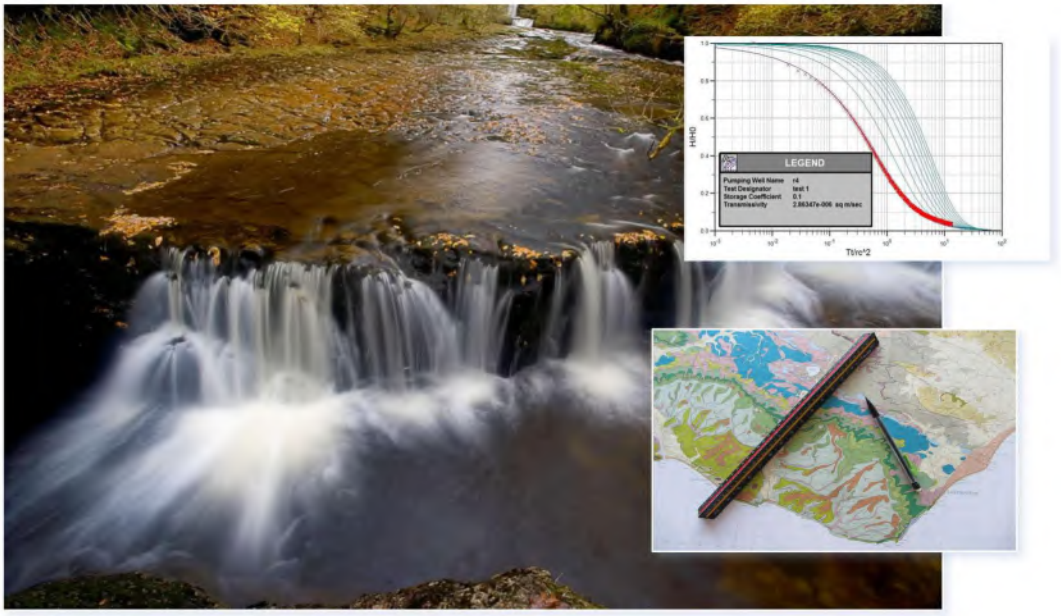


Hydrogeological Impact Assessment and Groundwater Pumping Test Report

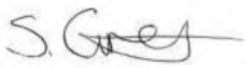
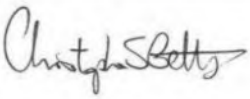
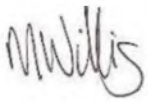
Ddole Farm

Llanbister, Llandrindod Wells, Powys, Wales, LD1 6SS

On Behalf of

Ddole Farm

Quality Management

Prepared by:	Scott Greaves BSc MSc FGS	
Reviewed by:	Chris Betts MSc FGS CGeol	
Reviewed & Authorised by:	Mike Willis BSc MSc FGS	
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Contents

Tables

Figures

Drawings

Drawing 1 Geology Map

Appendices

1 Background

Hydrogeo Limited (Hydrogeo) have been commissioned by Debra Lewis (The Client) to conduct a Hydrogeological Impact Assessment (HIA) and an abstraction borehole pumping test at Ddole Farm, Llanbister, Llandrindod Wells, Powys., LD1 6SS. The Site requires an abstraction license with Natural Resources Wales (NRW) as the required volume of abstraction to meet the Site needs is >20m^3/day.

This report details the following:

- Site setting and background;
- Setup of the pumping test;
- Results of the pumping test; and
- Analysis of the pumping test.
- Hydrogeological Impact Assessment (HIA)

The works were progressed under a Natural Resources Wales (NRW) 'Consent to Investigate a Groundwater Source' (REF: WA/055/0004/0008) issued on 5th August 2025.

The pumping test and subsequent analysis and reporting has been undertaken in support of a proposed abstraction license application at The Site.

1.1 Site Setting

Ddole Farm (hereafter referred to as "The Site) is located approximately 13km north-east of Llandrindod Wells. An Ordnance Survey (OS) map of the Site and surrounding area is included as Figure 1-1, with an aerial image of the Site and surrounding area highlighting the borehole locations shown as Figure 1-2.

The Site is situated over two separate land holdings (Ddole Farm and Vronganllwyd) with poultry broiler sheds and cattle at Ddole Farm and cattle at Vronganllwyd. The land at Vronganllwyd falls steeply to the south of the Site from a topographic high of approximately 325mAOD to a topographic low of approximately 300mAOD , toward an unnamed tributary of the River Camddwr. The topography at Ddole Farm ranges from approximately 290mAOD to 270mAOD.

Figure 1-1 Ordnance Survey Map Ddole Farm

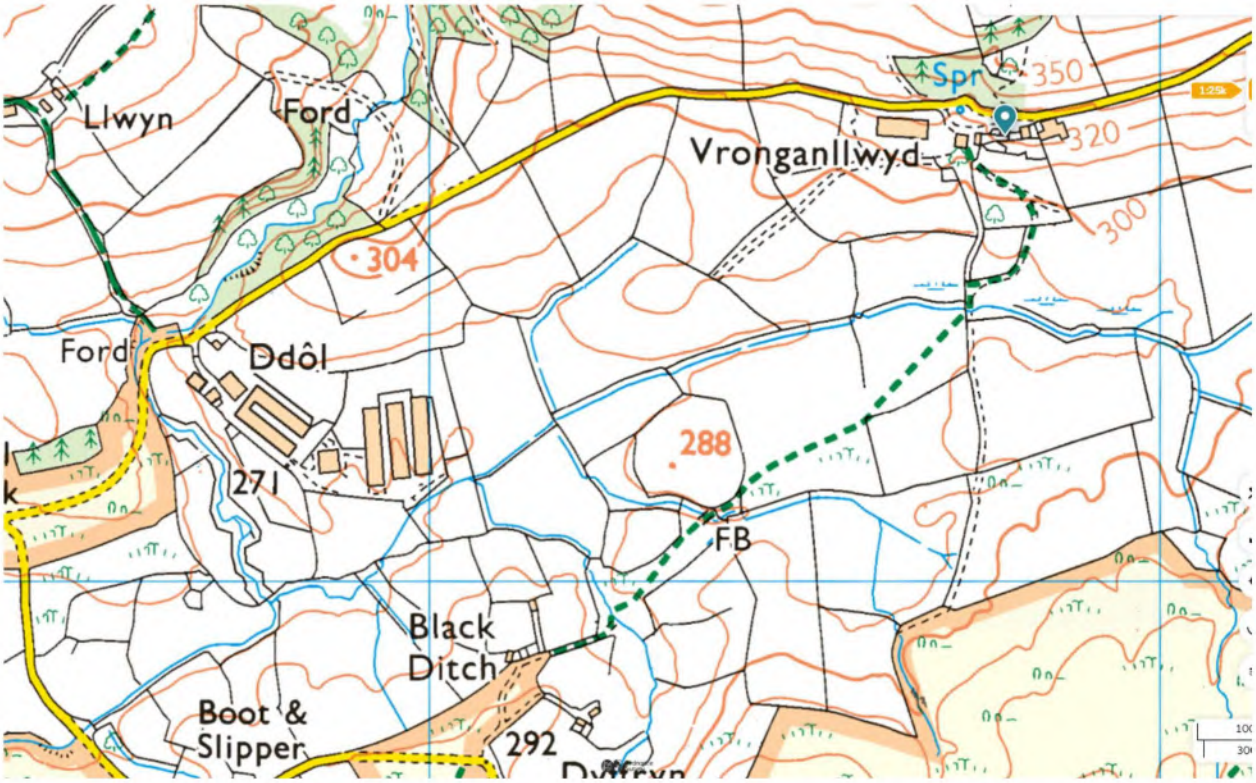


Figure 1-2 Aerial Image of Borehole Locations

1.2 Geology

The geology underlying the Site has been determined using the BGS Bedrock and Superficial Deposits datasets on the BGs GeoIndex. The Site is not covered by a 1:50,000 scale BGS sheet map.

The underlying geology (superficial and bedrock) at The Site is shown in Drawing 1.

Artificial Ground

Artificial ground consists of any areas where ground conditions have been significantly modified by man. These include excavations, infilled ground and made-up ground.

No artificial ground has been mapped across the Site, or in the vicinity of any of the abstraction boreholes.

Superficial Deposits

Superficial Deposits consist of near surface unconsolidated (loose) sedimentary deposits which have not yet become solid rock.

BGS data indicates that areas along the southern ownership boundary that are mapped as underlain by Glacial Till – diamicton. The BGS describes Glacial Till as *"Unsorted and unstratified drift, consisting of a heterogeneous mixture of clay, sand and gravel, and boulders varying widely in size and shape".*

The abstraction borehole locations are not mapped as underlain by any superficial deposits, however the drilling record available for BH3 indicates the presence of superficial deposits to a maximum depth of 14mBGL, and includes clays and gravels, grey clays and river gravels.

Bedrock Geology

Bedrock consists of the main mass of rocks forming the Earth's surface that are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

BGS mapping indicates that all boreholes are underlain by undifferentiated Wenlock Rocks. The Wenlock Rocks consist of primarily mudstones and limestones. The available borehole log for BH3 records medium to hard black shale from 14m below ground level (m BGL) to 50m BGL. No limestone strata were noted during the drilling.

1.3 BGS Borehole Records

The BGS Online GeoIndex has been reviewed for the availability of borehole logs in the vicinity of the Site. The GeoIndex indicates the presence of several boreholes, with the most relevant to the Site (closest and similar mapped geology) are summarised in Table 1-1.

Table 1-1 BGS Borehole Record Summary

Borehole Details	Ground Conditions and Additional Information
BGS Reference: SO17SW6 Name: Green Cottage Easting / Northing: 311770, 271820 Location: 1.km west Date: February 2026 Depth (m):60	• Ground level to 5m – CLAY • 5m to 6m – GRAVEL; • 6m to 7m – Fractured SLATE • 7m to 60m – SLATE Water strikes at 5m & 30m. Borehole drilled at 198mm diameter casing to 7.5m. Open hole drilling at 152mm from 7.5m to 60m. Borehole drilled at 282mm diameter from surface to 6m, then 165mm from 6m – 42m. Overflowing artesian groundwater. Installed with slotted uPVC from 19m – 60m, plain from Ground Level to 19m. Estimated yield of 1.8m^3/hour.
BGS Reference: SO17SW4 Name: Llanbister Easting / Northing: 2314129, 273900 Location: 2.15km north-east Date: 2013 Depth (m): 89.91	• Ground level to 0.91m – TOPSOIL • 0.91m to 5.5m – CLAY; • 5.5m – 89.91m – SHALE Borehole 200mm casing from ground level to 6m. Open hole drilling at 150mm diameter from 6m to 90m. Estimated flow rate of 4.86m^3/hour.

Borehole Details	Ground Conditions and Additional Information
BGS Reference: SO17SE5 Name: Bank Farm Easting / Northing: 315173, 271306 Location: 2.66km south-east Date: 2016 Depth (m): 83.82	• Ground level to 7.62m – CLAY; • 7.62m to 83.82m - SHALE Water strikes at 48.76m, 60.96m & 71.63m Borehole drilled in 200mm diameter from ground level to 10m, and 150mm diameter from 10m to 83m. Installed with slotted UPVC from 50m – 83m and plain from ground level to 50m. Rest water level on completion: 12.2m. Estimated yield of 5.5m^3/hour.

1.4 Hydrogeology

The hydrogeology of the Wenlock Rocks in the Welsh Borderland and Wales is characterised by dual porosity, where permeability is generally low within the rock matrix itself, but high along bedding planes, fractures and fissures. The sequence of rocks primarily acts as a Secondary B Aquifer. Secondary B Aquifers are rock layers with lower permeability that stores and yields limited amounts of groundwater generally through localised fissures and fractures.

The Site is mapped within an area of Medium Groundwater vulnerability, where some groundwater protection is offered by the presence of overlying superficial deposits.

Limited data of the aquifer properties exists for the Site area, available data within the *Minor Aquifers of England and Wales"* literature indicates that yields of up to 43m^3/day have been obtained from shallow wells and springs within the fissured Wenlock series.

1.5 Hydrology

Whilst obtaining the Groundwater Investigation Consent (GIC) with Natural Resources Wales (NRW), a Water Features Survey (WFS) identified the Camddwr River as the main hydrological feature within the vicinity of the Site. As part of the GIC works the Camddwr River was monitored prior to and during the constant rate testing of the on-site boreholes.

2 Pumping Test

As part of the Groundwater Investigation Consent, the following pump testing parameters were agreed with Natural Resources Wales (NRW):

- BH2 constant rate test at the maximum rate for 48 hours;
- BH3 constant rate test at the maximum rate for 48 hours;
- BH6 constant rate test at the maximum rate for 48 hours;
- BH2, BH3 and BH6 constant rate test at a rate totalling the maximum abstraction rate for 48 hours.

2.1 Monitoring Points

Based on the Water Features Survey (WFS) selected representative groundwater and surface water monitoring points were agreed with NRW prior to commencement of the pump testing. The monitoring points are identified within Figure 2-1, and include:

- Abstraction Borehole BH2;
- Abstraction Borehole BH3;
- Abstraction Borehole BH6;
- Camddwr River.

Surface water levels and groundwater levels within the on-site abstraction boreholes were recorded using electronic pressure transducers, with the on-site boreholes also being recorded at regular intervals using manual dips with an electronic dip-tape.

Table 2-1 provides a summary of the monitoring points during the pump testing of both on-site abstractions boreholes, with Figure 2-1 providing a map of the monitoring points.

Table 2-1 Pump Test Monitoring Points Summary Table

Point Ref	Location	Grid Reference	Approx. depth (m)	Distance from Borehole Locations (m)	Monitoring Parameter	Monitoring Method	Monitoring Horizon
BH2	On-site	SO 13727 72641	100m+ Anecdotally	N/A	Groundwater Level	Level Logger	Wenlock Rocks – Shales
BH3	On-site	SO 12719 72226	50m	N/A	Groundwater Level	Level Logger	Superficial Deposits and Wenlock Rocks – Shales
BH6	On-site	SO12769 72320	Unknown	N/A	Groundwater Level	Level Logger	Superficial Deposits and Wenlock Rocks – Shales
Camddwr River	50m north	SO 12678 72349	N/A	130m (BH3) to 1.11km (BH2)	Surface Water Monitoring	Level Logger	N/A

Figure 2-1 Monitoring Locations

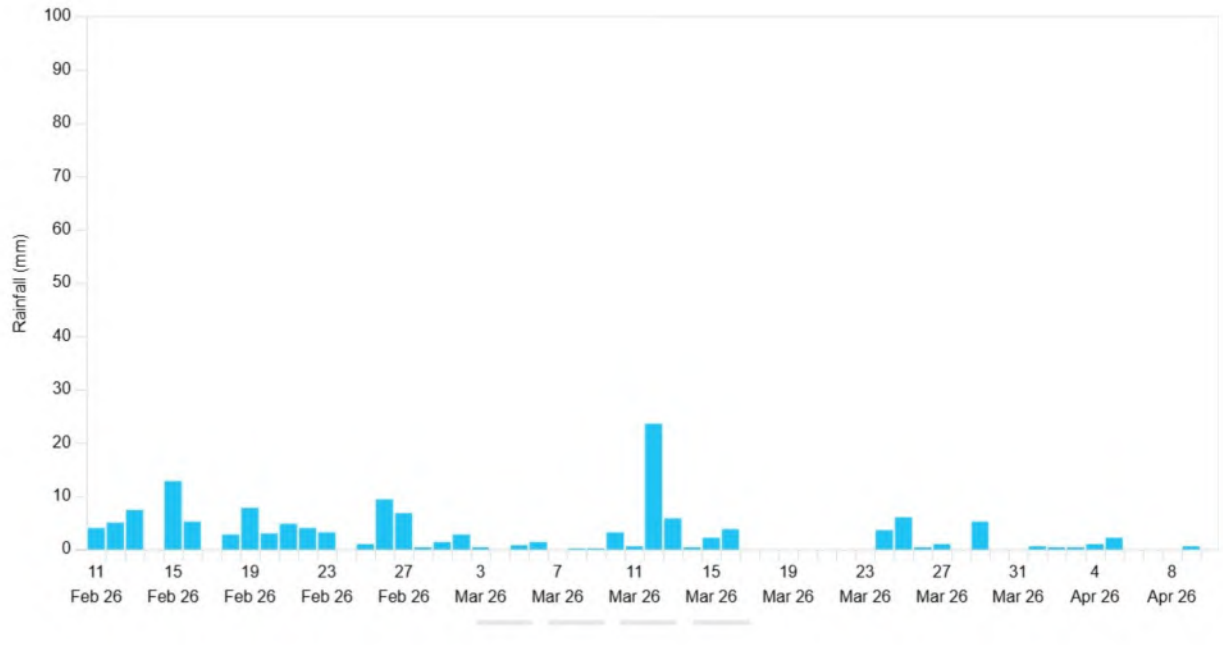
2.2 Discharge

No groundwater was discharged to ground during the pump testing at Site. All abstracted groundwater was stored in the sub-surface tank and above-ground storage take and used across the Site as usual for cattle, broiler shed and domestic uses.

2.3 Rainfall

Rainfall data from the Natural Resources Wales (NRW) Bleddfa rain gauge, located approximately 9km south-east of the Site has been obtained to support the reporting. The rain gauge is located at National Grid Reference (NGR): SO2034267678. Rainfall data collected at the rain gauge over the pump testing period is presented in Figure 2-2.

Figure 2-2 Bledffa Rain Gauge Data – February 2026 – April 2026.



The rain gauge data indicates that peak rainfall of 23.8mm was recorded on Thursday 12th March 2026 in the build-up to constant rate testing. It is noted that reduced rainfall levels during testing (22.8mm total) were recorded at the Bleddfa raingauge when compared to rainfall levels during the period of background groundwater monitoring (49.6mm) prior to constant rate testing.

2.4 Pre-test Monitoring

Groundwater levels were recorded over the days preceding the pumping tests at all boreholes to establish groundwater levels and general abstraction regimes at the Site. Electronic level loggers were installed into the boreholes, and the Camddwr River on 25th February 2026 and remained in place until 17th March 2026, where the pre-test monitoring data was downloaded and the level loggers re-installed ready for pump testing.

As the Site is an active cattle and poultry farm, limited periods of no groundwater abstraction were possible as the abstractions were required for on-going site operation and processes. Therefore, the pre-test background monitoring provides an indication of the typical usage of the boreholes on a day-to-day basis over the period.

BH2 Pre-Testing Monitoring

Pre-test monitoring at BH2 (25th February 2026 – 17/03/2026) indicates the typical pumping regime of BH2, with intermittent abstraction and recovery periods controlled by the float switch on the receiving sub-surface storage tank. Pre-test monitoring groundwater levels are presented in Figure 2-3 and indicate initially rising groundwater levels from 4.12mBGL (25/02/2026) to 3.36mBGL (27/02/2026). Resting groundwater levels then appear to fall from 3.36mBGL to the lowest level of 5.3mBGL (10/03/2026), prior to recovering following rainfall recharge prior to constant rate testing.

BH2 drawdown increases under normal pumping operations as the groundwater levels fall during drier periods, indicating that water bearing fissures and fractures at shallower depths are being dewatered. This results in a reduction of transmissivity and storage of the bedrock aquifer during this period, which is typical of a bedrock fissured aquifer.

Groundwater levels are shown to increase toward the latter stages of pre-test monitoring following recorded rainfall. Additionally, during this period it appears that there was an extended period of pumping, followed by longer periods where the borehole was not in use, suggesting that an extended period of pumping filled the storage tank, with water then being utilised from the tank.

BH3 Pre-Testing Monitoring

Pre-test monitoring at BH3 was progressed over the period 25th February 2026 – 17th March 2026 and shows frequent intermittent groundwater pumping. BH2 and BH3 are the most utilised boreholes and provide most of the site operation water. Groundwater levels across the pre-testing monitoring period are shown in Figure 2-3, and show the intermittent

pumping and recovery of the borehole which is controlled via a flow switch on a above ground storage tank.

Initial rest groundwater levels at BH3 are approximately 1.12mBGL (25/02/2026) and gradually decline over the pre-test monitoring to a level of 1.4mBGL (10/03/2026). Following this, groundwater levels recover following periods of rainfall rising to a level of 0.91mBGL.

Groundwater level changes are less pronounced when compared to the fluctuations recorded at BH2. This is associated with the multi-layered aquifer at BH3, where the borehole is installed within both some unconfined superficial deposits and bedrock aquifers, indicating that the superficial at this lower topographic elevation are less sensitive to changes in rainfall recharge.

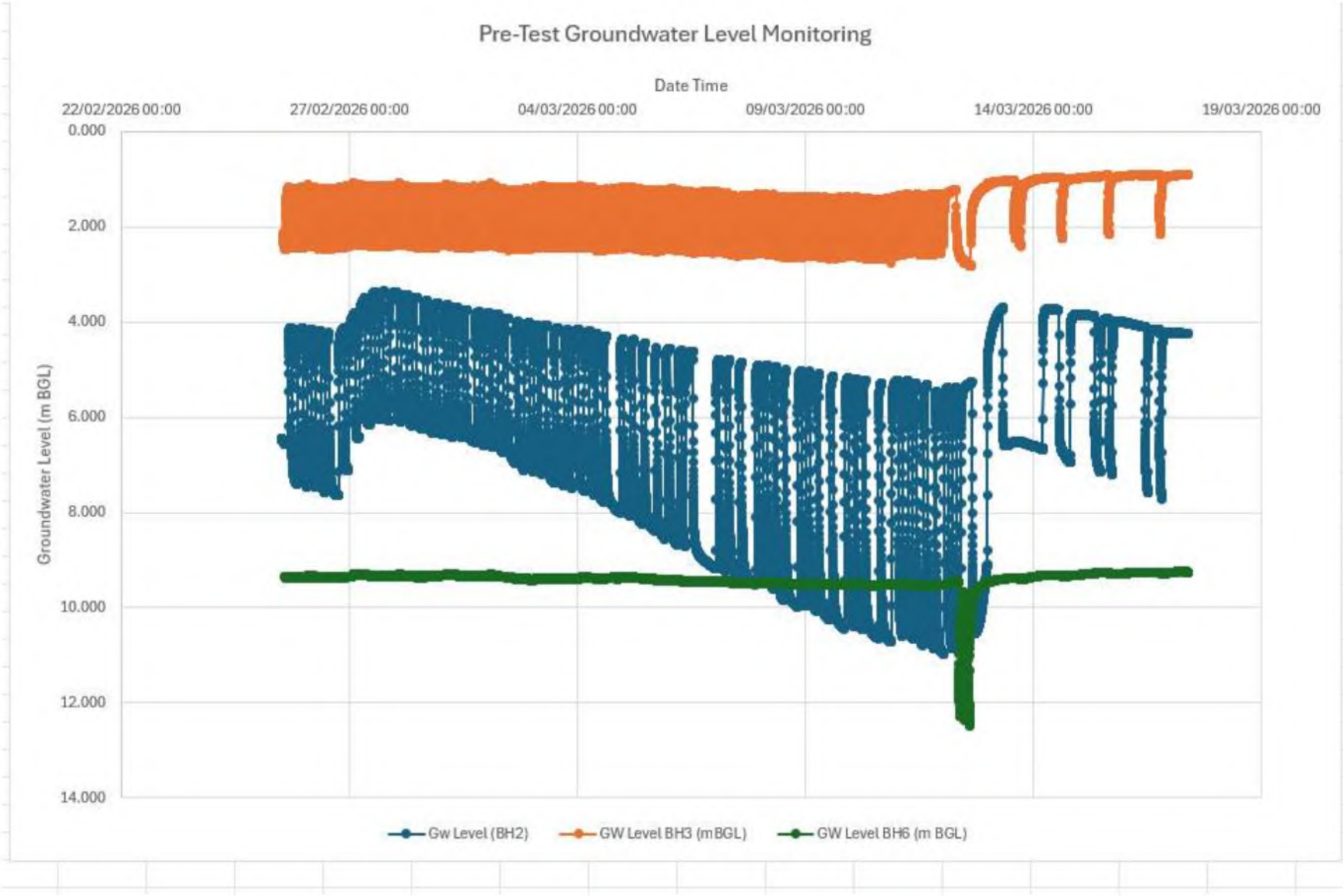
There also appears to be a change in groundwater abstraction toward the latter stages of pre-test monitoring at BH3, where a rise in groundwater levels is also recorded because of recorded rainfall, and groundwater levels appear to remain at rest levels for longer periods of time when compared to early periods of pre-test monitoring.

BH6 Pre-Testing Monitoring

Pre-test monitoring at BH6 was also progressed over the period 25th February 2026 – 17th March 2026 and provides details regarding the typical use of the borehole. The client has indicated that this borehole is used limitedly as a top-up supply when required to support abstraction at BH2 and BH3. This can be seen in the pre-test monitoring data (Figure 2-3) where intermittent groundwater abstraction has occurred over a 6-hour period on 12/03/2026.

Steady state groundwater levels at BH6 range 9.25mBGL (17/03/2026) – 9.55mBGL (11/03/2026).

Figure 2-3 Pre-Test Groundwater Level Monitoring



2.5 Constant Rate Testing

Following a period of background groundwater level monitoring constant rate tests were progressed at boreholes BH2, BH3 and BH6 individually, as well as a final constant rate test with all boreholes (BH2, BH3 & BH6) pumped simultaneously. Constant rate testing was progressed over the periods as follows:

- BH2 Constant Rate Test – 19th March to 21st March;
- BH3 Constant Rate Test – 23rd March to 25th March;
- BH6 Constant Rate Test – 2nd April to 4th April
- Combined Constant Rate Test – 7th April to 9th April

All constant rate tests were progressed for a period of 48-hours with manual dips recorded initially, with further data being recorded at 1-minute intervals by electronic pressure transducers installed within the borehole dip tubes. Note that due to operational challenges, it was not possible to pump BH2 for a period longer than 28-hours. NRW has been notified of this and are satisfied with the data collected at BH2.

Summarised in Table 2-2 is the meter readings and average flow rates for each of the boreholes during the individual constant rate tests.

Table 2-2 Meter Readings and Flow Rates

Borehole	Meter Reading at Test Start (m^3)	Meter Reading at Test End (m^3)	Average Flow Rate (m^3/hour)
BH2	331.305	379.24	1.5 (~31 hours of total pumping)
BH3	584.252	719.724	2.82
BH6	14.222	N/A (Faulty meter reading)	2.5 (spot checks during test)

BH2

The constant rate test at BH2 was progressed at a flow rate of 1.5m^3/hour. The constant rate test at BH2 was only able to be progressed for a maximum of 27 hours as the borehole

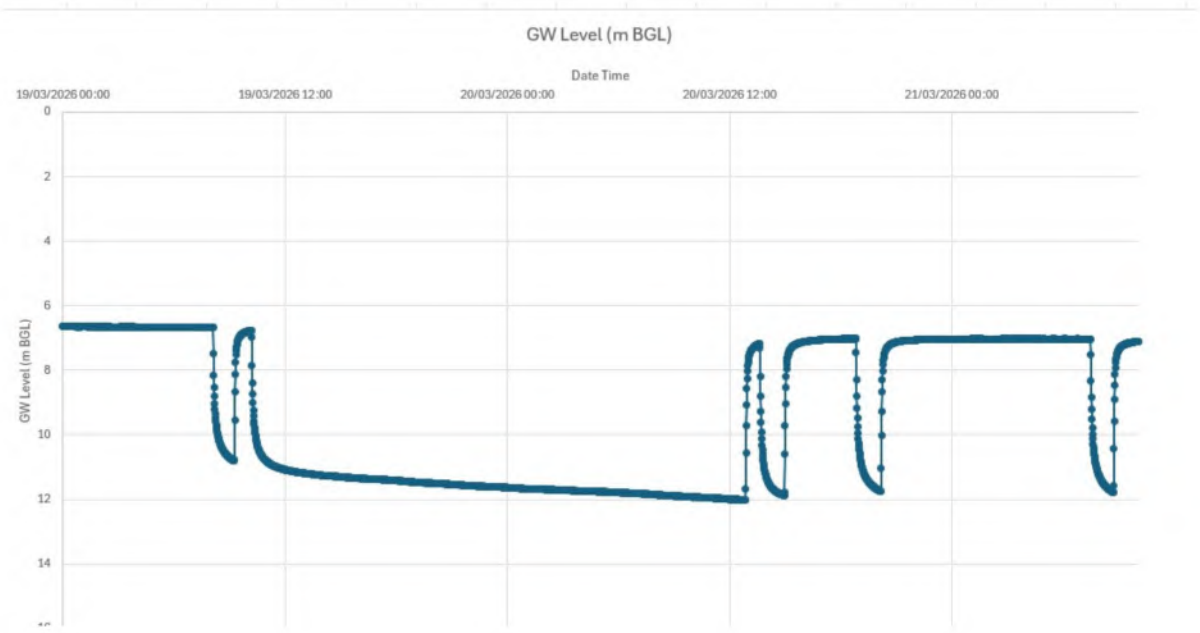
pump is controlled by the float switch on a sub-surface tank. This was discussed and agreed as acceptable with NRW (Correspondence included as Appendix B), with the level logger remaining in the borehole to capture subsequent incidents of groundwater pumping across the required 48-hours of testing.

As shown in Figure 2-4, the initial rest groundwater level was recorded at 6.77mBGL. The groundwater level is then shown to be drawn down initially rapidly representing initial well storage volume losses, and then subsequent steady drawdown of the groundwater level, reaching a near steady-state at approximately 11.9mBGL, indicating a total drawdown of 5.13m over the 27-hour period.

The groundwater level then rapidly recovers toward prior levels in 46minutes before the float switch is reactivated. Monitoring of the borehole over a 48-hour period, including 27-hours of constant rate pumping and 3no. intermittent pumping intervals (consisting of 80mins, 80mins and 74mins respectively) does not appear to result in any excessive drawdown of the groundwater level at BH2.

As the borehole pump is controlled by the tank float switch, groundwater abstraction is never operated over a significant continuous period. The operational groundwater pumping regime consistently allows for periods of groundwater level recovery, which is a preferred method of groundwater abstraction, as opposed to longer, continuous periods of pumping.

Figure 2-4 BH2 Constant Rate Test Groundwater Levels

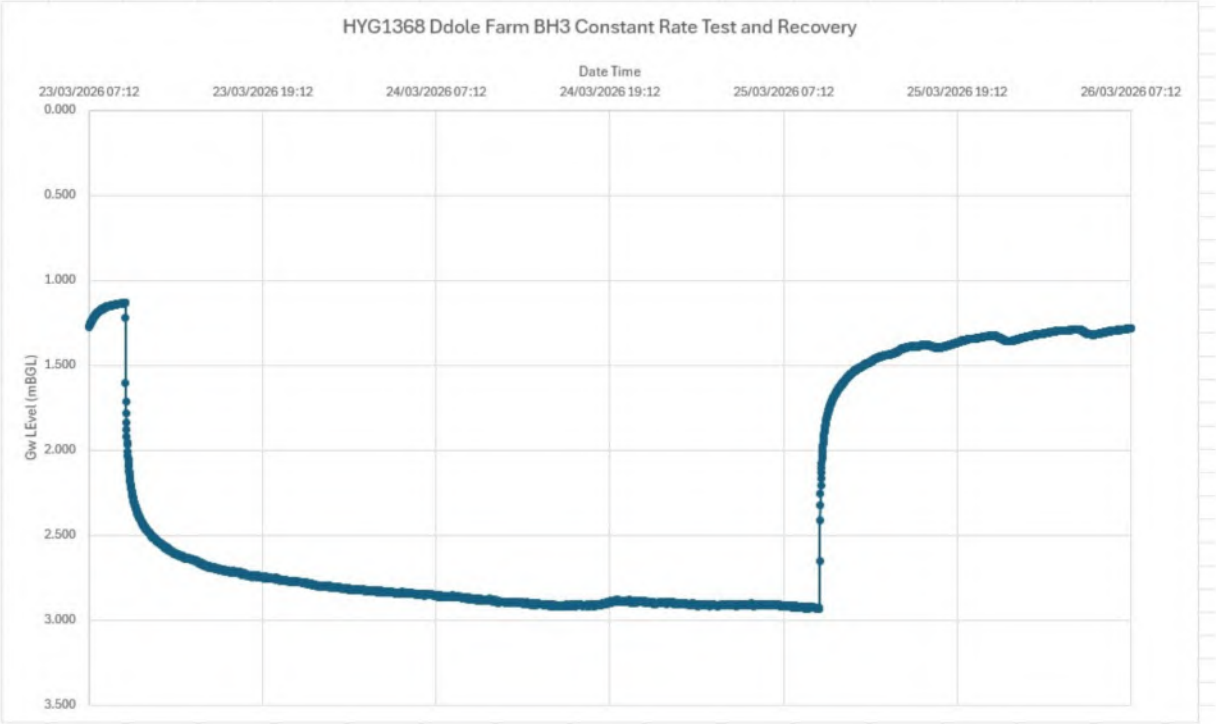


BH3

The constant rate test at BH3 was progressed over the period 23rd – 25th March 2026 and conducted at a maximum flow rate of 2.82m^3/hour. The groundwater levels monitored during the constant rate test at BH3 are shown in Figure 2-5.

Prior to commencement of the test, groundwater levels within BH3 were recorded at 1.13mBGL, and over the course of the 48-hours constant rate test were drawn down to a level of 2.93mBGL, resulting in a total draw down of 1.8m. Following cessation of pumping, groundwater rapidly recovered toward pre-test levels and reached 1.28mBGL on 26th March at 07:12, indicative of 88% recovery.

Figure 2-5 BH3 Constant Rate Test Groundwater Levels



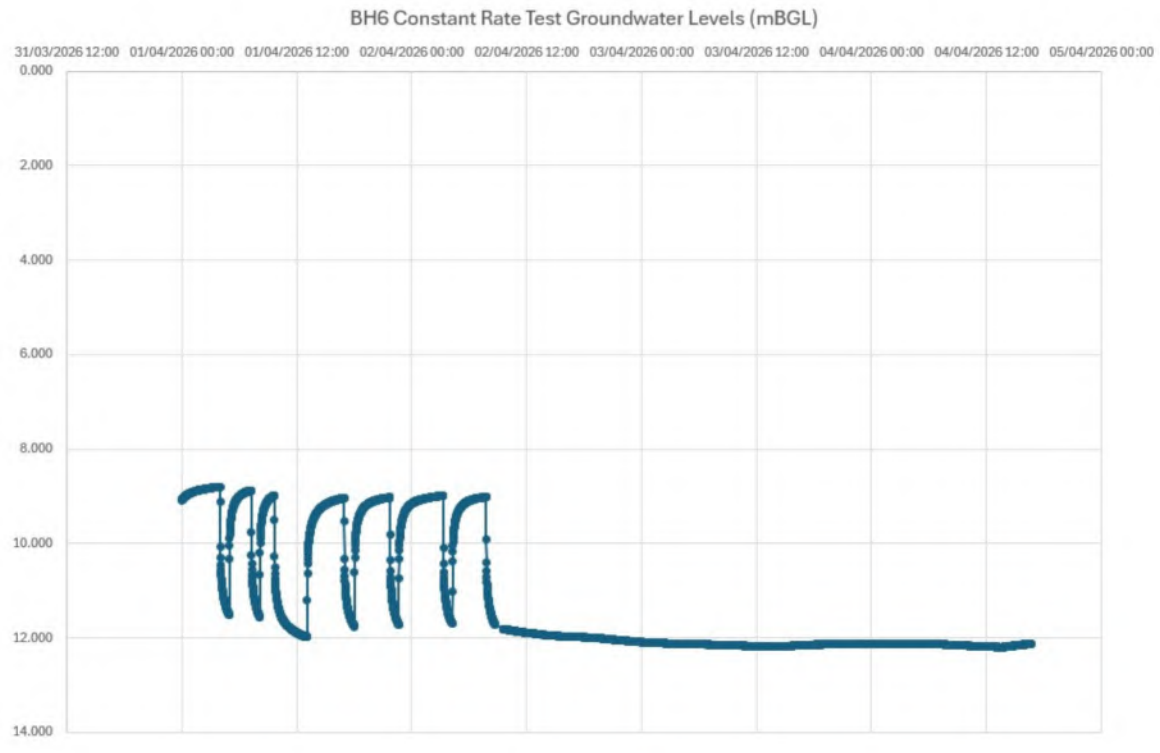
BH6

The Constant rate test at BH6 was progressed over the period 02/04/2026 – 04/04/2026 at a maximum rate of 2.5m^3/hour. The groundwater levels monitored during the constant rate test at BH6 are presented in Figure 2-6.

During the constant rate test the groundwater level was drawn down from an initial level of 9.02mBGL to a maximum reduced level of 12.19mBGL, resulting in a total drawdown of 3.17m over the course of the test. Initial drawdown was rapid which is likely indicative of existing well storage losses (groundwater volume within the monitoring standpipe and surrounding gravel filter pack). As the test continued, drawdown steadied reaching an equilibrium within the 48-hour test.

It is noted that groundwater levels did not fully recover following testing as the borehole was immediately required for on-site operations following approximately 4 hours of recovery.

Figure 2-6 BH6 Constant Rate Test



2.6 Combined Constant Rate Test

As part of the Groundwater Investigation Consent (GIC), constant rate testing of all boreholes (BH2, BH3 and BH6) simultaneously was required. The combined constant rate test was progressed beginning 7th April 2026, at an approximate combined flow rate totalling 6.5m^3/hour (156m^3/day) consisting of 1.2m^3/hour at BH2, 2.8m^3/hour at BH3 and 2.5m^3/hour at BH6. As per the GIC the combined test was progressed for 48-hours, with the test ending 9th April 2026.

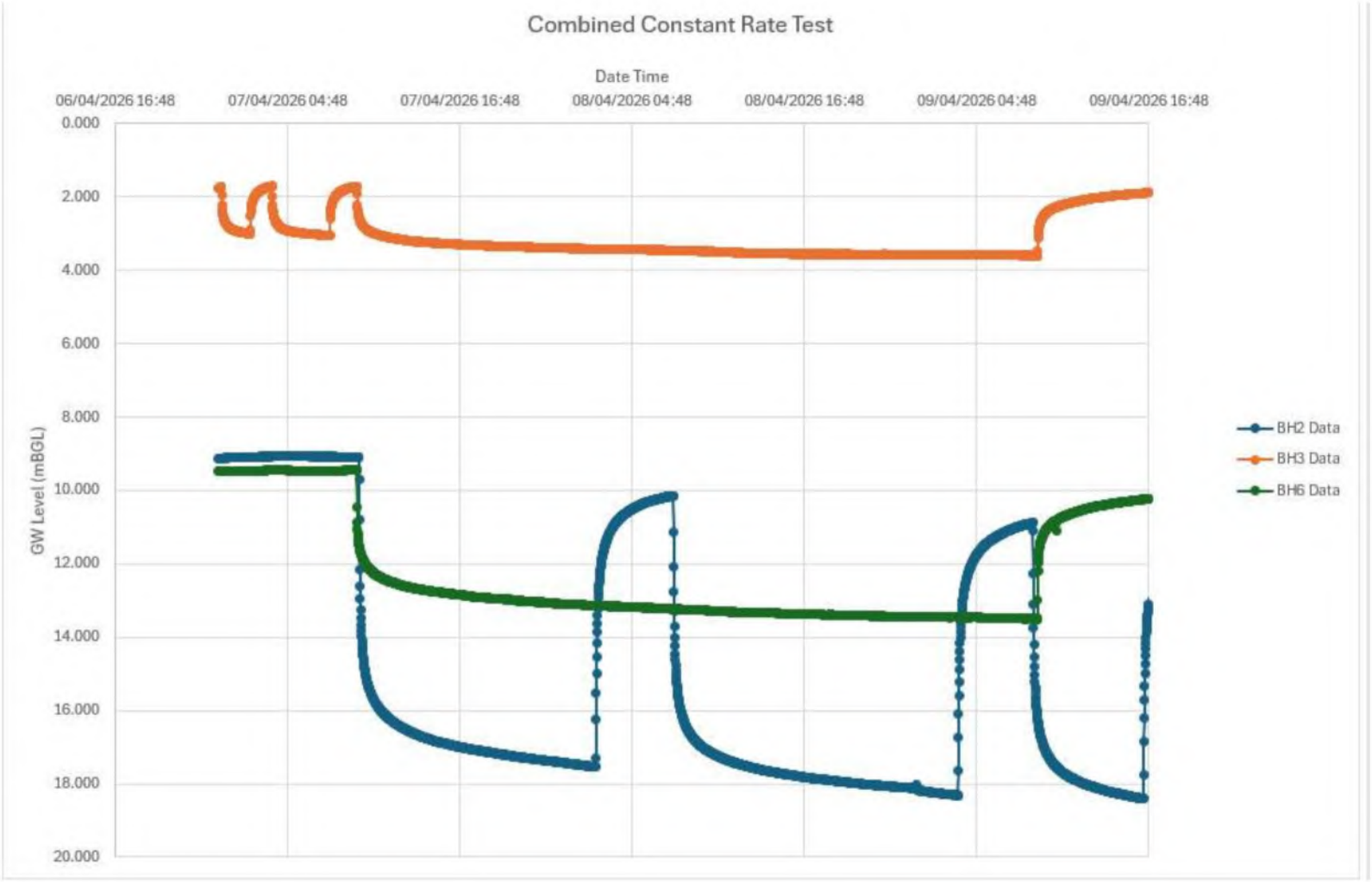
It is noted that the progression of constant rate testing for a period of 48-hours at BH2 was not possible, as the submerged borehole pump is controlled by a float switch within a sub-surface tank. It was discussed and agreed with Natural Resources Wales (NRW) that the borehole would be pumped until the float switch was activated, and a level logger to remain in the borehole to capture groundwater levels as the borehole pump was switch on and off with varying water levels in the tank for the remainder of the testing period. Hydrogeo correspondence with NRW regarding BH2 is included as Appendix B.

Groundwater levels monitored at boreholes BH2, BH3 and BH6 are presented in Figure 2-7.

Groundwater Levels in BH2 were drawn down from an initial resting level of 9.10mBGL, to a maximum reduced level of 18.40mBGL, indicating a maximum drawdown of 9.30m. Groundwater levels at BH3 were reduced from an initial resting level of 1.71mBGL, to a maximum drawn down level of 3.59mBGL, indicating a total drawdown of 1.88m. BH6 was drawn down from a pre-testing level of 9.44mBGL to a maximum of 13.5mBGL indicating a total draw down of the groundwater level of 4.06m.

During the combined constant rate testing, no excessive drawdown indicative of well interference as a result of drawdown superposition has been observed within the level logger data, or manual dip measurements progressed across the test.

Figure 2-7 Combined Constant Rate Test Groundwater Levels



2.7 Recovery Period

Following the cessation of constant rate pumping at all boreholes, the groundwater levels were allowed to recover back toward the initial baseline levels recorded prior to test commencement. Full recovery was not always possible due to elevated baseline groundwater levels prior to commencement of testing due to volumes of rainfall received, and the required usage of boreholes for on-going site operation. However, at least 88% recovery had occurred prior progression of subsequent tests and ultimate removal of groundwater level loggers.

Groundwater level recoveries are presented in Figure 2-4 - Figure 2-6 which show the groundwater recovery following completion of the constant rate testing. Details of groundwater level recovery following the individual borehole constant rate tests are detailed in the following sections.

BH2

Following completion of all testing (individual constant rate test & combined constant rate test) the groundwater level was allowed to recover toward pre-testing levels. The below bullet points detail the recovery of the groundwater level at BH2 following completion of testing.

- **Constant Rate Test** – Recovery from 12.01mBGL to 7.18mBGL in 46 minutes;
- **Combined Constant Rate Test** – Recovery from 18.4mBGL to 11.46mBGL in 2 hours 57minutes.

BH3

Upon completion of all testing (individual constant rate test & combined constant rate test) the groundwater level was allowed to recover toward pre-testing levels. The below bullet points detail the recovery of the groundwater level at the new borehole following completion of testing.

- **Constant Rate Test –** recovery from 2.93mBGL to 1.29mBGL in 18 hours 16 minutes.
- **Combined Constant Rate Test –** Recovery 3.59mBGL to 1.88mBGL in 7 hours 50minutes.

BH6

Upon completion of testing at BH6 during the individual pump test groundwater level recovery was recorded for 3 hours and 5 minutes. Following this the borehole was required for on-site use to provide the broiler sheds with water, and therefore full recovery was not possible. Full recovery was recorded at BH6 following completion of the combined constant rate testing. Details of the recoveries are as follows:

- **Constant Rate Test –** Recovery from 12.19mBGL to 12.12mBGL in 3 hours 5 minutes (Note, borehole was required for site operation near immediately after testing);
- **Combined Constant Rate Test –** Recovery from 13.5mBGL to 10.23mBGL in 7 hours 56 minutes.

2.8 Test Summary

A summary of the monitoring and test pumping procedures is shown in Table 2-3.

Table 2-3 Test Summary

Date	Time	Comment
25/02/2026	11:00	Electronic pressure transducers installed into all boreholes and the Camddwr River.
19/03/2026	10:13	**BH2** constant rate test start.
21/03/2026	10:13	**BH2** constant rate test end.
23/03/2026	09:26	**BH3** constant rate test start.
25/03/2026	09:30	**BH3** constant rate test end.
02/04/2026	10:08	**BH6** constant rate test start.
04/04/2026	13:35	**BH6** constant rate test end.
07/04/2026	09:26	**BH2, BH3 & BH3 Combined** constant rate test start
09/04/2026	09:03	**BH2, BH3 & BH3 Combined** constant rate test End.
10/04/2026	09:00	Level loggers retrieved.

The constant rate tests were progressed at Boreholes BH2 (1.2m^3/hour) BH3 (2.5m^3/hour) and BH6 (2.8m^3/hour) individually. Individual constant rate testing resulted in maximum drawdowns of 5.13m, 1.80m and 3.17m respectively.

Following completion of individual constant rate testing, the boreholes (BH2, BH3 & BH6) were then tested in combination for 48-hours, resulting in maximum observed drawdowns of 9.3m, 1.88m and 4.06m respectively.

Comparison of the drawdowns between the individual and combined constant rate pumping tests at the boreholes indicate maximum drawdown differences of +4.17m (BH2), +0.08m (BH3) and +0.89m (BH6) during the combined constant rate tests.

Although 4.17m of drawdown difference has been recorded at BH2 when comparing combined constant rate test against the individual constant rate test, the rest groundwater level in the leadup to the combined constant rate test was 2.6m lower when compared to the rest water level prior to the individual constant rate test. The additional drawdown was therefore only 1.57m.

It is already understood that there is greater drawdown at BH2 when groundwater levels are lower due to the fractured / fissured nature of the bedrock aquifer.

The drawdown differences at BH2, BH3, and BH6 between the individual and combined constant rate tests are not considered disernible.Following completion of combined testing groundwater levels recovered toward rest levels in 7 hours 50minutes, 2 hours 57minutes and 7 hours 56 minutes respectively.

3 Monitoring Points Data

3.1 Introduction

As detailed in Section 2.1 of this report, the Groundwater Investigation Consent (GIC) required the monitoring of the Camddwr River and the abstraction boreholes, BH2, BH3 and BH6. All positions were monitored over the period 25th February 2026 – 10th April 2026 via electronic pressure transducer.

Figure 3-7 includes graphed compensated level logger data collected at the Camddwr river and should be viewed in conjunction with this report section.

Where possible, groundwater abstraction wells have also been utilised as monitoring wells whist the other boreholes were undergoing constant rate testing. Throughout the period, monitoring wells may have been required for abstraction to allow for on-going site operation. Significant time-series data has been collected from all monitoring boreholes during the period of testing. Figure 3-1 - Figure 3-6 present the groundwater levels within the boreholes during these monitoring periods.

3.2 Monitoring of BH2

Borehole 2 was monitored during the constant rate pump testing at both Boreholes 3 and 6, over the periods 23/03/2026 – 25/03/2026 (BH3) and 02/04/2026 – 04/04/2026 (BH6). Groundwater levels observed within Borehole 2 across this period are shown in Figure 3-1 & Figure 3-2.

Observed groundwater levels at BH2 during the constant rate testing of BH3 does not appear to show any notable interactions or reduction in groundwater levels associated with the testing of these boreholes. There is a noted downward trend of BH2 groundwater levels during the testing of BH6, however, this is considered to be more likely representative of falling background groundwater levels due low recorded rainfall (0.4mm) over the testing period as opposed to drawdown impacts as a result of BH6 testing.

Figure 3-1 BH2 Groundwater Levels During BH3 Constant Rate Test

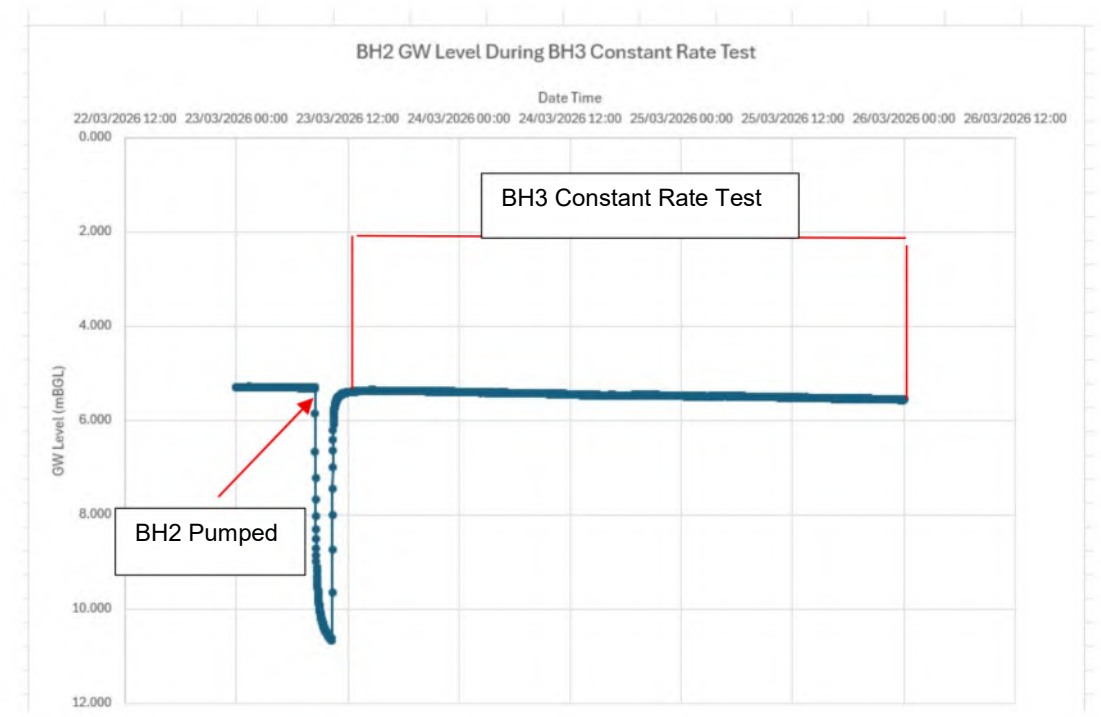
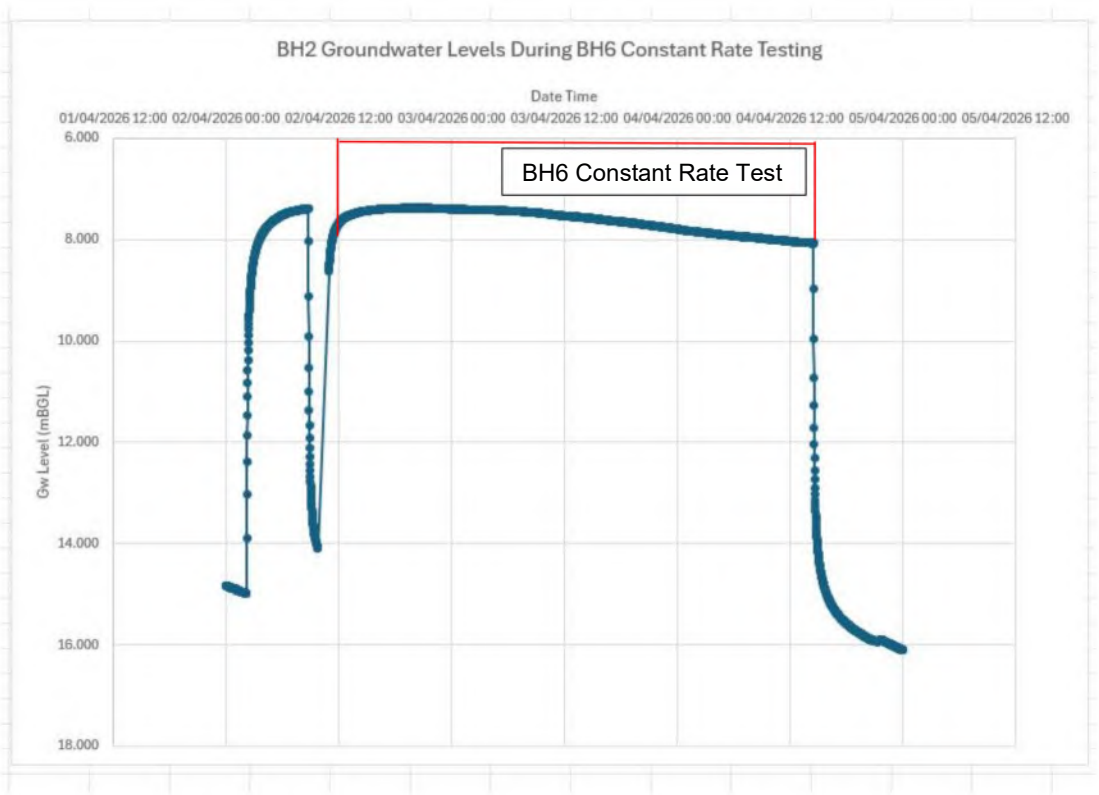


Figure 3-2 BH2 Groundwater Levels During BH6 Constant Rate Test



3.3 Monitoring of BH3

Borehole 3 was monitored during the constant rate pumping tests at both boreholes 2 and 6, over the periods 19/03/2026 – 21/03/2026 (BH2) and 02/04/2026 – 04/04/2026 (BH6). The groundwater levels observed during monitoring of BH3 are shown in in Figure 3-3 & Figure 3-4.

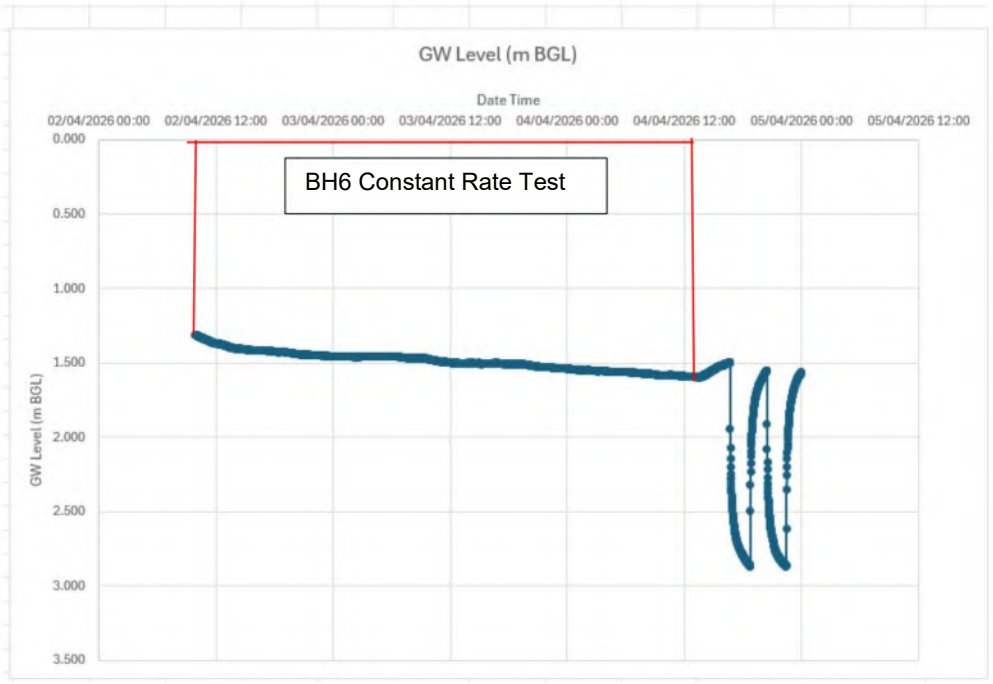
Monitoring of BH3 during the constant rate testing of BH2 does not indicate any notable reduction in groundwater levels that could be indicative of connectivity between BH2 and BH3.

Monitoring of BH3 groundwater levels do appear to indicate slightly reducing and slightly recovering groundwater levels in line with constant rate testing timings at BH6 (Pump on & Pump off) as shown in Figure 3-4. This indicates the potential for some degree of connectivity of aquifers between the borehole positions BH3 and BH6.

No discernible drawdown has been noted because of this potential connectivity between BH2 and BH6.

Figure 3-3 BH3 Groundwater Levels During BH2 Constant Rate Test

Figure 3-4 BH3 Groundwater Levels During BH6 Constant Rate Testing



3.4 Monitoring of BH6

Borehole 6 was monitored during the pumping tests of boreholes BH2 and BH3 over the periods 19/03/2026 – 21/03/2026 (BH2) and 23/03/2026 – 25/03/2026 (BH3). Groundwater levels recorded during the period are shown in Figure 3-5 & Figure 3-6.

BH6 was required for on-site water supply during the testing of BH2, and therefore intermittent groundwater abstraction periods are observed. It is noted that following pumping cessation at BH6, groundwater levels recovery fully, and do not appear to indicate any reduced groundwater levels because of the constant rate test at BH2.

Again, minor groundwater level drawdown and recovery is observed at BH6 during testing of BH3. The draw down and recovery aligns relatively well with pump-testing timings at BH3 (Pump on & Pump off) as indicated in Figure 3-6. Although some connectivity is observed, no discernible drawdown of groundwater levels is noted as a result of this connectivity.

Figure 3-5 BH6 Groundwater Levels During BH2 Constant Rate Testing

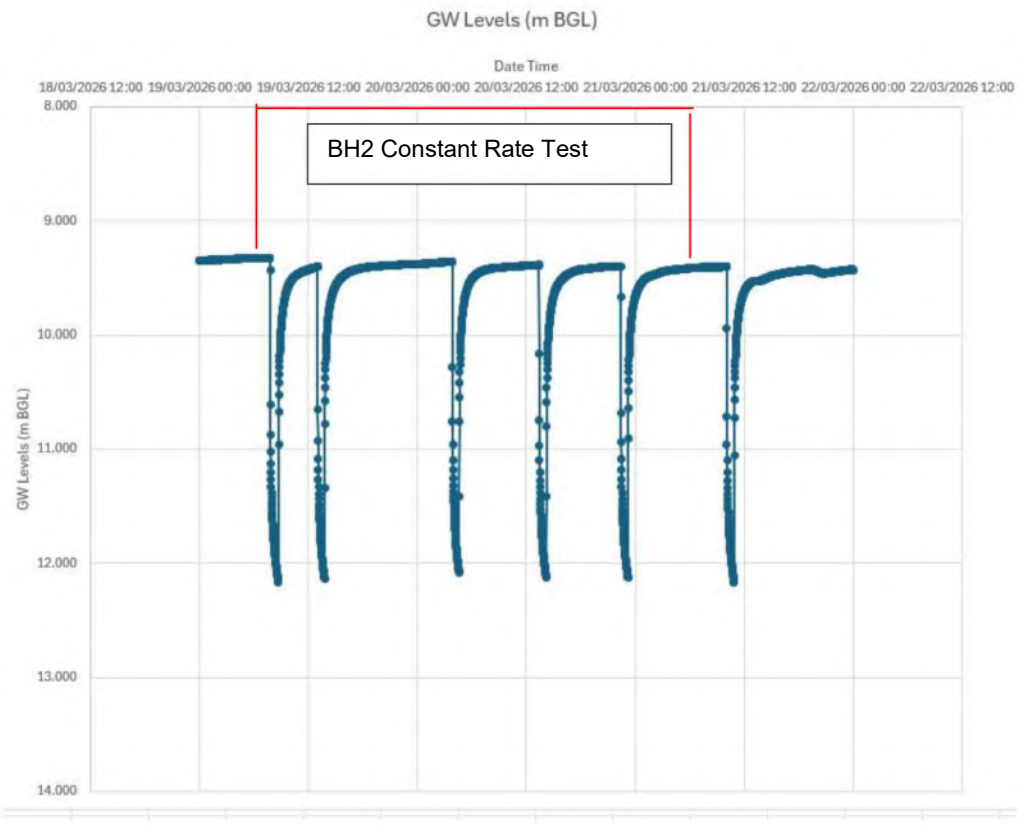
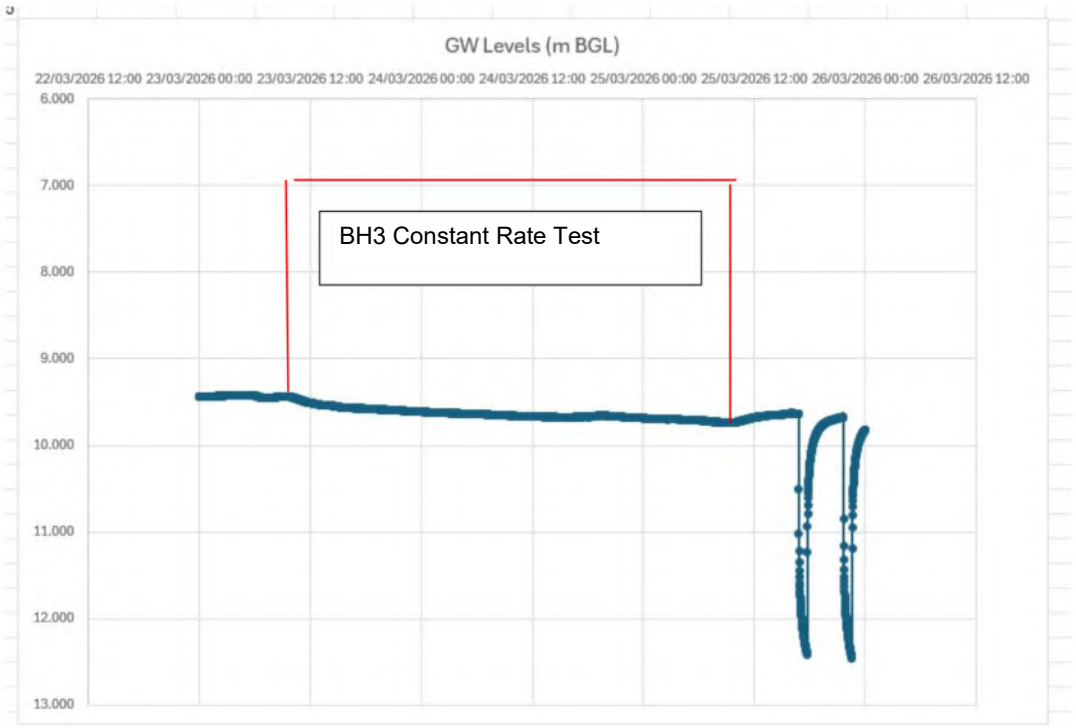


Figure 3-6 BH6 Groundwater Levels During BH3 Constant Rate Testing



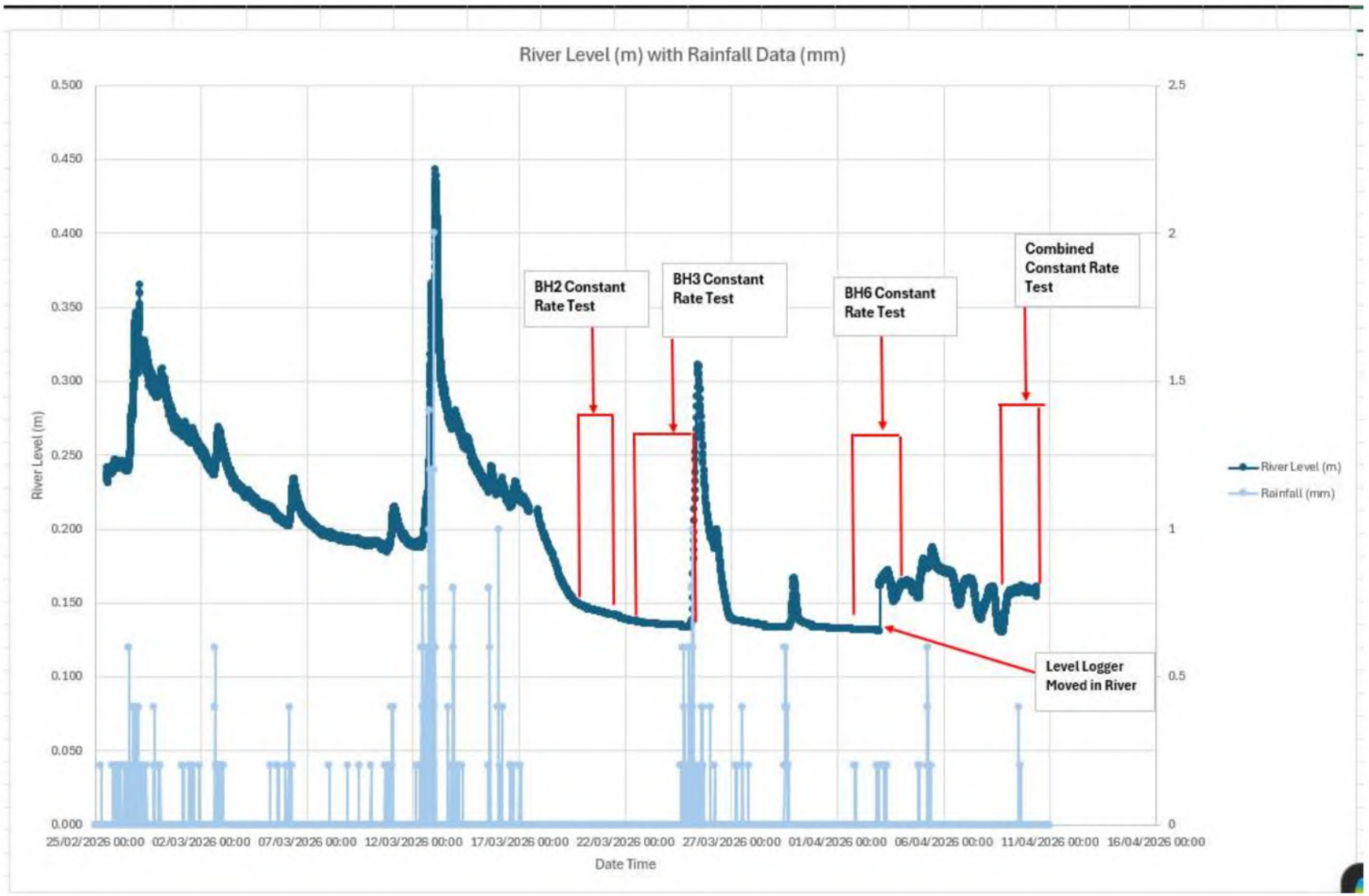
3.5 Camddwr River

The Camddwr River was monitored via level logger across the period 25th February 2026 – 10th April 2026. This period includes all on-site constant rate pump testing. All river levels recorded across the monitoring period are shown in Figure 3-7.

River levels in the Camddwr during the background monitoring period prior to testing (25th February 2026 – 18th March 2026) indicate that the river showed falling water levels from a maximum level of 0.365m 27th February to a minimum level of 0.185m 10th March.

As shown in Figure 3-7, no notable response in the Camddwr River level is noted during the highlighted periods of groundwater abstraction, with no observable reductions in groundwater level related to borehole testing.

Figure 3-7 Camddwr River Level (m)



4 Pumping Test Analysis

4.1 AquiferWin32 Analysis – Constant Rate Test

AquiferWin 32 has been used to calculate the transmissivity and storage coefficient from the constant rate pumping tests at BH2, BH3, and BH6. All constant rate pumping phases have been analysed using the Cooper and Jacob Straight Line Method and the Hantush confined Partial Penetration Methods.

The Hantush Confined Partial Penetration Method has been used based on the recorded geology within BH2, and the low storage coefficient determined within the Cooper and Jacob Straight Line analysis. It is noted that although the underlying aquifer is likely confined at depth with water stored within fissured / fractured zones within the wenlock bedrock, there are likely shallower portions of the aquifer which may remain unconfined.

Transmissivity values determined vary depending on the analysis methodology and weighting of the data used within the analysis. Where the **whole data range** of the constant rate test has been optimised, transmissivity values range:

- **BH2 –** 5.94m^2/day - 6.99m^2/day
- **BH3 –** 38.88m^2/day – 148.32m^2/day
- **BH6 -**42.1m^2/d – 84m^2/day

Generally, early drawdown data is considered more representative of the aquifer properties, as opposed to the whole or late dataset ranges. **Early Data** transmissivity values have been calculated as follows:

- **BH2 –** 2.26m^2/day – 7.77m^2/day
- **BH3 –** 25.18m^2/day – 90.82m^2/day
- **BH6 -**12.9m^2/day – 51.1m^2/day

A comparison between the combined constant rate test transmissivities and literature-based values is provided in Table 4-1.

The Physical Properties of Minor Aquifers in England and Wales literature summarises aquifer properties results for pre-Devonian aquifers in England and Wales, with no data available for solely for the Wenlock Rocks. The grouped data indicates 8no. transmissivity records ranging 0.71m^2/day to 3902m^2/day, with the 25th Percentile transmissivity at

2.51m^2/day and the 75th Percentile transmissivity at 150m^2/day. Specific capacity values are indicated as 25th Percentile 4.8m^3/day/m and 75th Percentile as 105m^3/day/m.

The Aquiferwin32 analysis outputs are presented below.

4.2 BH2 Analysis

Figure 4-1 BH2 Analysis Cooper and Jacob - Whole Data Optimised

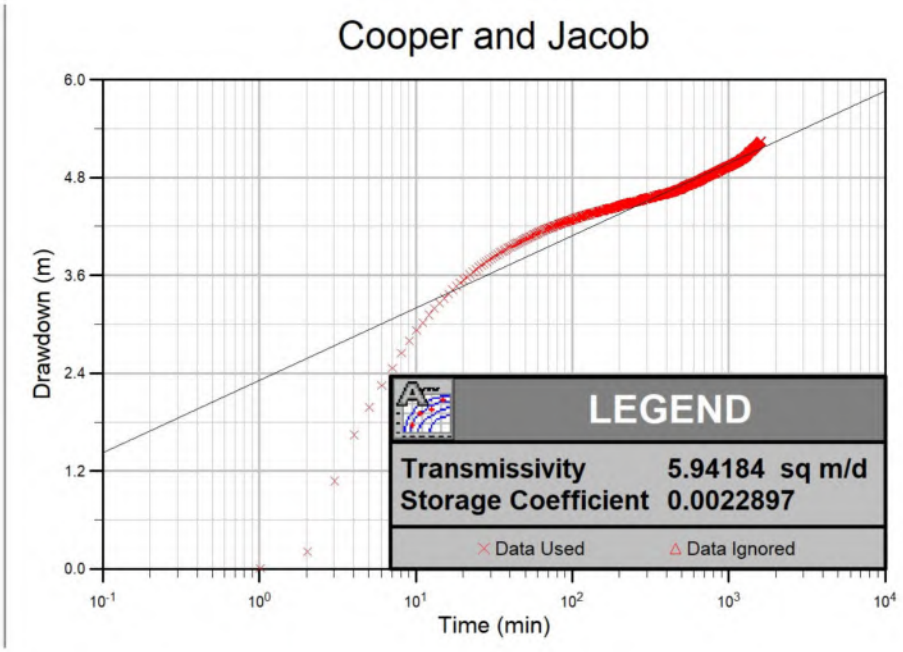


Figure 4-2 BH2 Analysis Cooper and Jacob - Early Data Optimised

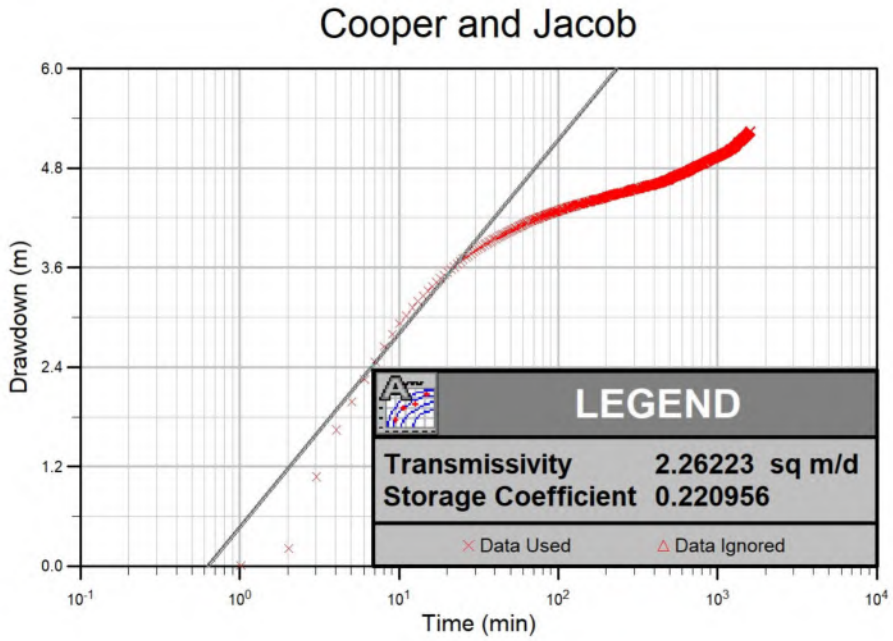


Figure 4-3 BH2 Analysis Hantush - Whole Data Optimised

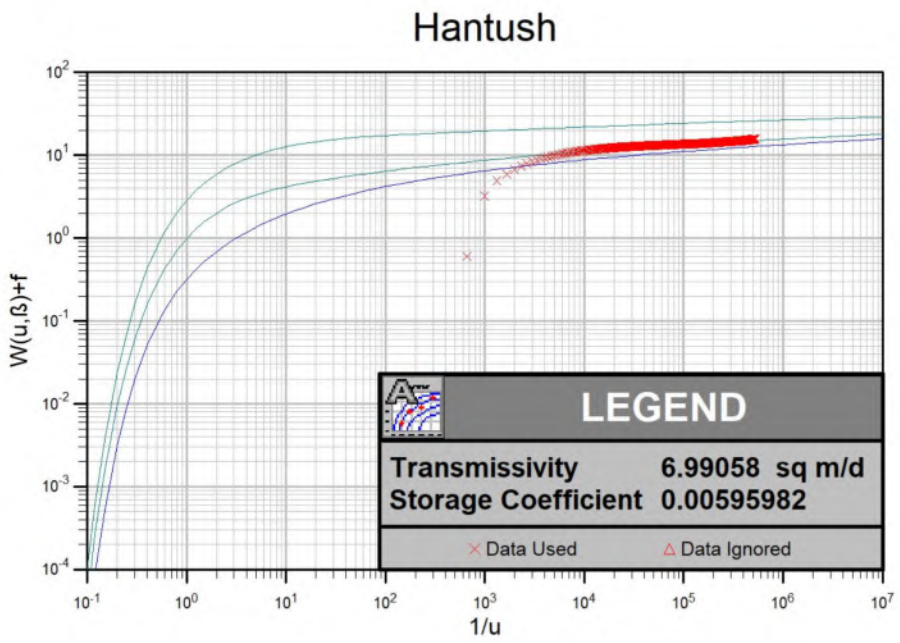
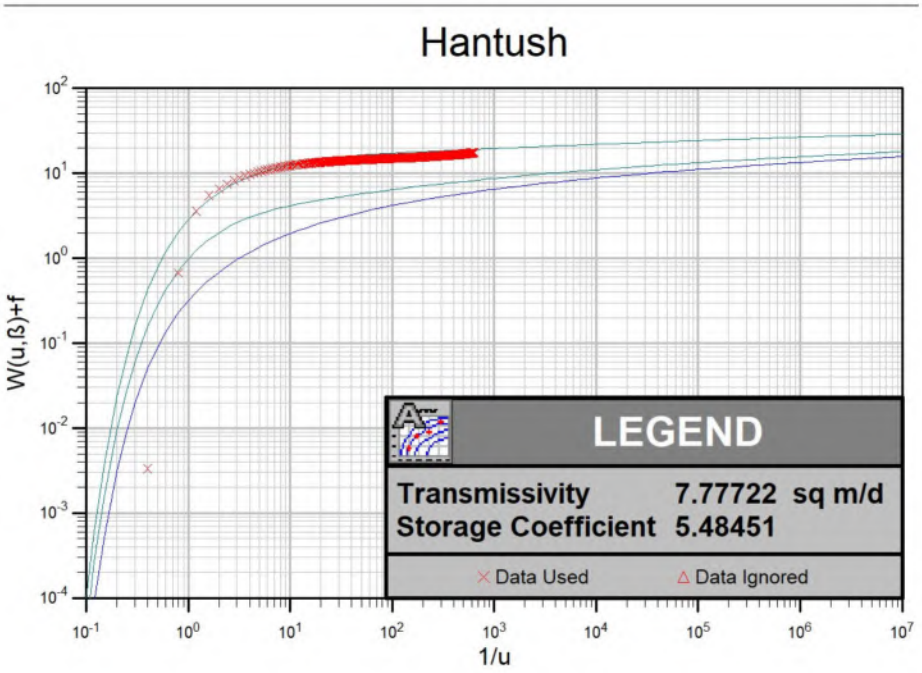


Figure 4-4 BH2 Analysis Hantush - Early Data Optimised



4.3 BH3 Analysis

Figure 4-5 BH3 Analysis - Cooper and Jacob – Whole Data Optimised

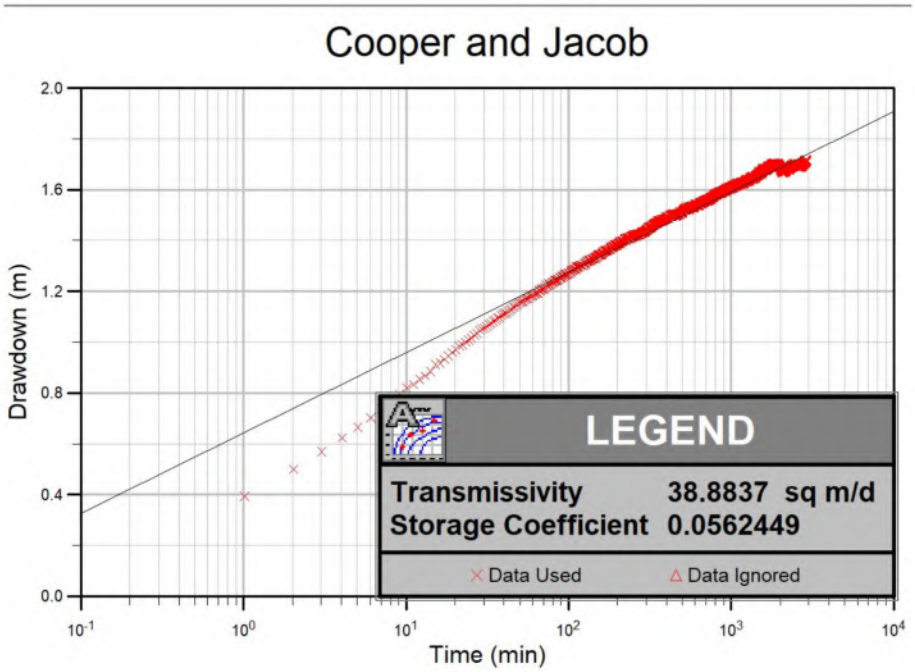


Figure 4-6 BH3 Analysis Cooper and Jacob - Early Data Optimised

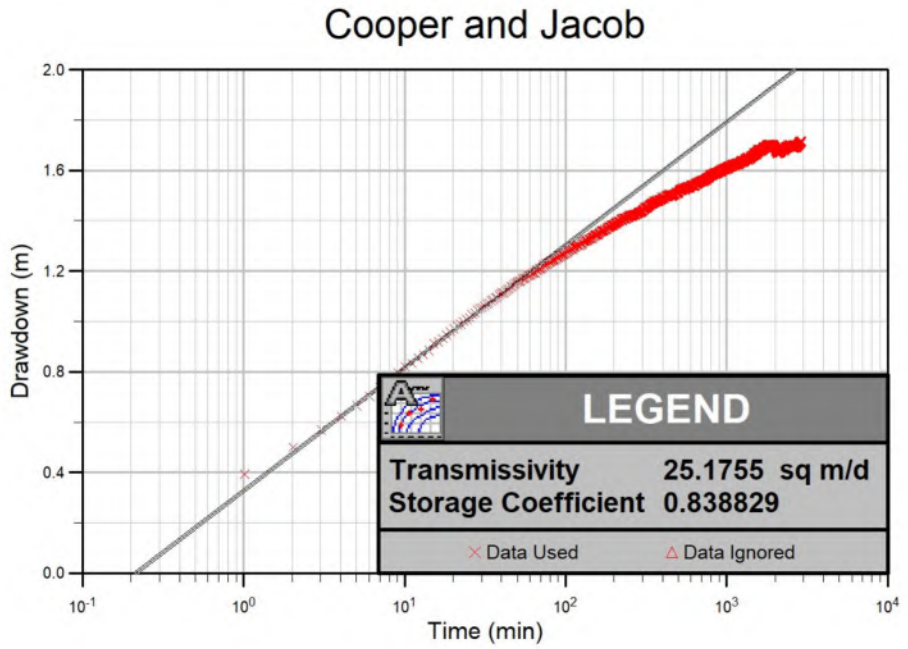


Figure 4-7 BH3 Analysis - Hantush - Whole Data Optimised

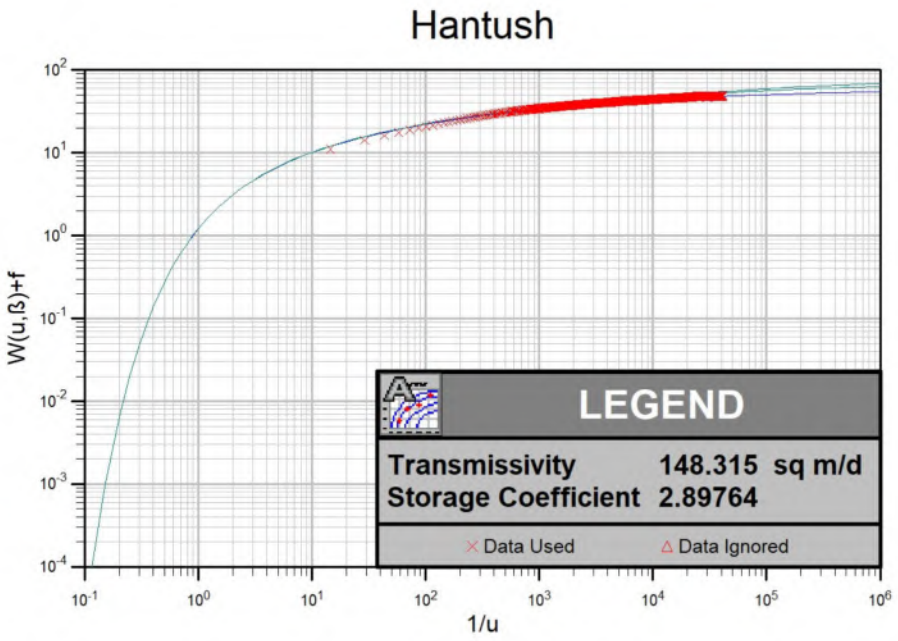
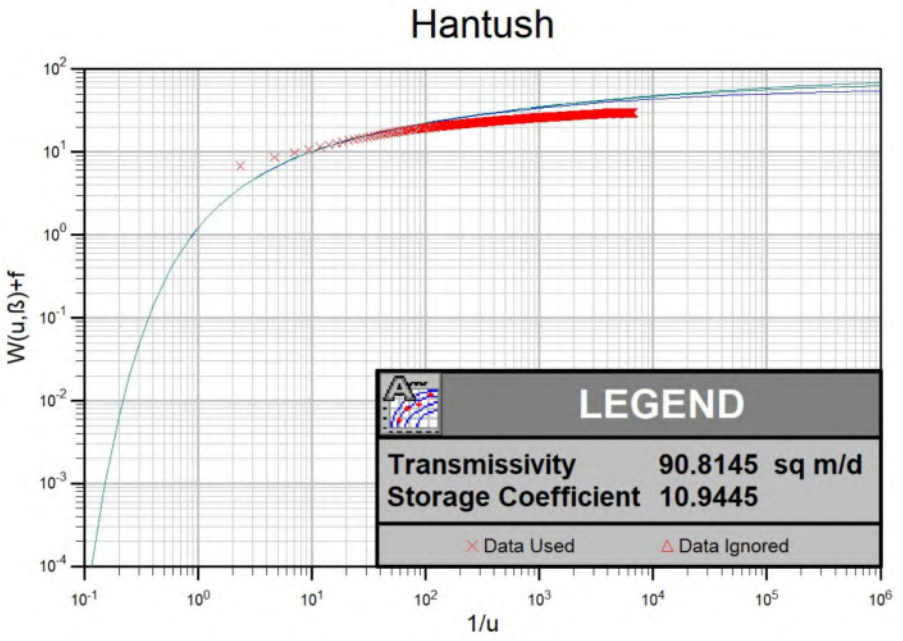


Figure 4-8 BH3 Analysis - Hantush - Early Data Optimised



4.4 BH6 Analysis

Figure 4-9 BH6 Analysis - Cooper and Jacob Whole Data

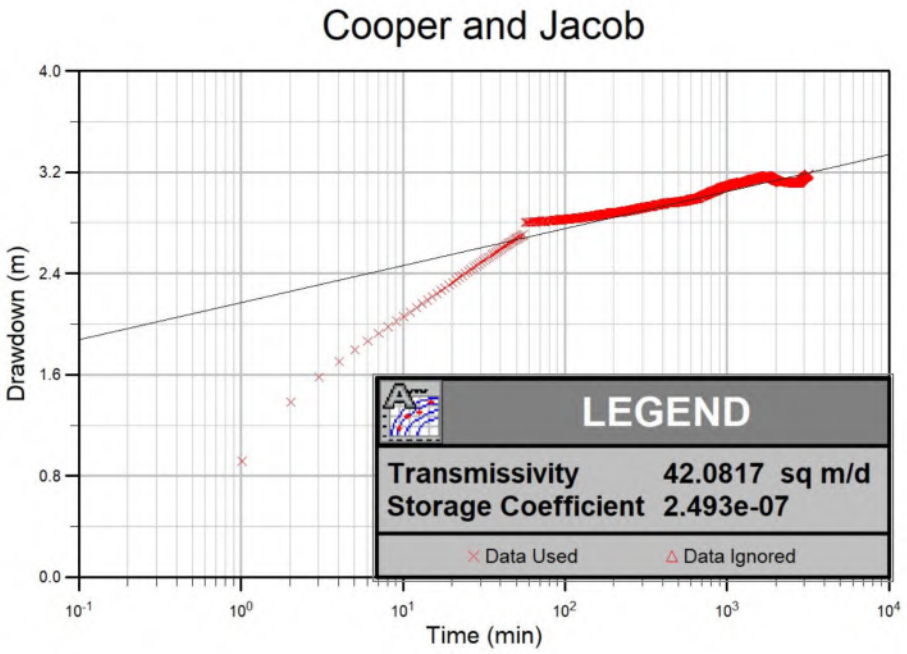
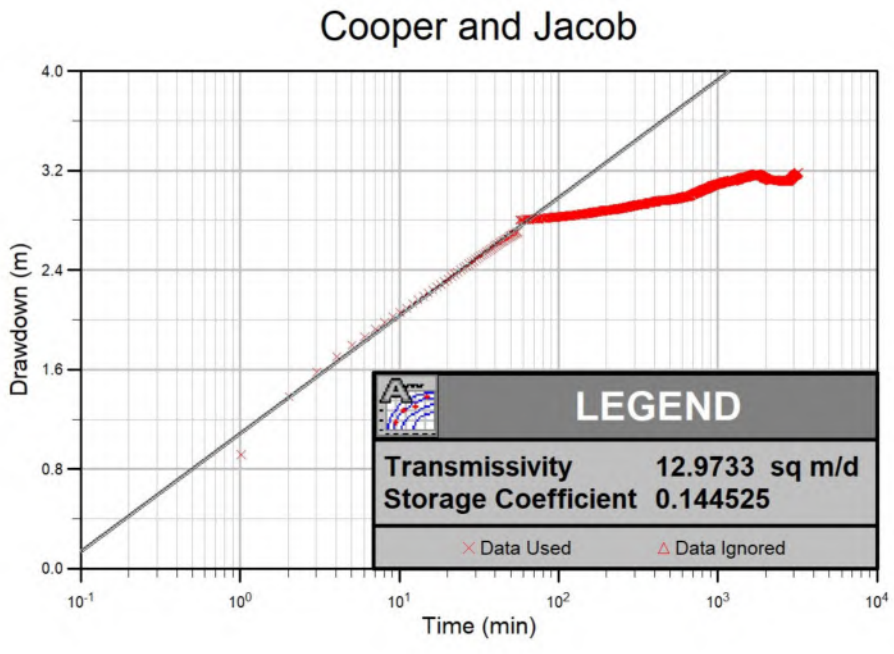
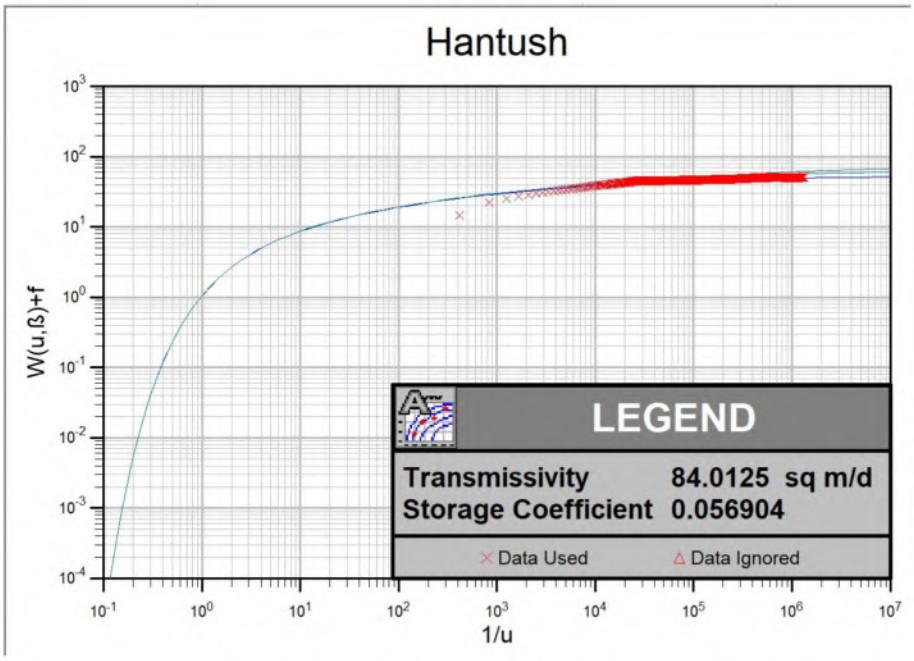
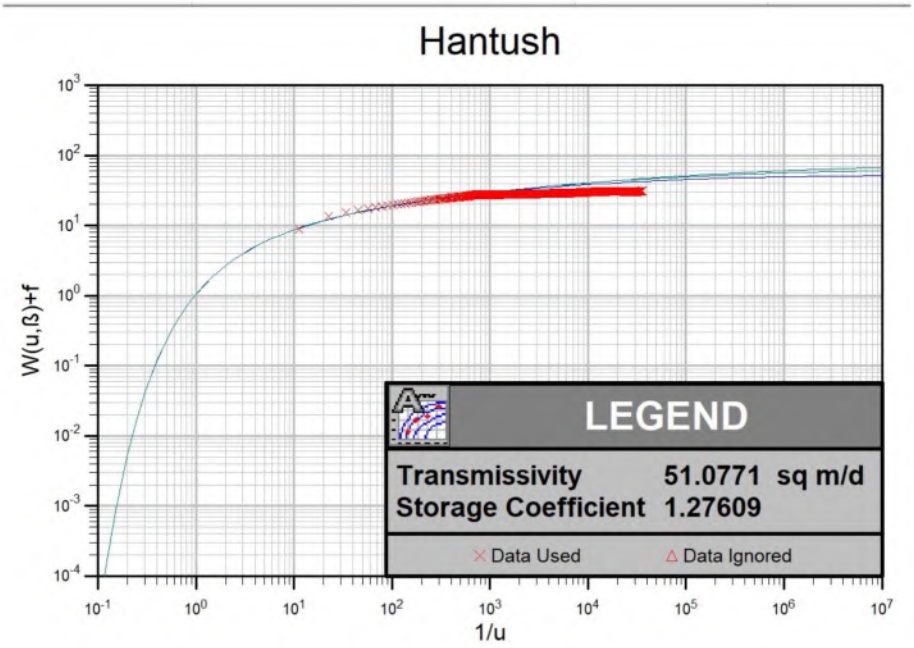


Figure 4-10 BH6 Analysis - Cooper and Jacob Early Data Optimised




Hantush
W(u,ß)+f
1/u
LEGEND
Transmissivity 84.0125 sq m/d
Storage Coefficient 0.056904
Data Used
Data Ignored


Hantush
W(u,ß)+f
1/u
LEGEND
Transmissivity 51.0771 sq m/d
Storage Coefficient 1.27609
Data Used
Data Ignored

4.5 Analysis Summary

The calculated aquifer transmissivities are presented in Table 4-1. Literature values from 'The Physical Properties of Major Aquifers in England and Wales' to allow comparison to published aquifer properties.

Table 4-1 Comparison of Aquifer Properties

Source	Value
Transmissivity	
Constant Rate Test (BH2) – Cooper Jacob Straight Line	2.26m^2/day
Constant Rate Test (BH2) – Hantusch Confined Partially Penetrating	7.77m^2/day
Constant Rate Test (BH3) - Cooper Jacob Straight Line	38.88m^2/day
Constant Rate Test (BH3) – Hantusch Confined Partially Penetrating	90.82m^2/day
Constant Rate Test (BH6) - Cooper Jacob Straight Line	12.9m^2/day
Constant Rate Test (BH6) – Hantusch Confined Partially Penetrating	51.1m^2/day
Literature Value - Range	0.71m^2/day to 3902m^2/day
Literature Value – 25th / 75th Percentile	2.51m^2/day / 150m^2/day
Specific Capacity	
BH2 – Specific Capacity (Constant Rate Test)	5.62m^3/day/m
BH3 – Specific Capacity (Constant Rate Test)	33.4m^3/day/m
BH6 – Specific Capacity (Constant Rate Test)	21.2m^3/day/m
Literature Value - Range	0.81m^3/d/m to 571m^3/d/m.
Literature Value – 25th / 75th Percentile	4.8m^3/day/m / 105m^3/d/m.

5 Hydrogeological Impact Appraisal

5.1 Introduction

This section of the report provides a Hydrogeological Impact Appraisal (HIA) following completion of pump testing of the abstraction boreholes, and monitoring of identified the Camddwr River, and in relation to the Wye Abstraction Licensing Strategy.

There is no separate groundwater licensing policy as such, and surface water availability may override local groundwater availability. The Abstraction License Strategy indicates that licenses will only be granted if it can be demonstrated that the abstractions (with appropriate restrictions) will have "*no adverse effect*" on the integrity of the River Wye SAC alone and in-combination with all other licensed abstractions.

The HIA assesses the following features in regard to potential impacts as a result of proposed abstraction at Ddole Farm.

- Impacts on the Camddwr River – River Wye SAC;
- Excessive groundwater drawdown within the underlying aquifer;

5.2 Impacts on the River Camddwr

The Camddwr River drains into the River Ithon approximately 3km south-west of the Site, which is a major tributary of the River Wye. The River Ithon reaches its confluence with the River Wye approximately 1.5km south of Newbridge-on-Wye, which is approximately 20km south-west of the Site. Both the Camdwwr River and the River Ithon form part of the River Wye Special Area of Conservation (SAC).

Monitoring of the Camddwr River over the period 25th February 2026 – 10th April 2026 has not shown any notable water level changes associated with test pumping at BH2, BH3, BH6 or boreholes in combination. The water level within the Camddwr River appears to be highly responsive to rainfall events and associated surface water runoff, as shown in Figure 3-7 with the river hydrograph indicating flashy water level responses to rainfall events, with short lag time between peak rainfall and peak river water levels. Lower water levels within the river also correspond well with periods of consecutive low / no rainfall.

Review of the encountered ground conditions and subsequent installation details for BH3 indicates that the borehole has encountered brown clay / gravels from 0.5m to 7m and river gravels from 12m – 14, and black shale from 14m to 50m. The borehole has been installed with slotted u.P.V.C standpipe between 8.7m – 14.7m, 26.7m – 32.7m and 38.7m

– 44.7m, indicating that the borehole is installed within the overlying superficial and underlying bedrock geology, with groundwater strikes at 2m, 12m and 35m. The borehole is therefore a multi-aquifer abstraction. Abstraction from BH3 is therefore considered to be the more sensitive borehole in relation to potential impacts on the River Camddwr.

Review of the BH3 groundwater levels against rainfall data across the whole monitoring period does indicate some correlation between fluctuating groundwater levels within the borehole and recorded rainfall levels.

The limited drawdowns during the combined constant rate testing at each of the borehole positions (9.3m, 1.88m and 4.06m respectively) suggest that no well interference or dewatering impact on river levels during the test period.

Based upon the pump testing and monitoring of the Camddwr River, on-site abstraction from boreholes BH2, BH3 and BH6 are considered to pose a Low Risk, with no discernible impacts noted on the Camdwwr River and associated River Wye Special Area of Conservation (DAC) as a result.

A Cooper-Jacob drawdown assessment has been progressed based on the aquifer parameters derived for BH3 using the Environment Agency (EA) Spreadsheet. This allows for the assessment of the potential drawdown impacts over time posed by the abstraction at BH3 on the Camddwr River. The spreadsheet is included as Appendix D.

Based on the aquifer parameters derived from the assessment, and the location of the River Camddwr in relation to BH3 (50m away), pumping of the borehole continuously for 24-hours would not result in drawdown at 50m. Drawdown at 50m occurs following continuous pumping of BH3 for 3-days. Operationally, BH3 is not pumped continuously for this period due to the float switch control on the storage tank, and therefore there is a low likelihood of drawdown impacts on the Camddwr River because of abstraction at BH3.

5.3 Excessive Drawdown Impacts on the Underlying Aquifer

The pump testing of BH2, BH3, and BH6 for a period of up to 48-hours during the combined constant rate test is considered a worst case abstraction scenario for the Site, where in reality the operation of the Site generally relies on intermittent abstractions from the boreholes, most notably from BH2 and BH3, with BH6 used as top up water during periods of high water demand.

All on-site boreholes feed water storage tanks that are controlled by float switches (BH2 feeds a sub-surface tank, with BH3 and BH6 feeding the same above ground storage

tank). This setup results in a long-term intermittent pumping pattern, where groundwater abstraction is followed by groundwater recovery once water levels within the on-site storage tanks reach the required level.

This longer-term pattern of groundwater abstraction is considered preferable when compared to continuous abstraction from the boreholes as excessive groundwater level drawdown is prevented, and risks associated with aquifer dewatering or reduction of groundwater levels beyond any high-flow zones are greatly reduced as periods of groundwater level recovery frequently occur.

Based on the depths of all boreholes, the approximate topographic levels, and the rest water levels recorded within the boreholes, it is noted that the resting groundwater level within BH2 (323mAOD) is significantly higher than those recorded within BH3 (~272mAOD) and BH6 (~269mAOD) indicating a maximum difference of 54m. This indicates that abstraction at BH2 is from a different aquifer / aquifer zone when compared to BH3 and BH6 which are likely to draw groundwater from both the underlying superficial and bedrock aquifers beneath the Site. This is further supported by the monitoring data where minor influences on the groundwater levels at BH3 and BH6 have been observed whilst constant rate testing of the other borehole (i.e. monitoring of BH3 during BH6 testing and vice-versa).

Observed groundwater levels from the individual borehole constant rate tested indicated maximum drawdowns of 5.13m, 1.80m and 3.17m at BH2, BH3, and BH6 respectively. Drawdowns observed during the combined constant rate testing (9.3m, 1.88m and 4.06m) remained comparable to those initially observed, with slight drawdown increases observed at all three boreholes. However, the additional drawdown is not considered representative of superposition of cones of depression resulting in additional drawdown and is more representative of lower groundwater levels as a result of reduced rainfall in the build up to and during the combined constant rate test.

Hydrogeo therefore consider that the abstraction operations on-site are unlikely to pose any discernible impacts to the underlying aquifer and present a Low Risk.

Table 5-1 Approximate Groundwater Levels (mAOD)

Borehole	Approximate Topographic Level (mAOD)	Rest Water Level (m)	Approximate Groundwater Level (mAOD)
BH2	327	4.12	323
BH3	273	1.12	272
BH6	278	9.25	269

NOTE: This is an approximate assessment of groundwater levels within the boreholes based on available data. Borehole installation details are unknown for BH2 and BH6 and therefore, slotted section depths are unknown.

6 Existing Water Uses

6.1 Introduction

The groundwater abstraction configuration at Ddole Farm consists of 3no. boreholes (BH2, BH3 & BH6) with electric submersible pumps. BH2 is located at Vronganllwyd (Approximately SO13727 72641), east of Ddole Farm. It is understood that BH2 feeds a sub-surface storage tank with pumping controlled via a float switch. The water from the tank is utilised by farming operations on-site (cattle drinking and washdown) as well as a small domestic supply. The water is also piped from Vronganllwyd to the broiler sheds at Ddole Farm to act as a supporting water supply.

BH3 is located at Ddole Farm (approximately SO12719 72226) and feeds an above ground water storage tank held within a shed at SO12774 72304. This borehole is also controlled via a float switch on the above-ground storage tank and acts as the main supply of water for the broiler shed operations at Ddole Farm.

BH6 is also located at Ddole Farm (approximately SO12769 72320) and feeds the same above-ground storage tank as BH3. This borehole is controlled via a float switch on the tank and is used much less frequently than borehole BH3. This borehole acts as a support supply to BH3 when water demand at the Site is at its peak.

6.2 Existing Water Use

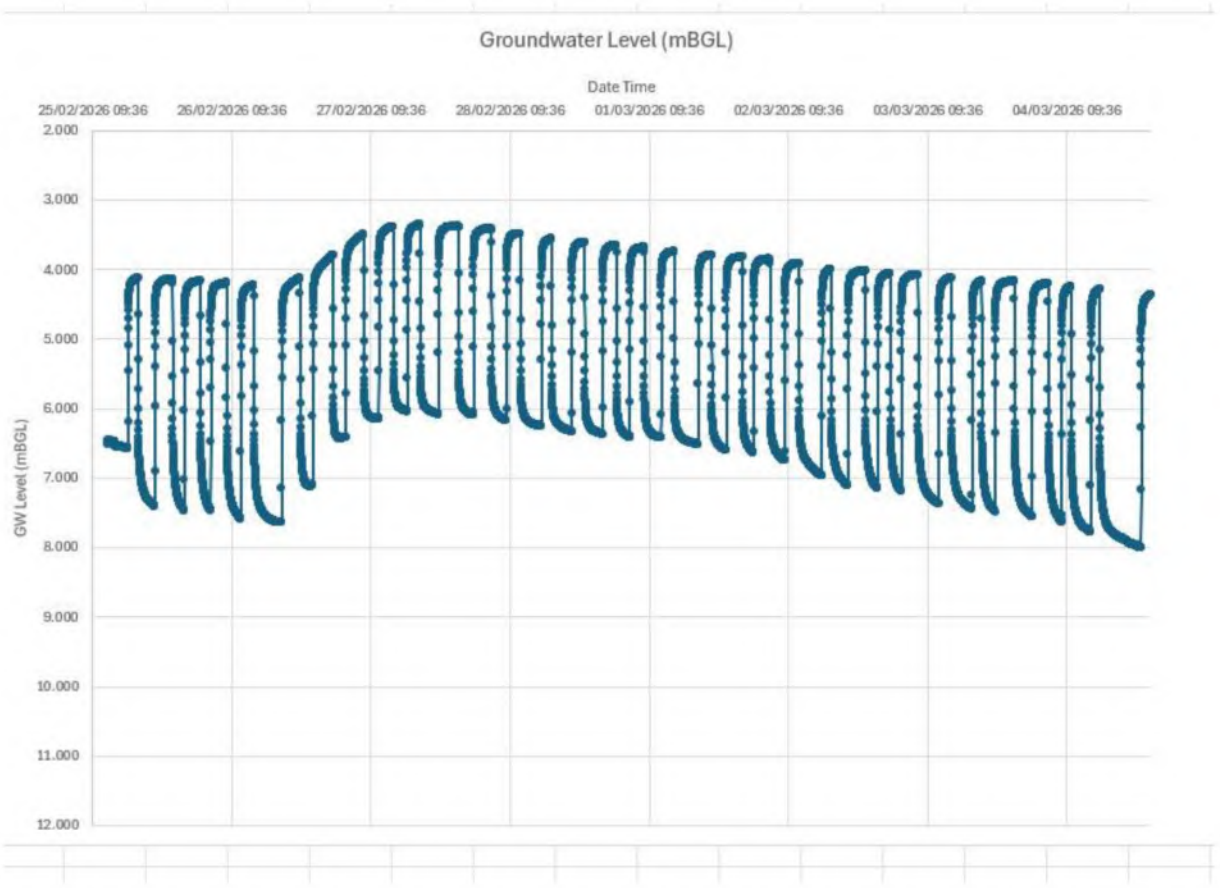
BH2

The existing water use at BH2 indicates that the maximum achievable flow rate from the borehole is approximately 1.25m^3/hour (30m^3/day for 24 hours of pumping). In reality this borehole is never pumped continuously for an extended period of time due to the pump being controlled by a float-switch on a sub-surface tank.

Typical usage of BH2 over a 7-day period is presented in Figure 6-1. The figure shows the groundwater levels which gives indication of the typical BH2 pumping regime over the 25th February 2026 – 4th March 2026. Intermittent pumping of the borehole is visible which is controlled by the tank float-switch.

Intermittent pumping with periods of groundwater level recovery is considered a preferred method of groundwater abstraction when compared to pumping over longer periods as it allows for periods where the pump is off and groundwater levels can recover, avoiding any excessive drawdowns and potential associated impacts such as de-watering.

Figure 6-1 BH2 Pumping 25th February 2026 - 4th March 2026



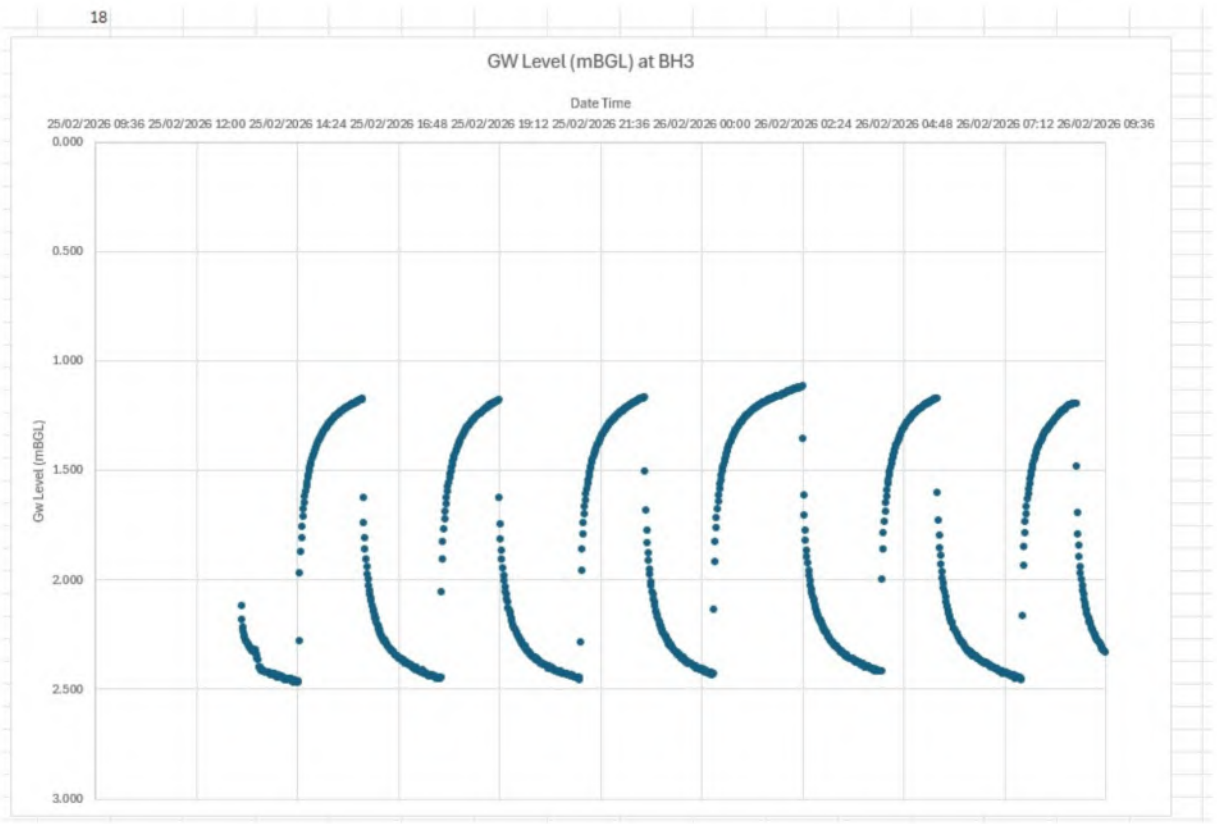
BH3

Following installation of a flow meter on the pipework from BH3 into the above-ground water storage tank, the maximum achievable flow rate is approximately 2.5m^3/hour (60m^3/day assuming 24-hour pumping). In reality this daily yield will not be achieved as the borehole pump is controlled by a float-switch on an above-ground storage tank which results in intermittent pumping of BH3.

Typical usage of BH3 over a 24-hour period (25th February 2026 – 26th February 2026) is presented in Figure 6-2. Groundwater levels were recorded over this period using an electronic level logger measuring pressure at 1-minute intervals.

The figure identifies 6no. instances of groundwater abstraction and subsequent groundwater recovery where the pump is switch off by the float-switch.

Figure 6-2 BH3 Pumping 25th February 2026 - 26th February 2026



BH6

Following installation of a flow meter on the pipework from BH6 into the above-ground water storage tank, the maximum achievable flow rate is approximately 2.8m^3/hour (67.2m^3/day assuming 24-hour pumping). This daily yield will not be achieved as the borehole pump is controlled by a float-switch on an above-ground storage tank which results in intermittent pumping of BH6.

Typical usage of BH6 at the Site is presented in Figure 6-3 & Figure 6-4 which indicate that over the 20-day period of initial level logger installation, the borehole was active on 3no. occasions on the 12th of March 2026.

Figure 6-3 BH6 Groundwater Levels 25th February 2026 - 17th March 2026

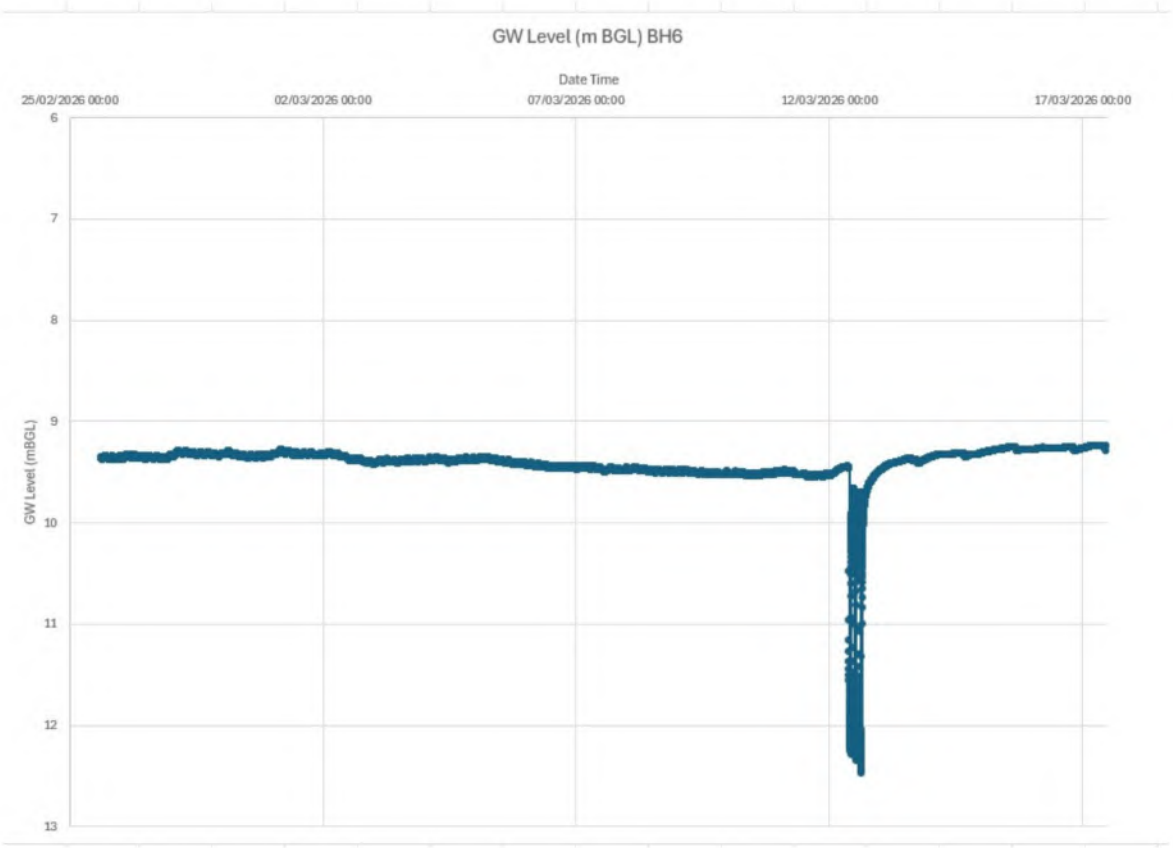
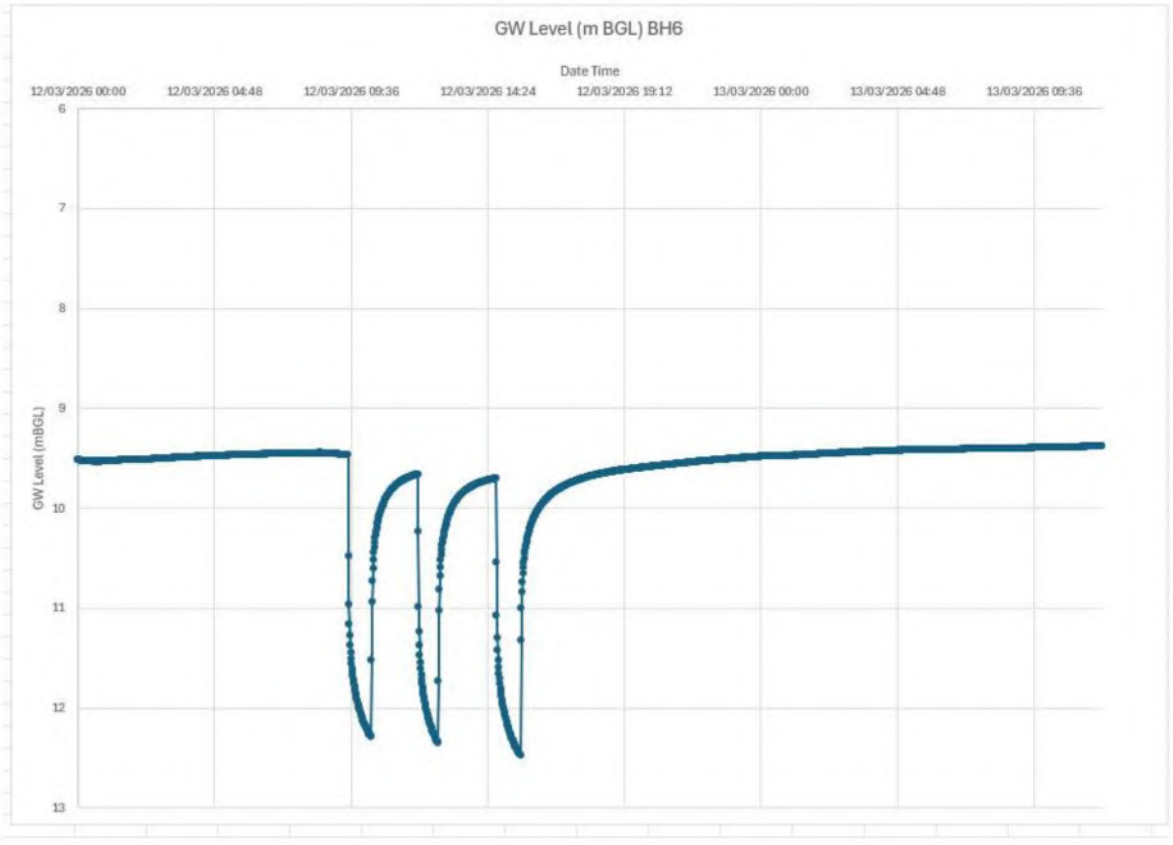


Figure 6-4 BH6 12th March 2026 - 13th March 2026



6.3 Proposed Water Usage

As BH2 is located closest to the Camddwr River, and abstracts groundwater from shallow superficial deposits as well as deeper bedrock, it is considered the most environmentally sensitive of the on-site boreholes. The HIA has indicated that a period of 3-days continuous groundwater abstraction from BH3 would result in a drawdown impact 50m away from the borehole (locality of river in relation to borehole).

From the monitoring data available, it appears that the maximum continuous period of groundwater abstraction from BH3 is 7-hours. It is noted that as part of the license application, on-site abstraction operations are to continue as they have previously, with no changes to abstraction schedules.

All submersible electric borehole pumps are controlled via the float switches on the water storage tanks, which results in a repeated intermittent pumping scenario, as opposed to continual longer-term abstractions. To ensure that this preferred method of intermittent pumping is continued, it may be prudent for the addition of timers onto the borehole pump circuits based on the recorded flow rates of the boreholes to ensure that no long-term periods of pumping, particularly at BH3 are progressed.

7 Conclusions

Groundwater from is sourced from both superficial deposits gravels near the river at BH3, as well as the underlying bedrock aquifer. BH2 and BH6 abstract groundwater from the underlying Undifferentiated Wenlock Rocks. Devensian Till is mapped as underlying the Site and likely confines groundwater in the bedrock aquifer.

BH2 is situated at a significantly higher topographic elevation when compared to BH3 and BH6 and is considered more sensitive to rainfall recharge. BH3, and likely BH6 utilise multi-aquifer wells with some abstraction from unconfined superficial deposits and confined bedrock aquifers, which may exist as individual fissured aquifers in the bedrock.

In accordance with the GIC all boreholes were constant rate tested individually, and in combination.

Monitoring data analysed from water features in the vicinity include the Camddwr River and the abstraction boreholes themselves. No well interference or impact on River levels were observed during the test.

Constant rate testing of all boreholes in combination resulted in maximum drawdowns of 9.3m, 1.88m and 4.06m at BH2, BH3 and BH6 respectively.

Aquifer parameters have been derived from the combined constant rate test pumping data at all boreholes (BH2, BH3 and BH6) using AquiferWin32. Transmissivity results were found to be toward the lower end of the published literature values (0.71m^2/day to 3902m^2/day), with calculated transmissivities of 2.26m^2/day (BH2), 38.9m^2/day (BH3) and 12.9m^2/day (BH6)

The specific capacity for each borehole has been calculated as follows:

- **BH2 –** 5.62m^3/day/m
- **BH3 –** 33.4m^3/day/m
- **BH6 –** 21.2m3/day/m

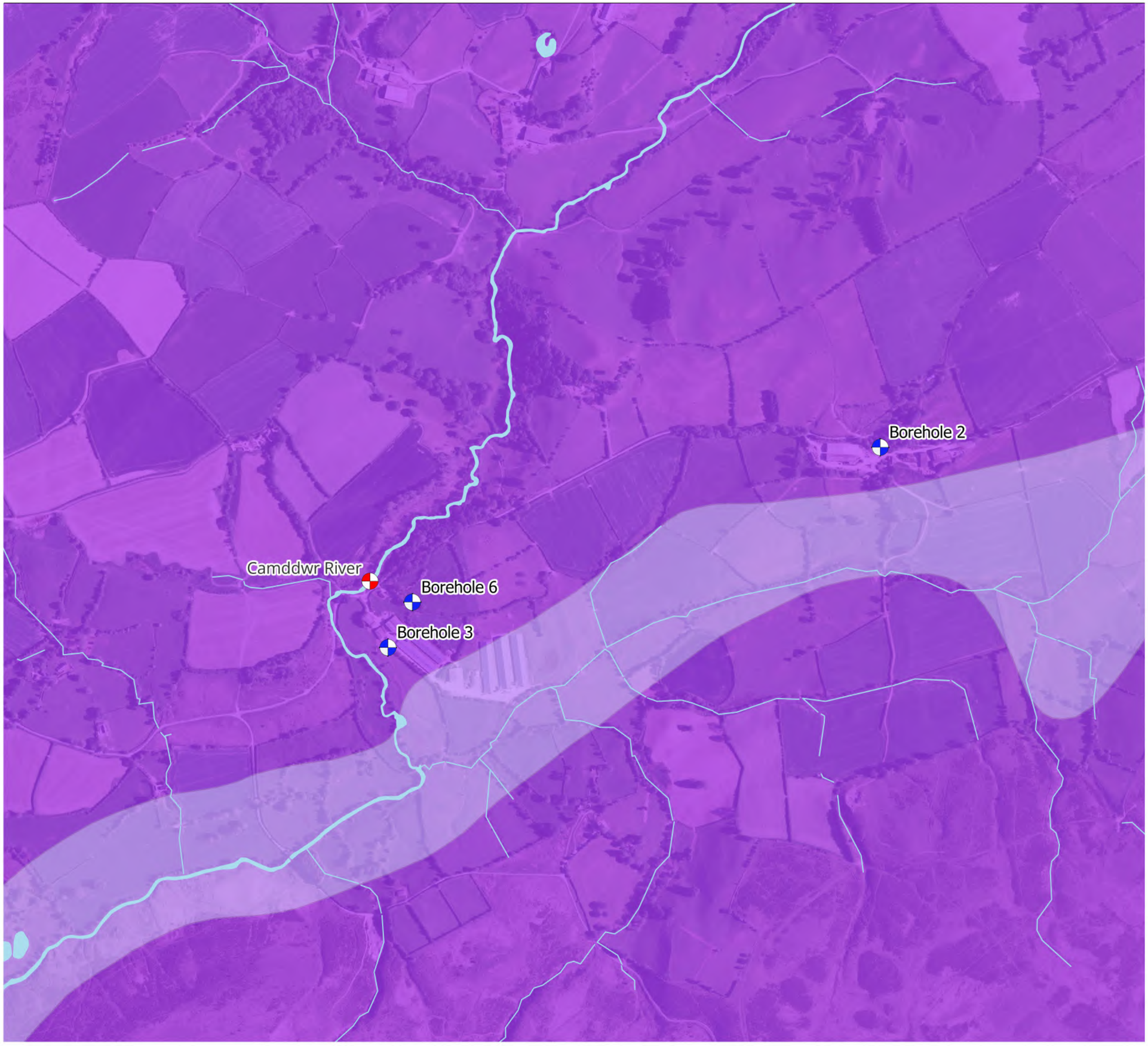
Following an assessment of the pump tests Hydrogeo conclude that the abstraction of groundwater at Ddole Farm of up to 90m^3/day does not result in any extensive drawdown impacts on the underlying aquifer, or have any discernible impacts on the sensitive Camddwr River and associated River Wye SAC, where groundwater abstraction continues to be managed by intermittent abstraction.

This Hydrogeological Impact Appraisal and Groundwater Pumping Test Report will be issued to Natural Resources Wales (NRW) to support the application for an abstraction license for the on-site boreholes.

Drawings

Drawing 1

Geology Map



HYDROGEO

HYG1368 Ddole Farm

DRAWING 1 Site Geology

KEY

HYG1368 T Ddole Farm Borehole Locations

Camddwr River Monitoring Location

OS_Open_Zoomstack waterlines

Watercourse

50k Bedrock Geology

Wenlock Rocks - Undifferentiated

50k Superficial Deposits

Devensian Till

N

0 125 250 375 500 m

Date	By	Paper	Scale	Rev
06 2026	SG	A3	1:7,500	1

Appendices

Appendix A

APEX Drilling Borehole Log

ENVIRONMENT AGENCY

Form WR – 38	*Ref: so127723 ddol farm, llanbister (lewis) log 1809*	Agency No.

BOREHOLE RECORD

A. ***SITE DETAILS***

Borehole drilled for:	Mr Lewis			
Location:	Ddol Farm, Llanbister, Llandrindod Wells, Powys			
N.G.R.:	SO 127 723			
Ground Level (if known):	SURFACE			
Drilling Company:	W.B. & A.D. MORGAN LTD., PRESTEIGNE, POWYS. LD8 2UF			
Date of Drilling:	**Commenced:**	26/4/04	**Completed:**	28/4/04

B. **CONSTRUCTION DETAILS**

Borehole datum (if not ground level) GROUNDLEVEL
(Point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)

Borehole drilled diameter.....		280	mm from	0	to	18	m/depth
		250	mm from	18	to	50	m/depth
Casing material: u.P.V.C and type (e.g. plain steel, plastic slotted)	diameter	165	mm from	0	to	47.5	m/depth
Plain	diameter	165	mm from	0	to	8.7	m/depth
Slotted	diameter	165	mm from	8.7	to	14.7	m/depth
Plain	diameter	165	mm from	14.7	to	26.7	m/depth
Slotted	diameter	165	mm from	26.7	to	32.7	m/depth
Plain	diameter	165	mm from	32.7	to	38.7	m/depth
Slotted	diameter	165	mm from	38.7	to	44.7	m/depth
Plain	diameter	165	mm from	44.7	to	47.5	m/depth

Grouting details:	Pour 7m	to surface
Water struck at:	2m, 12m, 35	m (depth below datum – mbd)
Rest water level on completion:	1.3	m (depth below datum – mbd)
Estimated blowout yield:	4,000	Gallons per hour

C. **STRATA LOG**

Description of Strata	**Thickness (m)**	**Depth (m)**
Overburden	0.5	0.5
Brown clay/gravels	6.5	7
Medium grey clay	5	12
River gravels	2	14
Medium black shale	15	29
Medium hard black shale	21	50

Other Comments (e.g. gas encountered, saline water intercepted, etc.)			
Gravel Pack Quantity:	2,250kg	Temp Steel Casing: Depth and Diameter	18m x 274mm
Cement:	300kg		
Rig & Crew:	Halco V666, D. Morris, D. Bebbington		

Appendix B

Natural Resources Wales (NRW) Email Correspondence

Outlook

RE: CONSENT: WA/055/0004/0008 - Ddole Farm

From Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Date Fri 4/10/2026 10:30 AM
To Scott Greaves <Scott@hydrogeo.co.uk>

Good morning Scott,

NRW Geoscience Team have confirmed that they have no issues given the operational constraints on site, but will require details/ explanation within the HIA on what was tested, pump durations and all monitoring etc. It appears that you have got good time series data for the groundwater levels from all the boreholes on site for some time (back to February) and we note that you will remove this today (10th April) – We would recommend keeping this for an extra week if possible, to get the post testing monitoring.

If during your analysis you note that anything is missing, then you should retest before submitting the formal application/ HIA, as you may be required to retest if the testing and analysis is insufficient.

Kind regards,

Alex Cowell
Swyddog Trwyddedu Adnoddau Dwr | Water Resources Permitting Officer
Cyfarwyddiaeth Strategaeth, Polisi a Thystiolaeth | Strategy, Policy and Evidence Directorate
Rhif ffôn | Phone number 0300 065 3888
Rhagenwau Ef/Ei | Pronouns His/Him

From: Scott Greaves <Scott@hydrogeo.co.uk>
Sent: 09 April 2026 12:58
To: Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Subject: Re: CONSENT: WA/055/0004/0008 - Ddole Farm

Thanks for this Alex,

Much appreciated

Scott Greaves
Geo-Environmental Consultant
BSc MSc FGS
Hydrogeo Ltd, Unit 4, Waddington House, Llanover Business Centre, Llanover, Abergavenny, NP7 9HA
Tel: +44 (0)1873 856813 Mobile: +44 (0)7397 507467 Email: scott@hydrogeo.co.uk

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From: Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Sent: Thursday, April 9, 2026 12:57 PM
To: Scott Greaves <Scott@hydrogeo.co.uk>
Subject: RE: CONSENT: WA/055/0004/0008 - Ddole Farm

Hi Scott,

Apologies for missing your telephone calls.

I'm unable to advise on the testing but I have forwarded your query to NRW's Geoscience team and will let you know their response as soon as possible.

Kind regards,

Alex Cowell
Swyddog Trwyddedu Adnoddau Dwr | Water Resources Permitting Officer
Cyfarwyddiaeth Strategaeth, Polisi a Thystiolaeth | Strategy, Policy and Evidence Directorate
Rhif ffôn | Phone number 0300 065 3888
Rhagenwau Ef/Ei | Pronouns His/Him

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.

Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

From: Scott Greaves <Scott@hydrogeo.co.uk>
Sent: 08 April 2026 12:17
To: Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Subject: Re: CONSENT: WA/055/0004/0008 - Ddole Farm

Hi Alex,

Hope all is well with yourself. I tried calling yesterday to discuss the details I have noted below. Please can you take a look at this and confirm this is a sufficient approach given the site difficulties in relation to BH2.

We have been progressing the pump testing at Ddole Farm, with all 3no. boreholes combined currently testing (Beginning yesterday morning). I have a query to run past you and your team following progression of the testing, and the works completed to date at BH2.

Constant rate testing at BH3 was successful for 48 hours as the submerged borehole pump is controlled by a float switch on an above ground storage tank. We were therefore able to secure this switch in the on position for 48 hours. The same was possible for BH6 which feeds the same tank.

This set up is not possible for BH2 as the borehole feeds a sub-surface tank with no possible access to the controlling float switch. The borehole pump is therefore fully controlled by the water level within the tank. It has therefore only been possible to test this borehole for a maximum continuous period of 28 hours prior to the float switch within the tank being activated and switching the pump off. It has not been possible to test BH2 whilst constantly pumping for a period greater than 28 hours.

It is thought that the same scenario will occur during this current combined pumping test where the BH2 pump will eventually activate the float switch and cut the pump.

I propose that the borehole pump runs continuously for the period of time until the float switch on the sub-surface tank is activated. At this point the pump will be automatically cut off but the electric supply remains allowing the borehole to be operated as it usually would following on-site farm use. This would result in the following during the combined 48 hour constant rate test.

- BH2 running for period of time until the float switch activated.
- BH2 then used as it would be during normal day - to day farming operations over the remaining period of the 48 hours where the pump is continuously switched on and off as water levels within the tank fluctuate, resulting in several periods of groundwater abstraction and groundwater recharge.
- Both BH3 and BH6 would remain actively abstracting for the whole 48 hour period.

I unfortunately think that given the current setup of the boreholes and tank system that this is the only way to obtain longer term data from BH2. We have installed a level logger in the borehole which is recording groundwater levels at 1-minute intervals over the period 25th February - Present, with the loggers scheduled to remain on-site until Friday 10th April.

I trust that this has been able to allow enough background data, data representative of daily farm use of BH2, and 28-hours constant rate test and subsequent recovery to satisfy NRW that best endeavours have been made to test this borehole as per the GIC.

I have attached initial background data captured from BH2 which shows the typical day-to-day use of the borehole. From this you should see the multiple instances of groundwater abstraction and groundwater recovery all controlled by the tank float switch.

Can you please confirm that this is an acceptable approach for the testing. Please feel free to call to discuss on the mobile number in my email footer if required.

Kind regards,

Scott Greaves
Geo-Environmental Consultant
BSc MSc FGS
Hydrogeo Ltd, Unit 4, Waddington House, Llanover Business Centre, Llanover, Abergavenny, NP7 9HA
Tel: +44 (0)1873 856813 Mobile: +44 (0)7397 507467 Email: scott@hydrogeo.co.uk

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From: Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Sent: Wednesday, February 18, 2026 3:42 PM
To: Scott Greaves <Scott@hydrogeo.co.uk>
Cc: Chris Betts <chris@hydrogeo.co.uk>
Subject: RE: CONSENT: WA/055/0004/0008 - Ddole Farm

Hi Scott,

Thanks for your email, very much appreciated.

Kind regards,

Alex Cowell
Swyddog Trwyddedu Adnoddau Dwr | Water Resources Permitting Officer
Cyfarwyddiaeth Strategaeth, Polisi a Thystiolaeth | Strategy, Policy and Evidence Directorate
Rhif ffôn | Phone number 0300 065 3888
Rhagenwau Ef/Ei | Pronouns His/Him

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.

Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

From: Scott Greaves <Scott@hydrogeo.co.uk>
Sent: 18 February 2026 14:29
To: Cowell, Alex <alex.cowell@cyfoethnaturiolcymru.gov.uk>
Cc: Chris Betts <chris@hydrogeo.co.uk>
Subject: CONSENT: WA/055/0004/0008 - Ddole Farm
Importance: High

Hi Alex,

Just an email to inform you that we are attending site tomorrow to install the dip tubes, flow meters and level loggers into the 3no. On-site boreholes and a level logger to the Camddwr watercourse.

We will then allow for a period of pre-test groundwater and surface water monitoring, with the intentions of beginning the pump test following the 10-day notice on 2nd March 2026.

Kind regards,

Scott Greaves
Geo-Environmental Consultant
BSc MSc FGS
Hydrogeo Ltd, Unit 4, Waddington House, Llanover Business Centre, Llanover, Abergavenny, NP7 9HA
Tel: +44 (0)1873 856813 Mobile: +44 (0)7397 507467 Email: scott@hydrogeo.co.uk

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Appendix C

Pumping Test Monitoring Results (electronic)

Appendix D

Environment Agency (EA) Drawdown Calculation Spreadsheet

5) Cooper Jacob (Time-variant unconfined aquifer)

(Based on Theis equation)

$$Q = \frac{4\pi Ts}{2.3\log\left(\frac{2.25Tt}{r^2 S}\right)}$$

$$s_c = \left(1 - \frac{s_a}{2b}\right)s_a$$

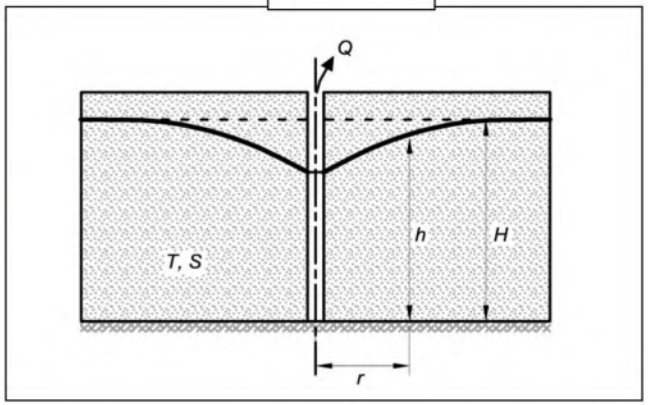
$$u = \frac{r^2 S}{4Tt}$$

Essential input
Optional input
Calculated

For assessing drawdown, s, at a distance, r, from a pumping well and a time, t

		expected		min	max	
Transmissivity of aquifer	T	38.88	m^2/d	29.619	276.05	m^2/d
Time from start of abstraction	t	3	d			
Storage coefficient	S	0.06		0.0001	0.071	
To find Q if s is known						
Height of water table at radius of influence	H		m			m
Height of water table at radius r	h		m			m
Measured drawdown = $(H-h_r)$	s_a	0	m	0	0	m
Original saturated thickness of aquifer	b	45.7	m			
Corrected drawdown	s_c	0.0	m	0.0	0.0	m
Distance from centre of well at r	r		m			
Use well function to determine if equation is valid	u	0		0	0	
Is equation valid ?		Yes		Yes	Yes	
Total discharge from well	Q	#DIV/0!	m^3/d	#DIV/0!	#DIV/0!	m^3/d
To find s if Q is known		$s = \frac{2.3Q}{4\pi T}\log\frac{2.25Tt}{r^2 S}$				
Total discharge from well	Q	67.7	m3/d			
Distance from centre of well at r	r	50	m			
Drawdown at distance r						
Calculated drawdown	s_c	0.1	m			
Actual drawdown	s_a	0.1	m			

Note: To check validity of this arrangement of equation, enter value for r in cell C19 as well



The following assumptions apply to this equation

- the aquifer is unconfined
- the aquifer has infinite areal extent
- the aquifer is homogeneous, and of uniform thickness
- flat initial water table
- the aquifer is pumped at a constant discharge rate
- the water removed from storage is discharged instantaneously with decline of head
- the diameter of the well is small, i.e. the storage in the well can be ignored
- the pumping well is fully penetrating, therefore receiving water from the entire saturated thickness of the aquifer

(from Kruseman & de Ridder, 1994)

Data sources (to complete an audit trail)		
Height of water table at radius of influence	H	
Height of water table at radius r	h	
Transmissivity of aquifer	T	Theis Unconfined analysis of constant rate pumping test
Time from start of abstraction	t	1 day continuous pumping
Storage coefficient	S	BGS technical report WD/00/04
Original saturated thickness of aquifer	b	
Distance from centre of well at r	r	
Total discharge from well	Q	Proposed maximum pumping rate