Technical Appendix 8.4

Fresh Water Pearl Mussel Survey

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Freshwater Pearl Mussel and Fish Habitat Surveys in relation to Euchanhead Renewable Energy Development and Proposed Access Route A

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Commissioned by
SLR Consulting Ltd

Survey undertaken by

Nith District Salmon Fishery Board

Internal Use

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Cover photo: Freshwater Pearl Mussel

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1 Introduction

1.1 Background

The River Nith is a river of major importance as a salmon and sea trout fishery and is the largest river in south west Scotland. The source of the River Nith is in Ayrshire and it flows through Dumfriesshire, spanning approximately one hundred kilometres to its estuary in the Solway Firth, a total catchment area of 1200 square kilometres.

The Nith catchment has been subject to a number of industrial processes. The upper catchment in north Dumfriesshire and extending upstream to its source, has formerly been mined for coal, initially by deep shaft and more recently, by surface mining methods. More recently, much of the water resource has been harnessed for the purposes of producing renewable energy. A number of windfarms have also been constructed throughout the catchment from north of the town of Dumfries to the river's source in Ayrshire. Any development located in the catchment has the potential to impact on the aquatic environment and the species that reside within.

1.2 Nith District Salmon Fishery Board (NDSFB)

The NDSFB is a statutory body constituted under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003, tasked with the management of migratory salmonid species within their catchment area. The Board is empowered to conduct works and execute measures to safeguard, improve and enhance stocks of migratory salmonids within its jurisdictional area. Any impacts on the aquatic environment that could potentially influence salmonid species of fish or species that they rely on for their survival, is of interest to NDSFB. Accordingly, NDSFB works closely with the various commercial interests throughout the catchment to ensure that their proposals and operations do not adversely impact on the aquatic environment.

1.3 Euchanhead Renewable Energy Development

A Renewable Energy Development has been proposed in the north west section of the River Nith catchment at Euchanhead. Approximately 90% of the footprint of the proposed Development is located within the catchment of the River Nith, the remaining 10% of the proposed Development straddles into the catchment of the River Dee/Ken which is managed by the Galloway Fisheries Trust (GFT). NDSFB and GFT have been informed of this proposal and are working with the developers, ScottishPower Renewables and their consultants, SLR Consulting Ltd. During 2019, NDSFB conducted a fisheries habitat walkover

survey of all watercourses within the footprint of the proposed Renewable Energy Development Site (Henderson 2019). Further to the initial Site fisheries walkover surveys, GFT and NDSFB have been commissioned to conduct Freshwater Pearl Mussel (FWPM) surveys in relation to those watercourses.

In addition, NDSFB are to conduct both fisheries walkover and FWPM surveys in relation to the proposed Access Route A. Two access routes to the Site from the public highway have been identified, referred to as Access Route A and Access Route B (for further details see EIA Report **Chapter 3 Description of the proposed Development**). The proposed Access Route A includes approximately 8.2 km of new track. The proposed Access Route B utilises existing roads and it is not expected to have to carry out any significant engineering works along this route. Survey of Access Route B was therefore not considered necessary. The access routes were still to be determined at the time of the previous walkover surveys.

These surveys form part of a suite of environmental audits to establish baseline data to inform the Environmental Impact Assessment. Information gained can be used to mitigate potential impacts and thus retain environmental status throughout the development phase of the project.

1.4 Freshwater Pearl Mussels (*Margaritifera margaritifera* L.)

Freshwater Pearl Mussels (FWPM) are a long-lived species of bi-valve, potentially living in excess of 100 hundred years and are currently in decline generally. The reasons for this trend include over fishing, use of pesticides, agricultural practise and engineering (Young 1991). FWPM do exist in Scotland and it is considered that half of the worlds populations of these species reside in Scottish watercourses (Young *et al* 2001).

1.4.1 Life Cycle

FWPM and salmonid species of fish survive together in watercourses. Part of the FWPM's lifecycle depends on the presence of salmonid species of fish (Hastie & Young, 2003). and both species require high quality water for their survival.

Unfertilised eggs present in brood pouches of female FWPM in early summer are exposed to sperm which is present in the watercourse at this time of the year. The sperm is ingested into these bi-valves by the action of taking in water to gain nutrients. In the late summer the incubated glochidia are expressed out into the watercourse following a pumping motion. The glochidia need to encounter a host fish, either salmon or trout and settle on

their gills. This procedure is left completely to chance and, for survival of the species, perhaps explains why millions of glochidia are expressed into the watercourse.

At this stage of their life cycle, the glochidia attachment to the gills of salmonid fish, this is referred to as encysting. The encysted gills of fish do not seem to harm the host and can be seen, if the gill covers of hosts are gently lifted, like grains of salt against the red gills. The life cycle stage of attachment to the gills of fish can last for several months until the young mussels detach from the host and, again by chance, fall off and are swept by the current of the watercourse to find suitable habitat on the river bed.

1.4.2 Legal Status

FWPM are afforded protection under a number of legislative listings including Annex II & IV of the EC Habitats Directive and Appendix II of the Bern Convention and schedule 5 section 9 (1) Wildlife and Countryside Act (1981). They are also listed as a priority species in the UKBAP. In order that this legislation is not unintentionally breached during construction works in, or near to, a watercourse it is appropriate that the area is surveyed by a qualified person licenced to conduct such surveys. The presence of FWPM is always conducted well in advance of any planned construction work, as is the case with Euchanhead, in order that due consideration can be taken of the survey results gained.

1.4.3 Habitat

FWPM require a mix of habitats in which to survive the various stages of their lifecycles (Skinner et al. 2003). They are typically found in fast flowing streams of high-water quality containing salmonid species of fish (Young 2005). This reliance of salmonid species dictates that watercourses that suit the various stages of salmonid life cycle i.e. gravels for spawning, streams for fry stages, riffles and runs for parr stages and pools for adult stages can accommodate FWPMs. An essential criterion for the survival of FWPM is the presence of stable substrate on which the mussels can anchor and not get swept away on the current.

2 **This Study**

2.1 Aims

This study set out with the following aims:

(a) To utilise the standard Scottish Natural Heritage (SNH n.d.) protocol to survey for the presence of FWPM at pre-determined sites within the watercourses which drain the land footprint of the proposed Euchanhead Renewable Energy Development.

(b) To utilise the standard Scottish Natural Heritage (SNH n.d.) protocol to survey for the presence of FWPM at pre-determined sites in watercourses which traverse the proposed Access Route A to Euchanhead Renewable Energy Development.

(c) To extend these surveys for a distance of 100 m upstream and 500 m downstream of the pre-determined points.

(d) To assess population densities of any FWPM found throughout this series of surveys.

(e) To consider population life stages of any FWPM found throughout this series of surveys.

(f) To record habitat data to determine the potential for Freshwater Pearl Mussels to be present in the watercourses which drain the catchment area of the proposed Euchanhead Renewable Energy Development and its proposed Access Route A.

(g) To produce data on the presence of suitable fish habitat on those watercourses which traverse the proposed Access Route A to Euchanhead Renewable Energy Development.

(h) To produce data to assist in the environmental policy, considerations and safeguards which may be implemented for the general protection of the Dee/Ken and River Nith catchments and their environs.

2.2 Feasibility

The methodology for surveying for the presence of FWPM is a visual process. It involves visual inspection and, where appropriate, requires that the surveyors enter the water and use a bathyscope for clearer inspection of the substrate on the river bed of a given section of watercourse. Therefore, survey feasibility and efficiency are improved greatly if conducted during the summer months when flows are low. Many of the watercourses surveyed during the walkover survey in 2019, typically had a peaty colouration to the water at that time. However, during this survey for FWPM, southwest Scotland was experiencing a prolonged severe drought which dictated that all watercourses were low and very clear, all of which made for optimum aquatic surveying conditions.

2.3 Site selection

This study conducted FWPM surveys at predetermined points within the proposed Euchanhead Renewable Energy Development Site and proposed Access Route A, applicable in the original proposals. Those proposals have subsequently been refined and as a consequence the watercourse crossing numbering may not match those in the EIA report. The Access Route A points were also surveyed for fish habitat. The points had been supplied to NDSFB and GFT from the developers of the project and were of strategic importance as areas where road construction activity is planned.

3 Freshwater Pearl Mussel survey methodology

The methodology employed is the standard Scottish Natural Heritage Freshwater Pearl Mussel Survey protocol for use in site-specific projects (SNH n.d.) Each FWPM survey commenced at the predetermined water crossing points and extended directly downstream to include the entire bed of the watercourse. The survey protocol in the area immediately downstream of the water crossing point entailed laying a 1 m x 1 m quadrat on the bed of the river and a visual search for FWPM was made using a bathyscope. In smaller watercourses, a quadrat was not used.

The protocol dictates that any FWPM found during the initial search are counted and measured in each quadrat. Detailed searches for any hidden and juvenile mussels are then conducted in 20% of the quadrats where visible mussels were found.

Following the initial survey in the area directly downstream from the water crossing, the FWPM survey was extended to 100 m upstream and 500 m downstream. This extended survey identified FWPM habitat which was then visually inspected for their presence. Any FWPM found during the extended search would then result in a 50 m transect being subject to a more detailed survey, as per the protocol.

Figure 1 – Surveying with Bathyscope

3.1.1 Data recording

The standard SNH protocol for recording FWPM was followed throughout this series of surveys. Field data sheets were populated at individual sites which included habitat, FWPM presence/abundance and general environmental data.

3.1.2 Data Analysis

Abundance of FWPM can be calculated using the following categories:

Number of live mussels per 50 m x 1 m transect	Abundance level
0	E
1-49	D
50-499	C
500-999	B
≥1000	A

3.2 Personnel

Within the catchment of the River Nith, NDSFB utilised the services of their own staff, who are qualified and licenced to conduct surveys for FWPM. The water crossings located within the Dee/Ken catchment were surveyed by staff from the Galloway Fisheries Trust also qualified and licenced to conduct FWPM surveys.

4 Fish habitat survey methodology

Fish habitat surveys were carried out using habitat protocols developed by the Scottish Fisheries Co-ordination Centre (SFCC, 2007) and adapted from the Environment Agency's manual Restoration of Riverine Salmon Habitats – A Guidance Manual (Hendry and Cragg-Hine, 1997). See **Table 1** for habitat type classification. This method assesses the substrate within a watercourse according to its suitability for different age classes of fish. It also identifies any barriers to migration within the watercourse.

Table 1: Habitat classification for walkover survey method

Habitat Type	Classification
Spawning gravel and silted spawning habitat	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Substrate size with a diameter of 0.8 to 10.2 cm
Fry (0+) habitat	Shallow (<20 cm) and fast flowing water indicative of riffles and runs with a substrate dominated by gravel and cobbles
Parr (1+) habitat	Riffle – run habitat that is generally faster and deeper than fry habitat (0.2 – 0.4 m). Substrate consists of gravels (16 – 64 mm), cobbles (64 – 256 mm) and boulder (> 256 mm)
Mixed juvenile habitat	A mix of fry and parr habitat, suited to both age classes in combination – the deeper, faster, larger substrate areas used by parr, and the shallower, slower, smaller substrate areas used by fry

Habitat Type	Classification
Glides	Smooth laminar flow with little surface turbulence and generally greater than 0.3 m deep
Pools	No perceptible flow and usually greater than 1 m deep Flow constriction Where physical features provide a narrowing of the channel resulting in increased velocity and depth (often combined with a localised increase in gradient and bedrock substrates)
Obstacles/Obstruction to migration	A structure or item identified as a potential obstruction to fish passage at certain water heights (e.g. impassable falls, weirs, bridge aprons, shallow braided river sections preventing upstream migration during low flows)

4.1 Personnel

Within the catchment of the River Nith, NDSFB utilised the services of their own staff, who are qualified and experienced in conducting fish habitat surveys in accordance with SFCC protocols.

4.2 Photography

All sites were photographed twice to provide an accurate record of conditions at time of survey. The first photograph was taken looking upstream from the water crossing point and the second photograph was taken 500 m downstream of the water crossing, looking upstream. These photographs are a useful aid in assessing environmental status and to assess the quality of each site with regard to its potential for FWPM and fisheries habitat.

5 Results

A total of twenty-seven sites were surveyed for FWPM in relation to the Site footprint for Euchanhead Renewable Energy Development as provided by SLR Consulting when commissioning the survey. Twenty-four of those sites are located in the Nith catchment and were surveyed by NDSFB. The remaining three sites were located in the Dee/Ken catchment and surveying was undertaken by GFT. An additional eight sites were surveyed for FWPM and fish habitat in the Nith catchment in relation to the proposed access track. A full list of site locations and associated information can be found in **Appendix 1**. Maps of the site locations can be found in **Appendix 2**.

The results from the FWPM surveys within the proposed Euchanhead Renewable Energy Development Site can be found below in **Section 5.1**. The results from the FWPM surveys along the proposed Access Route A can be found in **Section 5.2**. The results from the Fish Habitat surveys along the proposed Access Route A can be found in **Section 5.3**.

5.1 FWMP results from sites within proposed Site plan – WX01 to WX27b

WX01 – Existing crossing on unnamed tributary of Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX01	Unnamed tributary and Euchan Water	271247	606538	No	0.30	0.08	Moorland heath / clear fell	Rank grass and rashes	0	5	5	10	70	0	10	0	0	Poor habitat in the tributary. Euchan Water contained excellent FWPM habitat.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Site WX01 - upstream of WX01

Site WX01 – 500 m downstream from WX01

WX02 – Existing crossing on Poltallan Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX02	Poltallan Burn and Euchan Water	269671	606685	No	1.20	0.25	Clear fell conifer plantation	Rank grass and scrub	0	5	5	25	35	20	5	5	0	Good habitat available in the Poltallan Burn. Moderate habitat available in Euchan Water due to large expanses of deep pools and bedrock.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Poltallan Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX03 – Existing crossing on Slot Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX03	Slot Burn and Euchan Water	268977	606534	No	0.40	0.07	Conifer plantation and clear fell conifer	Conifers, rank grass and scrub	0	10	15	25	35	10	5	0	0	Poor habitat availability in the Slot Burn and moderate habitat in the Euchan Water.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Slot Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX04 – Existing crossing on Dalmet Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX04	Dalmet Burn and Euchan Water	268607	606330	No	0.80	0.08	Clear fell conifer plantation	Rank grass and scrub	0	0	10	30	20	30	10	0	0	Good habitat available throughout survey stretch.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Dalmet Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX05 – Existing crossing on Magheuchan Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX05	Magheuchan Burn and Euchan Water	268222	605782	No	0.45	0.05	Clear fell conifer plantation	Rank grass and scrub	0	0	5	20	40	30	5	0	0	Moderate habitat available in Magheuchan Burn turning to excellent habitat in the Euchan Water

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Magheuchan Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX06 – Existing crossing on Graystone Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX06	Graystone Burn and Euchan Water	268134	605632	No	0.30	0.04	Conifer plantation and clear fell conifer	Rank grass and scrub	0	0	10	10	20	10	20	30	0	Moderate habitat available in Graystone Burn. Poor habitat in the Euchan Water

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Graystone Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX07 – Existing crossing on Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX07	Euchan Water	268208	605331	No	3.10	0.26	Conifer plantation and clear fell conifer	Rank grass	0	0	5	10	10	15	30	30	0	Good habitat directly below water crossing but reduces in quality further downstream.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Euchan Water - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX08 – Existing crossing on unnamed tributary of Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX08	Unnamed tributary and Euchan Water	268100	604882	No	0.20	0.04	Conifer plantation and clear fell conifer	Rank grass	0	0	0	20	30	40	10	0	0	The tributary is deeply incised and contains poor/no habitat. Good habitat is available downstream the Euchan Water.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX09 – Existing crossing on unnamed tributary of Rye Grain Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX09	Unnamed tributary and Rye Grain Burn	267781	604399	No	0.00	0.00	Clear fell conifer plantation	Rank grass	0	0	0	0	0	0	0	0	100	No habitat available in tributary but good habitat available downstream in Rye Grain Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of existing crossing

Rye Grain Burn - 500 m downstream from crossing

WX10 – Proposed crossing on Unnamed tributary of upper Slot Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX10	Unnamed tributary Slot Burn and Euchan Water	268760	606825	No	0.10	0.04	Conifer plantation	Rank grass, scrub and conifers	30	10	10	30	0	10	0	10	0	No habitat in tributary but soon joins the Slot Burn where there is limited habitat available. Moderate habitat available in Euchan Water.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary of Slot Burn - upstream of proposed crossing

Euchan Water – 500 m downstream from crossing

WX11 – Proposed crossing on upper Slot Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX11	Slot Burn and Euchan Water	268729	606822	No	0.40	0.05	Conifer plantation and clear fell conifer	Rank grass, scrub and conifers	0	0	10	30	20	20	10	10	0	Poor habitat throughout the Slot Burn and moderate habitat in the Euchan Water.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of proposed crossing

Euchan Water – 500 m downstream from crossing

WX12 –Existing crossing on upper Slot Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX12	Slot Burn and Euchan Water	268749	606762	No	0.15	0.04	Conifer plantation and clear fell conifer	Rank grass, scrub and conifers	30	30	10	30	0	0	0	0	0	Poor habitat throughout the Slot Burn and moderate habitat in the Euchan Water.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Slot Burn - upstream of existing crossing

Euchan Water – 500 m downstream from crossing

WX13 – Proposed crossing on Upper Magheuchan Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX13	Magheuchan Burn	267717	606025	No	0.25	0.10	Conifer plantation	Rank grass, scrub and conifers	0	10	25	25	30	10	0	0	0	Heavily incised burn in upper reaches. No habitat and poor habitat lower down the survey stretch.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Magheuchan Burn - upstream of proposed crossing

Magheuchan Burn – 500 m downstream from crossing

WX14 – Proposed crossing on Big Torry Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX14	Big Torry Burn	266797	605485	No	0.30	0.03	Conifer plantation and moorland heath	Rank grass and conifer	0	0	0	0	0	0	0	0	100 Peat	Heavily incised into peat with no habitat available. Habitat improves downstream but overall poor.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Big Torry Burn - upstream of proposed crossing

Big Torry Burn – 500 m downstream from crossing

WX15 – Proposed crossing on unnamed tributary of Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX15	Unnamed tributary and Euchan Water	266745	604766	No	0.15	0.15	Conifer plantation	Moss and rank grass	0	0	0	0	0	0	0	0	100 Peat	No habitat. An ocherous discharge in the watercourse and carpeted with pine needles. Downstream of confluence with Euchan, the habitat is excellent.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of proposed crossing

Euchan Water – 500 m downstream from crossing

WX16 – Proposed crossing on unnamed tributary of Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX16	Unnamed tributary and Euchan Water	266695	604671	No	0.60	0.08	Conifer plantation	Rank grass	0	0	5	15	10	20	20	30	0	Poor habitat at proposed crossing point. Downstream in the Euchan the habitat is good.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of proposed crossing

Euchan Water – 500 m downstream from crossing

WX17 – Proposed crossing on Upper Euchan Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX17	Upper Euchan Water	266664	604488	No	1.20	0.12	Conifer plantation	Rank grass	0	0	5	45	20	10	10	0	10 Clay	Poor habitat at proposed crossing point but improving further downstream within survey area.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Euchan Water - upstream of proposed crossing

Euchan Water – 500 m downstream from crossing

WX18 – Proposed crossing on Mid Grain Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX18	Mid Grain Burn	266829	604102	No	0.65	0.19	Conifer plantation and clear fell conifer	Rank grass	0	0	10	60	25	5	0	0	0	Poor FWPM habitat at crossing point likely to be mobile, improving downstream.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Mid Grain Burn - upstream of proposed crossing

Mid Grain Burn – 500 m downstream from crossing

WX19 – Existing crossing on unnamed tributary of Mid Grain Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX19	Unnamed tributary and Mid Grain Burn	266973	604053	No	0.35	0.03	Clear fell conifer	Rank grass	0	0	15	25	25	20	15	0	0	Marginal watercourse, heavily incised through peat. No FWPM habitat in burn and moderate FWPM habitat downstream in Mid Grain Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of existing crossing

Mid Grain Burn – 500 m downstream from crossing

WX20 – Existing crossing on Upper Mid Grain Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX20	Upper Mid Grain Burn	266423	603721	No	0.90	0.07	Moorland heath and clear fell conifer plantation	Rank grass	0	0	10	15	25	40	10	0	0	Moderate habitat available throughout survey site.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Upper Mid Grain Burn - upstream of existing crossing

Upper Mid Grain Burn – 500 m downstream from crossing

WX21 – Proposed crossing on Upper Water of Ken

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX21	Upper Water of Ken	268266	602107	No	4.00	0.20	Conifer plantation and clear fell conifer	Grasses and rushes	0	0	0	12.5	12.5	20	25	30	0	Steep, top of section in a gorge. Some suitable habitat present.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Upper Water of Ken - upstream of existing crossing

Upper Water of Ken – 500 m downstream from crossing

WX22 – Proposed crossing on Upper Scaur Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX22	Upper Scaur Water	268508	602156	No	0.15	0.10	Conifer plantation and moorland heath	Rank grass and rushes	0	0	0	0	0	0	0	0	100 Peat	Deeply incised channel with ocherous discharge downstream. No habitat available.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Upper Scaur Water - upstream of proposed crossing

Upper Scaur Water – 500 m downstream from crossing

WX23 – Existing crossing on Upper Water of Ken

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX23	Upper Water of Ken	268429	601887	No	3.50	0.30	Conifer plantation and moorland heath	Grasses and tall herbs	0	0	0	10	15	25	20	30	0	Limited habitat for FWPM

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Upper Water of Ken - upstream of existing crossing

Upper Water of Ken – 500 m downstream from crossing

WX24 – Existing crossing on unnamed tributary of Fortypenny Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX24	Unnamed tributary and Fortypenny Burn	269058	601195	No	0.70	0.20	Conifer plantation	Grasses and tall herbs	0	0	5	45	25	15	5	5	0	Crossing point is on a tributary of main burn. Tributary is very narrow and totally unsuitable for FWPM. Steep gradient.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of existing crossing

Fortypenny Burn – 500 m downstream from crossing

WX25 – Existing crossing on Upper Shinnel Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX25	Upper Shinnel Water	269919	599940	No	1.00	0.12	Conifer plantation	Rank grass and scrub	0	5	15	5	70	5	0	0	0	Good to moderate FWPM habitat within watercourse.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other.

Upper Shinnel Water - upstream of existing crossing

Upper Shinnel Water – 500 m downstream from crossing

WX26 – Existing crossing on Horse Grain Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX26	Horse Grain Burn and Upper Shinnel Water	269624	599441	No	0.30	0.05	Clear fell conifer and wind blow conifer	Rank grass	0	5	20	25	20	20	10	0	0	The Horse Grain Burn is impacted by windblown conifers. Limited habitat available in Upper Scaur below confluence with Horse Grain Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Horse Grain Burn - upstream of existing crossing

Upper Shinnel – 500 m downstream from crossing

WX27 – Existing crossing on Fingland Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX27	Fingland Burn and Upper Shinnel Water	269474	599300	No	0.20	0.01	Clear fell conifer and wind blow conifer	Rank grass and scrub	100	0	0	0	0	0	0	0	0	Much of the flow of the Fingland Burn has been diverted degrading the watercourse and no FWPM habitat was present. Habitat improved in the lower section of this site.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Fingland Burn - upstream of existing crossing

Upper Shinnel – 500 m downstream from crossing

WX27b – Diverted watercourse (Fingland Burn)

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX27b	Diverted Fingland Burn	269580	599480	No	0.20	0.04	Clear fell conifer	Rank grass and moss	0	0	10	20	50	20	0	0	0	The upper Fingland Burn has been rechanneled when forestry drainage infrastructure has been instated and no longer follows the course on the map. It converges with roadside ditches which eventually enter the Horse Grain Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Fingland Burn - upstream of existing crossing

5.2 FWMP results from sites along proposed Access Route A – WX28 to WX35

WX28 – Proposed access road crossing on unnamed tributary of Big Torry Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX28	Unnamed tributary and Big Torry Burn	266713	605527	No	0.00	0.00	Moorland heath	Rank grass and rush	0	0	0	0	0	0	0	0	0	Completely incised watercourse emerging 50 m downstream as part of Big Torry Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of proposed crossing

Big Torry Burn – 500 m downstream from crossing

WX29 – Proposed access road crossing on unnamed tributary of Kello Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX29	Unnamed tributary and Upper Kello Water	265910	605065	No	0.00	0.00	Moorland health	Rank grass and rush	0	0	0	0	0	0	0	0	100 peat	The tributary is deeply incised at the proposed crossing site. Downstream the watercourse opens up and becomes more viable. Steep gradient and highly mobile.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Unnamed tributary - upstream of proposed crossing

Upper Kello Water – 500 m downstream from crossing

WX30 – Proposed access road crossing on Upper Kello Water

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX30	Upper Kello Water	265585	604943	No	0.40	0.08	Moorland health	Rank grass and rush	0	10	20	30	20	10	0	0	10 Peat	Poor FWPM habitat in upper reaches but improving towards bottom of survey stretch.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Upper Kello Water - upstream of proposed crossing

Upper Kello Water – 500 m downstream from crossing

WX31 – Proposed access road crossing on Earl Seat Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX31	Earl Seat Burn	265245	605353	No	0.00	0.00	Moorland health	Rank grass and rush	0	0	0	0	0	0	0	0	100 Peat	Burn is heavily incised at site of proposed water crossing with no habitat for FWPM. Burn improves downstream but poor habitat.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Earl Seat Burn - upstream of proposed crossing

Earl Seat Burn – 500 m downstream from crossing

WX32 – Proposed access road crossing on Little Poljorg Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX32	Little Poljorg Burn and Poljorg Burn	265299	606284	No	0.30	0.08	Moorland health	Rank grass and rush	0	0	10	40	35	15	0	0	0	Burn is incised into peat and contains poor FWPM habitat due to high gradient and mobility of substrate.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Little Poljorg Burn - upstream of proposed crossing

Poljorg Burn – 500 m downstream from crossing

WX33 – Proposed access road crossing on Poljorg Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX33	Poljorg Burn	265320	606365	No	0.00	0.00	Moorland health	Rank grass and rush	0	0	0	0	0	0	0	0	0	Deeply incised into peat with very fine substrate. Dry at crossing point. Steep gradient. No FWPM habitat.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Poljorg Burn - upstream of proposed crossing

Poljorg Burn – 500 m downstream from crossing

WX34 – Proposed access road crossing on Bottom Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX34	Bottom Burn	265356	606900	No	0.45	0.19	Moorland health	Rank grass and rush	0	0	0	10	50	20	10	10	0	The burn has a steep gradient. Poor FWPM habitat. Habitat improves further down Bottom Burn.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Bottom Burn - upstream of proposed crossing

Bottom Burn – 500 m downstream from crossing

WX35 – Proposed access road crossing on tributary of Bottom Burn

Water crossing code	Watercourses surveyed	Water crossing		FWPM present?	Average width (m)	Average depth (m)	Land use types	Bankside vegetation	Substrate %									FWPM habitat availability
		Easting	*Northing*						SI	FSA	CSA	GR	PE	CO	BO	BE	OTH	
WX35	Unnamed tributary and Bottom Burn	265355	606938	No	0.27	0.04	Moorland health	Rank grass and rush	0	0	0	10	55	15	5	15	0	No habitat due to steep gradient and mobile substrate.

Substrate: SI – Silt, FSA – Fine Sand, CSA – Coarse Sand, GR – Gravel, PE – Pebbles, CO – Cobbles, BO – Boulders, BE – Bedrock, OTH – Other

Tributary of Bottom Burn - upstream of proposed crossing

Bottom Burn – 500 m downstream from crossing

5.3 Fish habitat results from sites along proposed Access Route A – WX14, WX28 to WX35

Table 2: Fisheries Habitat survey results

Water crossing code	Watercourse surveyed	Upstream Easting	Upstream Northing	Downstream Easting	Downstream Northing	Overall fish habitat grading	Conductivity (µS)	Temperature (°C)	pH
WX14	Big Torry Burn	266790	605448	266424	606180	Moderate	60	8.5	6.19
WX28	Unnamed tributary of Big Torry Burn	266706	605514	266736	605733	None	-	-	-
WX29	Unnamed tributary of Upper Kello Water	265956	604993	265752	605333	Moderate	70	10.3	6.65
WX30	Upper Kello Water	265524	604643	267249	607678	Good	60	8.6	6.78
WX31	Earl Seat Burn	265240	605341	265909	606176	Moderate	90	6.3	5.84
WX32	Little Poljorg Burn	265060	606376	265529	606292	Poor	40	8.7	5.93
WX33	Poljorg Burn	265093	606401	265857	606157	None	-	-	-
WX34	Bottom Burn	265259	606894	267022	607503	Poor	40	8.3	5.31
WX35	Unnamed tributary of Bottom Burn	265327	606936	265508	606963	Poor	40	10.8	5.85

6 Discussion

Despite severe drought conditions prevailing during the survey period, the watercourses surveyed remained viable. The surveys for FWPM within the Site boundaries of Euchanhead Renewable Energy Development proved the presence of suitable habitat for FWPM however, no FWPM were found at any of the sites surveyed.

Some of the sites surveyed for FWPM along the proposed Access Route A to Euchanhead Renewable Energy Development at the water crossing points did not contain suitable habitat. In fact, at some of these locations the watercourses ran sub-surface. However, on inspection, a very short distance downstream a viable watercourse was formed. Generally speaking, the sites surveyed in relation to Access Route A were located at the source of many of the watercourses where gradients are steep. Substrate was fine and liable to be mobile during periods of high flow making an unstable river bed. FWPM require stability within the habitat on order that they can anchor successfully.

The sites surveyed for fish habitat were all located in the upper Kello catchment and were surveyed in relation to the proposed Access Route A (**Appendix 2**, Map 5). Some sites did contain fish habitat but that was limited by virtue of the fact that the crossing points are located at the very upper sections of the watercourses. Those watercourses were minor and considered marginal for fish. Indeed, it is entirely possible that fish may not be sustained in these watercourses permanently or in sufficient densities which could potentially explain the absence of FWPM.

Whilst the fish habitat was assessed at specific crossing points, due to the nature of the surveys being undertaken and the route which the surveyors followed, the entire watercourses were walked downstream to Dunside. Archive fishery data proves the presence of fish in the lower sections of many of these watercourses.

7 Conclusions

This study concludes that in the watercourses surveyed in the vicinity of the proposed Euchanhead Renewable Energy Development:

- That Freshwater Pearl Mussels were absent from all sites surveyed.
- That fish habitat was present in seven out of the nine sites surveyed in relation to the proposed Access Route A.
- That fish habitat was absent from two of the nine sites surveyed but did exist a very short distance downstream from the proposed water crossing points.

8 References

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Appendix 1: List of sites surveyed

Water crossing code	Watercourse	Catchment	Water crossing		Water crossing type	Altitude (m)	Date of survey	Weather conditions	Survey team	Surveys conducted
			Easting	Northing						
WX01	Unnamed tributary of Euchan Water	Euchan Water, Nith	271247	606538	Existing track access	317	20/05/20	Overcast and showers	JH & DP	FWPM
WX02	Poltallan Burn	Euchan Water, Nith	269671	606685	Existing track access	364	20/05/20	Overcast and showers	JH & DP	FWPM
WX03	Slot Burn	Euchan Water, Nith	268977	606534	Existing track access	391	20/05/20	Overcast and showers	JH & DP	FWPM
WX04	Dalmet Burn	Euchan Water, Nith	268607	606330	Existing track access	425	20/05/20	Overcast and showers	JH & DP	FWPM
WX05	Magheuchan Burn	Euchan Water, Nith	268222	605782	Existing track access	442	20/05/20	Overcast and showers	JH & DP	FWPM
WX06	Graystone Burn	Euchan Water, Nith	268134	605632	Existing track access	441	21/05/20	Sunny	JH & DP	FWPM
WX07	Euchan Water	Euchan Water, Nith	268208	605331	Existing track access	429	21/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX08	Unnamed tributary of Euchan Water	Euchan Water, Nith	268100	604882	Existing track access	469	21/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX09	Unnamed tributary of Rye Grain Burn	Euchan Water, Nith	267781	604399	Existing track access	502	21/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX10	Unnamed tributary of Slot Burn	Euchan Water, Nith	268760	606825	Proposed water crossing	480	20/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX11	Slot Burn	Euchan Water, Nith	268729	606822	Proposed water crossing	480	20/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX12	Slot Burn	Euchan Water, Nith	268749	606762	Existing water crossing	455	20/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX13	Magheuchan Burn	Euchan Water, Nith	267717	606025	Proposed water crossing	515	21/05/20	Cloudy with sunny spells	JH & DP	FWPM
WX14	Big Torry Burn	Kello Water, Nith	266797	605485	Proposed water crossing	534	25/05/20	Overcast	JH & DP	FWPM and Fish habitat
WX15	Unnamed tributary of Euchan Water	Euchan Water, Nith	266745	604766	Proposed water crossing	527	22/05/20	Overcast with showers	JH & DP	FWPM
WX16	Unnamed tributary of Euchan Water	Euchan Water, Nith	266695	604671	Proposed water crossing	529	22/05/20	Overcast with showers	JH & DP	FWPM
WX17	Upper Euchan Water	Euchan Water, Nith	266664	604488	Proposed water crossing	512	22/05/20	Overcast with showers	JH & DP	FWPM
WX18	Mid Grain Burn	Euchan Water, Nith	266829	604102	Existing water crossing	524	22/05/20	Overcast with showers	JH & DP	FWPM

Surveyors: JH – Jim Henderson (NDSFB), DP – Debbie Parke (NDSFB), JR – Jamie Ribbens (GFT), VS – Victoria Semple (GFT)

Appendix 1 continued: List of sites surveyed

Water crossing code	Watercourse	Catchment	Water crossing		Water crossing type	Altitude (m)	Date of survey	Weather conditions	Survey team	Surveys conducted
			Easting	Northing						
WX19	Unnamed tributary of Mid Grain Burn	Euchan Water, Nith	266973	604053	Existing water crossing	535	22/05/20	Overcast with showers	JH & DP	FWPM
WX20	Upper Mid Grain Burn	Euchan Water, Nith	266423	603721	Proposed water crossing	553	22/05/20	Overcast with showers	JH & DP	FWPM
WX21	Upper Water of Ken	Water of Ken, Dee	268266	602107	Proposed water crossing	370	26/05/20	Bright, sun	JR & VS	FWPM
WX22	Upper Scaur Water	Scaur Water, Nith	268508	602156	Proposed water crossing	352	19/05/20	Overcast with showers	JH & DP	FWPM
WX23	Upper Water of Ken	Water of Ken, Dee	268429	601887	Existing water crossing	348	26/05/20	Bright, sun	JR & VS	FWPM
WX24	Unnamed tributary of Fortypenny Burn	Water of Ken, Dee	269058	601195	Existing water crossing	430	26/05/20	Bright, sun	JR & VS	FWPM
WX25	Upper Shinnel Water	Shinnel Water, Nith	269919	599940	Existing water crossing	409	19/05/20	Overcast with showers	JH & DP	FWPM
WX26	Horse Grain Burn	Shinnel Water, Nith	269624	599441	Existing water crossing	485	19/05/20	Overcast with showers	JH & DP	FWPM
WX27	Fingland Burn	Shinnel Water, Nith	269474	599300	Existing water crossing	468	19/05/20	Overcast with showers	JH & DP	FWPM
WX28	Unnamed tributary of Big Torry Burn	Kello Water, Nith	266713	605527	Proposed water crossing	537	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX29	Unnamed tributary of Upper Kello Water	Kello Water, Nith	265910	605065	Proposed water crossing	539	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX30	Upper Kello Water	Kello Water, Nith	265585	604943	Proposed water crossing	541	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX31	Earl Seat Burn	Kello Water, Nith	265245	605353	Proposed water crossing	538	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX32	Little Poljorg Burn	Kello Water, Nith	265299	606284	Proposed water crossing	573	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX33	Poljorg Burn	Kello Water, Nith	265320	606365	Proposed water crossing	574	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX34	Bottom Burn	Kello Water, Nith	265356	606900	Proposed water crossing	559	25/05/20	Overcast	JH & DP	FWPM and fish habitat
WX35	Unnamed tributary of Bottom Burn	Kello Water, Nith	265355	606938	Proposed water crossing	563	25/05/20	Overcast	JH & DP	FWPM and fish habitat

Surveyors: JH – Jim Henderson (NDSFB), DP – Debbie Parke (NDSFB), JR – Jamie Ribbens (GFT), VS – Victoria Semple (GFT)

Appendix 2: Map 1 – Freshwater Pearl Mussel survey site locations

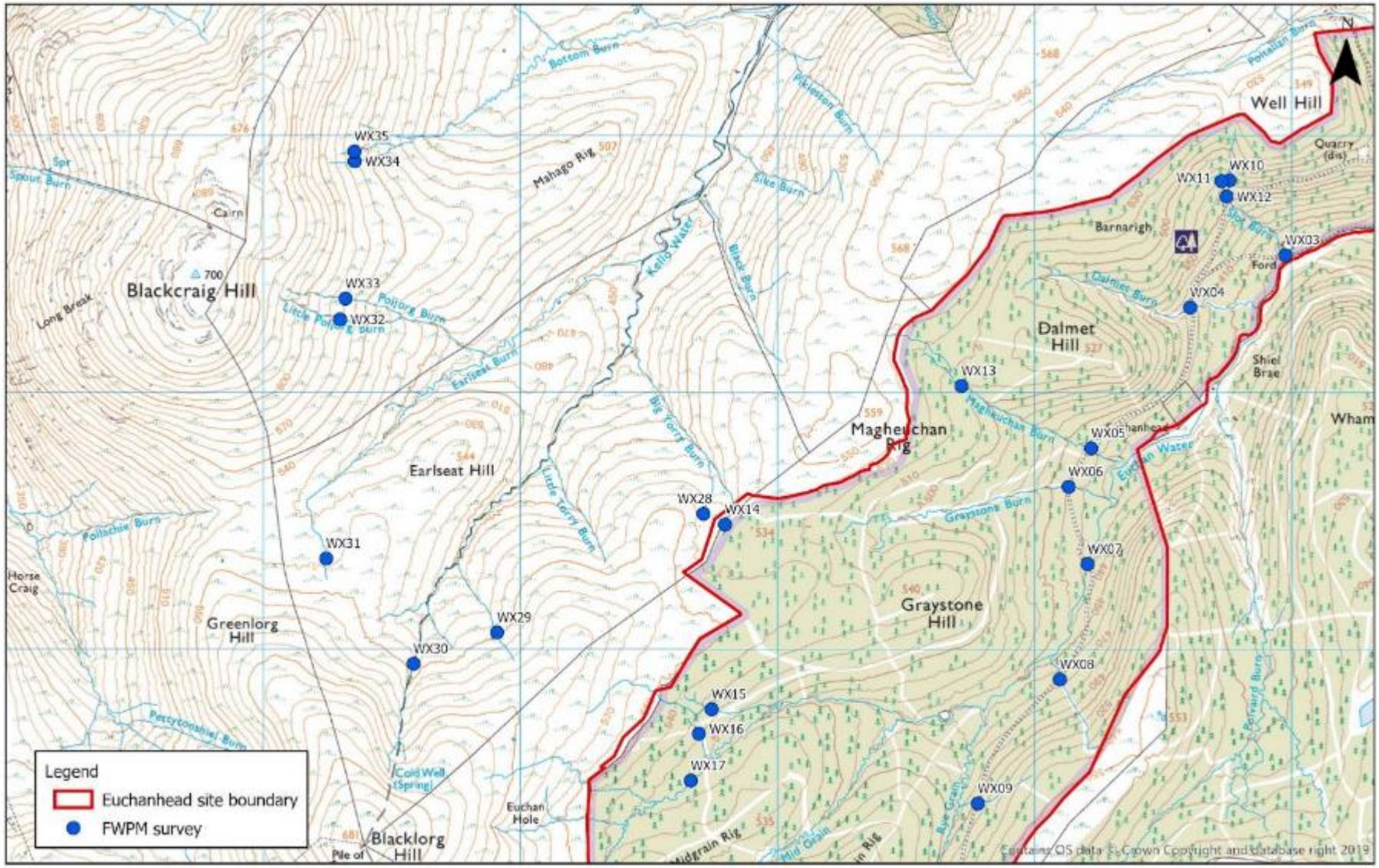
Euchanhead Renewable Energy Development
Freshwater Pearl Mussel Survey - Within Site Boundary
June 2020

Scale: 1:18,500

0 0.2 0.4 0.8 Kilometers

Nith District Salmon Fishery Board

Appendix 2 continued: Map 2 – Freshwater Pearl Mussel survey site locations



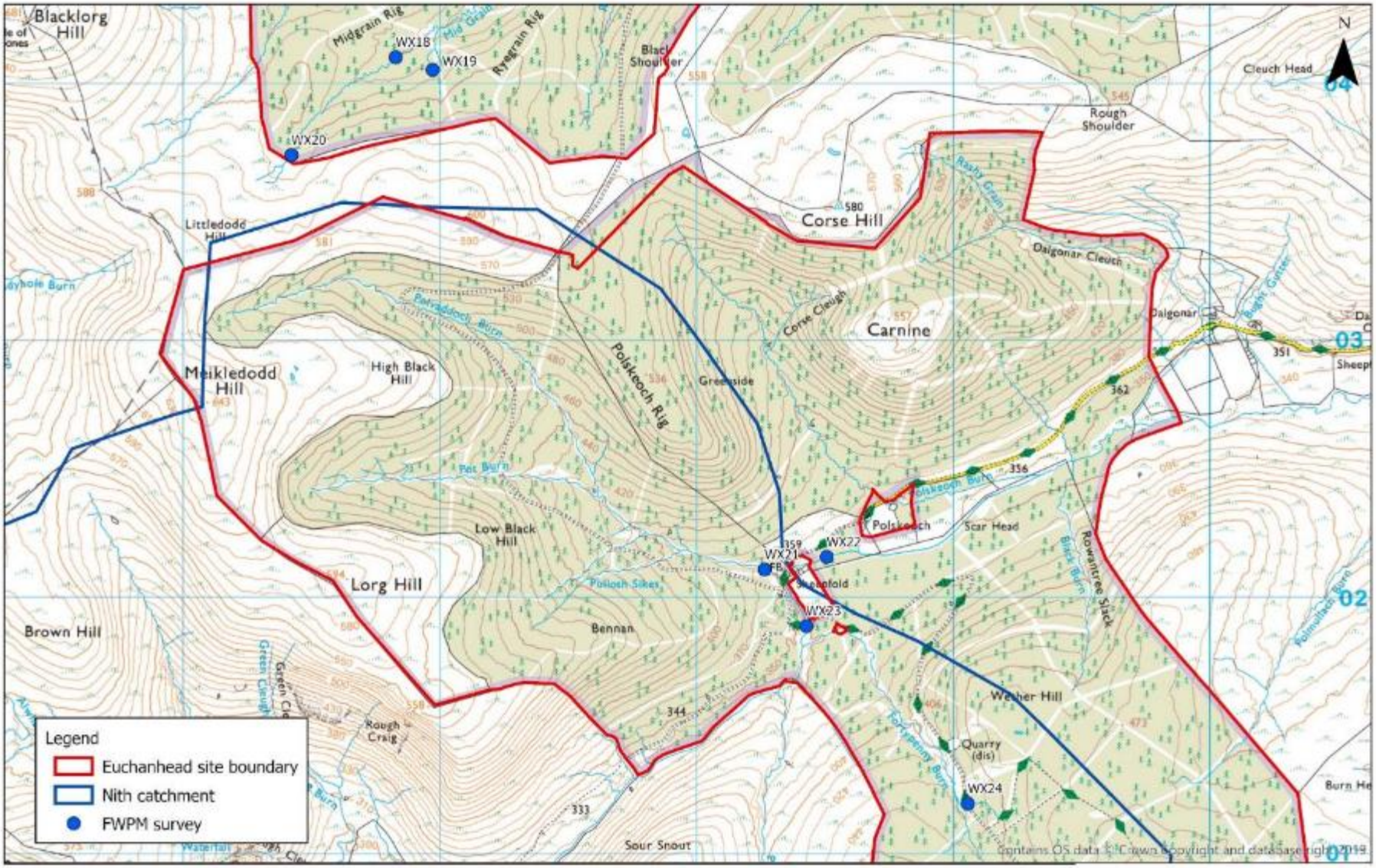
Euchanhead Renewable Energy Development
Freshwater Pearl Mussel Survey - Within Site Boundary and Access Route - June 2020

Scale: 1:18,500

0 0.2 0.4 0.8 Kilometers

Nith District Salmon Fishery Board

Appendix 2 continued: Map 3 – Freshwater Pearl Mussel survey site locations



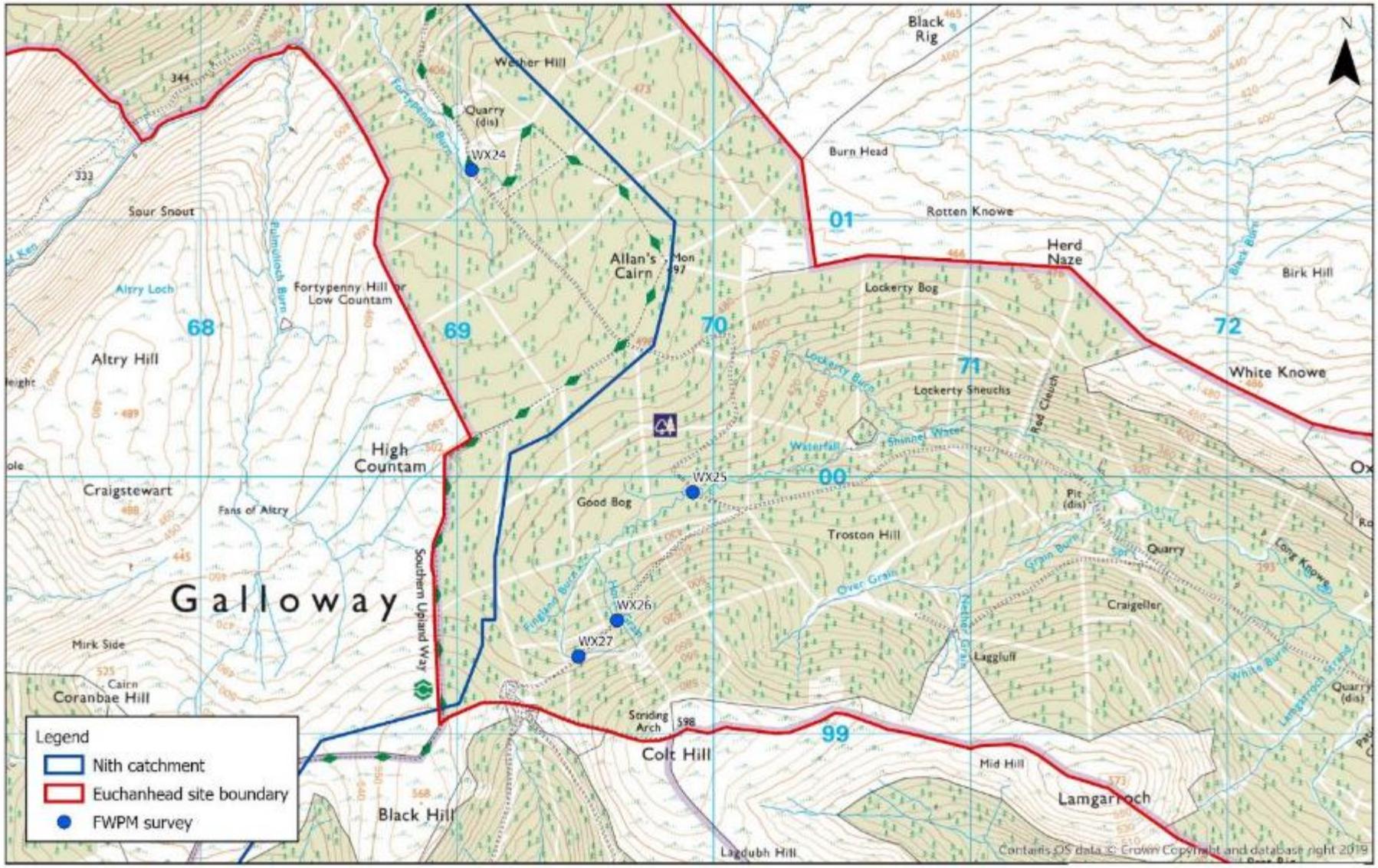
Euchanhead Renewables Development
Freshwater Pearl Mussel Survey - Within Site Boundary
June 2020

Scale: 1:18,500

0 0.2 0.4 0.8 Kilometers

Nith District Salmon Fishery Board

Appendix 2 continued: Map 4 – Freshwater Pearl Mussel survey site locations



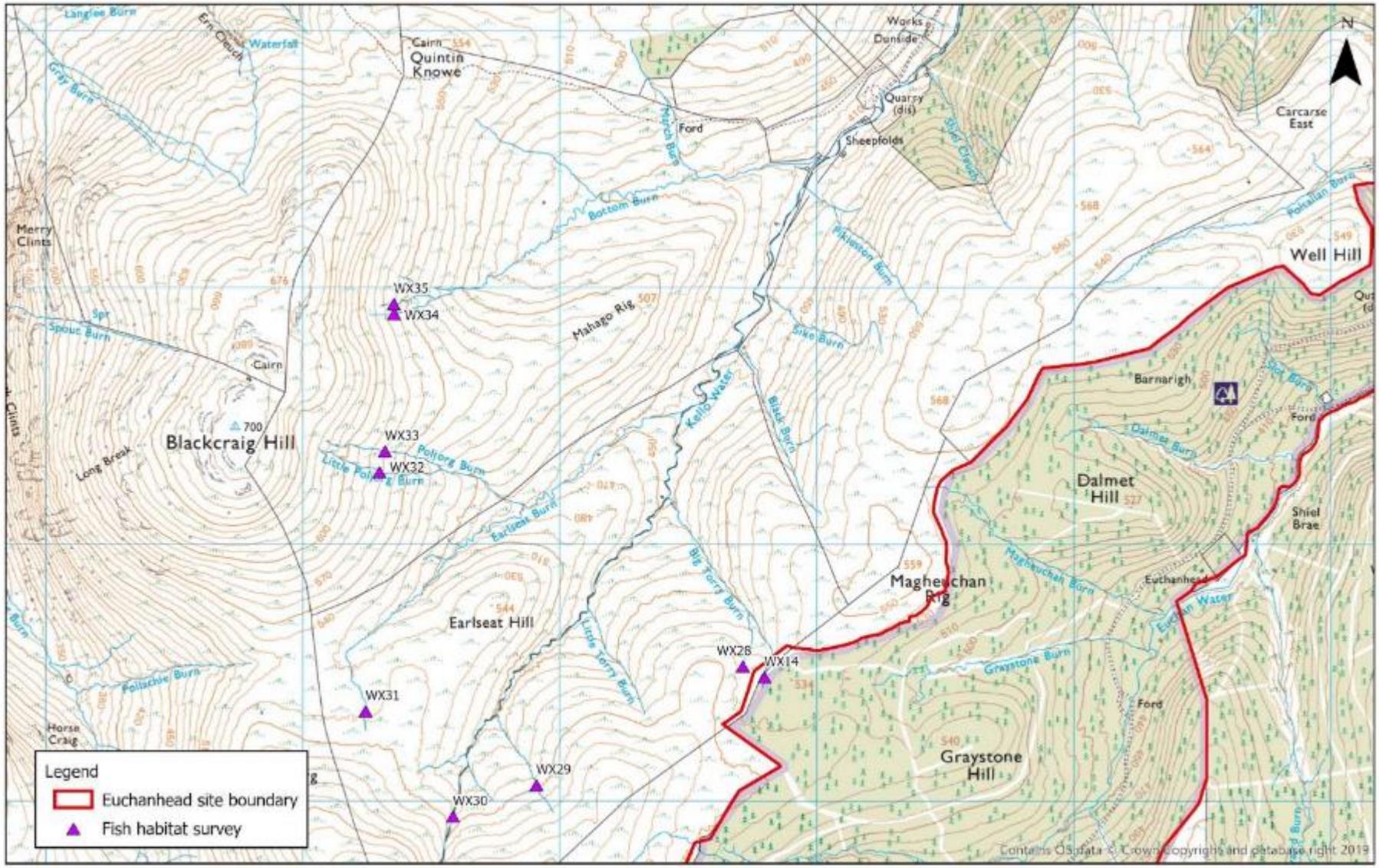
Euchanhead Renewable Energy Development
Freshwater Pearl Mussel Survey - Within Site Boundary
June 2020

Scale: 1:18,500

0 0.2 0.4 0.8 Kilometers

Nith District Salmon Fishery Board

Appendix 2 continued: Map 5 – Fish Habitat survey site locations



Euchanhead Renewables Development
Fish Habitat Survey - Access Route
June 2020

Scale: 1:18,500

0 0.2 0.4 0.8 Kilometers

Nith District Salmon Fishery Board

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