Moanmore Proposed Wind Farm

Baseline Aquatic Ecology

Produced by

AQUAFACT (APEM Group)

For

Greensource

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Table of Contents

List of Figures

List of Tables

Appendices

1. Introduction

AQUAFACT was contracted by Greensource to carry out a baseline aquatic survey for the Proposed Moanmore Wind Farm. Moanmore proposed wind farm is a 3-turbine wind farm to be located approximately 5 km northwest of the village of Kilrush, Co. Clare. The proposed wind farm is not within or bordering any Natura 2000 sites. Additionally, the Proposed Site is not within or bordering any Natural Heritage Areas (NHAs) or Proposed Natural Heritage Areas (pNHAs). The closest proposed Natural Heritage Area to the site is Poulnasherry Bay, located approximately 3km west of the site. The closest Natura 2000 sites are the Lower River Shannon SAC (site code: 00216) and the River Shannon and River Fergus Estuaries SPA (site code: 004007) which are approximately 2 km west of the wind farm at the closest point. There is ecological connectivity between these Natura sites and Moanmore wind farm via the Moyasta river. By river the SAC is approximately 2 km downstream of the proposed site. Three river locations were chosen to survey, two downstream and one upstream of the proposed site.

2. Methodology

Surveys of watercourses at, and within a potential Zone Of Influence of the proposed Development were undertaken on the 22nd of July 2022 and the 12th of October 2022 for the proposed wind farm Site, and on the 8th of November 2022 for the proposed Grid Connection. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The Autumn sampling event was limited due to flood conditions, whole sampling in the summer period was limited through dry river conditions. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003, Updated in 2022*' (Environment Agency, 2022), *Guidelines for Ecological Impact Assessment in the UK and Ireland*' (Chartered Institute of Ecology and Environmental Management, 2018 (Updated in 2022)) and the Irish Heritage Council's *'A Guide to Habitats in Ireland*' 2nd Edition (Fossitt, 2024). The EPA Biotic Index Biological River Quality Classification System (Q-value) (Toner *et al.,* 2005) has been used to monitor the ecological quality of streams and rivers in Ireland since 1971.

2.1. Kick sampling

Three locations were chosen for kick sampling (See Figure 2.1 and Table 2.1). The two-minute kick and one minute stone wash sampling method was employed to collect samples of macroinvertebrates for

analysis. This involved placing a standard hand net of pore size 500µm in the river facing upstream and disturbing the riverbed in front of the net mouth. The surveyor then moved in a diagonal direction upstream to ensure that different micro-habitats were included in the sample. Where present micro-habitats to survey include riffles, glides, and slow flows as well as net sweepings of marginal weed. The kick method dislodges macroinvertebrates from the substrates and submerged plant material. This was continued for approximately two minutes and followed by one minute of stone washing. Stone washing will sample the macroinvertebrates that may be epifaunal on stones at the site. The resulting sample was transferred from the net to a plastic bucket and fixed using a 70% ethanol solution

Once a sample station was surveyed all field equipment including nets, protective clothing and footwear was examined and picked free of organisms or debris and thoroughly cleaned and disinfected to ensure that no cross-contamination with invasive species or pathogens occurs. The equipment was also re-examined prior to use at the next sampling site. The IFI (2010)[1] Biosecurity protocol for field survey work was followed at all times.

The samples were then transported to the AQUAFACT laboratories where the macroinvertebrates were removed and identified using stereoscopic microscopes and the appropriate keys by a qualified freshwater taxonomist. The resulting species list was then used to assign a Biotic Index value (Q-Value) to the sampled streams.

[1]https://www.fisheriesireland.ie/sites/default/files/2021-06/research_biosecurity_biosecurity_for_fieldsurveys_2010.pdf

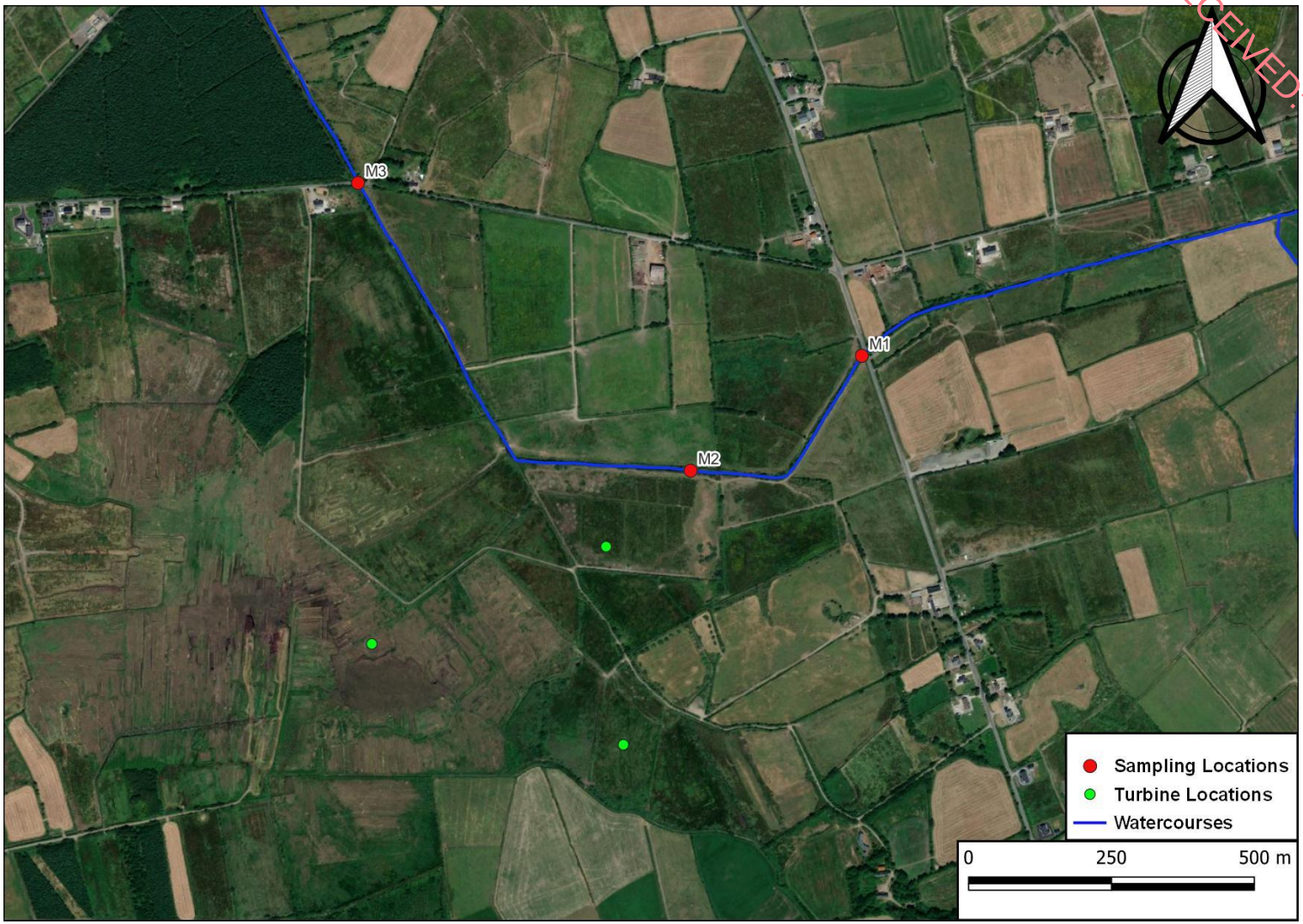


Figure 2.1: Moanmore survey locations and proposed turbine locations.

Table 2.1: Survey Location coordinates.

Station	Latitude	Longitude
M1	52.66741	-9.50407
M2	52.66556	-9.50927
M3	52.67005	-9.51721

2.2. The Biological River Classification System (Q-Scheme)

The Biological River Quality Classification System (Q-Scheme) has been in use in Ireland since 1971. It has undergone a number of modifications since then and has been included in the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998. It is routinely employed by the EPA. For the purpose of this assessment, benthic invertebrates have been divided into five indicator groups according to tolerance of pollution, particularly organic pollution.

In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results. The Biotic Index is a quality measurement for freshwater bodies that range from Q1 – Q5 with Q1 being of poorest quality and Q5 being pristine/unpolluted (see Table 2.2).

Table 2.2: Biotic Index scoring system for the Q-Scheme (Toner *et al*., 2005).

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	Unpolluted	Class A
Q3-4,	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

2.3. Water Sampling

Water sampling was carried out at all survey locations. Physicochemical data including temperature, dissolved oxygen, pH and turbidity were recoded using a YSI EXO2 probe. Water samples were also taken and tested for BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), suspended solids, Total Nitrogen, Nitrate, Nitrite, Phosphate and TPH (Total Petroleum Hydrocarbons). Samples were delivered to Complete Laboratory Solution (CLS) in Galway within 24hrs of sampling.

2.4. Walkover Survey

A walkover survey was carried out at all survey locations. The aim of the walkover survey was to identify the general habitats in the area, along with any sensitive or invasive species that may be present. Images were taken upstream and downstream of the river and any notable species were recorded. The suitability of the habitats for protected species such as white-clawed crayfish, Lamprey, Freshwater Pearl mussel and salmonids was considered.

3. Results

3.1. Macroinvertebrate Assessment

A list of all identified macroinvertebrate taxa is included in Appendix 1. Station M1 and M2 both increased in Q-value between the summer and autumn sampling events, increasing from moderately polluted (Q3) slightly polluted (Q3-4). Station M3 scored Q3 in both July and October. There were significant differences in the abundance and number of taxa captured between sampling events, with generally greater species richness observed in the October samples.

Table 3.1: Biological sampling results.

Location	Q-value July	Q-value October	Latest EPA Q Value
M1	Q3	Q3-4	Q3 (1991)
M2	Q3	Q3-4	N/A
M3	Q3	Q3	N/A

3.2. Water Sampling

The regulation parameters for surface waters and salmonid waters are presented in Table 3.2. Water sampling result from July 2022 are presented in Table 3.3 and results from October 2022 are presented in Table 3.4. The stream at M1 and M2 failed to meet water regulations for nitrates in summer (>0.14 mg/l). In autumn all three stations had elevated levels of nitrates compared to summer and were above regulations for surface waters in Ireland. The water chemistry results for salmonid waters were good at the 3 stations during July, while M3 had above regulation levels of suspended solids (34 mg/l) for salmonid waters in October.

Table 3.2: Regulation parameters for surface waters and salmonid waters.

Test	Unit	Surface water regulations 2009		Salmonid waters
BOD	mg/l	High </= 2.2	Good </= 2.6	</= 5
Suspended solids	mg/l			</= 25
Nitrate as N	mg/l	High </= 0.09	Good 0.14	
Nitrite as NO2	mg/l			</= 0.05
Phosphate as P filtered (low level SW or saline)	mg/l	High </= 0.045	Good </= 0.075	

Table 3.3: Water chemistry results from July 2022 sampling event.

Test	Units	M1	M2	M3
Dissolved Oxygen	%	98.6	100	106.1
Dissolved Oxygen	mg/l	10.02	10.08	8.09
Temperature	˚C	14.79	15.16	15.38
pH		8.3	7.69	8.09
Turbidity	NTU	15.4	9.2	13
BOD	mg/l	2	<2	1
Suspended Solids	mg/l	5	7	<2
COD	mg/l	39	39	38
Total Nitrogen as N	mg/l	0.631	0.603	0.593
Nitrate as NO3 (Ammonia)	mg/l	0.669	0.659	0.593
Nitrate as N	mg/l	0.151015801	0.148758465	0.133860045
Nitrite as NO2	mg/l	<0.017	<0.017	<0.017
TPH (>C5 - C44) by GC-FID	µg/l	95 **Unknown Pattern	78 **Unknown Pattern	63 **Unknown Pattern
Phosphate as P filtered (low level SW or saline)	mg/l	0.023	0.022	0.023

Table 3.4: Water chemistry results from October 2022 sampling event.

Test	Units	M1	M2	M3
Dissolved Oxygen	%	103.0	102.0	103.0
Dissolved Oxygen	mg/l	9.0	9.2	8.9
Temperature	˚C	12.5	12.8	12.8
pH		7	7.03	6.94
Turbidity	NTU	2.72	4.51	5.62
BOD	mg/l	1	2	2
Suspended Solids	mg/l	4	3	34
COD	mg/l	66	67	73
Total Nitrogen as N	mg/l	1.36	1.32	1.3
Nitrate as NO3 (Ammonia)	mg/l	0.813	0.817	0.733
Nitrate as N (Ammonia)	mg/l	0.183657	0.18456	0.165585
Nitrite as NO2	mg/l	<0.017	<0.017	<0.017
TPH (>C5 - C44) by GC-FID	µg/l	87 **Unknown Pattern	52 **Unknown Pattern	21 **Unknown Pattern
Phosphate as P filtered (low level SW or saline)	mg/l	0.02	0.018	0.017

3.3. Walkover survey

The area surrounding the three sample sites is mainly agricultural land, with peaty soils and some scattered forestry. All three stations were small shallow streams about 3 to 4m wide, with steep thickly vegetated banks. The riverbed at all stations was a mix of cobbles and fine gravel with a moderate level of siltation. There were slightly heavier siltation levels at M3. Siltation was reduced during the autumn sampling event due to the flood conditions but still present. There was a high level of shading at all stations, particularly station M3. The land immediately adjacent to the stream was pasture and cattle had open access at station M1 and M2. Due to the dry conditions water levels and flow in the stream was very low in summer. The discharge and volume of the stream was significantly higher in winter. The water had a slight peaty colour. There was evidence of eutrophication in the river with high abundance of filamentous algae particularly at station M1 during summer.

Despite the presence of moderate levels of siltation and modifications to the Moyasta River where locally it has been straightened and deepened, reducing its overall fisheries value, some instream recovery had occurred locally and several areas provided good quality salmonid nursery, holding and, to a more limited extent, spawning habitat. As discussed in the fisheries assessment Sites M1 and M2 provided better quality nursery and spawning habitat (cobbles and gravels), with site M3 of high value as a holding habitat for migratory and resident adult fish (i.e. deep pool and glide).

Lamprey ammocoetes were recorded at site M2 where localised soft sediment accumulations provided some sub-optimal suitability for larval burial.

As discussed in the fisheries assessment (Appendix 7.3), the Moyasta, along these reaches is prone to spate and relatively high flow rates and are thus not conducive to the deposition of organic-rich soft sediment required by juvenile lamprey. Although present, densities of *Lampetra* sp. are likely low within the Moyasta River given the inherent spate nature of the watercourse.

There was no evidence of otter tracks or spraint at any of the stations during the summer or autumn surveys. All stations are classified as FW2 depositing/lowland rivers under the Fossitt (2000) classification system. FW2 includes all watercourses where fine sediments are deposited on the riverbed. Due to the surrounding land-use, moderate siltation and instream macrophytes it is likely that the stream is experiencing some level of eutrophication.

4. Discussion

During the July sampling event all three stations received a value of Q3, indicating moderate pollution. The Q-score improved at M1 and M2 when sampled again in October, rising to Q3-4, or slightly polluted waters. The stream-bed at M1 and M2 had less siltation than M3, making them more suitable habitats for sensitive macroinvertebrate species. The increase in Q-values could be due to decreasing agricultural pollution in autumn following the cessation of spreading fertiliser (although this may be contradicted by the increased nitrate levels in October), or more favourable conditions for sensitive macroinvertebrate species were brought about by increased precipitation, flow speed, lowering temperatures and reductions in siltation on the streambed

Water chemistry results were similar for all three stations. The water was well oxygenated, had low biological oxygen demand (BOD) and high levels of nitrates. The physicochemical properties of the river water indicate favourable conditions for salmonids. The water was clear and had a peaty colour with low turbidity and low suspended solids in both seasons (with the exception of M3 in October). It is likely that pollution levels fluctuate seasonally, increasing in summer when the stream is sluggish, and the spreading of agricultural fertiliser is high.

SACs and SPAs within a 15km radius of the proposed site include the Tullaher Lough and Bog SAC (site code: 002343), the Lower River Shannon SAC (site code: 00216) and the River Shannon and River Fergus Estuaries SPA (site code: 004007). It is possible that the proposed Development could cause an indirect environmental

impact to these protected sites in the absence of mitigation. The River Shannon in particular shares direct connectivity with the Moyasta River and is approximately 2 km downstream of the nearest Moanmore sample station. In order to protect downstream aquatic receptors and designated areas as outlined, descriptive mitigation measures have been outlined in Chapter 9 Hydrology to avoid and/or minimise any potential adverse effects to water quality in the receiving surface water network. The details on how such measures will be applied (objectives, design considerations, layout) is contained in a Surface Water Management Plan (SWMP) appended to the CEMP (Appendix 2.1).

The SWMP will be distributed and discussed with all parties involved in construction phase (including any sub-contractors) to protect aquatic conservation interests within the study area and the downstream designated sites. Silt control will be a primary concern during construction stage, as silt has been identified as a sediment source for downstream areas. The SWMP sets out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase.

The following guidelines should be adhered to during construction of the proposed development:

- 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2008)
- 'River Crossings and Migratory Fish: Design Guidance' (Scottish Executive, 2000)
- 'Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters' (IFI, 2016)
- 'Control of water pollution from construction sites – Guidance for consultants and contractors' (Masters-Williams et al. 2001)
- 'Control of water pollution from linear construction projects' (Murnane et al. 2006).

5. References

The Irish Heritage Council (Fossitt, 2024) A Guide to Habitats in Ireland' 2nd Edition

P. Toner, J. Bowman, K. Clabby, J. Lucey, M. McGarrigle, C. Concannon, C. Clenaghan, P. Cunningham, J. Delaney, S. O'Boyle, M. MacCárthaigh, M. Craig and R. Quinn (2005) Water Quality in Ireland 2001-2003: Appendix 1. Published by the Environmental Protection Agency, Ireland.

Appendix 1

Taxa List

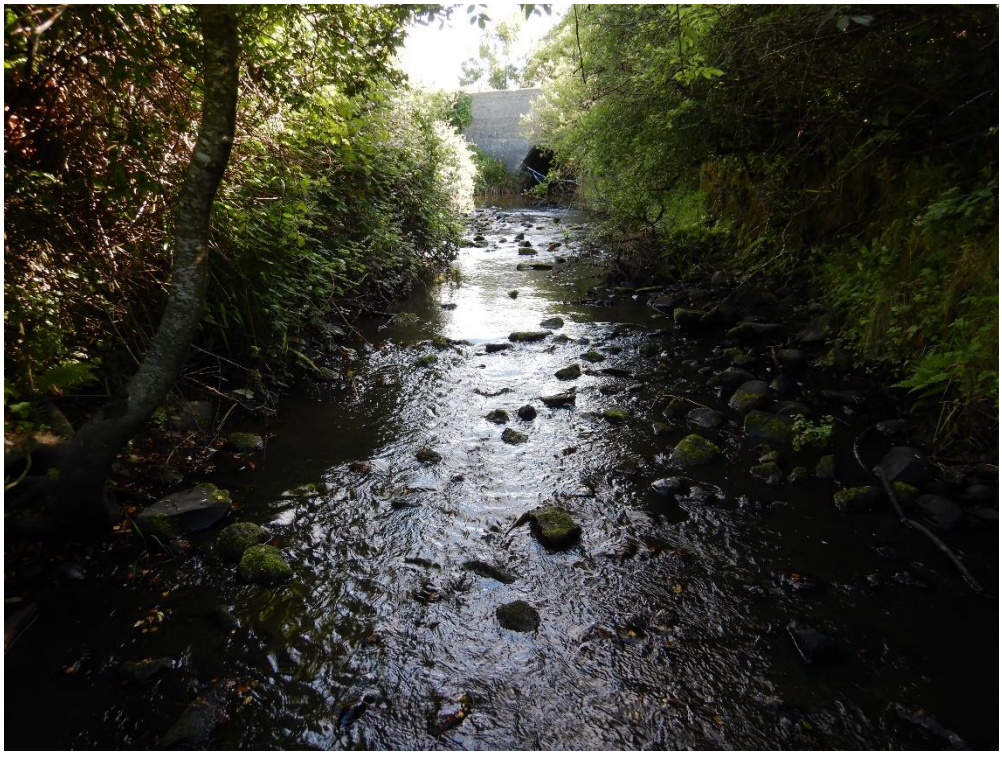
	M1		M2		M3	
Taxa	July	October	July	October	July	October
Ephemeroptera						
Ecdyonurus		10		2		
Baetis rhodanii	10	10	1	4		
Ephmerellidae	4		3		1	
Heptagenia	1					
Rhithrogena				1		
Caenis						1
Plecoptera						
Leuctra sp.	1	9		5	9	
Protonemura sp.	2	8		2		
Trichoptera						
Hydropsyche		29	2	4		
Lepidostomatidae		5		6		4
Agapetus						1
Limnephilidae		3			3	
Silo sp.				3		
Psychomyiidae					1	
Sericostomatidae	1	4		4	1	1
Rhyacophila	1	3	1	1		
Glossosoma		1	2			
Polycentropodidae		7				
Leptoceridae						5
Crustacea						
Gammaridae	34	48	46	52	7	5
Asellus aquaticus	1	10	1	4		2
Diptera						
Chironimidae	16	2		6	2	4
Simuliidae		1		1		9
Ceratopoginidae						10
Pediciidae		26	8	26		
Gastropoda						
Hydrobiidae	123	17	32	8	2	10
Planorbidae		3		2		
Annelida						
Glossiphoniidae	3	2	2	2	1	

	M1		M2		M3	
Taxa	July	October	July	October	July	October
Lumbriculidae				1		
Coleoptera						
Elmidae		12	2	5		8
Noteridae	4		1			
Gyrinidae				3		
Dryopidae						3
Bivalvia						
Sphaeriidae						2

Appendix 2

Site photos for July sampling event.

M1 upstream



M1 downstream

Instream macrophytes (*Potamogen sp.)* at station M1.

M2 upstream

M2 downstream

M3 upstream

M3 downstream

Appendix 2

Site photos for October sampling event

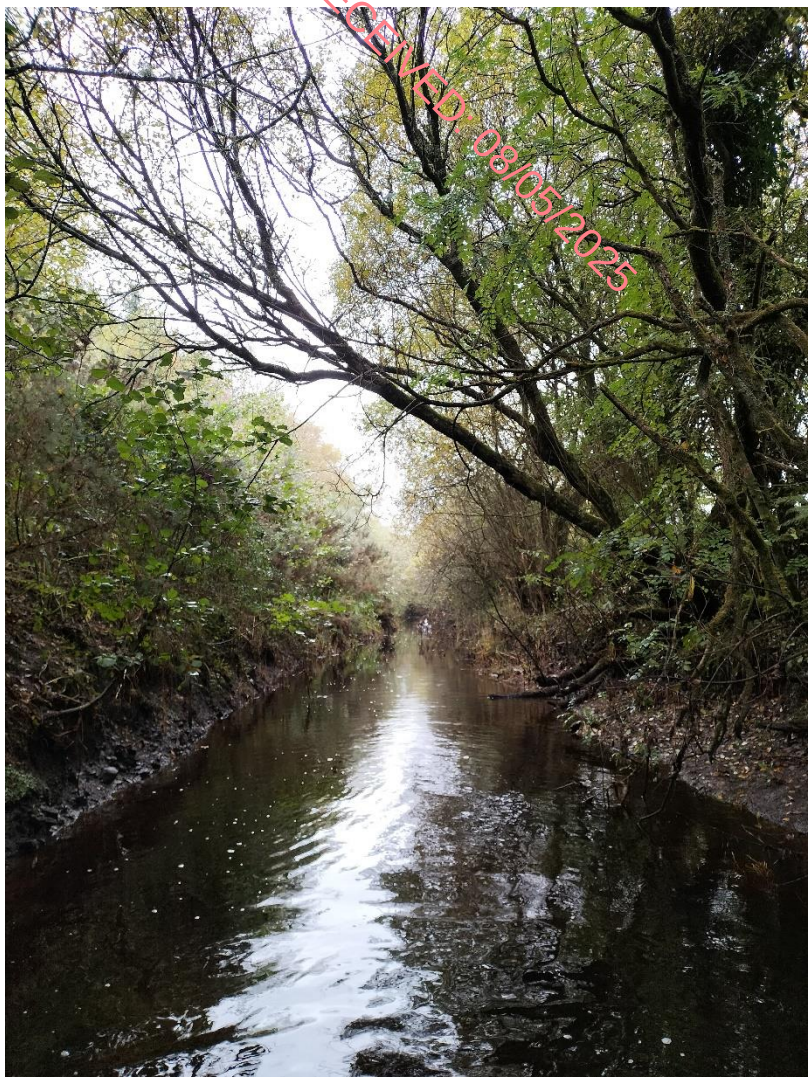
M1 upstream

M1 downstream

M2 upstream

M2 downstream

M3 downstream



M3 upstream