

**Qube Report Q1081/26**

February 2026

# **Flow Estimate for Afon Teifi at E:231350, N:240500**



**WHS**

# NSUGG Ltd

## Flow Estimate for Afon Teifi at E:231350, N:240500

### For and on behalf of Wallingford HydroSolutions Ltd.

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Position        *Senior Consultant*

This report has been prepared by WHS with all reasonable skill, care and diligence within the terms of the Contract with the client and taking account of both the resources allocated to it by agreement with the client and the data that was available to us. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of any nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.



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## 1 Introduction

This report presents the annual and monthly flow statistics for the site(s) requested using the WHS Qube water resource modelling system. The site location(s) have been confirmed using a digital map and copies of the correspondence are contained within Annex 1.

Qube is the online evolution of the LowFlows Enterprise water resource modelling system to move beyond the estimation of natural and influenced flow statistics. Qube enables the seamless modelling of both flow statistics and time series anywhere in the UK and Ireland.

Developed by WHS in partnership with the Environment Agency, Qube is used as a best practice tool for the estimation of flows in ungauged catchments by the Environment Agency, Natural Resources Wales, Scottish Environment Protection Agency, Northern Ireland Environment Agency, Environmental Protection Agency and the UK water industry.

The Qube underpinning science has been widely published in the scientific literature.

Section 2 presents the methods for the derivation of catchment characteristics and the annual and monthly flow estimates. Following the results for each site, Sections 4 and 5 present the assumptions and uncertainties within the flow estimates, followed by the consideration for use in section 6 and the warranty and liability in section 7.

WHS is committed to continuously improving company performance and customer satisfaction. We are proud of our ISO9001 quality certification and ISO14001 environmental management certification for the provision of environmental consultancy services, development of hydrological software and associated training. For further information on all of our services and software, please visit our website [www.hydrosolutions.co.uk](http://www.hydrosolutions.co.uk).

## 2 Derivation of the Qube Flows Results

The flow statistic estimates contained in this report have been produced by Qube using models and relationships that relate these flow statistics to the climatic and hydrological characteristics of the catchment of interest. Qube is the evolution of LowFlows Enterprise<sup>1</sup>. All flow statistics provided in this report are for natural flows, thus do not contain any artificial influences such as abstractions, discharges or impounding reservoirs.

The following catchment characteristics and flow statistics are provided:

- **Catchment Area:** The catchment boundary may be derived using either a Digital Terrain Model (DTM) to determine the topographic boundaries of the catchment or imported by the user.
- **Annual Mean Flow (MF):** The estimation of Mean Flow is based on a 1km grid of long term average annual runoff for the given period of record (POR). The POR runoff grids were modelled using the CERF rainfall runoff model and calibrated to the UK Centre for Ecology and Hydrology 1961-1990 runoff grid (an output of a deterministic water balance model using observed data from over 500 gauged catchments<sup>2</sup>).
- **Mean Monthly Flows (MMF):** The MMF for each month are derived from the natural MF estimate by distributing the total average flow volume for the year between the months of this year. This distribution is based upon observed data from hydrologically similar gauged catchments.
- **Annual Flow Duration Curve (FDC) statistics:** The flow duration curve statistics are estimated using a procedure based on measured flow data from hydrologically similar gauged catchments. The methodology was initially developed in 2002<sup>3</sup> and has been subsequently further refined. Where nested local data gauges (LDG) are available, the FDC is improved using naturalised gauged FDCs for the given period of record.
- **Mean Monthly Flow Duration Curves (MFDC):** The MFDC for each month is estimated using gauged MFDCs from hydrologically and climatologically similar catchments and the estimate of MMF for that month. Where LDG have been used, the MFDC's are adjusted using the LDG improved annual FDC.
- **Base-Flow Index (BFI):** The proportion of a hydrograph occurring as base flow, hence varying between zero and unity. BFI is indicative of catchment permeability with values approaching unity associated with highly permeable systems. BFI is estimated from a revised form of the BFIHOST multivariate linear regression equation<sup>4</sup>.

If these long term natural flow statistics were calculated directly from a gauged flow record the annual statistics would be equivalent to those calculated using all of the daily flow data from all years of record and the monthly statistics for a month equivalent to those calculated from the gauged data for that month from all years.

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<sup>1</sup> Young A. R., Grew R. and Holmes M.G.R. 2003. Low Flows 2000: A national water resources assessment and decision support. Water Science and Technology, 48 (10).

<sup>2</sup> Holmes, M.G.R., Young, A.R., Gustard, A.G. and Grew, R. 2002. A new approach to estimating Mean Flow in the United Kingdom. Hydrology and Earth System Sciences. 6(4) 709-720.

<sup>3</sup> Holmes, M.G.R., Young, A.R., Gustard, A.G. and Grew, R. 2002. A Region of Influence approach to predicting Flow Duration Curves within ungauged catchments. Hydrology and Earth System Sciences. 6(4) 721-731.

<sup>4</sup> Boorman, D.B., Hollis, J.M. and Lilly, A. 1994. Hydrology of Soil Types: a Hydrologically-based Classification of the Soils of the United Kingdom. IH Report 126.

### 3 Flow Results for Afon Teifi at E:231350, N:240500

#### 3.1 Catchment Characteristics

The catchment characteristics and map for this catchment are presented in the table and figure below. The catchment is underlain by bedrock largely consisting of mudstone with some interbedded sandstones. Superficial deposits of deposits till, glaciofluvial sheet deposits, alluvium and head are also present within the catchment. A gauge (62002 - Teifi at Llanfair) located within the same part of the river network as the target site was flagged as a source of local data and was used to improve the flow estimates.

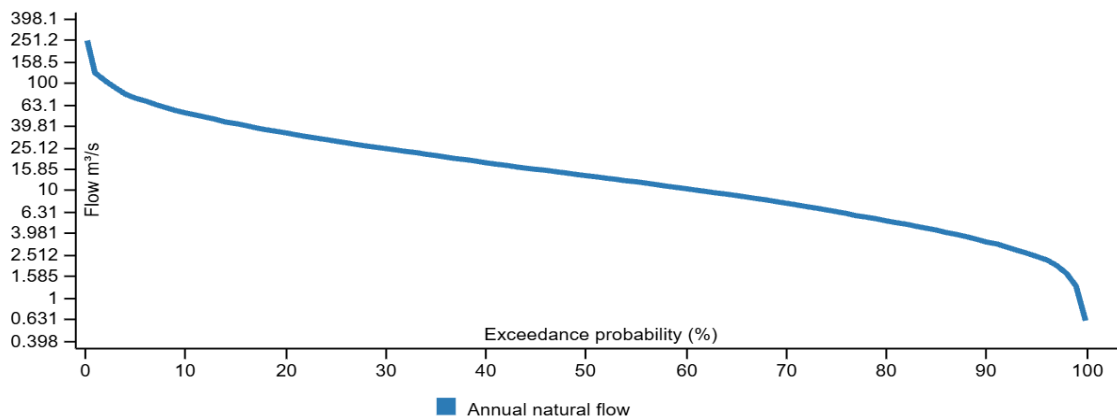
Catchment name	Catchment at 231356, 240462	Catchment area	702 km <sup>2</sup>
Location	231356, 240462	Hydrometric area	62



Catchment Boundary Map (Contains Ordnance Survey data © Crown copyright and database right 2026)

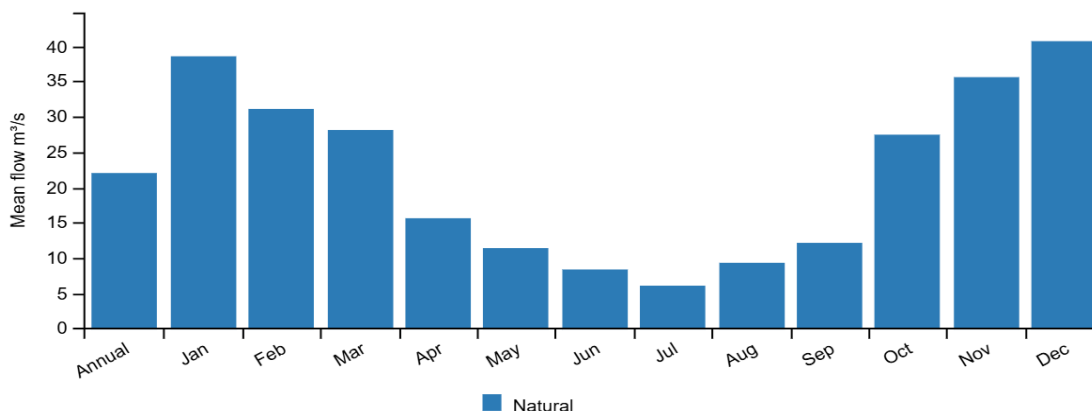
#### 3.2 Long Term Flow Statistics

Period of record	Full period of record	Runoff (Period of record)	959.1 mm
BFIHOST	0.5		



## Flow Estimated Q1081/26

### Annual Flow Duration Curve



### Annual and Monthly Mean Flow

#### Annual Flow Duration Curve Statistics (m³/s)

Percentile	Natural Flow
5	71.75
10	52.32
20	33.92
30	24.24
40	17.89
50	13.59
60	10.23
70	7.505
80	5.148
90	3.272
95	2.413
99	1.273

#### Annual and Monthly Mean Flows (m³/s)

	Natural Flow
Annual	21.9
January	38.4
February	30.95
March	27.97
April	15.49
May	11.27
June	8.245
July	5.954
August	9.189
September	12.01
October	27.32
November	35.45
December	40.54

### Region of Influence Stations

Reference number	Weight (%)	Q95 % MF
62001	38.9	11.2
62002	26.2	10.6
63001	12	9.622
45002	11.6	11.92
54038	11.4	8.067

### Local Data Gauges - On

Gauge	Location	Area km²	MF m³/s	Q95 m³/s
Teifi at Llanfair	upstream	517.6	16.29	1.827

**Lake Adjustment - Off**

Local data gauge(s) have been used to improve the flow estimate, therefore only lakes in the incremental area are considered. No lakes were found in the incremental catchment area.

**Natural Monthly Flow Duration Curve Statistics (m<sup>3</sup>/s)**

Percentile	January	February	March	April	May	June
5	93.87	79.03	70.3	41.07	28.42	22.98
10	73.92	64.38	52.38	31.13	21.86	16.35
20	54.79	45.56	38.81	22.24	16.48	11.24
30	44.74	33.76	30.72	17.09	13.05	8.64
40	36.18	26.91	25.24	13.96	10.45	6.689
50	30.02	22.05	20.38	11.91	8.684	5.42
60	25.03	18.11	16.88	10.13	7.053	4.532
70	20.6	15.28	14.35	8.484	5.853	3.852
80	15.85	12.63	11.93	6.729	4.824	3.208
90	11.57	10.1	9.294	5.246	3.588	2.601
95	8.44	8.574	7.751	4.366	3.023	2.274
99	5.643	6.531	5.726	3.316	2.371	1.69

Percentile	July	August	September	October	November	December
5	17.21	29.14	43.53	82.32	84.11	103.6
10	12.2	20.06	30.8	61.52	67.91	77.04
20	8.289	12.95	17.05	40.39	51.93	57.86
30	6.512	9.797	11.4	30.11	42.27	46.41
40	5.191	7.73	8.618	23.64	34.21	37.07
50	4.339	6.132	6.61	18.06	27.54	31.21
60	3.664	4.871	5.138	13.48	22.49	25.52
70	3.04	3.679	4.124	10.03	17.65	20.71
80	2.504	2.653	3.22	7.806	13.99	16.66
90	1.915	1.768	2.323	4.643	9.928	12.92
95	1.544	1.187	1.794	2.849	7.138	10.73
99	1.144	0.794	0.995	2.067	4.808	7.889

## 4 Assumptions

Assumptions implicit in the estimated flow estimates are:

- Only natural flow statistics have been estimated and the impact of any artificial influences (for example abstractions, discharges or impounding reservoirs) is not included.
- The topographic catchment area identified is assumed to accurately reflect the true catchment area contributing to flows at the catchment outlet.
- The flow estimates are based on long term average records.

## 5 Model Uncertainty

The figures for factorial standard error of estimate for long term mean flow and Q95 are shown in Table 3.2.1. So, as an example the uncertainty in the estimate of mean flow in Scotland will generally be less than 11%. These standard errors are presented as a general guide only and should be considered in the context of the information presented within section 6. These errors are broadly comparable to the sampling errors that might be expected if mean flow was calculated from two to three years of error free gauged data and Q95 for in the order of five years error free gauged data.

If these estimates are to be used for high value decision making we would recommend that the estimates are corroborated through appropriate local flow measurement. For advice on flow measurement please contact us at [info@hydrosolutions.co.uk](mailto:info@hydrosolutions.co.uk).

Table 3.2.1 Model Factorial Standard Error (FSE)

Regions of the UK	FSE Mean Flow	FSE Q95
England and Wales	16	42
Scotland	11	35
Northern Ireland	11	30

## 6 Consideration for Use

The predictive performance of the Mean Flow and FDC Estimation Models may vary according to local conditions. The following is a list of significant, but not comprehensive, issues that need to be considered when estimating flows within ungauged catchments:

- Care needs to be taken when interpreting the results in smaller groundwater catchments in which river flows may be strongly influenced by point geological controls (such as spring lines and swallow holes).
- A catchment water balance is assumed, which may be incorrect in smaller groundwater fed catchments where part of the regional groundwater flow bypasses the surface water catchment.
- The estimation of Mean Flow is based on a 1km grid of long term average annual runoff, derived using the CERF rainfall runoff model and calibrated using the outputs from a deterministic water balance model using observed data from over 500 gauged catchments. The predictive performance of the model may therefore be reduced in areas of low rainfall gauge density.
- Care needs to be taken when interpreting the result in very small catchments as the size of the catchment approached the spatial resolution of the underlying catchment characteristic datasets

(1 km<sup>2</sup>). For very small catchments it is recommended that the topographic contributing catchment is confirmed by a site walkover to identify any unmapped features that might modify the catchment area.

- Where available local measured flow data should be used to corroborate the flow estimates, which is good practice when using any generalised hydrological model.

## 7 Warranty and Liability

1. The assumptions and uncertainties associated with the flow estimation methods must be considered when making use of flow estimates produced by the system.
2. You are responsible for the interpretation of the Results presented within this report and training in the use of the estimation methods is strongly recommended.
3. Subject to 1 and 2 above, WHS do not seek to limit or exclude liability for personal injury or death arising from our negligence.
4. Except for 3 above our entire liability for any breach of our duties, whether or not attributable to our negligence, is limited to the fee that you have paid for this report.
5. Except for 3 and 4 above, in no event will WHS be liable to you for any damages, including lost profits, lost savings or other incidental or consequential damages arising on your use of the results even if we have been advised of the possibility of such damages.
6. Should any of these provisions be ruled invalid under any law or Act of Parliament, they shall be deemed modified or omitted only to the extent necessary to render them valid and the remainder of these provisions shall be upheld.

## Annex 1: Copies of key correspondence with the client

Hello,

Please accept this email as instruction to proceed with the Flow Estimation report. I would like to pay by credit card, so please can you arrange a 'pay now' invoice.

Many thanks

Kind regards

Nicola Sugg

**From:** LowFlows <[lowflows@hydrosolutions.co.uk](mailto:lowflows@hydrosolutions.co.uk)>

**Sent:** 12 February 2026 4:42 PM

**To:** Nicola Sugg <[nicola@nsugg.co.uk](mailto:nicola@nsugg.co.uk)>

**Subject:** Re: WHS Website enquiry - Thu, 12 Feb 2026 12:11:19 +0000

Hi Nicola,

Thanks for your email, I can advise that a flow estimate at this location will cost +VAT at 20%. As an existing customer WHS will require either a formal PO number or formal go ahead in advance before commencing the works.

If you wish to make payment of our invoice by credit, debit or AMEX cards, please can you confirm and I can arrange for our accounts team to provide you with a 'PAY NOW' invoice which has an embedded link to the secure Sage Pay portal. Alternatively, payment can be made via BACS by your accounts team:

By BACS Account- Wallingford Hydrosolutions Ltd Sort Code- 40-34-27 Account- 52177145

Once go ahead is received we will begin progressing the report and will look to deliver the report within 10 working days.

Kind Regards,

### **WHS Qube Estimation Service**

From: **WHS Website Enquiry** <[noreply@hydrosolutions.co.uk](mailto:noreply@hydrosolutions.co.uk)>

Date: Thu, 12 Feb 2026 at 12:11

Subject: WHS Website enquiry - Thu, 12 Feb 2026 12:11:19 +0000

To: <[software@hydrosolutions.co.uk](mailto:software@hydrosolutions.co.uk)>

Name: Nicola Sugg

Email: [nicola@nsugg.co.uk](mailto:nicola@nsugg.co.uk)

Message:

Please can I order a Qube Flow Estimation Report for the Afon Teifi near Newcastle Emlyn, at grid reference SN 31356 40462.