St Helena
Cloud Forest Project

Year 4 Climate and Water Resource Monitoring Report



June 2025

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Glossary

ANRD	Agriculture and Natural Resource Division
AWS	Automatic Weather Station
CABI	Centre for Agriculture and Bioscience International
UK CEH	UK Centre for Ecology and Hydrology
Connect	Connect Saint Helena Ltd
CSSF	Conflict, Stability and Security Fund
DEM	Digital Elevation Model
ERT	Electrical Resistivity Tomography
FCDO	Foreign, Commonwealth and Development Office
IPCC	Intergovernmental Panel on Climate Change
NEVC	North East Volcanic Centre
MAMSL	Metres Above Mean Sea Level
PEt	Potential Evapotranspiration
RSPB	Royal Society for the Protection of Birds
SHG	Saint Helena Government
SWVC	South Western Volcanic Center
TAG	Technical Advisory Group
UKOT	United Kingdom Overseas Territories
WRMP	Water Resource Management Plan
WTW	Water Treatment Works

1 Introduction

This report has been written as a continuation of Cloud Forest Project and Darwin Plus DPLUS103 project (St Helena Climate Change and Drought Warning Network) reports which have been published as 2 volumes in July 2023[1][2] and an addendum Cloud Forest Restoration Project report in October 2024[3]. Data collected between January 2024 and March 2024 was joint funded and data collected from April 2024 has been funded by the UK Government's Foreign, Commonwealth and Development Office (FCDO) through the Conflict, Stability and Security Fund (CSSF), as part of the 4 year Cloud Forest Restoration Project on St Helena which is managed by the Royal Society for the Protection of Birds (RSPB).

1.1 St Helena

The project is based on St Helena, a British Overseas Territory located in the South Atlantic Ocean. The island is formed from an extinct volcanic sea mount, has a sub-tropical climate and lies 4,000km east of Brazil and 1,950km west of Namibia. The island covers an area of 122km^2 (47sq miles) and is similar in size to the island of Jersey. Due to its volcanic origins, the island rises steeply from sea level to a central ridge of peaks that form a rugged and highly eroded volcanic terrain. Habitat zones include semi desert at sea level through to cloud forest at a maximum height of 823m above sea level.

1.2 Acknowledgements

We would like to thank Lawrence Muranganwa for his guidance and being a champion of the project over the past 7 years from project inception to the present, Robert George for all the fantastic geophysics and water resource monitoring work he has done over the past few years as Water Resource Monitoring Technician, Janet Lawrence (Connect Saint Helena CEO) for her encouragement and Darren Duncan (Portfolio Director – Environment Natural Resource and Planning (ENRP)) for all his support in SHG. We would also like to thank Mercy Ncube and Ryan Rumano at Connect for picking up the baton from Lawrence and Robert in early 2025.

We would also like to thank the FCDO and Sarah Havery, Shayla Ellick and Stuart Jennings from the RSPB for their continued Cloud Forest Project support.

1.3 Year 4 Objectives

The provision of water on St Helena is intimately linked to the distribution of habitats and in particular the cloud forest area above 650m. Previous work (DPLUS051[4], CEH 1990's[5] work)

[1] Palmer, S. Hendry, M. Sansom, B. Gray, A. (2023). DPLUS103: St Helena Climate Change and Drought Warning Network. Volume 1: Climate. Darwin Plus and FCDO.

[2] Sansom, B. Mullings-Smith, E. Groen, M. George, R. Gray, A. Walmsley, B (2023). DPLUS103: St Helena Climate Change and Drought Warning Network. Volume 2: Water Resources. Darwin Plus and FCDO.

[3] Sansom, B. Mullings-Smith, E. Groen, M. George, R. Henry, M (2024). St Helena Cloud Forest Project Year 3 Climate and Water Resource Addendum Report. FCDO.

[4] Sansom, B. Gray, A et al (2018). DPLUS051 Water Security and Sustainable Cloud Forest Restoration on St Helena.

[5] Gunston, H. and Rosier, P. (2002). Saint Helena Catching Mist and Clearing Flax CEH 2002

has demonstrated that native habitats function more effectively as hydrological units than introduced systems. These native habitats are the last refuges of St Helena's rich endemic flora and fauna but they are threatened by multiple drivers of extinction, e.g. invasive species habitat loss, genetic erosion and climate change.

For Year 4 of the Cloud Forest Project, the following water resource objectives were agreed between project partners and the FCDO, which builds on the work reported in the addendum report published in 2024:

1. Continuous water resource and climate monitoring data updated in Year 4.
    a. Stream level and stream flow data collection from monitoring network.
    b. Groundwater level data collection from monitoring network.
    c. Climate data collection from monitoring network.
    d. Charts and spreadsheets shown as evidence.

2. Island water balance - update water balance in Year 4.
    a. Developed using new climate and water resource data sets collected from Cloud Forest project monitoring activities.
    b. Output used to support water resource management decisions.

3. Climate change assessment – update in Year 4.
    a. Climate change scenario assessment of water balance.
    b. Climate change scenario assessment of monitoring data.
    c. Output used to assess impact of climate change on the water balance and expected change in stream flows and groundwater levels.
    d. Output used to support water resource management decisions.

4. Annual water resource and climate report - Year 4.
    a. Summarise changes in island data sets based on previous 3 years data.
    b. Output used to communicate the status of the islands water resources and climate (see attached EA water and climate report – we could follow the same format but write it as an annual report and in a shorter format).

This document comprises a report on the Year 4 objectives.

1.4 New Tree Diseases in St Helena

A plant pathogen study[6] was undertaken across the island in October 2022 (as part of DPLUS104) by a team from the Centre for Agriculture and Bioscience International (CABI). The CABI team identified a *Phytophthora* infection in a number of trees which were dying in the Peaks tree nursery, George Benjamin arboretum and in the Scotland tree nursery. The disease was found in Whitewoods, Dogwoods, She Cabbage, Bastard Gumwood and Redwood trees.

[6] Crozier, J. and Taylor, P (October 2022). New Tree Diseases in St Helena. Presentation at St Helena Museum.

Based on the findings of the study SHG formed a multi-agency Task Group to develop an action plan for controlling the plant disease. In November 2022 the Task Group restricted access to the Peaks where several of the DPLUS103 mist and rain dataloggers, automatic weather stations and water level monitoring sites are located. The Cloud Forest Project team have worked with the Task Group and their Technical Advisory Group (TAG) to arrange limited, controlled access to the Peaks so that project data can be collected.

Protocols implemented by the TAG have resulted in significantly less frequent data downloads since November 2022. The impact on Year 4 project work has been to limit the interpreted data set to data collected until the end of December 2024.

The water resource project team are continuing to collect data in impacted parts of the island, as and when permitted, and are working with SHG and the TAG to ensure project monitoring can continue. Upgrades to the monitoring network are enabling remote monitoring of climate and water resources data sets which are starting to mitigate impacts from the restricted access to the study area.

1.5 Personnel Changes

During the start of 2025 the role of Water Resource Monitoring Technician has been vacant in Connect Saint Helena. This has resulted in some delays obtaining monitoring data and necessary delays to monitoring network upgrades. Connect are in the process of transitioning the role of the project Water Resource Monitoring Technician into wider team roles to ensure that catchment monitoring data continues to be collected using a new telemetry system.

2 Climate Monitoring

2.1 AWS Data

The project surface climate monitoring network has continued to be monitored in Year 4 of the Cloud Forest Project. A detailed description of the monitoring network can be found in the joint Darwin Plus and Cloud Forest project reports published in July 2023[7].

The majority of the AWS network has recorded data gaps during 2024, with data being lost for short periods and requiring a power cycle of equipment to get it operational again. A new AWS was installed at The Depot in July 2024, along the Peaks ridge, south west of High Peak in the west of the island. However, The Peaks and The Depot stations have had significant data loss over 2024 due to technical issues and weather conditions in the area. Flagstaff AWS has not been replaced, so no data has been collected at that location during 2024.

An alternative location for The Depot AWS is being investigated in Year 5 of the project (2025 to 2026).

2.1.1 The Peaks AWS

The Peaks AWS only collected data between 15th May and 21st June 2024. During the end of 2023 there was an issue with the telemetry system (MiFi Router) that communicates the data to the cloud. Because of the wet and humid conditions in the area the equipment deteriorated quicker than anticipated which required the replacement of the MiFi Router. The procurement process also took longer than anticipated due to the current model being discontinued and an alternative model needing to be sourced. A temporary solution was adopted during May 2024 but this only lasted until June before the station went back offline.

2.1.2 The Depot AWS

The Depot only collected data between 6th February and 31st March 20224 and between 1st May & 30th June 2024. Again, this was due to technical issues with the telemetry system (MiFi Router), a new model router was installed in Sep 2024 but unfortunately this didn't solve the issue. Due to the unfavourable weather conditions at The Depot this had an effect on the equipment, this area is prone to being covered in low cloud regularly and the strong winds caused low temperatures which lead to issues regarding charging of the solar batteries affected the batteries charging performance, which lead the equipment to shut down due to low power.

2.1.3 High Peak AWS

The High Peak data set is mostly complete except for a period between 9th and 30th September 2024.

[7] Saint Helena Government (2023). DPLUS103 St Helena Climate Change and Drought Warning Network. Volume 1 – Climate, Volume 2 – Water Resources. Sansom B, George R, Mullings-Smith E, Groen M, Palmer S, Henry M, Walmsley B, Gray A, Muranganwa L.

2.1.4 Boxwood Hill AWS

The data record for Boxwood Hill AWS is incomplete with gaps between 22nd February and 31st March 2024, and between 10th and 16th April 2024.

2.1.5 Flagstaff AWS

No data is available for Flagstaff AWS in 2024. The weather station was damaged by cattle in October 2023 and has not been replaced.

2.1.6 Horse Pasture AWS

The Horse Pasture AWS data set for 2024 is almost complete except for a short sensor problem between 15th and 16th April where temperature and wind speed/direction data were not collected.

2.1.7 Sisters Walk AWS

The Sisters Walk AWS data set for 2024 is complete.

2.1.8 South West Point AWS

The data record for South West Point AWS is incomplete due to data collection issues between 12th and 25th February 2024, 1st and 2nd March 2024, 20th March and 30th April 2024, 15th to 28th May 2024, 28th July and 31st October 2024.

2.1.9 AWS Climographs

AWS data is presented in Appendix 1 and comprises a table summarising 2024 climate data for Bottom Woods MET Station, plus climographs for Boxwood Hill, Horse Pasture, Sisters Walk, South West Point and High Peak AWS.

At Bottom Woods MET station total rainfall for 2024 was 438.2mm compared to the average annual rainfall of 519.6mm between 2001 and 2024. The highest rainfall was in May (68.8mm), but less that the highest recorded rainfall for that month between 2001 and 2024 (115.2mm). There were no months without any rainfall days. April had the fewest days rainfall (11 days) whilst July had the most rainfall days (20 days), giving an average of 15.6 rain days per month for 2024 at Bottom Woods.

The highest temperature recorded in 2024 at Bottom Woods was 26.3°C in January and February. The overall average max daily temperature for 2024 was 23.1°C. The lowest temperature recorded was 13.1°C in October 2024.

A summary of AWS climate data and Hobo rain gauge monitoring data is presented in Table 2-1.

Table 2-1: Key Climate Data 2024

Monitoring Location	Average Temp (°C)	Max Temp (°C)	Min Temp (°C)	Average Station Pressure (Hpa)	Max Gusts (knots)	Average Wind Speeds (knots)	Total Rainfall (mm)
Boxwood Hill AWS	18.7	26.3	13.6	968.98	43.4	9.5	233.6
South West Point AWS	17.8	26.8	12.6	951.34	65.2	7.4	120.6
Sisters Walk AWS	22.9	31.8	17.0	1014.76	24.3	2.1	179.2
Horse Pasture AWS	16.7	28.9	11.2	953.10	66.9	15.2	104.8
High Peak AWS	15.9	28.0	11.0	932.64	31.0	4.9	807.4
Flagstaff AWS*							
The Peaks AWS**	16.1	20.9	13.5	935.48	20.9	2.9	57.8
The Depot AWS***	17.1	25.0	13.0	928.87	67.0	16.5	17.2
Bottom Woods Met Station	19.3	26.3	13.1			13.5	438.2
Stitches Ridge Rain Gauge							1269.6
Casons Rain Gauge							333.0
Diana's Peak Rain Gauge							958.8

* Flagstaff AWS equipment was damaged, so no data collected.
** The Peaks AWS had equipment problems meaning collected data only covers two months.
*** The Depot AWS also had equipment problems so only four months of data was available.

Highest annual rainfall was recorded at the Stitches Ridge rain gauge (1,269mm), with highest average wind speeds recorded at The Depot (16.5 knots). The highest average temperature was recorded at Sisters Walk in Jamestown (22.9°C) which also recorded the highest temperature for the year (31.8°C).

2.1.10 Wind Speed and Direction

Wind rose diagrams for Boxwood Hill, Horse Pasture, Sisters Walk, South West Point and High Peak AWS are presented in Appendix 1.

Boxwood Hill wind direction is predominantly from the south east with an average wind speed of 9 knots. A maximum wind speed of 43 knots was recorded in May 2024.

High Peak wind direction is predominantly from the south west and occasionally from the north east. Average recorded wind speed for 2024 was 4.37 knots with a maximum wind speed of 31 knots recorded in August 2024.

Horse Pasture wind direction is mainly from the east and south east. Average recorded wind speed for 2024 was 14.64 knots with a maximum wind speed of 66.9 knots recorded in August 2024.

Sisters Walk wind direction is predominantly from the south west. Average recorded wind speed for 2024 was 1.62 knots with a maximum wind speed of 24.3 knots recorded in October 2024.

South West Point wind direction is predominantly from the south west. Average recorded wind speed for 2024 was 7 knots, with a maximum wind speed of 46.1 knots recorded in June 2024 (note: there is no data for the months of April or between August and October 2024).

2.1.11 Equipment Upgrade Plans

Moving forward it was agreed that new more robust AWS would be ordered to replace those within the Cloud Forest (CF) and with some of the underspend from the CF project three new HOBO AWS were purchased that have integrated MiFi Routers for telemetry. These will directly replace The Peaks and High Peak in the exact location, but for The Depot it is proposed to install this station slightly down slope from the original to lessen the weather impacts. It is proposed to have the HOBO AWS installed by the end of April 2025.

Two of the Automatic Weather Stations within the Peaks National Park have been upgraded, with links to the live dashboards provided below. High Peak will be upgraded once a replacement is sent by the manufacturer, as there was an error with the one we received.

Peaks: https://www.licor.cloud/dashboards/f5b26aee-2635-40fa-ba88-087162df482e/true
Depot: https://www.licor.cloud/dashboards/16e0eb92-e753-4cf6-8999-5be2713ba5a6/true

These are in addition to the dashboard that Robert Howard set up last year for the mist and rainfall monitoring network (link here: LI-COR Cloud). All of these climate monitoring equipment provides a real-time look at conditions around the Peaks National Park, alerts us to equipment malfunctions sooner, and also allows us to reduce footfall for pathogen mitigation.

Although they have served us well over the past 3 to 4 years, it was time to retire the Davis Vantage Pro Automatic Weather Stations (AWS) and upgrade them with the more robust HOBO Advanced Cellular AWS. The HOBO AWS records the same weather condition as the previous Davis Vantage Pro; Temperature, Humidity, Rainfall, Wind Speed & Direction, but also has the addition of collecting data on Leaf Wetness, Soil Moisture and Solar Radiation.

Leaf Wetness measures the amount of dew and precipitation left on the surface of leaves, this can be used in conjunction with the Mist Capture equipment as a form of Quality Control.
Soil moisture has also been identified as a key component to record and, with addition of the Soil Moisture sensor, we can now accurately measure the amount of water held within the soil.
Lastly, with the addition of a pyranometer we can now measure solar radiation and solar energy during Year 5 of the project.

2.2 Mist and Rainfall Data

2.2.1 Daily Mist and Rain

Rainfall isohyets for 2024 using rainfall data from AWS and Hobo rain gauge data loggers is presented in Figure 2-1 overleaf. The isohyet map shows that the high rainfall hotspot is centred over Stitches Ridge in the Peaks.

Monthly mist and rainfall data for the Peaks monitoring locations is summarised in Table 2-2. Monthly rainfall and Mist recorded between August 2021 and March 2025 in the Peaks is shown in Figure 2-2 and Figure 2-3. Monthly mist and rain recoded between August 2021 and March 2025 is shown in Figure 2-4.

Rainfall data for Cabbage Tree Road and The Depot was limited due to equipment failure (grey cells in Table 2-2). Rainfall at Stitches Ridge, Casons and Diana's Peak ranged between 333mm (Casons) and 1,269.6mm (Stitches Ridge).

The Depot recorded the highest annual mist (23,836mm), however the readings are over 2 times higher than the combined mist recorded at the other 4 sites for 2024 (10,800mm) leading to concerns that this data may not be reliable. Further work is needed to confirm the accuracy of this data and the microclimate around the monitoring location. Due to these concerns, mist data collected at The Depot has been omitted from the 2024 water balance (Section 4).

For the other mist monitoring locations, total mist averaged 2,700mm in 2024 compared to 3,184mm for 2023. Monthly mist ranged between 15mm and 754mm (excluding The Depot). As discussed in the Year 3 report, studies of cloud forest mist capture across the world have reported mist contribution between 20mm/a and 1,990mm/a, with mist contributing between 5% and 75% of total catchment runoff[8].

[8] Ellison, D. *et al.* (2017) 'Trees, forests and water: Cool insights for a hot world', *Global Environmental Change*, 43, pp. 51–61. Available at: https://doi.org/10.1016/J.GLOENVCHA.2017.01.002

Figure 2-1: Rainfall Isohyets 2024

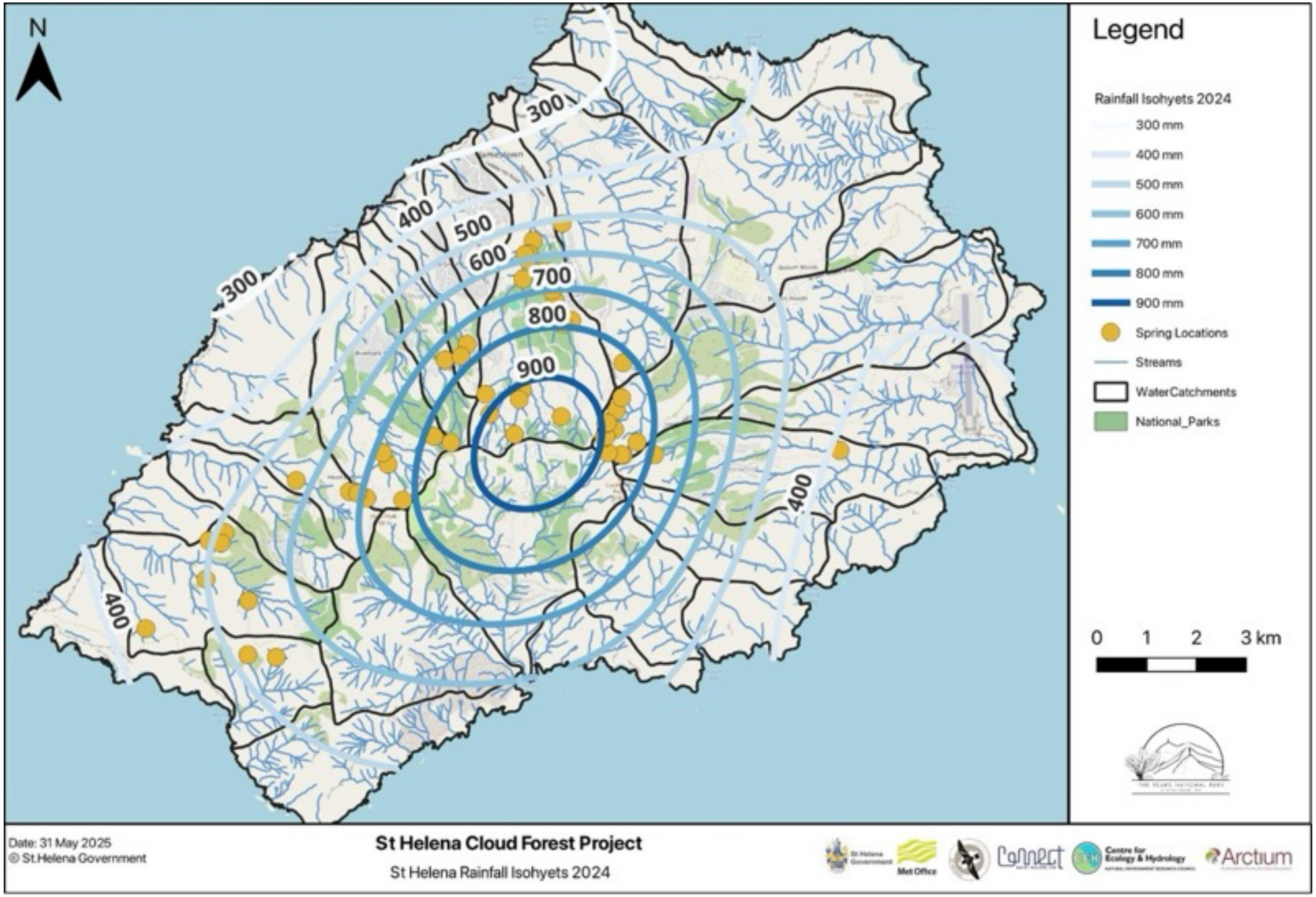


Table 2-2: The Peaks Monthly Rainfall and Mist Data 2024

Date	Stitches Ridge Monthly Mist (mm)	Stitches Ridge Monthly Rainfall (mm)	Casons Monthly Mist (mm)	Casons Monthly Rainfall (mm)	Cabbage Tree Road Monthly Mist (mm)	Cabbage Tree Road Monthly Rainfall (mm)	Diana's Peak Monthly Mist (mm)	Diana's Peak Monthly Rainfall (mm)	The Depot Monthly Mist (mm)	The Depot Monthly Rainfall (mm)
01/2024	32.2	21.8	49.2	6.0	38.4		68.2	19.6	354.8	7.6
02/2024	160.2	81.4	346.6	54.8	283.6		341.0	81.4	3230.0	85.2
03/2024	56.0	84.4	361.4	34.6	296.0		217.8	87.2	2961.2	61.8
04/2024		116.8	66.4	41.0	176.4		207.2	107.8	1102.6	71.0
05/2024		130.6	119.6	39.0	229.8	27.4	371.6	116.0	1650.0	104.0
06/2024	15.8	74.4	22.4	19.0		30.4	185.4	68.2	551.2	36.8
07/2024	139.2	151.8	360.8	68.2	186.0		272.8	104.2	1383.4	
08/2024	132.2	232.6	589.8	36.4	253.0		470.2	109.8	2189.8	
09/2024	77.4	149.8	664.6	11.0	232.2		475.2	82.4	2676.6	
10/2024	70.6	142.6	754.4	7.6	265.4		486.8	74.8	3300.2	
11/2024	31.6	56.0	333.6	4.4	131.4		247.8	37.6	2113.0	
12/2024	65.0	27.4	316.2	11.0	222.2		376.4	69.8	2323.2	
Total	780.2	1269.6	3985.0	333.0	2314.4	57.8	3720.4	958.8	23836.0	366.4
Min	15.8	21.8	22.4	4.4	38.4	27.4	68.2	19.6	354.8	7.6
Max	160.2	232.6	754.4	68.2	296.0	30.4	486.8	116.0	3300.2	104.0
Average	78.0	105.8	332.1	27.8	210.4	28.9	310.0	79.9	1986.3	61.1

Figure 2-2: Monthly Rainfall

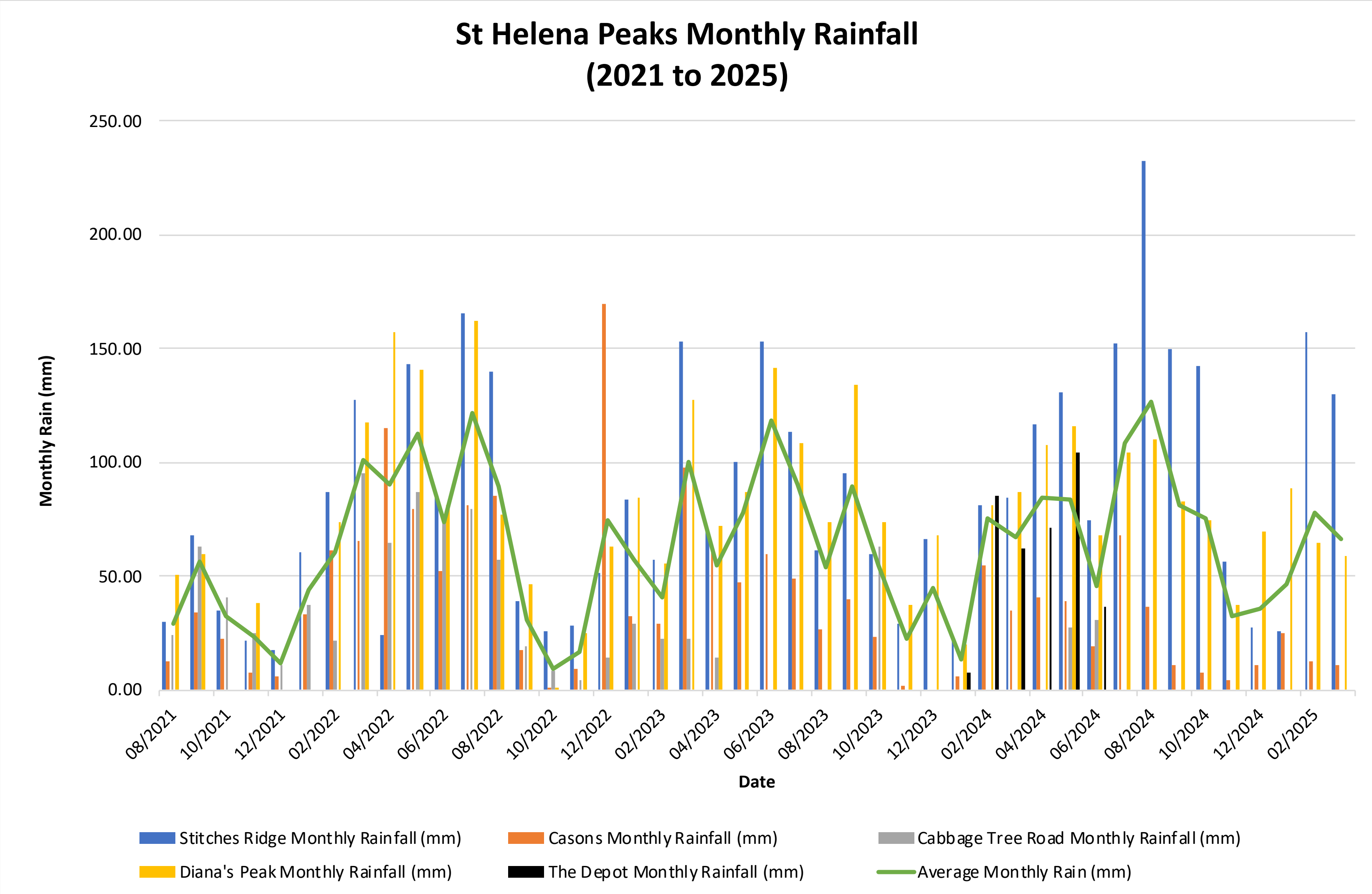


Figure 2-3: Monthly Mist

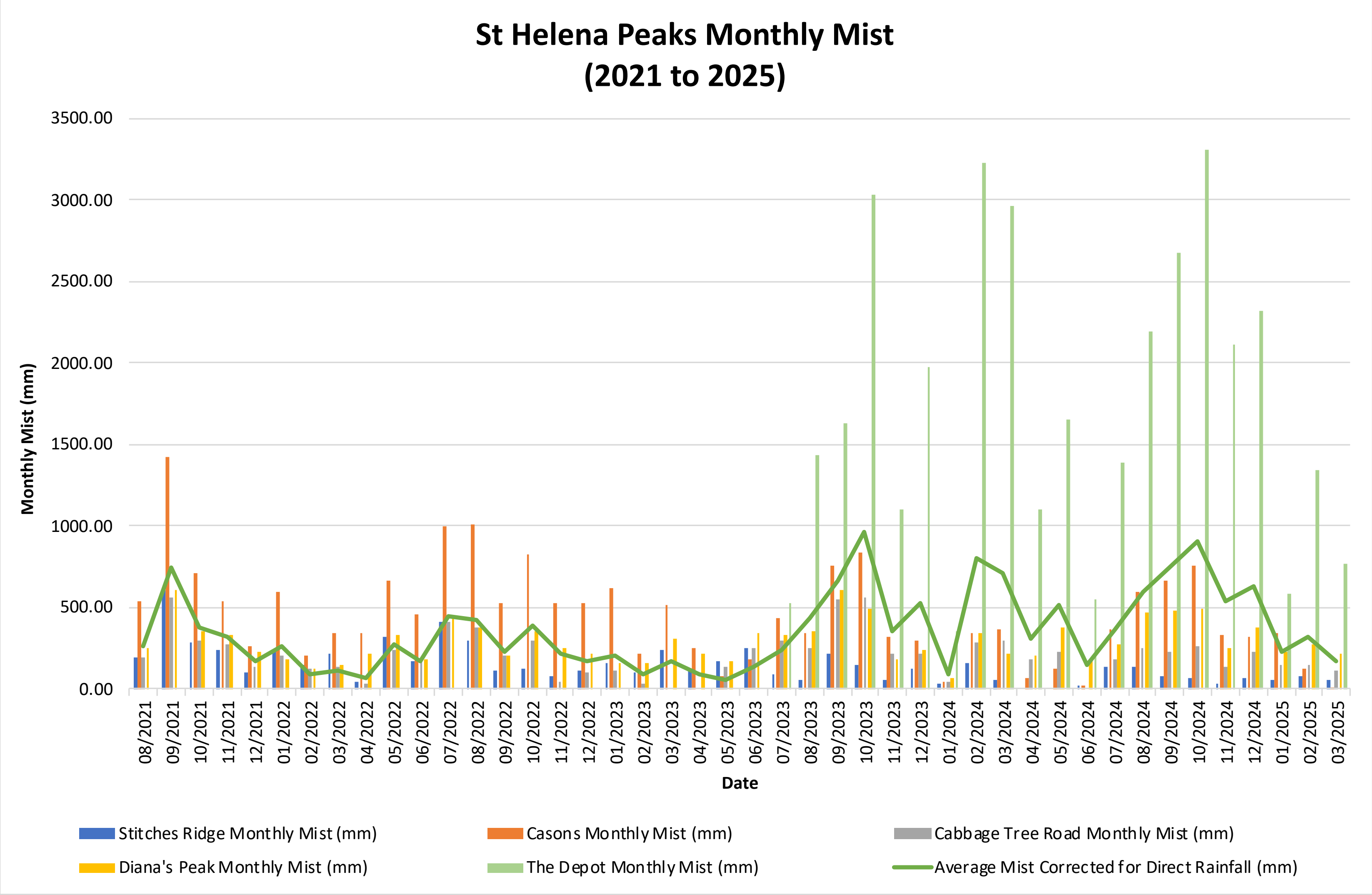
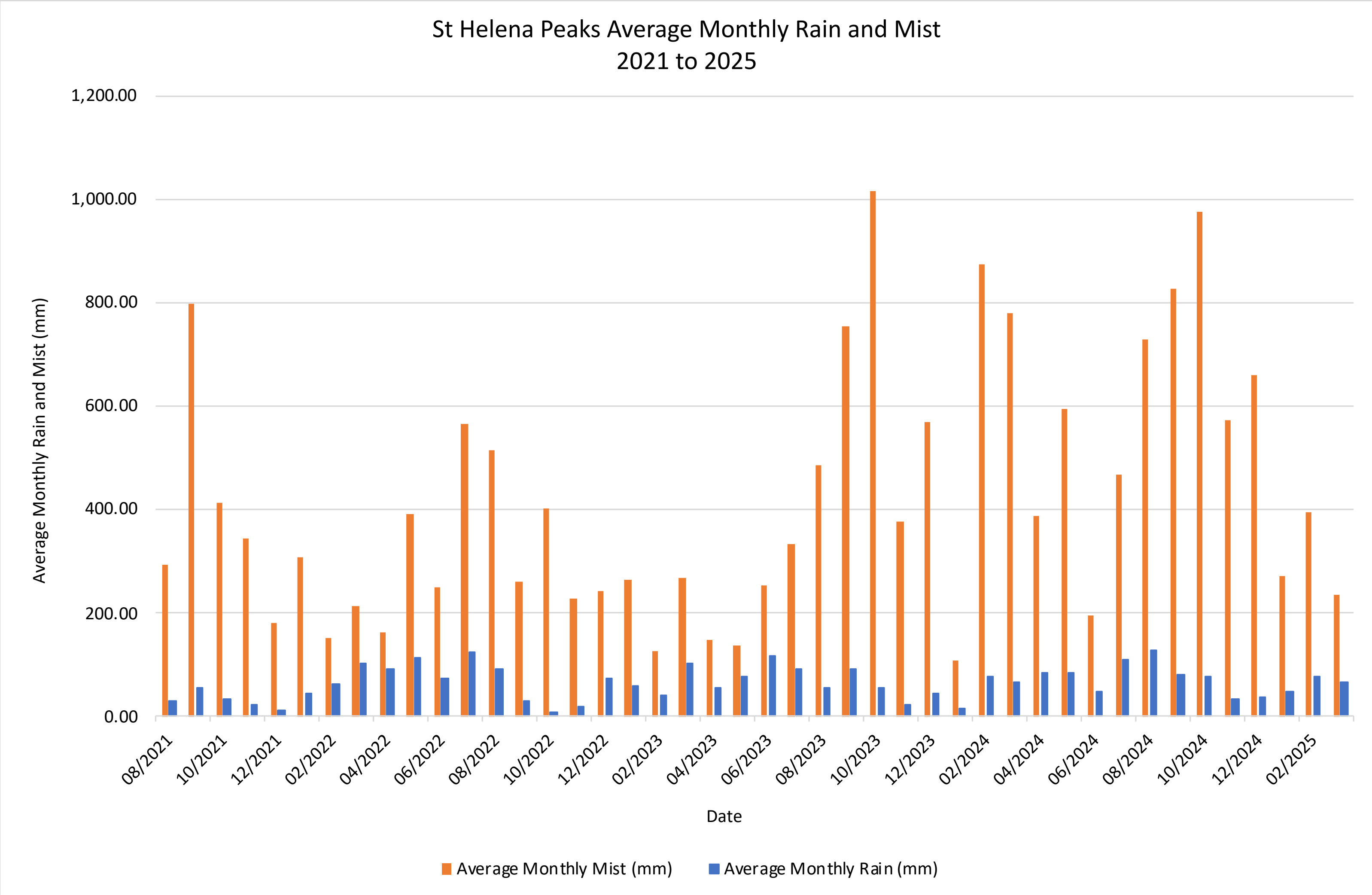


Figure 2-4: Average Monthly Rainfall and Mist



2.2.2 Rain and Mist Days

Table 2-3 and Figure 2-5 summarise the number of days per year where rain and mist were recorded or not recorded. Dry days are days where rain and mist are not recorded.

Table 2-3: Mist and Rainfall Days 2021 to 2024

Location	Recorded Rain (Days/Year)			
	2021	2022	2023	2024
Cabbage Tree Road	25	185	70	17
Diana's Peak	36	211	294	272
Stitches Ridge	81	213	251	215
Casons	84	215	223	184
The Depot				118
Location	**No Recorded Rain (Days/Year)**			
	2021	2022	2023	2024
Cabbage Tree Road	30	173	79	21
Diana's Peak	16	105	71	94
Stitches Ridge	57	125	114	146
Casons	54	125	114	175
The Depot				31
Location	**Recorded Mist (Days/Year)**			
	2021	2022	2023	2024
Cabbage Tree Road	132	249	227	269
Diana's Peak	137	339	345	340
Stitches Ridge	116	247	236	177
Casons	128	303	314	308
The Depot				335
Location	**No Recorded Mist (Days/Year)**			
	2021	2022	2023	2024
Cabbage Tree Road	6	51	112	59
Diana's Peak	1	19	19	23
Stitches Ridge	22	90	107	96
Casons	10	32	51	57
The Depot				19
Location	**Dry Days (Days/Year)**			
	2021	2022	2023	2024
Cabbage Tree Road	1	44	49	49
Diana's Peak	1	13	18	21
Stitches Ridge	21	84	92	82
Casons	9	31	35	50
The Depot				7

Note: The Cabbage Tree Road AWS was not working between May 2023 and December 2023, nor for most of 2024 so the rainfall data at this location is not representative of rainfall recorded at the other monitoring locations (salmon shaded cells). The data set for 2021 started in August, so is not representative of a full calendar year. This data set will improve in time as monitoring of climate variables continues across the island. The Depot monitoring location also stopped recording rainfall between July and December 2024, so data is not representative of a full calendar year.

A commentary of the 2022 and 2023 data was provided in the Year 3 Addendum report. Diana's Peak, and Casons had a similar number of recorded mist days, with Stitches Ridge reporting approximately 50% fewer mist days. Diana's Peak reported the highest number of rain days (272) with Cason's the lowest (184).

Average rainfall data across the Peaks monitoring network confirmed 2024 as slightly wetter than 2022 and 2023, with an average of 854mm rainfall recorded, compared with an average 825mm rainfall recorded in 2022 and an average rainfall of 806mm recorded in 2023.

2.3 Peaks Rainfall comparison

Table 2-4 summarises annual average rainfall in the Peaks between 2022 and 2024.

Table 2-4: Average Annual Rainfall

Year	Peaks Average Rainfall (mm)
2022	878
2023	825
2024	849

Rainfall data across the HOBO Peaks monitoring network confirmed 2024 as wetter year than 2023, but drier than 2022. For the 3 year data record, average rainfall in the Peaks is estimated as 850.6mm.

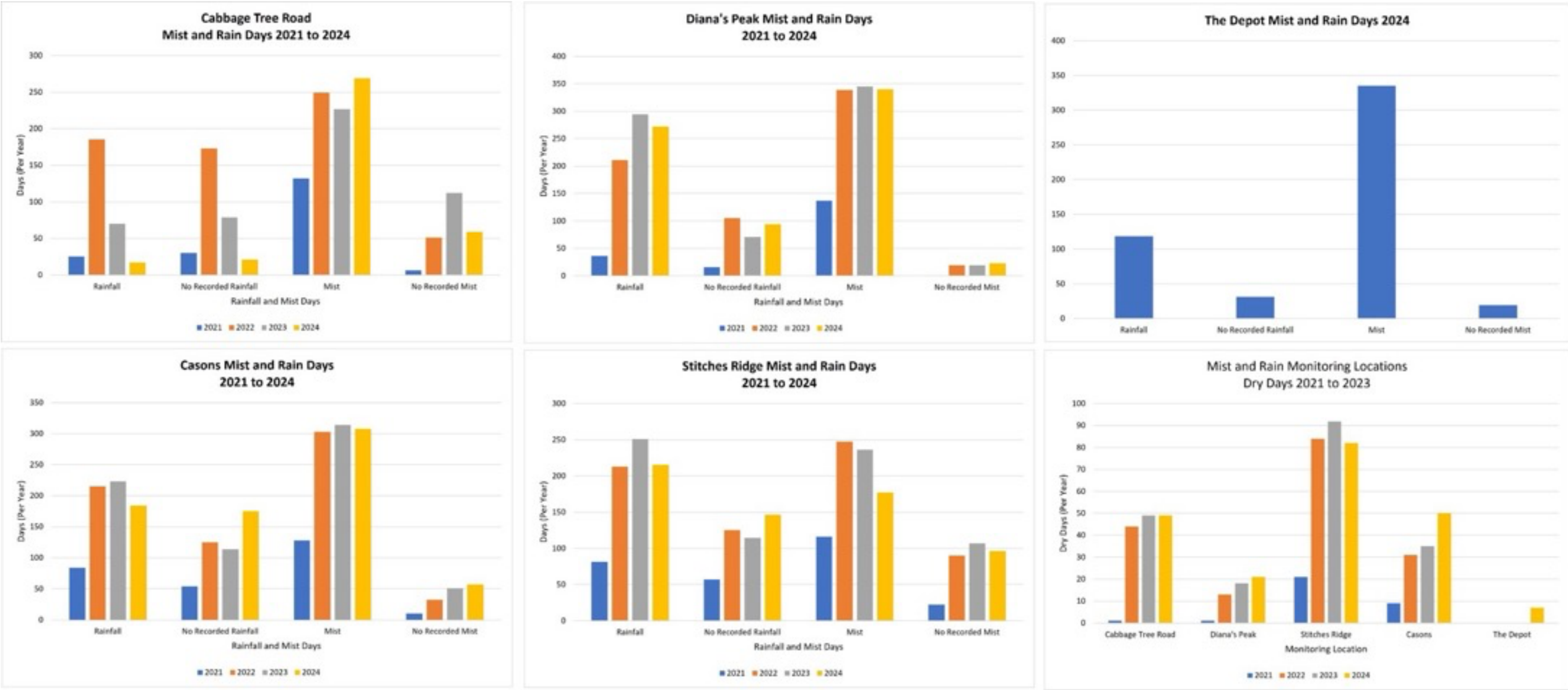
2.4 Mist Contribution to Recharge

For the purposes of the catchment water balances (Section 4), it has been assumed that 1000mm of the 2024 average mist is available for recharge, with the remaining mist evaporated from the cloud forest canopy (1,700mm). Based on this assumption, mist is estimated to contribute 58% of recharge in 2024 in water balance Zone 1 (land above 690m contour).

2.5 Potential Evapotranspiration

Equipment has been purchased to measure potential evapotranspiration (PEt) in the field, however this data has not been collected in Year 4 due to equipment issues and changes in staff within the water pillar team. It is hoped that field data can be collected in Year 5 to collect PEt readings within stands of flax and within the tree fern canopy of the cloud forest.

Figure 2-5: Mist and Rainfall Days 2021 to 2024



2.6 HOBO Mist and Rainfall Monitoring Network

In Year 3 of the project, funding enabled the procurement of new equipment needed to upgrade the mist and rainfall monitoring network from one that required manual data downloads, to one using a remotely operated telemetry system. A driving factor for this upgrade was the presence of pathogens within The Peaks National Park. Having monitoring equipment linked to a telemetry system would reduce the footfall in these restricted zones, reducing the risk of spreading the pathogens. HOBO was selected as the equipment supplier as their telemetry system could be retrofitted to the HOBO rain gauges that were already deployed in the field for monitoring mist and rainfall in The Peaks.

The 4G mobile network system utilises the islands mobile phone network to upload data to a cloud platform where it is accessed and monitored. The HOBO equipment that has been in place throughout the project also has a proven track record for its reliability, making it a more favourable choice.

Casons was selected as the pilot site for upgrading equipment as this site was more easily accessible for carrying tools and equipment. The upgrade consisted of mounting the MicroRX station, telemetry unit, and an additional solar panel to provide sufficient charge during the winter periods. To enable the station to collect data, data loggers on the rain gauges were replaced with smart sensors. Additionally, soil moisture content sensors were installed to provide soil percolation data at each monitoring location. Measures were put in place to ensure that the equipment was weatherproof and protected from rodents.

The pilot upgrade proved to be a success, with mist and rainfall data collected and uploaded to HOBOlink, HOBO's cloud platform, at six-hour intervals with no occurrences of any faults. As a result of the positive trial, the remaining sites within the mist and rainfall network were upgraded to the telemetry system. Mist and rainfall monitoring locations connected to the HOBOlink telemetry system are shown in Figure 2-6 overleaf. Mist and rainfall equipment connected to HOBOlink at Casons and Cabbage Tree Road are shown in Figure 2-7.

The system sends notifications whenever any faults occur and when they have been fixed. This has been particularly useful with Stitches Ridge, which is in a challenging location for network coverage and tends to have spells of missed connections to upload data to the cloud. Sometimes the connection can be lost for up to eight weeks. During these periods, the system records the data locally until a signal is found to upload the data to the cloud.

With all the data collected from the monitoring network, the public can also view this data as HOBOlink allows the user to create custom data dashboards. This also provides an added benefit to the Cloud Forest Project, as the Pathogen Taskforce Group are able to view pathway conditions within the Peaks National Park, aiding in their decision making for allowing or denying access to restricted zones. The dashboard has been shared with project partners and the public and can be found here: hobolink.licor.cloud/dashboards

Figure 2-6: Mist and Rainfall HOBO Telemetry Locations

Figure 2-7: HOBOlink equipment at Casons (l) and Cabbage Tree Road (r)


Black Bridge Data Collection

3 Water Resource Monitoring

3.1 Monitoring Network

During the past 12 months, gaps in the datasets have occurred. Reasons for this are:

- **Equipment failure**. As most of the data loggers that are deployed in the field are ageing, issues were encountered and rectified. There was no data collected between equipment failure and repairs. Some data loggers were damaged beyond repair, or in the case of Diver data loggers, couldn't be repaired due to their design.
- **Flooding**. Some of the v-notch weirs were inundated by heavy rain, therefore, stream level and flow data could not be calculated as the "v" was flooded and caused data loggers to be washed out of the structures. This is mainly down to the structures being too small to accommodate the stream flows.
- **Delayed maintenance to structures**. Lower Gents Bath's main piped source flow into the structure was arranged to bypass the v-notch and flow directly into the abstraction chamber due to leaks found in the weir. Streamflow into the structure coming from runoff from Upper Gents Bath flowed into Lower Gents Bath, however, silt and debris build up in the structure was far too much to record any meaningful data, as the data logger was fully submerged in this silt and was therefore removed until the required structure maintenance is completed.

A summary of gaps in the 2024 surface water monitoring data set is provided in Table 3-1

Table 3-1: Surface Water Monitoring Data Gaps 2024

Catchment	Monitoring Location	Data Gap(s)	Comment
Fishers Valley	SW01WG	10/02/24 to 31/12/24	38 days of data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers.
	SW02WG	22/03/24 to 31/12/24	81 days of data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers.
	SW03WG	22/03/24 to 31/12/24	81 days of data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers and weir plate.
	SW01BG	12/07/24 to 31/12/24	193 days of data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers.
	SW01LG	01/01/24 to 08/02/24 and between 12/07/24 to 31/12/24	154 days of data. Equipment failure stopped data collection. Awaiting

Catchment	Monitoring Location	Data Gap(s)	Comment
			upgrade with replacement telemetry loggers and weir plate.
James Valley	Black Bridge	28/03/24 to 31/12/24	87 days of data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers and weir plate.
	Drummonds Point		366 days of data (leap year). Missing flow values due to low water levels in the structure (no flow over the weir).Awaiting upgrade with replacement telemetry loggers and weir plate.
	Harpers	11/04/24 to 31/12/24	101 days of data with 5 days no flow over the weir. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers and weir plate.
	Lower Gents Bath	No data for 2024	See commentary in Section 3.1. Awaiting upgrade with replacement telemetry loggers and weir plate.
	Upper Gents Bath	28/03/24 to 18/07/24	113 days of missing data. Equipment failure stopped data collection. Awaiting upgrade with replacement telemetry loggers and weir plate.
	Osbournes 1		137 no flow days as water levels below the bottom of the "V". Awaiting upgrade with replacement telemetry loggers and weir plate.
	Osbournes 2	29/03/24 to 31/07/24	126 days of missing data due to equipment failure. Awaiting upgrade with replacement telemetry loggers and weir plate.

The surface water monitoring network has old end of life data loggers, with some causing data gaps, or in more severe cases, becoming inoperable. Connects water abstraction infrastructure were designed with a lack of knowledge for accurate flow record measurements. The Cloud Forest Project Water Pillar team made plans to upgrade the monitoring network to increase the accuracy in measuring flow and reduce data gaps previously experienced. Bespoke, engineered v-notch weir plates were sourced, as each structure has a different v-notch angle cut into the concrete blockwork alongside varying channel dimensions. Stage boards have also been purchased to ensure manual water level readings can be standardised if monitoring data collection personnel change. Piping was purchased locally to build stilling wells, which will eliminate occurrences of data logger displacement during the heavy rain seasons, with stilling well caps and padlocks sourced to reduce risk of tampering or vandalism.

The selected manufacturer for this telemetry equipment was once again HOBO, as the system is compatible with the islands mobile network, and it was logical to manage all sites together with the mist and rainfall monitoring network on one platform[9]. The pilot sites selected for this upgrade were Drummonds Point and Black Bridge. LevelScout data loggers were replaced with HOBO water level sensors, which are connected to interfaces that were then mounted to an installed post at each of the two sites. The sensors were configured to communicate to a MircoRX station in a mesh network arrangement, and given the steep topography and thick vegetation, a repeater was installed to boost the signal strength. Each water level sensor has integrated barometric pressure sensors and removes the previous process of barometric compensation to measure the height of the water column.

Unfortunately, the stilling wells and v-notch weir plate couldn't be installed to the appropriate structures as a high-powered SDS drill had to be purchased. Most sites within the monitoring network would be unsafe to carry a portable generator to as a power source for the installation equipment.

3.2 Data Collection

The project surface water and groundwater monitoring network has continued to be monitored in Year 4 of the Cloud Forest Project. A detailed description of the monitoring network can be found in the joint Darwin Plus and Cloud Forest project reports published in July 2023[10].

Data has been collected on a monthly basis. However, due to the continued access restrictions in the Peaks, data collection has at times been more sporadic at some monitoring locations.

3.3 Surface Water

The most complete record of island stream flows is provided in Appendix 2 of the 1990-2010 Water Plan[11]. The data set reported was for 19 catchments across the island, with daily flows recorded between 1975 and 1989. Nine of the catchments were reported to have limited data due to sporadic data collection. Where relevant, these historic flows have been used as a reference point for flows recorded between 2021 and 2024.

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[9] HOBOlink enables implementation of a triggered warning system for stream flows and levels. An example of this is if a logged data entry shows that flows have reduced to a level below a set parameter, a warning will be sent to alert the monitoring network operator that a potential drought could be experienced in the near future. This would escalate processes for key water resource management decision making to mitigate the effects of drought. The same can also be done for the opposite end of the scale, if flows exceed a certain parameter, then an alert can be sent to warn for potential flooding.

[10] Saint Helena Government (2023). DPLUS103 St Helena Climate Change and Drought Warning Network. Volume 1 – Climate, Volume 2 – Water Resources. Sansom B, George R, Mullings-Smith E, Groen M, Palmer S, Henry M, Walmsley B, Gray A, Muranganwa L.

[11] WS Atkins (1990). St Helena Water Plan 1990-2010. Public Works and Services Department, Saint Helena Government

3.3.1 Fishers Valley – the Peaks

Stream flow data collection started in May 2019 as part of an earlier funded monitoring project associated with the drafting of the Peaks Management Plan. Monitoring locations were integrated into the DPLUS103 monitoring network from April 2020 and have continued to be used for the Cloud Forest Project. A summary of stream flows is presented in Table 3-2. Water level and flow charts for all Fishers Valley monitoring locations are provided in Appendix 2.1.

Table 3-2: Fishers Valley Stream Flows in The Peaks

Monitoring Location	Year	Average Stream Flow (m^3/d)	Maximum Stream Flow** (m^3/d)	No flow days	Flow Per Annum (m^3/a)	St Helena Water Plan 1990 to 2010 (m^3/d)
SW01WG	2019*	48	58	58	9,736	64.7 avge 10.2 min
	2020	98	130	22	32,393	
	2021	60	130	25	21,767	
	2022	109	130	0	39,683	
	2023***	98	130	130	23,095	
	2024`	88	88	0	3520	
SW02WG	2019*	27	138	278	5,492	No data
	2020	77	202	115	27,639	
	2021~	51	177	133	12,006	
	2022~	144	204	0	47,382	
	2023	127	204	27	46,370	
	2024@	138	138	0	11,136	
SW03WG	2019*	121	230	20	No data	111 avge 42.6 min
	2020	98	389	8	34,820	
	2021	90	238	5	32,494	
	2022	56	191	0	20,498	
	2023	45	186	0	16,329	
	2024@	33	74	0	2646	
SW01BG	2019*	3	4	26	552	46.8 avge 9.6 min
	2020	3	4	1	1,040	
	2021	3	4	1	943	
	2022	3	4	0	1,166	
	2023	3	4	130&	773	
	2024#	3	4	0	524.23	
Leggs Gut	2022	886	3,399	0	290,451	70 avge 10.4 min
	2023	216	1,575	151^	46,408	
	2024&&	163	1,608	0	25,113	

*Note: 2019 is a partial year as data collection started in May 2019.
**Maximum flow in SW01GW, SW02WG and SW01BG is controlled by catchpit design and diameter of discharge pipe.
***No data collected at SW01WG between 6th January and 15th May 2023 due to equipment issues.
~The catchpit at SW02WG was reconstructed between August 2021 and February 2022, hence the number of no flow days.
`Water levels all below the bottom of the "V" in the weir except for a few days in July 2019.
&No data collected at Byrons Gut between 1st January and 15th May 2023 due to equipment issues.
^No data collected at Leggs gut between 11th August and 31st December 2023 due to equipment issues.
#No data collected at SW01BG between 12th July and 31st December 2024 due to equipment issues.

‘No data collected at SW01WG between 10th February and 31st December 2024 due to equipment issues.

@ No data collected at SW02WG and SW03WG between 22nd March and 31st December 2024 due to equipment issues. No flow data is for the length of the monitoring record.

&& No data collected at Leggs Gut between 1st January to 8th February 2024 and 12th July to 31st December 2024 due to equipment issues.

Due to the length of gaps in the data record for all Fishers Valley surface monitoring locations, an analysis of data trends is not possible.

3.3.2 James Valley

A summary of stream flows for monitoring locations in James Valley is presented in Table 3-3. Water level and flow charts for all JamesValley monitoring locations are provided in Appendix 2.1.

Table 3-3: James Valley Stream Flows

Monitoring Location	Year	Average Stream Flow (m^3/d)	Maximum Stream Flow (m^3/d)	No flow days	Flow Per Annum (m^3/a)	St Helena Water Plan 1990 to 2010 (m^3/d)
Black Bridge	2021*	320	852	0	81,047	282 avge 95.1 min
	2022	424	968	0	154,887	
	2023	316	675	4	114,225	
	2024˜	218	306	0	17,961	
Drummonds Point	2021*	234	575	150	24,342	206 avge
	2022	380	992	162	63,080	
	2023***	93	708	125	32,988	
	2024`	95	704	184	34,404	
Harpers	2021*	126	234	156	8,161**	- avge - min
	2022	279	657	39	90,837	
	2023	231	1,293	0	84,153	
	2024&	123	314	5	11,805	
Lower Gents Bath	2021*	315	451	0	79,603	Gents Bath Spring 23 avge 6.7 min
	2022	325	598	0	118,677	
	2023	161	449	21	58,584	
	2024#	-	-	-	-	
Upper Gents Bath	2021*	109	334	1	27,358	
	2022	124	338	0	40,675	
	2023^	107	259	60	30,670	
	2024‘	114	318	0	28,741	
Osbornes 1	2021*	117	352	70	21,277	Osbornes Spring 65 avge 16.5 min
	2022	257	579	190	44,983	
	2023	129	467	160	26,507	
	2024@	127	498	137	46,462	
Osbornes 2	2021*	211	1,455	3	52,695	
	2022	60	267	0	21,798	
	2023	24	49	0	8,700	
	2024&&	29	138	0	6,992	

* Note: 2021 is a partial year as data collection started in April 2021.

**Harpers dataloggers vandalised. No data collection between July 2021 and February 2022.
*** No data between 12th and 22nd June and between 20th August and 12th December at Drummonds Point due to equipment issues.
^ No data between 1st January and 1st March 2023 at Upper Gents Bath due to equipment issues.
˜No data for Black Bridge between 28th March and 31st December 2024 due to equipment issues.
`Missing flow data for Drummonds Point at several times during the year due to low water levels in the structure.
&No data for Harpers between 11th April and 31st December 2024 due to equipment issues.
#No data for Lower Gents Bath 2024 due to equipment issues.
‹No data for Upper Gents Bath between 28th March and 18th July 2024 due to equipment issues.
@Missing data for Osbornes 1 between 23rd January and 8th May 2024 due to low water levels in the structure.
&& No data for Osbornes 2 between 29th March and 31st July 2024 due to equipment issues.

Due to the significant amount of missing data due to problems with monitoring equipment, it is only possible to review the data sets for Drummonds Point and Osbournes 1.

Drummonds Point. Flow data appears comparable to 2023, however the Drummonds Point data set for 2023 was not complete due to a long period of problems with the data logger which was under reporting flows. Flows are significantly lower than recorded in 2021 and 2022.

Osbournes 1. Flows for the year are over 50% higher than 2023 and reflect a dryer summer as spring flows between January and May, were insufficient for water levels to reach the bottom of the "V".

The observation regarding v-notch weir maintenance from 2023 still stands. Collecting water level data at the Osbornes 1, Osbornes 2, Upper Gents Bath and Lower Gents Bath V-notch weirs show that the structures silt up very quickly, which could have an adverse impact on the data collected to calculate stream flows. It is recommended that all the islands' weirs are maintained on a more regular basis by Connect to des-silt the structures and ensure water flow is unobstructed.

3.3.3 Stream Hydrographs

Water flow hydrographs for the Fishers Valley monitoring locations between 2021 and 2024 are presented in Figure 3-1. Water flow hydrographs for the James Valley monitoring locations between 2021 and 2024 are presented in Figure 3-2. The water flow hydrographs for Fishers Valley and James Valley monitoring locations have not been interpreted due to the very short data records for 2024.

An evaluation of stream hydrograph data should improve significantly once the v-notch weir upgrades are completed and the water level and flow telemetry system is commissioned during 2025.

Figure 3-1: Fishers Valley Monthly Average Stream Flow and Rainfall

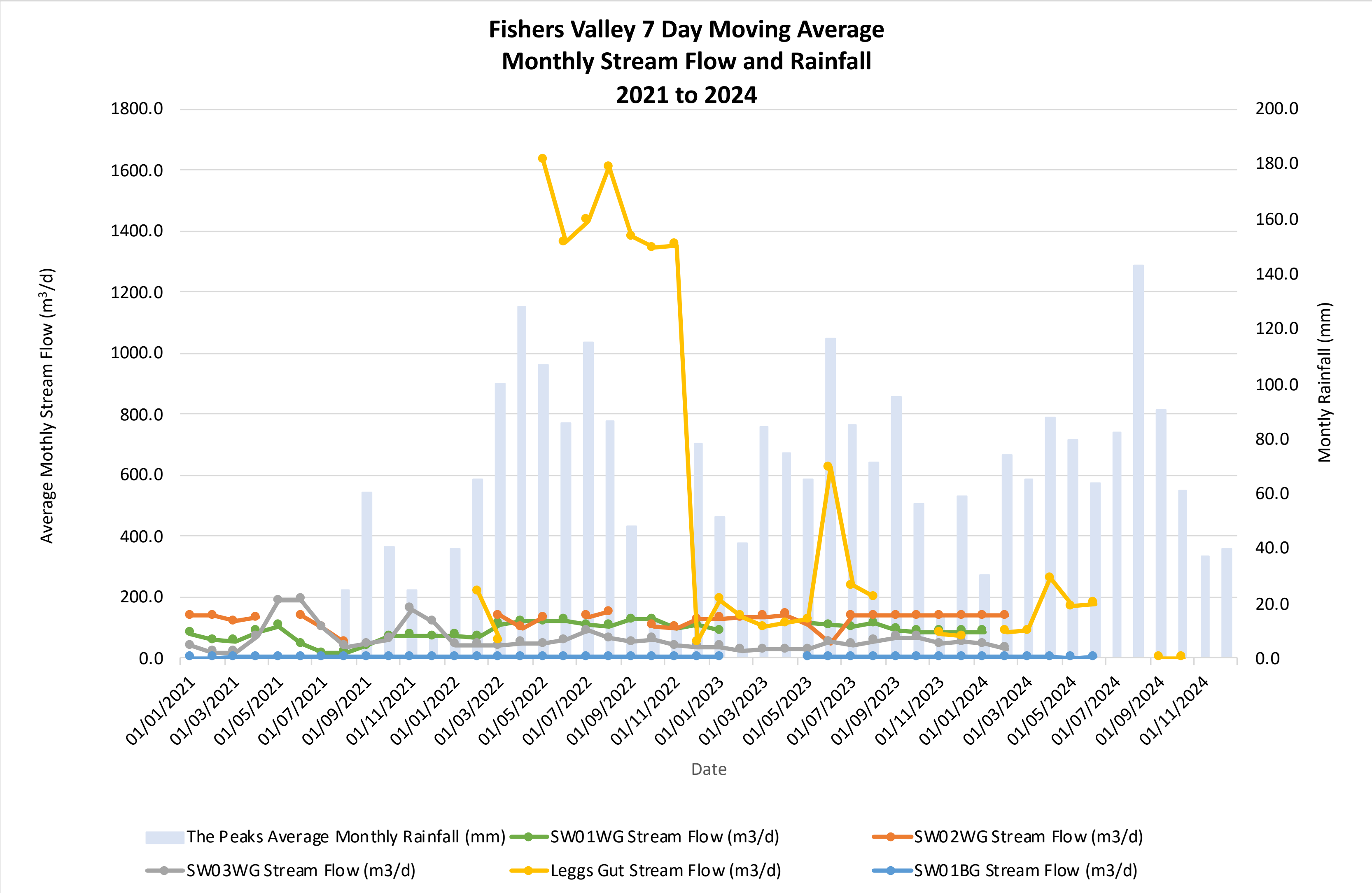
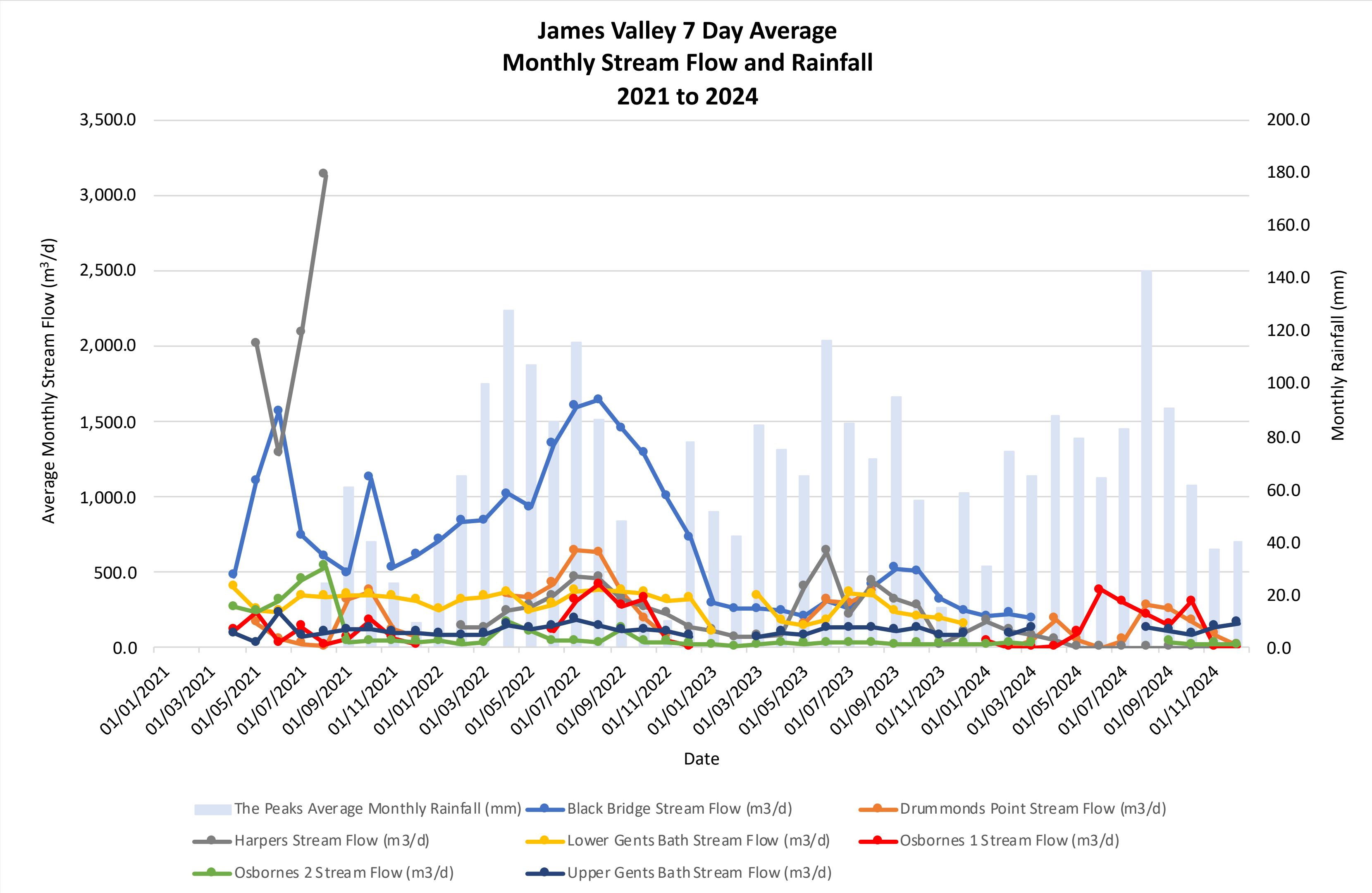


Figure 3-2: James Valley Monthly Average Stream Flow and Rainfall



3.4 Groundwater

A number of wellfields were developed after recommendations made by Lawrence[12], in particular Frenches Gut and Iron Pot which are located at the top of the Lemon Valley catchment. The Water Pillar team installed monitoring equipment in 3 boreholes as part of DPLUS103 and the Cloud Forest Project, located up and downstream of the Frenches Gut valley borehole and upstream of the Iron Pot pumping borehole to see if rainfall recharge could be seen in groundwater level responses. Groundwater was also monitoring in the WPS deep borehole at Molly's Gut (MGTBH01 and subsequently MGTBH02) and a shallow observation borehole in Fishers Valley.

3.4.1 Frenches Gut Well Field

Groundwater levels recorded in Frenches Gut boreholes between February 2022 and December 2024 are presented in Appendix 2.2.

FGBH01. Borehole FGBH01 is located upslope of the pumping borehole and continues to show a slow change in groundwater levels when compared with rainfall events. For the period between March 2022 and May 2023 the borehole shows a rise and fall in groundwater levels similar to a seasonal change. Groundwater is pumped on a short duration cycle where the pumped is switched on an off every few minutes, resulting in small fluctuations in groundwater levels. Data from May 2023 to May 2024 shows a flatter seasonal response in the second half of the water year. This could be due to reduced pumping at the abstraction (FGBH02), and higher rainfall recharge, resulting in higher groundwater levels between April 2024 and December 2024.

FGBH03. Borehole FGBH03 is located 98m downslope of the pumping borehole and has showed very minor changes in groundwater level when compared to rainfall events. However, it is influenced by rainfall recharge more directly than the other boreholes.

FGBH04. Deeper groundwater in borehole FGBH04 located 278m downslope of the pumping borehole showed almost no response to rainfall events across the 3 year monitoring record.

3.4.2 Iron Pot Well Field

Groundwater levels recorded in two Iron Pot boreholes between February 2022 and December 2024 are presented in Appendix 2.2.

Both of the Iron Pot boreholes monitored showed a response to rainfall events. Borehole IPBH01(LM11) upstream of the pumping borehole showed a longer response to rainfall events, whilst the shallower borehole IPBH02 (LM7) which was located 10m from the pumping borehole showed a similar response but also recorded more frequent short-term fluctuations which are attributed to the operation of the water supply borehole pump. More data analysis

[12] Lawrence, A. (1983). The Groundwater Resources of St Helena, WD_OS_83_12. Overseas Development Authority.

is required to determine the influence of the pumping borehole on observation borehole groundwater levels once pumped water levels can be recorded.

3.4.3 Molly's Gut Wellfield

Groundwater levels recorded in MGTBH02 between 2023 and 2024 are presented in Appendix 2.2. The data indicate that there is a mixed response to rainfall in 2023, but the relationship between rainfall recharge and a longer term groundwater recharge response cannot be made from the short data set.

The 2024 data set cannot be interpreted as logger data between 31st 1st January 2024 and 5th May 2024 indicates that groundwater levels had dramatically risen to ground level, however there is no report of high groundwater levels during this period as no manual water levels were taken. Given the previous year's groundwater levels, there are concerns regarding the quality of the 2024 data logger data, which may be related to incorrect calibration of the data logger. There is a large data gap between 11th May 2024 and 29th December 2024 which is understood to be due to data logger problems. The data logger started recording on 29th December 2024 and reported groundwater levels at ground level. Two manual water levels recorded in October and November 2024 record groundwater at 0.00 mbgl. None of the local climate data can explain such a large change in local groundwater levels during 2024. As a consequence, the data cannot be relied upon for the purposes of this report.

These discrepancies will be followed up during Year 5 of the project.

3.4.4 Fishers Valley

There is no groundwater monitoring data for the Fishers Valley boreholes in 2024. Issues with the collection of monitoring data from these locations will be rectified during Year 5 of the project.

Leggs Gut V-Notch Weir
Photography by Capricorn Studios
www.capricorn-studios.com

4 Water Balance 2024

4.1 Methodology

The Year 4 water balance using data collected during 2024 uses the method employed for the Year 3 catchment water balance reported in the project Year 3 addendum report. Each catchment has been subdivided into three zones by elevation:

- Zone 1. Land above the 690m contour (where previous studies have indicated mist interception in the cloud forest occurs alongside rainfall recharge).
- Zone 2. Land between the 500m and 690m contours (where rainfall recharge is believed to occur; and
- Zone 3. Land below the 500m contour (where PE is believed to be greater than rainfall e.g. no rainfall recharge occurs).

A review of previous water balances has highlighted how important the calculation of Potential Evapotranspiration (PE) is for an accurate balance. As a detailed assessment of PE has not been possible due to the short length of the recent monitoring record, however PE values from several literature sources and global PE modelling studies[13] had been used to develop four water balance scenarios:

A. Water Balance A – using PE for land above the 500m contour and below the 500m contour (derived by Ian Mathieson from Hutts Gate and Jamestown climate data[14]).
B. Water Balance B – a single value for PE derived by Mathieson from data collected at Hutts Gate.
C. Water Balance C – Global modelled values of PE for each zone.
D. Water Balance D – using PE values for each water catchment and zone using AWS data.

The following climate data scenarios were selected for 5 model runs of each water balance:

1. Average island rainfall for each zone. Zone 1 is assumed to have 100% mist contribution to total precipitation (rainfall + mist).
2. Zone rainfall for each catchment calculated from the climate monitoring network. Zone 1 is assumed to have 100% mist contribution to total precipitation (rainfall + mist).
3. Zone rainfall for each catchment calculated from the climate monitoring network. Zone 1 is assumed to have 10% mist contribution to total precipitation (rainfall + mist).
4. Zone rainfall for each catchment calculated from the climate monitoring network. Zone 1 is assumed to have 1000mm[15] mist contribution to total precipitation (rainfall + mist).
5. Zone rainfall for each catchment calculated from the climate monitoring network. It is assumed that there is no contribution from mist to total precipitation.

[13] Elnashar, A., Wang, L., Wu, B., Zhu, W., and Zeng, H.: Synthesis of global actual evapotranspiration from 1982 to 2019, Earth Syst. Sci. Data, 13, 447–480, https://doi.org/10.5194/essd-13-447-2021, 2021. Following values of PE estimated for each Zone from global model data: Zone 1 = 1000mm. Zone 2 = 500mm. Zone 3 = 1500mm.
[14] Atkins (1990) St Helena Water Plan (Final) 1990 – 2010. Public Works and Services Department, Saint Helena Government
[15] Ellison, D. *et al.* (2017) 'Trees, forests and water: Cool insights for a hot world', *Global Environmental Change*, 43, pp. 51–61. Available at: https://doi.org/10.1016/J.GLOENVCHA.2017.01.002

Mist data has been reported in Section 2.2. For the purposes of the water balances, it has been assumed that 1000mm of the 2024 average mist (2,700mm) is available for recharge, with the remaining mist evaporated from the cloud forest canopy. The Depot mist data has been excluded as there are concerns about the operation of the mist collecting equipment given the extreme mist values recorded for 2024 (23,836mm mist at The Depot for 2024).

4.2 Connect Saint Helena Water Abstraction

Long term abstraction data reported in the Year 3 addendum report has been used in the 2024 water balance.

4.3 Catchment Area Water Balance 2024

The water balance for 2024 has been calculated on a catchment basis and compared against catchment balances reported by the Public Works and Services Department in 1990[16]. For the purposes of this report, the most representative water balance scenario developed in Year 3 was Water Balance D – Scenario 4, using calculated PE values for 2023 climate data (a more complete data set than that collected in2024) and assuming 1000mm mist is available for recharge. Table 4-1 summarises the island water balance for Water Balance D climate scenario 4.

Table 4-1: Island Water Balance 2024

Water Balance Climate Scenario	Rainfall & Mist Recharge Above 690m (m^3/a)	Rainfall Recharge Between 500m and 690m (m^3/a)	Average Water Abstraction 2009-2022 (m^3 per annum)	Total Island Discharge (Million m^3 per annum)	St Helena Water Plan 1990 (Million m^3 per annum)	Lawrence 1983 (Million m^3 per annum)
4 - Zone Rainfall & 1000mm Mist	2,026,985	0	411,012	1.24	4.50	1.5 to 2.5

Note: No recharge below 500m

The hydrogeology report and conceptual model published by A.R. Lawrence[17] in 1983 assessed groundwater recharge in the area above the 500mASL contour (approximately the area above the 600mm rainfall isohyet) and reported an island water balance between 1.5 and 2.5Mm^3/a. The 2024 water balance is close to the lower bound of the water balance calculated by Lawrence and is significantly smaller than the water balance reported in the 2023 Cloud Forest Project addendum report (3.04Mm^3/a). The difference can be mainly attributed to the gaps in AWS rainfall record for the island which was a more limited data set (see Section 2.1) compared to the one recorded in 2023.

[16] Atkins (1990) St Helena Water Plan (Final) 1990 – 2010. Public Works and Services Department, Saint Helena Government

[17] Lawrence, A. (1983). The Groundwater Resources of St Helena, WD_OS_83_12. Overseas Development Authority

Development of a synthetic climate data set to fill gaps in the 2024 climate record to calculate a revised water balance have not been progressed, due to the size of the data gaps (several months) and the relatively short data record we have data for these monitoring locations.

The water balance for each catchment in each rainfall recharge zone is presented in Appendix 3. The key water resource catchments used by Connect Saint Helena are Deep Valley, Fishers Valley, James Valley and Lemon Valley. Table 4-2 summarises water balances for these key catchments using data for 2023.

Table 4-2: Key Water Supply Catchment Water Balances 2024

Catchment	Connect Abstraction (m^3/a)	Proportion of Total Abstraction (%)	Recharge (m^3/a)	Stream Flow (m^3/a)	Surplus/Defecit (m^3/a)	Surplus/ Defecit (%)
Deep Valley	40,950	13%	171,820	0	130,870	76%
Fishers Valley	87,038	28%	228,534	87,038	141,496	62%
James Valley	114,509	37%	359,376	65,593	244,867	68%
Lemon Valley	63,247	21%	264,486	0	201,239	76%
Total Abstraction	305,744.0	100%		**Total Surplus**	718,473	

The catchment water balances indicate that during 2024, each catchment had a surplus of over 60% available recharge. Much of the surplus recharge is groundwater recharge.

V-notch weirs across the island are being upgraded in 2025 and will improve the reliability and accuracy of surface water flow data collection. It is hoped that the problems encountered with the AWS during 2024 will be fixed in 2025, improving the climate data set for the year. Coupled with a longer data set, it is expected that the interpretation of water balance data between years will become more accurate and reliable.

4.4 Climate Change

A climate change assessment has not been completed as two assessments have been made for DPLUS103 published in 2023 and the Cloud Forest Project Water Pillar Year 3 Addendum report published in 2024. There is insufficient new or reliable monitoring data to warrant another assessment.

5 Conclusions

The monitoring data record has been patchy during 2024 due to ageing equipment and prolonged shipment times for surface water catchment upgrade equipment. It was hoped that a new telemetry system and v-notch weir upgrades could have been completed by the middle of 2024 and it is essential that this work is completed in 2025 to ensure that a more reliable surface water and groundwater data set can be recorded.

It is also hope that all the issues with the AWS can be rectified in 2025 to ensure that the island climate monitoring network can continue to deliver high quality data. Looking forward, Connect are in the process of transitioning the role of the project Water Resource Monitoring Technician into wider team roles to ensure that catchment monitoring data continues to be collected using the telemetry system. It is also hope that PEt data can be collected in the field during 2025 to further refine the island water balance.

The 2024 water balance was completed using a more limited climate monitoring network data record compared to 2023. However, the water balance indicates that for 2024 the island water supply was reliant on mist and rainfall recharge from the Cloud Forest and land above the 690m contour. This emphasises the need to continue with cloud forest restoration on the island to improve mist and rainfall interception.

Due to the impacts of the *Phytophthora* infection within endemic cloud forest vegetation, planned restoration of the cloud forest within the Peaks National Park is still a slow process. As discussed in the Year 3 Addendum report, that Crown land located within the Frenches Gut and Iron Pot wellfield catchments above the 690m contour should be considered for reforestation with endemic cloud forest, as the catchments are located at a distance from the main *Phytophthora* infection area.

A larger scale Gumwood restoration below the cloud forest should also be considered with an ecological/hydrological gradation between the two including trees on grazing land.

During Year 5 of the project, monitoring data collection improvements include:

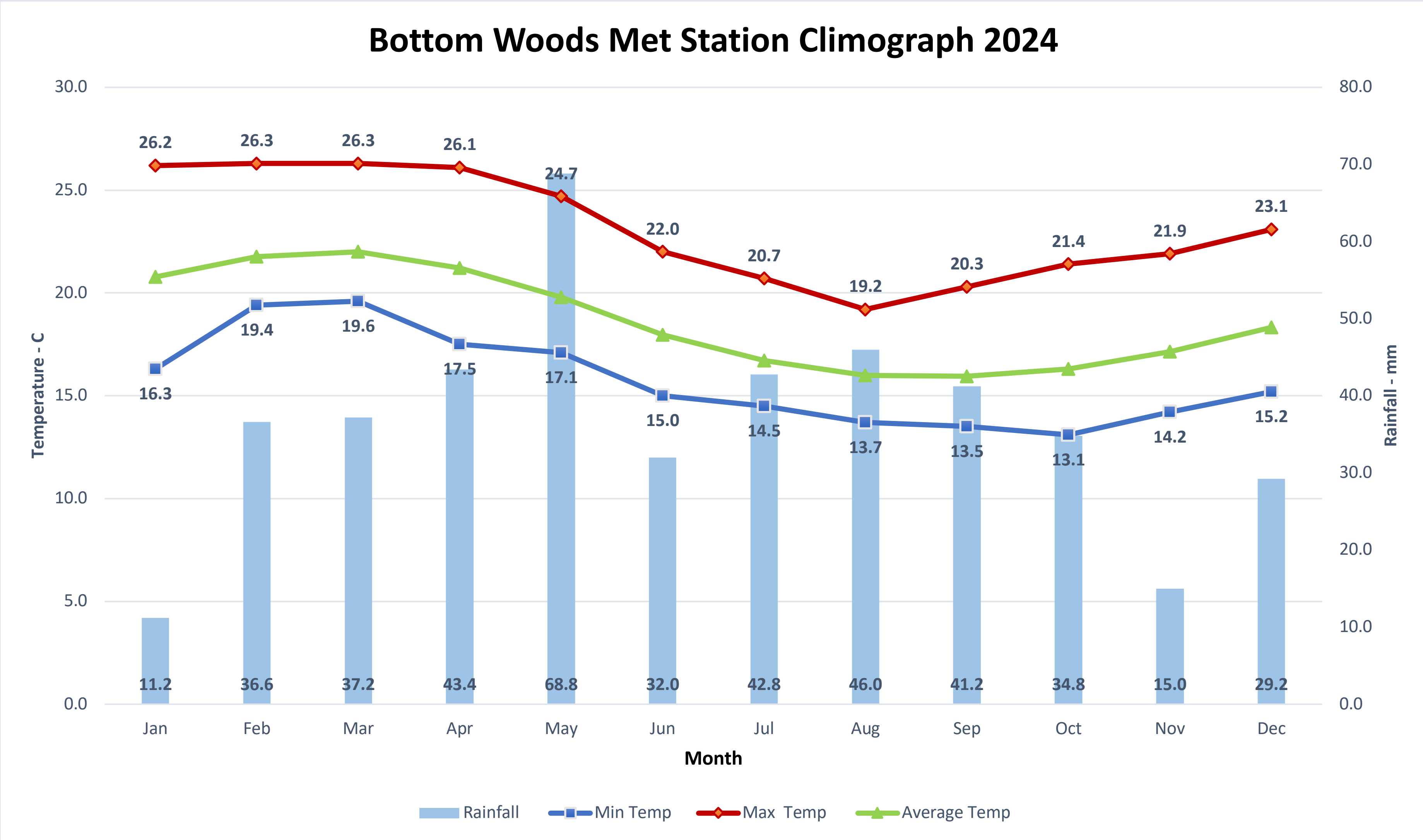
- the completion of AWS upgrades;
- installation of new v-notch weir plates and the Hobo telemetry system at surface water monitoring locations;
- an investigation into Fishers Valley groundwater monitoring locations to ensure continued data collection; and
- an investigation into the Molly's Gut groundwater monitoring location (MGTBH02.

Appendices

Appendix 1: Climate Monitoring Data

St Helena, Bottom Woods GCOS Station

	2024	2024	2024	Period 2001 - 2024	Period 2001 - 2024	Period 2001 - 2024	Period 2001 - 2024	Period 2001 - 2024	2024	Period 2001 - 2024	2024	2024	Period 2001 - 2024	Period 2001 - 2024	2024	2024	Period 2001 - 2024	Period 2001 - 2024
MONTH	**MONTHY _RAIN**	**MAX DAILY RAIN**	**RAIN DAYS**	**Avg MONTHY RAIN**	**Max MONTHY RAIN**	**Min MONTHY RAIN**	**MAX DAILY RAIN**	**Avg RAIN DAYS**	**SUN HOURS**	**Avg MONTHLY SUN**	**Avg DAILY MAX AIR TEMP**	**Max DAILY MAX AIR TEMP**	**Avg DAILY MAX AIR TEMP**	**Max DAILY MAX AIR TEMP**	**Avg DAILY MIN TEMP**	**Min DAILY MIN AIR TEMP**	**Avg DAILY MIN TEMP**	**Min DAILY MIN AIR TEMP**
1	11.2	2.0	13	34.1	72.2	7.2	31.0	20.0	224.9	150.8	24.7	26.2	22.9	26.2	18.5	16.3	17.9	15.0
2	36.6	7.8	16	43.7	12.8	4.0	33.6	18.0	87.1	157.1	24.5	26.3	23.9	27.1	20.3	19.4	19.0	16.4
3	37.2	8.8	20	60.3	104.0	23.4	26.2	20.0	108.3	166.9	24.8	26.3	23.9	27.5	20.5	19.6	19.3	16.1
4	43.4	13.4	11	50.3	82.4	8.8	49.0	18.0	179.7	147.8	24.5	26.1	23.0	26.1	19.4	17.5	18.7	13.7
5	68.8	22.6	12	42.4	115.2	15.4	34.6	16.0	167.2	148.9	22.4	24.2	21.9	26.4	18.4	17.1	17.5	12.9
6	32.0	6.9	15	55.2	107.8	16.6	24.0	19.0	88.9	112.3	20.3	22.0	20.1	24.1	16.4	15.0	16.0	11.1
7	42.8	8.8	20	55.3	105.8	4.4	18.2	18.0	60.3	109.3	18.9	20.7	18.7	22.9	16.5	14.5	15.0	10.1
8	46.0	13.8	19	57.6	106.0	15.6	15.8	21.0	55.9	84.1	18.1	19.2	18.0	21.5	14.7	13.7	14.4	10.8
9	41.2	10	18	51.0	82.4	20.6	11.8	18.0	67.8	63.2	18.4	20.3	18.0	22.3	14.6	13.5	14.3	12.0
10	34.8	7.4	14	27.7	62.8	9.6	16.6	15.0	84.5	67.3	18.9	21.4	18.4	23.1	14.9	13.1	14.6	11.5
11	15.0	6.6	13	19.4	38.8	3.2	22.8	14.0	78.9	88.3	20.3	21.9	19.7	25.3	15.5	14.2	15.3	11.9
12	29.2	5.4	16	22.6	43.2	6.8	10.6	15.0	75.7	116.7	21.3	23.1	21.3	24.4	16.8	15.2	16.4	12.7
ANNUAL	438.2	22.6	187	519.6	115.2	3.2	49.0	212.0	1279.2	1412.7	21.4	26.3	20.8	27.5	17.2	13.1	16.5	10.1



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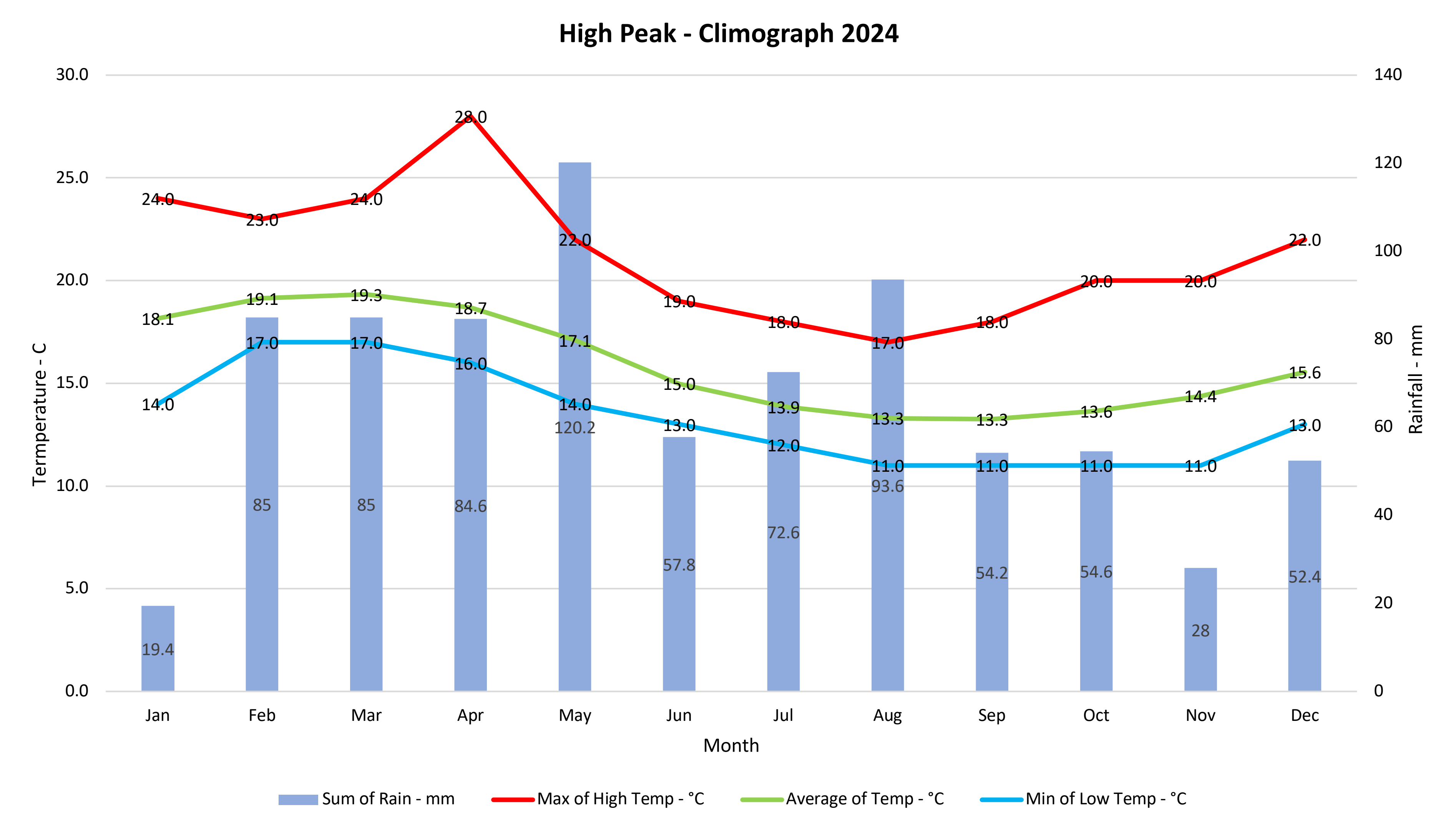
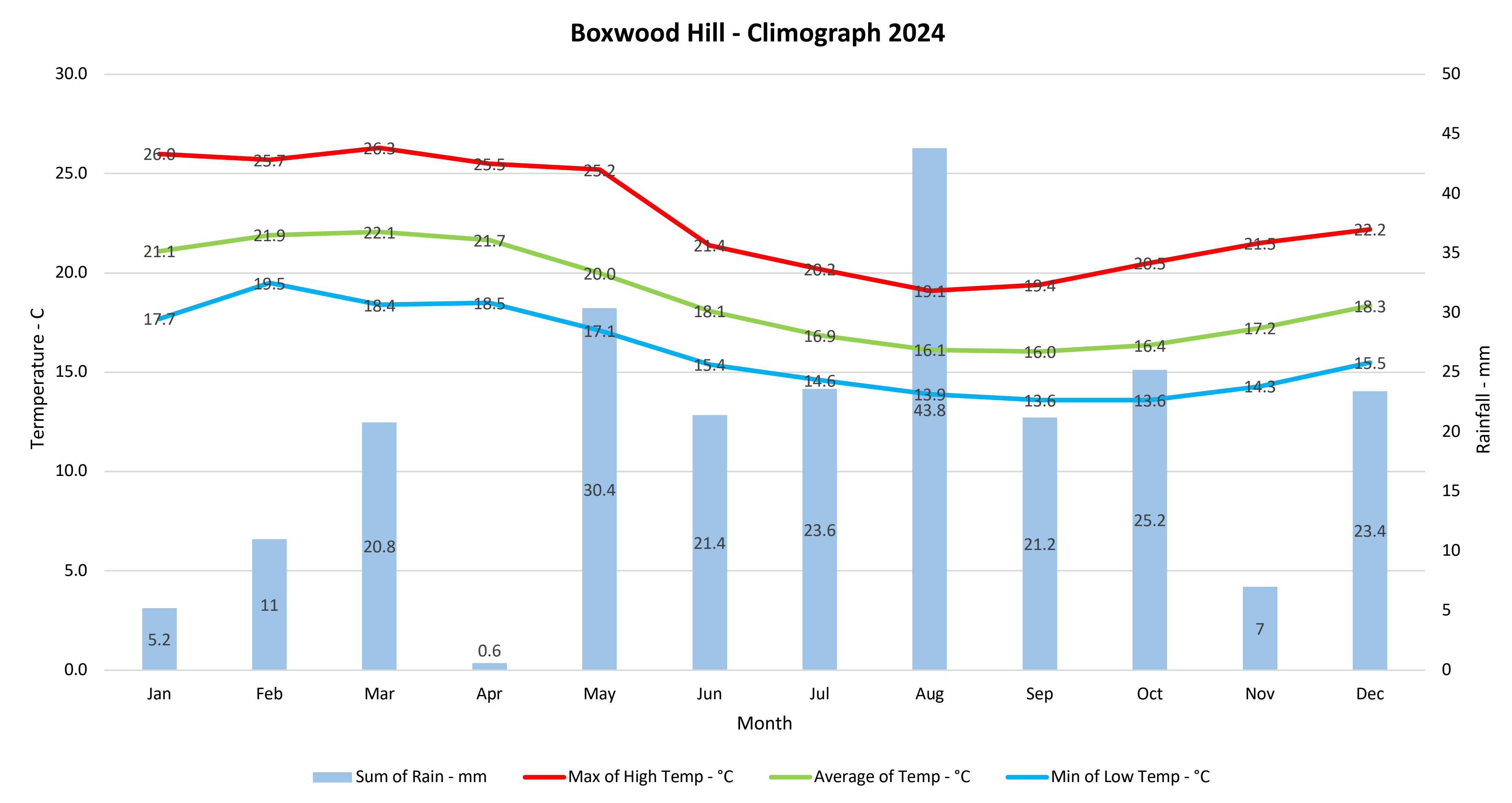


UK Government



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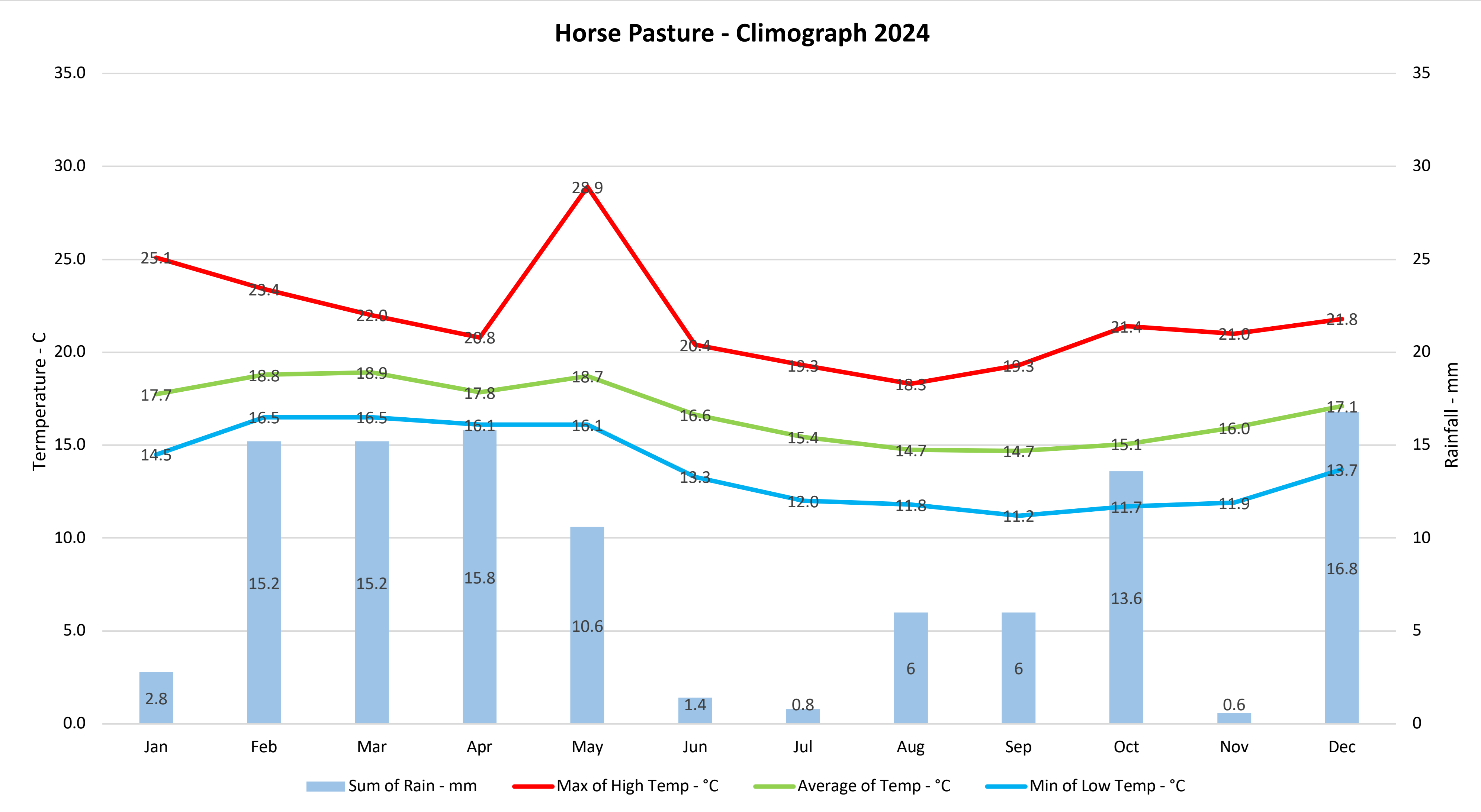
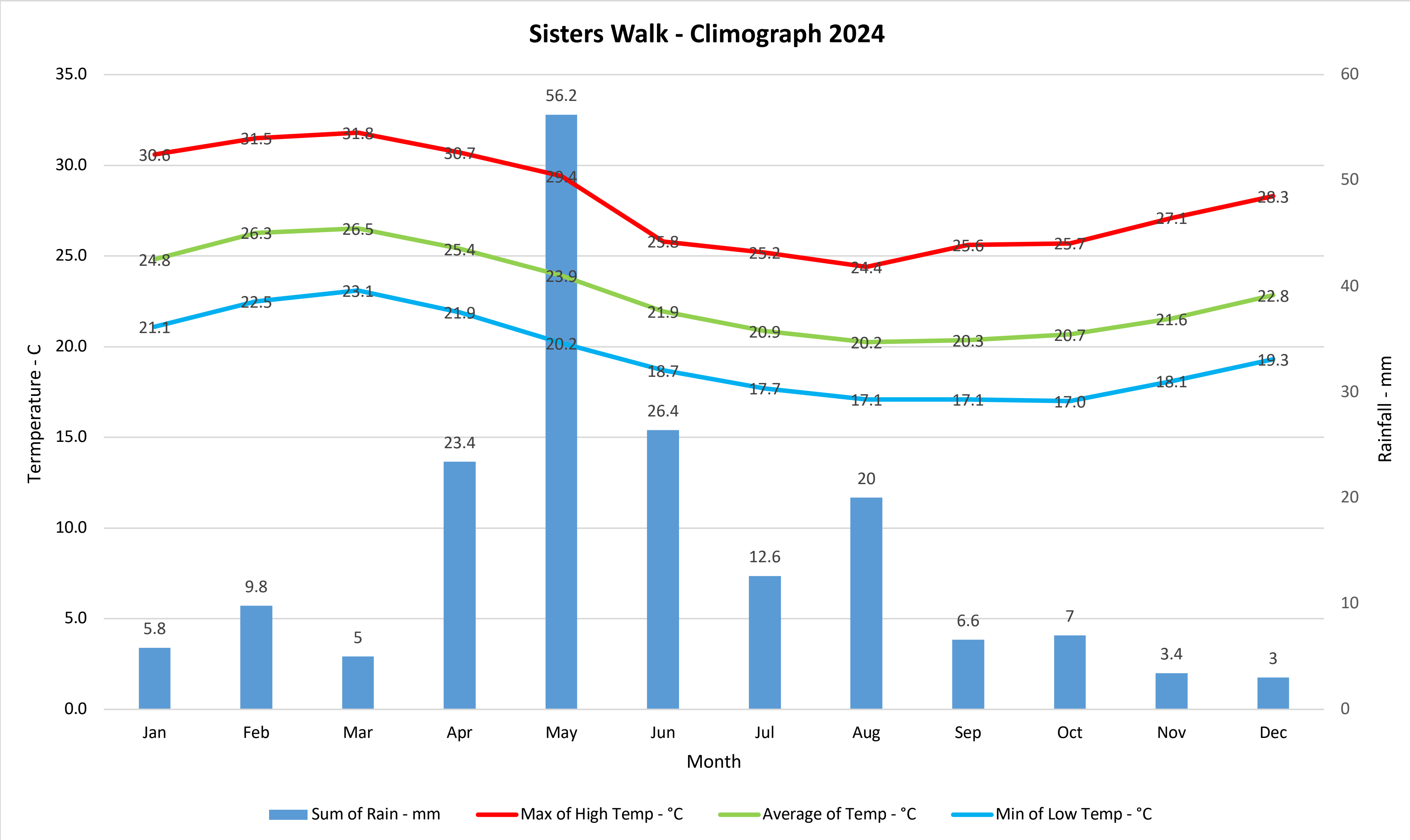
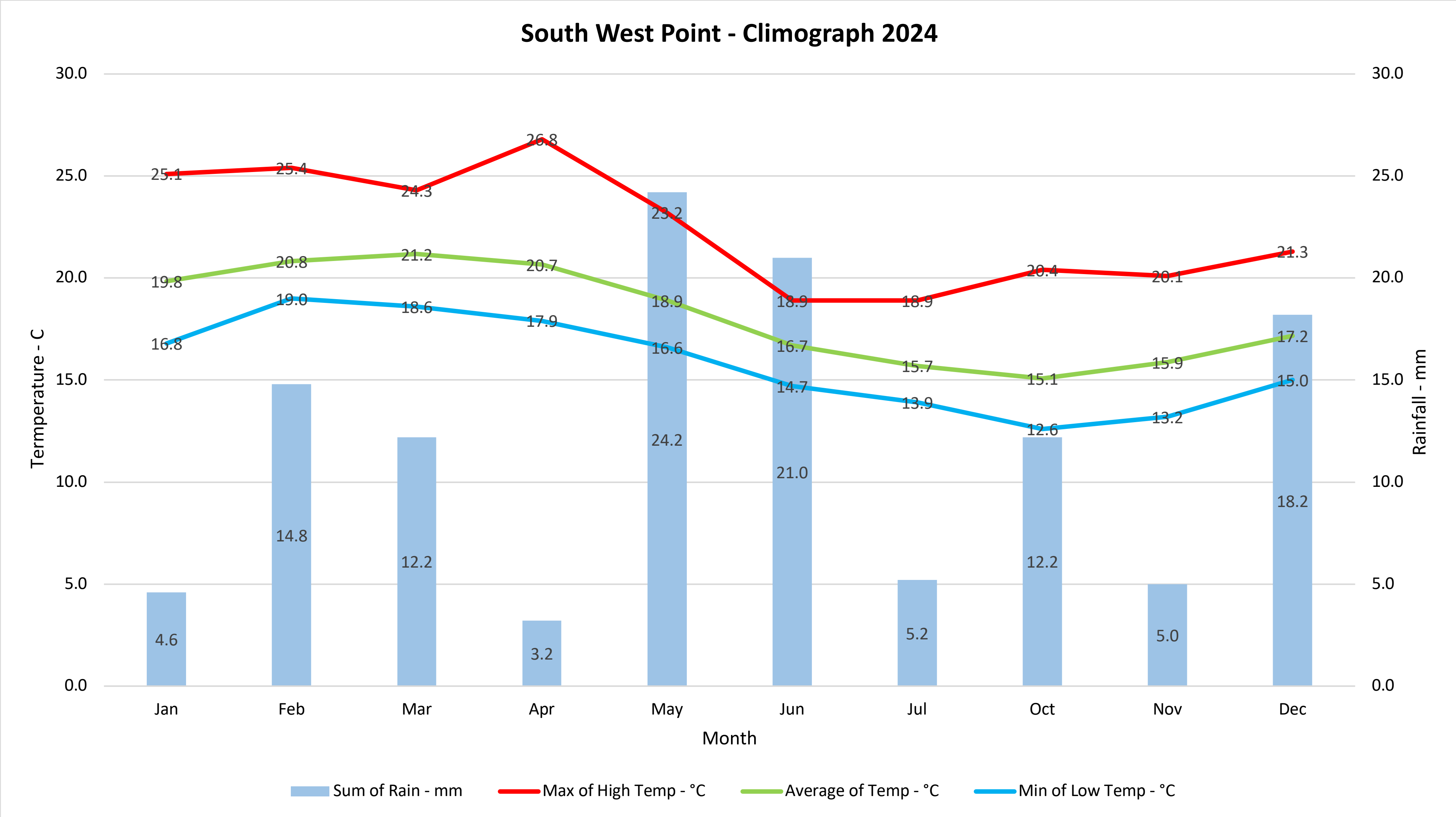
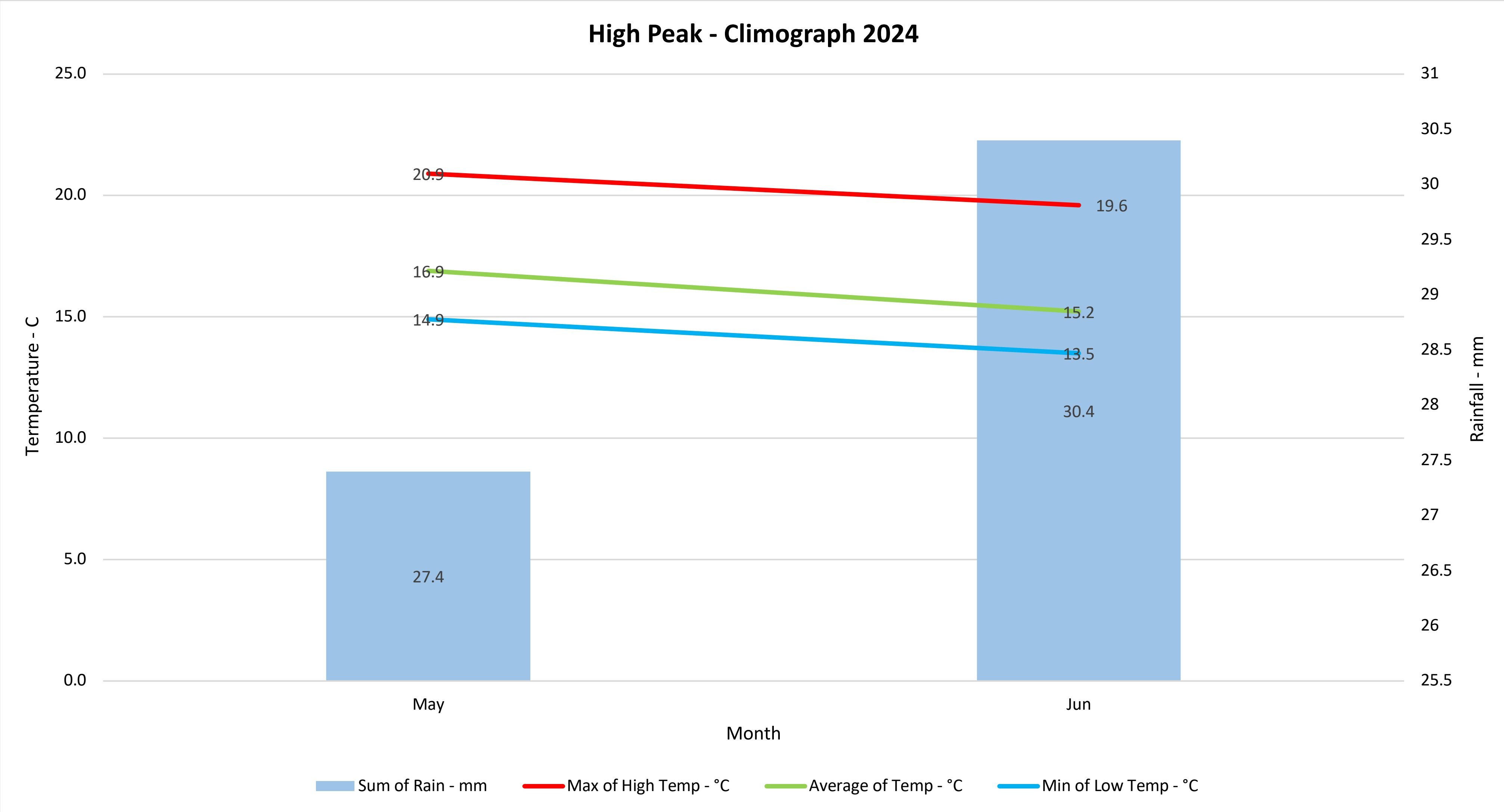
St Helena Cloud Forest Project
Year 4 Climate and Water Resource

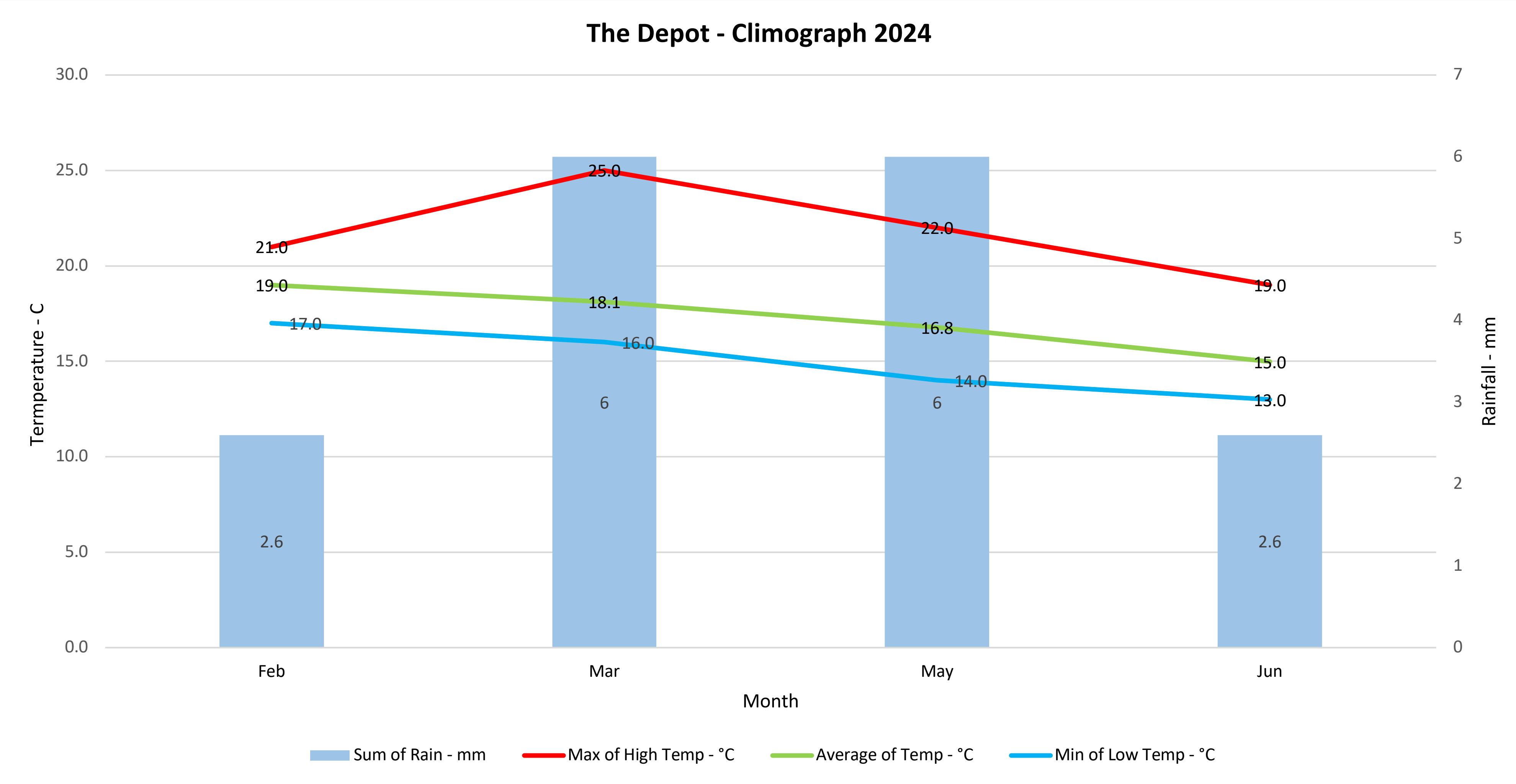


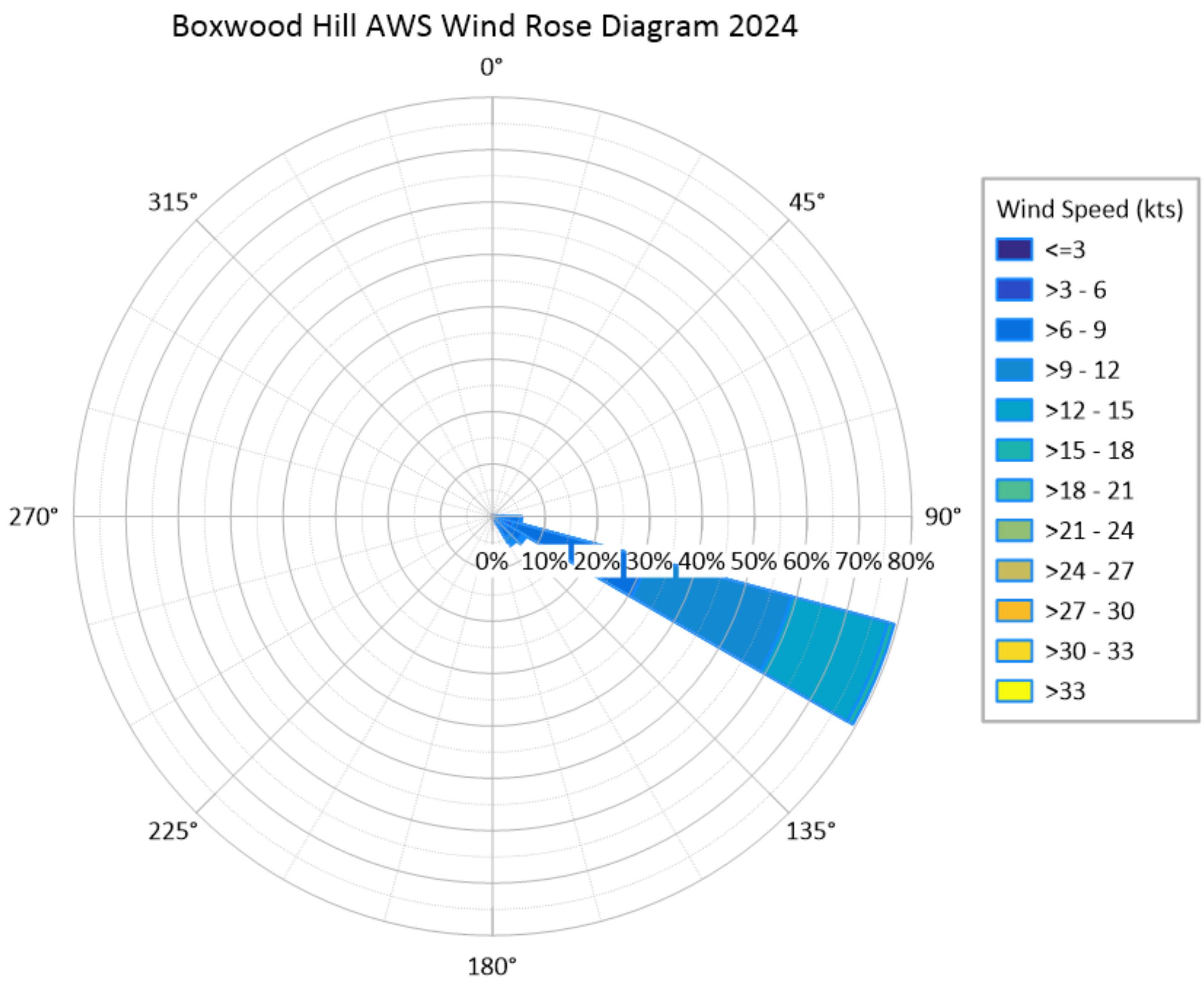
UK Government

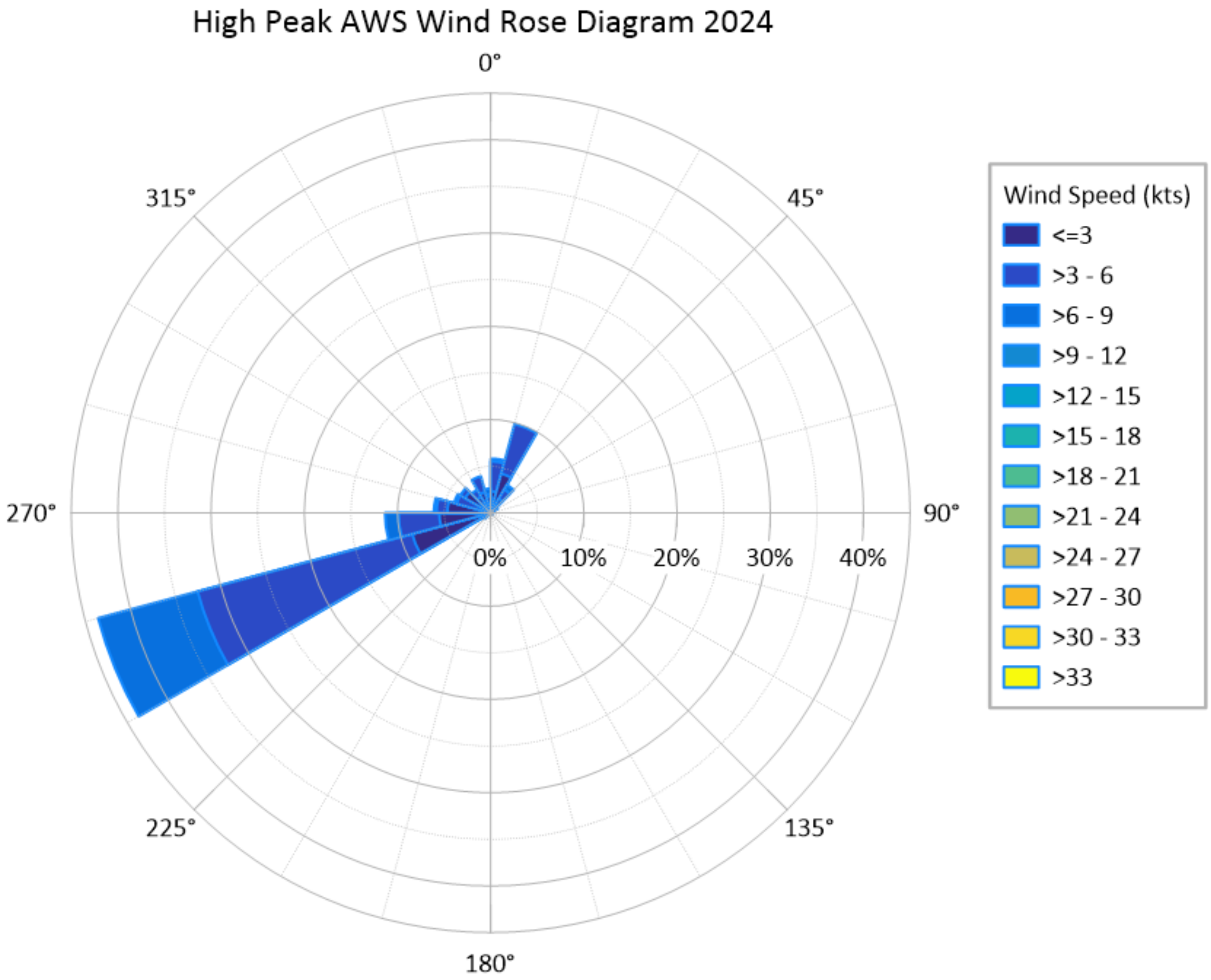

Sisters Walk - Climograph 2024
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Termperature - C
60
50
40
30
20
10
0
Rainfall - mm
56.2
30.6
31.5
31.8
30.7
29.4
25.8
25.2
24.4
25.6
25.7
27.1
28.3
24.8
26.3
26.5
25.4
23.9
21.9
20.9
20.2
20.3
20.7
21.6
22.8
21.1
22.5
23.1
21.9
20.2
18.7
17.7
17.1
17.1
17.0
18.1
19.3
5.8
9.8
5
23.4
26.4
12.6
20
6.6
7
3.4
3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Sum of Rain - mm
Max of High Temp - °C
Average of Temp - °C
Min of Low Temp - °C

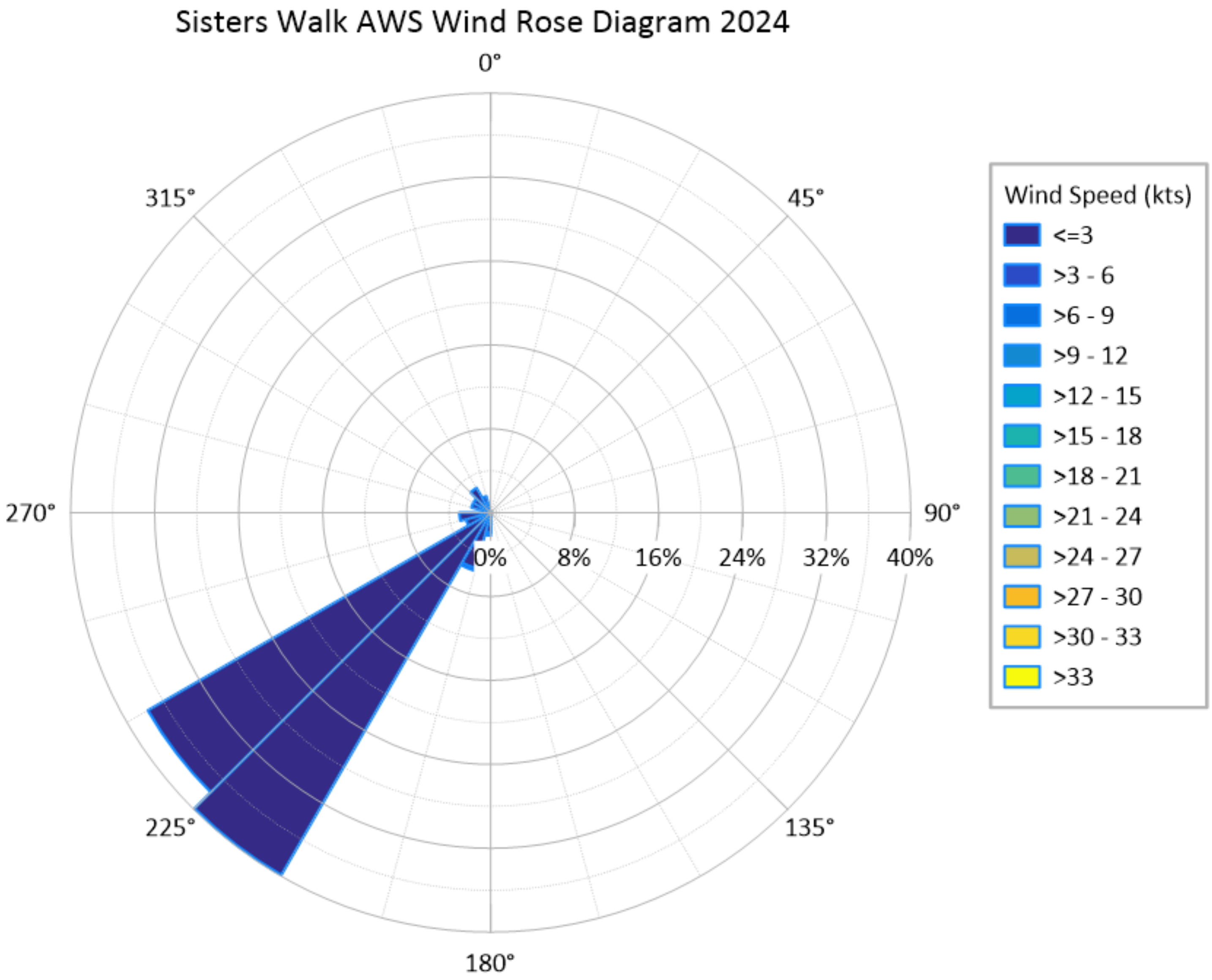

South West Point - Climograph 2024
Termperature - C
Rainfall - mm
Month
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Oct
Nov
Dec
25.1
25.4
24.3
26.8
23.2
18.9
18.9
20.4
20.1
21.3
19.8
20.8
21.2
20.7
18.9
16.7
15.7
15.1
15.9
17.2
16.8
19.0
18.6
17.9
16.6
14.7
13.9
12.6
13.2
15.0
4.6
14.8
12.2
3.2
24.2
21.0
5.2
12.2
5.0
18.2
Sum of Rain - mm
Max of High Temp - °C
Average of Temp - °C
Min of Low Temp - °C


High Peak - Climograph 2024
25.0
20.0
15.0
10.0
5.0
0.0
Termperature - C
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
26
25.5
Rainfall - mm
20.9
19.6
16.9
15.2
14.9
13.5
30.4
27.4
May
Jun
Month
Sum of Rain - mm
Max of High Temp - °C
Average of Temp - °C
Min of Low Temp - °C

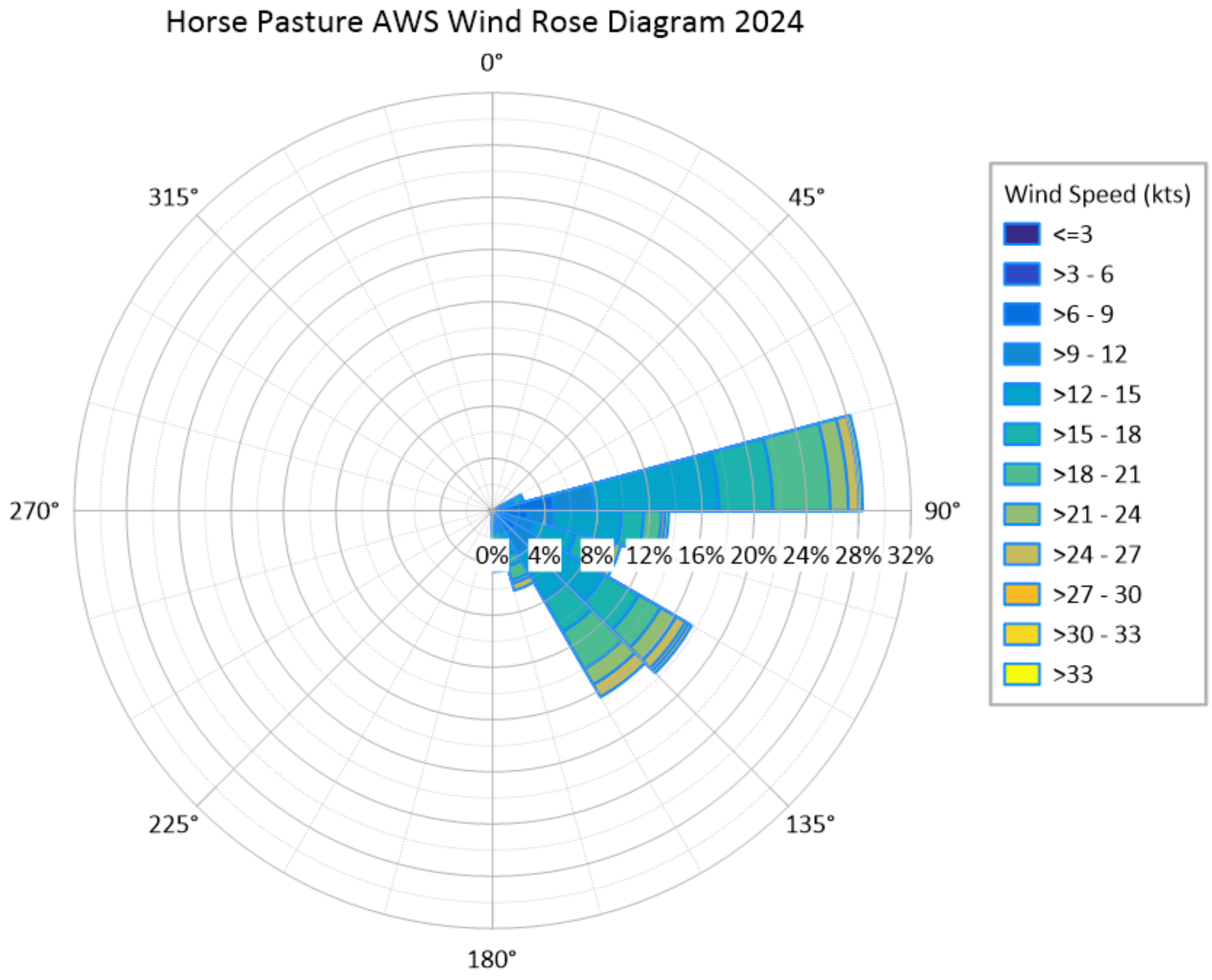

The Depot - Climograph 2024
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Termperature - C
7
6
5
4
3
2
1
0
Rainfall - mm
21.0
25.0
22.0
19.0
19.0
18.1
16.8
15.0
17.0
16.0
14.0
13.0
2.6
6
6
2.6
Feb
Mar
May
Jun
Month
Sum of Rain - mm
Max of High Temp - °C
Average of Temp - °C
Min of Low Temp - °C

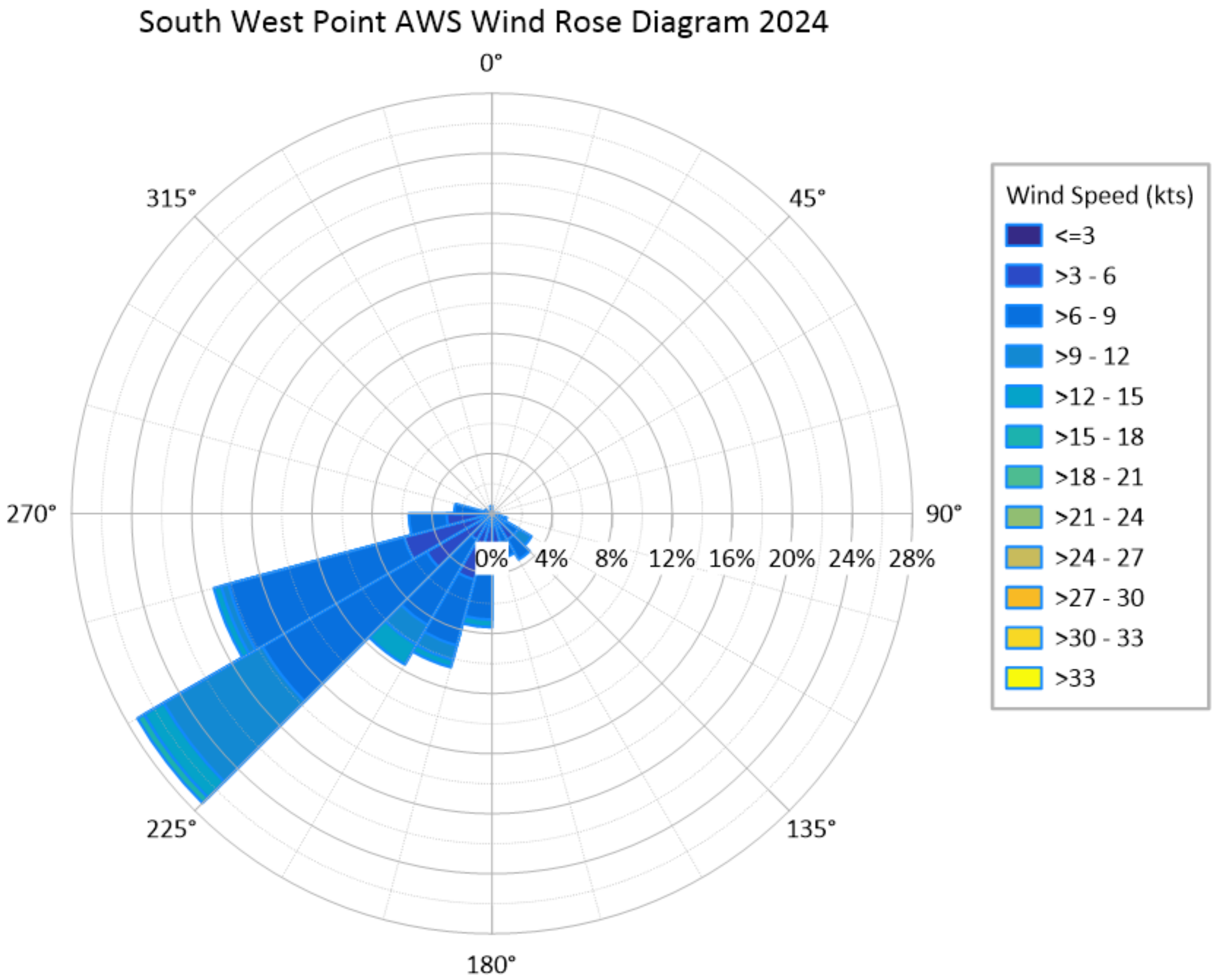

Boxwood Hill AWS Wind Rose Diagram 2024
0°
45°
90°
135°
180°
225°
270°
315°
0%
10%
20%
30%
40%
50%
60%
70%
80%
Wind Speed (kts)
<=3
>3 - 6
>6 - 9
>9 - 12
>12 - 15
>15 - 18
>18 - 21
>21 - 24
>24 - 27
>27 - 30
>30 - 33
>33


High Peak AWS Wind Rose Diagram 2024
0°
45°
90°
135°
180°
225°
270°
315°
0%
10%
20%
30%
40%
Wind Speed (kts)
<=3
>3 - 6
>6 - 9
>9 - 12
>12 - 15
>15 - 18
>18 - 21
>21 - 24
>24 - 27
>27 - 30
>30 - 33
>33



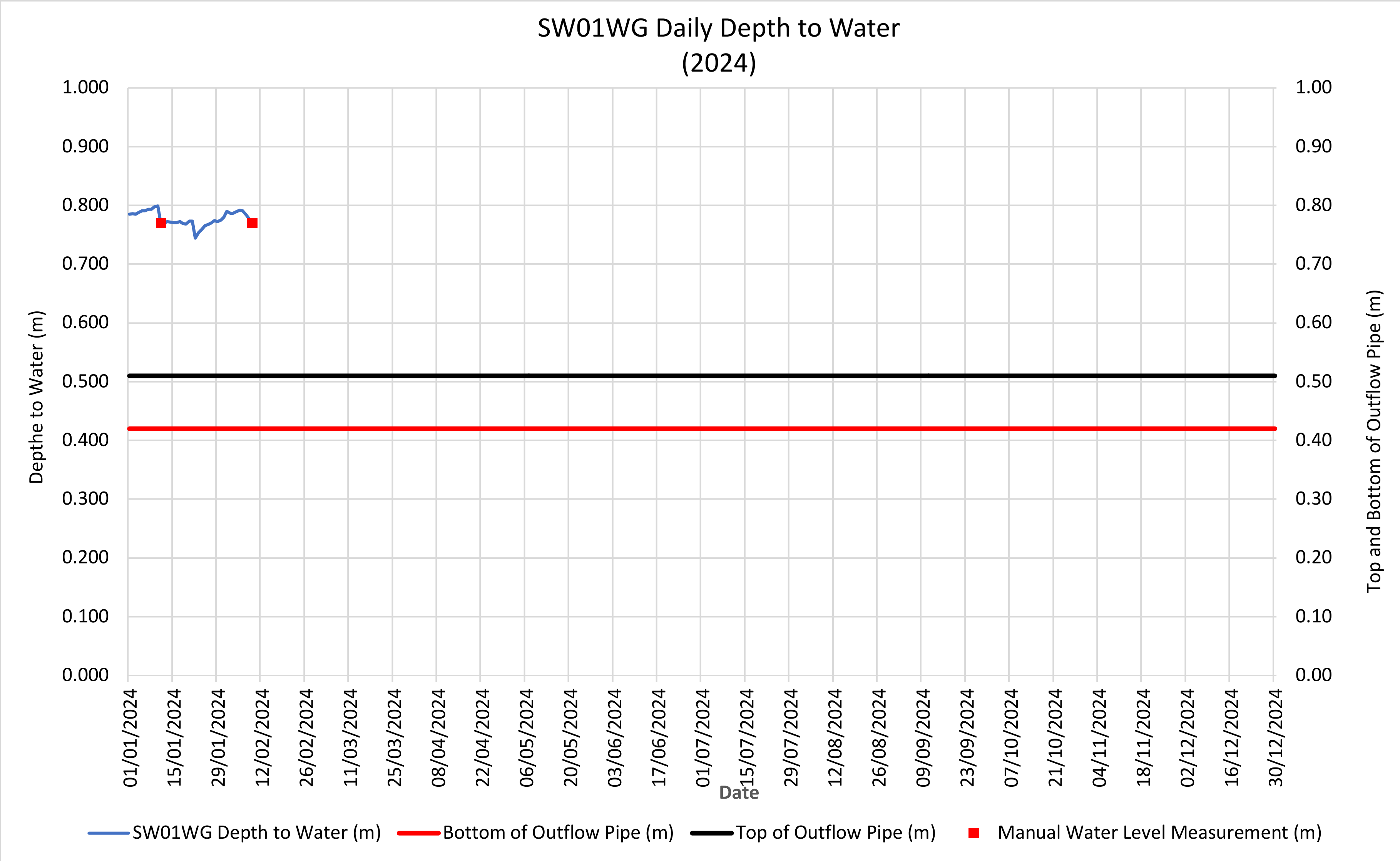
UK Government

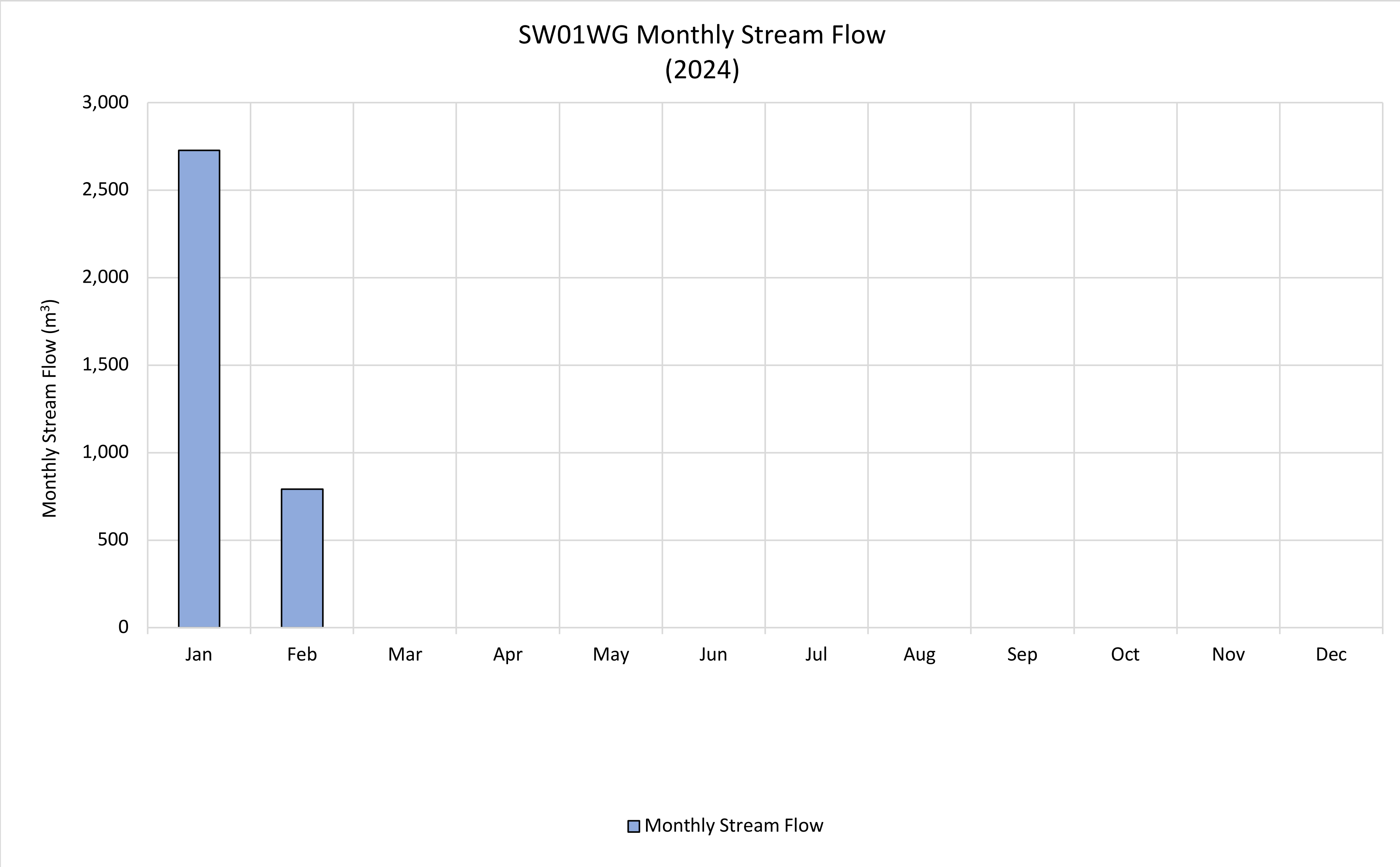

Horse Pasture AWS Wind Rose Diagram 2024
0°
45°
90°
135°
180°
225°
270°
315°
0%
4%
8%
12%
16%
20%
24%
28%
32%
Wind Speed (kts)
<=3
>3 - 6
>6 - 9
>9 - 12
>12 - 15
>15 - 18
>18 - 21
>21 - 24
>24 - 27
>27 - 30
>30 - 33
>33

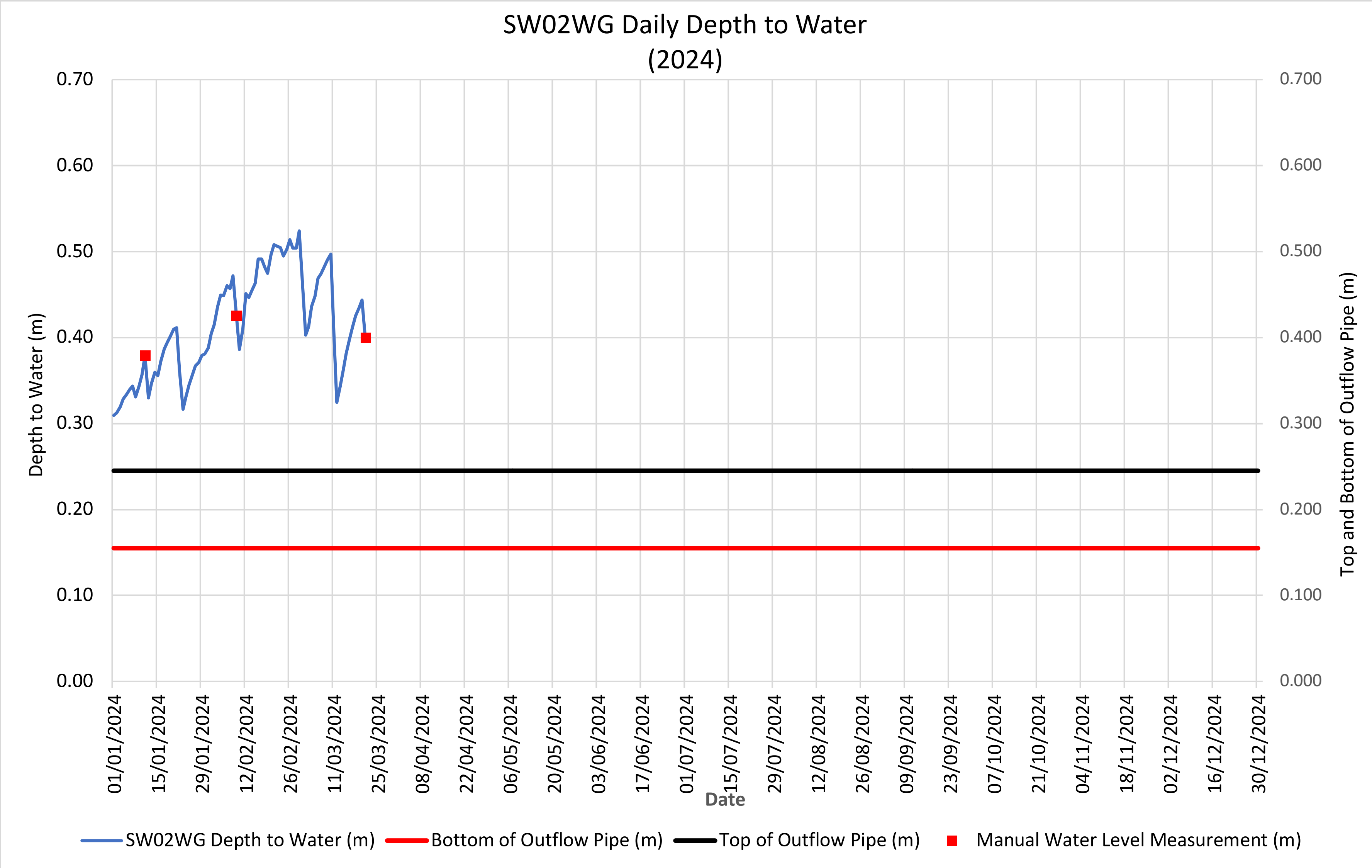

South West Point AWS Wind Rose Diagram 2024
0°
45°
90°
135°
180°
225°
270°
315°
0%
4%
8%
12%
16%
20%
24%
28%
Wind Speed (kts)
<=3
>3 - 6
>6 - 9
>9 - 12
>12 - 15
>15 - 18
>18 - 21
>21 - 24
>24 - 27
>27 - 30
>30 - 33
>33

Appendix 2: Surface Water and Groundwater Data

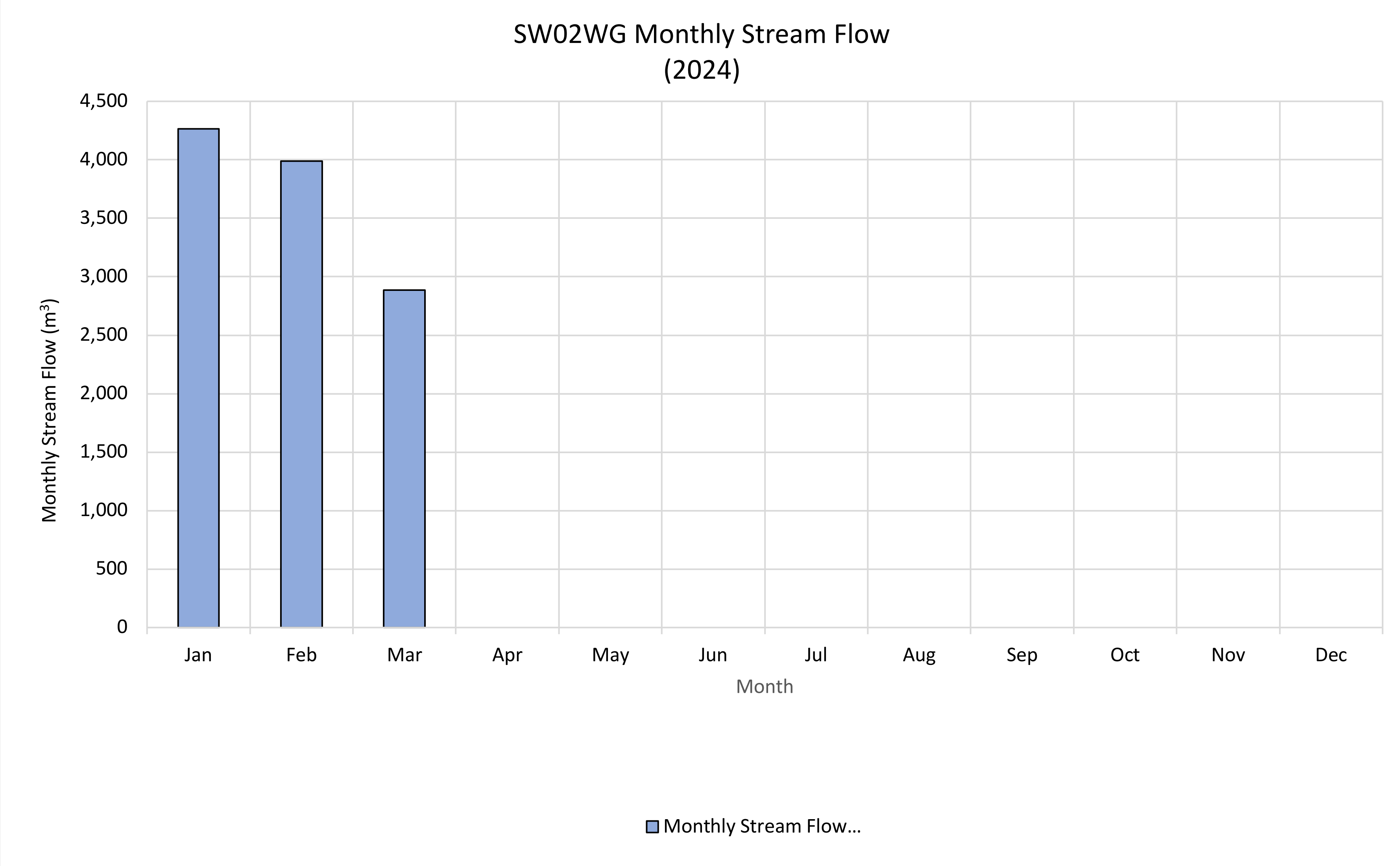
Appendix 2.1: Surface Water Data

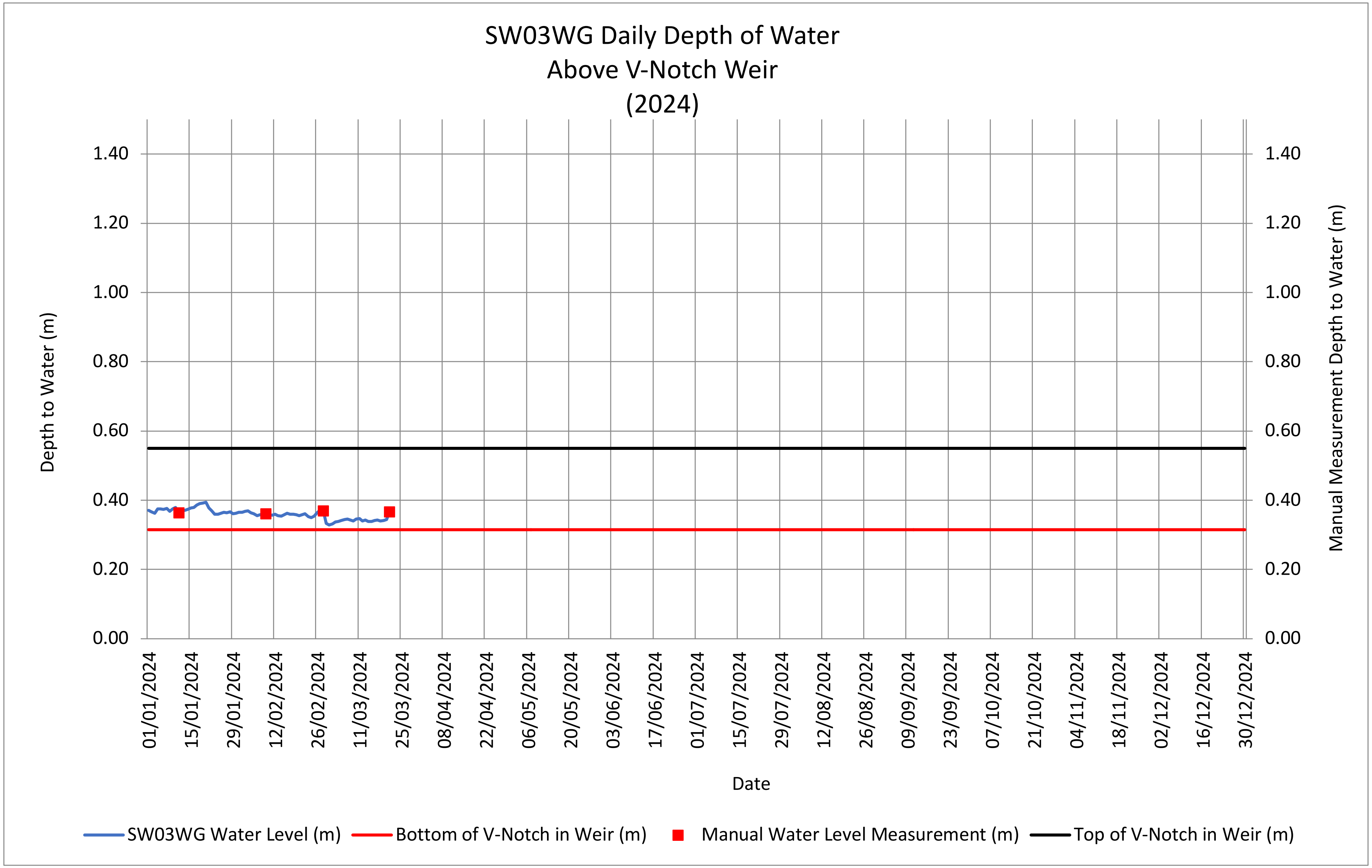

SW01WG Daily Depth to Water
(2024)
Depthe to Water (m)
Top and Bottom of Outflow Pipe (m)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
SW01WG Depth to Water (m)
Bottom of Outflow Pipe (m)
Top of Outflow Pipe (m)
Manual Water Level Measurement (m)

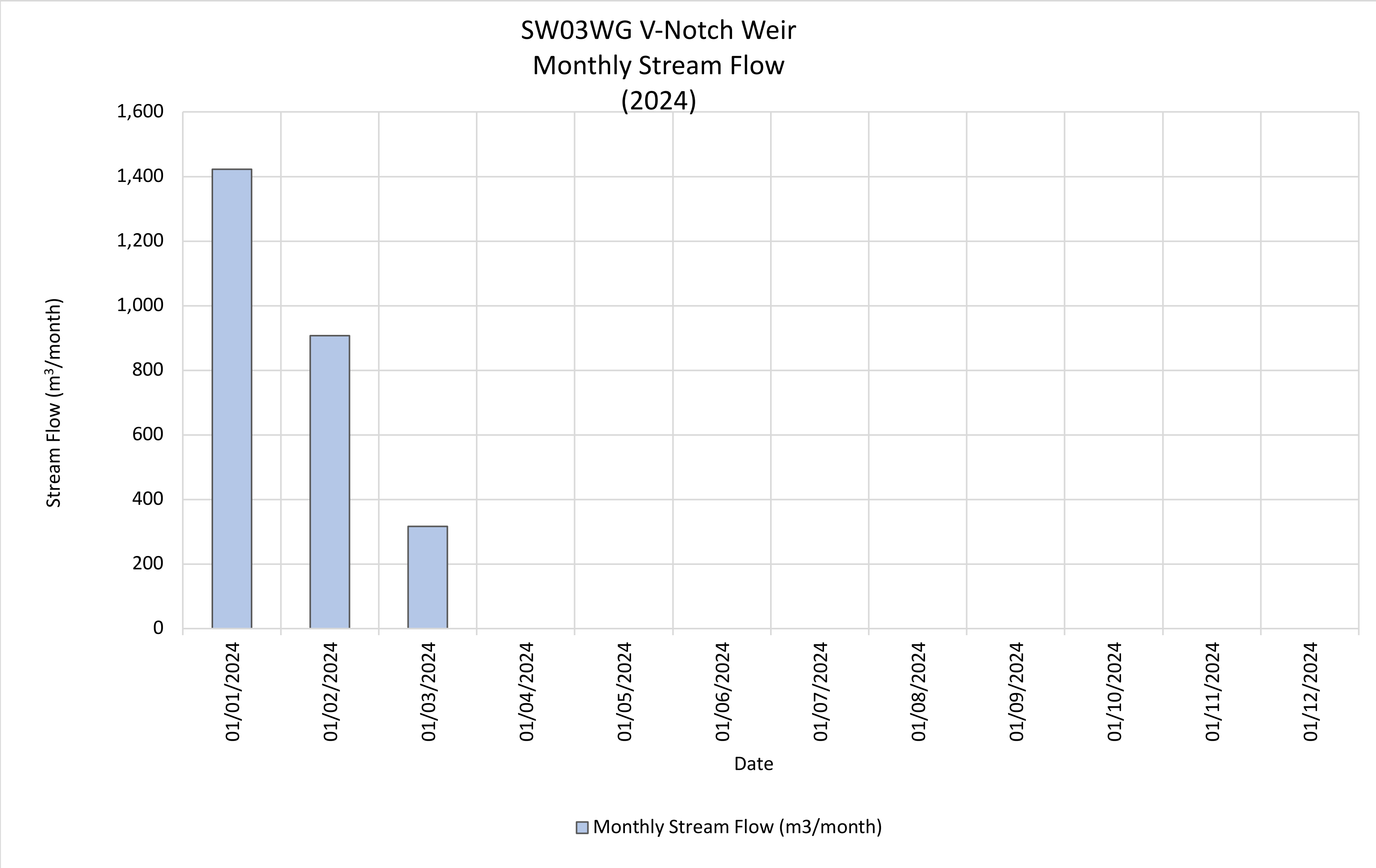

SW01WG Monthly Stream Flow
(2024)
3,000
2,500
2,000
1,500
1,000
500
0
Monthly Stream Flow (m3)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monthly Stream Flow

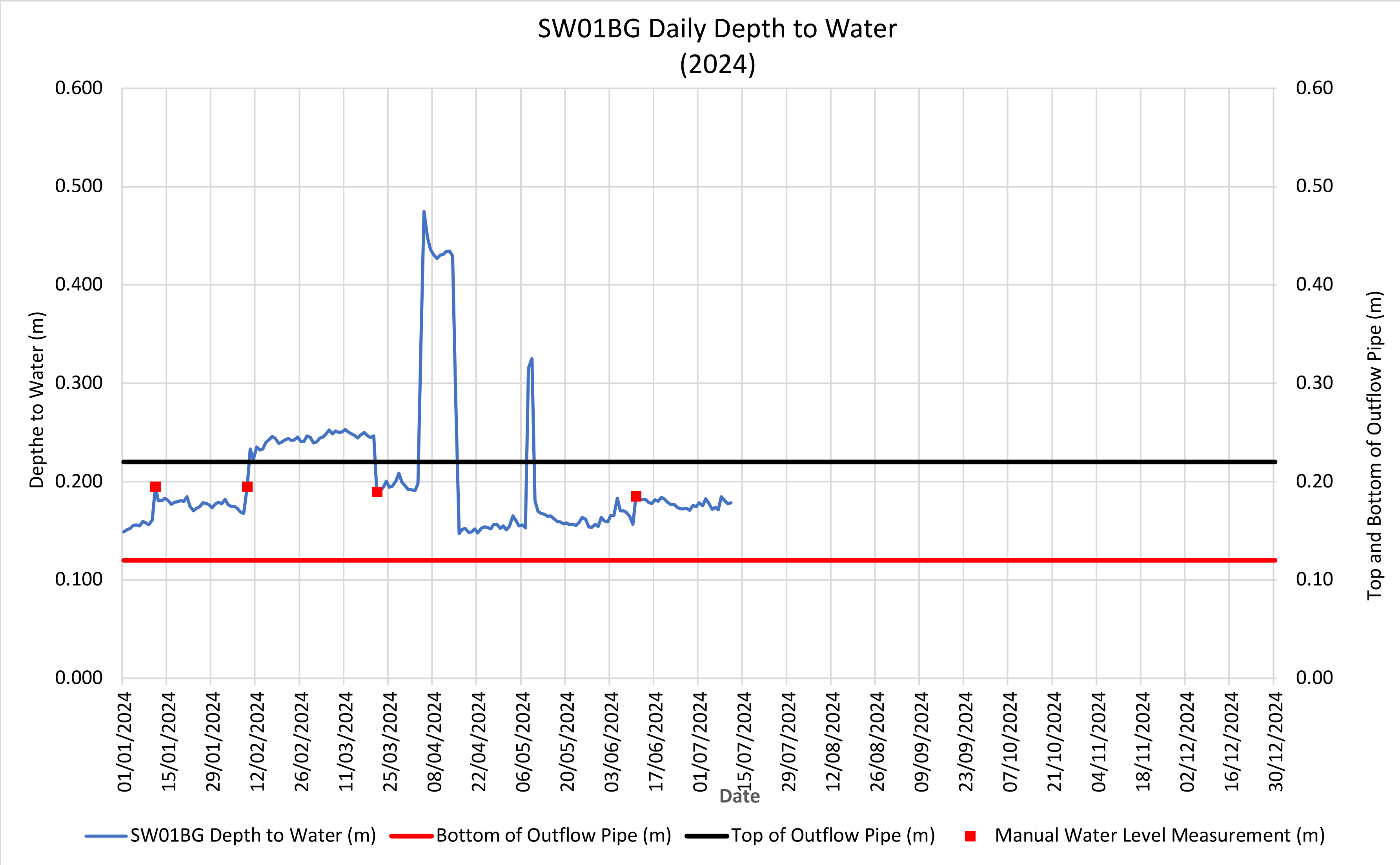


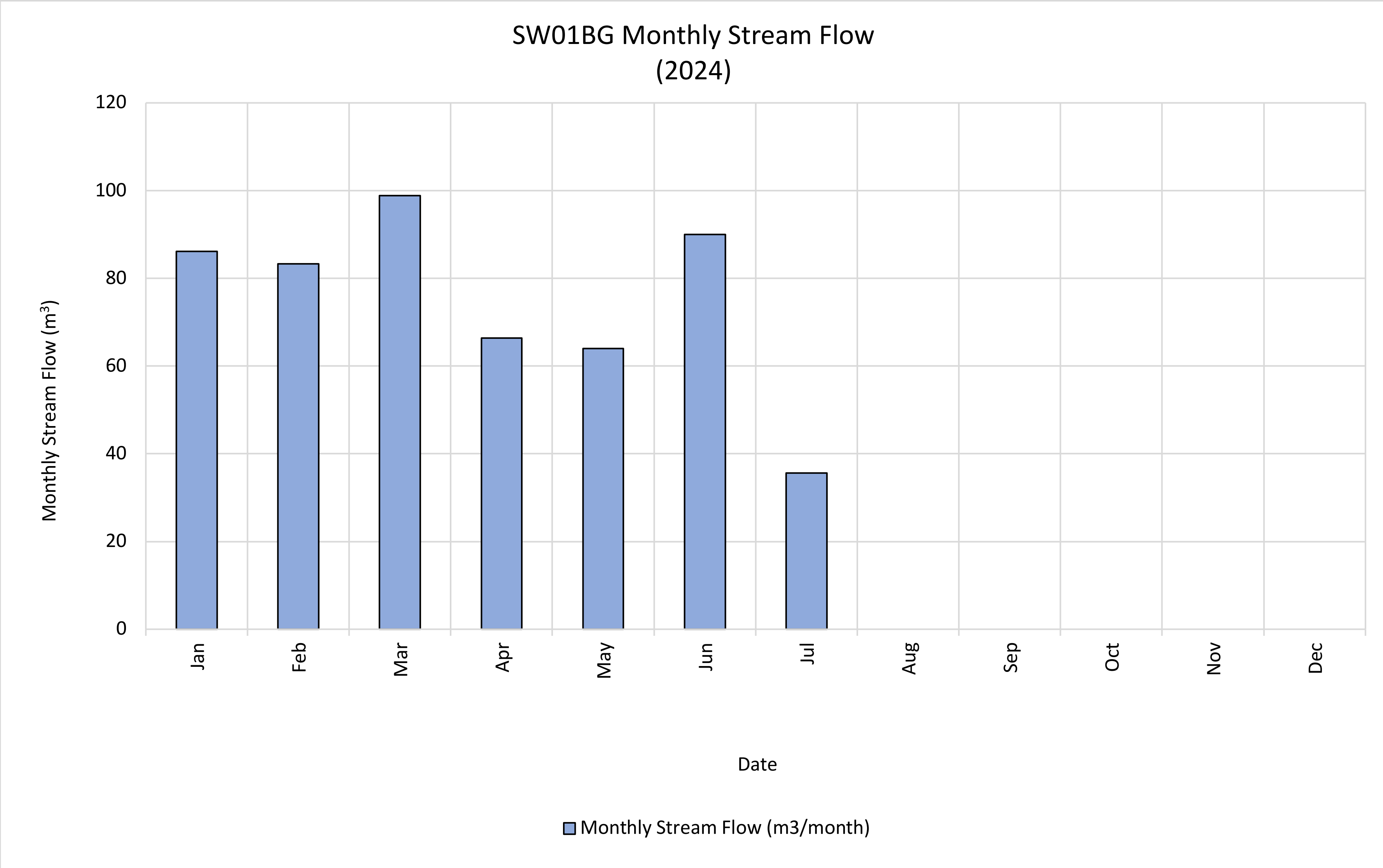
UK Government

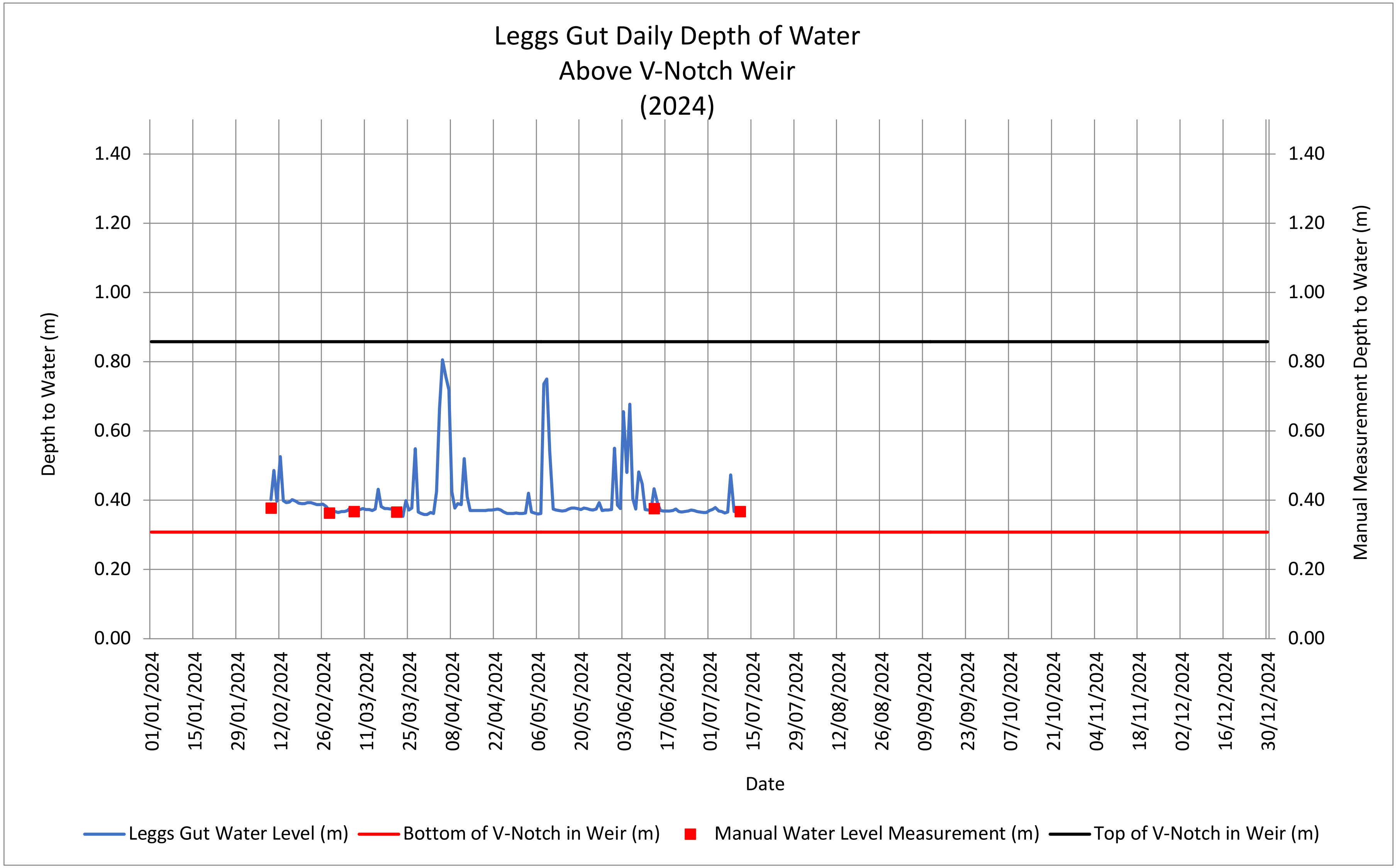

SW02WG Monthly Stream Flow
(2024)
Monthly Stream Flow (m³)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Monthly Stream Flow...

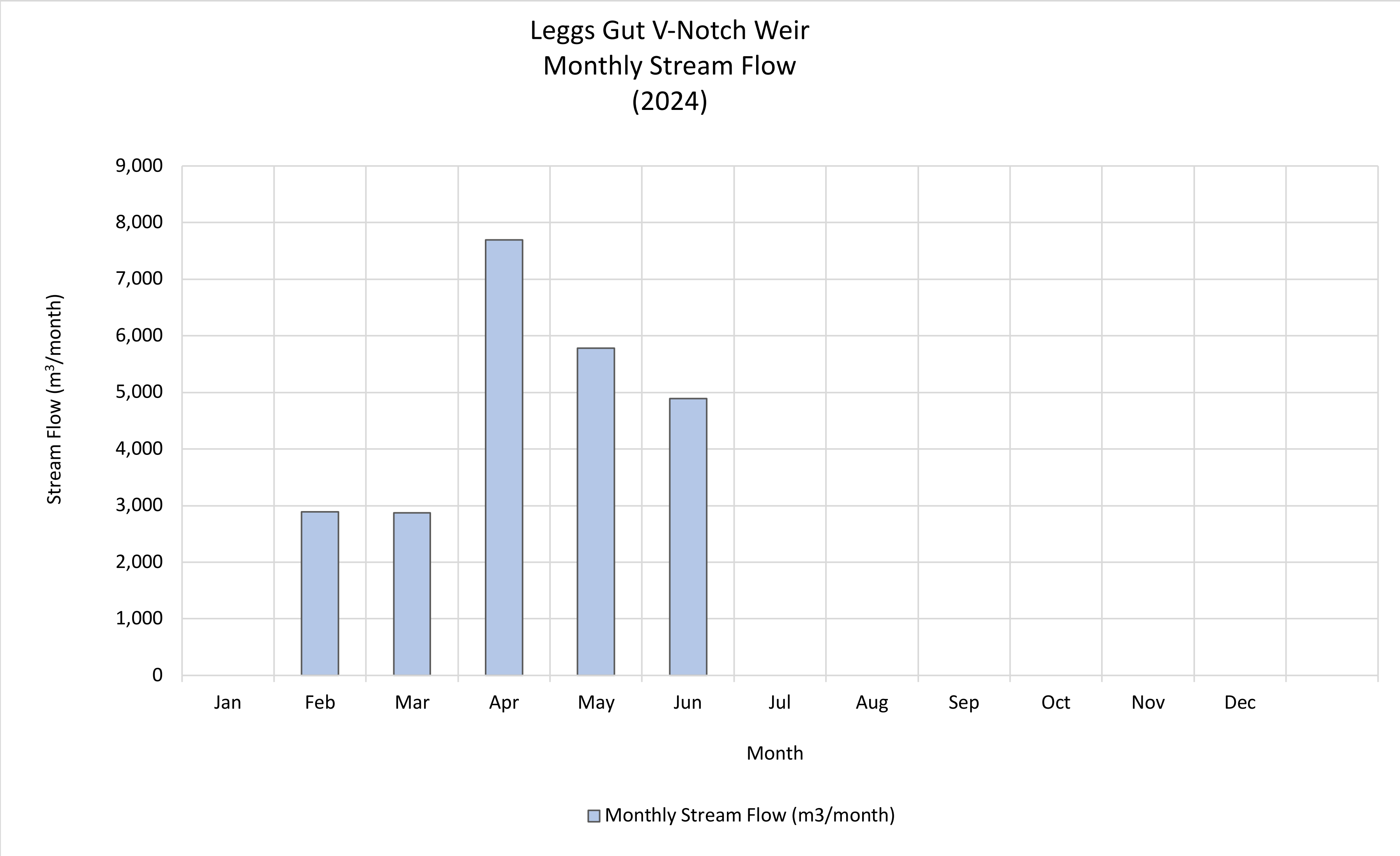

SW03WG Daily Depth of Water
Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
SW03WG Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)

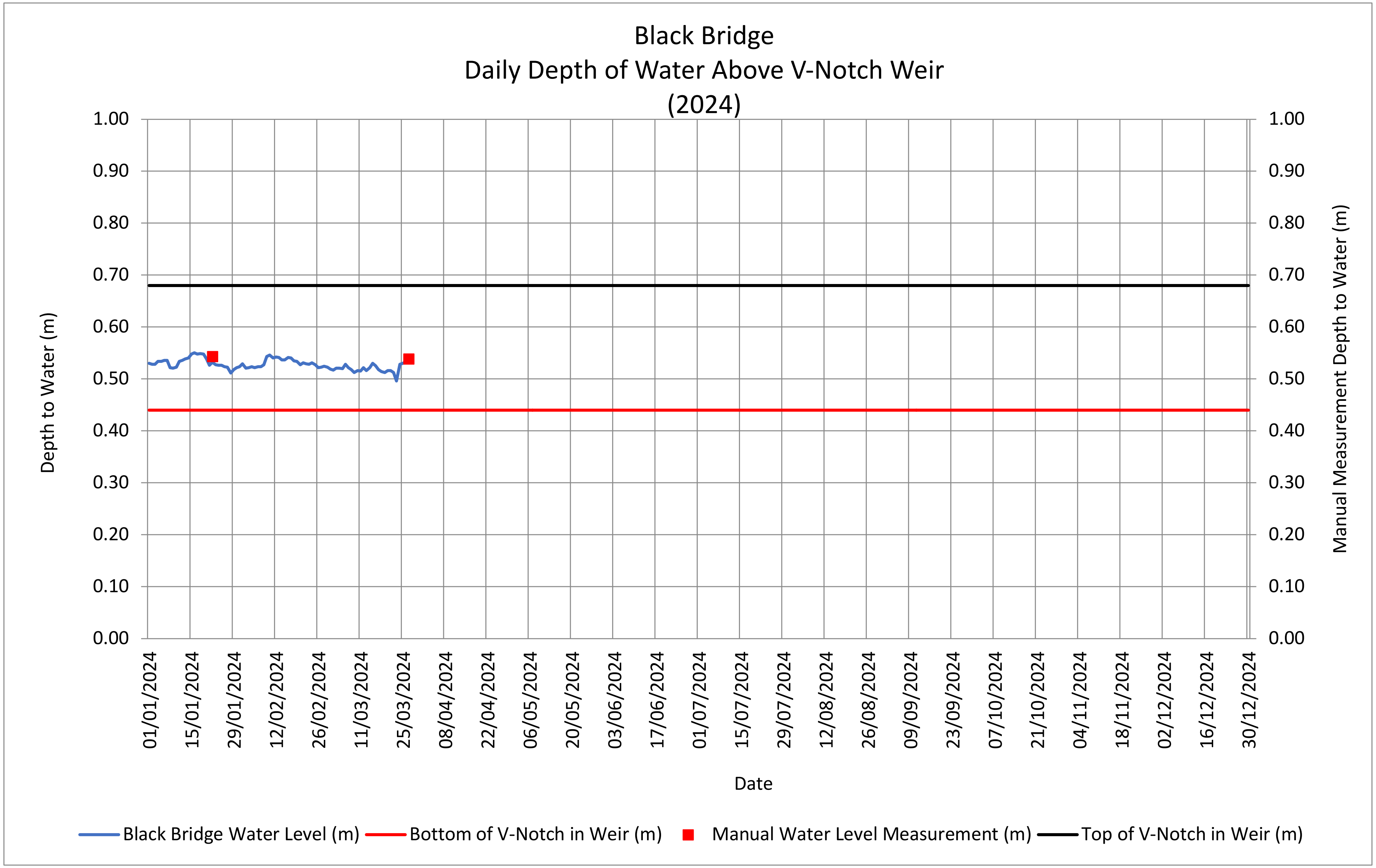

SW03WG V-Notch Weir
Monthly Stream Flow
(2024)
Stream Flow (m3/month)
1,600
1,400
1,200
1,000
800
600
400
200
0
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/month)

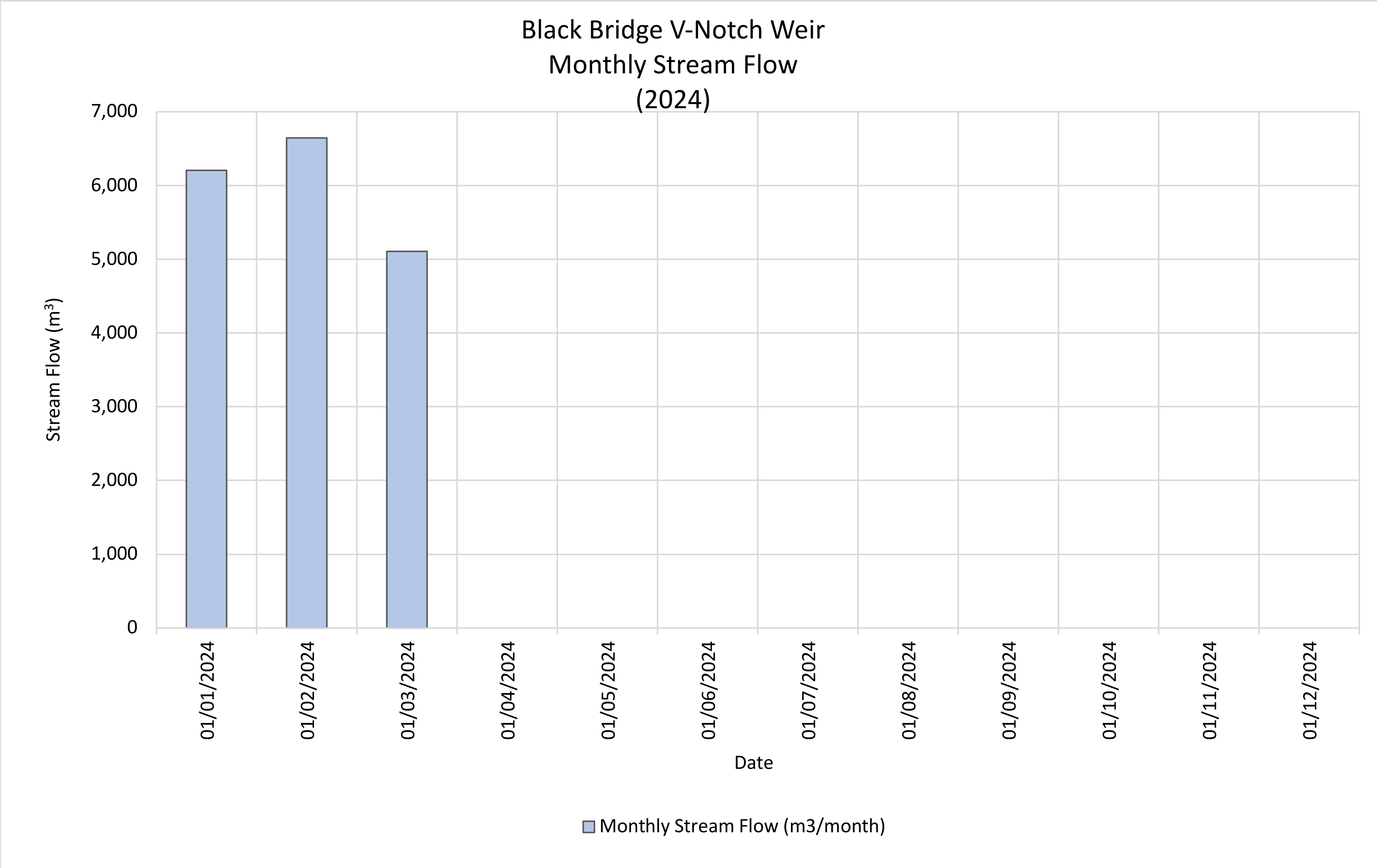

SW01BG Daily Depth to Water
(2024)
Depthe to Water (m)
Top and Bottom of Outflow Pipe (m)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
SW01BG Depth to Water (m)
Bottom of Outflow Pipe (m)
Top of Outflow Pipe (m)
Manual Water Level Measurement (m)

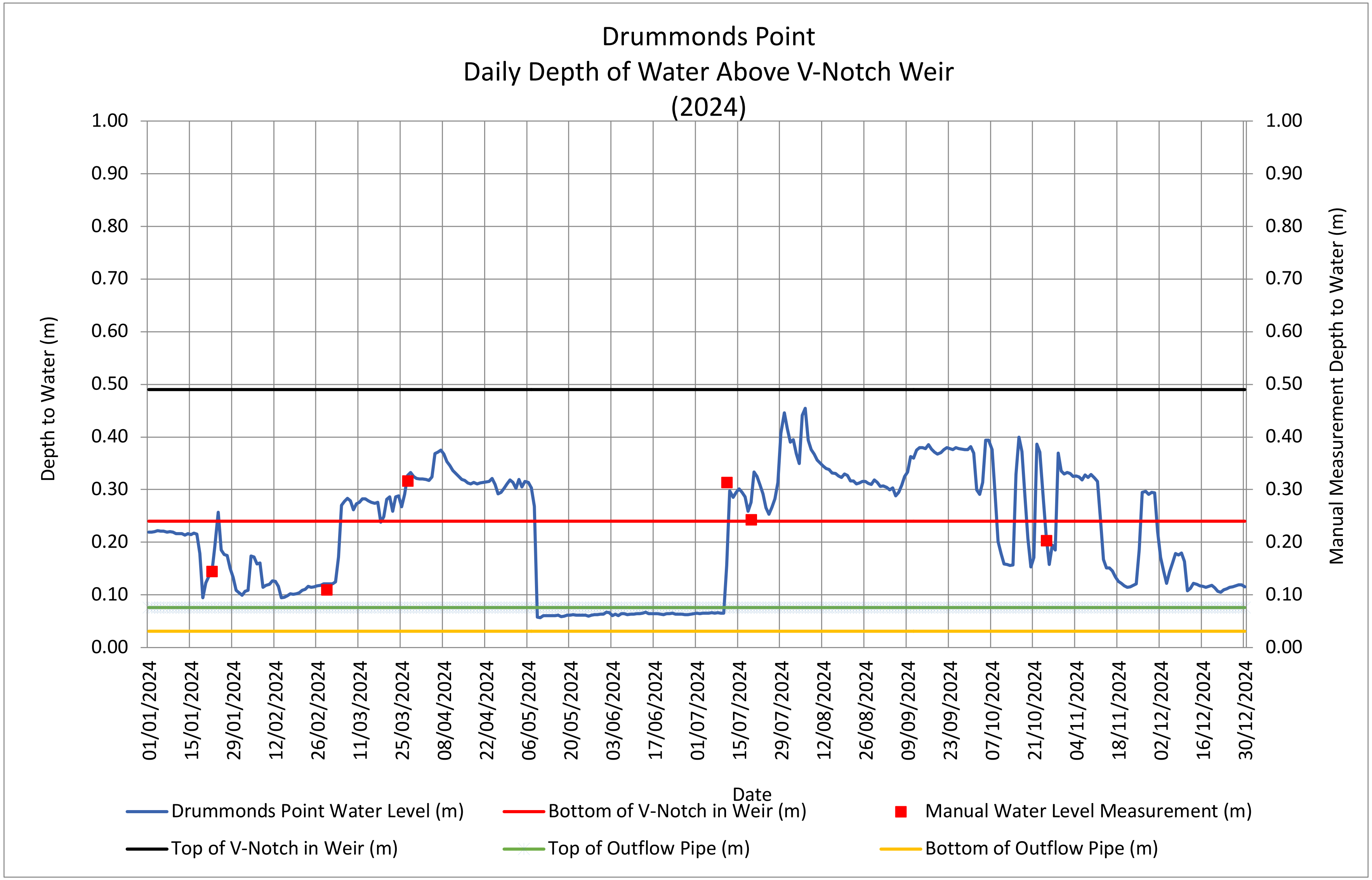

SW01BG Monthly Stream Flow
(2024)
Monthly Stream Flow (m³)
120
100
80
60
40
20
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Monthly Stream Flow (m3/month)


Leggs Gut Daily Depth of Water
Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
Leggs Gut Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)


Leggs Gut V-Notch Weir
Monthly Stream Flow
(2024)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Stream Flow (m3/month)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Monthly Stream Flow (m3/month)


Black Bridge
Daily Depth of Water Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
Black Bridge Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)


Black Bridge V-Notch Weir
Monthly Stream Flow
(2024)
Stream Flow (m3)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/month)



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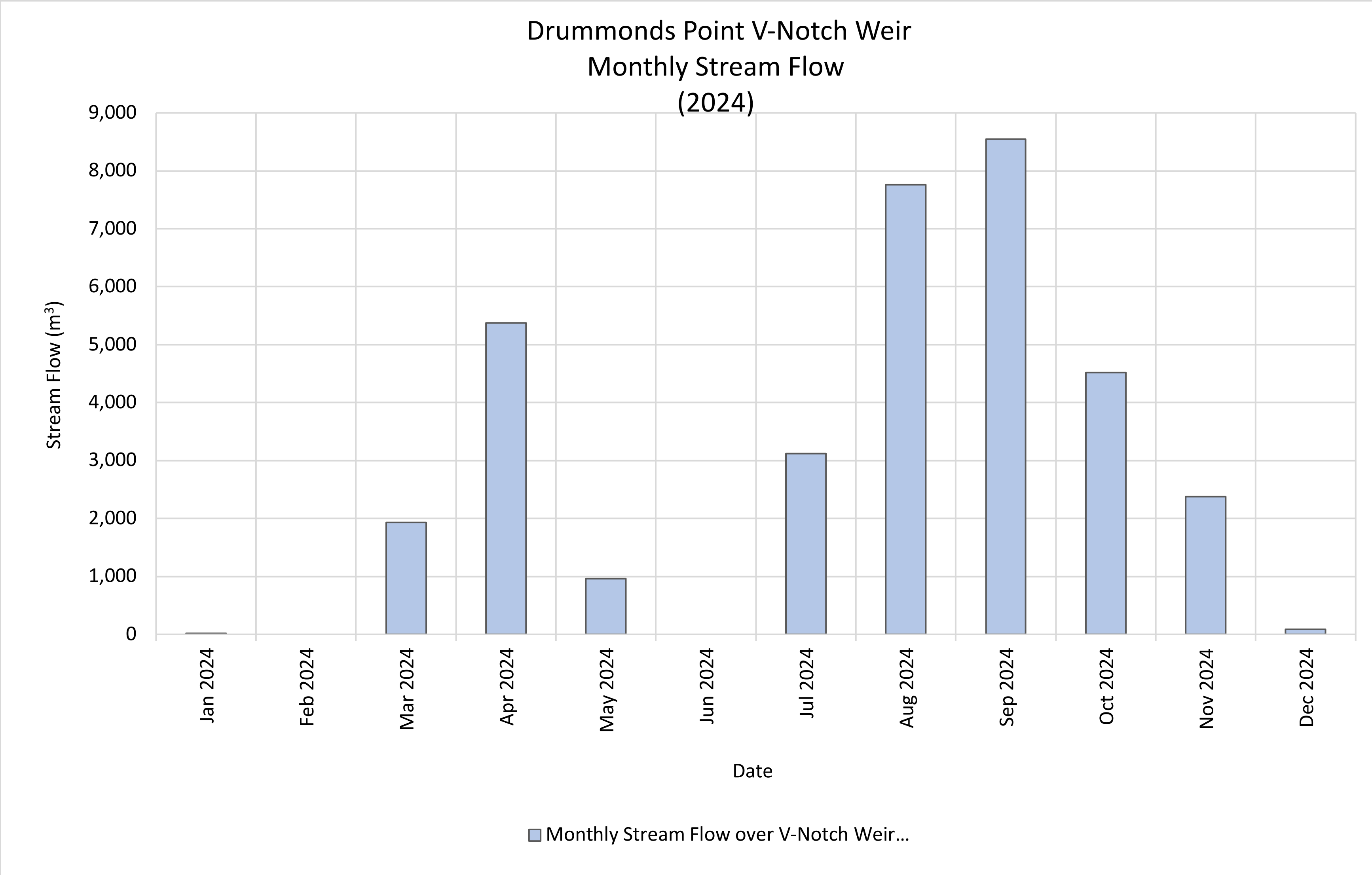
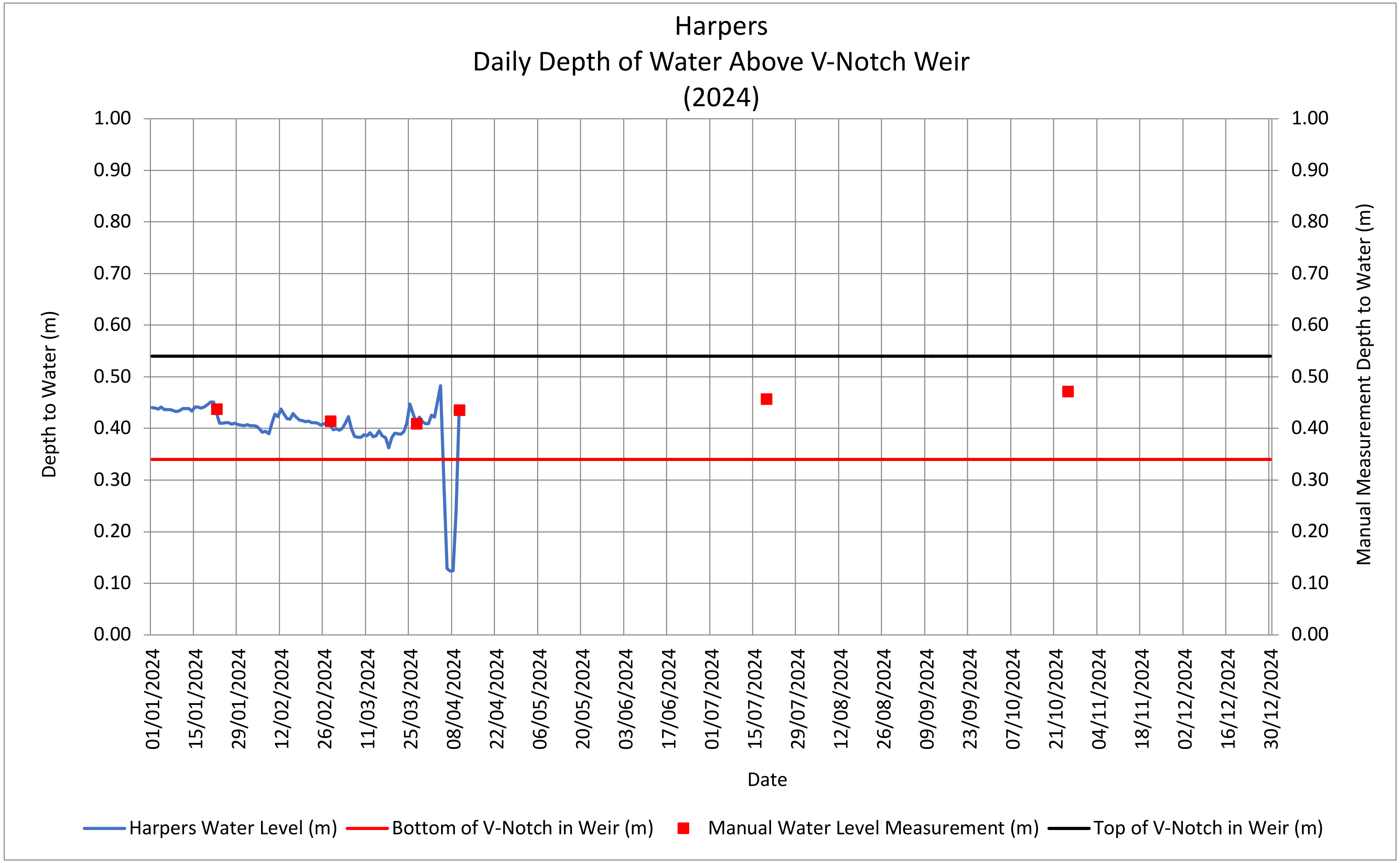
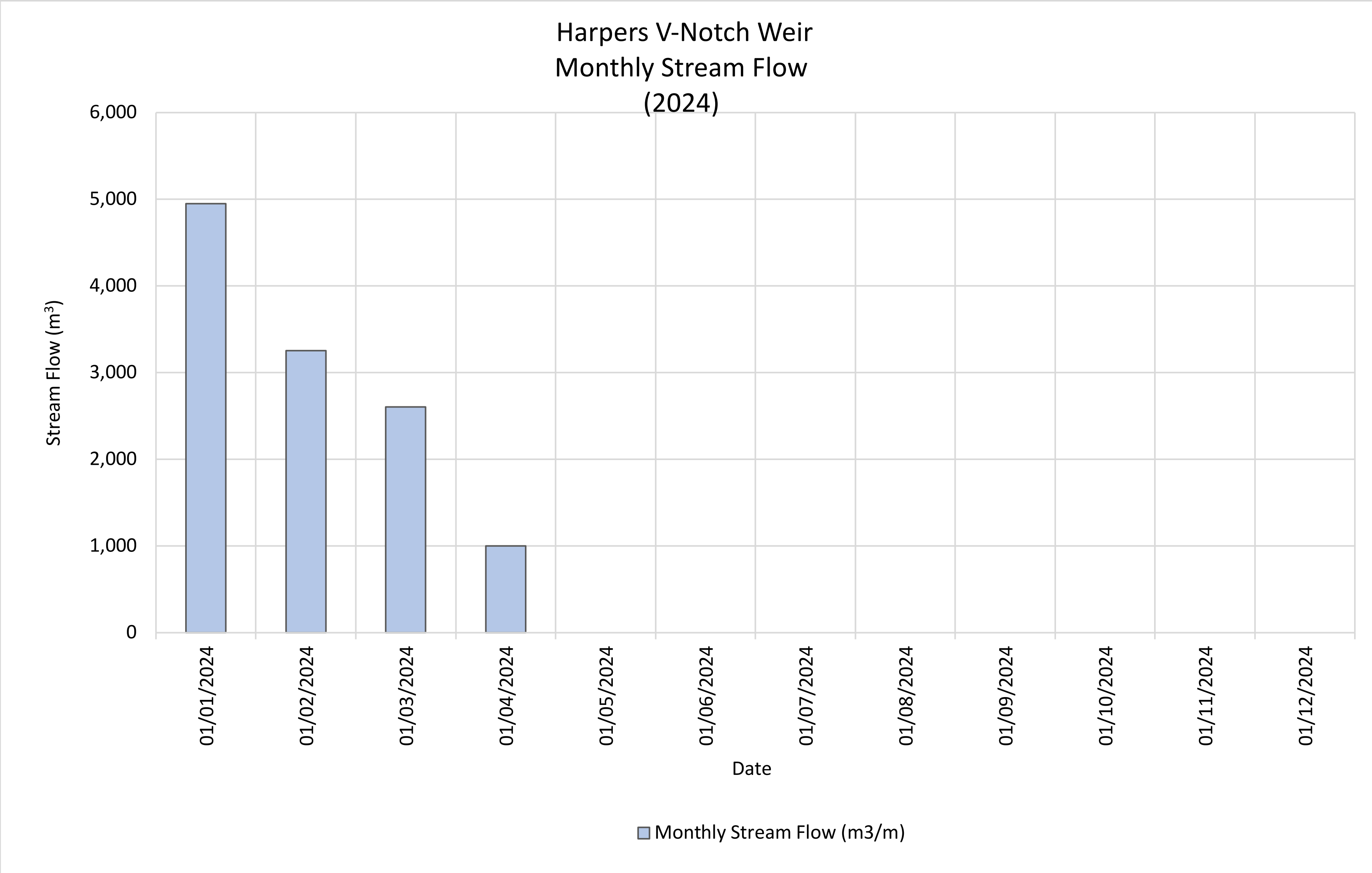
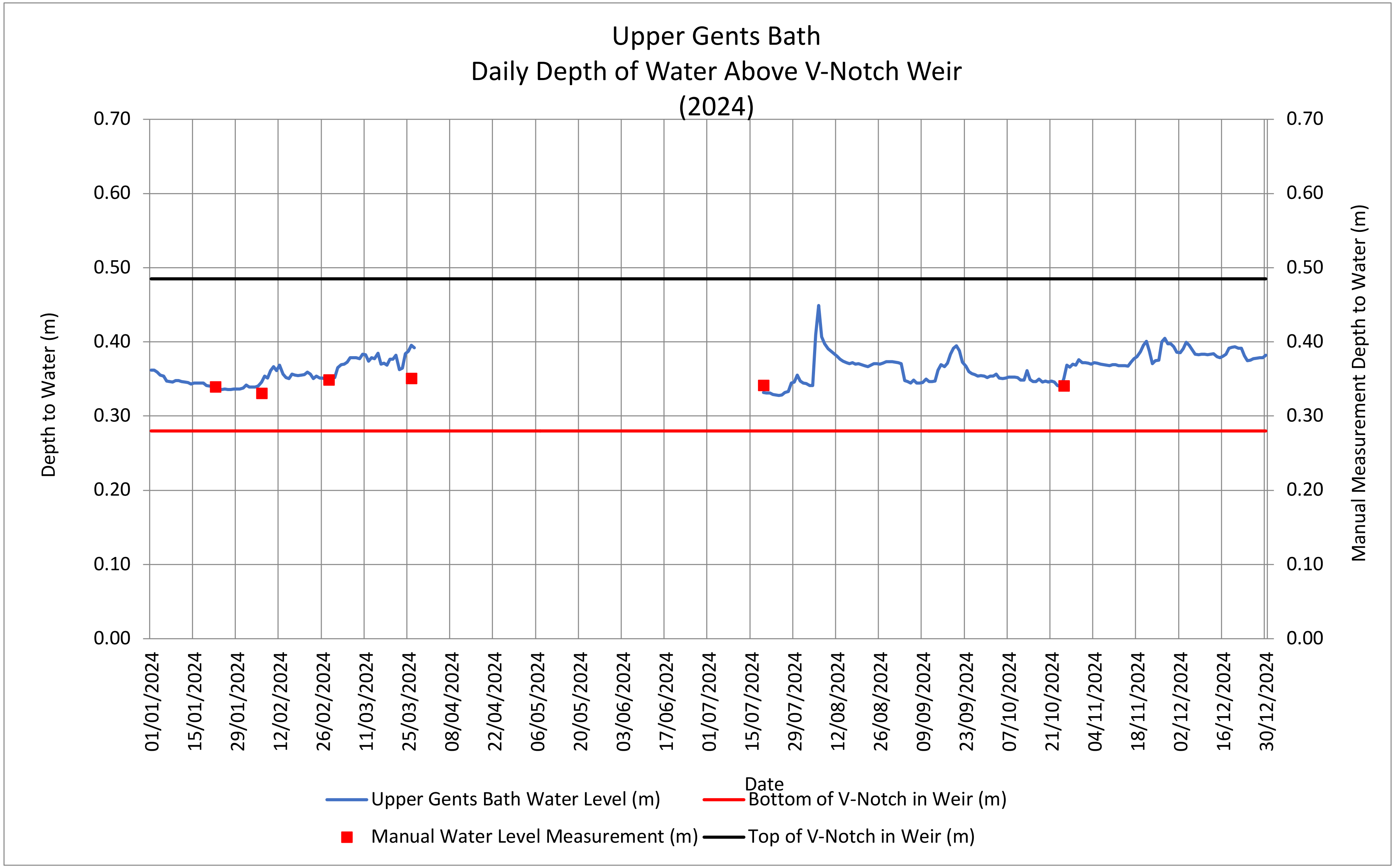
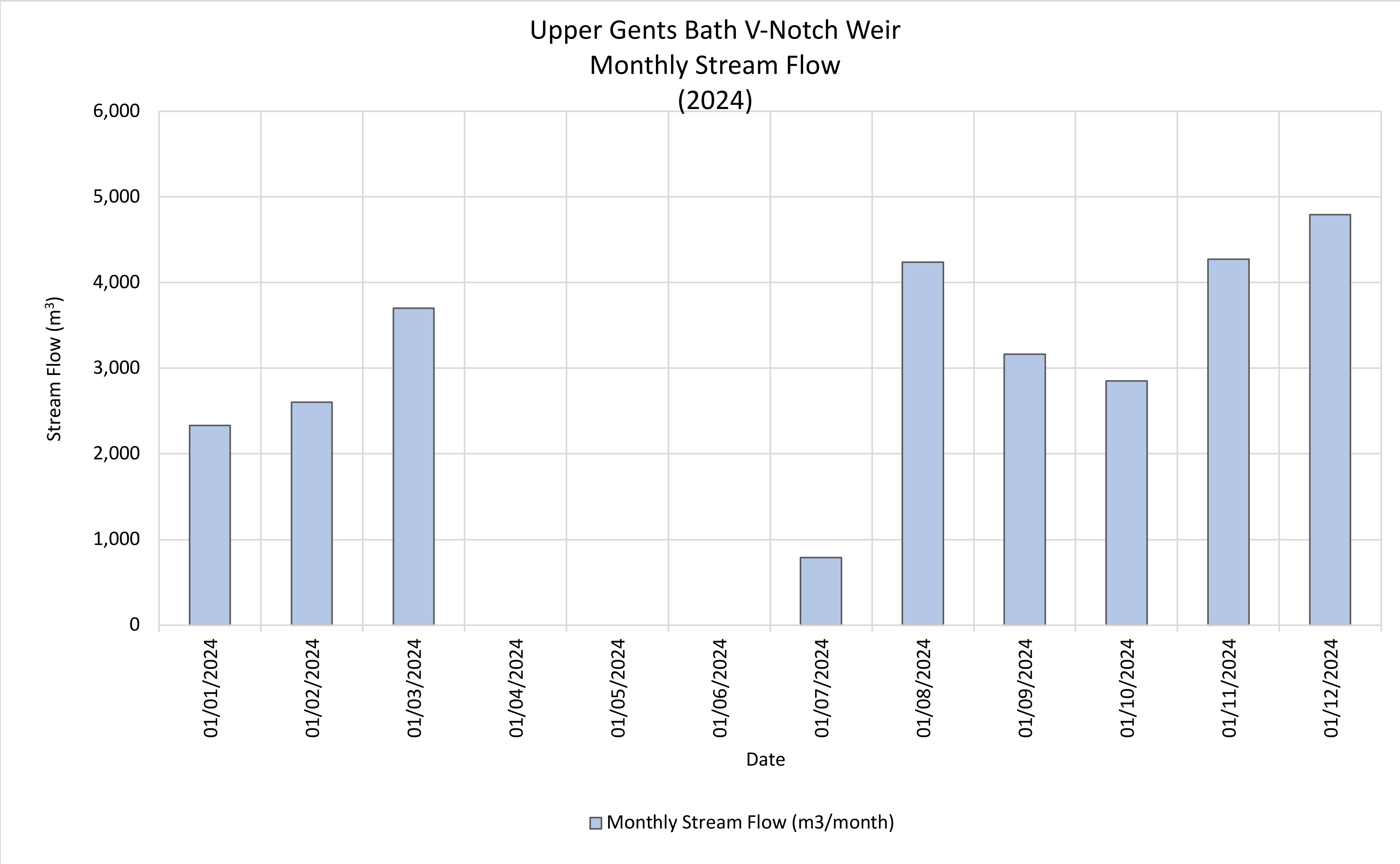
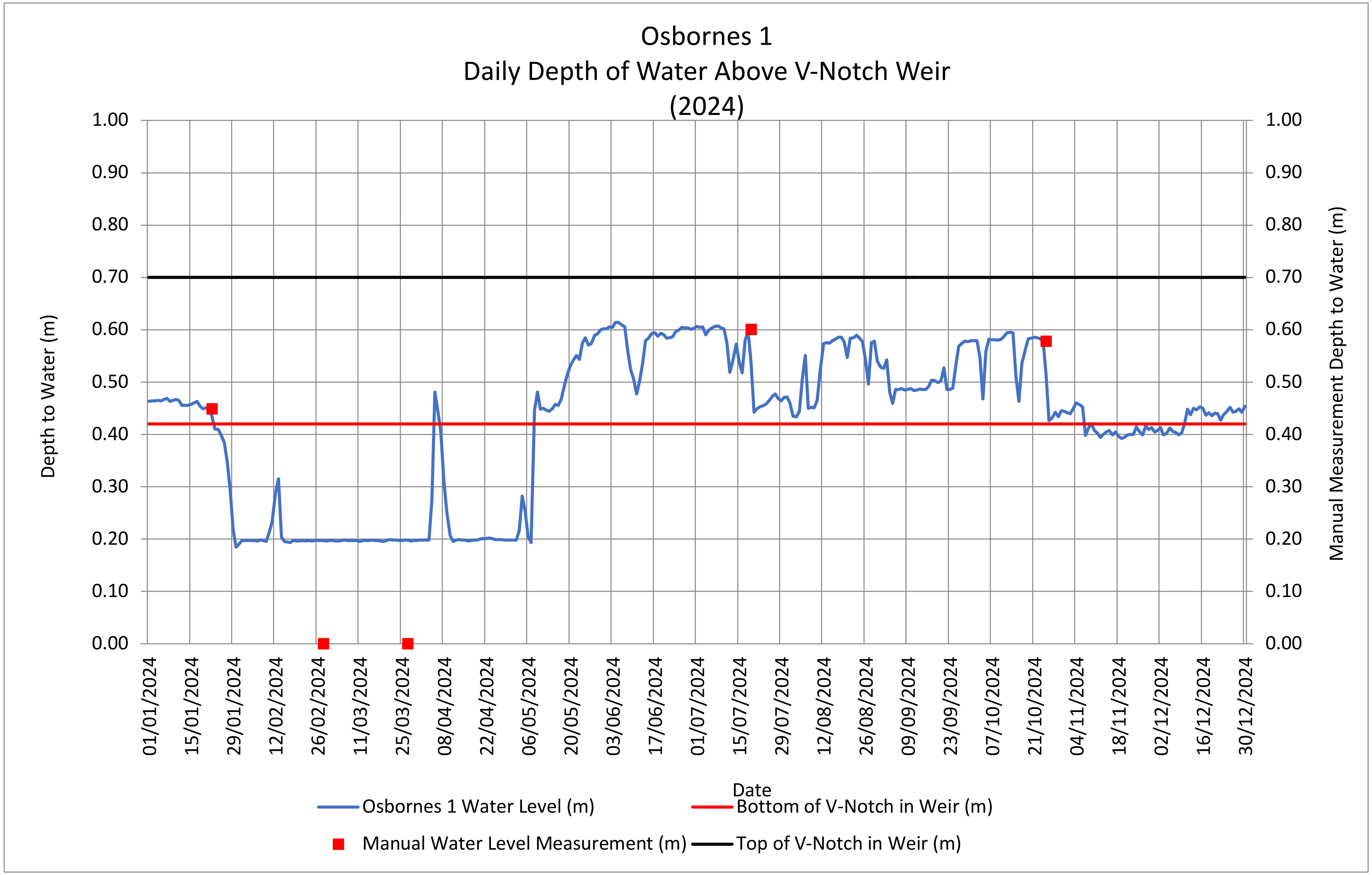

Drummonds Point V-Notch Weir
Monthly Stream Flow
(2024)
Stream Flow (m³)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan 2024
Feb 2024
Mar 2024
Apr 2024
May 2024
Jun 2024
Jul 2024
Aug 2024
Sep 2024
Oct 2024
Nov 2024
Dec 2024
Date
Monthly Stream Flow over V-Notch Weir...

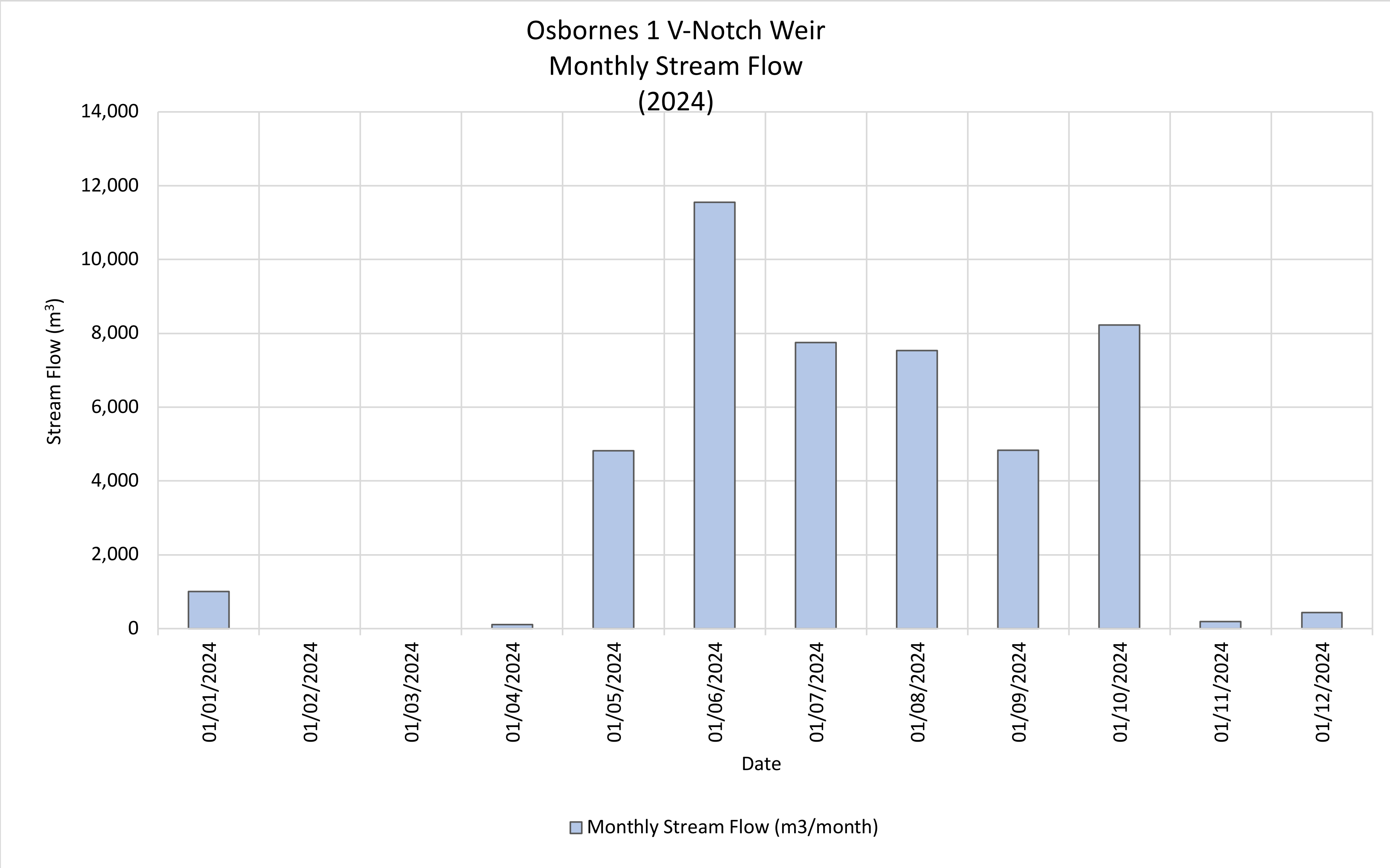

Harpers
Daily Depth of Water Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
Date
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Harpers Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)

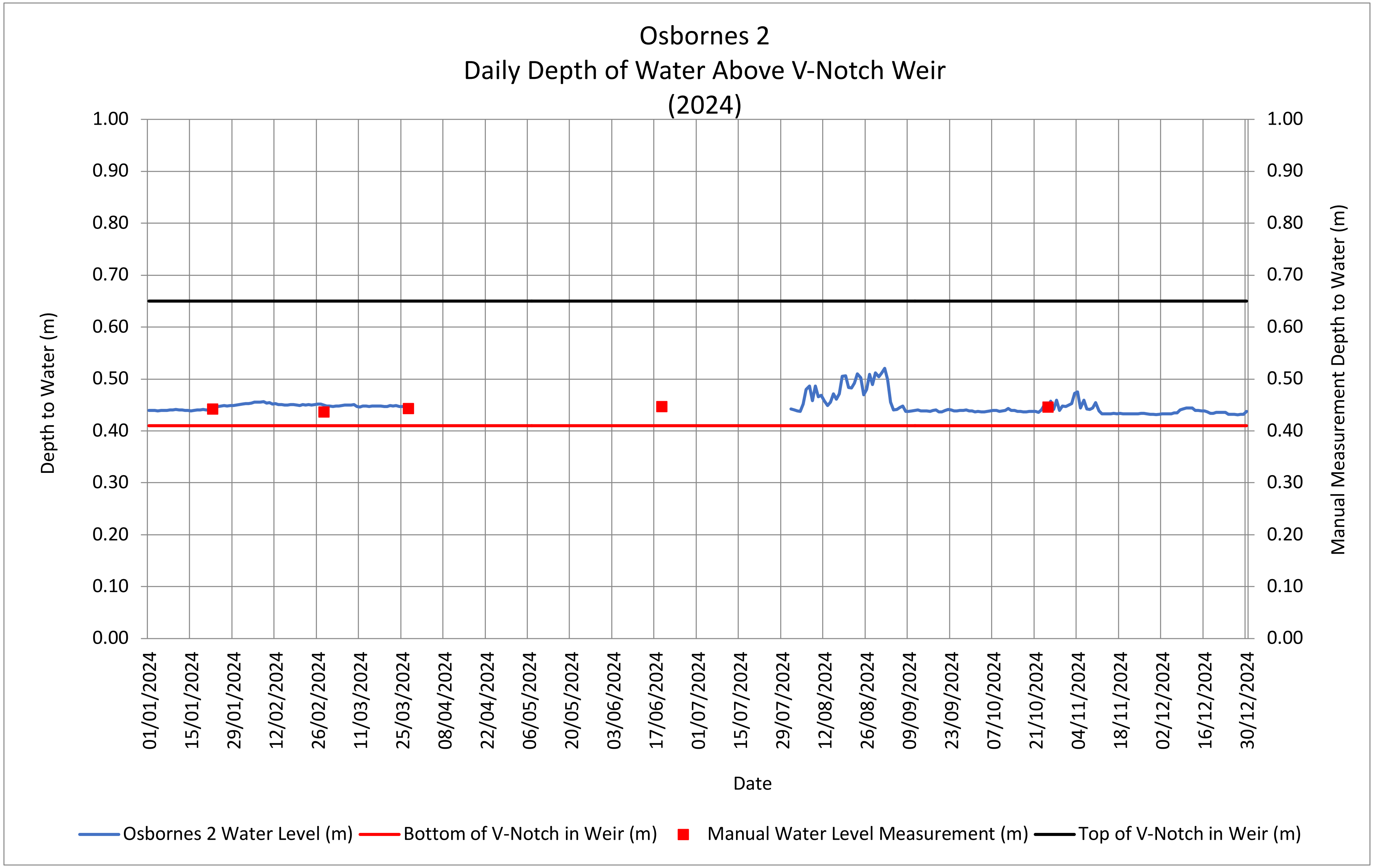

Harpers V-Notch Weir
Monthly Stream Flow
(2024)
6,000
5,000
4,000
3,000
2,000
1,000
0
Stream Flow (m3)
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/m)

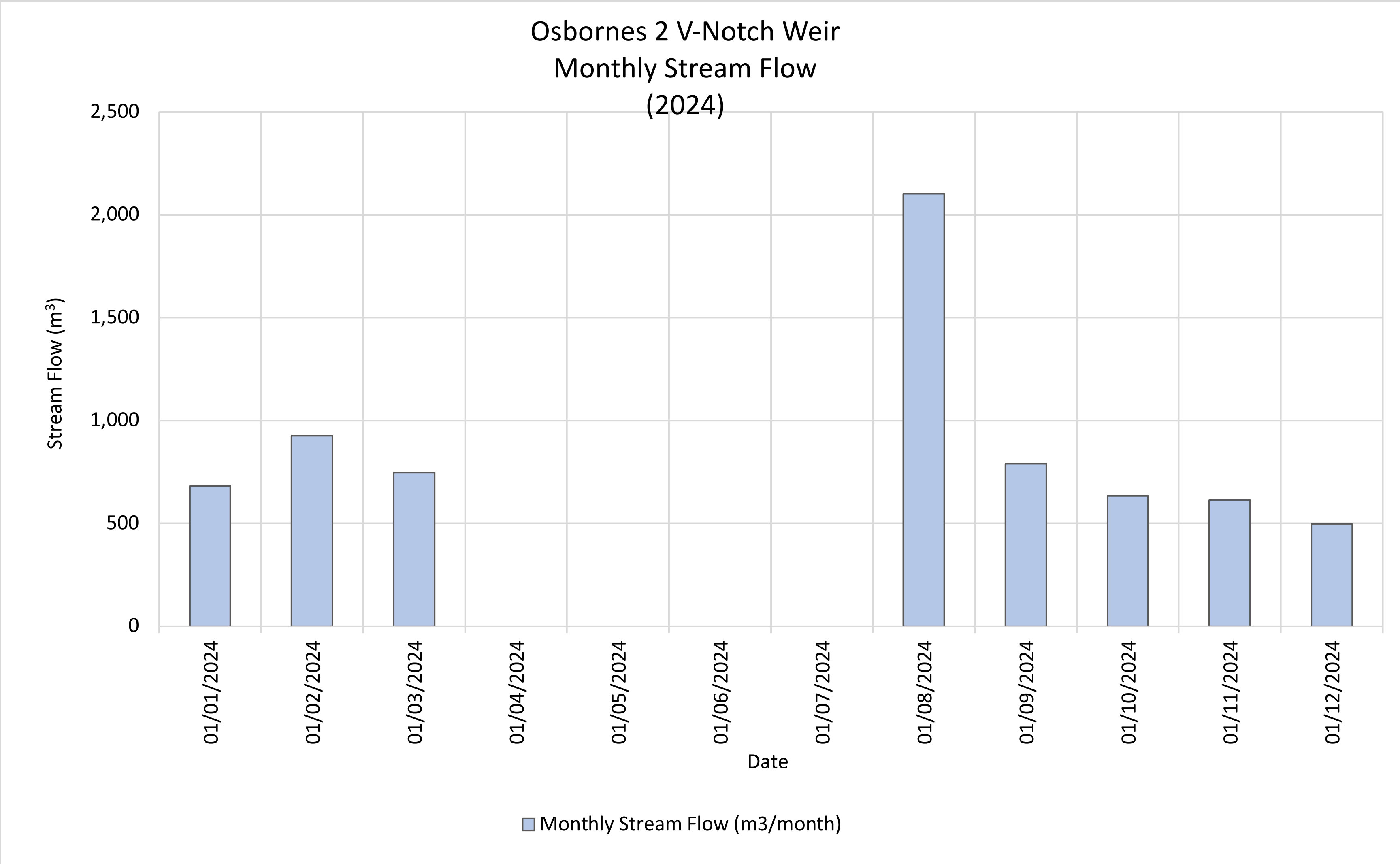

Upper Gents Bath
Daily Depth of Water Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
Upper Gents Bath Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)


Upper Gents Bath V-Notch Weir
Monthly Stream Flow
(2024)
6,000
5,000
4,000
3,000
2,000
1,000
0
Stream Flow (m3)
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/month)

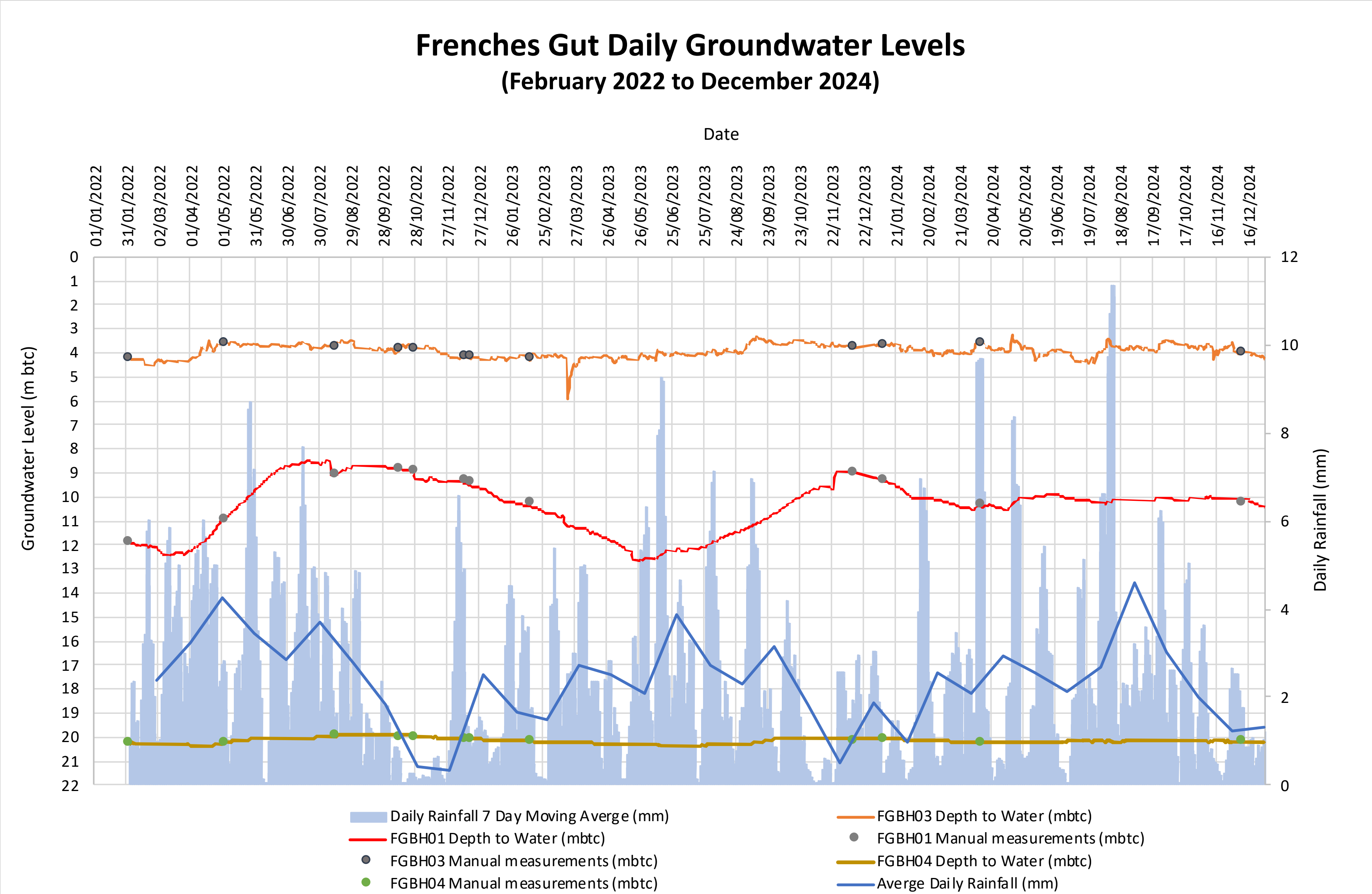

Osbornes 1
Daily Depth of Water Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
Osbornes 1 Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)

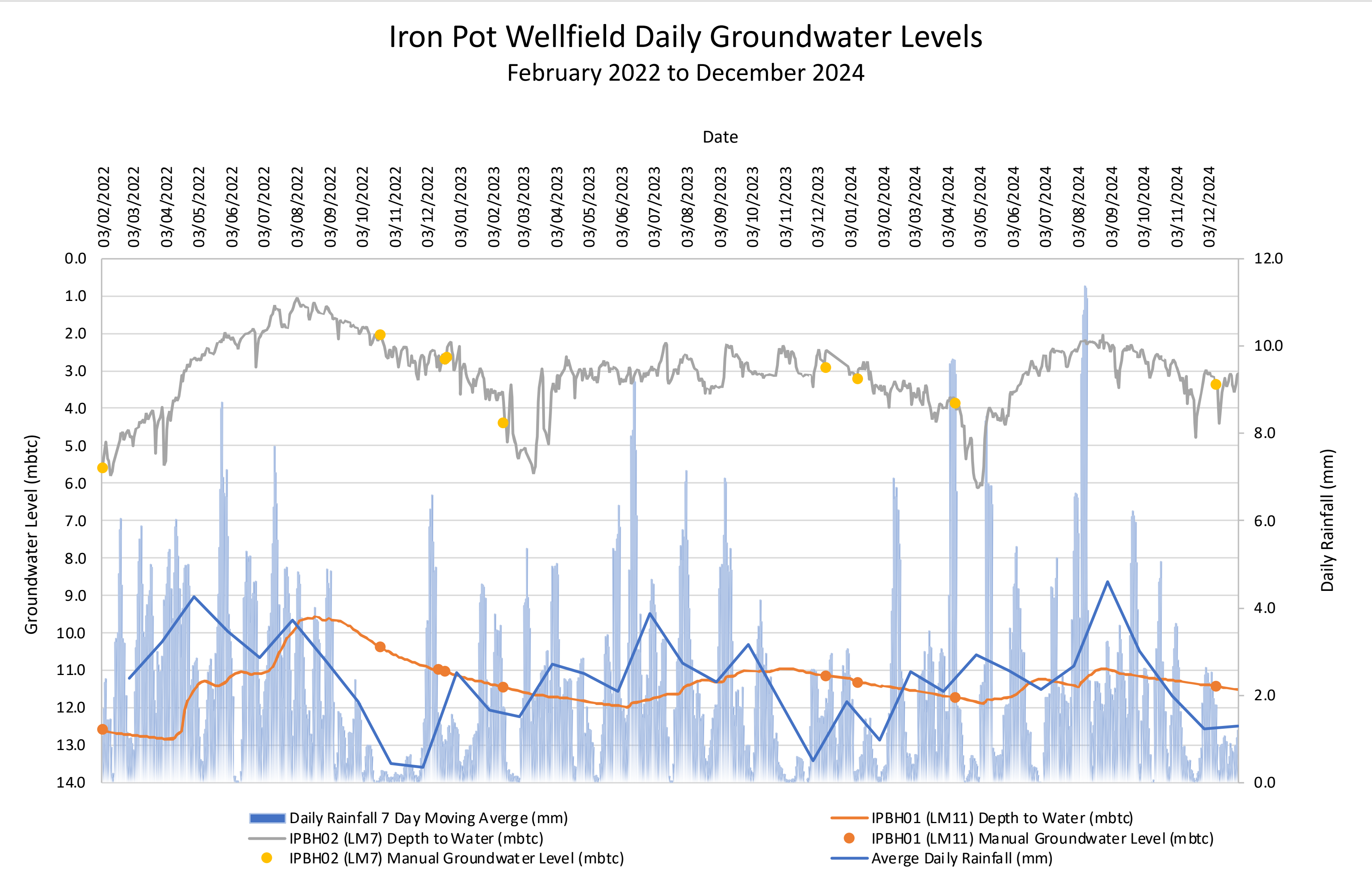

Osbornes 1 V-Notch Weir
Monthly Stream Flow
(2024)
Stream Flow (m³)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/month)

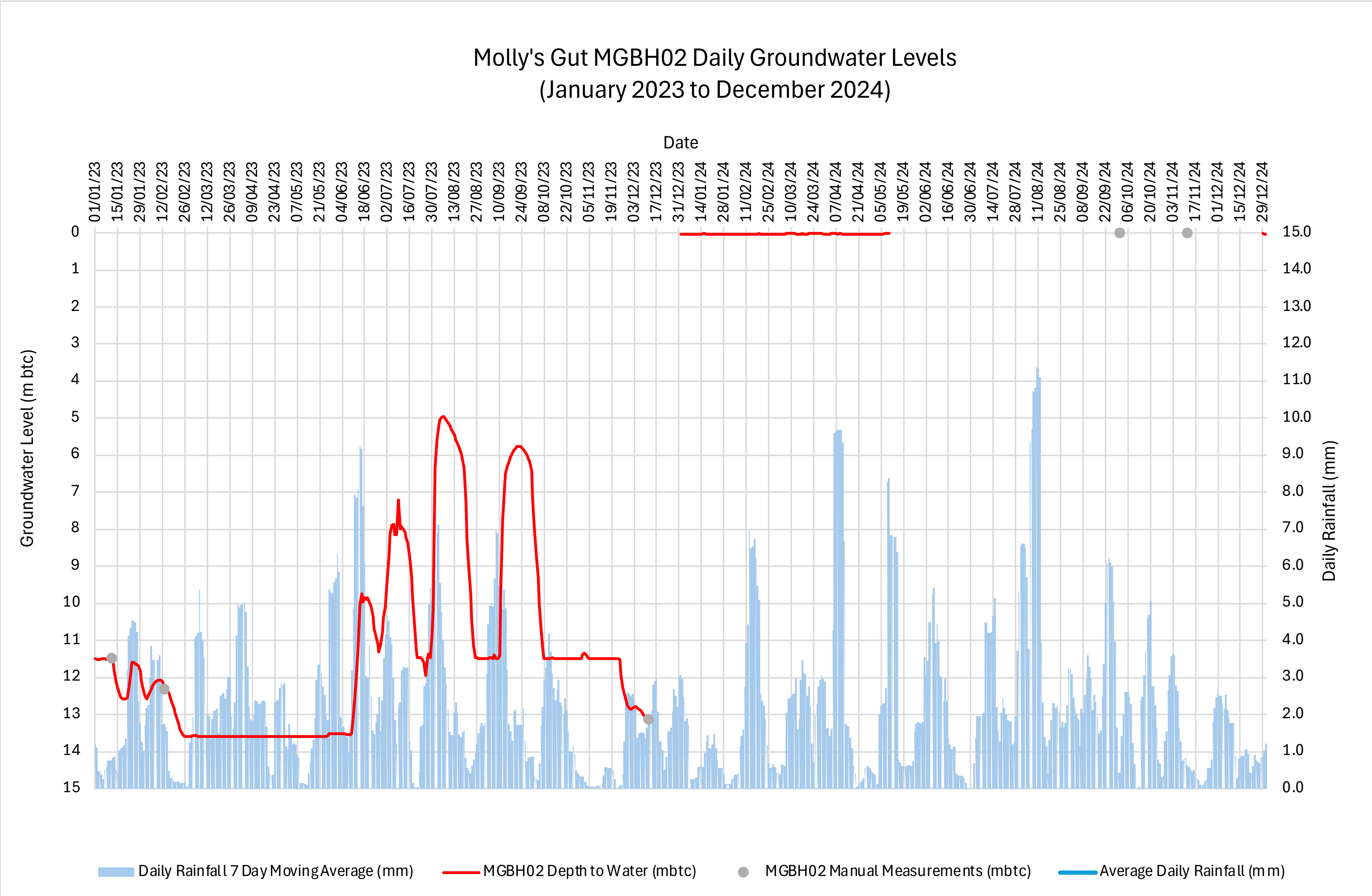

Osbornes 2
Daily Depth of Water Above V-Notch Weir
(2024)
Depth to Water (m)
Manual Measurement Depth to Water (m)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01/01/2024
15/01/2024
29/01/2024
12/02/2024
26/02/2024
11/03/2024
25/03/2024
08/04/2024
22/04/2024
06/05/2024
20/05/2024
03/06/2024
17/06/2024
01/07/2024
15/07/2024
29/07/2024
12/08/2024
26/08/2024
09/09/2024
23/09/2024
07/10/2024
21/10/2024
04/11/2024
18/11/2024
02/12/2024
16/12/2024
30/12/2024
Date
Osbornes 2 Water Level (m)
Bottom of V-Notch in Weir (m)
Manual Water Level Measurement (m)
Top of V-Notch in Weir (m)


Osbornes 2 V-Notch Weir
Monthly Stream Flow
(2024)
Stream Flow (m3)
2,500
2,000
1,500
1,000
500
0
01/01/2024
01/02/2024
01/03/2024
01/04/2024
01/05/2024
01/06/2024
01/07/2024
01/08/2024
01/09/2024
01/10/2024
01/11/2024
01/12/2024
Date
Monthly Stream Flow (m3/month)

Appendix 2.2: Groundwater Data


Frenches Gut Daily Groundwater Levels
(February 2022 to December 2024)
Date
01/01/2022
31/01/2022
02/03/2022
01/04/2022
01/05/2022
31/05/2022
30/06/2022
30/07/2022
29/08/2022
28/09/2022
28/10/2022
27/11/2022
27/12/2022
26/01/2023
25/02/2023
27/03/2023
26/04/2023
26/05/2023
25/06/2023
25/07/2023
24/08/2023
23/09/2023
23/10/2023
22/11/2023
22/12/2023
21/01/2024
20/02/2024
21/03/2024
20/04/2024
20/05/2024
19/06/2024
19/07/2024
18/08/2024
17/09/2024
17/10/2024
16/11/2024
16/12/2024
Groundwater Level (m btc)
Daily Rainfall (mm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
12
10
8
6
4
2
0
Daily Rainfall 7 Day Moving Averge (mm)
FGBH03 Depth to Water (mbtc)
FGBH01 Depth to Water (mbtc)
FGBH01 Manual measurements (mbtc)
FGBH03 Manual measurements (mbtc)
FGBH04 Depth to Water (mbtc)
FGBH04 Manual measurements (mbtc)
Averge Daily Rainfall (mm)


Iron Pot Wellfield Daily Groundwater Levels
February 2022 to December 2024
Date
Groundwater Level (mbtc)
Daily Rainfall (mm)
Daily Rainfall 7 Day Moving Averge (mm)
IPBH02 (LM7) Depth to Water (mbtc)
IPBH02 (LM7) Manual Groundwater Level (mbtc)
IPBH01 (LM11) Depth to Water (mbtc)
IPBH01 (LM11) Manual Groundwater Level (mbtc)
Averge Daily Rainfall (mm)


Molly's Gut MGBH02 Daily Groundwater Levels
(January 2023 to December 2024)
Date
01/01/23 15/01/23 29/01/23 12/02/23 26/02/23 12/03/23 26/03/23 09/04/23 23/04/23 07/05/23 21/05/23 04/06/23 18/06/23 02/07/23 16/07/23 30/07/23 13/08/23 27/08/23 10/09/23 24/09/23 08/10/23 22/10/23 05/11/23 19/11/23 03/12/23 17/12/23 31/12/23 14/01/24 28/01/24 11/02/24 25/02/24 10/03/24 24/03/24 07/04/24 21/04/24 05/05/24 19/05/24 02/06/24 16/06/24 30/06/24 14/07/24 28/07/24 11/08/24 25/08/24 08/09/24 22/09/24 06/10/24 20/10/24 03/11/24 17/11/24 01/12/24 15/12/24 29/12/24
Groundwater Level (m btc)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Daily Rainfall (mm)
15.0 14.0 13.0 12.0 11.0 10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.0
Daily Rainfall 7 Day Moving Average (mm)
MGBH02 Depth to Water (mbtc)
MGBH02 Manual Measurements (mbtc)
Average Daily Rainfall (mm)

Appendix 3: Water Balance

St Helena Water Catchment Areas

Sources: Connect Catchment GIS Shapefile
Saint Helena Government 50m contour Shapefile

Note: 1. Each catchment has been split into 3 sections: Above 690m, between 500m and 690m and below 500m elevation.
2. The catchment sub-divisions have been selected as mist + rain are expected to contribute to the water balance above 690m elevation.
3. Rainfall is expected to contribute to the water balance between 500m and 690m elevation based on literature review.
4. Rainfall below 500m is not expected to contribute to the water balance as the lilterature review has reported earlier studies showing evaporation exceeding recharge below 500m elevation.

Above 690m Elevation

Catchment No.	Catchment Name	Catchment Area (m^2)	Catchment Area (Km^2)
20	Banks Valley	375.1	0.00
13a	Broad Gut	123,679.0	0.12
15	Deep Valley	152,672.7	0.15
17	Fishers Valley	190,204.1	0.19
7	Friars Valley	66,974.4	0.07
24	James Valley	291,328.3	0.29
8	Lemon Valley	233,958.2	0.23
12	Manati Bay Stream	5.5	0.00
10	Old Woman Valley	35,692.0	0.04
14	Powells Valley	24,242.1	0.02
13	Sandy Bay Gut	292,974.8	0.29
16	Sharks Valley	133,104.9	0.13
9	Swanley Valley	194,856.4	0.19
11	Thompsons Valley	27,048.8	0.03
Unspecified 15	Unspecified 15	785.7	0.00
Unspecified 7	Unspecified 7	2,520.2	0.00

Between 500m and 690m Elevation

Catchment No.	Catchment Name	Catchment Area (m^2)	Catchment Area (Km^2)
20	Banks Valley	372,939.5	0.37
5	Breakneck Valley	226,578.4	0.23
13a	Broad Gut	1,486,528.9	1.49
15	Deep Valley	800,556.5	0.80
16a	Dry Gut	93,867.0	0.09
17	Fishers Valley	2,192,532.4	2.19
7	Friars Valley	983,987.3	0.98
24	James Valley	3,528,191.5	3.53
8	Lemon Valley	3,402,362.3	3.40
12	Manati Bay Stream	756,257.4	0.76
10	Old Woman Valley	1,293,765.1	1.29
14	Powells Valley	577,873.7	0.58
18	Ruperts Valley	1,064,442.5	1.06
13	Sandy Bay Gut	2,182,797.6	2.18
16	Sharks Valley	1,490,817.6	1.49
9	Swanley Valley	1,221,145.1	1.22
11	Thompsons Valley	2,087,721.8	2.09
19	Turks Cap Valley	1,417,761.3	1.42
Unspecified 15	Unspecified 15	579,053.2	0.58
Unspecified 18	Unspecified 18	556,087.8	0.56
Unspecified 3	Unspecified 3	65,141.2	0.07
Unspecified 5	Unspecified 5	290,422.7	0.29
Unspecified 6	Unspecified 6	285,515.2	0.29
Unspecified 7	Unspecified 7	157,821.50	0.16
6	Youngs Valley	646,281.1	0.65

Below 500m Elevation

Catchment No.	Catchment Name	Catchment Area (m^2)	Catchment Area (Km^2)
20	Banks Valley	2,708,851.9	2.71
5	Breakneck Valley	1,627,466.2	1.63
13a	Broad Gut	4,537,192.0	4.54
15	Deep Valley	2,370,166.2	2.37
16a	Dry Gut	4,673,263.2	4.67
17	Fishers Valley	7,911,585.6	7.91
7	Friars Valley	1,226,981.7	1.23
01-Apr	James Valley	3,376,946.6	3.38
8	Lemon Valley	2,427,219.7	2.43
12	Manati Bay Stream	1,870,097.4	1.87
10	Old Woman Valley	1,875,327.0	1.88
14	Powells Valley	2,781,802.6	2.78
18	Ruperts Valley	7,106,926.8	7.11
13	Sandy Bay Gut	5,122,567.5	5.12
16	Sharks Valley	4,075,764.1	4.08
9	Swanley Valley	1,471,298.6	1.47
11	Thompsons Valley	3,192,623.0	3.19
19	Turks Cap Valley	7,307,172.3	7.31
Unspecified 1	Unspecified 1	1,766,040.2	1.77
Unspecified 10	Unspecified 10	526,821.1	0.53
Unspecified 11	Unspecified 11	576,125.4	0.58
Unspecified 12	Unspecified 12	227,962.3	0.23
Unspecified 13	Unspecified 13	671,201.0	0.67
Unspecified 14	Unspecified 14	193,361.6	0.19
Unspecified 15	Unspecified 15	3,123,226.4	3.12
Unspecified 16	Unspecified 16	2,332,823.5	2.33
Unspecified 17	Unspecified 17	1,350,132.0	1.35
Unspecified 18	Unspecified 18	3,758,141.8	3.76
Unspecified 2	Unspecified 2	298,786.5	0.30
Unspecified 3	Unspecified 3	1,952,966.3	1.95
Unspecified 4	Unspecified 4	1,838,693.3	1.84
Unspecified 5	Unspecified 5	4,368,054.1	4.37
Unspecified 6	Unspecified 6	2,551,404.8	2.55
Unspecified 7	Unspecified 7	1,370,593.5	1.37
Unspecified 8	Unspecified 8	53,608.7	0.05
Unspecified 9	Unspecified 9	47,647.1	0.05
6	Youngs Valley	1,010,597.6	1.01

Water Balance D, Scenario 4 – Zone 1 Catchment Water Balance 2024

Catchment	Catchment Area (m^2)	Catchment Rainfall (m/a)	Catchment Mist (m/a)	PE (m)	Rainfall Recharge (m^3/a)	Streamflow (m^3/a)	Connect Abstraction (m^3/a)	Surplus/Defecit (m^3/a)
James Valley	291,701.70	0.903	1.000	0.671	359,376.49			359,376.49
Sandy Bay Gut	293,349.40	0.855	1.000	0.671	347,325.69			347,325.69
Lemon Valley	234,265.70	0.800	1.000	0.671	264,485.98			264,485.98
Fishers Valley	190,445.00	0.871	1.000	0.671	228,534.00	94,228.0	87,038.0	47,268.00
Swanley Valley	195,114.40	0.708	1.000	0.671	202,333.63			202,333.63
Deep Valley	152,865.20	0.795	1.000	0.671	171,820.48			171,820.48
Sharks Valley	133,245.40	0.816	1.000	0.671	152,565.98			152,565.98
Broad Gut	123,842.50	0.716	1.000	0.671	129,415.41			129,415.41
Friars Valley	67,061.60	0.863	1.000	0.671	79,937.43			79,937.43
Old Woman Valley	35,739.40	0.667	1.000	0.671	35,596.44			35,596.44
Powells Valley	24,272.70	0.798	1.000	0.671	27,355.33			27,355.33
Thompsons Valley	27,084.80	0.605	1.000	0.671	25,297.20			25,297.20
Unspecified 7	2,535.60	0.499	1.000	0.671	2,099.48			2,099.48
Unspecified 15	786.70	0.395	1.000	0.671	569.57			569.57
Banks Valley	375.50	0.395	1.000	0.671	271.86			271.86

Water Balance D, Scenario 4 – Zone 2 Catchment Water Balance 2024

Catchment	Catchment Area (m^2)	Catchment Rainfall (m/a)	Catchment Mist (m/a)	PE (m)	Rainfall Recharge (m^3/a)	Streamflow (m^3/a)	Connect Abstraction (m^3/a)	Surplus/Defecit (m^3/a)
James Valley	3,532,719.00	0.829		0.671	558,169.60	90,054.0	65,593.0	402,522.60
Sandy Bay Gut	2,185,614.90	0.841		0.671	371,554.53			371,554.53
Fishers Valley	2,195,277.50	0.717		0.671	100,982.77	5,036.0	22,566.0	73,380.76
Friars Valley	985,272.00	0.756		0.671	83,748.12			83,748.12
Ruperts Valley	1,065,784.50	0.733		0.671	66,078.64			66,078.64
Youngs Valley	647,121.50	0.750		0.671	51,122.60			51,122.60
Powells Valley	578,603.00	0.741		0.671	40,502.21			40,502.21
Broad Gut	1,488,498.60	0.697		0.671	38,700.96			38,700.96
Sharks Valley	1,492,678.60	0.681		0.671	14,926.79			14,926.79
Unspecified 4	15,354.30	0.724		0.671	813.78			813.78
Deep Valley	801,557.90	0.667		0.671	-3,206.23	40,950.0	40,950.0	-85,106.23
Dry Gut	93,983.00	0.585		0.671	-8,082.54			-8,082.54
Unspecified 3	65,222.30	0.531		0.671	-9,131.12			-9,131.12
Breakneck Valley	226,871.90	0.616		0.671	-12,477.95			-12,477.95
Unspecified 7	142,680.60	0.484		0.671	-26,681.27			-26,681.27
Unspecified 5	290,809.70	0.512		0.671	-46,238.74			-46,238.74
Unspecified 6	285,907.20	0.435		0.671	-67,474.10			-67,474.10
Lemon Valley	3,406,854.90	0.650		0.671	-71,543.95		63,247.0	-134,790.95
Manati Bay Strear	757,274.70	0.544		0.671	-96,173.89			-96,173.89
Banks Valley	373,403.40	0.386		0.671	-106,419.97			-106,419.97
Swanley Valley	1,222,773.00	0.574		0.671	-118,608.98			-118,608.98
Old Woman Valley	1,295,499.10	0.578		0.671	-120,481.42			-120,481.42
Unspecified 18	556,833.20	0.446		0.671	-125,287.47			-125,287.47
Unspecified 15	579,758.40	0.420		0.671	-145,519.36			-145,519.36
Turks Cap Valley	1,419,514.10	0.560		0.671	-157,566.07			-157,566.07
Thompsons Valley	2,090,547.70	0.550		0.671	-252,956.27			-252,956.27
					-41,249.34		**Total Surplus/Defecit**	**-116,689.06**

UK Government

Water Balance D, Scenario 4 – Zone 3 Catchment Water Balance 2024

Catchment	Catchment Area (m^2)	Catchment Rainfall (m/a)	Catchment Mist (m/a)	PE (m)	Rainfall Recharge (m^3/a)	Streamflow (m^3/a)	Connect Abstraction (m^3/a)	Surplus/Defecit (m^3/a)
Unspecified 9	47,710.10	0.328		0.976	-30,916.14			-30,916.14
Unspecified 8	53,679.90	0.341		0.976	-34,086.74			-34,086.74
Unspecified 14	193,608.80	0.266		0.976	-137,462.25			-137,462.25
Unspecified 12	228,256.60	0.276		0.976	-159,779.62			-159,779.62
Unspecified 2	299,140.90	0.360		0.976	-184,270.79			-184,270.79
Unspecified 10	527,512.20	0.328		0.976	-341,827.91			-341,827.91
Unspecified 11	576,873.80	0.353		0.976	-359,392.38			-359,392.38
Unspecified 13	672,056.30	0.293		0.976	-459,014.45			-459,014.45
Youngs Valley	1,011,921.80	0.498		0.976	-483,698.62			-483,698.62
Friars Valley	1,228,595.90	0.511		0.976	-571,297.09			-571,297.09
Unspecified 4	1,841,027.90	0.625		0.976	-646,200.79			-646,200.79
Swanley Valley	1,473,286.40	0.504		0.976	-695,391.18			-695,391.18
Unspecified 7	1,372,476.00	0.434		0.976	-743,881.99			-743,881.99
Unspecified 17	1,351,720.50	0.415		0.976	-758,315.20			-758,315.20
Breakneck Valley	1,629,582.50	0.467		0.976	-829,457.49			-829,457.49
Old Woman Valley	1,877,865.90	0.516		0.976	-863,818.31			-863,818.31
Sandy Bay Gut	5,129,175.20	0.804		0.976	-882,218.13	27,468.0		-909,686.13
Manati Bay Stream	1,872,619.20	0.504		0.976	-883,876.26			-883,876.26
Powells Valley	2,785,309.40	0.658		0.976	-885,728.39			-885,728.39
Unspecified 3	1,955,379.50	0.489		0.976	-952,269.82			-952,269.82
Deep Valley	2,373,087.70	0.521		0.976	-1,079,754.90			-1,079,754.90
Unspecified 1	1,768,169.20	0.335		0.976	-1,133,396.46			-1,133,396.46
Lemon Valley	2,430,440.00	0.482		0.976	-1,200,637.36			-1,200,637.36
James Valley	3,381,289.40	0.607		0.976	-1,247,695.79		48,916.0	-1,296,611.79
Unspecified 16	2,335,628.20	0.437		0.976	-1,258,903.60			-1,258,903.60
Broad Gut	4,543,142.10	0.695		0.976	-1,276,622.93			-1,276,622.93
Unspecified 6	2,554,937.50	0.410		0.976	-1,446,094.63			-1,446,094.63
Thompsons Valley	3,196,983.50	0.504		0.976	-1,508,976.21			-1,508,976.21
Banks Valley	2,712,265.50	0.345		0.976	-1,711,439.53			-1,711,439.53
Unspecified 15	3,127,058.70	0.384		0.976	-1,851,218.75			-1,851,218.75
Sharks Valley	4,080,737.90	0.502		0.976	-1,934,269.76			-1,934,269.76
Unspecified 5	4,373,845.00	0.523		0.976	-1,981,351.79			-1,981,351.79
Unspecified 18	3,763,213.40	0.382		0.976	-2,235,348.76			-2,235,348.76
Dry Gut	4,678,875.00	0.465		0.976	-2,390,905.13			-2,390,905.13
Ruperts Valley	7,115,929.20	0.585		0.976	-2,782,328.32			-2,782,328.32
Fishers Valley	7,921,167.00	0.614		0.976	-2,867,462.45			-2,867,462.45
Turks Cap Valley	7,316,126.60	0.515		0.976	-3,372,734.36			-3,372,734.36
							Total Surplus/Defecit	**-42,258,428.29**