

Torfichen Wind Farm

Fish Survey Report

Appendix 8.4

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Torfichen Windfarm Baseline Surveys



Report prepared for MacArthur Green

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Quality management

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Executive Summary

- Forth Rivers Consulting (hereafter FRC) were hired by MacArthur Green on behalf of the Applicant to obtain baseline fisheries data and information relevant to inform an ecological impact assessment for Torfichen Wind Farm (the Proposed Development).
- FRC have provided baseline salmonid electrofishing surveys and associated reporting for the Proposed Development based on an appropriate and representative sampling strategy.
- FRC were also asked to provide any desk-based information on the presence/absence of species, habitat suitability, and the distribution of the following within the site/respective catchments:
 - lamprey species and freshwater pearl mussel;
 - invasive non-native species (e.g., North American signal crayfish, Japanese knotweed etc.); and
 - any notable barriers to fish migration.
- The site and immediately surrounding area includes several hill burns including Black Burn, Latch Burn and Wesley Cleugh Burn. In addition to these smaller burns there are several larger tributaries to the Gore Water and South Esk that originate within the site, and which were also surveyed.
- Fully quantitative and semi-quantitative electrofishing surveys were undertaken on five burns with the aim of establishing habitat quality, fish species presence and absence as well as density estimates of salmonid juveniles.
- The surveys were carried out between the 11 October 2022 and 14 October 2022.
- One of the electrofishing surveys of a small burn within the site (Site 3) was not undertaken as the burn was found to be running below the surface and was inaccessible for fishing. This burn was indicative of many of the burns within the site.
- The Wesley Cleugh Burn was originally within the sampling strategy; however, due to problems with landowner permission to provide access, it was removed from the surveys. An additional sampling site on the Purvies Hill Burn north of the Proposed Development was included as an alternative (Site 4).
- Trout populations were recorded at two of the fully quantitative sites (the Purvies Hill Burn and the Middleton North Burn) and on one of the semi-quantitative sites (the Black Burn).
- Two burns recorded no fish – the Latch Burn and the Purvies Hill Burn (Upper) sites.
- Habitat of the electrofishing sites was varied. The semi-quantitative sites were mostly in the upper reaches and were representative of upland habitat that were unlikely to have large populations or diverse fish communities. Fully quantitative sites were downstream of the site to provide baseline information of salmonid communities.
- Other species of conservation interest were surveyed for and not found during the survey i.e., eels and lamprey.
- A desk-based assessment of Invasive Non-Native Species (INNS) found none within the site; however, some species were found within 5 km of the Proposed Development.
- A desk-based assessment of barriers to migration found several barriers of importance downstream of the site that halt Atlantic salmon migration.
- The presence of spawning and juvenile trout downstream of the site should be considered a constraint to the Proposed Development, requiring appropriate mitigation and control measures during construction and operation.

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1. Introduction

1.1. Background to the Study

Forth Rivers Consulting (hereafter FRC) were commissioned by MacArthur Green on behalf of the Applicant to undertake baseline electrofishing and fish habitat surveys for Torfichen Wind Farm (the Proposed Development). In addition to this, FRC were asked to provide any desk-based information on the presence/absence, habitat suitability the distribution of the following within the site/respective catchments:

- lamprey species (*Lampetra* spp.) and freshwater pearl mussel (*Margaritifera margaritifera*);
- Invasive non-native species (INNS) (e.g., North American signal crayfish (*Pacifastacus leniusculus*), Japanese knotweed (*Fallopia japonica*) etc.); and
- any notable barriers to fish migration.

The Proposed Development location is shown below in **Figure 1.1** (N.B. EIA Scoping Report site boundary shown).

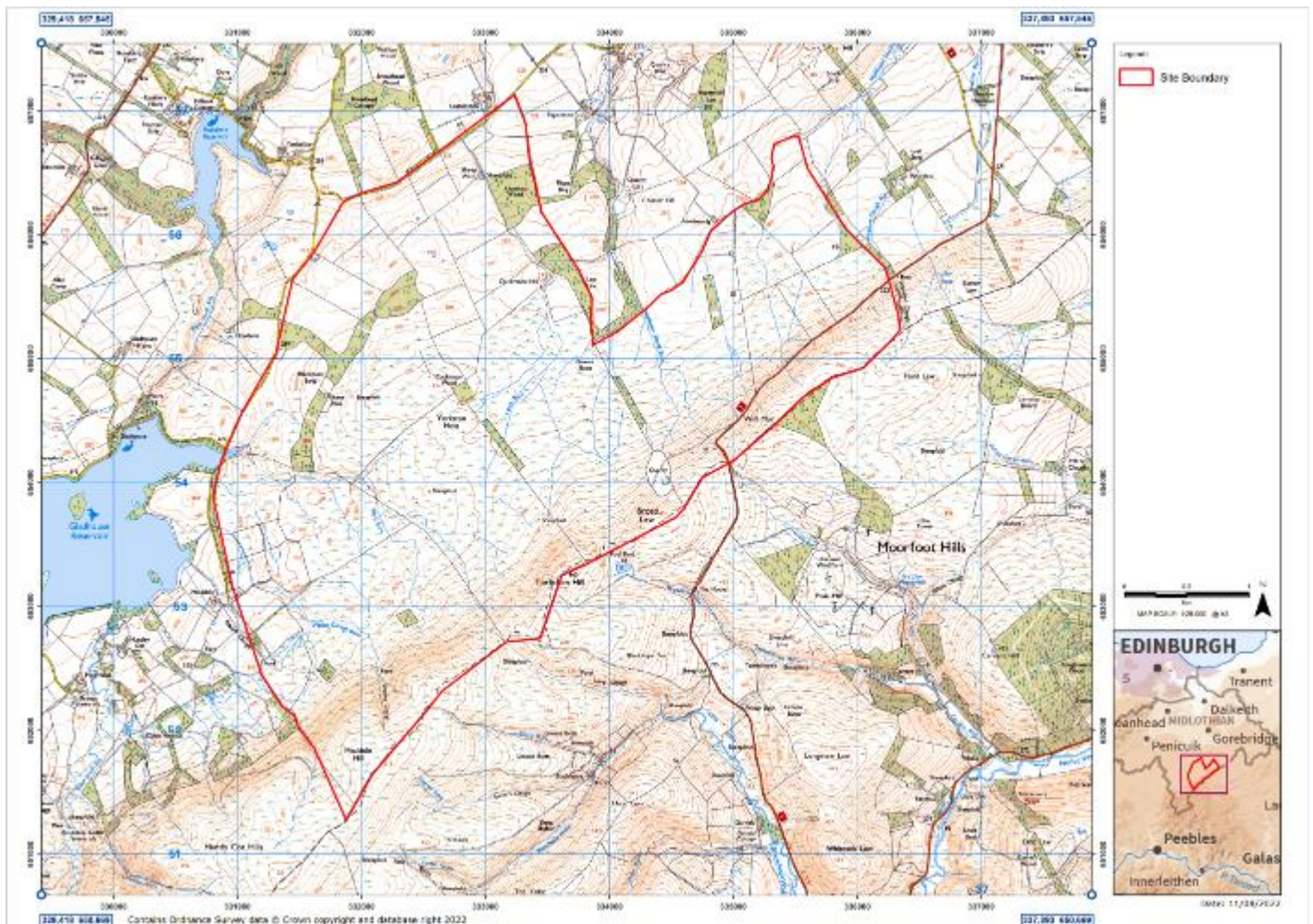


Figure 1.1. Proposed Development location (map provided by MacArthur Green)

The Proposed Development sits (almost) entirely within the Lothian River Esk catchment (see **Figure 1.1**), specifically the South Esk branch of the river. The Proposed Development sits close to the East bank of Gladhouse Reservoir (NGR NT29825,53680). It borders the Tweed catchment to the South, but the Proposed Development does not impact it.

The Lothian River Esk has two significant main stems for much of its length - the North Esk and the South Esk. The North Esk rises in the Pentland Hills and the South Esk rises on the western slopes of Blackhope Scar in the Moorfoot Hills at an altitude of 651 m. The South Esk headwaters drain a moorland landscape underlain by sedimentary mudstone and sandstone rocks. The surface layer comprises alluvium in the valley and deep peat on higher grounds (**Figure 1.2**). This type of geology generally produces slightly acidic or neutral waters which have naturally low to medium productivity and in combination with the narrow contours and high gradient will produce depauperate communities in the upland habitat in which the Proposed Development resides.

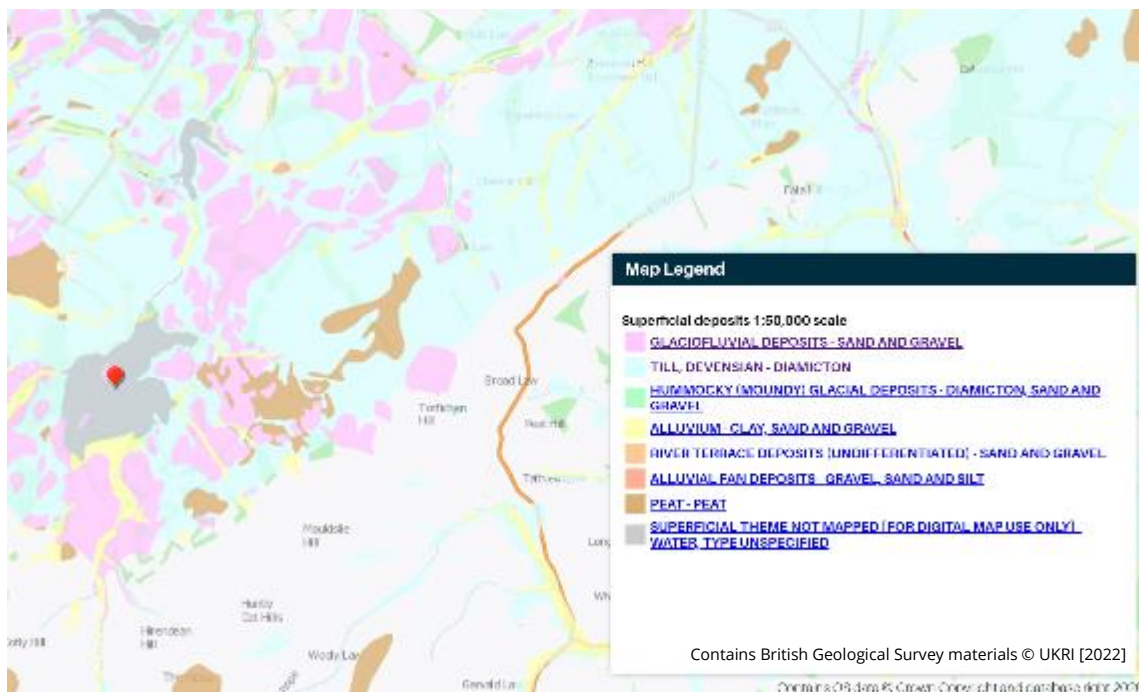


Figure 1.2 shows the geological data for superficial deposits of the area around the project development. The pin is located at Gladhouse Reservoir.

1.2. Proposed Development Proposals

The Proposed Development comprises the installation of a wind farm development at Torfichen Hill, on land to the east of Gladhouse Reservoir, as described within **Chapter 3: Project Description** of the EIA Report.

1.3. This Report

This report outlines the methodology, results and evaluation of the electrofishing and fish habitat surveys and desk-based assessment as well as identifying appropriate mitigation measures and recommendations for ecological enhancement.

The aims of this report were to build a picture of fish populations currently there, including habitat availability. The objectives of this report are to provide:

- the results of the surveys;
- an evaluation of these results;
- baseline assessments on other freshwater species, barriers and non-native species pertaining to the project; and
- identification of mitigation requirements.

1.4. Conservation Status

Gladhouse Reservoir is designated as a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and RAMSAR for Pink-footed goose (*Anser brachyrhynchus*).

2. Methodology

2.1. Fish Habitat Survey

The Forth Rivers Trust (hereafter FRT) do not hold any historic data records on these smaller tributaries to the River South Esk so it was proposed that FRC would visit the sites to undertake electrofishing surveys and assess the fish presence and habitat.

Seven electrofishing sites were suggested by FRC based on experience of electrofishing in the Esks, on upland habitat, and the likelihood of finding salmonid populations in this area (**Figure 1.1**). The sites are suggested as baseline sampling locations for the EIA Report. They could also be used for monitoring during and after construction, upon discussion with the client, and depending on the results of the baseline survey. FRC selected these sites as they were believed to be an appropriate and representative sampling strategy in the absence of power calculations.

A fish habitat suitability survey was undertaken to assess in-stream habitat for salmonids (*Salmo salar* and *S. trutta*), lamprey and eel (*Anguilla anguilla*). This survey followed a standard walkover survey approach adapted from Hendry and Cragg-Hine (1997) which records optimal and suboptimal habitat for salmonid life stages and was extended to include lamprey and eels. This survey methodology has been successfully used by FRC throughout the Forth catchment. The description of habitat can be seen in **Table 2.1**.

Three locations were electrofished semi-quantitatively (i.e., recording the area systematically surveyed) to determine what species are present. It is known that there are trout further downstream in the catchment and so three sites further downstream of the site were electrofished fully quantitatively. The surveys focussed where possible on suitable juvenile and nursery areas where the young were most likely to be found as well as habitat where parr were likely to be found.

Six survey areas were systematically electrofished from one end to the other using a two or three-person team (one site could not be fished, see Section 3 below). One team member worked the anode, and one team member used a banner net to capture fish with suitable fish storage equipment on side. A backpack E-FISH 500W electrofishing kit was used. Fish were kept in recovery buckets, counted between runs and released at the end of the survey.

If the habitat walkover survey identified areas of suitable lamprey habitat i.e., fluvial deposits of high organic fine silt, appropriate deposits would be revisited with electrofishing equipment and a targeted lamprey survey would be undertaken to determine the presence or absence of lamprey species.

FRC staff currently hold Marine Scotland licenses to use electrofishing and netting equipment and at least one team member attending was suitably licensed and a team leader. All team members are trained and experienced in electrofishing. Scottish Fisheries Coordination Centre (SFCC) protocols were followed to carry out the electrofishing. This refers particularly to safe use of equipment, safe working in water and best practice for fish processing and welfare.

Table 2.1. Habitat types and descriptions used during the survey (adapted from Hendry and Cragg-Hine, 1997)

Habitat Type	Description
Spawning habitat	Optimally, stable gravel that isn't compacted with a lattice of grain sizes in the size range of 16 mm to 256 mm, but with the majority of particles < 150 mm and a mean size of approximately 80 mm. Substrates < 2 mm should not exceed 20%. Water depth at least 15 cm but not > 75 cm. Water velocities should be in the range of 30 - 70 cm/s.
Fry habitat	Water depth of around 20 cm or less with surface turbulence, fast flow and substrate dominated by pebbles and cobbles.
Parr habitat	Water 20-40 cm deep, fast-flowing, surface turbulent with pebble, cobble and boulder substrate.
Pool	Slow, deep flow, usually > 40 cm depth, surface unbroken
Glide	Smooth flow with little surface turbulence. Small substrates dominated by cobbles and fine materials.
Mixed fry and parr habitat	Areas with features of both fry and parr habitat.
Bedrock	Habitat dominated by sheets of bare rock unsuited to juvenile fish.
Lamprey habitat	Silty deposits with organic content.

The electrofishing survey was undertaken over three days by five licenced surveyors – Amy Fergusson (team leader), Joanna Girvan, Jack Wootton, Kyle Hind, and Niall Proven from the 10 October 2022 – 14 October 2022 during suitable weather conditions. The survey followed the standard methodology set out by the SFCC (SFCC, 2007b and c). The team leader has completed the ‘Managing Electrofishing Operations’ course administered by the SFCC, while the other two team members has completed the SFCC introductory course in the use of electrofishing techniques.

A total of four semi-quantitative electrofishing sites were selected for survey that were within/close to the site:

1. NGR NT 31079 54270 Black Burn east of Gladhouse Reservoir (Site 1);
2. NGR NT 33555 55634 Latch Burn (Site 2);
3. NGR NT 34376 55182 Middleton North Burn (Upper) (Site 3); and
4. NGR NT 33072 57068 Purvies Hill Burn (Upper) (Site 4).

Three fully quantitative sites downstream of the Proposed Development were included within the sampling strategy to inform the baseline survey. These sites were considered more likely to provide diversity of species and larger densities of trout:

5. NGR NT 32729 58947 Purvies Hill Burn Lower (Site 5);
6. NGR NT 34355 57658 Middleton North Burn (Lower) (Site 6); and
7. NGR NT 36585 57775 Middleton South Burn (Site 7).

The semi-quantitative surveys involved selecting accessible sites with the most suitable habitat for salmonid fry and parr considering the limitations of the habitat available. These sites were then systematically fished in an upstream direction using an E-FISH 500W backpack electrofishing kit with one handheld anode and a cathode.

Conductivity was taken at each of the sites and an appropriate voltage of between 180-250V was set to be effective. Smooth direct current was used as this is least likely to injure fish during this type of survey. The water temperature varied between 7.3°C and 10.3°C during the days of surveying.

A banner net and hand nets were used to capture fish which were quickly transferred to a holding bucket using a small hand net. Fish in the bucket were monitored for signs of stress.

The semi-quantitative methodology is a single pass survey that enables fish species presence/absence and minimum densities of juvenile salmonids to be determined. Fully quantitative surveys involve netting off the defined area and undertaking the survey three times to show depletion.

Captured fish were maintained on the bank in large buckets for photographs and to remove them from the survey area during fully quantitative surveys. Fish were anaesthetised with benzocaine and measured where appropriate. Fish were allowed to recover fully in clean water before being returned to the burn.

2.2. Lamprey Survey

The habitat surveys undertaken at each survey location identified areas of suitable lamprey habitat i.e., fluvial deposits of high organic fine silt. Appropriate deposits were revisited with electrofishing equipment and a targeted lamprey survey was undertaken to determine the presence or absence of lamprey species. This involves holding the anode just above the deposit and applying a pulsed current for 40 seconds followed by no current for 10 seconds. Where possible lamprey would be identified to species level.

3. Results

3.1. Fish and Habitat Surveys

A total of four semi-quantitative electrofishing sites were selected for survey that were within/close to the site:

1. NGR NT 31079 54270 Black Burn east of Gladhouse Reservoir (Site 1);
2. NGR NT 33555 55634 Latch Burn (Site 2);
3. NGR NT 34376 55182 Middleton North Burn (Upper) (Site 3); and
4. NGR NT 33072 57068 Purvies Hill Burn (Upper) (Site 4).

Site 3 (Middleton North Burn (Upper)) was not fishable on closer inspection of the survey site. Occluding terrestrial vegetation resulted in an undefined and inaccessible channel that flowed beneath the surface of the vegetation. This burn and the ones on either side were scrutinised to look for a suitable entry point but none was found. FRC determined that within the site, this upland burn is indicative of the majority of the burns that can be found in the area. These burns are very narrow and highly inaccessible, very acidic and have low spawning potential so are unlikely to provide suitable habitat for fish species. This reduces the direct impacts of the Proposed Development on fish populations within the site.

Three fully quantitative sites downstream of the site were included within the sampling strategy to inform the baseline survey:

1. NGR NT 32729 58947 Purvies Hill Burn (Lower) (Site 5);
2. NGR NT 34355 57658 Middleton North Burn (Lower) (Site 6); and
3. NGR NT 36585 57775 Middleton South Burn (Site 7).

Site locations are shown on **Figure 3.1**.

Survey Locations

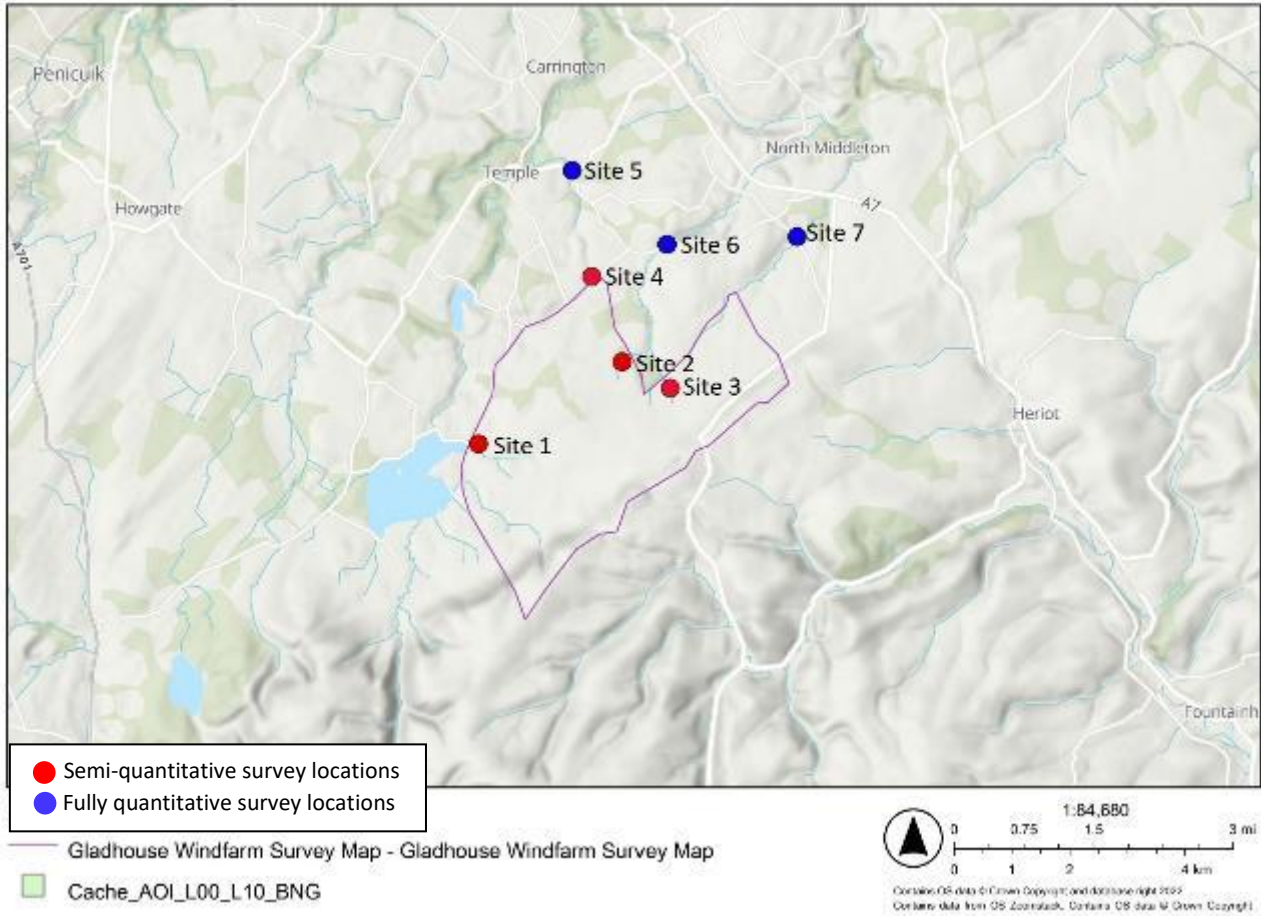


Figure 3.1 shows a map of the survey locations that were visited for electrofishing and habitat assessment.

Table 3.1. Results from surveys at each location

Site	Results	Area fished (m ²)
1	8 brown trout	53.65
2	0 fish	39.80
3	No fishing done	0.00
4	0 fish	65.00
5	2 brown trout, 7 stickleback	119.80
6	2 brown trout, 53 stickleback	74.12
7	165 minnow, 2 stickleback	131.40

Site 1

The Black Burn (**Figure 3.1a**) is located to the east of Gladhouse reservoir, circumnavigates along its edge in an artificial channel to flow into the South Esk main stem at the reservoir spillway.

The channel varied in width at Site 1 as it flowed from a natural upland burn of around 1 m, into an artificial channel of around 2.4 m wide. The depth remained consistently over 50 cm throughout the survey.



Figure 3.1a. Site 1 – Black Burn.

The habitat assessment of the survey site on the Black Burn showed the channel had been straightened at the survey location to create a deep pool which is suitable for parr and adult salmonids. The substrate within the channel was artificial boulder (50%) from the construction of the reservoir, which provided interstitial space for additional instream cover, and silt/sand combination (50%) as the channel narrowed. Marginal, draped and instream vegetation provided bankside cover for fish.

A total of eight brown trout (*Salmo trutta*) were captured during the survey in an area of 53.65 m². Some examples of these fish can be seen in **Figures 3.1b** and **3.1c**.

- one brown trout fry;
- six brown trout parr; and
- one brown trout adult.

Therefore, there is a calculated density of 0.149/m² for brown trout on the Black Burn.

No other fish species were caught in the survey.



Figure 3.1b. Adult trout that was resident within the Black Burn survey site



Figure 3.1c. Trout parr captured during electrofishing survey of the Black Burn

Site 2

The Latch Burn (**Figure 3.1d**) is an upland tributary to the Middleton North Burn that flows off Yorkston Moss. As an upland burn the channel was small and shallow with little bankside cover and had a higher acidity not conducive to good fishery potential. The channel was heavily silted with no good spawning substrate within the site.



Figure 3.1d Latch Burn facing upstream

No fish were captured during the survey.

Site 3

Site 3, Middleton North Burn (Upper), (**Figure 3.1e**) is within the site. Site 3 was not fishable. A visual survey was undertaken at the site and on neighbouring burns to determine habitat characteristics. This burn is within an upland moorland habitat, extremely narrow (~30-50 cm wide) and acidic. The burn was occluded with rush vegetation which consequently resulted in the lack of a defined and flowing channel.

No suitable habitat was present for fish populations to reside in this channel.



Figure 3.1e. Middleton North Burn (Upper) (Site 3) that was running below ground (looking upstream)

Site 4

Purvies Hill Burn (Upper), Site 4, (**Figure 3.1f**) is located north of the Proposed Development at Outerston Farm. The burn lies within a woodland surrounded by farmland, it is abstracted by the farmer and has poor quality bankside vegetation dominated by butterbur (*Petasites hybridus*). The channel width is approximately 1.6 m wide on average and is very shallow. Throughout the site is a combination of run/glide flow and small substrate sizes (<64 mm). Habitat would be conducive to potential salmonid spawning however is excessively silted in up to 50% of the channel.

No fish were captured during the survey.



Figure 3.1f Purvies Hill Burn (Upper) survey site

Site 5

The Purvies Hill Burn (Lower) fully quantitative survey (**Figure 3.1g**) undertaken in the lower reaches of the burn towards its confluence with the South Esk main stem (~1 km downstream). The survey site was a combination of run/riffle/glide habitat with shallow pools at 20%. Substrate was mixed fry and parr habitat. Flow constriction in the

form of large woody debris across the entire width of the channel provided a narrowing of the channel and a large pool with additional instream cover within the structure.



Figure 3.1g. Purvies Hill Burn (Lower) fully quantitative site.

A total of two brown trout fry were captured during the survey in an area of 119.8 m².

Therefore, there is a calculated density of 0.017/m² for brown trout on the Purvies Hill Burn (Lower).

An additional seven stickleback (*Gasterosteus aculeatus*) were caught in the survey.

Site 6

The Middleton North Burn (Lower) (**Figure 3.1h**) was located within scrubland habitat and was heavily encroached with vegetation. The burn was predominantly shallow with small amounts of gravel/pebble/cobble and large deposits of silt throughout. It can be defined as mixed fry parr habitat but is heavily silted (40%). Flow through the channel was predominantly glide with some run (30%) and pool (15%).



Figure 3.1h Middleton North Burn (Lower)

A total of two brown trout fry were captured during the survey in an area of 74.12 m².

Therefore, there is a calculated density of 0.027/m² for brown trout on the Middleton North Burn (Lower).

An additional 53 stickleback were caught in the survey.

Site 7

The Middleton South Burn (**Figure 3.1i**) was surveyed in broadleaved woodland habitat downstream of a large concrete culvert. The habitat was suitable mixed fry parr habitat with pebble dominating along with gravel and cobble. There were a number of pools as well as run/riffle/glide flow with good bankside cover in the form of large woody debris, tree roots and undercut banks. Suitable lamprey habitat was available in addition to good cover for eels at the edge of the culvert.



Figure 3.1i Middleton South Burn survey site

No brown trout were captured during the survey. A total of 165 minnows (*Phoxinus phoxinus*) (**Figure 3.1j**) and two sticklebacks were captured during the survey.



Figure 3.1j Minnow surveyed from the Middleton South Burn (site 7)

3.2. Desk-based Assessment

3.2.1. Lamprey spp.

FRT have undertaken electrofishing surveys on the South Esk since 2011. Internal archived data held by FRT indicates that lamprey reside within the South Esk and notable populations exist within the Gore Water which is a major tributary. The Middleton North and Middleton South burns that originate within the site feed into the Gore Water approximately 6 km downstream at Borthwick. Lamprey have been captured during electrofishing surveys by FRT up to grid reference NT 36710 59766.

During the electrofishing surveys, a lamprey specific search was undertaken for ammocetes in suitable habitat. Larval lampreys prefer stable areas of silt and sand in shallow waters with low velocity with some organic detritus present. Still/marginal habitat is optimal.

No lampreys were caught during the surveys at any of the sites although suitable habitat was present at each location.

3.2.2. Freshwater Pearl Mussel

Freshwater pearl mussel (FWPM) are protected (see **Appendix 1.** for legislation relating to freshwater species) and therefore data related to the specific locations of these bivalves is not readily available. The Joint Nature Conservation Committee (JNCC) provide updates regarding known distribution of FWPM (JNCC, 2019). Scotland is one of the remaining strongholds of this species in Europe.

There were no records of FWPM noted within the surveyed sites or Lothian Esks, and the Proposed Development does not lie within the UK distribution of this species (JNCC, 2019).

FWPM require specific habitat of clean, cold well oxygenated water that has a boulder-pebble mix with sand distributed throughout. This habitat requirement overlaps to an extent with salmon parr habitat. Due to anthropogenic interference such as substantial barriers to fish migration on the South Esk there is little habitat connectivity which seriously impacts on the distribution of these species within catchments. Furthermore, due to the industrial mining history of the Lothian Esks, many tributaries are slightly acidic to which FWPM is sensitive, creating inadequate conditions for survival.

3.2.3. Barriers

Removal of any redundant obstructions is always beneficial to both river geomorphology and ecology. It is not only migratory species that require passage throughout a system. Barriers prevent upstream migration of resident fish to take advantage of spawning and juvenile habitat. They also inhibit downstream movement to take up new residency, which is one of the ways riverine fish stocks naturally achieve optimal habitat use.

On the Lothian Esks there are a large number of barriers to fish migration due to its industrial heritage. Atlantic salmon are unable to access the majority of the South Esk system due to impassable barriers low in the catchment at Dalkeith. **Figure 3.2a** shows the extent of these man-made barriers in relation to the Proposed Development. There are three barriers circled on the South Esk that are impassable man-made barriers considered by SEPA to be of high priority for removal to improve habitat connectivity for migratory species (Buddendorf *et al.* 2019). This data has been compiled from SEPA obstacles to fish passage database (SEPA, 2019) and FRT internal data on locations of barriers within the District.

Lothian Esk Barriers

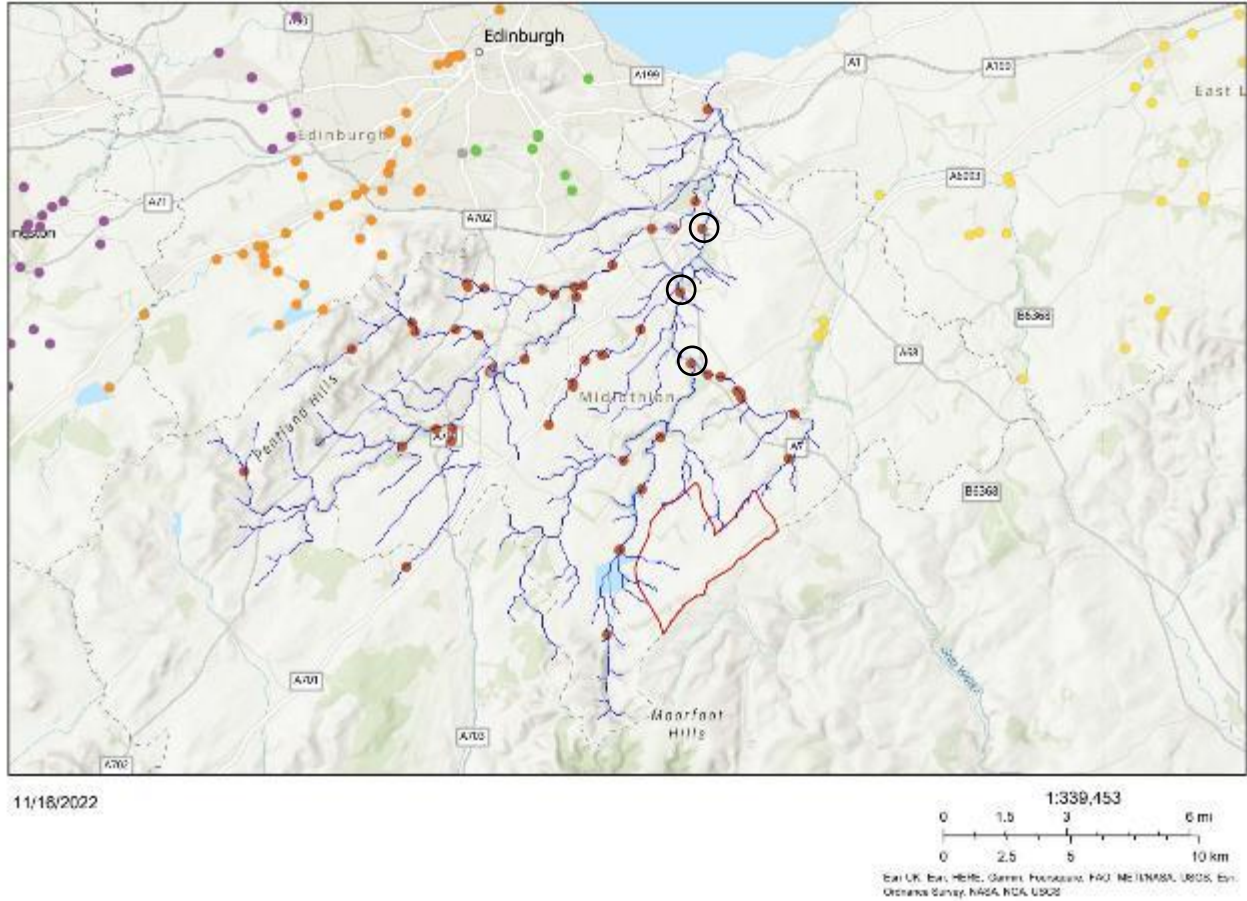


Figure 3.2a. Map of the barriers within the Lothian Esk's catchment in relation to the Proposed Development.

3.2.4. Invasive Non-Native Species

A search for Japanese knotweed, giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam (*Impatiens glandulifera*), American skunk cabbage (*Lysichiton americanus*), American mink (*Neovison vison*), American signal crayfish and Rhododendron (*Rhododendron ponticum*) was undertaken. Desk-based assessments have shown that no invasive non-native species are present within the site.

Common databases such as the National Biodiversity Network (NBN) Atlas, in addition to the FRT internal database, were utilised and found that Japanese knotweed and rhododendron are recorded on the Purvies Hill Burn at various points along its extent. In addition, a stand of Japanese knotweed has been recorded 1 km to the east of the Proposed Development (**Figure 3.2b**).

Invasive Non-Native Species

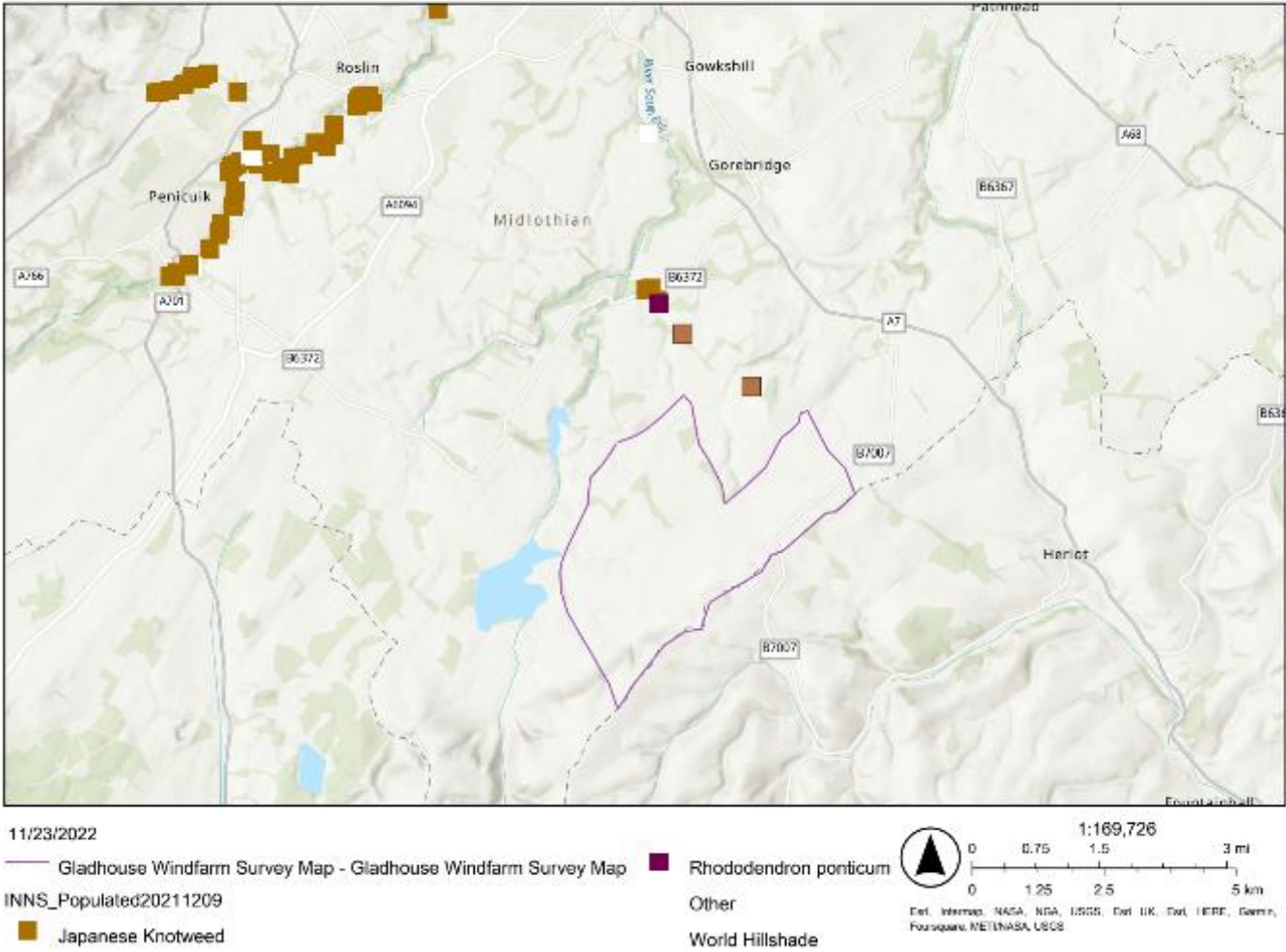


Figure 3.2b. Map provided by FRT database of invasive non-native species in relation to the Proposed Development.

4. Evaluation and Mitigation Requirements

4.1. Limitations

Site 3 (Middleton North Burn (Upper)) could not be electrofished on closer inspection of the survey site. The narrow burn was occluded with rush vegetation which consequently resulted in a lack of defined and flowing channel. This small burn and the ones on either side were scrutinised to look for a suitable entry point but none was found. FRC determined that within the site, this unnamed upland burn is indicative of the majority of the burns that can be found in the site and are low impact burns on fish populations.

On discussion with the Applicant, the survey location on the Wesley Cleugh Burn was removed from the sampling strategy due to landowner discussion over access during deer rutting season. An alternative location (Purvies Hill Burn (Upper) – Site 4) was included within the survey instead.

The NBN Atlas data would not allow the use of the invasive non-native species data within the vicinity of the site due to licencing restrictions for commercial use. The data was therefore ground-truthed to determine the locations of stands in the vicinity of the Proposed Development and this data was input into the FRT internal database.

4.2. Discussion

Brown trout are present in one of the burns a short distance downstream of the site (Black Burn). Fish rescues should therefore be considered before any works commence in the channel of the Black Burn, if such works are required. Similarly, the Wesley Cleugh Burn – although not surveyed during this survey due to access permission – is likely to have a population of resident trout due to its open connection with the reservoir and so should be considered for a fish rescue before work takes place in-channel, if such works are required.

Minnnows and sticklebacks were also identified during the surveys. The Middleton South Burn (Site 7) was selected for a fully quantitative survey due to its size and likelihood of finding a resident trout population. However, the three-pass survey captured 165 minnow and two sticklebacks but no brown trout despite the suitable habitat. This is possibly due to the presence of two barriers: the first around 500 m downstream and the second around 3 km downstream of the survey location. FRT archive electrofishing data indicates trout presence within this channel downstream of these barriers.

Very little anthropogenic disturbance was recorded during the survey except at Site 1 on the Black Burn along the edge of Gladhouse Reservoir where the burn had been incised by an artificial channel (**Figure 3.1a.**).

4.3. Mitigation

Further surveys may be required if construction will involve in-channel works.

There are mitigation measures to consider with regard to the fish community and in-stream working as follows:

- Ideally, any in-channel works should take place between the 1st May and the 31st of September. Outside of this window, salmonid fish become much more sensitive to disturbance as spawning and incubation take place over the winter.
- A comprehensive sediment management plan is necessary to protect habitat and young fish downstream of the works.
- The sites chosen were representative of the area of proposed works and so indicate that presence of resident brown trout is likely in the larger burns within and immediately around the site (Black Burn and

Wesley Cleugh Burn). Where in-channel works cannot be avoided, the work should be preceded by an electrofishing survey to determine if brown trout are present.

- If brown trout are present, a fish rescue would be required before any works take place in the channel or any channels are crossed, including the positioning of any coffer dams, sandbags or culverts in the water.

Close liaison between the contractor and the fish rescue team would be required regarding the timings of activities.

To protect habitat and species downstream of the works the contractor should have silt management plans, Construction Environmental Management Plans (CEMP) and an Environmental/Ecological Clerk of Works (ECoW) in place to ensure all mitigation and plans are implemented by contractors.

If any burns will be culverted, SEPA have produced a Position Statement and Supporting Guidance sheet (SEPA, 2015) and good practice guidance for River Crossings (SEPA, 2010). The guidance includes mitigation such as ensuring that natural low flow depths are maintained throughout the culvert and that the base should comprise natural substrate.

5. References

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6. Appendices

6.1. Appendix 1 – Legislation

Atlantic salmon (*Salmo salar*)

Atlantic salmon is protected under Annex II and V of the EC Habitats Directive, and the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Atlantic salmon are listed as a UKBAP priority species. Under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003:

Under Section 23, Subsection 1, Paragraphs (a) it is an offence to:

- Knowingly take, injure or destroy young salmon (smolt, parr, fry, or alevin) and spawning beds.

Under Section 23, Subsection 2, Paragraphs (a) and (b) it is an offence to:

- Knowingly injure or disturb any salmon spawn; or
- Disturb any spawning bed or any bank or shallow in which the spawn of salmon may be.

Under Section 23, Subsection 3 it is an offence to:

- Obstruct or impede salmon in their passage to any such bed, bank or shallow during the annual close time.

Atlantic salmon are anadromous fish. The life cycle of an Atlantic salmon involves undergoing the smolting process as it migrates down the river from spawning habitats in the headwaters to the estuary. After several years at sea the salmon will return to the same river to spawn as a mature adult.

Adult salmon will spawn in redds which are cut into clean gravels. This process usually takes place around October/November and the eggs will develop and hatch into fry in Spring. Alevins (and further developed into fry) need clean, cold, oxygenated water – often shallow and fast flowing so that a constant supply of oxygen is supplied. As they develop into parr they will seek out deeper areas of the river. Whilst in the river salmon feed on invertebrates. In Scotland, juvenile salmon usually remain in freshwater for around 3 years.

Brown/sea trout (*Salmo trutta*)

Brown trout can remain residents within the river or undertake the same process as salmon and migrate to sea becoming Sea trout. They are protected from certain methods and seasons of exploitation; however, do not receive extensive protection within conservation legislation. Brown/sea trout are, however, listed as a UKBAP priority species.

European eel (*Anguilla anguilla*)

Eels are protected under Appendix II of CITES and listed as a UKBAP priority species. The population of European eels has diminished by approximately 95% since 1980 where a large-scale population decline occurred. In addition, there is an exploitation of juvenile eels worldwide and therefore legislation has been designed to address this. In 2007 the European Commission implemented Council Regulation (EC) No 1100/2007 which requires member states to pull together Eel management plans, limiting the exploitation of eels and maximising the migration capacity of rivers for eel.

Lamprey spp.

River lamprey (*Lampetra fluviatilis*)

River lamprey are protected under Annexes II and V of the EU Habitats Directive, Appendix III of the Bern Convention, and are on the UKBAP Priority List. River lamprey migrate up rivers to spawn between April and May, sharing similar spawning habitat to salmonids.

Brook lamprey (*Lampetra planeri*)

Brook lamprey are protected under Annex II of the EU Habitats Directive and Appendix III of the Bern Convention. Brook lamprey are the smallest of the native lamprey species, and unlike other lamprey they do not feed during their adult phase. Brook lamprey are entirely freshwater and they migrate between habitats within the river. The adults migrate upstream in the autumn where they remain until spring where they spawn in gravel beds. Once hatched the ammocoete drift downstream to burrow in silty sand.

Freshwater pearl mussel (*Margaritifera margaritifera*)

Freshwater pearl mussel (FWPM) are protected under Annexes II and V of the EU Habitats Directive and are listed in the 2017 IUCN Red List as endangered and decreasing (Moorkens *et al.* 2017). They are given full protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), making it an offence to intentionally or recklessly:

- kill, injure or take a wild invertebrate listed on Schedule 5;
- damage, destroy or obstruct access to any structure or place which such an animal uses for shelter or protection; and
- disturb such an animal when it is occupying a structure or place for that purpose.

It is also an offence to:

- possess or control, sell, offer for sale or possess or transport for the purpose of sale any live or dead invertebrate listed on Schedule 5 or any derivative of such an animal; and

Knowingly causing or permitting any of the above acts to be carried out is also an offence.