts. Another region that revealed declining trends is the Lowveld, although not alarming. All other regions indicated upwards trends in response to groundwater replenishment (Section 4).