

March 2025

Glen Earrach Pumped Storage Hydro

Environmental Impact Assessment Report

Volume 5: Appendices

Appendix 10.5: Loch nam Breac Dearga Chemistry Results

Glen Earrach Energy Ltd

Quality information

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Table of Contents

1.	Introduction.....	1
2.	Assessment.....	2
2.1	Methodology	2
2.2	Results.....	2
3.	Conclusions.....	8

Tables

Table 1 Chemistry results from Loch nam Breac Dearga.....	2
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Figures

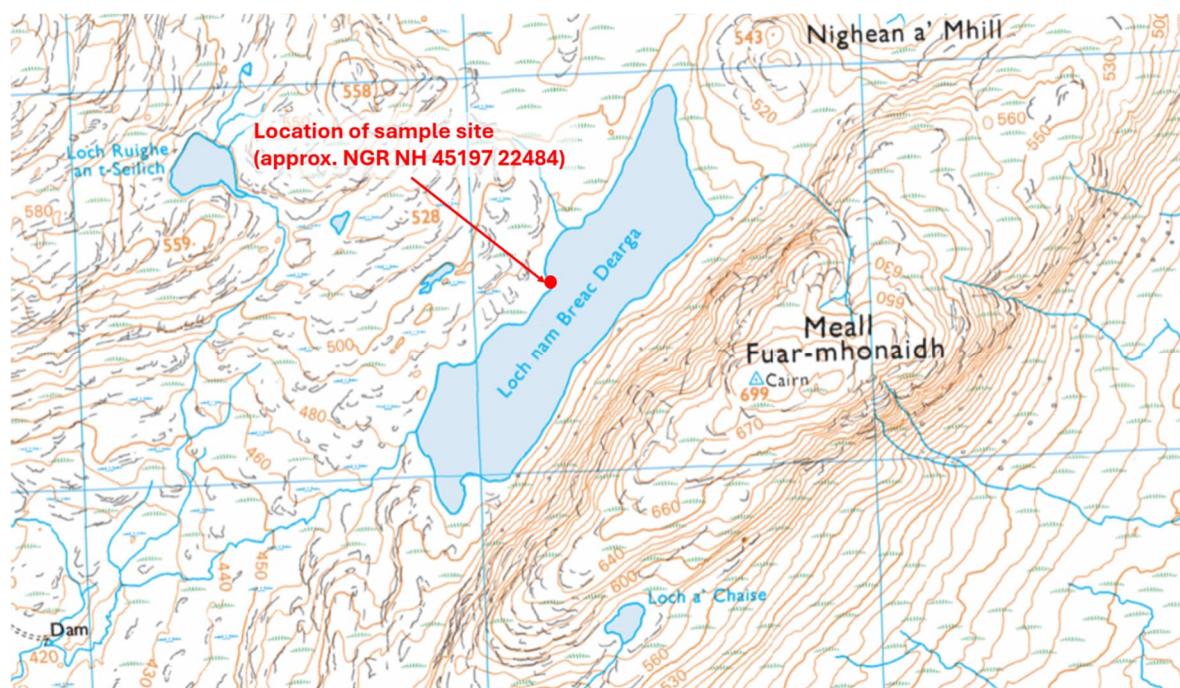
Plate 1 Panoramic image of Loch nam Breac Dearga	1
Insert 2 Loch nam Breac Dearga water sample location.....	2

1. Introduction

- 1.1 The Headpond is located across the current location of Loch nam Breac Dearga and so the loch will be lost to the Proposed Development in its current form. Loch nam Breac Dearga is a small loch, approximately 0.25 km² in area and 1 km long. The loch reaches depths of around 21.3 m with a mean depth of 7.5 m and it has a 1.42 km² catchment area. The loch is longest in a northeast to southwest axis, with the Meall Fuar-mhonaidh forming a steep ridge along its southeastern bank. The remaining shorelines are sloped more gently from open moorland, with a small tributary entering the loch at NGR NH 45246 22611. The loch as viewed from its northern bank is shown in **Plate 1 Panoramic image of Loch nam Breac Dearga**, a panoramic image of Loch nam Breac Dearga. This was taken at NGR NH 45173 22522 on the northern shore, looking south, on 19th September 2024, the day of the site visit. The sampling site location the data is presented here is shown in **Insert 2 Loch nam Breac Dearga water sample location**.
- 1.2 As an isolated and relatively small upland water body SEPA does not routinely monitor its water quality. Due to its upland location and the lack of any obvious pressure on water quality, it is expected that water quality would generally represent natural conditions and be good. To support this assumption, visual and olfactory observations were made during a site visit undertaken on the 19th of September 2024, as well as a single sample collected for laboratory water quality analysis. This sample was not intended as a detailed water quality baseline of this loch as this would require sampling over a much longer period. As described in **Chapter 10 Water Environment (Volume 2: Main Report)**, this offers only a 'snap-shot' of the water quality of the loch at that time and assessed only for certain key parameters.



Plate 1 Panoramic image of Loch nam Breac Dearga



Insert 2 Loch nam Breac Dearga water sample location

2. Assessment

2.1 Methodology

2.1.1 Water was investigated in the field using a calibrated hand-held In-Situ Aqua Troll 500 water quality meter and a single water sample was collected for laboratory analysis from NGR NH 45203 22462 during the site walkover which was undertaken during sunny and warm weather conditions with no rainfall (see **Plate 1 Panoramic image of Loch nam Breac Dearga** and **Insert 2 Loch nam Breac Dearga water sample location**).

2.1.2 The water sample was collected by suitably trained AECOM Water Scientists, stored and transported in accordance with British Standards (BS) Institution ISO 5667, particularly the following parts:

- BS EN ISO 5667-3:2018 Water quality. Sampling. Preservation and handling of water samples.
- BS EN ISO 5667-4:2016 Water quality. Sampling. Guidance on sampling from lakes, natural and man-made.
- BS EN ISO 5667-14:2018 Water quality. Sampling. Guidance on quality assurance and quality control of environmental water sampling and handling.

2.2 Results

2.2.1 The results of the water quality analysis are presented in **Table 1 Chemistry results from Loch nam Breac Dearga**.

Table 1 Chemistry results from Loch nam Breac Dearga

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
On-site field measurements				
pH	pH units	N/A	N/A	8.27

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
Reduction Potential	mV	N/A	N/A	54.8
Dissolved Oxygen Concentration	Mg/l	N/A	N/A	10.81
Dissolved Oxygen Saturation	%	N/A	N/A	110.58
Electrical Conductivity	µS/cm	N/A	N/A	29.96
Total Dissolved Solids	Ppt	N/A	N/A	0.02
Temperature	°C	N/A	N/A	14.52
General Inorganics				
pH in water	pH Units	N/A	N/A	8.1
Temperature on Receipt	°C	N/A	N/A	19
Electrical conductivity of water	µS/cm	N/A	N/A	26.4
Turbidity	NTU	N/A	N/A	4.1
Sulphate as SO ₄	mg/l	400 ¹	N/A	0.822
Chloride	mg/l	250000 ¹	N/A	4.2
Dissolved Phosphate as PO ₄	µg/l	N/A	N/A	< 62
Ammoniacal Nitrogen as N	µg/l	N/A	N/A	< 15
Ammonia as NH ₃	µg/l	N/A	N/A	< 15
Dissolved Organic Carbon (DOC)	mg/l	N/A	N/A	4.14
Nitrate as N	mg/l	N/A	N/A	0.01
Nitrate as NO ₃	mg/l	N/A	N/A	0.05
Nitrite as N	µg/l	N/A	N/A	< 5.0
Nitrite as NO ₂	µg/l	N/A	N/A	4.1
Alkalinity as CaCO ₃	mg/l	N/A	N/A	< 3
BOD (Biochemical Oxygen Demand) (Total)	mg/l	N/A	N/A	< 1.0
Total Suspended Solids	mg/l	N/A	N/A	< 2.0
Bicarbonate as HCO ₃	mg/l	N/A	N/A	< 10
Dissolved Oxygen	mg/l	N/A	N/A	9
Speciated PAHs				
Naphthalene	µg/l	2	N/A	< 0.01
Acenaphthylene	µg/l	N/A	N/A	< 0.01
Acenaphthene	µg/l	N/A	N/A	< 0.01
Fluorene	µg/l	N/A	N/A	< 0.01
Phenanthrene	µg/l	N/A	N/A	< 0.01
Anthracene	µg/l	0.1	0.1	< 0.01
Fluoranthene	µg/l	0.0063	N/A	< 0.01

¹ Non-Statutory Standard

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
Pyrene	µg/l	N/A	N/A	< 0.01
Benzo(a)anthracene	µg/l	N/A	N/A	< 0.01
Chrysene	µg/l	N/A	N/A	< 0.01
Benzo(b)fluoranthene	µg/l	0.017	0.017	< 0.01
Benzo(k)fluoranthene	µg/l	0.017	0.017	< 0.01
Benzo(a)pyrene	µg/l	0.00017	N/A	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	N/A	N/A	< 0.01
Dibenz(a,h)anthracene	µg/l	N/A	N/A	< 0.01
Benzo(ghi)perylene	µg/l	0.00082	0.00082	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	N/A	N/A	< 0.16
Metals				
Calcium (dissolved)	mg/l	N/A	N/A	< 0.02
Iron (dissolved)	mg/l	N/A	N/A	0.025
Magnesium (dissolved)	mg/l	N/A	N/A	0.46
Potassium (dissolved)	mg/l	N/A	N/A	0.13
Sodium (dissolved)	mg/l	N/A	N/A	2.8
Iron (total)	mg/l	1000	N/A	0.06
Manganese (total)	µg/l	N/A	N/A	7.5
Phosphorus (total)	µg/l	N/A	N/A	< 20
Arsenic (dissolved)	µg/l	50	N/A	< 0.15
Cadmium (dissolved)	µg/l	N/A	N/A	< 0.02
Chromium (dissolved)	µg/l	N/A	N/A	0.2
Copper (dissolved) (bioavailable in freshwater)	µg/l	1	N/A	2.2
Lead (dissolved)	µg/l	1.2	14	< 0.2
Manganese (dissolved)	µg/l	N/A	N/A	0.46
Mercury (dissolved)	µg/l	0.07 ²	0.07	< 0.05
Nickel (dissolved)	µg/l	4	34	< 0.5
Selenium (dissolved)	µg/l	N/A	N/A	< 0.6
Zinc (dissolved)	µg/l	10.9	N/A	4.3
Petroleum Hydrocarbons				
TPH-CWG - Aliphatic >C5 - C6	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	N/A	N/A	< 10

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
TPH-CWG - Aliphatic >C12 - C16	µg/l	N/A	N/A	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	N/A	N/A	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	N/A	N/A	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	N/A	N/A	< 10
TPH-CWG - Aromatic >C5 - C7	µg/l	N/A	N/A	
TPH-CWG - Aromatic >C7 - C8	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	N/A	N/A	< 1.0
TPH-CWG - Aromatic >C12 - C16	µg/l	N/A	N/A	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	N/A	N/A	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	N/A	N/A	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	N/A	N/A	< 10
VOCs				
Chloromethane	µg/l	N/A	N/A	< 3.0
Chloroethane	µg/l	N/A	N/A	< 3.0
Bromomethane	µg/l	N/A	N/A	< 3.0
Vinyl Chloride	µg/l	N/A	N/A	< 3.0
Trichlorofluoromethane	µg/l	N/A	N/A	< 3.0
1,1-Dichloroethene	µg/l	N/A	N/A	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane##	µg/l	N/A	N/A	< 3.0
Trans 1,2-dichloroethylene	µg/l	N/A	N/A	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	N/A	N/A	< 3.0
1,1-Dichloroethane	µg/l	10	N/A	< 3.0
2,2-Dichloropropane	µg/l	N/A	N/A	< 3.0
Chloroform	µg/l	2.5	N/A	< 3.0
1,1,1-Trichloroethane	µg/l	N/A	N/A	< 3.0
1,2-Dichloroethane	µg/l	10	N/A	< 3.0
1,1-Dichloropropene	µg/l	N/A	N/A	< 3.0
Cis-1,2-dichloroethene	µg/l	N/A	N/A	< 3.0
Benzene	µg/l	10	50	< 3.0
Carbontetrachloride	µg/l	12	N/A	< 3.0

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
1,2-Dichloropropane	µg/l	N/A	N/A	< 3.0
Trichloroethene	µg/l	N/A	N/A	< 3.0
Dibromomethane	µg/l	N/A	N/A	< 3.0
Bromodichloromethane	µg/l	N/A	N/A	< 3.0
Cis-1,3-dichloropropene	µg/l	N/A	N/A	< 3.0
Trans-1,3-dichloropropene	µg/l	N/A	N/A	< 3.0
Toluene	µg/l	N/A	N/A	< 3.0
1,1,2-Trichloroethane	µg/l	N/A	N/A	< 3.0
1,3-Dichloropropane	µg/l	N/A	N/A	< 3.0
Dibromochloromethane	µg/l	N/A	N/A	< 3.0
Tetrachloroethene	µg/l	140	N/A	< 3.0
1,2-Dibromoethane	µg/l	N/A	N/A	< 3.0
Chlorobenzene	µg/l	N/A	N/A	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	N/A	N/A	< 3.0
Ethylbenzene	µg/l	20	200	< 3.0
p & m-Xylene	µg/l	N/A	N/A	< 3.0
Styrene	µg/l	50	500	< 3.0
Bromoform	µg/l	N/A	N/A	< 3.0
o-Xylene	µg/l	N/A	N/A	< 3.0
Isopropylbenzene	µg/l	N/A	N/A	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	N/A	N/A	< 3.0
Bromobenzene	µg/l	N/A	N/A	< 3.0
n-Propylbenzene	µg/l	N/A	N/A	< 3.0
2-Chlorotoluene	µg/l	N/A	N/A	< 3.0
4-Chlorotoluene	µg/l	N/A	N/A	< 3.0
1,3,5-Trimethylbenzene	µg/l	N/A	N/A	< 3.0
tert-Butylbenzene	µg/l	N/A	N/A	< 3.0
1,2,4-Trimethylbenzene	µg/l	N/A	N/A	< 3.0
sec-Butylbenzene##	µg/l	N/A	N/A	< 3.0
1,3-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
p-Isopropyltoluene	µg/l	N/A	N/A	< 3.0
1,4-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
1,2-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
Butylbenzene	µg/l	N/A	N/A	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	N/A	N/A	< 3.0
1,2,4-Trichlorobenzene	µg/l	N/A	N/A	< 3.0
Hexachlorobutadiene	µg/l	0.6 ²	0.6	< 3.0

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
1,2,3-Trichlorobenzene	µg/l	N/A	N/A	< 3.0
SVOCs	µg/l	N/A	N/A	< 3.0
Aniline	µg/l	N/A	N/A	< 3.0
Phenol	µg/l	N/A	N/A	< 3.0
2-Chlorophenol	µg/l	N/A	N/A	< 3.0
Bis(2-chloroethyl)ether	µg/l	N/A	N/A	< 3.0
1,3-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
1,2-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
1,4-Dichlorobenzene	µg/l	N/A	N/A	< 3.0
Bis(2-chloroisopropyl)ether	µg/l	N/A	N/A	< 3.0
2-Methylphenol	µg/l	N/A	N/A	< 3.0
Hexachloroethane	µg/l	N/A	N/A	< 3.0
Nitrobenzene	µg/l	N/A	N/A	< 3.0
4-Methylphenol	µg/l	N/A	N/A	< 3.0
Isophorone	µg/l	N/A	N/A	< 3.0
2-Nitrophenol	µg/l	N/A	N/A	< 3.0
2,4-Dimethylphenol	µg/l	N/A	N/A	< 3.0
Bis(2-chloroethoxy)methane	µg/l	N/A	N/A	< 3.0
1,2,4-Trichlorobenzene	µg/l	N/A	N/A	< 3.0
Naphthalene	µg/l	2	130	< 3.0
2,4-Dichlorophenol	µg/l	N/A	N/A	< 3.0
4-Chloroaniline	µg/l	N/A	N/A	< 3.0
Hexachlorobutadiene	µg/l	N/A	N/A	< 3.0
4-Chloro-3-methylphenol	µg/l	N/A	N/A	< 3.0
2,4,6-Trichlorophenol	µg/l	N/A	N/A	< 3.0
2,4,5-Trichlorophenol	µg/l	N/A	N/A	< 3.0
2-Methylnaphthalene	µg/l	N/A	N/A	< 3.0
2-Chloronaphthalene	µg/l	N/A	N/A	< 3.0
Dimethylphthalate	µg/l	800	4000	< 3.0
2,6-Dinitrotoluene	µg/l	N/A	N/A	< 3.0
Acenaphthylene	µg/l	N/A	N/A	< 3.0
Acenaphthene	µg/l	N/A	N/A	< 3.0
2,4-Dinitrotoluene	µg/l	N/A	N/A	< 3.0
Dibenzofuran	µg/l	N/A	N/A	< 3.0
4-Chlorophenyl phenyl ether	µg/l	N/A	N/A	< 3.0
Diethyl phthalate	µg/l	N/A	N/A	< 3.0
4-Nitroaniline	µg/l	N/A	N/A	< 3.0

Determinand	Units	Environmental Quality Standard (Annual Average)	Environmental Quality Standard (Maximum Allowable Concentration)	Loch nam Breac Dearga (SW8)
Fluorene	µg/l	N/A	N/A	< 3.0
Azobenzene	µg/l	N/A	N/A	< 3.0
Bromophenyl phenyl ether	µg/l	N/A	N/A	< 3.0
Hexachlorobenzene	µg/l	0.05 ²	0.05	< 3.0
Phenanthrene	µg/l	N/A	N/A	< 3.0
Anthracene	µg/l	N/A	N/A	< 3.0
Carbazole	µg/l	N/A	N/A	< 3.0
Dibutyl phthalate	µg/l	N/A	N/A	< 3.0
Anthraquinone	µg/l	N/A	N/A	< 3.0
Fluoranthene	µg/l	0.0063	0.12	< 3.0
Pyrene	µg/l	N/A	N/A	< 3.0
Butyl benzyl phthalate	µg/l	N/A	N/A	< 3.0
Benzo(a)anthracene	µg/l	N/A	N/A	< 3.0
Chrysene	µg/l	N/A	N/A	< 3.0
Benzo(b)fluoranthene	µg/l	N/A	N/A	< 3.0
Benzo(k)fluoranthene	µg/l	N/A	N/A	< 3.0
Benzo(a)pyrene	µg/l	0.00017	0.27	< 3.0
Indeno(1,2,3-cd)pyrene	µg/l	N/A	N/A	< 3.0
Dibenz(a,h)anthracene	µg/l	N/A	N/A	< 3.0
Benzo(ghi)perylene	µg/l	N/A	N/A	< 3.0

3. Conclusions

3.1 The following conclusions have been drawn from the results of the analysis:

- The sample results were compared to the corresponding Environmental Quality Standard (EQS)³. All determinands which had an EQS were below the level, or were at, their limit of detection. For a limited number of determinands the LOD was above the EQS (e.g. Fluoranthene, Benzo(a)pyrene, Chloroform, Hexachlorobutadiene, Naphthalene and Hexachlorobenzene). Although we cannot state with certainty whether the concentration of these determinands is below the EQS, given the isolated and upland nature of the loch without any anthropogenic discharges, they are unlikely to be present, which is in keeping with the results generally.
- The sample had a relatively neutral pH, very low electrical conductivity and total suspended solids, and a relatively high dissolved oxygen. DOC was slightly elevated reflecting humic compounds leached from surrounding peat soils.
- Nutrients and BOD were also very low.
- The majority of heavy metals including arsenic, chromium, cadmium, lead, mercury and nickel etc. are below their limit of detection. The exception is dissolved copper where a value of 2.2 µg/l was

² Maximum Allowable Concentration

³ SEPA, 2019. Environmental Quality Standards and Standards for Discharges to Surface Waters. Supporting Guidance (WAT-SG-53). Available at <https://www.sepa.org.uk/media/152957/wat-sg-53-environmental-quality-standards-for-discharges-to-surface-waters.pdf>

recorded. However, the EQS for copper is bioavailable and that tends to be an order of magnitude higher than the dissolved value.

- All soluble volatile organic compounds (SVOCs), volatile organic compounds (VOCs), Petroleum Hydrocarbons, Monoaromatics and Oxygenates were below their limit of detection. Although, it is worth noting that some of the limits of detection for the SVOCs, VOCs and Petroleum Hydrocarbons, Monoaromatics and Oxygenates are above their corresponding EQS value.
- The temperature of the water upon receipt for analysis was 19°C, warmer than the 14.52°C recorded at the site, and so some parameters such as BOD, electrical conductivity and ammonia may not be wholly accurate.

3.2 Overall, from the results of a single sample, it can be determined that the water quality of Loch nam Breac Dearga is very good with no signs of chemical contamination.

