NRW Hydro Power Supplementary Information

This document provides additional information relating to the construction of a Micro Hydro Scheme on the Nant Ffynnon-wen.

TGVHydro

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TGVHydro Ltd

CRiC

Beaufort Street

Crickhowell,

Powys

NP8 1BN

Tel: 07969 137719

Email: info@tgvhydro.co.uk

Supplementary Notes for NRW Form – WRD

Section 5: Abstraction quantities

Table 1: Calculated quantities of water to be abstracted

Purpose	*Maximum yearly m^3*	*Maximum daily m^3*	*Maximum hourly m^3*	*Hours per day*	*Peak Instantaneous flow rate litres/second*
Nant Ffynnon-wen (main catchment – main intake)	At 365 days of maximum daily abstraction = 378,432.0 m^3	1,036.8 m^3	43.0 m^3	24	12.0 ls^{-1}
Unnamed tributary (feeding catchment – feeding intake)	At 365 days of maximum daily abstraction = 315,360.0 m^3	864.0	36.0	24	10 ls^{-1}
Total	693,792.0 m^3	1900.8 m^3	79.2 m^3		

How the figures have been calculated for the main intake:

Peak instantaneous flow.

Abstraction will be all flow up to the value of 70% of flow, above Q95 (HOF), up to 12.0 l/s (75% of Qmean).

The peak instantaneous abstraction for the catchment at the point of abstraction for the main intake is 12.0 ls^{-1}.

The value of Q95 (HOF) at the point of abstraction is 1.9 ls^{-1}.

Hours per day.

When water is available above Q95 the hydro scheme will operate for 24 hours/day.

Maximum Hourly m^3

Maximum hourly rate assumes peak consumption of 12.0, in accordance with the NRW Guidance, for the full 1 hour period. Maximum hourly abstraction would therefore be:

Peak instantaneous abstraction (ls^{-1}) x 60 (seconds) x 60 (minutes) /1000 **= Volume in m^3**

So if the restricted flow is 12.0 ls^{-1} the calculation is (12 x 60 x 60)/1000 = **43.0m^3**

Maximum Daily m^3

Maximum daily rate assumes peak abstraction for the entire 24 hours period (in accordance with the NRW Guidance) which is 43.0 m^3 per hour.

Maximum daily abstraction would be: 43.0 m^3 x 24 (hrs) = **1,036.8 m^3**

Maximum Yearly m^3

Table below shows abstraction based on WHS Lowflows historical data. This indicates maximum yearly abstraction, based on average rainfall, will total **160,418 m^3**.

During particularly wet years the averages may be exceeded and therefore it is theoretically possible, for the purposes of this NRW abstraction application, that the maximum yearly abstraction could be based on peak instantaneous abstraction for 24 hours a day for 365 days per year (in line with the NRW Guidelines). In which case the theoretical maximum abstraction would be:
1,036.8 m^3 x 365 = **378,432.0 m^3**

Table 2: Calculation of Average Annual Abstraction (data from WHS Lowflows)

Calculates How Much Water The System Will Use								
% of year flow will be exceeded	Period Flow Rate (l/s)	Q95 Adjusted Flow (l/s)	Allowed Abstraction flow from Q95 Flow	TGV Design Abstraction flow (l/s)	% of Allowed flow used by TGV design	Residual Flow in Watercourse Above HOF (l/s)		Abstracted Volume M^3
100%	0.00	0.00	0.00	0.00	0.00	0.00	100%	0
95%	1.90	0.00	0.00	0.00	0.00	1.90	100%	0
90%	2.24	0.34	0.24	0.00	0.00	2.24	100%	0
85%	2.24	0.34	0.24	0.00	0.00	2.24	100%	0
80%	2.24	0.34	0.24	0.00	0.00	2.24	100%	0
75%	3.36	1.46	1.02	1.02	1.00	2.34	70%	1,611
70%	4.48	2.58	1.81	1.81	1.00	2.67	60%	2,848
65%	4.48	2.58	1.81	1.81	1.00	2.67	60%	2,848
60%	4.48	2.58	1.81	1.81	1.00	2.67	60%	2,848
55%	5.60	3.70	2.59	2.59	1.00	3.01	54%	4,084
50%	6.72	4.82	3.37	3.37	1.00	3.35	50%	5,320
45%	8.96	7.06	4.94	4.94	1.00	4.02	45%	7,793
40%	11.20	9.30	6.51	6.51	1.00	4.69	42%	10,265
35%	13.44	11.54	8.08	8.08	1.00	5.36	40%	12,737
30%	15.68	13.78	9.65	9.65	1.00	6.03	38%	15,210
25%	19.04	17.14	12.00	12.00	1.00	7.04	37%	18,918
20%	22.40	20.50	14.35	12.04	0.84	10.36	46%	18,984
15%	31.36	29.46	20.62	12.04	0.58	19.32	62%	18,984
10%	40.32	38.42	26.89	12.04	0.45	28.28	70%	18,984
5%	60.48	58.58	41.01	12.04	0.29	48.44	80%	18,984
						Average annual abstraction (m^3)		160,418

How the figures have been calculated for the feeding intake:

Peak instantaneous flow.

Abstraction will be all flow up to the value of 70% of flow, above Q95 (HOF), up to 10.0 l/s (37% of Qmean).

The peak instantaneous abstraction for the catchment at the point of abstraction for the main intake is 10.0 ls^{-1}.

The value of Q95 (HOF) at the point of abstraction is 3.5 ls^{-1}.

Hours per day.

When water is available above Q95 the hydro scheme will operate for 24 hours/day.

Maximum Hourly m^3

Maximum hourly rate assumes peak consumption of 12.0, in accordance with the NRW Guidance, for the full 1 hour period. Maximum hourly abstraction would therefore be:

Peak instantaneous abstraction (ls^{-1}) x 60 (seconds) x 60 (minutes) /1000 = **Volume in m^3**

So if the restricted flow is 10.0 ls^{-1} the calculation is (10 x 60 x 60)/1000 = **36.0m^3**

Maximum Daily m^3

Maximum daily rate assumes peak abstraction for the entire 24 hours period (in accordance with the NRW Guidance) which is 36.0 m^3 per hour.

Maximum daily abstraction would be: 36.0 m^3 x 24 (hrs) = **864.0 m^3**

Maximum Yearly m^3

Table below shows abstraction based on WHS Lowflows historical data. This indicates maximum yearly abstraction, based on average rainfall, will total **199,131 m^3**.

During particularly wet years the averages may be exceeded and therefore it is theoretically possible, for the purposes of this NRW abstraction application, that the maximum yearly abstraction could be based on peak instantaneous abstraction for 24 hours a day for 365 days per year (in line with the NRW Guidelines). In which case the theoretical maximum abstraction would be:

864.0 m^3 x 365 = **315,360 m^3**

Table 2: Calculation of Average Annual Abstraction (data from WHS Lowflows)

Calculates How Much Water The System Will Use								
% of year flow will be exceeded	Period Flow Rate (l/s)	Q95 Adjusted Flow (l/s)	Allowed Abstraction flow from Q95 Flow	TGV Design Abstraction flow (l/s)	% of Allowed flow used by TGV design	Residual Flow in Watercourse Above HOF (l/s)		Abstracted Volume M^3
100%	2.25	0.00	0.00	0.00	0.00	2.25	100%	0
95%	3.50	0.00	0.00	0.00	0.00	3.50	100%	0
90%	4.50	1.00	0.70	0.00	0.00	4.50	100%	0
85%	5.63	2.13	1.49	1.49	1.00	4.14	74%	2,345
80%	6.75	3.25	2.28	2.28	1.00	4.48	66%	3,587
75%	7.88	4.38	3.06	3.06	1.00	4.81	61%	4,829
70%	9.00	5.50	3.85	3.85	1.00	5.15	57%	6,071
65%	10.13	6.63	4.64	4.64	1.00	5.49	54%	7,312
60%	11.25	7.75	5.43	5.43	1.00	5.83	52%	8,554
55%	13.50	10.00	7.00	7.00	1.00	6.50	48%	11,038
50%	15.75	12.25	8.58	8.58	1.00	7.18	46%	13,521
45%	18.00	14.50	10.15	10.00	0.98	8.00	44%	15,764
40%	20.25	16.75	11.73	10.00	0.85	10.25	51%	15,764
35%	23.63	20.13	14.09	10.00	0.71	13.63	58%	15,764
30%	27.00	23.50	16.45	10.00	0.61	17.00	63%	15,764
25%	33.75	30.25	21.18	10.00	0.47	23.75	70%	15,764
20%	40.50	37.00	25.90	10.00	0.39	30.50	75%	15,764
15%	51.75	48.25	33.78	10.00	0.30	41.75	81%	15,764
10%	63.00	59.50	41.65	10.00	0.24	53.00	84%	15,764
5%	87.75	84.25	58.98	10.00	0.17	77.75	89%	15,764
							Average annual abstraction (m^3)	199,131

Application Summary Information

Measurements:

Abstraction Point (main intake): SN 76512 21969
Abstraction Point (Feeding intake): SN 76628 22209
Existing Height for main intake: 296.000m AOD
Existing Height for feeding intake: 296.000m AOD
Discharge Point: SN 76006 22175
Depleted Reach: 670m
Gross Head: 57m
Net Head: 54.0m
Gradient: 11.5%

Hydrology:

Q10: 103.0 l/s
Qmean: 43.0 l/s
Q95: 5.4 l/s
Catchment Upstream (of abstraction point): 0.69 km^2

Zone Applied for:

Zone 3 – Q95 HOF and 70/30% split