
Kirkan Wind Farm
Environmental Impact Assessment Report
Appendix 6.4: Fish Habitat Survey



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1 INTRODUCTION

1.1.1 This appendix has been prepared to accompany Chapter 6: Ecology of the Kirkan Wind Farm Environmental Impact Assessment Report (EIA-R).

1.1.2 It presents detailed methodologies and results of desk study and field surveys completed to establish baseline fish habitat conditions and should be read with reference to figures 6.12 to 6.14 presented in Volume 3 of the EIA-R.

1.1.3 The following species of conservation significance are considered due to their potential presence and importance within proximity to the proposed development:

- European eel *Anguilla anguilla*;
- Atlantic salmon *Salmo salar*;
- Brown trout/ sea trout *Salmo trutta*;
- River lamprey *Lampetra fluviatilis*;
- Brook lamprey *Lampetra planeri*; and,
- Sea lamprey *Petromyzon marinus*.

2 METHODOLOGY

2.1 Study Area

2.1.1 The study area included all watercourses within the project area, extended to include a 2.5 km reach of the Glascarnoch River, to the north of project area.

2.2 Desk Study

2.2.1 A desk study was undertaken to identify any classified waterbodies and existing fisheries records within and in proximity to the project area.

2.2.2 The following key sources were consulted:

- Scotland's Environment website (<http://map.environment.scotland.gov.uk>);
- Cromarty Firth Fisheries Fishery Management Plan: 2008; and,
- Cromarty Firth Fishery Board.

2.3 Fish Habitat Survey

2.3.1 A Fish Habitat Survey was completed of all watercourses within the study area by experienced ecologists between 18th and 22nd June 2018, in order to identify any areas of critical fish habitat (i.e. spawning, nursery areas, juvenile and adult holding areas).

2.3.2 Survey was undertaken in normal flow conditions. **Plates 1 and 2** below show water level data throughout the survey period. **Plate 3** below shows the range of water levels of the Blackwater at Garve (taken from <http://apps.sepa.org.uk/> on Thursday 21st June 2018).

- 2.3.3 Average level on record at Garve is 0.332 m.
- 2.3.4 An initial gradient analysis of the study area was completed based on the contour intervals using the ArcGIS platform, and during a study area walkover. This allowed for the identification of linear 100 m stretches of watercourses within the study area with a gradient of $\geq 6\%$.
- 2.3.5 All such stretches of watercourses with a gradient of $\geq 6\%$ are considered to be unsuitable or non-productive fish habitat for species of conservation significance listed above. Mills (1973¹) found that gradients of $<3\%$ were favourable for Atlantic salmon; whilst sea trout were found to spawn in streams with gradients of up to 4% . Most populations of lamprey occur where the average stream gradient is $1.9 - 5.7$ m/km, being rarely found where gradients exceed 7.8 m/km or 0.78% (Maitland and Campbell, 1992²). Whilst gradients of $\geq 6\%$ are considered to be “unsuitable” fish habitat, it is recognised that small, often isolated, populations of brown trout may occur in locally suitable habitat between $5-10\%$ gradient (*M. Bates. pers. obs.*).
- 2.3.6 Watercourses with gradients of $\geq 6\%$ are often narrow upland headwaters (usually 1st and 2nd order) with typically dynamic discharges (often shallow water between spates), frequent bedrock outcrops (often chutes and falls) and lack of stabilised substrates (and macrophytes) that do not provide critical functional habitat for spawning, juvenile and/or adult fish. The sources of upland headwaters are often associated with a localised reduction in gradient, where the channel often becomes partly subterranean and/or grades into a diffuse flush vegetation.
- 2.3.7 The watercourses within the study area were systematically walked (including in-stream inspections where required) and habitats mapped according to the classification presented in **Table 2.1**. Specifically, the habitat survey focused on the identification of the following:
- Spawning habitat for salmonid and lamprey species;
 - Nursery habitat for lamprey species;
 - Areas of habitat important for juvenile salmonids (fry and parr); and,
 - Areas of habitat important for adult holding areas.
- 2.3.8 The habitat classification used was based on the Scottish Fisheries Co-ordination Centre’s Habitat Surveys Training Course Manual (SFCC 2007), and the Environment Agency’s Restoration of Riverine Salmon Habitats Guidance Manual (Hendry & Cragg-Hine, 1997³), and a review of key habitat requirements for other species of conservation significance including lamprey and salmonids (e.g. Maitland, 2003⁴; Hendry & Cragg-Hine, 2003⁵).
- 2.3.9 At 100 m intervals a description of the channel and substrate was completed over a sample 10 m section. The following information was collected at each sample location: channel gradient; substrate composition (% bedrock, boulders >256 mm, cobbles $65-256$ mm, pebbles $4-64$ mm, gravel $2-4$ mm,

¹ Mills, D.H. (1973) Preliminary assessment of the characteristics of spawning tributaries of the River Tweed with a view to management. In: M.W. Smith & W.M. Carter (eds.). International Atlantic Salmon Symposium, St Andrew’s, International Atlantic Salmon Special Publication Series 4 (1), 145-55.

² Maitland, P.S. and Campbell, R.N. (1992) *Freshwater Fishes of the British Isles*. New Naturalist. HarperCollins, London.

³ Hendry, K. & Cragg-Hine, D. (1997) *Restoration of riverine salmon habitats: A guidance manual*. R&D Technical Report W44. Environment Agency, Bristol.

⁴ Maitland, P.S. (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

⁵ Hendry K & Cragg-Hine D. (2003) *Ecology of the Atlantic Salmon*. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

coarse sand 0.5-2 mm and fine sand/silt/peat <0.5 mm); average wetted channel width (m); average depth (m) and turbidity (1 [clear] – 3 [turbid]). A photograph was taken showing the watercourse upstream from each of the sample points.

Plate 1: Water level data from <http://apps.sepa.org.uk/> for nearest gauging station (Blackwater at Garve) for Monday 18 June 2018 to Thursday 21 June 2018.

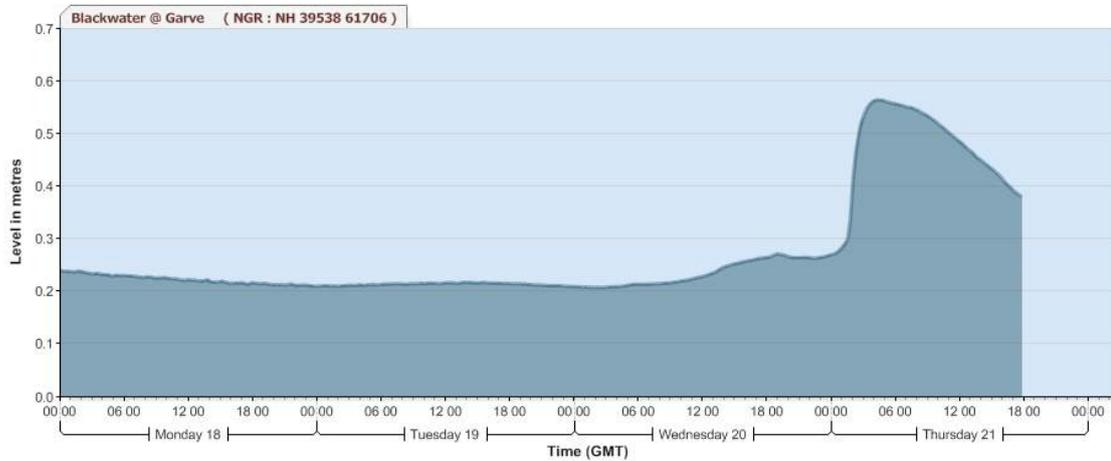


Plate 2: Water level data from <http://apps.sepa.org.uk/> for nearest gauging station (Blackwater at Garve) for Tuesday 19 June 2018 to Friday 21 June 2018.

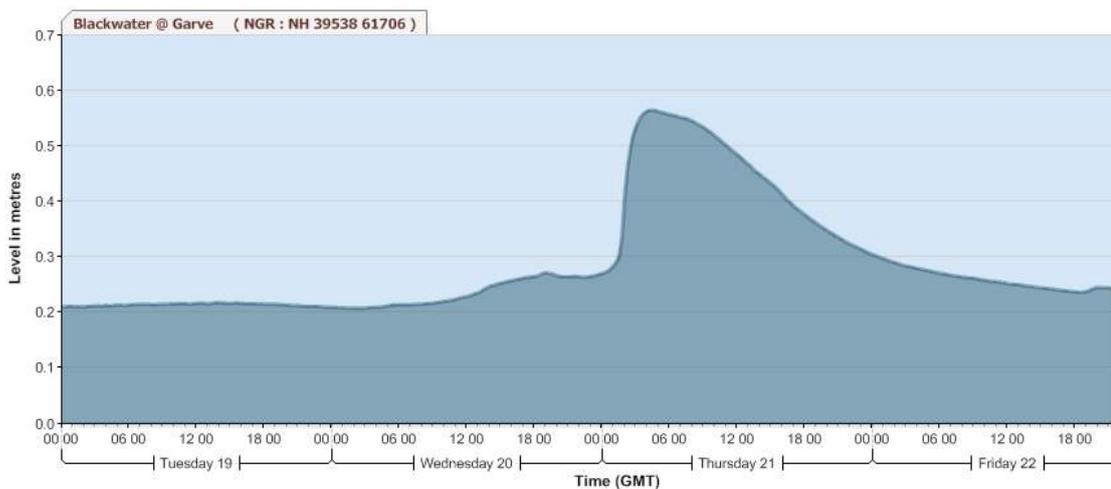
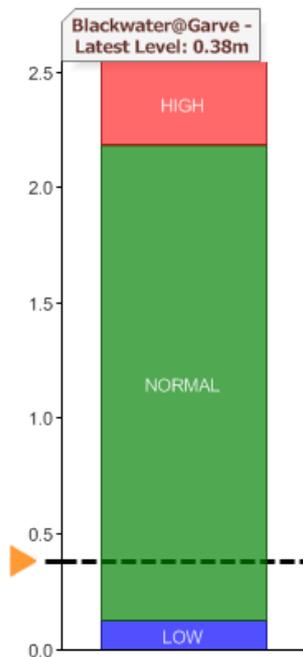


Plate 4: Range of water levels from <http://apps.sepa.org.uk/> for nearest gauging station (Blackwater at Garve). Level shown is from Thursday 21 June 2018



Personnel

2.3.10 Fieldwork has been completed by Mr S. Knowles MCIEEM and Mr J. Daisley MCIEEM; both professional ecologists of 18 and 8 years respectively and highly experienced in fish habitat surveys throughout Scotland.

Fish River Habitat Classifications

2.3.11 **Table 2.1** details Fish River Habitat Classifications.

Table 2.1. Fish Habitat Classifications.

Cat.	Habitat Type	Description	Species Suitability
1 1a 1b 1c	Unsuitable Steep > 10% gradient 6-10% gradient Other – ephemeral, shallow drains, dry beds	Usually 1 st – 2 nd order watercourses with steep gradient, ≥6% slopes (often substantially greater), abundant bedrock, lack of fixed substrates, high velocity (<i>e.g.</i> headwaters/rivulets). Also includes less steep ephemeral stretches (<i>e.g.</i> headwater sources), shallow drains and modified watercourses with dry beds.	No productive fish habitat, although some species may migrate through these areas (also refer to 7. Rapids) depending on whether they represent a migration barrier.
2 2a 2b	Spawning Habitat Salmonids Lamprey	Stable “gravels” of minimum 15-30 cm depth, optimal 20-30 mm, not compacted or with excessive silt/sands (<20% by weight) for salmonids. Lamprey spawning habitat where “gravels” include sands. Often at tail end of pools or	Spawning habitat - Atlantic salmon (<i>c.</i> 9 m ² per pair) and sea/brown trout; lamprey.

Cat.	Habitat Type	Description	Species Suitability
		upstream ends of riffle-runs ensuring oxygenated substrate. Can also be found at end of weir pools.	
3	Riffle	Shallow (< 20 cm) and fast flowing, with upstream-facing wavelets which are unbroken (although often some broken water), with substrate dominated by gravel and cobbles.	Fry (0+) habitat – Atlantic salmon/ brown trout/sea trout.
4 4a 4b	Run Shallow (< 0.5 m deep) Deep (>0.5 m deep)	Generally deeper (20-40 cm) and less steep bed compared to riffle, with substrate of boulders, cobbles and gravels. Usually disturbed, rippled surface. Often located immediately downstream of riffle.	Mixed salmonid juvenile habitat. Fry (0+) & Par (1+) habitat - Atlantic salmon/ brown trout/sea trout.
5 5a 5b	Glide Shallow (<0.5 m deep) Deep (> 0.5 m deep)	Shallow gradient stretches with smooth laminar flow with little surface turbulence and generally > 30 cm deep; water flow is silent. Often located below pools.	European eel; non-productive salmonid habitat, although may provide some shelter for adults.
6 6a 6b 6c	Pool Plunge/Scour pool Meander pool Weir/bridge pool	No perceptible flow, eddying and usually > 100 cm deep. Substrate with high proportion of sand and silts. Often located on the outside of meanders, but includes natural scour or plunge pools and artificial weir pools.	Adult refugia Atlantic salmon, sea/brown trout, European eel.
7 7a 7b 7c	Rapids Steep - >10% gradient Moderate - 6-10% gradient Low - <6% gradient	Sections of relatively steep gradient with fast currents and turbulence, with mixed flow types, including free-fall, chutes and broken, with obstructions such as large boulders, rock outcrops and falls.	Negative feature for migratory species and may pose a migratory barrier; elvers and yellow eels limited to velocity of <0.5 m/sec and 2.0 m/sec respectively; lamprey to 2 m/sec.
8 8a 8b	Banks of fine sediment of silts and sands Optimal Sub-optimal	Limited flow (sometimes back-flow) allowing deposition of silts/sands, not anoxic, with/without riparian trees. Optimal habitat is stable fine sediment and sand ≥15 cm deep with some organic detritus. Sub-optimal habitat includes small areas of deposited silts/sands behind boulders.	Lamprey ammocoete nursery and adult refuge.
9 9a 9b 9c 9d 9e	Vegetation features Riparian trees (tunnel) Flow constriction Aquatic macrophytes Emergent	Closed woodland canopy forming tunnel vegetation In-stream emergent, boulders Stands of aquatic and floating vegetation Stands of emergent (usually marginal)	Tunnel riparian trees may be negative feature for salmonids, although tree roots and fallen trees may provide refugia for Atlantic salmon/ brown trout/sea trout and European eel. Aquatics/emergents

Cat.	Habitat Type	Description	Species Suitability
	macrophytes Large woody debris	vegetation LWD forming dams, etc.	provide cover for fish, particularly juveniles.
10	Obstructions to migration	Impassable waterfalls, rapids, flow constrictions, weirs, bridge sills, culverts, shallow braided river sections, pollution preventing upstream migration.	All migratory species; impassability varies between species. Leaping ability: <3.7 m Atlantic salmon; <1.81 trout; European eel and lamprey none.
11 11a 11b 11c	Other features Side channel Backwater Artificial channel	Includes other channel features, with side channel (connected to main channel) and backwaters. Artificial channels may comprise either man-made banks and/or beds.	Side channel/backwater often important refugia for juveniles. Artificial channels have limited diversity and are often non-productive fish habitat.

Survey Limitations

2.3.12 The fish habitat survey was completed within the normal range of flows for watercourses in the geographical area, as defined by Scottish Environmental Protection Agency (SEPA) (refer to <http://apps.sepa.org.uk/>). The study is considered not to be subject to any significant survey limitations, although inspection of the bed sections in certain sections (e.g. deeper areas of the Glascarnoch River and Black Water) was limited by turbidity.

3 RESULTS

3.1 Desk Study

3.1.1 The European Water Framework Directive (WFD) requires that surface waterbodies in member states are classified according to ecological status. The Scotland's Environment website (<http://map.environment.scotland.gov.uk>) confirms the status of the following watercourses within the study area:

- Glascarnoch River: Bad status/potential;
- Blackwater: Good status/potential; and,
- Abhainn Srath Rainich: Good status/potential.

3.1.2 The remainder of the watercourses in the study area are not classified.

3.1.3 The known distribution of fish and presence of barriers to movement in proximity to the project area is summarised in the Cromarty Firth Fisheries Fishery Management Plan: 2008, and primarily concerns the Glascarnoch River and upper reaches of the Blackwater which lie to the north of the project area.

3.1.4 The upper waters of the Blackwater have been severely impacted by the Conon Basin Hydroelectric Scheme, which has resulted in most of the spawning streams and habitat being lost. As such, a compensation package allows for the trapping of Atlantic salmon at a heck on Loch na Croic, some 10 km downstream of the study area. Fish are then used as broodstock at the Contin hatchery, with the Glascarnoch River and Blackwater stocked with juvenile salmon on an annual basis. The Management Plan notes that, despite the impacts of the hydroscheme, the Blackwater provides a vital salmon nursery area. The Upper Blackwater is noted as having 280,750 m² of suitable juvenile habitat and the lower reaches of the Allt Bad-an t-Seabhaig as having 5,725 m².

- 3.1.5 Scotland's Environment map (<https://map.environment.gov.scot/sewebmap/>) shows the falls at Silver Bridge, some 7 km downstream of the study area on the Blackwater as an *Impassable Barrier*. However, the Management Plan notes that the falls are a *significant obstacle*; the Black Water upstream of here is not listed as impassable. The Management Plan does show the Glascarnoch River from the dam to the Blackwater confluence as impassable. Likewise, the lower reaches of Allt Bad-an t-Seabhaig are shown as impassable.
- 3.1.6 The Glascarnoch and upper Blackwater within the project area are subject to electrofishing monitoring by the Cromarty Firth Fishery Board but at the time of consultation detailed data was not made available. However, it is acknowledged that brown trout, European eel and *Lampetra* species are also present on the Blackwater, although sea trout are understood to be largely confined to the lower reaches.
- 3.1.7 Given the barriers downstream, it is considered that *Lampetra* species within the study area would be confined to brook lamprey; sea and river lamprey are likely to be absent.

3.2 Fish Habitat Survey

- 3.2.1 The following presents results of the fish habitat survey for each of the watercourses within the study area, including a summary of channel characteristics at time of survey and should be read with reference to **Figures 6.12 to 6.14**.
- 3.2.2 The habitats of the watercourses shown in these figures are characterised based on the habitat classifications in **Table 2.1**. and can largely be considered as 'unsuitable' fish habitat, or 'suitable' fish habitat (all of the other habitats stated in **Table 2.1**). The exception to this is 'rapids' are largely sub-optimal for fish species.
- 3.2.3 Environmental data for sample points is provided in **Annex 1**, with photographic plates presented in **Annex 2**.

Glascarnoch River: Sample Points 1 to 32

- 3.2.4 The channel and fish habitats of the Glascarnoch River have been notably influenced by the Glascarnoch Dam, located immediately upstream. It has an average wetted width of around 8.5 m, ranging from 0.5 m in constricted parts to greater than 40 m where it is impounded by a weir near to its downstream end. Depth (at time of survey) ranges from 0.1 m to greater than 1 m (again where it is impounded by the weir). Channel gradient in the main is very shallow, averaging less than 1 % throughout the sampled area, although gradient increases markedly over a short gorge section (between Sample Points 12 and 14) which contains a 2 stage bedrock waterfall, comprising falls of c.2 m and 3 m. Gradient also increases markedly between the weir and the confluence with the Blackwater (Sample Points 31 to 32).
- 3.2.5 Water quality (at the time of survey) appeared generally poor (eutrophic) with suspended and filamentous algae evident. Peat staining was also evident, limiting views of the channel substrate in places, particularly in the weir pool section where the bed was completely obscured.
- 3.2.6 The majority of the habitats within the watercourse comprise *4a Shallow Run* with Category *9c Aquatic Macrophytes* being a significant feature and comprising emergent rushes and sedges in the upper reaches, with beds of water crowfoots *Ranunculus* sp. lower down. The upper reaches comprise *5a Shallow Glide* where the gradient is very shallow and there are areas of almost no perceptible flow. The lower reaches comprise *6c Weir Pool* which extends for a c.200 m section. Beyond this where the gradient increases, Categories *3 Riffle* and *7c Low Rapids* are present.
- 3.2.7 Substrate type throughout the watercourse section is dominated by boulders and cobbles, with pebbles present to a lesser extent (**Annex 1**).

3.2.8 No significant areas of high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout (although, the substrate in the upper reaches of the weir pool were completely obscured at the time of survey), with any deep stabilised “gravels” being very restricted to small areas (typically <0.5 m² and in the lee of larger boulders). The run habitats present provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]). Fine sand and silt accounts for a very small amount of the sampled substrate and no significant areas that could provide *Category 8 lamprey nursery habitat* were noted, although this could potentially be present in the weir pool.

Blackwater: Sample Points 33 to 62

3.2.9 The length of the Blackwater surveyed has an average wetted width of c.22 m, ranging from 8 m to 35 m. Average depth (at time of survey) was around 0.3 m and ranged from 0.2 m to greater than 1 m. Sampled channel gradient averaged around 3.5 %, producing a largely lively flow throughout. This ranged from 2 % in the run sections to 7 % in bedrock gorge sections in the lower reaches.

3.2.10 Water quality (at the time of survey) appeared poor (eutrophic) in places with suspended and filamentous algae evident. Peat staining was also evident.

3.2.11 The upper reaches of the Blackwater comprise in the main *4a Shallow Run* (with *Category 9c Aquatic Macrophytes* being a secondary feature), interspersed with *Category 3 Riffle*. The lower reaches are much more dynamic and, although shallow runs are present, are typified by significant areas of *7c Rapids, Low* and discrete *7a Rapids Steep* through bedrock gorge sections. Where gradient exceeds 6 %, this has been categorised as *1b Unsuitable* (but this is not representative of a barrier to salmonid fish movement).

3.2.12 Substrate type throughout the sampled area (**Annex 1**) is dominated by boulders and cobbles, with bedrock and pebbles accounted for a lesser extent.

3.2.13 No significant areas of high calibre *Category 2a Salmonid spawning habitat* were noted for Atlantic salmon or sea trout, with any deep stabilised “gravels” being very restricted to small areas (typically <0.5 m² and in the lee of larger boulders). The run habitats present provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]), whereas much of the gorge sections were not considered to provide functional fish habitat. Fine sand and silt is almost absent in the sampled substrate, reflecting the relatively dynamic flow regime, and no significant areas that could provide *Category 8 lamprey nursery habitat* were noted.

Abhainn Srath Rainich: Sample Points 63 and 64

3.2.14 The section of the Abhainn Srath Rainich sampled has an average wetted width of around 10 m, with an average depth (at time of survey) around 0.3 m. Sampled channel gradient ranged between 2 and 4 %.

3.2.15 The upper reaches of the watercourse section sample comprise *Category 6c Bridge Pool*, immediately downstream of the A835 road bridge. Below this is a fairly dynamic section of *7c Rapids, Low* and then *4a Shallow Run*.

3.2.16 Sampled substrate type within the study area (**Annex 1**) primarily comprises boulders, with a small extent of cobbles. In the entire reach, no high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout. The run habitats provides mixed salmonid juvenile habitat (including fry [0+] and parr [1+]); the pool section provides refuge habitat for adult fish.

Alltan a' Chleirich: Sample Points 65 to 85

- 3.2.17 The Alltan a' Chleirich has an average wetted width of less than 2 m, with an average depth (at time of survey) of around 0.4 m. Sampled channel gradient averages less than 3 %, with a range of between around 1.5 % in the upper reaches to greater than 6 % in the tumbly, middle reaches.
- 3.2.18 The upper reaches of the Alltan a' Chleirich comprise Categories *1c Unsuitable* (Sample Points 65 to 70 – infilling with bog vegetation and unproductive hagg watercourse) and *1b Unsuitable Gradient* (Sample Points 70 to 72 - > 6 % gradient including a c.6m bedrock waterfall). Below this steep section there is a mix of *4a Shallow Run* and *5a Shallow Glide* through peatlands, interspersed with Categories *7b Rapids, Moderate* and *7c Rapids Low*. A c.100 m section of *1b Unsuitable Gradient* is also present between Sample Points 80 and 81.
- 3.2.19 Substrate type throughout the samples section (**Annex 1**) varies according to gradient: bedrock is present in the steepest sections; runs interspersed with rapids are dominated by boulders with cobbles; and the more benign glide sections are dominated by peaty substrates.
- 3.2.20 No high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout, with any deep stabilised “gravels” being very restricted to small areas (typically <0.2 m² and in the lee of larger boulders) and therefore more suited to the smaller brown trout. The run habitats provides mixed salmonid juvenile habitat (including fry [0+] and parr [1+]), whereas much of the *Category 1b Unsuitable* sections do not provide functional fish habitat.
- 3.2.21 No significant areas of *Category 8 Lamprey nursery habitat* were noted.

Allt Bad an t-Seabhaig: Sample Points 86 to 125

- 3.2.22 The Allt Bad an t-Seabhaig has an average wetted width of around 3 m, with an average depth (at time of survey) of around 0.4 m. Depth ranges from less than 0.2 m in the upper reaches to greater than 0.7 m in deep runs. Sampled channel gradient averages just under 4 %, with a range of between c.1 % in more benign sections to greater than 6 %.
- 3.2.23 The extreme upper reaches of the Allt Bad an t-Seabhaig (Sample Points 86 to 88) are classified as *Category 1b Unsuitable* due to a gradient of greater than 6 %. Below this the gradient is greatly reduced. From around Sample Point 90 to Sample Point 100 the regime is relatively benign and glides through peatlands, both *5a Shallow Glide* and *5b Deep Glide* dominate. Below this point the gradient increases and the dominant habitat types are *4a Shallow Run* (with *7c Low Rapids*) and *7c Low Rapids*. There is also a c.100 m section around Sample Point 123 that is categorised as *1b Unsuitable* due to gradient which also includes a c.6 m high waterfall. This feature represents a natural barrier to fish migration.
- 3.2.24 Substrate type throughout the study area (**Annex 1**) varies according to gradient: bedrock and boulders dominate in the extreme upper reaches; the more benign glide sections are dominated by peaty substrates; boulders and cobbles dominates in the steeper, lower sections of runs interspersed with rapid.
- 3.2.25 No high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout, with any deep stabilised “gravels” being very restricted to very small areas (typically <0.5 m² and in the lee of larger boulders). The run habitats provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]), whereas much of the *Category 1b Unsuitable* sections do not provide functional fish habitat. No significant areas of *Category 8 Lamprey nursery habitat* were noted.

Un-named tributary of Blackwater: Sample Points 126 to 135

- 3.2.26 Fish habitat of the un-named tributary of the Blackwater has been categorised as *1c Unsuitable* for its entire length as it is infilled and/or infilling with bog vegetation and provides no functional fish habitat.

Allt Glac an t-Sithein and headwaters/tributaries: Sample Points 136 to 198

- 3.2.27 Fish habitat of the Allt Glac an t-Sithein headwaters and tributaries (Sample Points 136 to 165, 168 to 174 and 179 to 185) have been categorised as mainly *1c Unsuitable* (subterranean, infilling or unproductive hagg watercourse) and also *1b Unsuitable Gradient*. These sections do not provide functional fish habitat and are not considered further.
- 3.2.28 The main stem of the Allt Glac an t-Sithein (Sample Points 175 to 198) has an average wetted width of around 2.5 m. It has an average depth (at time of survey) of just under 0.5 m, although this average is somewhat skewed by a 1.2 m meander pool at Sample Point 191 and the typical depth ranges from 0.2 to 0.4 m. Sampled channel gradient averages over 2 %.
- 3.2.29 The substrate type of the main stem of the Allt Glac an t-Sithein (**Annex 1**) in the more benign glide sections (Categories *5a Shallow Run* and *5b Deep Run*) is dominated by peaty substrates with boulders and cobbles dominating in the more dynamic run and rapid sections. These sections (Categories *4a Shallow Run*, interspersed with *7b Moderate Rapids* and *7c Low Rapids*) between Sample Points 187 and 196 have some areas of deep stabilised “gravels” providing potential salmonid spawning habitat. However, these range from 1 to 3 m² in extent and are not classified as high calibre *Category 2a Salmonid spawning habitat*.
- 3.2.30 Mixed salmonid juvenile habitat (including fry [0+] and parr [1+]) is present throughout this section.
- 3.2.31 Note separately that brown trout were observed in the Allt Glac an t-Sithein during a watercourse survey completed by hydrologists in August 2018.

Allt Cearc an t-Slugain and Tributary: Sample Points 199 to 227

- 3.2.32 Fish habitat of the Allt Cearc an t-Slugain tributary (Sample Points 207 to 216) has been categorised as *1c Unsuitable* (unproductive hagg watercourse in upper region; infilling with bog vegetation in middle region; largely subterranean in lower region), and does not provide functional fish habitat.
- 3.2.33 The main stem of the Allt Cearc an t-Slugain (Sample Points 199 to 206 and 217 to 227) is a tumbling, upland watercourse with an average sampled width of less than 2m and an average depth (at time of survey) of under 0.3 m. Sampled channel gradient averages a little over 2.5 %, overall.
- 3.2.34 The main stem of the Allt Cearc an t-Slugain comprises, in the main, *4a Shallow Run* with *7c Low Rapids*. More benign glide sections are rare and are confined to mid- to lower reaches.
- 3.2.35 The substrate of the main stem of the Allt Cearc an t-Slugain is dominated by boulders with lesser amounts of cobbles and a fairly even mix of the smaller types.
- 3.2.36 No high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout, with any deep stabilised “gravels” being very restricted to very small areas (typically <0.5 m² and in the lee of larger boulders) and therefore more suited to the smaller brown trout.
- 3.2.37 The run habitats of the lower reaches provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]).

Feith Bhaite and tributaries: Sample Points 228 to 259

- 3.2.38 The southern tributary of the Feith Bhaite (Sample Points 242 to 250) has been categorised as *1c Unsuitable* (largely subterranean), does not provide functional fish habitat.
- 3.2.39 The northern tributary (Sample Points 252 to 258) has been categorised *1c Unsuitable (largely subterranean or infilling)* and *1b Unsuitable (gradient)* for much of its length. Although the lower region has been categorised as *4a Shallow Run* this is marginal at best and this section is very unlikely to provide functional fish habitat.
- 3.2.40 The main stem of the Feith Bhaite (Sample Points 228 to 241, 251 and 259) is a narrow, relatively shallow watercourse with an average sampled width of less than 1 m and an average depth (at time of survey) of under 0.5 m. It has an average sampled channel gradient of a little over 2.3 %, although in the main it is relatively low gradient of 1.5 to 2.0 % with the relatively steep (4 to 6 %) upper 200 m skewing the average somewhat.
- 3.2.41 The main stem of the Feith Bhaite comprises, in the main, *4a Shallow Run* with *7b Moderate Rapids* present in the extreme upper reaches and between sections of run habitat in the mid and lower regions. More benign glide sections are rare.
- 3.2.42 The substrate of the main stem of the Feith Bhaite is dominated by a relatively even mix of boulders, cobbles and pebbles in the run sections.
- 3.2.43 No high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout. The run habitats of the mid to lower reaches provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]). No significant areas of *Category 8 Lamprey nursery habitat* were noted in the more benign sections.

Un-named tributaries of the Glascarnoch River: Sample Points 260 to 284

- 3.2.44 Five unnamed tributaries of the Glascarnoch River sampled do not, in the main, provide functional fish habitat. The easternmost tributary (Sample Points 260 to 263) has been categorised *1c Unsuitable (diffuse, subterranean)*. The next west tributary (Sample Points 264 to 266) has likewise been categorised *1c Unsuitable (largely subterranean)* for most of its length with a short section of *1b Unsuitable Gradient* at its northern end.
- 3.2.45 The middle of the five unnamed tributaries (Sample Points 267 to 279) is unsuitable for most its length with only a very short section of *4a Shallow Run* present at its downstream end. Fish passage, however, into the tributary is impeded by a section of stepped gabions immediately to the south of the road culvert.
- 3.2.46 Tributary Sample Points 270 to 273 has again been categorised *1c Unsuitable* for virtually all of its length. Fish passage is also impeded by a c.6 m high bedrock rapid (*Category 7a Rapids, steep*) immediately to the south of the road culvert.
- 3.2.47 The western most of the 5 unnamed tributaries, again is unsuitable for fish for most of its length, but has a c.200 m section categorised as *4a Shallow Run*. However, this is marginal at best and this section very unlikely to provide functional fish habitat.

Allt Giubhais Beag: Sample Points 285 to 320

- 3.2.48 The Allt Giubhais Beag is a tumbling, narrow upland watercourse with an average wetted width of around 1.5 m and an average depth (at time of survey) of less than 0.25 m. Gradient is relatively steep with a sampled channel gradient of 3.3 % (which includes a c.700 m headwater section where gradients are 1 to 1.5 %).

- 3.2.49 The headwaters from Sample Point 285 to 294 have been categorised as *1c Unsuitable (infilling with bog vegetation), subterranean and unproductive hagg watercourse*). Downstream from this, to almost the mid-point, habitats are almost entirely *4a Shallow Run*, interspersed with *7b Moderate Rapids*. Two steep bedrock waterfalls (*7a*) are present in the upper region of this section. These have a vertical drop of c. 5 m and 1.5 m respectively, and represent a migratory barrier to fish. The watercourse becomes more dynamic downstream of the mid-point with a series of pool and rapid complexes (*6a* and *7b/7c*) between areas of *4a Shallow Run*. This includes a gorge section around Sample Points 313 and 314 which could not be accessed for health and safety reasons. Two dams are also present, 1.5 m and 6 m in height, the latter presenting a significant barrier to fish migration. Fish passage is further impeded by a gabion “dam” immediately to the south of the road culvert.
- 3.2.50 In the areas of watercourse downstream of the unsuitable headwaters, the sampled substrate of the Allt Giubhais Beag comprises almost 20 % bedrock, with almost 50 % boulders and 25 % cobbles, reflecting the dynamic nature of the watercourse.
- 3.2.51 No high calibre *Category 2a Salmonid spawning habitat* was noted for Atlantic salmon or sea trout. Any deep stabilised “gravels” were very restricted to very small areas (typically <0.5 m² and in the lee of larger boulders) and therefore more suited to the smaller brown trout whose passage is impeded by a number of natural and man-made features noted above. The run habitats of the mid to lower reaches provide mixed salmonid juvenile habitat (including fry [0+] and parr [1+]).

3.3 Summary

- 3.3.1 Adult Atlantic salmon within the study area are highly likely to be confined to the Blackwater and possibly the lower reaches of the Allt Bad an t-Seabhaig, the Abhainn Srath Rainich, and the Allt Cearc an t-Slugain. However, no significant areas of high calibre *Category 2a Salmonid spawning habitat* were identified within these watercourses and, together with the stocked Glascarnoch River, provide more valuable habitat for juvenile fish.
- 3.3.2 Brown trout are likely to be widely distributed in areas of suitable habitat throughout the study area.
- 3.3.3 Although acknowledged as present in the Blackwater, suitable habitat for European eel is patchy throughout the study area and is probably restricted to more benign sections (e.g. Categories 5 Glide and 6 Pool), outwith the more dynamic reaches.
- 3.3.4 Although spawning habitat for brook lamprey is present, nursery habitat is severely limited with no significant areas noted. Distribution is likely to be patchy.

ANNEX 1: ENVIRONMENTAL DATA TABLES

Table A1.1: Environmental data for Glascarnoch River; Sample Points 1 to 32.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
1	331	34726 70687	0	75	20	5	0	0	trace	5	0.25	2	0	915
2	330	34811 70634	0	15	45	20	0	5	15	3.5	0.15	1	0	916
3	329	34885 70567	0	20	30	20	10	10	10	5	0.3	2	0	917
4	328	34962 70506	0	0	10	35	10	15	30	18	0.4	2	0	918
5	327	35043 70513	0	15	35	45	5	0	0	12	0.5	2	0	919
6	326	35118 70561	0	20	50	25	0	0	5	8	0.3	2	0	920
7	325	35199 70506	0	65	15	10	0	0	10	7	0.2	2	1	921
8	324	35275 70450	0	5	35	45	0	0	15	8	0.4	2	1	922
9	323	35365 70410	0	5	35	45	0	0	15	3.5	0.2	2	1	923
10	322	35451 70359	0	20	45	25	0	0	10	5	0.2	2	1	924
11	321	35540 70313	0	15	50	25	0	0	10	3.5	0.2	2	1	925
12	320	35631 70271	80	15	5	0	0	0	trace	4	0.3	2	1.5	926
13	319	35727 70246	35	60	5	0	0	0	0	15	0.5	1	2	927
14	318	35825 70243	90	5	5	0	0	0	0	0.5	0.1	1	2	928
15	317	35924 70262	50	40	10	0	0	0	0	3	0.35	1	2	929
16	316	36019 70253	5	90	5	0	0	0	trace	4	0.25	1	1	930
17	315	36111 70236	15	75	10	0	0	0	0	3.5	0.4	1	2	931
18	314	36206 70266	10	85	5	0	0	0	0	7	0.3	1	2	932
19	313	36299 70303	10	80	10	0	0	0	trace	7	0.2	1	1.5	933
20	312	36396 70321	55	80	10	5	0	0	0	7	0.15	1	1	934
21	311	36496 70319	0	50	40	10	0	0		14	0.15	1	1	935
22	310	36591 70341	0	40	40	15	0	0	5	13	0.5	3	0	936
23	309	36682 70383	0	20	65	10	0	0	5	13	0.5	2	0	937
24	308	36778 70389	0	15	65	15	0	0	5	6	0.1	2	1.5	938
25	307	36811 70483	0	15	70	10	0	0	5	8	0.15	2	1	939
26	306	36847 70576	5	25	65	0	0	0	5	19	0.2	2	0	940
27	305	36892 70666	0	20	60	15	0	0	5	18	0.2	2	0	941
28	304	36953 70744	0	30	60	5	0	0	5	18	0.2	2	0	942
29	303	37035 70802	0	35	55	5	0	0	5	20	1	2	0	943
30	302	37125 70844	Unknown							22	>1	3	0	944

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
31	301	37211 70832	Unknown							40	>1	3	0	945
32	300	37296 70779	10	75	10	2.5	2.5	trace	trace	7	>0.5	2	4.5	1185

Table A1.2: Environmental data from Black Water; Sample Points 33 to 62.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
33	299	37388 70749	10	70	10	5	2.5	2.5	trace	10	>0.5	2	4	1186
34	298	37488 70748	0	15	80	5	0	0	0	10	>0.5	2	3	1187
35	297	37588 70745	0	15	80	5	0	0	0	8	>0.5	2	3	1188
36	296	37688 70741	0	20	70	10	0	0	trace	35	0.2	2	2	1189
37	295	37786 70721	0	30	60	10	0	0	0	30	0.25	2	2	1190
38	294	37882 70696	0	35	55	5	2.5	2.5	trace	30	0.25	2	2.5	1191
39	293	37966 70646	80	15	5	0	0	0	0	20	0.25	2	5	1192
40	292	38043 70581	0	60	35	5	0	0	0	14	0.3	2	4	1193
41	291	38099 70498	0	90	10	0	0	0	0	8+9	0.5	2	3.5	1194
42	290	38160 70420	0	85	10	5	0	0	0	30	0.3	2	3	1195
43	289	38220 70340	0	75	25	0	0	0	0	30	0.3	2	3	1196
44	288	38289 70270	45	40	15	0	0	0	0	25	0.25	2	5	1197
45	287	38344 70187	0	40	45	10	5	0	0	25	0.2	2	2.5	1198
46	286	38402 70106	0	10	75	10	5	0	0	20	0.1	2	2	1199
47	206	38464 70034	0	5	80	10	5	0	0	20	0.2	2	2	1200
48	205	38564 70027	0	65	30	5	0	0	0	18	0.4	2	3.5	1228
49	204	38654 69989	0	65	30	5	0	0	0	18	0.4	2	3	1227
50	203	38723 69917	10	75	15	0	0	0	0	20	0.4	2	3.5	1226
51	202	38788 69841	0	65	30	5	0	0	0	20	0.3	2	3	1225
52	201	38854 69766	0	35	60	5	0	0	0	25	0.3	2	2.5	1224
53	186	38950 69659	0	30	60	10	0	0	0	30	0.4	2	2.5	1223
54	177	39029 69601	0	75	20	5	0	0	0	20	0.3	2	3.5	1238
55	176	39119 69559	0	75	20	5	0	0	0	20	0.3	2	4	1237
56	175	39205 69508	100	0	0	0	0	0	0	10	>1	3	6	1236
57	174	39303 69486	50	50	0	0	0	0	0	18	0.7	2	5	1235
58	173	39393 69445	100	0	0	0	0	0	0	15	>1	2	7	No access

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
59	172	39484 69404	100	0	0	0	0	0	0	18	>1	3	4	1234
60	171	39578 69369	0	80	10	10	0	0	0	35	0.4	2	4	1233
61	170	39668 69326	0	80	15	5	0	0	0	25	0.4	2	3.5	1232
62	169	39763 69295	0	75	20	5	0	0	0	28	0.4	2	3.5	1231

Table A1.3: Environmental data from Abhainn Srath Rainich; Sample Points 63 and 64.

Sample Points	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
63	168	39816 69340	0	95	5	0	0	0	0	9	0.3	2	4	1230
64	167	39817 69440	0	90	10	0	0	0	0	12	0.3	2	2	1229

Table A1.4: Environmental data from Alltan a' Chleirich; Sample Points 65 to 85.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
65	19	35979 67121	0	0	0	0	5	30	65	1	0.25	2	1.5	1124
66	20	36070 67134	0	0	0	0	0	0	100	1	0.7	3	1.5	1125
67	21	36142 67099	0	0	0	0	0	0	100	1.5	0.1	3	1.5	1126
68	22	36123 67011	0	30	0	0	0	10	60	2	0.5	2	1.5	1127
69	27	36154 66958	0	50	15	0	0	15	20	0.75	0.5	3	1.5	1128
70	28	36238 66912	0	30	30	10	10	15	5	0.25	0.15	2	2.5	1129
71	29	36335 66899	100	0	0	0	0	0	0	4	<0.1	1	>6	1130
72	30	36422 66914	0	75	10	10	5	0	0	5	0.3	2	>6	1131
73	31	36510 66893	15	60	10	10	5	0	0	2	0.25	2	4	1132
74	32	36584 66914	0	0	0	0	0	20	80	2.5	0.65	2	3.5	1133
75	33	36653 66980	0	15	10	15	10	20	30	0.5	0.35	3	4.5	1134
76	34	36648 67076	0	60	30	10	0	0	0	1.25	0.45	2	5	1135
77	35	36696 67126	0	0	10	20	20	30	20	1.5	0.6	3	3	1136
78	36	36675 67145	0	0	0	0	0	0	100	1.5	0.65	3	2.5	1137

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
79	43	36740 67144	0	60	15	10	5	0	10	2	0.6	3	2.5	1138
80	42	36764 67219	0	30	20	10	10	0	30	0.85	0.5	3	5	1139
81	41	36788 67311	0	10	70	10	10	0	0	1	0.2	2	4	1140
82	40	36871 67323	0	0	0	0	0	0	100	1	0.4	3	2	1141
83	44	36907 67302	0	30	5	10	10	40	5	4	0.4	3	1.5	1142
84	45	36955 67241	0	65	2.5	2.5	10	20	0	3	0.3	2	2	1143
85	46	37011 67308	0	40	10	20	20	10	0	3.2	0.4	2	>6	1144

Table A1.5: Environmental data from Allt Bad ant-Seabhaig; Sample Points 86 to 125.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
86	38	36983 67099	0	45	20	5	10	15	0	0.25	0.15	2	6	1147
87	37	37063 67157	60	40	0	0	0	0	0	0.4	0.2	2	>6	1146
89	47	37084 67332	0	55	35	10	0	0	0	1.5	0.3	2	3.5	1148
88	39	37104 67248	0	0	0	0	10	30	60	0.3	0.3	2	2	1145
90	48	37154 67400	0	0	0	90	10	0	0	1.2	0.4	2	2.5	1149
91	49	37177 67456	0	0	0	0	0	0	100	2.5	0.5	2	1.5	1150
92	69	37184 67569	0	20	5	5	20	20	30	3.5	0.6	2	1	1151
93	68	37216 67597	0	0	0	0	0	20	80	2	0.7	2	1.5	1152
94	67	37246 67659	0	0	0	0	0	15	85	1.75	0.7	2	1	1153
95	66	37274 67710	0	0	0	0	0	5	95	2.5	0.75	2	1.5	1154
96	65	37318 67791	0	35	5	0	0	5	55	3.5	1.2	2	1.5	1155
97	70	37372 67840	0	0	0	0	0	0	100	3.5	1.3	2	1.5	1156
98	71	37427 67919	0	45	20	10	5	20	0	3	0.4	2	3	1157
99	99	37463 68017	0	0	0	0	0	0	100	3.5	<0.05	2	4	1158
100	73	37489 67955	0	65	25	5	5	0	0	2.5	0.45	2	4	1159
101	74	37566 68019	0	70	15	10	5	0	trace	1.25	0.45	2	4	1160
102	75	37622 68096	0	55	15	5	0	10	15	3.5	0.6	3	2.5	1161
103	76	37705 68139	0	65	15	10	0	0	10	2.5	0.6	2	4	1162
104	77	37728 68232	0	80	15	2.5	2.5	0	0	4	0.8	2	4.5	1163
105	78	37798 68294	0	75	10	10	5	0	0	3.5	0.35	2	4	1164
106	79	37862 68362	0	75	10	10	5	0	0	4	0.35	2	4.5	1165

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
107	80	37933 68425	0	0	65	15	10	10	0	4.5	0.4	2	5	1166
108	81	38015 68482	0	70	15	10	5	0	0	4	0.35	2	5	1167
109	82	38096 68539	0	80	10	10	0	0	0	3.5	0.35	2	5.5	1168
110	83	38164 68609	0	90	5	5	0	0	0	4.5	0.3	2	5	1169
111	84	38214 68693	0	75	20	5	0	0	0	2.5	0.25	2	5	1170
112	85	38231 68786	0	85	10	5	0	0	0	4.5	0.2	2	5.5	1171
113	86	38251 68875	0	80	10	10	0	0	0	3.5	0.35	2	4	1172
114	87	38305 68951	0	80	15	5	0	0	0	3	0.2	2	6	1173
115	88	38357 69035	0	85	10	5	0	0	0	4.5	0.2	2	>6	1174
116	89	38392 69128	0	90	5	5	0	0	0	4	0.4	2	>6	1175
117	90	38395 69226	0	85	10	5	0	0	0	2.5	0.4	2	6	1176
118	91	38461 69291	0	50	20	10	0	10	10	4	0.35	2	3	1177
119	92	38553 69304	0	70	15	10	5	0	0	4.5	0.45	2	4	1178
120	93	38647 69319	0	65	15	10	5	5	0	4	0.35	2	5	1179
121	94	38678 69409	100	0	0	0	0	0	0	5.5	0.2	2	10	1180
122	95	38740 69483	40	60	0	0	0	0	0	3.5	0.25	2	>6	1181
123	96	38813 69530	70	25	5	0	0	0	0	3.5	0.25	2	>6	1182
124	97	38894 69555	0	80	10	5	5	0	0	3.5	0.3	2	5	1183
125	98	38980 69583	40	50	10	0	0	0	0	3	0.35	2	6	1184

Table A1.6: Environmental data from un-named tributary of Black Water; Sample Points 126 to 135.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
126	165	38193 69490	0	0	0	0	0	0	100	1	<0.1	1	0	1213
127	166	38273 69502	0	0	0	0	0	0	100	1	<0.1	2	1	1214
128	178	38319 69519	0	0	0	0	0	0	100	2	<0.1	2	0	1215
129	179	38412 69499	0	0	0	0	0	0	100	0.5	0.2	2	1	1216
130	180	38495 69534	0	0	0	0	0	0	100	0.5	0.2	2	1	1217
131	181	38589 69563	0	0	0	0	0	0	100	0.7	<0.1	2	2	1218
132	182	38656 69621	0	0	0	0	0	0	100	1	0.4	2	3.5	1219
133	183	38730 69681	0	0	0	0	0	0	100	1	<0.1	2	3.5	1220
134	184	38821 69691	0	0	0	0	0	0	100	0.7	<0.1	2	1	1221

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
135	185	38888 69688									<0.1	2	1	1222

Table A1.7: Environmental data from Allt Glac an t-Sithein and headwaters/tributaries; Sample Points 136 to 198.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
136	51	35516 67569	0	75	15	5	0	0	5	1	0.05	2	1.5	985
137	52	35612 67563	0	0	0	0	0	0	100	1	0.05	2	2	986
138	53	35707 67542	0	35	25	30	0	5	5	0.75	0.05	2	1.5	987
139	54	35767 67602	0	0	15	55	5	5	20	0.3	0.05	3	2	988
140	55	35796 67697	Subterranean										2.5	989
141	56	35865 67761	20	40	20	10	0	0	10	0.2	0.1	2	3.5	990
142	57	35945 67813	Subterranean										3.5	991
143	58	36016 67883	Subterranean										3.5	992
144	59	36079 67959	0	0	0	5	0	5	90	0.3	0.15	2	4	993
145	60	36153 68017	Subterranean										4.5	994
146	61	36235 68073	0	70	10	15	5	0	0	0.5	0.3	2	4.5	995
147	124	35650 68267	0	0	0	0	0	0	100	3	<0.05	2	3	1004
148	125	35726 68216	0	0	0	0	0	0	100	4	0.05	2	5	1003
149	126	35811 68171	0	50	35	0	0	0	15	1	0.05	2	6	1002
150	127	35904 68156	Subterranean										5.5	1001
151	128	35991 68110	0	30	50	5	5	5	5	0.2	0.3	3	6	1000
152	129	36086 68106	Subterranean										5.5	999
153	130	36183 68113	0	25	65	0	0	5	5	0.75	0.45	3	4.5	998
154	133	35852 68333	0	0	0	0	0	0	100	0.75	<0.05	2	3	1008
155	134	35906 68258	0	0	0	0	0	0	100	0.5	<0.01	2	5	1010
156	113	35740 68543	0	0	0	0	0	0	100	2	<0.05	3	1.5	1005
157	112	35779 68462	0	20	40	0	0	0	40	1.5	0.1	3	2.5	1006
158	111	35837 68388	0	10	10	5	5	10	50	0.5	0.2	2	3	1007
159	110	35899 68313	0	0	0	0	0	20	80	0.5	<0.1	2	4	1009
160	106	35984 68214	Subterranean										5	1011
161	107	36063 68182	0	45	5	0	0	5	45	0.2	0.25	2	5.5	1012
162	108	36150 68166	0	0	0	0	0	10	90	0.3	0.15	2	5.5	1013
163	109	36236 68117	0	70	10	10	5	5	0	0.3	0.3	3	4.5	997

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
164	105	36293 68097	0	60	30	10	0	0	0	1	0.55	3	5	996
165	117	36351 68080	30	20	10	30	5	5	0	1.3	0.35	2	4.5	1015
166	116	36437 68121	0	35	15	10	10	10	20	1	0.35	3	3	1016
167	115	36467 68213	0	45	40	10	5	0	0	1	0.25	2	3	1017
168	123	36822 67896	Subterranean										2	1023
169	122	36747 67924	Subterranean										3	1022
170	121	36667 67968	0	15	35	30	10	10	0	0.5	0.3	2	3	1021
171	120	36617 68044	Subterranean										3	1020
172	119	36585 68133	0	30	10	10	0	10	40	0.5	0.5	3	5	1019
173	118	36527 68212	0	20	20	20	10	10	20	1	0.4	3	2	1018
174	114	36513 68291	0	0	0	0	0	0	100	1	<0.01	2	3	1024
175	131	36506 68308	0	10	40	20	10	10	0	0.5	0.25	3	1.5	1025
176	132	36518 68403	0	10	10	20	30	20	10	2	0.6	3	1	1026
177	135	36567 68456	0	0	20	30	10	20	20	1	0.3	2	1	1027
178	139	36452 68451	Subterranean										7	1030
179	138	36525 68487	0	0	0	0	0	10	90	0.8	0.1	2	1.5	1029
180	156	36566 68510	0	0	0	0	0	0	100	0.3	0.65	2	1	1028
181	136	36625 68516	0	0	10	10	0	30	50	1	0.2	2	1.5	1031
182	137	36719 68533	0	0	0	20	40	30	10	3	0.4	3	1.5	1032
183	143	36475 68671	Subterranean										3.5	1036
184	142	36555 68618	0	0	0	0	0	0	100	0.3	0.05	3	3.5	1035
185	141	36641 68579	0	0	0	0	0	0	100	0.3	0.05	2	2	1034
186	140	36729 68555	0	0	0	0	0	0	100	0.5	0.1	2	1.5	1033
187	144	36756 68617	0	60	15	20	5	0	0	3	0.1	2	2.5	1037
188	145	36785 68712	0	20	10	5	5	10	50	4.5	0.4	2	2.5	1038
189	146	36772 68806	0	40	15	20	10	10	5	3.5	0.45	2	4	1083
190	147	36754 68901	0	85	15	0	0	0	trace	2.5	0.3	2	3.5	1084
191	148	36743 68979	0	0	0	0	0	0	100	2.5	1.2	3	1.5	1085
192	149	36823 68989	0	40	20	5	5	20	10	2	0.8	3	2	1086
193	150	36916 69000	0	20	10	15	5	20	20	4	1	3	2	1087
194	151	36944 69074	0	55	25	10	5	5	0	4	0.2	3	3	1088
195	152	36941 69171	0	20	15	30	10	10	15	2.5	0.6	3	2.5	1089
196	153	37012 69212	0	25	35	20	10	10	5	2.5	0.5	3	3	1090
197	154	37065 69291	0	60	30	10	0	0	0	3	0.2	3	3	1091

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
198	155	37105 69379	0	30	35	25	10	0	0	3	0.6	3	3.5	1092

Table A1.8: Environmental data from Allt Cearc an t-Slugain and tributary; Sample Points 199 to 227.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
199	157	37155 69413	0	70	20	5	0	2.5	2.5	2	0.35	2	4	1093
200	158	37249 69395	0	85	10	0	0	5	0	1	0.15	2	4	1094
201	159	37325 69411	0	25	45	10	0	0	20	1	0.25	2	3	1095
202	160	37414 69446	0	0	0	0	0	0	100	0.2	0.1	2	1.5	1096
203	161	37487 69419	0	15	0	0	15	45	30	1	0.75	3	1	1097
204	162	37576 69445	0	80	20	0	0	0	0	4	0.15	2	>6	1098
205	163	37664 69459	0	0	70	15	5	5	5	2.5	0.2	2	>6	1099
206	164	37730 69507	0	0	0	0	5	75	20	0.75	0.2	2	1	1100
207	187	37260 69668	0	0	0	0	0	0	100	2.5	0.1	2	1.5	1109
208	188	37293 69749	0	0	0	0	0	0	100	3	<0.05	2	1	1108
209	189	37354 69759	0	0	0	0	0	0	100	2	0.1	22	1	1107
210	190	37426 69728	0	0	0	0	0	0	100	1.2	0.15	2	1	1106
211	191	37518 69702	0	0	0	0	0	0	100	1.25	0.4	3	1	1105
212	212	37532 69722	0	0	0	0	0	0	100	0.25	0.05	2	2.5	1104
213	209	37588 69708	0	0	0	0	0	0	100	0.5	0.05	2	2	1103
214	207	37677 69670	0	0	0	0	0	0	100	0.15	0.2	2	2.5	1102
215	208	37725 69585	0	70	0	0	0	0	30	0.3	0.1	2	3	1101
216	285	37779 69510	0	90	0	10	0	0	0	1	0.3	2	1	1212
217	284	37841 69472	0	100	0	0	0	0	0	1.5	0.2	2	2	1211
218	283	37919 69529	0	90	10	0	0	0	0	2	0.2	2	3.5	1210
219	282	37972 69599	0	100	0	0	0	0	0	1.5	0.1	2	2	1209
220	281	38043 69664	0	90	10	0	0	0	0	1.5	0.2	2	3	1208
221	280	38100 69723	0	95	5	0	0	0	0	1.5	0.2	2	4	1207
222	279	38166 69776	0	0	0	5	80	10	5	1	0.6	2	2	1206
223	278	38193 69861	0	100	0	0	0	0	0	2.5	0.1	2	2.5	1205
224	277	38218 69956	0	95	5	0	0	0	0	3	0.1	2	3.5	1204
225	276	38267 70031	0	95	5	0	0	0	0	2	0.2	2	3	1203
226	275	38354 70057	0	90	5	5	0	0	0	2	0.2	2	3	1202

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
227	274	38442 70022	0	0	90	5	5	0	0	2	0.2	2	2.5	1201

Table A1.9: Environmental data from Feith Bhaite and tributaries; Sample Points 228 to 259.

Sample Point	No.	OS Grid Ref (all NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
228	264	37086 69406	15	40	0	0	0	5	40	4	0.5	3	3	1110
229	263	37073 69503	0	0	10	20	20	20	30	0.8	0.6	3	2.5	1111
230	262	37144 69562	0	45	15	10	10	15	5	2	0.45	2	4	1112
231	261	37142 69649	10	60	25	5	0	0	0	2	0.5	2	6	1113
232	260	37162 69728	0	30	35	30	5	0	0	3	0.3	2	4	1114
233	259	37129 69807	0	0	15	55	20	10	0	3	0.05	2	3	1115
234	258	37123 69885	0	0	0	30	30	20	10	0.4	0.25	2	2.5	1116
235	257	37110 69964	0	20	40	10	5	10	15	0.45	0.9	3	2	1117
236	265	37075 69982	0	60	20	0	0	10	10	0.35	0.45	3	1.5	1118
237	266	37015 70042	0	20	20	0	0	10	50	0.5	0.55	3	1.5	1119
238	267	36965 70090	0	0	10	20	10	10	50	0.4	0.5	3	1.5	1120
239	268	36898 70135	0	0	0	0	0	0	100	0.5	0.4	3	1	1121
240	269	36815 70120	0	0	0	0	0	0	100	0.3	0.6	3	1	1122
241	270	36719 70123	0	50	45	5	0	0	0	2	0.35	2	2	1123
242	340	36280 69436	0	0	0	20	45	25	10	0.15	<0.05	1	>6	1082
243	339	36312 69530	Subterranean										>6	1081
244	338	36319 69623	0	0	0	0	10	40	50	0.25	0.2	2	6	1080
245	337	36367 69686	0	0	0	0	10	30	60	0.45	0.05	2	4	1079
246	336	36407 69777	0	0	0	10	20	30	40	0.25	<0.05	2	5	1078
247	335	36431 69874	0	25	50	15	0	5	5	0.3	<0.05	2	5	1077
248	334	36473 69961	0	50	0	0	0	5	45	0.3	0.15	2	5	1076
249	333	36542 70025	Subterranean										6	1075
250	332	36615 70091	Subterranean										4	1074
251	200	36654 70148	0	15	45	20	0	5	10	1.5	0.75	3	1.5	1073
252	192	36230 69768	0	35	35	0	0	0	30	0.2	0.1	2	4	1065
253	193	36236 69863	0	45	15	0	0	10	30	0.3	0.2	1	4	1066
254	194	36261 69958	0	85	10	0	0	0	5	0.5	0.45	2	5	1067
255	195	36331 70029	0	80	10	5	0	0	5	0.3	0.5	2	6	1068

Sample Point	No.	OS Grid Ref (all NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
256	196	36394 70098	0	0	0	0	0	0	100	0.3	0.1	2	4	1069
257	197	36472 70144	0	0	0	0	0	0	100	0.45	0.1	1	2.5	1070
258	198	36544 70207	0	0	0	0	0	0	100	1	0.1	2	1	1071
259	199	36633 70227	0	0	0	0	0	15	85	1	0.2	1	1	1072

Table A1.10: Environmental data from un-named tributaries of the Glascarnoch River; Sample points 260 to 284.

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
260	249	36037 69968	0	0	0	0	0	40	60	0.3	0.6	1	3.5	1059
261	250	36105 70026	0	10	10	0	0	0	80	0.45	<0.05	3	4	1060
262	251	36166 70090	0	0	10	10	30	35	15	0.3	0.2	2	3.5	1064
263	252	36222 70159	0	0	15	0	0	0	85	0.2	0.1	2	2.5	1063
264	246	35981 69962	0	30	0	0	0	0	70	0.6	<0.05	2	4	1058
265	247	36053 70026	0	10	0	0	0	0	90	0.3	0.2	1	4	1061
266	248	36058 70109	0	20	10	0	0	0	70	0.25	0.25	1	3.5	1062
267	253	35823 69973	0	30	0	30	20	10	10	0.3	0.1	1	4.5	1057
268	254	35897 70028	0	25	0	0	0	0	75	0.45	0.05	1	5	1056
269	255	35937 70117	0	0	0	0	0	0	100	0.25	0.1	1	4.5	1055
270	256	35485 69999	0	0	0	0	0	0	100	0.35	<0.05	3	2	1051
271	271	35565 70046	0	0	0	0	0	0	100	0.25	<0.05	3	3.5	1052
272	272	35649 70067	0	30	20	10	0	10	30	0.35	0.15	1	4	1053
273	273	35730 70102	0	40	35	10	10	0	5	1.2	0.5	1	4	1054
274	214	35239 69625	0	0	0	0	0	0	100	0.3	0.05	2	4	1049
275	213	35251 69714	Subterranean										3.5	1048

Sample Point	No.	OS Grid Ref (NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
276	210	35272 69712	0	0	0	0	0	0	100	2.5	0.1	2	3.5	1047
277	211	35323 69703	Subterranean										4	1050
278	347	35260 69786	0	20	10	0	0	10	60	0.3	0.15	2	4	1046
279	346	35256 69885	0	0	15	15	10	20	40	0.4	0.15	2	4	1045
280	345	35285 69977	0	0	0	0	0	5	95	0.3	0.05	2	2.5	1044
281	344	35334 70020	0	0	0	0	0	25	75	1	0.5	2	3.5	1043
282	343	35378 70098	0	40	20	5	10	15	10	0.7	0.5	3	4	1042
283	342	35450 70158	0	0	0	0	0	0	100	0.3	0.165	1	3	1041
284	341	35527 70220	0	0	0	0	0	0	100	0.4	0.15	1	2.5	1040

Table A1.11: Environmental data from Allt Giubhais Beag; Sample Points 285 to 320.

Sample Point	No.	OS Grid Ref (all NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
285	64	35266 67814	0	0	0	0	0	0	100	0.5	0.4	3	1	981
286	72	35255 67851	0	0	0	0	0	0	100	0.3	0.05	3	1	980
287	103	35286 67900	0	15	35	5	5	10	30	2	0.35	3	1.5	979
288	102	35287 67993	0	0	0	0		0	100	0.25	0.05	3	<1%	978
289	101	35257 68078	0	10	0	0	5	10	75	1	0.25	3	1	975
290	100	35359 68047	0	0	0	0	0	0	100	1	0.1	3	<1%	977
291	104	35327 68103	0	0	0	0	0	0	100	1.5	0.1	3	<1%	976
292	239	35249 68142	0	5	0	0	0	0	95	0.25	0.35	3	<1%	974
293	238	35196 68216	0	0	0	0	0	10	90	0.1	0.1	3	1	973
294	237	35143 68299	0	10	50	25	5	5	5	0.25	0.15	3	2	972
295	236	35095 68372	0	70	25	5	0	0	0	2	0.35	3	5	971
296	235	35027 68431	0	77.5	20	2.5	0	0	0	1	0.3	3	5	970
297	234	34945 68482	40	50	10	0	0	0	0	1.25	0.3	2	5	969
298	233	34870 68537	10	65	20	5	0	0	0	2	0.5	3	5	968

Sample Point	No.	OS Grid Ref (all NH)	Bedrock	Boulders >256 mm	Cobbles 65–256 mm	Pebbles 4–64mm	Gravel 2–4mm	Coarse sand 0.5–2mm	Fine sand/silt <0.5mm	Av. wetted width (m)	Av. depth (m)	Turbidity (1 clear:-3 turbid)	Gradient (%)	Photographic Plate
299	232	34780 68577	0	50	45	5	0	0	0	0.5	0.2	2	5	967
300	231	34700 68610	0	10	55	20	5	5	5	0.3	0.4	3	4	966
301	228	34657 68829	0	40	30	20	10	0	0	1.5	0.2	2	3	963
302	227	34693 68895	0	45	50	5	0	0	0	2	0.2	2	4	962
303	226	34735 68974	0	85	15	0	0	0	0	2	0.25	3	4	961
304	225	34727 69052	5	80	10	5	0	0	0	3	0.2	3	4	960
305	224	34716 69136	10	80	5	5	0	0	0	2.5	0.25	2	4.5	959
306	223	34748 69227	5	50	40	5	0	0	0	2	0.15	2	4	958
307	222	34757 69314	10	60	25	5	0	0	0	2.5	0.25	3	4	957
308	221	34777 69401	5	55	30	10	0	0	0	3	0.15	3	3.5	956
309	220	34802 69485	0	65	25	10	0	0	0	2	0.35	3	3.5	955
310	219	34825 69564	0	30	60	10	0	0	0	2.5	0.2	2	3	954
311	218	34841 69639	20	20	30	25	5	0	0	4	>0.5	3	2.5	953
312	217	34885 69725	50	40	10	0	0	0	0	2	0.15	2	3.5	952
313	216	34936 69805	60	35	5	0	0	0	0	1.5	0.2	2	3.5	No access
314	215	34997 69882	90	10	0	0	0	0	0	2	0.2	2	4	No access
315	240	35029 69924	50	40	10	0	0	0	0	1.5	0.2	2	4	951
316	241	35076 69984	90	10	0	0	0	0	0	1	0.2	2	4	950
317	242	35091 70073	20	70	10	5	5	0	0	1.5	0.15	2	3	949
318	243	35142 70157	0	70	25	5	0	0	trace	2	0.25	2	2.5	948
319	244	35130 70241	10	30	20	20	10	10	0	1.5	0.15	2	2.5	947
320	245	35174 70328	0	20	55	10	10	5	0	2	0.2	2	2.5	946

ANNEX 2: PHOTOGRAPHIC PLATES

Sample Point 1



Sample Point 2



Sample Point 3



Sample Point 4



Sample Point 5



Sample Point 6



Sample Point 7



Sample Point 8



Sample Point 9



Sample Point 10



Sample Point 11



Sample Point 12



Sample Point 13



Sample Point 14



Sample Point 15



Sample Point 16



Sample Point 17



Sample Point 18



Sample Point 19



Sample Point 20



Sample Point 21



Sample Point 22



Sample Point 23



Sample Point 24



Sample Point 25



Sample Point 26



Sample Point 27



Sample Point 28



Sample Point 29



Sample Point 30



Sample Point 31



Sample Point 32



Sample Point 33



Sample Point 34



Sample Point 35



Sample Point 36



Sample Point 37



Sample Point 38



Sample Point 39



Sample Point 40



Sample Point 41



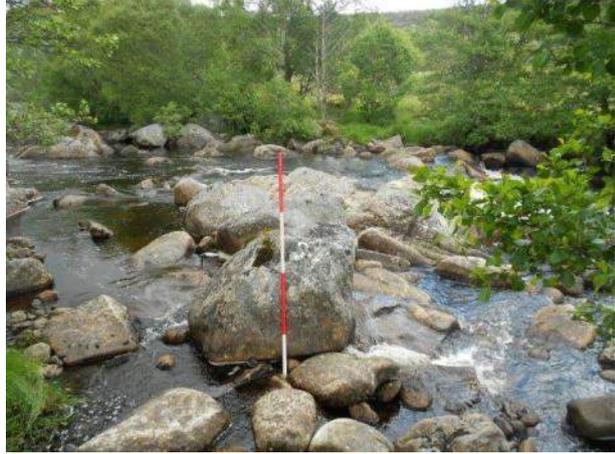
Sample Point 42



Sample Point 43



Sample Point 44



Sample Point 45



Sample Point 46



Sample Point 47



Sample Point 48



Sample Point 49



Sample Point 50



Sample Point 51



Sample Point 52



Sample Point 53



Sample Point 54



Sample Point 55



Sample Point 56



Sample Point 57 (NB: Point 58- no access)



Sample Point 59



Sample Point 60



Sample Point 61



Sample Point 62



Sample Point 63



Sample Point 64



Sample Point 65



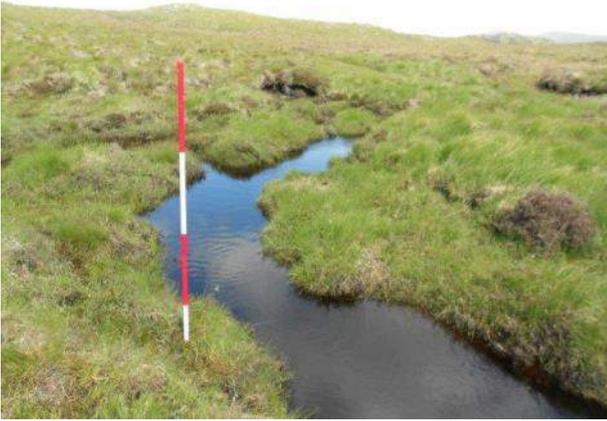
Sample Point 66



Sample Point 67



Sample Point 68



Sample Point 69



Sample Point 70



Sample Point 71



Sample Point 72



Sample Point 73



Sample Point 74



Sample Point 75



Sample Point 76



Sample Point 77



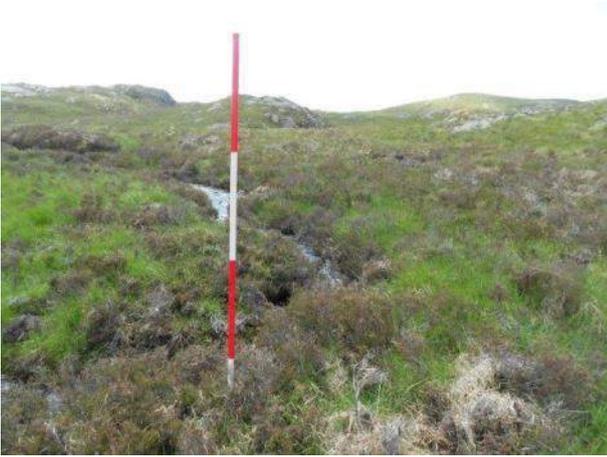
Sample Point 78



Sample Point 79



Sample Point 80



Sample Point 81



Sample Point 82



Sample Point 83



Sample Point 84



Sample Point 85



Sample Point 86



Sample Point 88



Sample Point 90



Sample Point 87



Sample Point 89



Sample Point 91



Sample Point 92



Sample Point 93



Sample Point 94



Sample Point 95



Sample Point 96



Sample Point 97



Sample Point 98



Sample Point 99



Sample Point 100



Sample Point 101



Sample Point 102



Sample Point 103



Sample Point 104



Sample Point 105



Sample Point 106



Sample Point 107



Sample Point 108



Sample Point 109



Sample Point 110



Sample Point 111



Sample Point 112



Sample Point 113



Sample Point 114



Sample Point 115



Sample Point 116



Sample Point 117



Sample Point 118



Sample Point 119



Sample Point 120



Sample Point 121



Sample Point 122



Sample Point 123



Sample Point 124



Sample Point 125



Sample Point 126



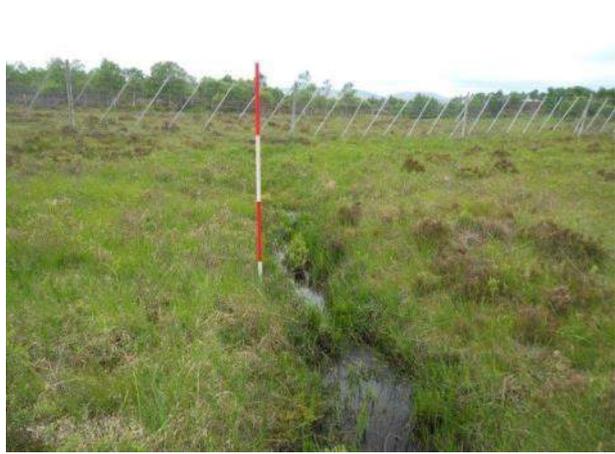
Sample Point 127



Sample Point 128



Sample Point 129



Sample Point 130



Sample Point 131



Sample Point 132



Sample Point 133



Sample Point 134



Sample Point 135



Sample Point 136



Sample Point 137



Sample Point 138



Sample Point 139



Sample Point 140



Sample Point 141



Sample Point 142



Sample Point 143



Sample Point 144



Sample Point 145



Sample Point 146



Sample Point 147



Sample Point 148



Sample Point 149



Sample Point 150



Sample Point 151



Sample Point 152



Sample Point 153



Sample Point 154



Sample Point 155



Sample Point 156



Sample Point 157



Sample Point 158



Sample Point 159



Sample Point 160



Sample Point 161



Sample Point 162



Sample Point 163



Sample Point 164



Sample Point 165



Sample Point 166



Sample Point 167



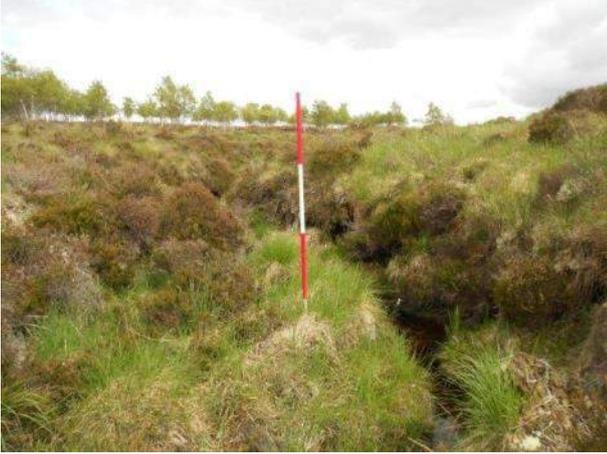
Sample Point 168



Sample Point 169



Sample Point 170



Sample Point 171



Sample Point 172



Sample Point 173



Sample Point 174



Sample Point 175



Sample Point 176



Sample Point 177



Sample Point 178



Sample Point 179



Sample Point 180



Sample Point 181



Sample Point 182



Sample Point 183



Sample Point 184



Sample Point 185



Sample Point 186



Sample Point 187



Sample Point 188



Sample Point 189



Sample Point 190



Sample Point 191



Sample Point 192



Sample Point 193



Sample Point 194



Sample Point 195



Sample Point 196



Sample Point 197



Sample Point 198



Sample Point 199



Sample Point 200



Sample Point 201



Sample Point 202



Sample Point 203



Sample Point 204



Sample Point 205



Sample Point206



Sample Point207



Sample Point 208



Sample Point 209



Sample Point 210



Sample Point 211



Sample Point 212



Sample Point 213



Sample Point 214



Sample Point 215



Sample Point 216



Sample Point 217



Sample Point 218



Sample Point 219



Sample Point 220



Sample Point 221



Sample Point 222



Sample Point 223



Sample Point 224



Sample Point 225



Sample Point 226



Sample Point 227



Sample Point 228



Sample Point 229



Sample Point 230



Sample Point 231



Sample Point 232



Sample Point 233



Sample Point 234



Sample Point 235



Sample Point 236



Sample Point 237



Sample Point 238



Sample Point 239



Sample Point 240



Sample Point 241



Sample Point 242



Sample Point 243



Sample Point 244



Sample Point 245



Sample Point 246



Sample Point 247



Sample Point 248



Sample Point 249



Sample Point 250



Sample Point 251



Sample Point 252



Sample Point 253



Sample Point 254



Sample Point 255



Sample Point 256



Sample Point 257



Sample Point 258



Sample Point 259



Sample Point 260



Sample Point 261



Sample Point 262



Sample Point 263



Sample Point 264



Sample Point 265



Sample Point 266



Sample Point 267



Sample Point 268



Sample Point 269



Sample Point 270



Sample Point 271



Sample Point 272



Sample Point 273



Sample Point 274



Sample Point 275



Sample Point 276



Sample Point 277



Sample Point 278



Sample Point 279



Sample Point 280



Sample Point 281



Sample Point 282



Sample Point 283



Sample Point 284



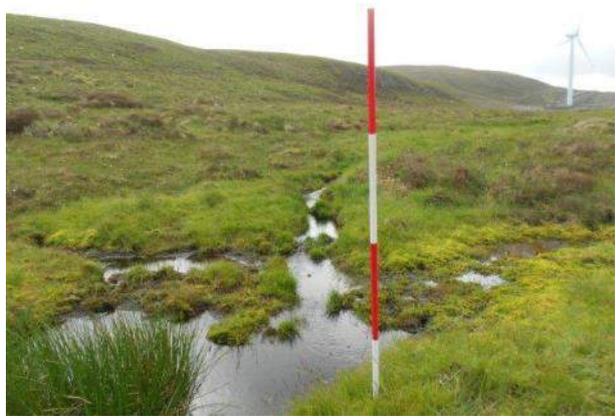
Sample Point 285



Sample Point 286



Sample Point 287



Sample Point 288



Sample Point 289



Sample Point 290



Sample Point 291



Sample Point 292



Sample Point 293



Sample Point 294



Sample Point 295



Sample Point 296



Sample Point 297



Sample Point 298



Sample Point 299



Sample Point 300



Sample Point 301



Sample Point 302



Sample Point 303



Sample Point 304



Sample Point 305



Sample Point 306



Sample Point 307



Sample Point 308



Sample Point 309



Sample Point 310



Sample Point 311



Sample Point 312



Sample Point 315 (NB: No access Points 313, 314)



Sample Point 316



Sample Point 317



Sample Point 318



Sample Point 319



Sample Point 320

