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Company Registration Number 7417466
MCS Hydro Transition Installer 123

Geomorphological Stage 1 Photo Survey - Version 1 (Date: 16th October 2021)
Applicant's Name: Stephen Cochrane
Site Name: Glandwr Mill
Site Address: Glandwr Mill, Barmouth, LL42 1TG
Watercourse Name: Afon Dwynant

All photo location numbers refer to the numbers highlighted yellow on the attached site plan.

Key points:

1. The hydropower scheme proposed is 9kW and will produce an estimated 57,000 kWh (units) of electricity per year sufficient for 15 average UK homes (appliances only, not space heating) and 16 tonnes of carbon dioxide savings annually.

2. There is a disused hydropower scheme at the site. The intention is to renovate it. The stone weir is in good repair and only requires minor modifications so that the abstraction can be controlled in accordance to NRW guidelines. The existing Gilkes Francis turbine is supplied by a leat, linked to this stone weir, and by a plastic penstock (pipe). The turbine needs renovating and the leat wall needs repair.

3. Intake Grid Reference: SH 63384 17585
4. Intake coanda weir crest elevation: 21.993mAOD
5. Power House Grid Reference: SH 63458 17451
6. Power House floor elevation : 6.389mAOD
7. Outfall Grid Reference: SH 63459 17451
8. Mean river water level at outfall: 4.9mAOD

9. Catchment Area and Watercourse Flow
    a. Catchment Area: 10.753 square kilometres
    b. Annual Rainfall: 1703mm
    c. Annual Runoff: 1249mm
    d. Average Daily Flow (ADF): 426 litres per second
    e. Length of depleted reach: 160 metres
    f. Gross Head: Coanda Crest to Water Level at Outfall: 17 metres
    g. Average depleted reach gradient 11%

10. Flow Rates & Abstraction Regime
    a. Gross Head: Leat Water Level to Turbine Runner Shaft 13.59 metres
    b. Net Head 12.90 metres

c.	Design Flow (Max Turbine Flow):	90 litres per second
d.	Minimum Turbine Flow:	5 litres per second
e.	Hands Off Flow (Q95):	42 litres per second
f.	Abstraction Regime Above Q95:	70%

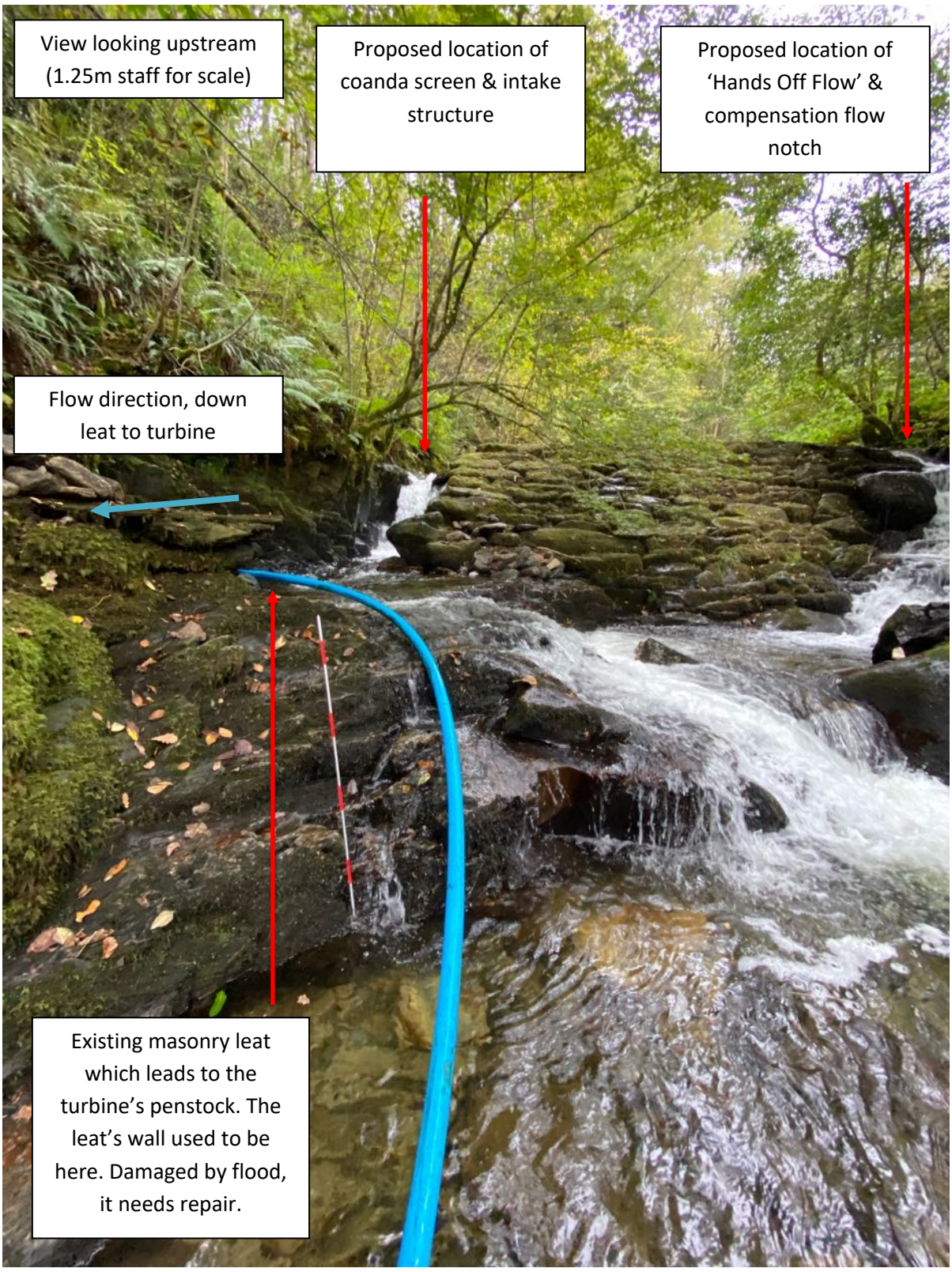
Effect of abstraction on Flow Regime:

% Exceedance Probability	Flow upstream of abstraction [l/s]	Abstraction [l/s]	Abstraction as percentage of upstream flow	Residual flow downstream of weir [l/s]	Residual flow as percentage of upstream flow
5%	1359	90.0	6.6%	1269	93.4%
10%	973	90.0	9.2%	883	90.8%
15%	807	90.0	11.2%	717	88.8%
20%	640	90.0	14.1%	550	85.9%
25%	550	90.0	16.4%	460	83.6%
30%	459	90.0	19.6%	369	80.4%
35%	398	90.0	22.6%	308	77.4%
40%	336	90.0	26.8%	246	73.2%
45%	295	90.0	30.5%	205	69.5%
50%	254	90.0	35.4%	164	64.6%
55%	224	90.0	40.3%	134	59.7%
60%	193	90.0	46.6%	103	53.4%
65%	167	87.5	52.4%	80	47.6%
70%	141	69.3	49.1%	72	50.9%
75%	119	53.9	45.3%	65	54.7%
80%	97	38.5	39.7%	59	60.3%
85%	78	24.9	32.1%	53	67.9%
90%	58	11.2	19.3%	47	80.7%
95%	42	0.0	0.0%	42	100.0%
100%	22	0.0	0.0%	22	100.0%

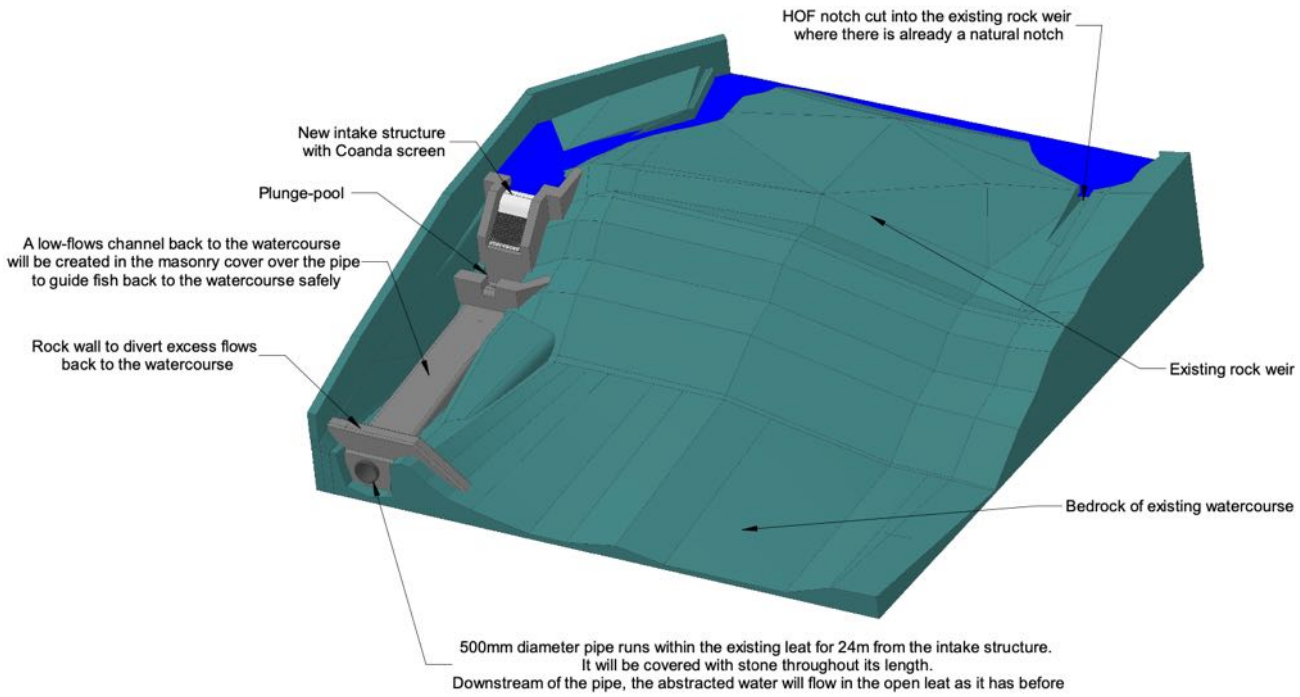
Structures in or near the watercourse

Intake site: (Location 8) NGR : SH 63384 17585

A stone weir exists at the intake site, as shown in the photos and drawings below:

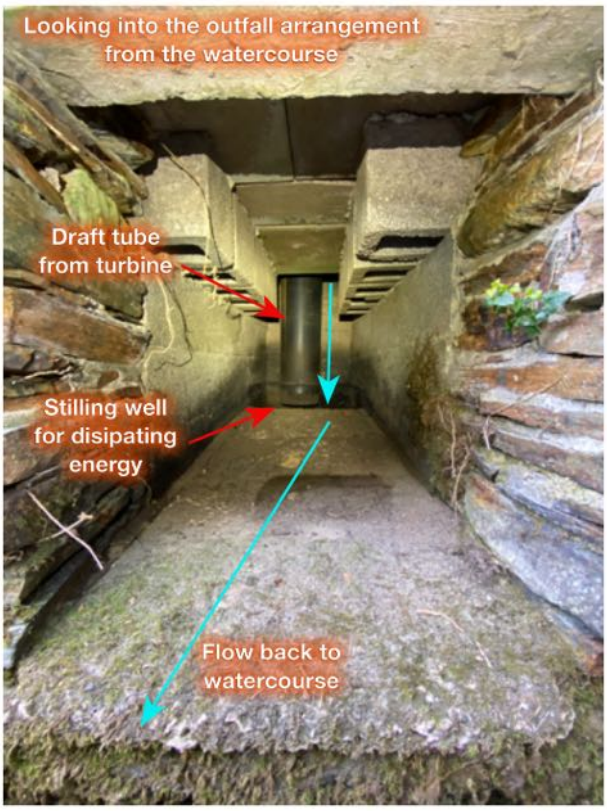


Please see attached drawings 21072701 to 21072705 for details of the bed profile at the intake site and for detailed construction drawings of the proposed modifications. The image below shows a summary of the proposed modifications:



Structures in or near the watercourse (continued)

Outfall site: (Location 15) NGR : SH 63459 17451

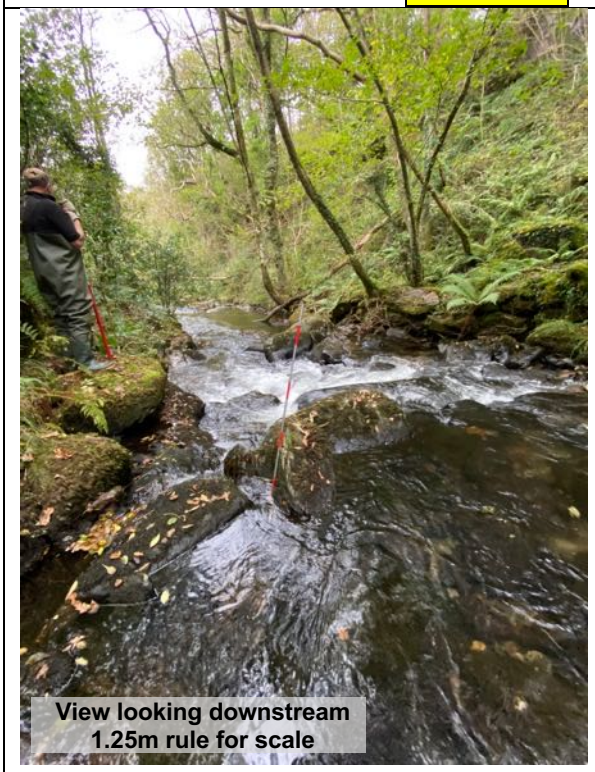


- No modifications to the outfall are proposed
- Energy from the water exiting the turbine is dissipated by means of a stilling well prior to its discharge to the watercourse
- No screen is proposed due to the fact that the draft tube protects against fish entering the turbine. In addition, the 0.5m vertical drop to the watercourse acts as a barrier.
- The discharge is onto loose boulders under which lies bedrock. There are no signs of erosion damage from the previous use of the turbine.

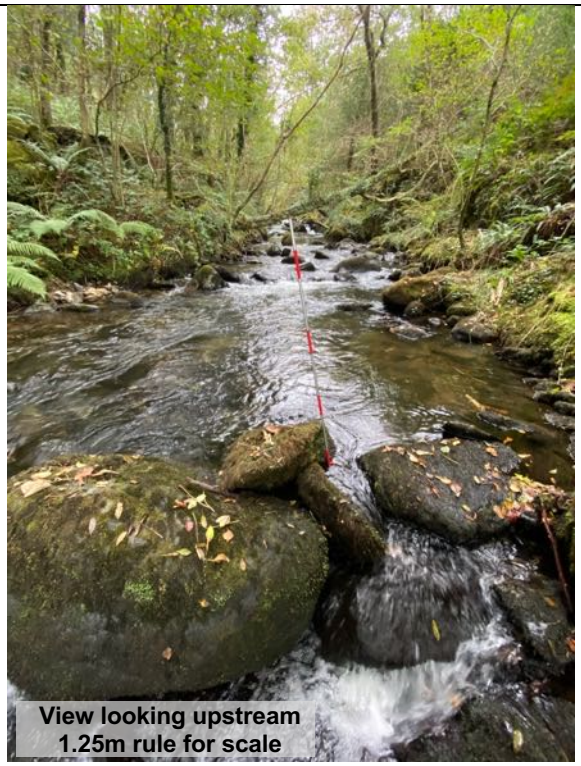
Structures in or near the watercourse (continued)
Leat – runs for 110m from the stone weir to the penstock which supplies the turbine

Photos From Upstream of the Depleted Reach

Location 1 NGR : SH 63570 17992



View looking downstream
1.25m rule for scale

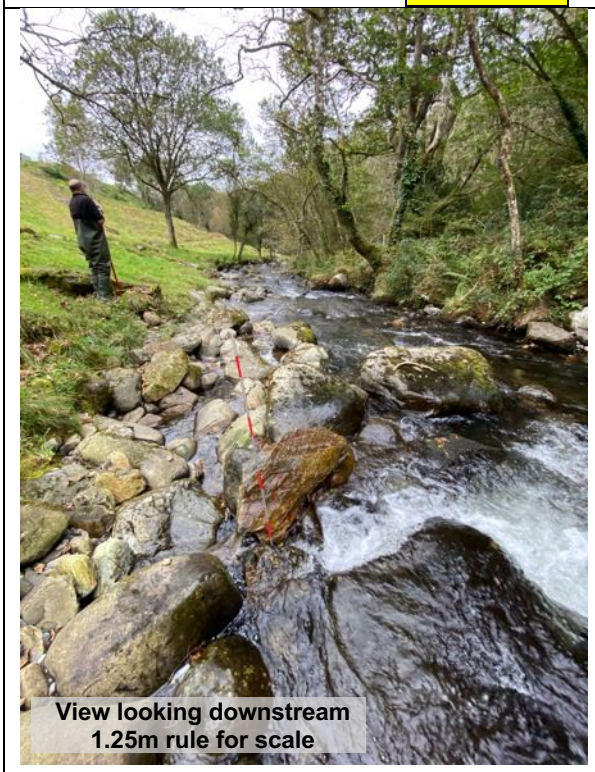


View looking upstream
1.25m rule for scale

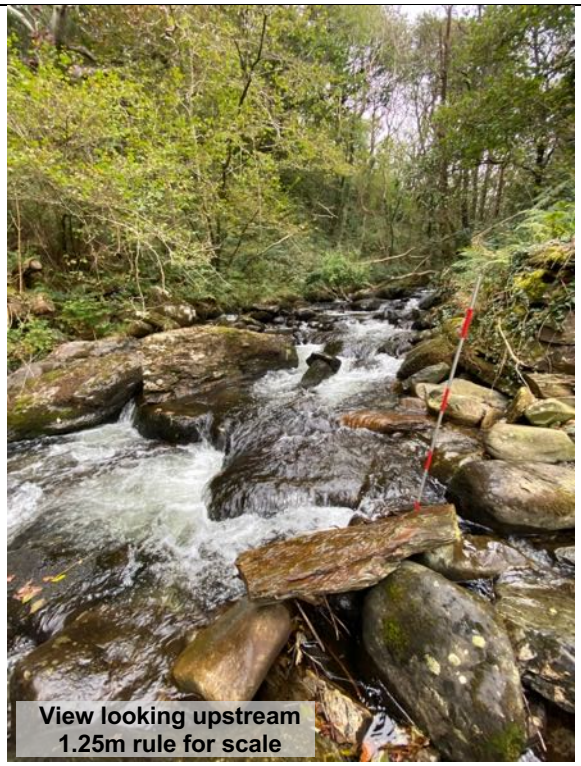
Bed Material
100mm pen for scale

Photos From Upstream of the Depleted Reach (continued)

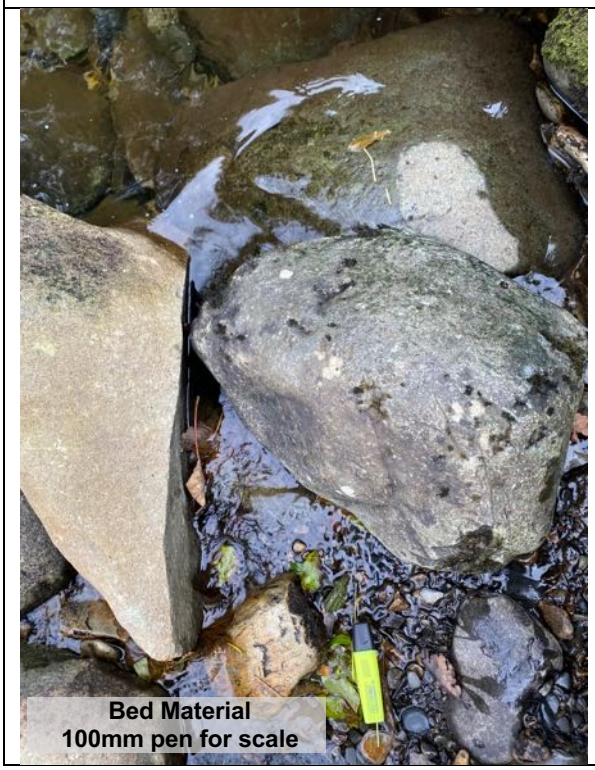
Location 2 NGR : SH 63537 17954



View looking downstream
1.25m rule for scale



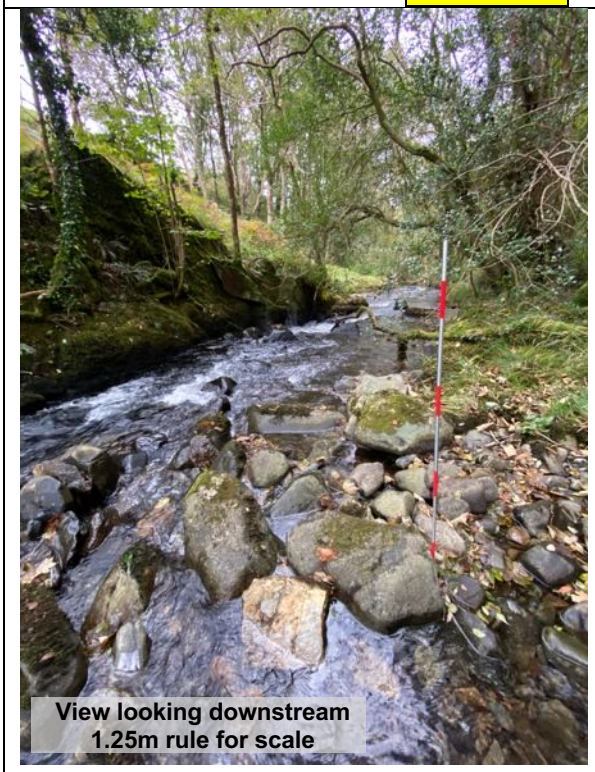
View looking upstream
1.25m rule for scale



Bed Material
100mm pen for scale

Photos From Upstream of the Depleted Reach (continued)

Location 3 NGR : SH 63486 17871



View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

Bed Material
100mm pen for scale

Photos From Upstream of the Depleted Reach (continued)

Location 4 NGR : SH 63436 17773

View looking downstream
1.25m rule for scale

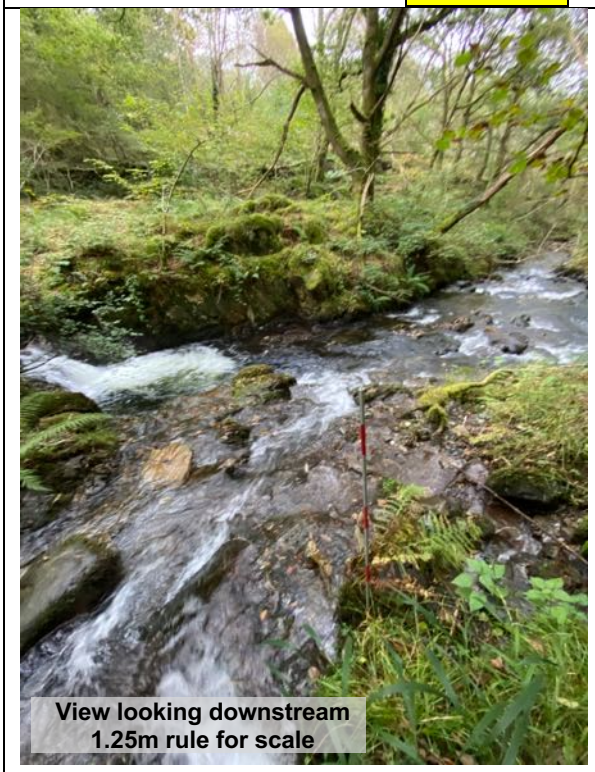
View looking upstream
1.25m rule for scale

Bed Material
100mm pen for scale

800mm deep pool
1.25m rule for scale

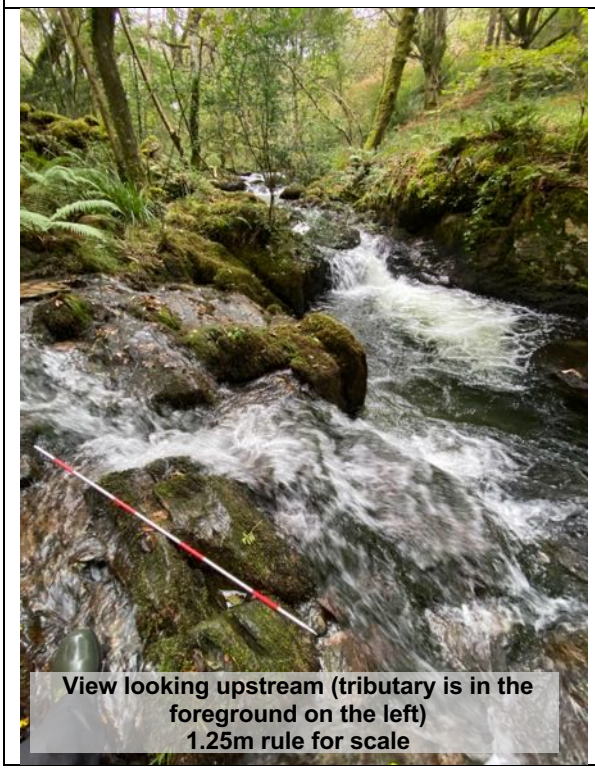
Photos From Upstream of the Depleted Reach (continued)

Location 5 NGR : SH 63413 17750



View looking downstream
1.25m rule for scale

View looking up the tributary
1.25m rule for scale



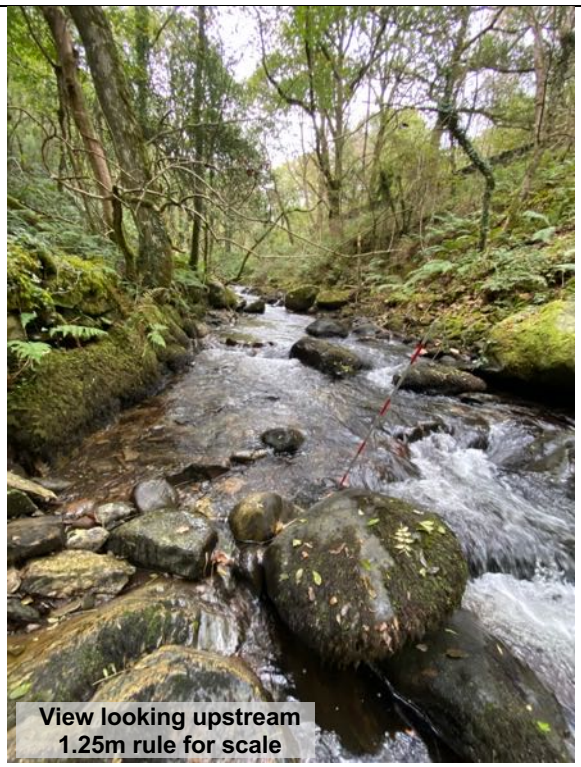
View looking upstream (tributary is in the foreground on the left)
1.25m rule for scale

Bed Material
100mm pen for scale

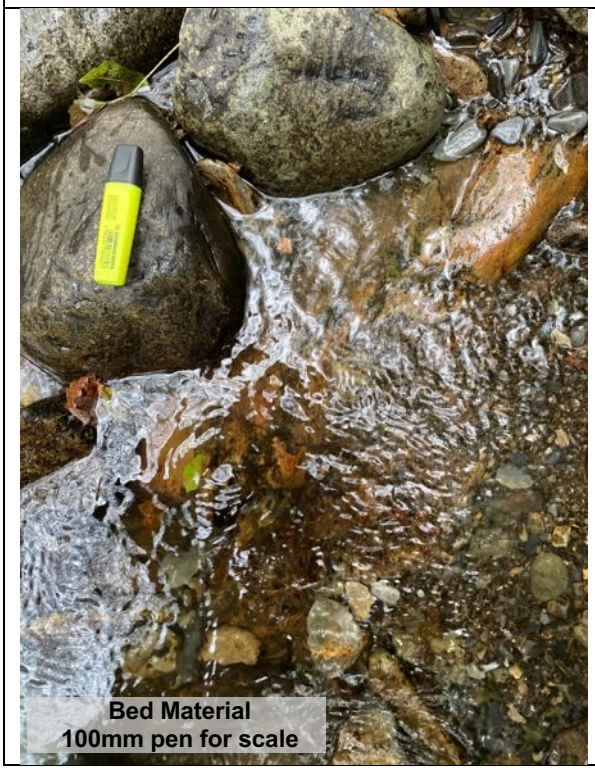
Photos From Upstream of the Depleted Reach (continued)

Location 6 NGR : SH 63403 17684

View looking downstream
1.25m rule for scale



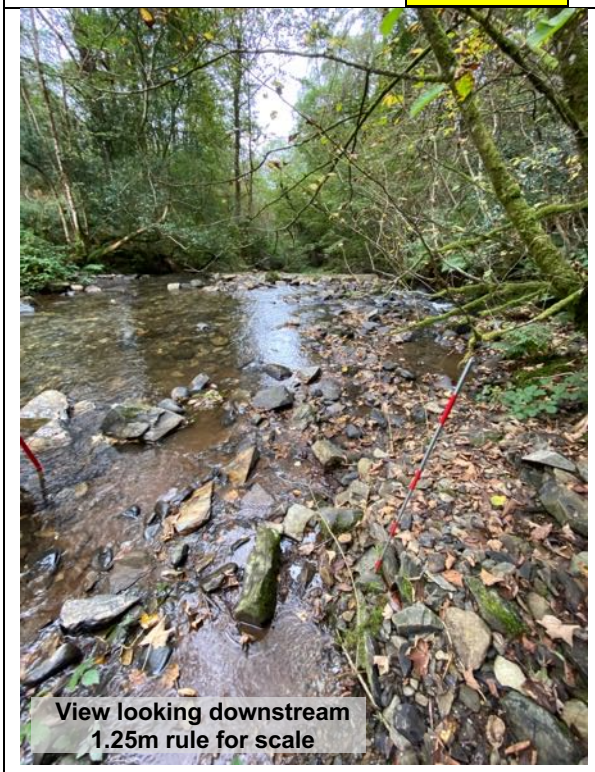
View looking upstream
1.25m rule for scale



Bed Material
100mm pen for scale

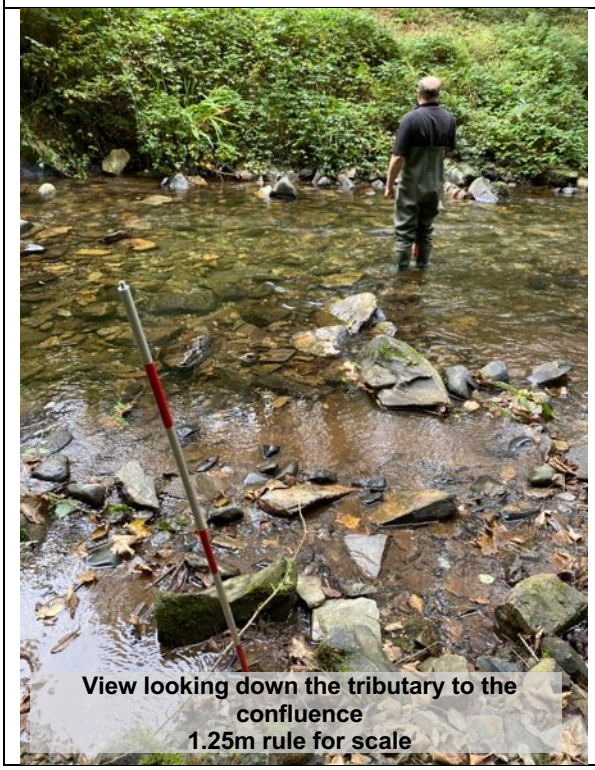
Photos From Upstream of the Depleted Reach (continued)

Location 7 NGR : SH 63383 17602



View looking downstream
1.25m rule for scale

View looking up the tributary
1.25m rule for scale

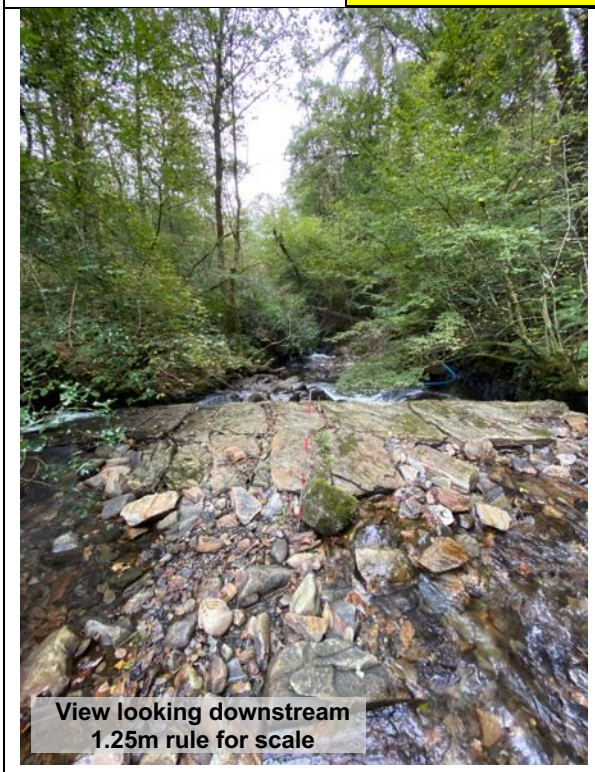


View looking down the tributary to the confluence
1.25m rule for scale

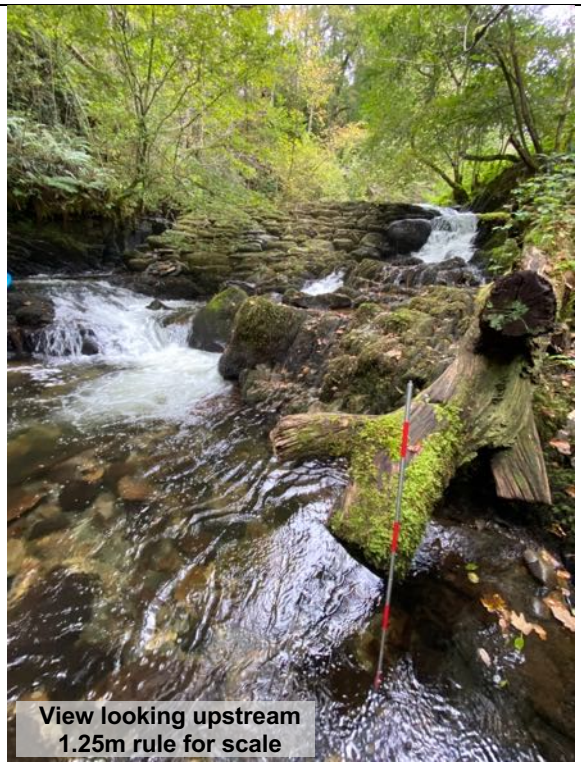
Bed Material
100mm pen for scale

Photos From the Depleted Reach

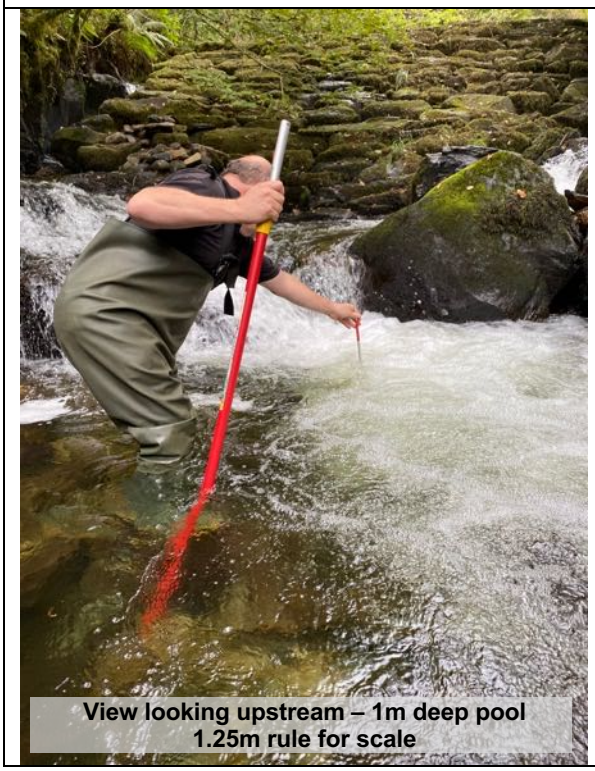
Location 8 - Intake NGR : SH 63384 17585



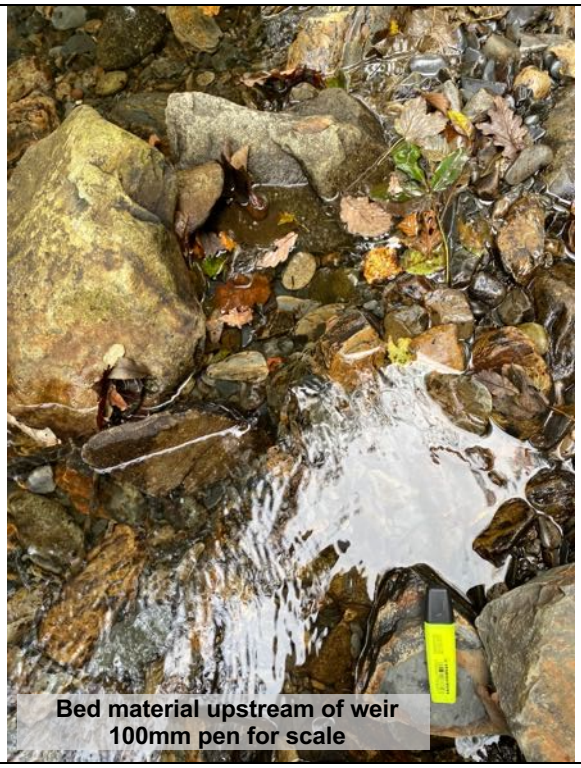
View looking downstream
1.25m rule for scale



View looking upstream
1.25m rule for scale



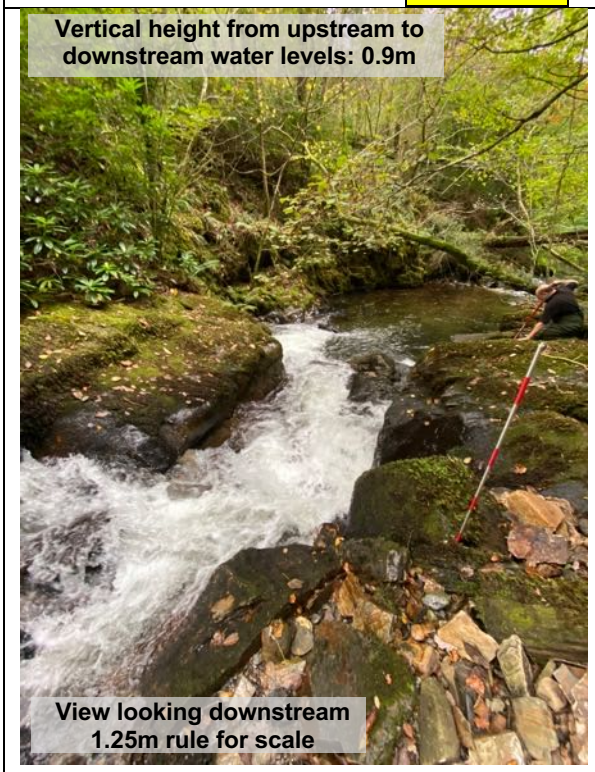
View looking upstream – 1m deep pool
1.25m rule for scale

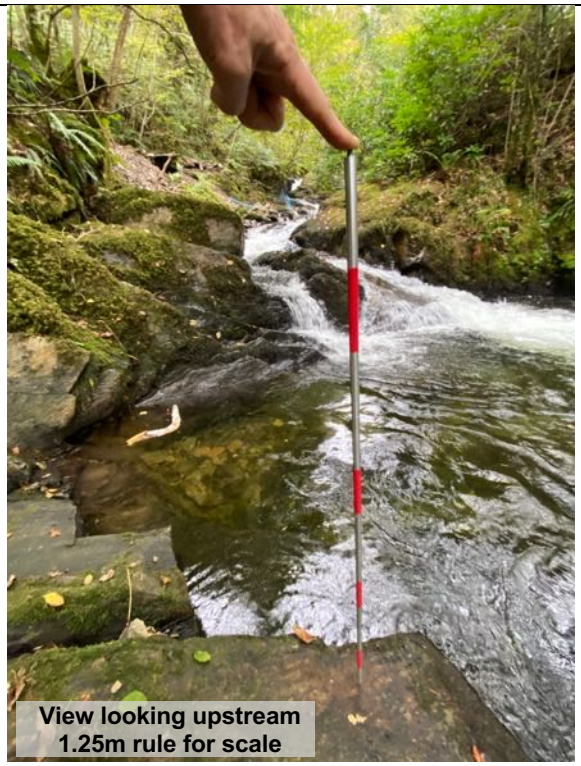


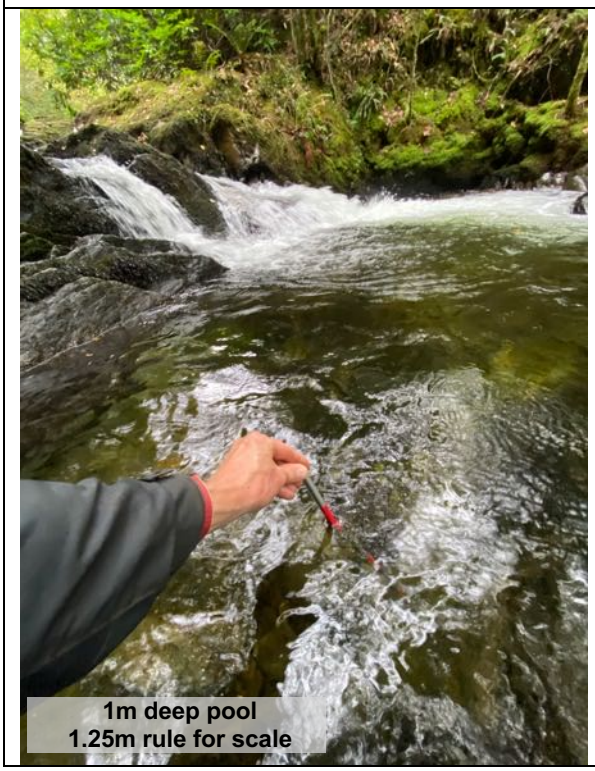
Bed material upstream of weir
100mm pen for scale

Photos From the Depleted Reach (continued)

Location 9 NGR : SH 63398 17575

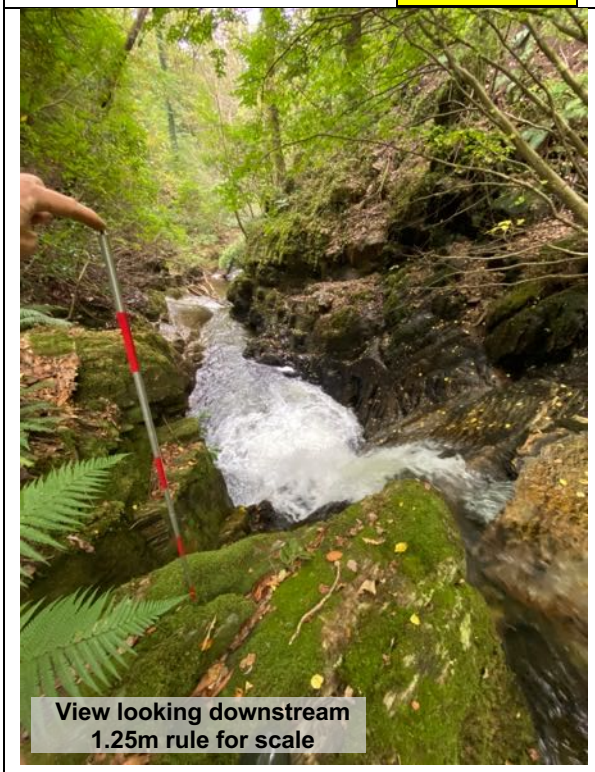






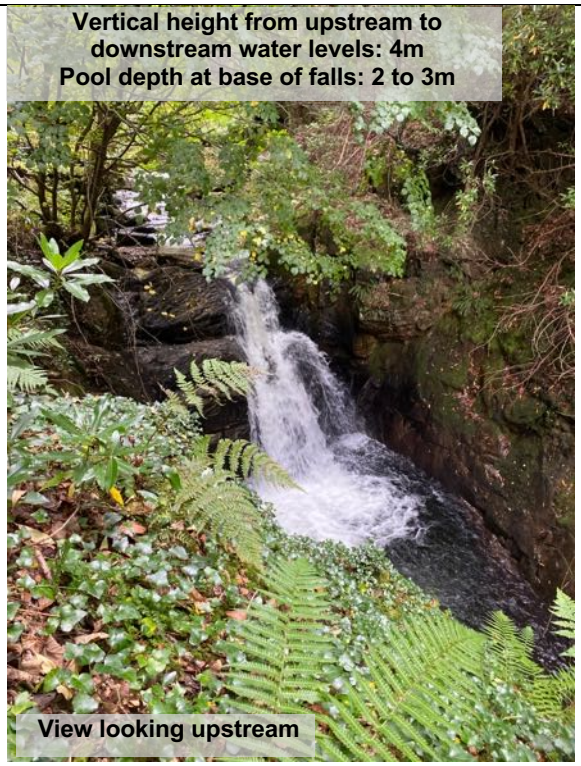
Photos From the Depleted Reach (continued)

Location 10 NGR : SH 63418 17553



View looking downstream
1.25m rule for scale

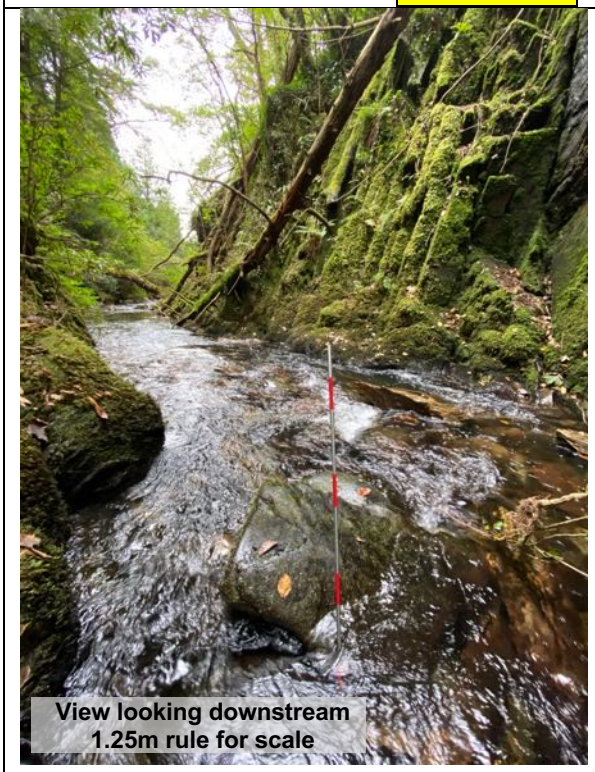
Vertical height from upstream to downstream water levels: 4m
Pool depth at base of falls: 2 to 3m



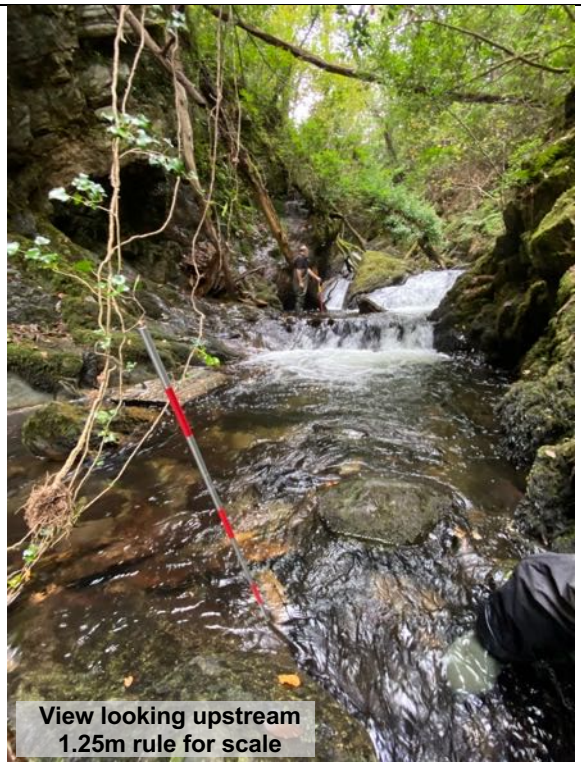
View looking upstream

Photos From the Depleted Reach (continued)

Location 11 NGR : SH 63433 17534



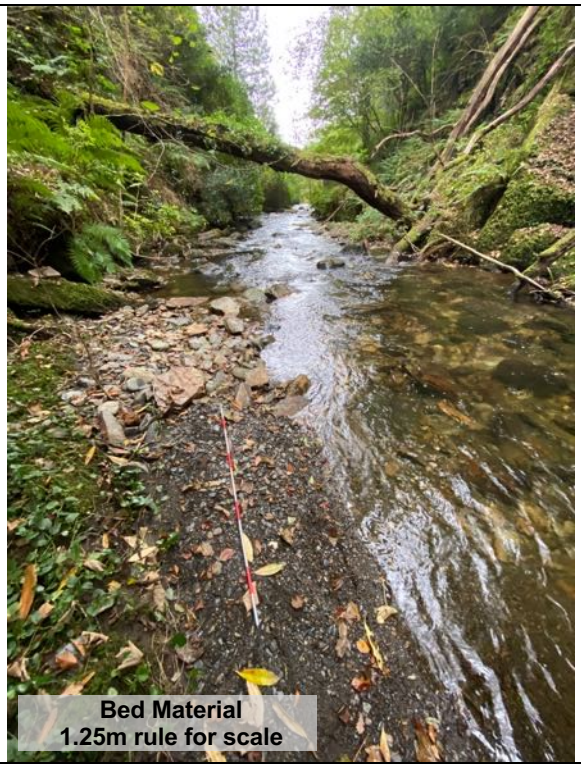
View looking downstream
1.25m rule for scale



View looking upstream
1.25m rule for scale

Total of 2m drop down the two falls in the foreground. In the background there's another fall of about 2.5m

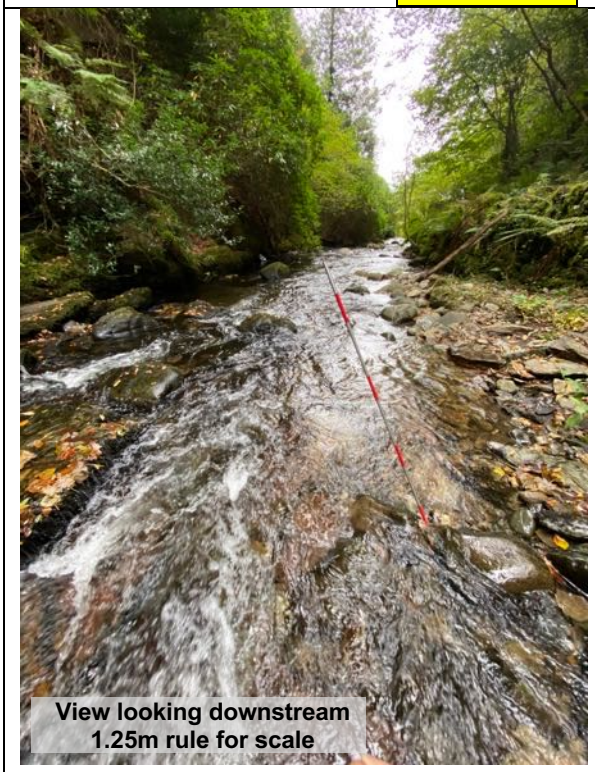
1m deep pool



Bed Material
1.25m rule for scale

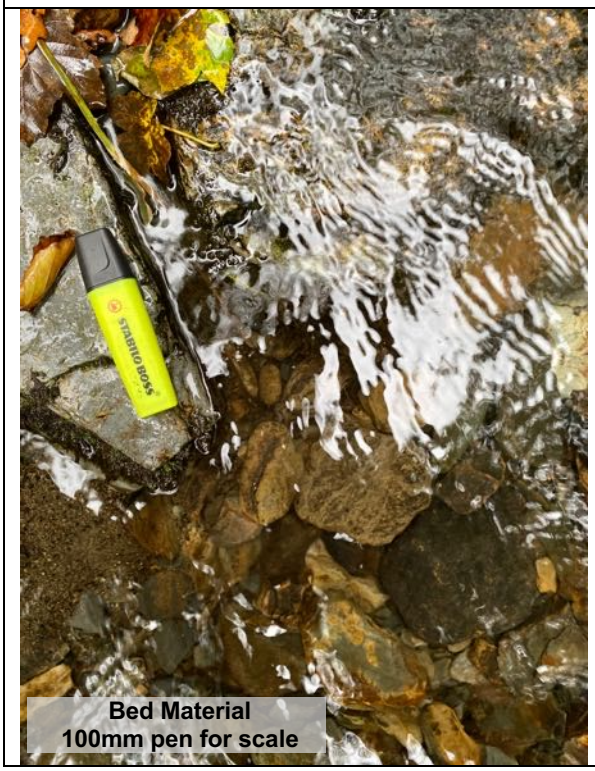
Photos From the Depleted Reach (continued)

Location 12 NGR : SH 63447 17504



View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale



Bed Material
100mm pen for scale

Photos From the Depleted Reach (continued)

Location 13 NGR : SH 63459 17475

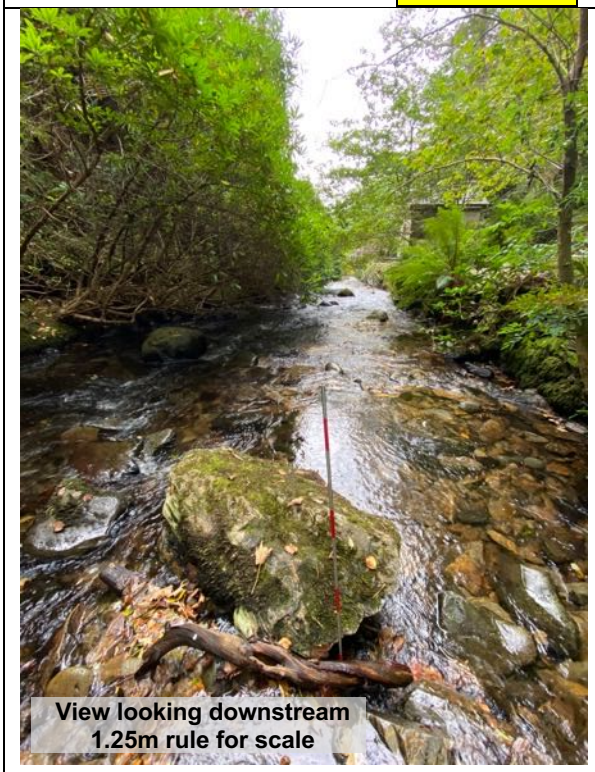
View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

Bed Material
100mm pen for scale

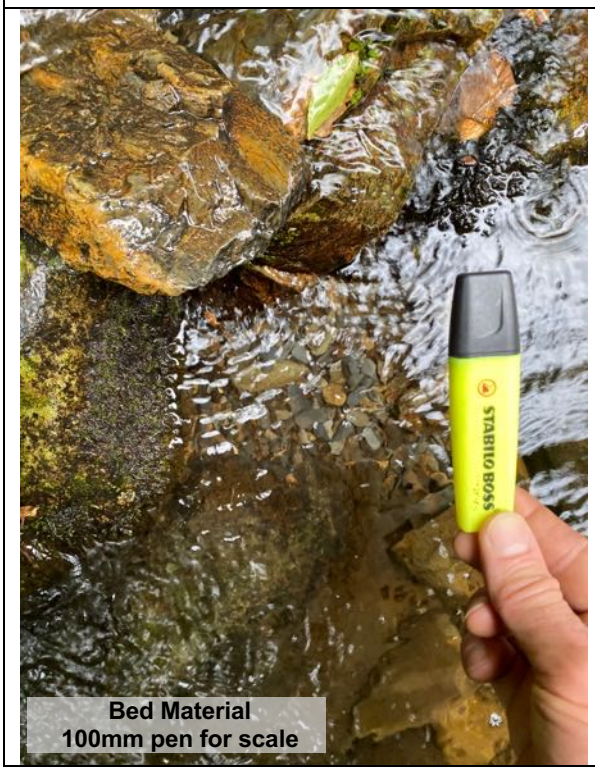
Photos From the Depleted Reach (continued)

Location 14 NGR : SH 63462 17461



View looking downstream
1.25m rule for scale

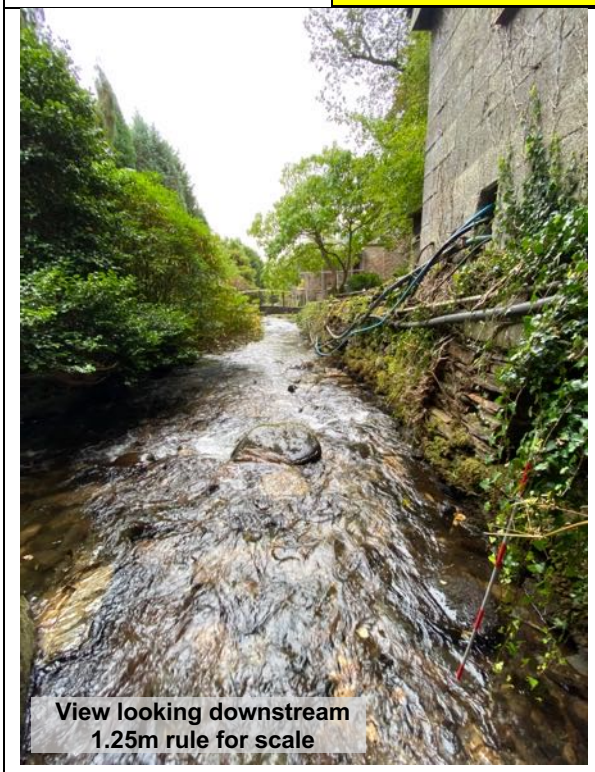
View looking upstream
1.25m rule for scale



Bed Material
100mm pen for scale

Photos From the Depleted Reach (continued)

Location 15 - Outfall NGR : SH 63459 17451



View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

Bed Material
100mm pen for scale

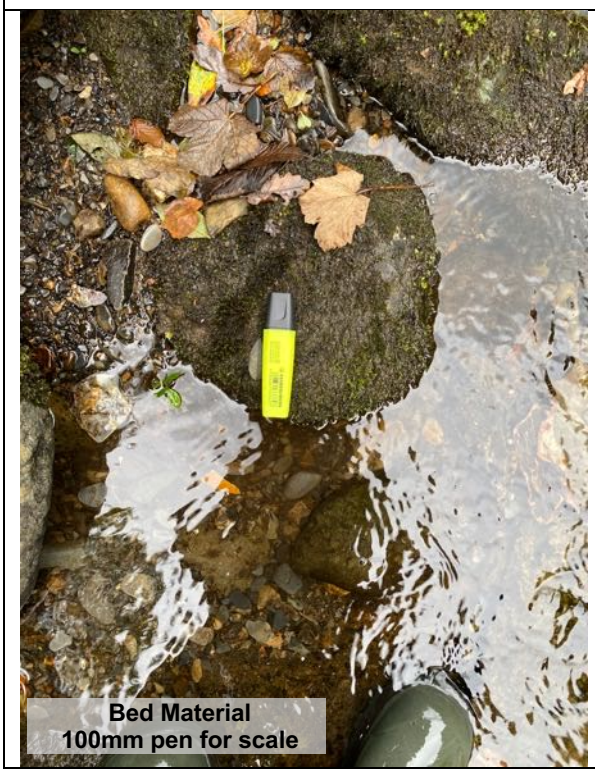
1.25m rule for scale

Photos From Downstream of the Depleted Reach

Location 16 NGR : SH 63471 17403

View looking downstream
1.25m rule for scale

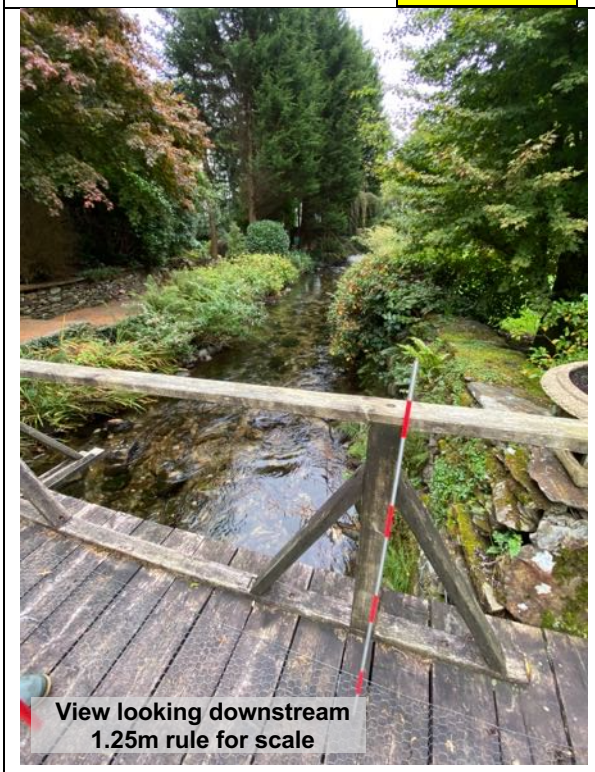
View looking upstream
1.25m rule for scale



Bed Material
100mm pen for scale

Photos From Downstream of the Depleted Reach (continued)

Location 17 NGR : SH 63478 17384

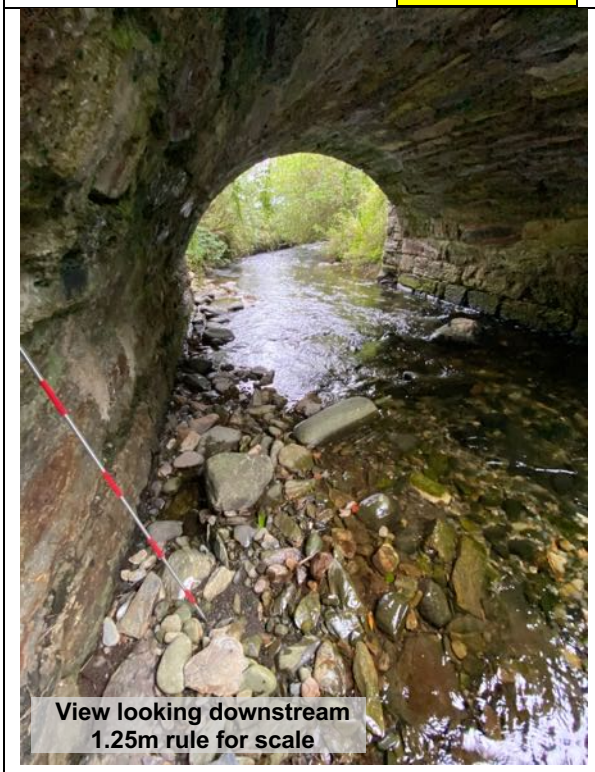


View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

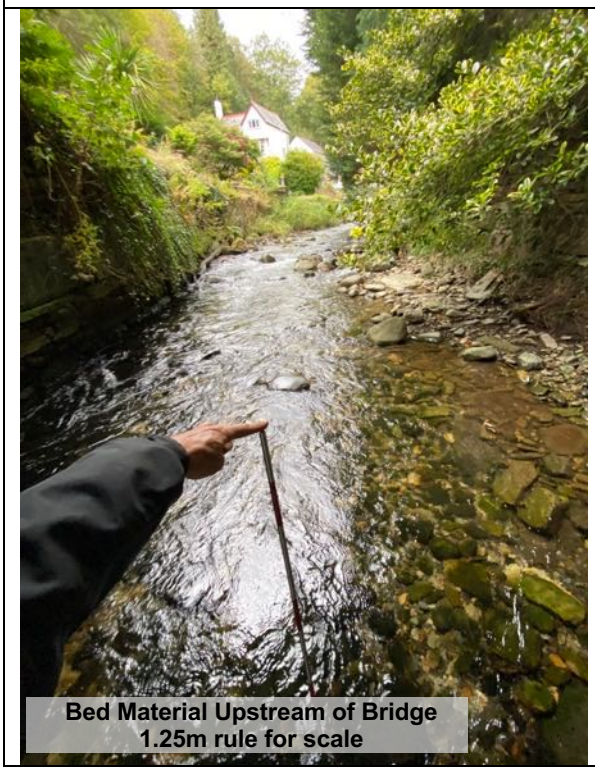
Photos From Downstream of the Depleted Reach (continued)

Location 18 NGR : SH 63495 17325



View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale



Bed Material Upstream of Bridge
1.25m rule for scale

Bed Material Downstream of Bridge
100mm pen for scale

Photos From Downstream of the Depleted Reach (continued)

Location 19 NGR : SH 63500 17268

View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

Bed Material Upstream of Bridge
100mm pen for scale

Bed Material Downstream of Bridge
1.25m rule for scale

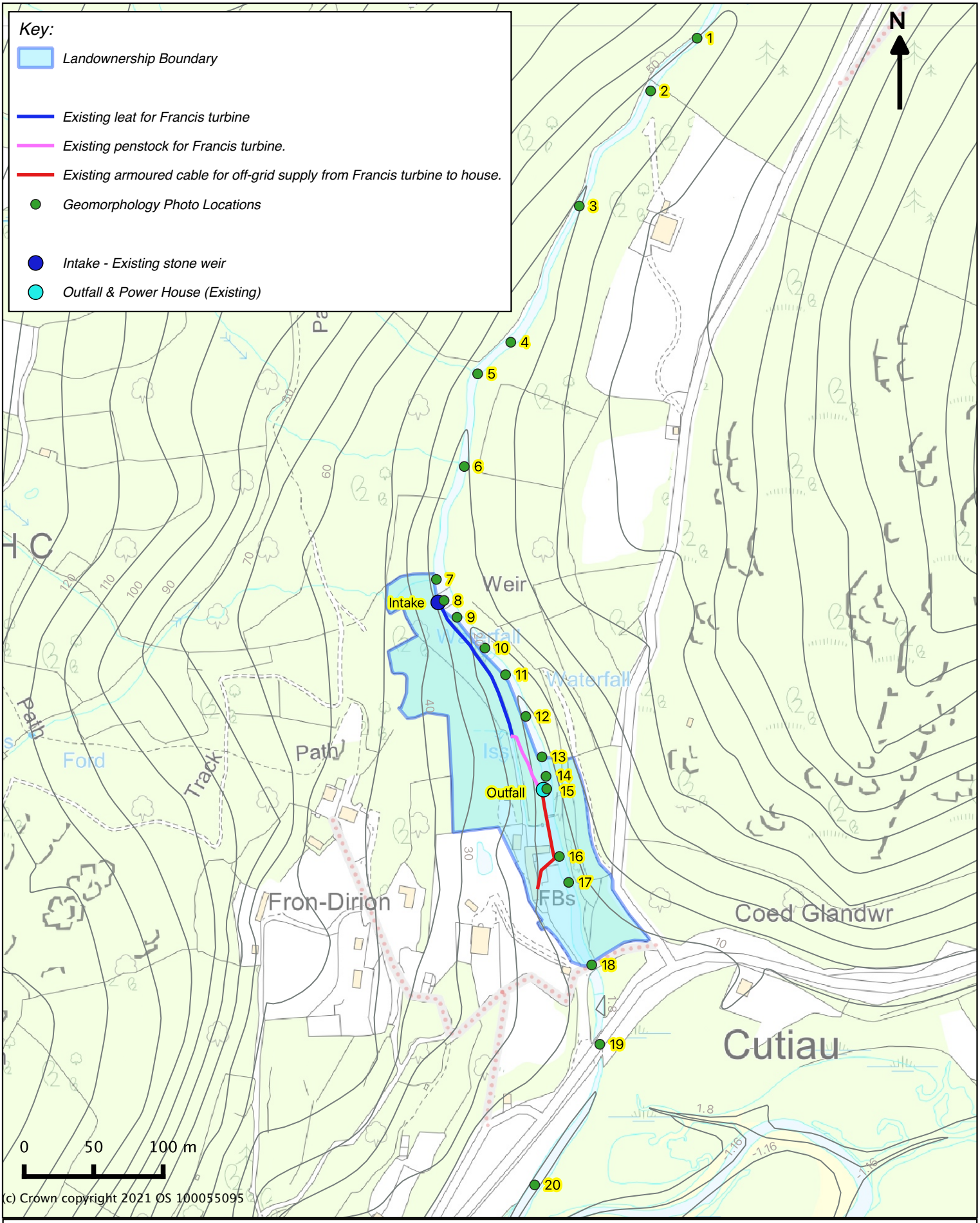
Photos From Downstream of the Depleted Reach (continued)

Location 20 NGR : SH 63454 17167

View looking downstream
1.25m rule for scale

View looking upstream
1.25m rule for scale

Bed Material
100mm pen for scale



Client: Stephen Cochrane
Installation Address: Glandwr Mill, Barmouth, LL42 1TG
Drawing Title: Geomorphology Photo Locations
Drawn By: LMB
Date: 17th October 2021
Scale @ A4: 1:3,500
Dwg No: 211017LB01
Version: 1

Greenearth Hydro

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