Glenburnie Wind Farm

AEI Technical Appendix 8.8

Shadow Habitats Regulations Appraisal: Report to Inform Appropriate Assessment

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Contents

Acronyms and Abbreviations

Table 1 List of Acronyms and Abbreviations

Acronym	Abbreviation
AA	Appropriate Assessment
AEOI	Adverse Effect On Integrity
AOD	Above Ordnance Datum
BESS	Battery Energy Storage System
CO	Conservation Objective
COP	Conservation Advice Package
DRP	Decommissioning and Restoration Plan
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
HRA	Habitats Regulations Appraisal
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
INNS	Invasive non-native species
LSE	Likely significant effect
NVC	National Vegetation Classification
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SBC	Scottish Borders Council
SEPA	Scottish Environmental Protection Agency
SFCC	Scottish Fisheries Coordination Centre
SSSI	Site of Special Scientific Interest
SPA	Special Protection Area
TWIC	The Wildlife Information Centre
ZOI	Zone of Influence

1 Introduction

1.1.1 SLR Consulting were commissioned by Renewable Energy Systems (RES) Ltd (the applicant) to carry out a Shadow Habitats Regulations Appraisal (HRA) for the proposed construction and operation of an onshore wind farm, Longcroft Wind Farm (the 'original proposed development').

1.1.2 An HRA screening assessment was conducted in 2023 and subsequently updated in 2025 in light of major design changes. The screening assessment concluded that, in the absence of mitigation, Likely Significant Effects (LSEs) on the qualifying interest of the River Tweed SAC could not be ruled out without further assessment and/or mitigation. All qualifying features of the SAC were screened into this report to inform appropriate assessment (RIAA). The Fala Flow Ramsar and Greenlaw Moor Ramsar were screened out of further assessment and not considered within this RIAA.

1.1.3 The 'revised proposed development' refers to all the permanent and temporary civil, electrical, environmental infrastructure proposed to be constructed or installed within the site and detailed in **AEI Chapter 3**: Revised Proposed Development Description. The 'site' is defined as the area bounded by the site boundary as shown on **AEI Figure 1.2:** Site Boundary.

1.1.4 This RIAA includes information for the Competent Authority (in this case the Scottish Borders Council) to determine if the revised proposed development works are likely to have a significant effect on 'European'/Internationally important sites with regard to their conservation objectives and whether there will be an adverse effect on the integrity of any the site/their features, with and without mitigation.

1.1.5 This RIAA covers the River Tweed SAC only; effects on Special Protection Areas (SPAs) are addressed in a separate report (AEI Technical Appendix 9.2).

1.2 Evidence of Technical Competence and Experience

1.2.1 This assessment has been carried out by Rowan Smith MSc BSC (Hons). Rowan is a senior ecologist with over 6 years professional experience in the environmental sector specialising in aquatic/riparian ecology and impact assessment. Rowan has a proven track record of project managing ecological elements of large scale (2000 MW) energy infrastructure projects, including pump storage hydro schemes, wind farms and solar farms across Scotland where she compiled a range of assessments including EIA, Ecological Impact Assessments (EcIAs) and Habitats Regulations Appraisals.

1.2.2 This revised assessment has been reviewed by Richard Arnold (MCIEEM) Technical Director. Richard has over 26 years of experience as a professional ecological consultant. Richard has worked on projects in most development sectors, including pipelines, cable routes, railways, roads, urban regeneration, ports, power stations and renewable energy projects, such as windfarms, and at all stages of the development process, from design to completed development. His work includes undertaking and directing ecology surveys, ecological impact assessments, Habitats Regulations Assessments, protected species licensing and on-site mitigation. Consequently, he has in depth knowledge of biodiversity legislation and planning guidance relating to nature conservation.

2 Step 4: Appropriate Assessment

2.1 Step 1: Information on the Proposed Development and on the European Site

Step 1, Part 1: Information on the Proposed Development

The Proposed Development

Full Description

2.1.1 The revised proposed development, is a proposed 12 turbine wind farm located north-east of the A697, approximately 9.9 km north north-east of Lauder in the Scottish Borders. The site is within the administrative boundary of Scottish Borders Council.

2.1.2 Twelve three bladed horizontal axis wind turbines of up to 220 m tip height are proposed. The wind turbines would be nominally rated at 6.6 MW. Each turbine would be accompanied with low to medium voltage transformers and related switchgear, a wind turbine foundation and hardstand areas for erection cranes.

2.1.3 Additional infrastructure includes a network of on-site tracks including an access track and site entrance from the public road network, borrow pits (dependent on availability of stone within the site), a substation compound, control building, welfare facilities, communications mast, a battery energy storage system (BESS) compound.

Construction

2.1.4 The construction phase will include the erection of 12 wind turbines, and construction of associated infrastructure including: access tracks; wind turbine foundations; substation compounds (containing electrical infrastructure, control building, welfare facilities and a communications mast); a battery energy storage system (BESS) compounds; borrow pit; transfer station; temporary construction compounds; and a network of buried electrical and communication cables.

2.1.5 It is anticipated that high disturbance activities, e.g. blasting, will be required for the borrow pits but is dependent on underlying geology.

2.1.6 The candidate wind turbine is the SG 6.6-170. This model is up to 220 m in height to blade tip with current models having 6.6 MW generating capacity (likely to be higher at the point of construction due to technological advancements); this specification is what the assessment has been based off. At each wind turbine low to medium voltage transformers and related switchgear will also be present.

2.1.7 No tree clearance is currently planned for the revised proposed development.

2.1.8 Construction is estimated to last 16 months and will include the following construction/ installation activities (in chronological order and with indicative timescales):

- Activity 1 – mobilisation; to be undertaken in month one and two.
- Activity 2 – site entrance and access tracks; to be undertaken in months one to seven;
- Activity 3 – crane hardstands; to be undertaken in months two to eight;

- Activity 4 – wind turbine foundations; to be undertaken in months five to eleven;
- Activity 5 – substation and BESS compounds; to be undertaken in months seven to twelve;
- Activity 6 – cable installation; to be undertaken in months eight to twelve;
- Activity 7 – wind turbine deliveries; to be undertaken in months eleven to thirteen;
- Activity 8 – wind turbine erection; to be undertaken in months eleven to fifteen and;
- Activity 9 – operational takeover to be undertaken in months fifteen to sixteen

2.1.9 Construction will adhere to considerate construction standards, with works generally occurring between Monday and Saturday 7:00am-19:00pm. Some exceptions will need to be made to the working hours during foundation pours and wind turbine erection.

2.1.10 A total of 11 watercourse crossings are proposed. Of these, five are upgrades to existing watercourses and six are new. Water crossings will comprise a mixture of single span bridges, bottomless arch or closed culverts. For the purposes of this assessment, a worst-case scenario is taken forward as a precautionary approach, in that the design will be mainly closed culverts and some bridges with the natural watercourse bed lost for the full crossing width (estimated at 7 m). The watercourses are narrow or dry in these areas, so we have used a precautionary watercourse width of 50 cm (equivalent to 7 m x 0.5 m x 6new crossings = 21 m^2, < 0.001 ha loss). Water flow and up-down stream connectivity for wildlife will be maintained.

Operation

2.1.11 The revised proposed development is expected to operate for up to 50 years. Once operational the wind turbines on site will be automated and there will be no permanent staff with minimal traffic associated. Maintenance and servicing will occur periodically and comprise the main source of traffic and other activity.

Decommissioning

2.1.12 The revised proposed development would be designed with an operational life of 50 years. At the end of its operational life the revised proposed development would then be decommissioned in accordance with a Decommissioning and Restoration Plan (DRP) which would be submitted to Scottish Borders Council (SBC) for approval not later than 12 months prior to the start of decommissioning. Alternatively, a new application could be made to extend its operational life.

2.1.13 Decommissioning will involve similar levels of activity and disturbance as the construction phase with minor exceptions such as the cables being left in place to avoid unnecessary ground disturbance. The assessment of LSEs from the decommissioning phase are currently assumed to be equivalent to that of the construction phase of this assessment at this juncture yet it is advised this assessment be revisited at a future date in advance of decommissioning.

The Project Site

Habitats (Annex I)

2.1.14 Three Annex I habitats were identified within the site and include:

- [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation;
- [4030] European dry heaths; and

- [7130] Blanket bog.

Species (Annex II)

2.1.15 A total of three Annex II species were identified within the site and include:

- Otter;
- Atlantic salmon; and
- River lamprey.

2.1.16 For the purposes of this assessment, it is assumed that brook lamprey are also likely to be present alongside river lamprey due to similar habitat types and life history strategy.

2.1.17 Annex I birds have been excluded from this description

Ecological Connections

2.1.18 Migratory fish will travel upstream for spawning. Given direct hydrological connectivity between the site and the River Tweed SAC, which is designated in part for migratory fish, there is the potential for adverse effect within the SAC. The effects of the works associated with the revised proposed development has potential to affect the downstream sections also.

2.1.19 Male otters may have a home range of up to 40 km[1] and can range along water courses but also between catchments. Given the complexity and abundance of the freshwater network in the catchment, it is assumed that otters that may disperse out from the River Tweed SAC (one designated feature) will likely be ecologically connected to the site and within the zone of influence of the works. A range of 250 m is assumed for potential direct impacts and up to 10 km geographic distance is assumed for potential indirect effect (given that 40 km of watercourse home range could be accommodated within a 10 km direct range).

2.1.20 Assessment of effect will consider ecological connectivity considering habitats within 10 km and species home ranges in terms in the absence of mitigation.

Hydrological Connections

2.1.21 The site is within the River Tweed catchment. A full account of hydrological connectivity is provided within the **AEI Chapter 10: Hydrology, Hydrogeology & Geology**.

2.1.22 Assessment of effect will consider hydrological connectivity/water quality/habitat degradation up to 10 km as within the zone of 'discernible' effects on aquatic receptors including aquatic habitats in their own right and species home range in hydrological terms in the absence of mitigation. A 2 km screening buffer is considered for direct effect.

2.2 Step 1, Part 2: Information on European and Ramsar Sites

Brief Description

[1] NatureScot. (2012). River Tweed Special Area of Conservation: Conservation Advice Package. [Online] Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8369/conservation-advice-package.pdf

2.2.1 The River Tweed SAC (NatureScot Site Code: 8369), its major tributaries and many smaller tributaries are designated as the River Tweed SAC. In Scotland, the River Tweed and six major tributaries only (the Blackadder and Whiteadder, Bowmont, Teviot, Ettrick and Yarrow), are also notified as the River Tweed Site of Special Scientific Interest (SSSI).

2.2.2 Over 80% of the River Tweed catchment is within Scotland; this extends over an area of 3,740 ha and a cumulative river length of over 1,280 km. The remaining area lies within England and contains primarily the mouth of the river at Berwick-upon-Tweed with some minor tributaries.

2.2.3 All features are in 'Favourable maintained' condition with the exceptions of sea lamprey and river habitat with floating vegetation considered to be in 'Unfavourable declining' / 'Unfavourable maintained'.

Qualifying/Special Conservation Interest

2.2.4 All features of the River Tweed SAC were screened into the ALSE, hereafter, assessed in Section 2.3. Relevant ecological information for each species is provided.

Rivers with Floating Vegetation often dominated by water-crowfoot

2.2.5 The River Tweed represents sub-type 2 of rivers with floating vegetation, also known as 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]'. Sub-type 2 is widespread throughout the UK, however, is commoner in the south of England. Considerable geographic and ecological variation is common in this sub-type extending from lime-rich substrate to meso/oligotrophic rocks. The habitat is the most species-rich example of a river with *Ranunculus* in Scotland and is the only site selected for this habitat in Scotland[2].

2.2.6 The River Tweed contains species considered to be at their most northerly range including stream water-crowfoot, *R. penicillatus*, and flowering-rush *Butomus umbellatus,* in addition to *R. fluitans*, common water-crowfoot, *R. aquatilis,* and pond water-crowfoot, *R. peltatus* and a range of hybrids.

2.2.7 No surveys were undertaken to inform this HRA. For the purposes of this assessment, it is considered that all species suited to the upland environments present on site are present within the zone of influence (ZOI).

2.2.8 The River Tweed has a cumulative river length of over 1,280 km. Of this around 6.8% of the extent of watercourse contains water crowfoot-related vegetation within this habitat. Survey work from the latest site condition monitoring exercise (2013) found that this vegetation type is reasonably well spread throughout most of the SAC. As such on a precautionary basis it is considered this habitat is equally spread throughout watercourses contained within the site and 2 km downstream screening buffer for direct effect (taken from the most downstream extent of the site boundary). This includes a total length of 4.5 km of which 0.306 km (6.8% of the watercourse) is considered to contain water crowfoot-related vegetation.

Otter

[2] JNCC. (2025). 3260 Water courses of plain to montane levels with Ranunculion fluitantis and Callitricho-Batrachion vegetation. [Online] Available at: https://sac.jncc.gov.uk/habitat/H3260/

2.2.9 No otter signs were identified within the site, however, signs upstream and downstream on the same watercourse, the Soonhope Burn, indicate likely use within the site. This included one resting location and three spraints; no breeding holts were identified.

2.2.10 No signs of otter were identified on the Whalplaw burn, the primary watercourse running through the site. Given the large home ranges of otter, however, up to 40 km for male, for the purposes of this assessment it is assumed that otter utilise all watercourses within the site and a 250 m buffer for the purposes of assessment of disturbance. A 2 km screening buffer has been applied for potential effects of prey species.

2.2.11 The two main watercourses of the site; Soonhope Burn and Whaplaw Burn were all generally deemed to have low potential for otter with the exception of the southern section of the Soonhope Burn which was considered to provide moderate value for short-term shelter for otter with degraded banks leaving overhangs and potential lay-ups. Notable features that could be used for shelter such as overhanging banks, tree root systems and rock piles were infrequent or entirely absent along most of all surveyed watercourses. Bankside vegetation within the site was of generally poor value for otter with few areas of dense scrub offering potential areas of shelter.

Atlantic salmon

2.2.12 Fully quantitative electrofishing surveys and fish habitat surveys were conducted across 13 locations within and near to the site in August 2023 (refer to **EIA Technical Appendix 8.5**).

2.2.13 No salmon were identified in the site of the original proposed development during electrofishing surveys in 2023. The closest salmon identified was 500 m downstream of the site, this was 1.5 km downstream from the original proposed development. Salmon may however be present in smaller numbers upstream and within the site due to a lack of impassable instream barriers. Obstacles and steep inclines were noted within the site of the revised proposed development, as such habitats are less suitable and unlikely to contain significant numbers of salmon.

2.2.14 Brown trout, *Salmo trutta*, were present in significant numbers at most survey locations and was the dominant species identified. No European eels were identified during surveys and no optimal eel habitat was found across all surveyed locations. Undercutting of the banks was very shallow and a minimal instream cover provided only some potential opportunity for eel. Brown trout and eel hold value in their importance as prey species for otter.

River and Brook lamprey

2.2.15 One juvenile river lamprey was identified at a control site during electrofishing surveys on the Kelphope burn, out with the site and not hydrologically connected to the revised proposed development's potential downstream zone of influence.

2.2.16 No brook lamprey were identified at any electrofishing location.

2.2.17 Under a precautionary basis river and brook lamprey are taken to have similar distribution to Atlantic salmon within the site and relevant 2 km screening buffer as they may be present in low numbers.

Sea lamprey

2.2.18 No sea lamprey were identified at any electrofishing location.

2.2.19 Information regarding sea lamprey distribution within the River Tweed catchment is sparse. It is, however, believed that conventional electrofishing survey techniques are unlikely to detect individuals due to tendencies to occupy deeper water beyond the reach of conventional techniques. Given water depth was minimal on site, it is considered that electrofishing surveys would have detected all species present. As such it is considered that sea lamprey are unlikely to be present within the site or any survey location and have been screened out of assessment for direct impacts (within 2 km), however, under a precautionary basis they have been assessed for indirect effect (within 10 km).

2.2.20 Similar to barriers and obstacles affecting river and brook lamprey, accessibility to watercourses within the site is considered to be naturally limited. As such restoration of population within the site is considered unlikely.

2.3 Step 2: Implications for the European Sites

Step 2, Part 1: Effects of the Revised Proposed Development Alone

2.3.1 The following potential pressures were screened in for assessment within the HRA screening document (**AEI Technical Appendix 8.7**).

Construction/Decommissioning

- Direct and indirect habitat loss/degradation of watercourses (including water quality, changes to waterflow and reduced air quality);
- Direct and indirect impacts to aquatic receptors (via reduced water quality, changes to waterflow, reduced air quality);
- Direct or indirect mortality (killing or injury);
- Direct and Indirect disturbance to species (Increased noise and vibration disturbance);
- Direct and Indirect disturbance to species (lighting and visual disturbance);
- Direct and Indirect disturbance to/ displacement of species (visual disturbance from plant, machinery, site operatives and activities);
- Direct and indirect disturbance to/ displacement of prey species; and
- Invasive Non-Native Species (INNS) introduction.

Operation and Maintenance

- Direct or indirect mortality (killing or injury); and
- INNS introduction.

Step 2, Part 2: Effects of the Revised Proposed Development In-combination

Identification of Cumulative Developments and Plans

2.3.2 Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a particular location. The potential for cumulative effects with other developments has been assessed here.

2.3.3 For aquatic receptors potential cumulative effects are only likely to be significant for other developments located relatively close by (i.e., within 10 km) and within the same hydrological sub-catchments, therefore, this RIAA has assessed the cumulative effects on aquatic receptors within the same sub-catchment (the Leader Water catchment, the largest watercourse hydrologically connected to the site within 10 km). As a precautionary approach, beyond 10 km no discernible effects of pollution, with or in absence of mitigation, is deemed to have the potential to result in LSEs and they are considered outside of the ZOI.

2.3.4 Projects considered for inclusion for cumulative effects are detailed in **Table 2**. These include developments within the relevant study areas which are either operational, under construction, consented or for which a planning application has been submitted.

Table 2 Developments Considered for In-combination effect

Developments	Status	Distance from Site (km)	Number of Turbines	River Sub-Catchment
Ditchers Law Wind Farm	Application	<5	15	Leader Water - Tweed
Dun Law II Wind Farm	Operational	5-10	35	Humbie Water – Birns Water – Tyne Leader Water - Tweed
Toddleburn Wind Farm	Operational	5-10	12	Leader Water – Tweed

2.3.5 All potential LSEs for riparian habitat, otter and fish species will require to be assessed, as for the revised proposed development alone.

2.3.6 Construction timeframes for Ditcher Law Wind Farm are unknown. Under a precautionary basis it is assumed there will be overlap in construction phases of both developments.

2.3.7 Both Dun Law II Wind Farm and Toddleburn Wind Farm are currently within their operational phase and not considered for construction/decommissioning effect, only operational.

Assessment of Effects

2.3.8 Potential pressures that cannot be ruled out for LSE on the revised proposed development alone have been included in the assessment of effects of the revised proposed development in-combination (refer to Section 2.3.1).

Step 2, Part 3: Assessment of effects on Conservation Objectives

River Tweed SAC Project Alone

Conservation Objectives for all Qualifying Features

1. **To ensure that the qualifying feature of the River Tweed SAC is in favourable condition and make and appropriate contribution to achieving favourable conservation status.**

   The assessment of Favourable Conservation Status (FCS) for qualifying features is determined via objectives 2a-c for all species, for which see below.

2. To ensure that the integrity of the River Tweed SAC is restored by meeting objectives 2a, 2b and 2c for the qualifying feature

Objectives 2a, 2b and 2c are assessed separately for each qualifying feature. For the purposes of this assessment, and in line with advice in the Conservation Advice Package (CAP), river and brook lamprey have been considered together due to similarities in habitat requirements, life cycle and distribution within the River Tweed Catchment.

Rivers with Floating Vegetation often dominated by water-crowfoot

2a Maintain the extent and distribution of the habitat within the River Tweed SAC

2.3.9 A survey conducted in 2013 categorised all 18 survey areas as in unfavourable condition due to river modification. Moreover, a further six factors were identified in have local impacts including a lack of bankside trees; lack of riparian buffer; lack of woody debris; siltation; presence of invasive non-native species; and presence of filamentous algae[3]. Of these it is believed that lack of bankside trees, riparian buffer and woody debris are issues within the revised site boundary and 2 km screening buffer.

2.3.10 The River Tweed has a cumulative river length of over 1,280 km. Of this around 6.8% of the extent of watercourse contains water crowfoot-related vegetation within this habitat. Survey work from the latest site condition monitoring exercise (2013) found that this vegetation type is reasonably well spread throughout most of the SAC[3]. As such on a precautionary basis it is considered this habitat is equally spread throughout watercourses contained within the site boundary and 2 km downstream screening buffer (taken from the most downstream extent of the site boundary). This includes a total length of 4.5 km of which 0.306 km (6.8% of the watercourse) is considered to contain water crowfoot-related vegetation.

2.3.11 The extent and distribution of the habitat within the River Tweed is assessed through six attributes relevant to the structure, function and supporting processes of the river (labelled i-vi) and include: flow; water quality; physical habitat structure; sediment regime; biological assemblages: aquatic plants; and absence of high-impact invasive non-native species. These are assessed individually under conservation objection 2b.

2b Restore the Structure, function and supporting processes of the habitat

Flow

2.3.12 River flow is critical to riverine flora and is dependent on a number of characteristics including velocity, water depth, wetted area, substrate quality, dissolved oxygen and water temperature. Of these velocity, water depth, wetted area and water temperature are unlikely to change as a result of the revised proposed development as no changes to hydrological regimes (abstraction of discharges) are predicted for the Whalplaw or Soonhope Burn. It is possible that introduction of fine sediments through construction related pollution may compromise substrate quality by smothering existing substrate, and pollutants with high biological or chemical oxygen demand (BOD/COD), e.g. organic matter, may deplete dissolved oxygen content in the absence of mitigation. There is no

[3] NatureScot. (2018). River Tweed Special Area of Conservation (SAC): Conservation Advice Package. [Online] Available at: https://www.nature.scot/sites/default/files/special-area-conservation/8369/conservation-advice-package.pdf

pathway for aquatic effect for the Soonhope burn due to infrastructure being located within the Whalplaw burn catchment, however, both could be affected by airborne pollutants, e.g. dust from access tracks or borrow pits. Whilst the risk of LSE is minimal due to increased distances and dilution by air/water it cannot be concluded that conservation objection 2a and 2b will not be undermined in the absence of mitigation measures.

2.3.13 Hydrology may adversely affect macrophytes by fluctuating water levels and by mechanical stress caused by waves and water flow.

Water quality

2.3.14 Water quality strongly influences the condition of river plant communities. The buffer capacity of the Whalplaw burn is considered to be good considering it is classified as in 'good' condition under SEPA classification[4]. As mentioned for attribute i-flow, deterioration of water quality cannot be ruled out in the absence of mitigation for dust/suspended solids in having adverse effect in the absence of mitigation. A number of other quality water parameters may affect the structure, functioning and supporting processes of macrophytes including temperature[6], dissolved oxygen, pH[5], BOD, total ammonia, sediment (assessed in attribute iv) and soluble reactive phosphorous (as listed in CAP), as such it cannot be concluded that conservation objection 2a and 2b will not be undermined in the absence of mitigation measures.

Physical habitat structure

2.3.15 Sections of the affected Whalplaw burn are considered to have poor physical habitat structure due to a number of factors including: lack of riparian habitat; limited bankside cover; erosion features on meanders; and grazing of livestock/deer limiting succession of vegetation. Culverts and other watercourse crossing structures are proposed upstream of the SAC on the Whalplaw burn as such the 'degree of naturalness' is likely to be maintained at baseline levels. No modifications to the Whalplaw or Soonhope burn are proposed under the revised proposed development, as such no LSE is predicted.

Sediment regime

2.3.16 Macrophytes and emergent vegetation are sensitive to fine sediment input as elevated total suspended solids in high concentrations have the ability to block light and impair photosynthetic ability of plants; higher turbidity has been seen to limit macrophyte distribution to mainly turbidity tolerant species. Factors associated with sediment input such as high organic matter, low dissolved oxygen content and nutrient limitations are also known to influence the distribution and diversity of macrophytes[6]. There is a risk of sediment input from works near watercourses, watercourse crossing installations and airborne dust. Inputs are likely to be low levels in nature (e.g. diffuse pollution) or low in frequency (e.g. during crossing installation), however, in-combination they have the potential

[4] SEPA. (2025). Water Classification Hub. [Online] Available at: https://informatics.sepa.org.uk/WaterClassificationHub/

[5] Szabo, S., Fedor, N., Koleszar, G., Braun, M., Korponai, J., Kocic, A., Jilt, S. and Olah, V. (2024). Submerged macrophytes can maintain stable dominance over free-floating competitors through high pH. *Freshwater Biology.* 70(1), e14363.

[6] Dar, N. A., Pandit, A. K. and Ganai, B. A. (2014). Factors affecting the distribution patterns of aquatic macrophytes. *Limnological Review.* 14(2). pp. 75-81.

to provide a cumulative effect that may deteriorate habitat quality in the absence of mitigation, as such LSE cannot be ruled out.

Biological assemblages: aquatic plants

2.3.17 Aquatic plant communities form the principle basis for SAC selection for habitat H3260 (these are provided in Appendix C). Under the precautionary principle it is assumed that all species that inhabit upland sites are present. Given LSE cannot be ruled out for attributes i, ii and iv, it is assumed LSE cannot be ruled out as effecting biological assemblages.

Absence of high-impact invasive non-native species

2.3.18 Habitat assessments identified no invasive non-native species (INNS) present within the application boundary or survey buffer. A hydrological pathway exists between the revised proposed development and the River Tweed SAC. Anthropogenic introduction of invasive species has been recognised as an important source of macrophyte decline and/or extinction, usually through uncontrolled spread and outcompeting native species[7]. Introduction of INNS via construction vehicles (e.g. tyre treads, dirty equipment) has been a historical source of establishment within Scotland. Risk of INNS transfer is highest during the construction phase along the access track on watercourse crossing locations. Although no crossing locations are located within the SAC, all are located upstream and as such have a clear hydrological pathway to the SAC.

2.3.19 No water is being brought on site, as such it is considered unlikely that fish species will be introduced on site via construction work: bullhead, *Cottus gobio,* pink salmon, *Oncorhynchus gorbuscha*, and American signal crayfish, *Pacifastacus leniusculus,* are all cited as problematic species in the CAP.

2.3.20 As such there is considered to be a pathway for the introduction of INNS (excluding fish species) and that there is a risk that that the **revised proposed development could undermine Conservation Objective 2b for the habitat**

2.3.21 Overall, it is concluded that in the absence of mitigation, there is a **medium risk that the revised proposed development could undermine Conservation Objective 2a and 2b for the habitat** through a number of attributes including: i) Flow; (ii) water quality; (iv) sediment regime; (v) biological assemblages: aquatic plants; and (vi) absence of high-impact invasive non-native species due to the number of pathways identified.

2c Restore, the distribution and viability of the habitat

2.3.22 Restoration of distribution and viability is additionally considered in conservation objection 2b through attributes 2a-2b.

2.3.23 Overall, a number of factors including flow, water quality and sediment regime in the absence of mitigation measures may hinder restoration objectives as such there is a **medium risk that the revised proposed development could undermine Conservation Objective 2c for the habitat.**

Otter

2a Maintain the population of otter as a viable component of the [SAC]

[7] Madzivanzira, T. C., Coetzee, J. A. and Dalu, T. (2023). Factors Structuring Aquatic Macrophytes. *Springer Nature.* pp. 21-52.

2.3.24 The Conservation Advice Package States:
'The conditions for the long-term existence of the otter population at the River Tweed SAC should be maintained. This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. This includes:

- Avoiding effects that could lead to a permanent reduction in the otter population through mortality, injury, or impacts caused by disturbance or displacement;
- Maintaining the species' ability to use all areas of importance within the site (to be considered under conservation objective 2b);
- Maintaining access to, and availability of, undisturbed resting places; and
- Maintaining access to, and availability of, supporting habitats and prey (to be considered
- under conservation objective 2c).'

2.3.25 Otter is a wide-ranging and highly mobile species. The population at the River Tweed SAC is reliant on suitable habitat within the site and downstream, with the former considered unlikely to be viable (capable of being self-sustaining) in isolation. The home range of an otter will vary depending on their sex, habitat quality and food availability. It will also vary between freshwater and coastal environments. Males living in freshwater (i.e. rivers and streams) can have a mean linear range size of around 40 km and females living in the same habitat can have a linear home range of around 20 km.

2.3.26 At this SAC, some otters that have parts of their territories within the site may also feed in coastal waters that lie outwith the boundary of the site. In coastal areas otter densities may be as high as 0.5 - 0.7 animals/km with smaller linear home ranges, typically 4 km[3,8]. The mouth of the River Tweed is in excess of 80 km, as such based on known maximum ranges of male otter and considerably smaller home ranges of coastal otter, taken to extend a maximum of 4 km upstream on a precautionary basis, coastal otter have been screened out of further assessment.

Avoiding effects that could lead to a permanent reduction in the otter population through mortality, injury, or impacts caused by disturbance

2.3.27 The death or injury of an otter could affect the conservation status of this species in the SAC, and could represent an offence under relevant legislation.

2.3.28 New access tracks are proposed in addition to upgrades to current farm track to facilitate movement of construction vehicles and to allow access during operational/maintenance phase. As such the extent of road network and traffic is expected to significantly increase from the current baseline increasing the risk of road collisions. A total of 12 watercourse crossing point are proposed, these areas present the highest likely risk of collision with vehicles where otter are most likely to come into contact with vehicles. Although no spraints or resting locations were identified on these watercourses otter may utilise these on occasion for commuting purposes and/or begin utilising these areas prior to construction. Extensive tributary burns within the River Tweed catchment are noted in supplying good feeding habitat to otter[9].

[8] International Otter Survival Fund. (2025). Eurasian Otter (*Lutra lutra*). [Online] Available at: https://www.otter.org/eurasian-otter

[9] JNCC. (2025). 1355 Otter *lutra lutra.* [Online] Available at: https://sac.jncc.gov.uk/species/S1355/

2.3.29 The works are likely to require open trenches and large excavations (e.g. borrow pit/SuDs). As such in an unmitigated scenario there is a risk of otter becoming trapped / injured in such features. Smaller turf/soil stripping will be required in areas to create level ground, e.g. for turbine foundations, however, these are unlikely to be significant (<1 m), with no realistic prospect of otters becoming trapped or injured in such features.

2.3.30 Otter is widespread locally and nationally, with the Scottish population estimated to be 8,000[10]. Otters that live in freshwater habitats occupy very large home ranges which may contain up to 30 resting sites[11]. Otters are able to adapt to a certain level of human disturbance[12]. NatureScot advise exclusion zones of 200 m around breeding holts, and 30 m around non-breeding resting places, with a development licence required if such exclusion zones are not possible[13].

2.3.31 One resting location and three spraints were identified on the Soonhope burn, which forms the western boundary of the revised proposed development. Although no resting locations or spraints were identified on the Whalplaw burn it is considered that otter will utilise all watercourses within the River Tweed SAC, which is inclusive of all watercourses within the revised application boundary. Electrofishing on the Whalplaw burn indicated presence of salmonids, favoured prey species of otter, as such it contains an established food source which is likely to be utilised throughout the year. Any disruption to prey species will affect otter through reduced prey availability which may result in otter utilising other sections of the River Tweed, which may in turn increase predation burdens in other parts of the catchment. Otter have high calorific requirements and must eat around 1-1.5 kg of prey daily[10].

2.3.32 No otter resting location or habitats within 30 m would be lost or damaged as a result of the construction work, therefore, disturbance of an otter in a structure or place it uses for shelter or protection is unlikely. For the purposes of assessment, a 30 m buffer was applied to resting locations in line with NatureScot guidance[14].

2.3.33 No breeding holts were identified within the site or buffer. Riparian habitat was considered poor for natal holt availability with exposed banks characterised by minimal tree and scrub coverage, minimal large rocks or riverbank crevices, or other cavity forming features. As such it is considered unlikely without intervention that the site will support significant breeding opportunities in the future.

Maintaining access to, and availability of, undisturbed resting places

2.3.34 As previously stated, no otter resting locations or habitats within 30 m would be damaged or disturbed as a result of the revised proposed development. Moreover, no proposed infrastructure or

[10] NatureScot. (2024). Information on otter. [Online] Available at: https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/otter#:~:text=Today%2C%20the%20species%20is%20flourishing,lochs%2C%20rivers%20or%20the%20sea

[11] Environment Agency. (1999.) Otters and River Habitat Management. Environment Agency: Bristol.

[12] Chanin, P. (2003). Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature: Peterborough

[13] NatureScot. (2018). Protected Species Advice for Developers. [Online] Available at: https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20otter.pdf

[14] NatureScot. (2024). Standing advice for planning consultations – Otters. [Online] Available at: https://www.nature.scot/doc/standing-advice-planning-consultations-otters

temporary construction compounds would result in the creation of any significant obstructions between identified otter resting locations and known foraging range (indicated by spraints).

2.3.35 A total of 12 watercourse crossings are proposed, of these five are upgrades to existing watercourses and seven are new. Watercourse crossings will comprise a mixture of single span bridges, bottomless arch or closed culverts. Incorrect or poor installation of crossings, e.g. failing to maintain a suitable flow of water or creating bridges too narrow, may force otter to utilise riverbanks instead which increases their risk of travel collision during construction periods. Moreover, where crossings limit migratory fish passage, reductions in prey availability upstream of crossings is likely to occur which may limit use by otter in the future.

2.3.36 Overall, it is concluded that in the absence of mitigation, there is a **low risk that the revised proposed development could undermine Conservation Objective 2a for otter** including death or injury via road collision, entrapment in pits/deep excavations and disruptions to prey species availability.

2b. Maintain the distribution of otter throughout the [SAC]

2.3.37 The Conservation Advice Package states:
'The spatial extent of otter within the River Tweed SAC should be maintained' and 'the ability for otter to use and access all areas of importance within the River Tweed SAC should be maintained'.

2.3.38 The current spatial extent of otter recorded on site is exclusively within the Soonhope burn with features recorded within the site, and upstream, as such the full extent of this watercourse is considered to be used by otter. No signs were identified on the Whalplaw burn, however, it is considered that otter are likely to use this due to favoured prey species presence, and resting location availability. Seasonal use of sites means otters may use this location at periods of the year other than those surveyed, and is such is considered to be used by otter under a precautionary basis. Spraints can be used to provide an estimation of distribution but do not indicate activity levels, as such otter may be active in areas with no spraints[15].

2.3.39 In the absence of mitigation measures there are a number of construction related activities that have the potential to cause displacement (through disturbance) or create barrier effects that affect species distribution. This includes night-time lighting positioned at or near watercourses, watercourse crossing construction and heavy traffic use, piling and/or blasting, and general disturbance from human activity (and dogs) by watercourses, especially during dusk/dawn periods when otter are most active. Activities are not proposed to occur sequentially but running concurrently, as such disturbing effects are likely to have in-combination effects in the absence of mitigation. Construction and maintenance works are not predicted to effect any of the Soonhope burn, as such risk of disturbance is located primarily with the Whalplaw burn where infrastructure is concentrated.

2.3.40 Effects of limited distribution by salmonids is likely to directly affect otter distribution changing foraging and hunting behaviours over time as prey resources are depleted.

[15] Kruuk, H. (2006). Otters ecology, behaviour and conservation. Oxford.

2.3.41 Overall, it is concluded that in the absence of mitigation, there is a **low risk that the revised proposed development could undermine Conservation Objective 2b for otter** during construction and decommissioning phases.

2c Maintain the habitats supporting otter within the [SAC] and availability of food

2.3.42 The conservation advice package states:
'The distribution and extent of otter habitat within the River Tweed SAC should be maintained, together with the structure, function and supporting processes of the habitat. Sufficiently high-water quality and natural flow conditions should be maintained to provide the necessary conditions for otter and their prey.'

2.3.43 Sufficiently high-water quality and natural flow conditions are required to maintain the habitat conditions necessary for otter, and their prey species. Construction and use of watercourse crossings has the potential to introduce pollutants to watercourses including suspended solids, fuels/oils, water acidification (i.e. through concrete washout) and increases in temperature, and subsequent decreases of dissolved oxygen content, through clearance of riparian vegetation. Reduction in water quality may adversely affect fish through impaired respiration ability, smothering of salmonid redds reducing fecundity, injury and/or mortality due to heavy metal contamination[16], in addition to other seasonally important prey species such as amphibians[17]. Both the Soonhope and Whalplaw burn are considered to be in 'good' condition[4], and as such are likely to have some buffer capacity thus low levels of pollution are unlikely to significantly alter prey species. In an unmitigated scenario there is a potential for a larger fuel spill/pollution event, albeit low.

2.3.44 Maintenance of riverine habitat in the lower sections of the River Tweed to support coastal otter requiring freshwater to remove salt from fur is not considered within the AA given the distance is >80 km from the revised proposed development. Under a worst-case scenario significant pollution events are unlikely to be detectable at this distance the volume of receptive body (River Tweed) and the dilution resulting from inflowing tributaries.

2.3.45 Overall, it is concluded that the revised proposed development there is a **low risk that it would undermine Conservation Objective 2c for otter** in an unmitigated scenario during construction and decommissioning phases only.

Atlantic Salmon

2a. Maintain the population of the species, including range of genetic types, as a viable component of the [SAC]

2.3.46 The Conservation Advice Package states:
'Effects should be avoided that could lead to a permanent reduction in the Atlantic salmon population or that prevent the population recovering, through mortality, injury, or impacts caused

[16] Wildhaber, Y. S., Michel, C., Epting, J., Wildhaber, R. A., Huber, E., Huggenberger, P., Burkhardt-Holm, P. and Alewell, C. (2014). Effects of river morphology, hydraulic gradients, and sediment deposition on water exchange and oxygen dynamics in salmonid redds. *Science of the Total Environment.* 470-471. pp. 488-500.

[17] Weber, J. M. (1990). Seasonal exploitation of amphibians by otters (*Lutra lutra*) in north-east Scotland. *Journal of Zoology.* 220(4).

by disturbance or displacement. This includes for example the effects caused by the construction of in-stream barriers to migration, changes in water flow rates or water quality'.

2.3.47 Atlantic salmon were not identified within the site, with the closest site identifying the species located 500 m downstream of the revised site boundary, and in excess of 1.5 km from the nearest infrastructure (a watercourse crossing). Salmon are considered unlikely to have significant distribution within the site due to the presence of instream barriers and steep gradient likely to create obstacles or barriers to movement.

2.3.48 Noise and vibration have the potential for behavioural, sub-lethal and lethal effects dependent on the distance between effect and receptor, extent and duration. Density of water affects sound, and it travels faster in water than in air (4.8x faster). For example, 100 Hz sound has wavelength of 3.43 m in air, but 15 m in water. All fishes (including elasmobranchs) detect and use particle motion, particularly at frequencies below several hundred Hz. In the case of Atlantic salmon, the swim bladder is positioned further from the ear, so the species experiences more sensitivity to vibration than directly from sound pressure[18]. Salmonids are only sensitive to particle motion and show sensitivity to only a narrow band of frequencies[19]. Mortality and potential mortal injury for salmonids is considered to be: 210 dB SELcum or > 207 dB peak; recoverable injury for salmonids was: 203 dB SELcum or > 207 dB peak; impairment (recoverable injury) for salmonids: > 186 dB SELcum; and impairment (Temporary threshold shift (TTS)) for salmonids: > 186 dB SELcum. Considering the distance from nearest infrastructure and known salmon is >1.5 km it is considered outwith the distance to cause injury and/or mortality as a result of highly disruptive activities (e.g. piling or blasting) and as such is unlikely to undermine conservation objection 2a.

2.3.49 A deterioration of water quality as a result of contamination from fuel and / or chemical leakages could adversely affect salmon populations. Fuel and / or chemical leaks high in concentrations (e.g. major oil spill event) could result in directly mortality at close ranges and sub-lethal effects at low concentrations (e.g. diffuse pollution/sedimentation)[20]. Given the distance between nearest source and receptor, >1.5 km, direct mortality is considered unlikely, however, in the absence of mitigation sub-lethal effects could result in injury. Where pollution events overlap with sensitive salmonid spawning periods October – February before fish hatch from redds as 'alevins', eggs are at risk of smothering from suspended solids. A good supply of oxygen facilitated by a flow of water through gravels is essential for eggs to develop, introduction of fine sediments and sand limits oxygen flow resulting in egg mortality[16]. Moreover, increasing the pollution load on kelt may reduce survivability during seaward migration as individuals are already in a weakened body condition and more

[18] Popper, A.N. and Hawkins, A.D. (2019). An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. *Journal of fish biology*, 94(5), pp.692-713.

[19] Popper, A.N. and Hawkins, A.D. (2019). An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. Journal of fish biology, 94(5), pp.704-705.

[20] Kroglund, F., Rosseland, B. O., Teien, H. C., Salbu, B., Kristensen, T. and Finstad, B. (2008). Water quality limits for Atlantic salmon (*Salmo salar* L.) exposed to short term reduction in pH and increased aluminimum simulating episodes. *Hydrology and Earth System Sciences.* 12(2). pp.491-507.

susceptible to effects of pollution. Kelts are important for population viability and stability as they return to natal rivers as repeat spawners[21].

2.3.50 Increased predation of salmon through flood lighting during the construction phase, and permanent lighting on turbines during operation, illuminating watercourses is considered to have a de minimis effect during construction periods given the distance between source and receptor.

2.3.51 Overall, it is concluded that the revised proposed development poses a **low risk of undermining Conservation Objective 2a for salmon** in an unmitigated scenario via water quality deterioration.

2b Maintain the distribution of the species throughout the [SAC]

2.3.52 Current distribution of salmon is limited within the site due to the presence of natural obstacles and barriers. As such installation of culverts is unlikely to present barriers to salmon movement throughout the site, thus distribution is unlikely to change as a result of the revised proposed development.

2.3.53 Potential impacts associated with noise and vibration are not expected to be produced at levels capable of causing injury and / or mortality, or so high that they form a barrier to migration through dissuasion.

2.3.54 A deterioration of water quality as a result of contamination from fuel and / or chemical leakages could create dissuasion responses with fish deterred from moving upstream into areas of higher pollution or less favourable habitats. Given the distance between source and receptor, >1.5 km, deterrence is considered unlikely for low levels of pollution, however, a high concentration pollution event may temporarily force individuals to move downstream. It is expected that any pollution related impacts associated with salmon would incur in the construction phase only due to limited personnel on site during the operational phase. It is unlikely that pollution would deteriorate habitat to an extent that salmon would not move back into an area given the >1.5 km distance, however, in an unmitigated scenario this cannot be ruled out. Similarly, airborne pollution, afforded a 2 km screening parameter, has limited pathway for effect considering the distance and dispersal effect in an area of higher winds and exposed landscape.

2.3.55 The Conservation advice package states that salmon should be present in all areas of the catchment to which they have natural access, as such distribution beyond areas of significant obstacles and/or barriers to migration have not been considered.

2.3.56 Overall, it is concluded that the revised proposed development would pose a **low risk of undermining Conservation Objective 2b for salmon in an unmitigated scenario** via a risk of hydrological and airborne pollution.

2c Maintain the habitats supporting the species within the [SAC] and availability of food

2.3.57 The revised proposed development is unlikely to contribute significantly to deterioration, improvement or plateau in habitat quality due to the distance between the works and nearest

[21] Simmons, O. M., Aldven, D., Forseth, T., Muller, S., Calles, O., Andreasson, P. and Silva, A. T. (2024). An overview of kelt migration in regulated rivers: status, knowledge gaps, and future directions toward safe downstream passage at hydropower facilities. *Reviews in Fisheries Science & Aquaculture.* 32(4). pp. 657-678.

salmon (>1.5 km). However, under a worst-case scenario, deterioration of water quality may result from aquatic pollution events (low or high concentration) or airborne pollution, both within a 2 km screening buffer. This has the potential to deteriorate a number of habitats affecting different life stages including juvenile rearing sites, adult resting sites (some may be present within the river for a year prior to spawning), and/or spawning substrates.

2.3.58 Natural flow conditions are not anticipated to change under the revised proposed development. As such effects resulting from depleted or increased flow are unlikely to result in adverse effect.

2.3.59 The distribution of salmon within the SAC may be affected by disturbance originating both within and out with the site (including estuarine and marine environments). Plans or projects causing displacement and/or barrier effects to salmon are likely to affect species distribution within the site. Accessibility and the ability to access habitats unhindered is discussed under conservation objection 2b.

2.3.60 Food availability for juvenile salmon, the only life stage actively feeding in freshwater, is likely to be unaffected by the revised proposed development due to the distance between the closest infrastructure and the nearest known salmon. However, under a worst-case scenario macroinvertebrates (favoured prey species) may be affected by a high concentration pollution event or cumulative low concentrations that build up over time and as such adverse effect on salmon food supply cannot be ruled out without mitigation.

2.3.61 Additionally, smolts and adult salmon are known to widely fast during migration periods, not actively seeking out food and eating opportunistically.

2.3.62 Overall, it is concluded that the revised proposed development would pose a **low risk of undermining Conservation Objective 2c for salmon in an unmitigated scenario** via a risk of hydrological and airborne pollution affecting prey species availability.

River and Brook Lamprey

2a Maintain the population of lamprey species as a viable component of the [SAC]

2.3.63 The COP states that:
'The conditions for the long-term existence of the brook and river lamprey at the River Tweed SAC should be maintained'.

2.3.64 Electrofishing surveys identified no brook lamprey with in the Soonhope burn, Whalplaw burn or control site. Considering the electrofishing locations extend beyond 2 km from the revised proposed development boundary (furthest downstream extent) brook lamprey are considered to be out with the relevant screening buffer for airborne and hydrological pollutants as such no LSE is predicted on population.

2.3.65 One juvenile river lamprey was identified within the control site, no individuals were identified on the Soonhope or Whalplaw burn. Similar to brook lamprey, electrofishing sites extended beyond 2 km and as such it is concluded that the revised proposed development could **not undermine Conservation Objective 2a for river and brook lamprey in an unmitigated scenario.**

2.3.66 As neither species of lamprey is currently within the site, introduction of barriers (not currently predicted) to movement in upstream sections of the catchment is not considered to hinder population growth by preventing upward migration of river lamprey when spawning (brook lamprey are non-migratory).

2b Maintain the distribution of lamprey species throughout the [SAC]

2.3.67 Considering no river or brook lamprey are present within the site or 2 km screening buffer for effect it is considered that mortality, injury or disturbance/deterrence of individuals is likely to affect distribution of the site.

2.3.68 Changes in hydrological regimes have the potential to retain fine sediments starving downstream areas or causing elevated flows capable of washing/eroding material and carrying this downstream, however, no changes to the hydrological regime are predicted (either abstraction or discharges effecting high or low flows) as such maintenance of habitats to support lamprey is unaffected. This includes the presence of fine sediments for ammocetes (juvenile life stage) and coarser, well-oxygenated substrate suitable for spawning[22].

2.3.69 Construction of watercourse crossings in the upper catchment do not pose direct barriers to distribution given locations do not coincide with known lamprey distribution, however, indirect effect through fine sediment retention may reduce suitability of downstream habitats. Given the types of crossings proposed, e.g. culvert and bridges, and no incorporation of weirs and/or barriers capable of sedimentation it is considered that the revised proposed development **would not undermine Conservation Objective 2a for river and brook lamprey in an unmitigated scenario.**

2c Maintain the habitats supporting lamprey species within the [SAC] and availability of food

2.3.70 As concluded for conservation objection 2b, habitats supporting lamprey will not be affected due to distance between source and receptor regarding pollution pathways, a lack of changing hydrological regimes and a lack of barriers to migration.

2.3.71 Lamprey larvae feed by filtering fine organic particles (notably diatoms and algae); food availability is not considered to be affected by the revised proposed development. Adult brook lamprey do not feed as adults and therefore adverse effect is not considered.

2.3.72 Information on water quality requirements for lamprey is minimal; mortality has been linked to pollution events although critical thresholds are not available[23]. Water quality requirements between river, brook (and sea lamprey) are considered to be similar for the purposes of this assessment.

2.3.73 Larval lamprey are know to be tolerant of short term low oxygen conditions compared to salmonids, and are capable of surviving in almost anoxic conditions within their burrows for a couple of hours[24].

[22] Harvey, J. and Cowx, I. (2003). Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis, L. planeri* and *Petromyzon marinus.* Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

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

[24] Hill, B. J. and Potter, I. C. (1970). Oxygen consumption in the ammocoetes of the lamprey Icthyomyzon hubbsi. Journal of Experimental Biology. 53. pp. 47–57.

However, in the event of prolonged or significant pollution larvae will emerge from burrowing habitat and be susceptible to anoxia[25].

2.3.74 Larval lamprey are also susceptible to temperature changes with limited optimal conditions (10-14 °C), increases in surface run-off on impermeable surfaces, e.g. tracks, wind turbine bases has the potential to cause thermal pollution[26]. In adults spawning is determined by water temperatures, average of 10-11°C (March-April) although 8.5-12°C is also cited[27].

2.3.75 Adult river lamprey migrate to coastal and estuarine locations to feed parasitically on fish (with one known exception in Scotland – Loch Lomond[28]). Effects on coastal and estuarine fish are considered to have a de minimis effect due to the distance between source and receptor (>80 km) and dilution factor of the River Tweed and other tributaries resulting in negligible changes to water quality.

2.3.76 Overall, it is concluded that the revised proposed development would pose a **low risk of undermining Conservation Objective 2c for river and brook lamprey in an unmitigated scenario** as a result of water quality deterioration.

Sea lamprey

2a Restore the population of the species as a viable component of the [SAC]

2.3.77 Little information is available regarding the distribution and density of sea lamprey within the SAC. Two monitoring locations relevant to this revised proposed development are noted, one on the Whalplaw burn and one on the Soonhope burn, both indicated absence of all lamprey species[29].

2.3.78 It is believed that conventional electrofishing survey techniques are unlikely to detect lamprey individuals due to their tendencies to occupy deeper water beyond the reach of conventional electrofishing techniques. However, water depth was minimal on [SAC], and so electrofishing surveys would have detected all species present. As such, it is considered that sea lamprey are unlikely to be present within the revised site boundary or any survey location. Similar to barriers and obstacles affecting river and brook lamprey, accessibility to watercourses within the revised site boundary is naturally limited. As such restoration within the site is not required given it is beyond natural accessibility and sea lamprey are unlikely to have occurred here historically.

2.3.79 Overall, it is concluded that the revised proposed development **would not undermine Conservation Objective 2a for sea lamprey in an unmitigated scenario.**

2b Restore the distribution of the species throughout the site

2.3.80 Sea lamprey are absent from areas within the revised site boundary and downstream screening buffer due to limited natural accessibility and are unlikely to have occurred here historically (no

[25] Potter, I. C. (1970). The life cycles and ecology of Australian lampreys of the genus Mordacia. Journal of Zoology. 161. pp. 487–511.

[26] Thomas, M. L. H. (1962). Observations on the ecology of ammocoetes of *Petromyzon marinus* L. and *Entosphenus lamottenii* (Le Sueur). in the Great Lakes watershed. MSc Thesis, University of Toronto.

[27] Hardisty, M. W. and Potter, I. C. (eds) (1971). The biology of lampreys. Academic Press, London.

[28] NatureScot. (2023). Lamprey. [Online] Available at: https://www.nature.scot/plants-animals-and-fungi/fish/freshwater-fish/lamprey

[29] The Tweed Foundation. (2014). The Three British species of Lamprey: River, Brook and Sea. [Online] Available at: https://rivertweed.org.uk/media/elflhyq5/lamprey.pdf

historical records). As such there is no requirement to restore thus it is considered restoration of distribution **would not undermine Conservation Objective 2b for sea lamprey.**

2c Restore the habitats supporting the species within the site and availability of food

2.3.81 Freshwater habitats suitable for sea lamprey vary between life stages. Juvenile sea lamprey require the presence of suitable silt beds to burry in and passively feed. Limited precise information is available on adult sea lamprey habitat during their freshwater phase, it believed they require calmer waters to rest pre-spawning and a highly oxygenated mix of cobble/pebble to spawn in (usually at the tail end of pools).

2.3.82 Adult sea lamprey migrate to coastal locations to feed parasitically on fish. Effects on marine fish are considered to have a de minimis effect due to the distance between source and receptor (>80 km) and dilution factor of the River Tweed and other tributaries resulting in negligible changes to water quality. Overall, it is concluded that the revised proposed development would not hinder efforts to restore the habitats and availability of food in the reaches where this species occurs (and could occur under the 'restore' objective' and therefore **not undermine Conservation Objective 2c for sea lamprey in an unmitigated scenario**.

In-combination effects of the revised proposed development with other developments

2.3.83 In combination effects of the revised proposed development with other developments is assessed in **Table 3**.

2.3.84 A summary of the effects for the revised proposed development alone and in-combination effects for the River Tweed SAC are provided in **Table 4**.

Table 3 Assessment of In-combination Effects

Project Name / Distance	Details of Development	Status	In-combination effects
Ditchers Law Wind Farm <5 km	The development will comprise 9 wind turbines up to 200 m tip height with a generation capacity of 59.4 MW in addition to 30 MW storage capacity.	Application	This development is located approximately 2.8 km upstream of the Cleekhimin burn confluence with the Leader Water (both the Soonhoope and Whalplaw burn are tributaries of the Cleekhimin Burn), it is expected any in-combination effect on water quality will be highest at this juncture representing the smallest distance from both developments. The Leader water is noted as being of 'moderate ecological status', and as such is considered to have some buffering capacity against pollutants. Given the site is located a further 6.25 km upstream (total distance of 9.05 km) of this it is considered any water quality pollution will have diluted beyond detection and unlikely to affect any qualifying feature. The development is located approximately 4 km straight line distance (from site boundary to site boundary) and as such is considered out with the 2 km screening buffer for airborne pollutants. Given the upland location of both developments, and typically high wind speeds, it is considered any airborne pollutants

Project Name / Distance	Details of Development	Status	In-combination effects
			during all development phases will sufficiently disperse beyond discernible effect. No significant in-combination effects predicted.
Dun Law II Wind Farm 5-10 km	The development comprises 61 wind turbines with an installed capacity of 47 MW and has been operational since 2000.	Operational	This development is not considered for in-combination effect within construction/decommissioning phases. This development is 6.55 km in distance to the Cleekhimin Burn (total distance of 9.35 km). Given operational phases of wind farms produce negligible pollution, associated with infrequent maintenance visits, coincidence of the operational phase with the revised proposed development in addition to the distance is considered unlikely to undermine conservation objectives. The development is located approximately 8.7 km straight line distance (from site boundary to site boundary) and as such is considered out with the 2 km screening buffer for airborne pollutants. No significant in-combination effects predicted.

Project Name / Distance	Details of Development	Status	In-combination effects
Toddleburn Wind Farm 5-10 km	The development comprises 12 wind turbines with an installed capacity of 27.6 MW and has been operational since 2010.	Operational	This development is not considered for in-combination effect within construction/decommissioning phases. This development is 7.48 km in distance to the Cleekhimin Burn (total distance of 10.28 km) and therefore out with the 10 km screening parameter for hydrological effect during operational phases. The development is located approximately 8.7 km straight line distance (from site boundary to site boundary) and as such is considered out with the 2 km screening buffer for airborne pollutants. No significant in-combination effects predicted.

Table 4 Summary of Effects for the Revised Proposed Development Alone and In-combination for the River Tweed SAC in the Absence of Mitigation

Feature	Objective	Risk of Undermining the Conservation Objectives for the **Revised Proposed Development** Alone	Risk of Undermining the Conservation Objectives for the **Revised Proposed Development** In-Combination
Riverine Habitat	2a. Maintain the extent and distribution of the habitat within the River Tweed SAC	**Medium risk**	None
	2b. Restore the structure, function and supporting processes of the habitat	**Medium risk**	None
	2c. Restore, the distribution and viability of typical species of the habitat	**Medium risk**	None
Otter	2a. Maintain the population of otter as a viable component of the site	**Low risk**	None
	2b. Maintain the distribution of otter throughout the site	**Low risk**	None
	2c. Maintain the habitats supporting otter within the site and availability of food	**Low risk**	None
Atlantic salmon	2a. Maintain the population of the species, including range of genetic types, as a viable component of the site	**Low risk**	None
	2b. Maintain the distribution of the species throughout the site	**Low risk**	None
	2c. Maintain the habitats supporting the species within the site and availability of food	**Low risk**	None
River and Brook lamprey	2a. Maintain the population of lamprey species as a viable component of the site	None	None
	2b. Maintain the distribution of lamprey species throughout the site	None	None
	2c. Maintain the habitats supporting lamprey species within the site and availability of food	**Low risk**	None
Sea lamprey	2a. Restore the population of the species as a viable component of the site	None	None
	2b. Restore the distribution of the species throughout the site	None	None
	2c. Restore the habitats supporting the species within the site and availability of food	None	None

2.4 Step 3: Mitigation Measures

Generic Mitigation Measures

2.4.1 'Generic' mitigation measures are considered appropriate for all qualifying features of the River Tweed SAC.

ECoW

2.4.2 A suitably qualified ECoW would be employed for the duration of the construction and reinstatement periods, to ensure natural heritage interests are safeguarded, although this may not necessarily be a full-time role throughout. The role of the ECoW would include the following tasks:

- To give toolbox talks to all staff onsite, e.g., an ecological induction, so staff are aware of the ecological sensitivities on the site, species specific information (e.g. otter resting locations and their disturbance buffer), conditions of any licences and the legal implications of not complying with agreed working practices;
- To undertake pre-construction surveys and checks for otter (and other non-qualifying protected species) and advise on ecological issues where required;
- To undertake in-situ and ex-situ water quality monitoring to monitor compliance with baseline conditions and/or parameters for the most sensitive aquatic species (in this case Atlantic salmon), or ensure a suitably qualified individual is appointed;
- Conduct a pre-works survey for the presence of INNS and remain vigilant for signs of INNS establishment during construction. Where INNS are identified appropriate measures should be taken to avoid establishment and/or further spread; and
- To assist with hydrological and silt mitigation measures.

INNS Management

2.4.3 Contractors will be required to adhere to standard operational biosecurity measures underpinned by legal responsibilities in dealing with non-native species under the Wildlife and Countryside Act 1981 making it an offence to plant or otherwise cause to grow in the wild any non-native plant[30]. As such cases of INNS introduction via poor construction practices is considered negligible.

Fish

Construction Run Off and Pollution

2.4.4 The ECoW would provide appropriate recommendations for silt mitigation and surface run-off where appropriate. This may include appropriate installation of silt fencing or the use of silt-busters (or similar) to reduce fine solid content in effluent.

2.4.5 Works would avoid a 50 m buffer of any primary watercourse, the Soonhope Burn and Whalplaw Burn, with the exception of watercourse crossing construction.

Water Quality Monitoring

[30] Scottish Government. (2025). Wildlife Management. [Online] Available at: https://www.gov.scot/policies/wildlife-management/invasive-non-native-species/#:~:text=The%20Act%20(sections%2014%20to,place%20outwith%20its%20native%20range.

2.4.6 The ECoW would implement a suitable water quality monitoring regime. Analysis of water quality results should compare parameters to known thresholds to affect Atlantic salmon and lamprey (sp.). The monitoring regime would cover pre-construction periods to establish baseline conditions, the construction period and a suitable period after to monitor ongoing (potential) pollution on-site and ensure silt mitigation measures are working effectively. Placement of in-situ automatic water quality data loggers set at regular monitoring intervals for parameters such as pH, conductivity, temperature, dissolved oxygen, and turbidity could replace in-situ monitoring and would allow real time data to be collected and, by using telemetry, viewed remotely. This would provide an early warning system for potential pollution events on site allowing emergency anti-pollution measures to be quickly mobilised, in accordance with those stated in the Construction Environmental Management Plan (CEMP). This would be accompanied by a regular ex-situ (laboratory tested) sampling suite at monthly intervals allowing a wider sampling suite of parameters specific to Atlantic salmon to be assessed and monitored.

Silt Mitigation

2.4.7 The ECoW will monitor any siltation that arises from construction related activities and recommend appropriate silt mitigation measures, e.g. silt fencing or silt buster/settlement tanks. The installation of any SuDS ponds beyond those planned under the CEMP should be designed by a suitably experienced hydrologist.

Culvert Design

2.4.8 Watercourse crossings would avoid identified areas of suitable brown trout spawning where possible (important food source of otter), or areas containing important macrophyte assemblages.

2.4.9 Culverts would be appropriately installed to minimise effect on fish passage, silt retention and/or flow conditions. Installation would follow best practice guidance for installation and blockage prevention[31].

Avoiding Sensitive Spawning Periods

2.4.10 Instream works should avoid sensitive spawning periods for Atlantic salmon (October-February) and lamprey sp. (April to May). Although works may not result in the direct loss of spawning habitat, siltation and pollutants arising from the works may affect egg viability of redds downstream (where salmonid spawning potential ranged from Optimal to Sub-Optimal).

Rivers with Floating Vegetation

Water Quality, silt mitigation measures

2.4.11 In-situ and ex-situ water quality monitoring and employment of silt mitigation measures within the site would identify/mitigate any pollution as a result of the revised proposed development. This is outlined in Section 2.4.2-6.

[31] UK Government. (2021). Culvert design and operation guide. [Online] Available at: Culvert design and operation guide - GOV.UK

2.4.12 Prior to installation of culverts the ECoW or suitably qualified individual would conduct a search for macrophyte presence and where necessary works would be microsited to avoid presence. Where presence cannot be avoided individual plants should be moved to a suitable location.

Otter

Pre-works Check

2.4.13 Due to the time that will have elapsed since the last surveys and the possibility that otter activity could have changed in the intervening period, a pre-construction survey for otter would be undertaken. The survey would cover all watercourses within the site and a 250 m buffer upstream and downstream.

2.4.14 Currently a disturbance licence is not required given current infrastructure; no works are predicted within 30 m disturbances zones for non-breeding features. No breeding holts or features with suitability for breeding were identified within the site or a 200 m buffer[32]. Should pre-works checks identify the presence of additional features within relevant buffers (30 m for non-breeding features and 200 m for breeding), and where mitigation or avoidance is not possible (following the mitigation hierarchy), a NatureScot disturbance licence would be prepared. This would be accompanied by a Species Protection Plan outlining additional mitigation measures to reduce adverse effect.

Speed Limits

2.4.15 During construction, operation and decommissioning phases, site speed limits of 15 mph would reduce the likelihood of accidental direct/ indirect injury/ killing of otter. Additionally, working outwith the main hours of otter activity (dawn and dusk) substantially reduces the likelihood of collision.

Safe Work Practices

2.4.16 All potentially dangerous substance or materials within the temporary construction compound would be carefully stored to prevent then causing any harm to any nocturnal animals which may enter the compound at night.

2.4.17 During construction, all excavations greater than 1 m depth would either be covered at night or designed to include a ramp to allow animals a means of escape should they fall in. Should an otter become trapped, all works within 200 m of the animal(s) would cease and the advice of the ECoW and/or project ecologist be sought immediately.

2.4.18 A procedure should be in place during the construction phase which outlines what to do if any protected species or its resting place is encountered during works.

2.4.19 No dogs (with the exception of ecological detection dogs, e.g. for bat carcass monitoring) should be brought on to site (with the exception of indoor areas) to prevent disturbance of otter.

2.4.20 Works would avoid a 50 m buffer of any primary watercourse, the Soonhope Burn and Whalplaw Burn, with the exception of watercourse crossing construction.

[32] NatureScot. (2024). Standing advice for planning consultations – Otter. [Online] Available at: https://www.nature.scot/doc/standing-advice-planning-consultations-otters

2.4.21 Any clearance of riparian vegetation, where unavoidable, should be checked by the ECoW prior to clearance to account for the presence of new resting locations/breeding holts.

3 Step 5: Effects on Integrity

3.1.1 Through the implementation of mitigation measures implemented no adverse effects are predicted on the conservation objection of the River Tweed SAC, consequently no adverse effects on integrity of the SAC are predicted.

3.1.2 A number of enhancement and restoration measures are proposed, in some cases these will measurably improve habitat and/or food availability for qualifying species of the River Tweed SAC.

4 Conclusion

4.1.1 All qualifying features or the River Tweed SAC were screened into the RIAA including rivers with floating vegetation; otter; Atlantic salmon; river lamprey and brook lamprey; and sea lamprey.

4.1.2 A number of pathways for LSE were identified within all development phases (construction, operation and decommissioning phases) for the revised proposed development alone, in the absence of mitigation measures a risk of undermining conservation objectives were identified. No LSE were identified within the in-combination assessment. With the application of mitigation measures no residual LSE are predicted, thus **the revised proposed development can be concluded as unlikely to cause adverse effect on integrity of the River Tweed SAC**.

Appendix A: Conservation Advice Package: River Tweed SAC

RIVER TWEED SPECIAL AREA OF CONSERVATION (SAC)

Designation date: 17 March 2005

Administrative area: Northumberland; Scottish Borders

Qualifying Interests for which the site is designated:

SCIENTIFIC NAME	COMMON NAME
Lampetra fluviatilis	River lamprey
Lampetra planeri	Brook lamprey
Lutra lutra	Otter
Petromyzon marinus	Sea lamprey
Salmo salar	Atlantic salmon
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Rivers with floating vegetation often dominated by water-crowfoot

EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

Citation for Special Area of Conservation (SAC)

Name:	River Tweed
Unitary Authority/County:	Northumberland, Scottish Borders
SAC status:	English part designated on 1 April 2005 Scottish part designated on 17 March 2005
Grid reference:	NT503338
SAC EU code:	UK0012691
Area (ha):	3797.41
Component SSSI:	Abbey St Bathans Woodlands SSSI, Kirkhope Linns SSSI, Lennel, Charley's Brae SSSI, Riskinhope SSSI, River Tweed SSSI, Tweed Catchment Rivers – England: Lower Tweed and Whiteadder SSSI, Tweed Catchment Rivers – England: Till Catchment SSSI, Tweed River SSSI

Site description:
The River Tweed drains a large catchment on the east coast of the UK, with sub-catchments in both Scotland and England. It shows a strong nutrient gradient along its length, with oligotrophic (nutrient-poor) conditions in its headwaters, and nutrient-rich lowland conditions just before it enters the sea at Berwick. The river has a high ecological diversity which reflects the mixed geology of the catchment. Stream water-crowfoot *Ranunculus penicillatus* ssp. *pseudofluitans*, a species of southern rivers and streams, here occurs at its most northerly location as does fan-leaved water-crowfoot *R. circinatus*, along with river water-crowfoot *R. fluitans*, common water-crowfoot *R. aquatilis*, pond water-crowfoot *R. peltatus* and a range of hybrids.

The fish fauna of the river is one of the richest in Great Britain. The Tweed supports a very large, high-quality Atlantic salmon *Salmo salar* population with large seasonal migrations: one run in the spring and a larger one in the autumn. The high proportion of the River Tweed accessible to salmon, and the variety of habitat conditions in the river, has resulted in it supporting the full range of salmon life-history types, with sub-populations of spring, summer salmon and grilse all being present. Salmon require clean gravel beds for spawning. The presence of brook *Lampetra planeri*, river *Lampetra fluviatilis* and sea lampreys *Petromyzon marinus* throughout the catchment is also important. These species prefer the lower gradient, fast flowing rivers with boulders as spawning grounds and the juveniles show preference for silty areas in slower flowing waters.

The extensive water and riparian habitats of the Tweed provide conditions suitable for all necessary aspects of otters' *Lutra lutra* life cycles. The extensive tributary burns provide good feeding habitat.

Qualifying habitats: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. (Rivers with floating vegetation often dominated by water-crowfoot)

Qualifying species: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Atlantic salmon *Salmo salar*
- Brook lamprey *Lampetra planeri*
- Otter *Lutra lutra*
- River lamprey *Lampetra fluviatilis*
- Sea lamprey *Petromyzon marinus*

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK0012691
Date of registration: 14 June 2005

Signed: Trevor Salmon

On behalf of the Secretary of State for Environment, Food and Rural Affairs

European Site Conservation Objectives for River Tweed Special Area of Conservation Site Code: UK0012691

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- **The extent and distribution of qualifying natural habitats and habitats of qualifying species**
- **The structure and function (including typical species) of qualifying natural habitats**
- **The structure and function of the habitats of qualifying species**
- **The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely**
- **The populations of qualifying species, and,**
- **The distribution of qualifying species within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document (where available), which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Rivers with floating vegetation often dominated by water-crowfoot

S1095. *Petromyzon marinus*; Sea lamprey

S1096. *Lampetra planeri*; Brook lamprey

S1099. *Lampetra fluviatilis*; River lamprey

S1106. *Salmo salar*; Atlantic salmon

S1355. *Lutra lutra*; Otter

This is a cross border site

This site crosses the border between England and Scotland. Some features may only occur in one Country. The advice of Scottish Natural Heritage should therefore be sought separately.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 4). This document updates and replaces an earlier version dated 22 February 2016 to reflect the consolidation of the Habitats Regulations in 2017.

NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

RIVER TWEED SPECIAL AREA OF CONSERVATION (SAC)

CONSERVATION ADVICE PACKAGE

The Yarrow from the bridge at the Gordon Arms © NatureScot

Site Details

Site name: River Tweed

Site map: https://sitelink.nature.scot/site/8369

Location: Scottish Borders; Northumberland

Site code: UK0012691

Area (ha): 3,742.65 (length 1,284.69 km)

Date designated: 17 March 2005

Qualifying features

Qualifying feature	SCM assessed condition	SCM visit date	UK overall Conservation Status
Rivers with floating vegetation often dominated by water-crowfoot (water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation). [H3260]	Unfavourable No change	27 September 2013	Unfavourable- bad
Sea lamprey (*Petromyzon marinus*) [S1095]	Unfavourable Declining	22 November 2018	Unknown
Brook lamprey (*Lampetra planeri)* [S1096]	Favourable Maintained	22 November 2018	Unknown
River lamprey (*Lampetra fluviatilis)* [S1099]	Favourable Maintained	22 November 2018	Favourable
Atlantic salmon (*Salmo salar*) [S1106]	Favourable Maintained	5 August 2011	Unfavourable - Inadequate
Otter(*Lutra lutra*) [S1355]	Favourable Maintained	11 December 2011	Favourable

Notes:
Assessed condition refers to the condition of the SAC feature assessed at a site level as part of NatureScot's Site Condition Monitoring (SCM) programme.
Conservation status is the overall condition of the feature throughout its range within the UK as reported to the European Commission under Article 17 of the Habitats Directive in 2019.

Overlapping Protected Areas:

The River Tweed, its major tributaries and many smaller tributaries are designated as the River Tweed SAC. In Scotland, the River Tweed and six major tributaries only (the Blackadder and Whiteadder, Bowmont, Teviot, Ettrick and Yarrow), are also notified as the River Tweed Site of Special Scientific Interest (SSSI). The Site Management Statement provides information on the wider ecological importance of the River Tweed SSSI, including its plant and invertebrate populations.

The River Tweed SAC partly overlaps with the Moorfoot Hills SAC.

The SAC also at least partly overlaps with the following SSSIs:
Abbey St Bathans Woodlands; Airhouse Wood; Avenel Hill and Gorge; Glenkinnon Burn; Kirkhope Linns; Lennel, Charley's Brae; Lintmill Railway Cutting; Makerstoun - Corbie Craigs to Trows' Craigs; Moorfoot Hills; Newtown St Boswells Woods; Riskinhope; St Mary's Loch; Tweedwood – Gateheugh; Whiteadder Water.

Further information on these protected areas can be found on SiteLink.

Key factors affecting the qualifying features

Rivers with floating vegetation often dominated by water-crowfoot
This feature type relates to the river habitat as a whole, including its aquatic plant communities. It is often characterised by the abundance of water-crowfoot species (*Ranunculus* spp., subgenus *Batrachium*), which form floating mats within river channels and have white flowers in early to mid-summer.

The River Tweed is the most species-rich example of a river with *Ranunculus* in Scotland. It has been designated as a 'whole river system', with all major tributaries and sub-tributaries included within the designation. This therefore covers the full ecological continuum that is characteristic of river ecosystems. The river has a high ecological diversity which reflects the size, mixed geology and altitudinal range of the catchment.

The feature has been assessed through NatureScot's site condition monitoring programme as being in unfavourable condition at this SAC. This is largely due to modification of the river channel through caulds, croys and other structures. In a river survey from 2013, all 18 survey areas were in unfavourable condition due to river modification. In addition, a further six factors were identified that had a significant, but more local impact on the river. These issues were: lack of bankside trees; lack of riparian buffer; lack of woody debris; siltation; presence of invasive non-native species, presence of filamentous algae. Although many aspects of the wider river ecosystem are largely in good condition, much work still needs to be done to bring the river itself into favourable condition.

The river habitat can be adversely affected by nutrient enrichment, mainly from sewage inputs and agriculture, and where agriculture has caused serious siltation. It is also vulnerable to artificial reductions in river flows caused by abstractions or flow diversions and to unsympathetic channel or bank engineering works.

Brook, river and sea lamprey
The brook lamprey is a primitive species of jawless fish that is eel-like in shape. It is the most abundant, widespread, and smallest species of lamprey found in Scotland and spends its entire life in fresh water. Larval lamprey (also termed ammocoetes) are filter feeders that trap water-borne fine organic matter. Their habitat commonly comprises fine sediment in which they remain buried until they metamorphose into adults. Following metamorphosis, the adults migrate upstream to spawn in clean gravel beds.

River and sea lamprey are primitive anadromous species of jawless fish that are eel-like in shape. They spend the majority of their lives as larvae buried in fine sediment in rivers where they filter feed by trapping water-borne fine organic matter. The larval phase of river lamprey lasts for approximately four years after which it metamorphoses and migrates to estuaries where it resides for one to two years and feeds on a variety of fish. The mature river lamprey then migrate upstream to spawn. The larval phase of sea lamprey lasts for approximately five years after which it metamorphoses and migrates to sea. Relatively little is known about its marine phase, but adult sea lamprey have been found in both shallow coastal and deep off-shore waters where they feed on a variety of fish. After approximately one to two years the adults will return to fresh water to spawn.

Adult river and sea lamprey require migration routes that are free of obstacles. Impassable manmade structures, e.g. dams and weirs, will restrict their distribution across a catchment – natural obstacles, e.g. waterfalls, will also do the same.

The sea lamprey has been assessed through NatureScot's site condition monitoring programme as being in unfavourable condition at this SAC due to a restricted distribution within the Tweed catchment. The Mertoun weir at St Boswells is potentially a significant obstacle for sea lamprey, although other fish species are largely successful at migrating upstream of the structure. Despite the presence of a fish pass, river flow rates over the weir, particularly during upstream migrations, may not be suitable for the species. As a result, sea lamprey may be largely restricted to the lower Tweed.

There is a level of uncertainty over this, however. *An assessment of Lamprey Distribution and Abundance in the River Tweed cSAC / SSSI* (report by Tweed Foundation, November 2004) noted sea lamprey records from the Gala Water and the Ettrick, both considerably upstream of the Mertoun weir. The site condition monitoring report does acknowledge that flow conditions suitable for upstream migration will vary from year to year, and could be highly unpredictable. It is possible, therefore, that sea lamprey could migrate upstream of the weir if suitable river conditions coincide with migration times, although this may not be identified by individual surveys. Furthermore, it is recognised that traditional survey techniques may not be sufficiently effective at recording the true distribution of sea lamprey.

Based on current survey data, sea lamprey is in unfavourable condition, but better evidence is required to give a true picture of the species distribution and the impacts of the Mertoun weir on this. Use of techniques such as eDNA will be helpful in this regard.

Habitat degradation is one of the key factors affecting brook, river and sea lamprey. They require clean, well oxygenated water and suitable substrates to use as spawning and nursery habitats. Activities such as river engineering or poor catchment management that could result in these habitats being damaged or removed could affect them. Indirect unwanted effects such as the smothering of habitat with fine material as a result of eutrophication could also affect lamprey.

Atlantic salmon

Atlantic salmon live in both freshwater and marine environments as part of their lifecycle. They hatch and live in freshwater as juveniles and then migrate to sea as adults. After one year or more at sea the adults return to their natal river to spawn. This homing behaviour has resulted in the development of genetically distinct populations of Atlantic salmon between Scottish rivers and several distinct populations may exist within the same river.

Atlantic salmon numbers have declined throughout their geographic range, including in Scottish rivers. They may be impacted by a range of pressures in the freshwater and marine phases of their lifecycle. In the freshwater environment these pressures may include, amongst others: over-fishing, loss of habitat connectivity, habitat degradation, climate change-related changes to surface water temperature and hydrology, built development (such as hydropower), invasive non-native species, direct and diffuse pollution, predation and the inappropriate stocking of conspecifics.

The Tweed is the largest and most important salmon rod fishery in Europe. This significance has long been recognised, with salmon-related bequests, royal assents and legislation dating back to the 12th century. Historically, most salmon were caught by netting, with 300 people directly employed in this activity at the end of the 18th century. The industry was also of considerable export value.

In the early 1900s there were over 80 salmon nets active on the Tweed and Berwickshire coast. There are now only five registered salmon nets, although even at those locations the purpose is now conservation and research. The impact of netting on salmon numbers should not be under-estimated. A 2011 site condition monitoring report on salmon SACs reported findings by the Environment Agency that about 70% of the salmon catch by the North East England net fishery was from Scottish rivers and potentially half of this was from the Tweed catchment. Closure of this fishery will therefore have brought significant benefits to wild salmon numbers in the Tweed.

On a much smaller scale, fish-eating birds, will take salmon - an entirely natural process of the river system. Where there is concern about predation by birds, fishery managers can apply for a control license. In recent years, licenses to control up to 54 goosander and 15 cormorant have been approved annually. Research has recently been carried out to give a better understanding of predation by fish-eating birds. This may influence the need for licences in future

Historically, water quality issues and blockages to fish migration were significant concerns across the River Tweed catchment. Principal issues of industrial and domestic pollution have now been addressed, and major blockages to fish migration have been amended to allow fish passage. As such, aquatic habitats in the river are generally in good condition. Tackling diffuse pollution remains a priority for river enhancement, with efforts focused on the agriculture, forestry and development sectors.

Maintaining good water quality and river habitat condition is progressed through a regulatory process that involves the Scottish Borders Council and the River Tweed

Commission. Proactive enhancement of river ecology is also promoted by these organisations and by nature charities such as the Tweed Forum.

In Scotland Atlantic salmon SACs extend to the tidal limit of rivers only. Marine mortality is however one of the key issues facing Atlantic salmon in Scotland and elsewhere. Environmental factors, climate change, marine developments, enhanced sea lice burdens associated with aquaculture, by-catch in pelagic fisheries, over-exploitation, prey availability, pollution and predation are all key factors that could affect this species. However, the exact nature of these interactions is not fully understood.

Otter

Otter require continued proximity to unpolluted open water either freshwater or coastal. There should be a plentiful food supply and features for providing shelter for both resting and breeding. They are wide ranging and occur at low densities throughout the catchment of the River Tweed and its tributaries.

Previous population declines in otters were primarily due to pollution and persecution. A report in 2011 (Site Condition Monitoring for Otters, SNH commissioned report No 521) showed that the presence of otter in survey locations on the Tweed had increased from about 45% occupancy in the late 1970s to about 95% occupancy between 2005 and 2011. A large scale survey has not been repeated since, but anecdotal evidence suggests that otter continue to be found throughout the Tweed catchment and in healthy numbers.

The main human impacts on otter are likely to be through materials or equipment discarded in the river or coastal waters that may trap otter, or through road traffic accidents. Although these factors could have a local impact on otter there is no evidence to suggest that they affect the Tweed population as a whole.

Further information about these species and habitats can be found on the JNCC website.

Conservation Priorities

There is unlikely to be any conflict between management of the features of the River Tweed SAC as they require similar environmental conditions. If any conservation management conflicts between the qualifying features of the River Tweed were to arise, consideration should first be given to those features in unfavourable condition. However, the impact of any proposed management measure on all the qualifying features should first be considered as part of a Habitats Regulations Appraisal.

The River Tweed SAC partly overlaps with Moorfoot Hills SAC, which has blanket bog as a Priority Feature. Broadly similar management is likely to be suitable for both blanket bog and the river SAC features although careful consideration would be needed before planting trees adjacent to the river to benefit the river SAC features within Moorfoot Hills SAC.

Any pro-active management for the River Tweed SAC or assessment of plans or projects will need to take account of all the interests of Moorfoot Hills SAC where the

sites overlap. If any management conflicts were to arise between the qualifying features of the River Tweed SAC and Moorfoot Hills SAC where the sites overlap, blanket bog should be given priority, followed by any features in unfavourable condition. This is because blanket bog is a Priority Feature and because management to benefit the River Tweed SAC could be done outwith the Moorfoot Hills SAC.

Conservation Objectives for rivers with floating vegetation often dominated by water-crowfoot (water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation).

1. To ensure that the qualifying feature of the River Tweed SAC is in favourable condition and make an appropriate contribution to achieving favourable conservation status.
Favourable Conservation Status (FCS) is considered at a European biogeographic level. When determining whether management measures may be required to ensure that the conservation objectives for this site are achieved, the focus should be on maintaining or restoring the contribution that this site makes to FCS. When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, b and c). If broader information on the feature is available then it should be used to provide context to the site-based appraisal. Note that "appropriate" within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of the River Tweed SAC is restored by meeting objectives 2a, 2b and 2c for the qualifying feature.
The aim at this SAC is to restore the qualifying habitat to a favourable condition as a contribution to its wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will be restored. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the restoration of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover. This objective recognises that the qualifying habitat is exposed to a wide range of drivers of change. Some of these are natural and are not a direct result of human influences. Such changes in the habitats' extent, distribution or condition within the site which are brought about by natural processes, directly or indirectly, are normally considered compatible with the site's conservation objectives. An exception to this is when the favourable condition of a habitat is dependent on halting or managing natural succession. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

2a. Maintain the extent and distribution of the habitat within the River Tweed SAC

80% of the River Tweed catchment is within Scotland. This area of the River Tweed designation extends to over 3,740 ha with a cumulative river length of over 1,280 km. The extent of water crowfoot-related vegetation within this habitat has been recorded in the Standard Data Form as 254.5ha, amounting to about 6.8% of the River Tweed SAC area. Survey work for the latest site condition monitoring exercise found that this vegetation type is reasonably well spread throughout most of the SAC.

The extent of river habitat within the designation, and the distribution of its characteristic species should be maintained.

2b. Restore the structure, function and supporting processes of the habitat

The river system should provide unpolluted and natural habitat. This condition should not be restricted by pollution or human activities. Where the river habitat has deteriorated, natural river conditions should be restored.

The distribution, extent and viability of the habitat within the River Tweed SAC, together with the structure, function and supporting processes of the habitat, should be restored.

Six attributes are relevant to the structure, function and supporting processes of the river.

(i) Flow

River flow affects a range of factors of critical importance to riverine flora and fauna, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. The maintenance of both flushing flows and seasonal base flows, based on natural hydrological processes, is vital. There already exist some significant abstractions from the River Tweed as well as compensation flows from reservoirs connected to the River Tweed to reduce impacts of low flows. These should ensure they contribute effectively to as natural a flow regime as possible.

Target: the flow regime of the river should be protected and daily flows should be close to what would be expected in the absence of abstractions and discharges (the naturalised flow). Flow targets for Water Framework Directive (WFD) 'high' ecological status should be used to avoid deterioration and for restoration where this is technically feasible.

(ii) Water quality

Water quality strongly influences the condition of riverine plant communities and other species that inhabit these rivers. Organic pollution from (point and diffuse sources) is a particular threat to water quality, leading to enrichment and adverse impacts on the characteristic plants and animals. Acidification can also cause major changes to plants, animals and ecosystem functioning. Upland streams are particularly susceptible to acidification, owing to the higher levels of precipitation in these areas.

Targets: the CSM Guidance for Rivers includes water quality targets, as follows:

- *10%ile DO (% saturation) 85*
- *Mean BOD (mg L-1) 1.5*
- *90%ile total ammonia (NH3-N, mg L-1) 0.25*
- *95%ile un-ionised ammonia (NH3-N, mg L-1) 0.025*
- *Mean pH >6.54*

Nutrient concentrations should be near-natural. Soluble reactive phosphorus (SRP) is particularly important and targets should vary depending upon river size, site altitude and alkalinity. Given that the River Tweed SAC covers a large catchment and each of these

elements varies throughout the site, it is not appropriate to set one catchment-wide target for SRP.

Water quality targets for Water Framework Directive (WFD) should be used to avoid deterioration and for restoration where required. Data from SEPA's Water Environment Hub shows that water quality on 85% of individual water courses in the Tweed catchment is classed as High or Good (2014). The remainder were classed as Moderate water quality, with no water courses classed as Poor or Bad.

Rivers of High water quality were all towards the upper reaches of the catchment. There was no coherent distribution pattern of rivers with Moderate water quality. The Tweed downstream of Coldstream, and some of its tributaries, are historic problem areas for diffuse agricultural pollution, but Moderate water quality was also found in the middle reaches of the catchment (e.g. the Leader and the Whiteadder) and the upper reaches (e.g. the Lyne Water and Eddleston Water).

The projected water quality for 2021 is for 91% of water courses in the Tweed catchment to be classed as Good or High. By 2027 this figure should be 95%.

Control of diffuse pollution from agriculture is important and many farms have now fenced off river banks to prevent access by livestock, or have implemented buffer margins around arable fields. This has been supported by agri-environment schemes, but SEPA has also targeted different sub-catchments to identify pollution risks on farms and ensure that they are addressed.

(iii) Physical habitat structure

Watercourses with a high degree of naturalness are governed by dynamic processes that result in a variety of constantly changing physical habitat features, including a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel sedimentation features, erosion features and both in-channel and bankside vegetation cover. Modifications to physical habitat structure, or prevention of natural change processes, may be detrimental to any or all of these features. Ecological connectivity between habitats is also important, both within the river and between the river and its banks, riparian zone and wider floodplain and catchment. The river should therefore follow its natural course with little modification and near-natural bank and riparian zone vegetation. Restoration of modified water courses may be necessary. Where modifications have been made to the river and its corridor in urban areas, significant restoration may sometimes be impractical.

The Tweed is a post-industrial river that was modified extensively through the 1800s to provide water and water power for various industries throughout the catchment. Agricultural improvements at this time resulted in the straightening of meanders and the drainage of flood plains to provide grazing and tillage. Bridges and other transport infrastructure have further modified the river bank.

The pace of river modification has slowed considerably since then, although additional strengthening works are still required or requested on a more local scale. Restoration of some stretches of river has taken place, most notably the re-meandering work on the Eddleston Water. Other similar projects have also been implemented, but further restoration works are required to move the river channel into a natural condition.

(iv) Sediment regime

Many characteristic species of different river types are susceptible to elevated solids levels, through reduced light availability (for photosynthesis), the clogging of respiratory structures, impaired visibility or siltation of coarse substrates. There should therefore be no unnaturally high levels of siltation in the river, including their frequency, duration and scale of elevated

silt levels.
See comments for (ii) Water Quality. Some lower stretches of the SAC show impacts from agricultural diffuse pollution. This will include from suspended solids.

(v) Biological assemblages: aquatic plants
Aquatic plant communities form the principle basis for SAC selection for habitat H3260. Furthermore, they form an important structural and functional element in rivers, including rare plant taxa that contribute to local distinctiveness, such as river jelly lichen.

Target: the LEAFPACS WFD monitoring tool should give a result of 'high' ecological status for an assessment unit.

(vi) Absence of high-impact invasive non-native species
Invasive Non-native Species (INNS) can constitute a major threat to the River Tweed.

A number of invasive plant species are recorded on the Tweed catchment, most notably Japanese knotweed (*Raynoutria japonica*), giant hogweed (*Heracleum mantegazzianum*) and Himalayan balsam (*Impatiens glandulifera*). These species can smother existing native vegetation but also make the river bank unstable resulting in erosion.

Signal crayfish (*Pacifastacus leniusculus*) has also been recorded in the Tweed, primarily on the Till (England) but unconfirmed reports suggest the species is also present on the Leithen Water.

Bullhead (*Cottus gobio*) is not considered native to Scotland and competes effectively for resources. Populations of salmon and trout are known to decline when bullhead are introduced to a river. It is resident on the Teviot in sufficient abundance that control measures are not practical. Pacific (pink) salmon (*Oncorhynchus gorbuscha*) are also present in small number although there is no evidence that they are breeding on the Tweed.

Mink (*Neovison vison*) are occasionally recorded within the Tweed catchment. Although they are certainly an unwanted predator, there are only a few observations each year and there is no sense that the species is present in significant number.

Restoration work is therefore required so as to meet this conservation objective. The Tweed Invasives Project is hosted by the Tweed Forum and aims to control the presence of invasive plants on the Tweed. Contractors and teams of volunteers are used to monitor and spray populations of plants. A rust (*Puccinia komarovii* var. *glanduliferae*) has also been released on the Tweed to control Himalayan balsam. Along with project partners, the 'Check, Clean, Dry' campaign is promoted to reduce the spread or introduction of invasive species from elsewhere.

Target: no 'high-impact' alien species established, i.e. self-sustaining populations. Removal of existing populations of all of the above INNS.

2c. Restore, the distribution and viability of typical species of the habitat

Sufficiently high water quality and natural, river morphology and flow conditions, should be in place to provide the necessary conditions for the habitat and its typical species

This river habitat is characterised by the abundance of water-crowfoot *Ranunculus* spp., subgenus *Batrachium*. Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. This vegetation may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals within the river.

The River Tweed SAC is the most species-rich example, by far, of a river with *Ranunculus* in Scotland. The river has a high ecological diversity which reflects the mixed geology of the catchment. The species found in the SAC include: stream water-crowfoot *Ranunculus penicillatus* ssp. *pseudofluitans*; fan-leaved water-crowfoot *R. circinatus*; river water-crowfoot *R. fluitans*; common water-crowfoot *R. aquatilis*; pond water-crowfoot *R. peltatus*; a range of hybrids, including the nationally scarce Kelso water crowfoot *R. peltatus x fluitans*. The Tweed is also the most northerly site for flowering-rush *Butomus umbellatus.*

The wider assemblage of river and bankside plants also forms part of the River Tweed SSSI citation. 13 species were included in the latest site condition monitoring survey, including flat sedge (*Blysmus compressus*) shady horsetail (*Equisetum pratense*) and hairy stonecrop (*Sedum villosum*). Although distribution of some species was highly restricted, the catchment as a whole scored well above the threshold for a designated site.

Many of these species require specific habitat conditions, often including a level of grazing or soil disturbance. It is possible that water quality initiatives such as fencing-off the river bank could remove grazing and thereby affect the viability of some of these species. Fencing off sections of water course is important from a water quality perspective but it should not be a universal management tool. It is important to identify the locations of rarer species to determine specific management prescriptions that will enhance water quality without compromising other aspects of biodiversity.

The diversity of habitat across the catchment will support a broad range of species, although the natural dynamics of the river may mean that individual populations are relatively transient. Species that occupy exposed gravel bars, for example, will be resident only as long as the gravel bar is present and un-vegetated.

Wading birds, including oystercatcher and the much rarer little ringed plover, will use gravel bars for nesting. This could cause conflict between nesting birds and some river management operations. Since these birds are often camouflaged, or timid and evasive, nesting birds may not always be obvious during simple walk-over surveys. It is possible, therefore, that some river-works during the breeding season will disturb nesting birds. This is a wildlife crime and landowners and contractors should be aware of the risks. With appropriate planning this risk can be avoided.

Other birds on the Tweed include dipper, kingfisher, heron, goosander, red-breasted merganser and mallard.

The range of habitats in the catchment, from gravel bars to wet flushes and wooded canopies, supports a broad diversity of invertebrate. Eight nationally scarce or Red data Book flies have been recorded from various habitats, including the empid *Tachydromia woodi*, the soldier fly *Oxycera paradalina* and the cranefly *Tipula cheethami*.

This vegetation and other riverine flora and fauna can be affected by pressures impacting on the SAC habitat, including:

- Pollution: from a wide range of sources (both point and diffuse) throughout the catchment. Consequences include eutrophication, anoxia, siltation, toxicity and acidification.
- Invasive non-native species: riparian plant species are present (and extensive) in some areas of the River Tweed catchment. Himalayan balsam, Japanese knotweed and giant hogweed lead to the exclusion or suppression of native plant communities and a fundamental alteration to the integrity of the riparian habitat structure.
- Flow and habitat modifications: physical habitat modifications and modifications to the natural flow regime occur. These affect plants, fish and invertebrates adapted to high

current velocities. Abstraction and diversion also affect habitat extent, resulting in rivers of smaller size, power and velocity.

Overarching Conservation Objectives for all species

1. To ensure that the qualifying features of the River Tweed SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.

Favourable Conservation Status (FCS) is considered at a European biogeographic level. When determining whether management measures may be required to ensure that the conservation objectives for this site are achieved, the focus should be on maintaining or restoring the contribution that this site makes to FCS.

When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met. Further details on how these appraisals should be carried out in relation to maintaining site integrity is provided by objective 2 (including parts a, band c). If broader information on the feature is available then it should be used to provide context to the site-based appraisal.

Note that "appropriate" within this part of the conservation objectives is included to indicate that the contribution to FCS varies from site to site and feature to feature.

2. To ensure that the integrity of the River Tweed SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature.

The aim at this SAC is to maintain, or where appropriate restore, the qualifying species in a favourable condition as a contribution to their wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will be restored. Note that not all of these will be relevant for every activity being considered. Any impacts on the objectives shown in 2a, 2b or 2c below must not persist so that they prevent the restoration of site integrity. Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover.

This objective recognises that the qualifying species are exposed to a wide range of drivers of change. Some of these are natural (e.g. population fluctuations/ shifts or habitat changes resulting from natural processes) and are not a direct result of human influences. Such changes in the qualifying species' distribution and use of the site, which are brought about by natural processes, directly or indirectly, are normally considered compatible with the site's conservation objectives. An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case by case basis.

Conservation Objectives for sea lamprey (*Petromyzon marinus*)

2a. Restore the population of the species as a viable component of the site

The conditions for the long-term existence of the sea lamprey at the River Tweed SAC should be restored.

An estimate of the number of sea lamprey occupying the site is not available and, due to the difficulties of surveying the species, is unlikely to become so. The actual number may vary both inter-annually and intra-annually according to a variety of environmental factors including changes in the amount of larval habitat as it is altered, removed, or created by variations in flow and the availability of sediment. Because we cannot measure absolute population numbers we use distribution and relative abundance as a measure of population viability.

This conservation objective will be considered to have been met if the conditions necessary for the long-term survival of the sea lamprey remain. These include:

- Avoiding direct or indirect effects that could lead to a permanent reduction in the number of sea lamprey through mortality, injury, disturbance, or displacement. The effects may be caused by the direct or indirect physical alteration of habitat as a result of development or river engineering, or by pollution associated with these activities or from point or diffuse catchment sources - see conservation objective 2c.
- Ensuring that the sea lamprey are able to gain access to and use all parts of the site in which they would be expected to occur naturally - see conservation objective 2b.
- Ensuring that sea lamprey are able to migrate unhindered to the sea.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective. The appraisal should also consider the life cycle and life history of sea lamprey and the scale and duration of the impact being assessed. For example, an activity that prevented access to or altered spawning habitat during the period when sea lamprey spawn could lead to a reduction in the number of larvae produced and so eventually a reduction in the number of adults associated within the affected cohort.

2b. Restore the distribution of the species throughout the site

The spatial extent of sea lamprey within the boundary of the River Tweed SAC should be restored.

Distribution of the sea lamprey within the River Tweed SAC should not be restricted by pollution, artificial structures or human activities.

Relatively little is known about the distribution and density of sea lamprey within the SAC due to limitations in current survey methods. To date, conventional electrofishing surveys have recorded relatively few sea lamprey larvae and the total has frequently been two orders of magnitude less than that for *Lampetra*. It is thought that sea lamprey larvae may occupy similar habitat to that used by *Lampetra* but in deeper water that is beyond the reach of conventional electrofishing surveys.

When considering the impact of a plan or project any accessible suitable habitat should be considered to have the potential to contain sea lamprey larvae, although in practice some may be naturally unoccupied.

The distribution of sea lamprey across the site may be affected by disturbance originating from within or outside it (including at sea) this includes the Berwickshire and North

Northumberland Coast SAC and coastal plus deep off-shore waters. Plans or projects that lead to the displacement of sea lamprey or which impede or prevent the species movement may also affect its distribution. Examples of activities that may affect the distribution of sea lamprey include: the construction of engineered structures (e.g. bridge abutments or piers) or the removal of accumulations of sediment to maintain the conveyance capacity of culverts, both of which may lead to the direct loss of juvenile habitat; poor land use that leads to fine organic matter or sediment being washed into a river and smothering spawning habitat; and the construction of hydroelectric power offtake weirs which may prevent adults from reaching spawning sites. A number of other artificial structures, such as weirs and dams, likely impeded the movement of sea lamprey to certain parts of the catchment.

Mertoun weir is potentially a significant obstacle for upstream migration of sea lamprey, as discussed on page 4.

2c. Restore the habitats supporting the species within the site and availability of food

The distribution and extent of sea lamprey habitat within the River Tweed SAC, together with the structure, function and supporting processes of the habitat, should be restored.

Sufficiently high water quality and natural flow conditions should be in place to provide the necessary conditions for sea lamprey.

Sea lamprey larvae feed by filtering fine organic particles, especially diatoms and other algae, as well as protozoans and detritus, from the surface of the silt around the mouths of their burrows. A naturally functioning river system in a well-managed catchment should provide adequate food. Adult sea lamprey feed on a variety of fish in estuaries and the sea.

Both the larval and adult phases of sea lamprey require clean, well oxygenated water. The larvae commonly burrow into soft sediment in the margins of streams and rivers. They may also be found in detritus overlying coarse substrate, amongst submerged tree roots, emergent vegetation rooted in silt, shallow patches of fine sediment among coarser substratum, or submerged branches or twigs that have trapped fine sediment. The unconsolidated nature of their habitat means that it may be readily altered by sufficiently powerful flows. The distribution and abundance of habitat may therefore undergo significant intra-annual or inter-annual change in a naturally functioning river system. Adult sea lamprey spawn in nests comprising gravel and some sand in flowing water. Suitable conditions are often found at the tail-end of pools.

Low flow conditions may leave sea lamprey habitats unusable, influencing both:
- juvenile habitat, particularly that in the margins as the wetted width of a watercourse is reduced and
- adult spawning habitat.

The natural flow regime of the river should be protected. Low and high flow conditions may occur artificially e.g. through poor hydroelectric power scheme flow management. However, daily flows should be close to those expected in the absence of abstractions and discharges, with no obvious problems with water availability. Water flow and quality standards for Good Ecological Status (GES) under the Water Framework Directive should be met. These targets are intended to support a healthy, naturally functioning riverine ecosystem which protects the whole biological community and individual species to a degree characteristic of the river.

The geomorphology and so the physical sea lamprey habitat available in a river may change in response to changes in flow, but also as a direct or indirect result of human intervention. River engineering may, for example, result in hydraulic conditions that cause the erosion of larval habitat.

The morphology of a naturally functioning river system will provide the range of habitats needed by sea lamprey. For this the river should follow its natural course, with little modification and a natural riparian zone with emergent vegetation and native trees. There should also be no unnaturally high levels of siltation. Artificial in-channel structures, e.g. weirs, dams and fords, should not bar or impede the movement of sea lamprey (see observations on Mertoun weir on page 4) and the movement of sediment which may limit the availability of material needed to replenish spawning habitat.

Man-made (and natural) changes to the water quality of the site may have direct or indirect effects on sea lamprey habitat. Examples of manmade effects include: silt laden runoff from poorly managed tilled land smothering redds; and pollution caused by inadequately treated discharges, e.g. from sewage treatment works.

Conservation Objectives for brook lamprey (*Lampetra planeri*) and river lamprey (*Lampetra fluviatilis*)

2a. Maintain the population of lamprey species as a viable component of the site

The conditions for the long-term existence of the brook and river lamprey at the River Tweed SAC should be maintained.

An estimate of the number of brook and river lamprey occupying the site is not available and, due to the difficulties of surveying the species, is unlikely to become available. The actual number may vary both inter-annually and intra-annually according to a variety of environmental factors including changes in the amount of juvenile habitat as it is altered, removed, or created by variations in flow and the availability of sediment. Because we cannot measure absolute population numbers we use distribution and relative abundance as a measure of population viability.

This conservation objective will be considered to have been met if the conditions necessary for the long-term survival of these species remain. These include:

- Avoiding direct or indirect effects that could lead to a permanent reduction in the number of brook and river lamprey through mortality, injury, disturbance, or displacement. The effects may be caused by the direct or indirect physical alteration of habitat as a result of development or river engineering, or by pollution associated with these activities or from point or diffuse catchment sources - see conservation objective 2c.
- Ensuring that these species are able to gain access to and use all parts of the site in which they would be expected to occur naturally - see conservation objective 2b.
- Ensuring that the river lamprey are able to migrate unhindered to estuaries.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective. The appraisal should also consider the life cycle and life history of the species and the scale and duration of the impact being assessed. For example, an activity that prevented access to or altered spawning habitat during the period when lamprey spawn could lead to a reduction in the number of larvae produced and so eventually a reduction in the number of adults associated within the affected cohort.

2b. Maintain the distribution of lamprey species throughout the site

The spatial extent of brook and river lamprey within the boundary of the River Tweed SAC should be maintained.

Distribution of the brook and river lamprey within the River Tweed SAC should not be restricted by pollution, artificial structures or human activities.

Thus far surveys have reported the number and distribution of brook and river lamprey combined. Distinguishing between the larvae of brook and river lamprey using physical characteristics, is not possible.

Collectively, *Lampetra* species remain widespread across the Tweed catchment, with a high percentage occupancy rate of sampled locations in recent site condition monitoring surveys (2011 and 2018). Lamprey were found in the upper, middle and lower Tweed, the Ettrick, Teviot, Whiteadder and Leithen Water. Hearthstanes was the most upstream sampling site on the Tweed, with lamprey larvae being found about 16 km from the source of the river. This suggests that the physical and biological conditions in the river system favour these species.

When considering the impact of a plan or project any accessible suitable habitat should be expected to contain the larvae of lamprey species', although in practice some may be naturally unoccupied.

The distribution of brook and river lamprey across the site may be affected by disturbance originating from within or outside it this includes the Berwickshire and North Northumberland Coast SAC. Plans or projects that lead to the displacement of lamprey species' or which impede or prevent the species' movement may also affect its distribution. Examples of activities that may affect the distribution of lamprey include: the construction of engineered structures (e.g. bridge abutments or piers) or the removal of accumulations of sediment to maintain the conveyance capacity of culverts, both of which may lead to the direct loss of juvenile habitat; poor land use that leads to fine organic matter or sediment being washed into a river and smothering spawning habitat; and the construction of hydroelectric power offtake weirs which may prevent adults from reaching spawning sites.

2c. Maintain the habitats supporting lamprey species within the site and availability of food

The distribution and extent of brook and river lamprey habitat within the River Tweed SAC, together with the structure, function and supporting processes of the habitat, should be maintained.

Sufficiently high water quality and natural flow conditions should be in place to provide the necessary conditions for lamprey species'.

Lamprey larvae feed by filtering fine organic particles, especially diatoms and other algae, as well as protozoans and detritus, from the surface of the silt around the mouths of their burrows. A naturally functioning river system, in a well-managed catchment, should provide adequate food. Adult river lamprey feed on a variety of fish in estuaries.

Both the larval and adult phases of lamprey require clean, well oxygenated water. The larvae commonly burrow into soft sediment in the margins of streams and rivers. They may also be found in detritus overlying coarse substrate, amongst submerged tree roots, emergent vegetation rooted in silt, shallow patches of fine sediment among coarser substratum, or submerged branches or twigs that have trapped fine sediment. The unconsolidated nature of their habitat means that it may be readily altered by sufficiently powerful flows. The distribution and abundance of habitat may therefore undergo significant intra-annual or inter-annual change in a naturally functioning river system. Adult brook lamprey spawn in nests created in gravel beds and typically at the tail-end of pools. The size of the gravel beds vary, ranging from $< 1\ m^2$ to $> 10\ m^2$. Adult river lamprey spawn in nests comprising gravel and

some sand in flowing water. Suitable conditions are often found at the tail-end of pools.

Low flow conditions may leave lamprey habitats unusable, influencing both:
- juvenile habitat, particularly that in the margins as the wetted width of a watercourse is reduced and
- adult spawning habitat.

The natural flow regime of the river should be protected. Low and high flow conditions may occur artificially e.g. through poor hydroelectric power scheme flow management. However, daily flows should be close to those expected in the absence of abstractions and discharges, with no obvious problems with water availability. Water flow and quality standards for Good Ecological Status (GES) under the Water Framework Directive should be met. These targets are intended to support a healthy, naturally functioning riverine ecosystem which protects the whole biological community and individual species to a degree characteristic of the river.

The geomorphology and so the physical lamprey habitat available in a river may change in response to changes in flow, but also as a direct or indirect result of human intervention. River engineering may, for example, result in hydraulic conditions that cause the erosion of larval habitat.

The morphology of a naturally functioning river system will provide the range of habitats needed by lamprey. For this the river should follow its natural course, with little modification and a natural riparian zone with emergent vegetation and native trees. There should also be no unnaturally high levels of siltation. Artificial in-channel structures, e.g. weirs, dams and fords, should not bar or impede the movement of lamprey and the movement of sediment which may limit the availability of material needed to replenish spawning habitat.

Man-made (and natural) changes to the water quality of the site may have direct or indirect effects on lamprey habitat. Examples of manmade effects include: silt laden runoff from poorly managed tilled land smothering redds; and pollution caused by inadequately treated discharges, e.g. from sewage treatment works.

Conservation Objectives for Atlantic salmon (*Salmo salar*)

2a. Maintain the population of the species, including range of genetic types, as a viable component of the site

The conditions for the species' long-term existence at the River Tweed SAC should be maintained.

This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. These conditions include:

- Effects should be avoided that could lead to a permanent reduction in the Atlantic salmon population or that prevent the population recovering, through mortality, injury, or impacts caused by disturbance or displacement. This includes for example the effects caused by the construction of in-stream barriers to migration, changes in water flow rates or water quality. Observed densities therefore need to be assessed in relation to the expectation for the River Tweed overall and for each river reach, based on productivity and natural habitat character of the system. However, these should not differ significantly from those expected for the river type/reach under conditions of high physical and chemical quality.

- The numbers of returning Atlantic salmon should be sufficient to maintain the long-term viability of each life history type. All returning adults and emigrating smolts must have

unhindered access between freshwater and marine habitats (see conservation objective 2b). All supporting freshwater habitats must be of sufficient quality and quantity to support both adult and juvenile fish (see conservation objective 2c). Different rivers have different seasonal patterns of adult migration associated with the environmental characteristics of the catchment and river system. Multi-sea winter fish are an important component of a natural Atlantic salmon run and the spring run component has declined considerably in recent years. The seasonal pattern of migration characteristic of the river and, in particular, the multi-sea-winter stock component, should be maintained.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective. The appraisal should also consider the life history traits of the species, including maintaining all genetic types of Atlantic salmon, and the scale and duration of the impact being assessed. Impacts resulting in the loss of genetically distinct populations of Atlantic salmon would not be considered temporary in nature as these adaptive traits may have evolved over generations and could not be recovered if lost.

2b. Maintain the distribution of the species throughout the site

The distribution of Atlantic salmon within the River Tweed SAC should not be restricted by pollution or human activities.

Access to spawning sites, juvenile rearing sites and areas where adult Atlantic salmon may rest prior to spawning (some may be present within the river for a year prior to spawning), should all be maintained. Juvenile Atlantic salmon should be present in all areas of the catchment to which they, and adult fish, have natural access. This does not include areas above naturally impassable barriers, but areas where access has been limited by man-made obstructions.

A 2011 site condition monitoring assessment of salmon in Scottish SACs concluded that the Tweed catchment sustained consistently high juvenile fish densities. This was due variously to: good quality salmon-related habitat; a high number of adult salmon reaching spawning grounds; the absence of negative pressures on fish numbers. Various initiatives in the catchment over the last 30 years will have aided this situation, including the continued removal of river obstructions through the 1990s and the significant reduction in salmon netting in the early 2000s. All major blockages to fish migration in the Tweed catchment have now been addressed, although minor or localised issues may remain.

The distribution of Atlantic salmon within the site may be affected by disturbance originating both within and outwith the site (including estuarine and coastal areas). Plans and projects that cause displacement and barrier effects to the species, for example by impeding access to spawning areas or downstream passage of smolts to the sea, can also affect species distribution. Examples may include: the provision of compensation flows which are inadequate to allow adult Atlantic salmon to reach known spawning areas; the presence of physical in-stream structures such as flow deflectors, coffer dams etc. which may increase flow velocity to that which is beyond the swimming capacity of migrating fish or sustained noise generation (such as that caused by piling) in places that cannot be avoided by migrating Atlantic salmon.

2c. Maintain the habitats supporting the species within the site and availability of food

The distribution and extent of Atlantic salmon habitat within the River Tweed SAC should be maintained, together with the structure, function and supporting processes of the habitat.

Sufficiently high water quality and natural flow conditions should be in place to provide the necessary conditions for Atlantic salmon.

Atlantic salmon spawn in late autumn and early winter, depositing their eggs in redds which they excavate in gravel and pebble beds. Eggs are often deposited in areas of accelerating flow, such as the tail end of pools and glides, upstream from riffles. However, in upland streams eggs may be deposited in any areas of gravel that can be physically moved by the fish. A good supply of oxygen is essential for eggs to develop and this is facilitated by a flow of water through the gravel. Therefore, clogging these fine sediments with silt and fine sand can reduce the water and oxygen flow resulting in egg mortality. Egg survival is also affected by redd 'washout' during winter spates, resulting in the physical scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all influence the extent of siltation and scale of washouts.

After hatching the young fry remain in the gravel until March to early May, when they disperse and set up territories. Atlantic salmon fry prefer fast flows (>30 cm/s) and favour areas with surface turbulence (riffle habitat). They require a rough bed of pebble, cobble and gravel and water <20 cm deep. Good cover is essential for maintaining high fry densities, such as cover from stones, plants or debris.

Atlantic salmon that have survived their first winter (parr) prefer deeper water than fry (typically 20-40 cm) and a coarser substrate of pebbles, cobbles and boulders. Cover remains important for adult Atlantic salmon particularly in smaller streams and rivers. In larger rivers and lochs this type of cover may be less important.

Favoured habitat used by adult fish include pools of at least 1.5 m depth, with cover from features such as undercut banks, instream vegetation, submerged objects and even surface turbulence. Spawning habitat is defined as stable coarse substrate without an armoured layer, in the pebble to cobble size range (16-256 mm) but with the majority being <150 mm. Water depth during the spawning and incubation periods should be 15-75 cm. Coarse woody debris should be retained where appropriate as it plays a significant role in the formation of new gravel beds.

Juvenile Atlantic salmon (fry and parr) maintain feeding stations within rivers and defend these aggressively. The invertebrates which they feed upon are intercepted by juvenile fish as they drift downstream, and may be of aquatic or terrestrial origin.

At sea, adult Atlantic salmon feed on range of prey items, including marine amphipods, shrimps and squid and fish, such as sand eels, capelin and herring. Adults do not feed once they return to freshwater.

As a result of their life history Atlantic salmon stocks can be impacted in both freshwater and marine habitats. In freshwater, both water quality and water quantity are key issues. Salmonids require access to rivers with unpolluted and well-oxygenated water with a habitat mosaic which comprises suitable spawning gravels, cobbles and boulders. In terms of water quality, these fish also require enough water to ensure access to and from spawning areas, as well as enough water to maintain an adequate level of juvenile habitat.

Over-exploitation, inappropriate stocking activities, riparian land management operations (such as those related to forestry and agriculture), in-stream engineering and alterations to natural water flow regimes (including those relating to hydropower development), invasive non-native species, physical barriers to migration (such as historic caulds and lades), pollution (direct and diffuse) and direct damage to spawning habitat (e.g. through mineral or gravel extraction) can all impact the quality of freshwater environments and their value to Atlantic salmon. Climate change, and the rises in water temperatures during summer, may also be a factor in determining the suitability of some waterbodies for Atlantic salmon. Therefore cover is important for Atlantic salmon, particularly in smaller streams. The shade

from bushes next to the river or overhanging trees is likely to help to prevent fish from becoming stressed due to high water temperatures which often occur in combination with low water levels. Where the river is larger, this may be less important as deep water can provide cool refuge.

Water quality, hydrology, and habitat standards for Good Ecological Status (GES) under the Water Framework Directive should be met. These targets are intended to support a healthy, naturally functioning riverine ecosystem which protects the whole biological community and individual species to a degree characteristic of the river.

Conservation Objectives for otter (*Lutra lutra*)

2a. Maintain the population of otter as a viable component of the site

The conditions for the long-term existence of the otter at the River Tweed SAC should be maintained.

An estimate of the number of otters occupying the River Tweed SAC is not available and therefore there is no numerical baseline that can be given for the SAC.

This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. This includes:

- Avoiding effects that could lead to a permanent reduction in the otter population through mortality, injury, or impacts caused by disturbance or displacement. This includes for example the effects caused by development, river engineering, water pollution, roads without adequate crossing provision for otters or suitable culverts, or entanglement in fishing gear. Otters can drown in unprotected or disused fishing gear such as eel traps or fyke nets, so these should be removed, or if active, an otter guard fitted.
- Maintaining the species' ability to use all areas of importance within the site (to be considered under conservation objective 2b)
- Maintaining access to, and availability of, undisturbed resting places
- Maintaining access to, and availability of, supporting habitats and prey (to be considered under conservation objective 2c).

Otter is a wide-ranging and highly mobile species. The population at the River Tweed SAC is reliant on suitable habitat in the surrounding countryside including the adjoining Moorfoot Hills SAC and Berwickshire and North Northumberland Coast SAC, it is unlikely to be viable (capable of being self-sustaining) in isolation. The home range of an otter will vary depending on their sex, habitat quality and food availability. It will also vary between freshwater and coastal environments. At this SAC some otters that have parts of their territories within the site may also feed in coastal waters that lie outwith the boundary of the site (for example in the Berwickshire and North Northumberland Coast SAC). In coastal areas otter densities may be as high as 0.5 - 0.7 animals/km. Males living in rivers and streams can have a mean linear range size of around 40km and females living in the same habitat can have a linear home range of around 20km. Males have been known to range as far as 80km.

When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective.

Otters are a European protected species (EPS) and it is an offence to deliberately or recklessly capture, injure, kill, harass or disturb them in certain circumstances, or to damage or destroy their breeding or resting places anywhere in Scotland unless a licence has been issued to do so. A licence can only be issued for particular purposes which the law allows. Further, there must be no satisfactory alternative and no detrimental impact on the

contribution to the maintenance of otter at a favourable conservation status for a licence to be issued. This assessment considers impacts on the otter population at a local and regional level. The licensing requirement is in addition to considering whether a plan or project will result in any impacts (including incidental impacts) to the otter population within the SAC.

2b. Maintain the distribution of otter throughout the site

The spatial extent of otter within the River Tweed SAC should be maintained.

The ability for otter to use and access all areas of importance within the River Tweed SAC should be maintained.

Otters could occur throughout the Tweed river system, with higher population densities (smaller home ranges) expected in habitats with more abundant food and resting places.

Distribution of otters within the site can be affected by disturbance originating both within and outwith the site. Plans and projects that cause displacement and barrier effects to the species can also affect species distribution. Examples include use of night-time floodlighting of watercourses, road and bridge construction works and general disturbance from human activity (and dogs) by watercourses especially at dusk/night-time.

2c. Maintain the habitats supporting otter within the site and availability of food

The distribution and extent of otter habitat within the River Tweed SAC should be maintained, together with the structure, function and supporting processes of the habitat.

Sufficiently high water quality and natural flow conditions should be maintained to provide the necessary conditions for otter and their prey.

Otters require suitable habitat for foraging, breeding and resting. In freshwater environments abundant boulders, riverbank crevices, or other cavity-forming features such as tree root systems are needed to provide secure holt sites above high water. Dense scrub is also valuable for providing lie-ups and couches. Suitable areas supporting a healthy fish population within a nearby watercourse or still water body are required within each otter's home range, to enable foraging for key prey species such as salmonids and eels. Access to ponds, ditches, reedbeds and wetlands where amphibians may breed is also important. Otters which forage along the coast as well as using the site, also need freshwater within the site to remove salt from their fur.

The Tweed Forum, Borders Forest Trust and other organisations have been effective at working with landowners to improve habitat quality throughout the Tweed catchment. Tree planting and riparian fencing has been particularly prominent and should allow the development of a more natural and wooded river corridor. Such work has been achieved through successive agri-environment schemes as well as specific initiatives such as the Eddleston Re-meandering Project.

Changes to water flow and water quality can adversely affect otter habitat and prey on which they depend. Otters' food supply is normally associated with good water quality and therefore the Water flow and quality standards for Good Ecological Status (GES) under the Water Framework Directive should be met. These targets are intended to support a healthy, naturally functioning riverine ecosystem which protects the whole biological community and individual species to a degree characteristic of the river.

As a European Protected Species, as well as listed specifically in the SSSI citation, otters are a material consideration in planning and forestry assessments. Both industries should

have well-developed survey and operational techniques for preventing disturbance to the species.

Conservation Measures

Parts of the River Tweed SAC are notified as a Site of Special Scientific Interest (SSSI) and management changes described on the SSSI list of Operations Requiring Consent must have prior consent from SNH (NatureScot).

Current and recommended management for rivers with floating vegetation often dominated by water-crowfoot, sea lamprey, river lamprey, brook lamprey, Atlantic salmon and otter

Issue	Measure	Responsible party
Ongoing species protection for salmon, lamprey species and otter	Legislation is in place to manage and protect Atlantic salmon in freshwater and at sea. This includes a statutory close season and catch & release period.	All
	Develop an Atlantic salmon conservation plan for all rivers, or Atlantic salmon management units (if several small rivers are considered to be so close in terms of geography and stock size as to merit a single plan).	Marine Scotland Science Fishery managers NatureScot SEPA
	Voluntary catch and release policy for anglers.	Fishery managers
	The Scotland Act 1998 (River Tweed) Order 2006 charges The River Tweed Commission with the general preservation and increase of Atlantic salmon, sea trout, trout and other freshwater fish (lamprey species') in the River Tweed and its tributaries.	The River Tweed Commission
	Otter are a European protected species and therefore the species protection provisions of the Habitats Regulations apply.	All
Forest planting and harvesting operations resulting in silt/nutrients entering the river – may affect salmon and lamprey species' spawning areas	Planning and implementation of forest operations should better identify high risk areas. Management should include improved pollution control, blocking of drains and careful harvesting in riparian areas.	Scottish Forestry, Forestry & Land Scotland, Forestry owners and managers
	Promote adherence to the Forest and Water Guidelines, and published best practice, during forest restructuring and highlight the need to strictly control fine sediment and other diffuse pollution release into the river. Forestry planting and harvesting in the catchment needs to be planned so that heavy rainfall and droughts are buffered by the forest rather than exacerbating high/low extremes in flow.	Scottish Forestry, Forestry & Land Scotland, Forestry owners and managers
	Review the Forest & Water guidelines to reflect the needs of river SACs. This will ensure adequate protection of the water course and development of an appropriate riparian zone across the catchment.	Scottish Forestry (South of Scotland area), Forestry & Land Scotland, NatureScot,

		forestry industry representatives
Sediment load in river from un-forested land – may affect salmon and lamprey species spawning areas	Ensure minimal poaching, tracking, or trampling by deer, livestock, visitors and vehicles to prevent an unnatural sediment load from being washed into the river.	Land managers, NatureScot, SGRPID (GEAC)
	Drain blocking in open peatland in the catchment to help to buffer high/low extremes in flow rate and reduce sediment run-off into the river.	Land managers
Water quality	Implement and maintain monitoring of key water quality parameters.	NatureScot/SEPA,
	Any development proposals in the catchment should include appropriate measures to minimise sediment run-off and prevent pollutants from entering the river.	Scottish Borders Council
River development– otter	Near the river, minimise habitat loss, deterioration, disturbance and displacement related to development (including night-time lighting).	Scottish Borders Council, SEPA, NatureScot
	Prevent or mitigate significant new disturbance to river banks from developments which can lead to recreational use of the riparian corridor.	Scottish Borders Council, NatureScot
Road mortality - otter	Any upgrading or bridges or culverts, or widening of roads such as the A68, or other work on roads, should be assessed and adequate allowance made for otters to safely use underpasses or culverts, so they are not forced to cross the road. Implement mitigation measures where areas of excessive mortality are identified, e.g. urban areas or at road crossing points.	Transport Scotland, Scottish Borders Council, NatureScot Landowner, NatureScot
Beneficial habitat management	Evaluation of diffuse pollution and morphological pressures through the river basin planning process and the implementation of restoration measures to maintain or improve habitat for lamprey species', Atlantic salmon and otter. Secure funding and build upon current river and catchment restoration projects, (e.g. for the Eddleston Water, Gala Water and River Till) to extend restoration initiatives into other parts of the catchment.	RPID, SEPA, NatureScot, Tweed Forum
	Promotion of measures to increase resilience to climate change, particularly the creation of native riparian woodland and improved connection with floodplains. Measures to promote coordinated, catchment-scale activity are particularly important. Native tree planting in appropriate locations would help improve	River Tweed Commission, NatureScot, SEPA, SBC, FCS, RPID, Tweed Forum

	the riparian habitat for lamprey species, Atlantic salmon and otter.	
	Restore riparian and catchment peatlands to reduce fine sediment concentrations, improve floodplain connectivity and restore more natural hydrological regime to benefit lamprey species', Atlantic salmon and otter. Continue this work via the Peatland ACTION project, agri-environment measures and good forestry design and management.	NatureScot, SEPA, FCS, RPID, Tweed Forum.
	Establish a gazetteer of notable or sensitive species across the Tweed catchment, along with their habitat requirements. This will inform land management decisions.	The Wildlife Information Centre, NatureScot
	Encourage specific conservation management where rarer or more sensitive plant species occur. This is to prevent loss of species diversity through land use changes or through water quality initiatives such as fencing of river banks.	NatureScot, Scottish Forestry, RPID
	Raise awareness among landowners and contractors about CAR licenses, SSSI consents, and the potential for river operations to disturb birds during the breeding season.	SEPA, NatureScot, Land managers, contractors
Population size	Encourage the natural processes of river flow and morphology through a policy of non-intervention and thereby improve salmonid and lamprey species' recruitment and survival, plus otter survival.	All
By-catch – otter	Disused eel or fyke nets should be removed when found. Any active nets should use otter guards.	Land managers
River barriers – Atlantic salmon and lamprey species'	Removal of barriers to fish passage. The Solway Tweed River Basin Management Plan has identified rivers where fish migration is impeded and has established a timescale for remedial work.	SEPA, Land managers, Fishery managers, NatureScot
	Assess the conditions around Mertoun weir and the impact this may have on migration of sea lamprey, and other fish species.	SEPA, Tweed Foundation, NatureScot
Invasive species	All anglers and other water users (such as canoeists or researchers) should follow the Check, Clean, Dry biosecurity procedures to help prevent the spread of problem non-native species. Continue to monitor, control and eradicate all 'high-impact' invasive non-native species in the catchment with the continuation of the 'Tweed Invasives Project'. This is being	All, Tweed Forum

	implemented to control and eradicate giant hogweed, Himalayan balsam and Japanese knotweed. Signal crayfish have been recorded in the Tweed catchment, but monitoring is required to understand distribution and numbers.	
Research – salmon Low numbers of adult and/or juvenile Atlantic salmon	Development and introduction of long-term monitoring protocols for juvenile Atlantic salmon in SACs.	Marine Scotland Science
	Develop and implement monitoring protocol to allow robust, catch independent, assessment of adult population size.	Marine Scotland Science
	Monitor the presence and distribution of aquatic non-native species which may adversely impact Atlantic salmon.	SEPA
	Investigate genetic diversity of salmon from different tributaries.	Tweed Foundation
Atlantic salmon marine survival -	Monitoring of post-smolt Atlantic salmon to determine their behaviour at sea and better understand the impact of enhanced sea lice burdens.	Marine Scotland (Marine Scotland Science and Farmed Fish Health Inspectorate) Atlantic Salmon Trust
Research – lamprey species To improve knowledge of the species	Distinguishing between the larvae of river or brook lamprey (i.e. Lampetra) and those of sea lamprey (i.e. Petromyzon) is possible, using physical characteristics. However, the number of sea lamprey larvae caught during conventional electrofishing surveys is low and there is a consensus amongst lamprey experts that sea lamprey larvae may occupy similar habitat to that used by Lampetra, but in areas of deeper water. Alternative survey methods are being investigated. Distinguishing between the larvae of brook and river lamprey is not possible, using physical characteristics. To date assessments have reported the number and distribution of Lampetra, i.e. brook and river lamprey combined. Initial eDNA research suggests that brook and river lamprey are too genetically similar to allow them to be differentiated. However, work is ongoing and a technique that allows the independent assessment of brook and river lamprey populations may be established.	NatureScot, Universities
	Establish an accurate distribution map of sea lamprey across the catchment.	Tweed Foundation
Water Flow – Atlantic salmon and lamprey species'	Manage abstraction and water transfers to ensure that access to essential habitats by Atlantic salmon is maintained and water flow is not lowered/raised in a way that would	SEPA, NatureScot, Scottish Water, water companies

	reduce the populations of lamprey species'.	

Contact details: NatureScot
Anderson's Chambers
Market Street
Galashiels
TD1 3AF
Tel: 01896 661 710

Approved on 26 March 2020 by:

Greg Mudge
Principal Advisor
International Designations

Denise Reed
Area Manager
Tayside and Grampian

River Tweed

EC Site Code UK0012691

Special Area of Conservation (SAC) shown thus .

England

Longitude · 2°47' 30" W

Latitude 55°36' 00" N

Length within Scotland.1116 32 km

Length within England· 168 37

Total length of SAC 1284 69 km

Area within Scotland· 3379 59

Area within England 416 29

Total area of SAC 3795.88 ha

Scale · 1·300 000

0 1 2 3 4 5 10 kms

0 1 2 3 4 5 miles

Map 1 of 1

Version Number 7 (04/03/05)

Projection British National Grid

Special Area of Conservation
Scottish component Designated under
EC Directive 92/43/EC
by Scottish Ministers
on 17th March 2005

The boundary, if possible follows a demarcating feature on the ground, such as a fence, wall or roadside
In the absence of such features, the boundary either runs parallel to the normal river channel edge, typically 5 metres from the channel edge, or in some cases will follow another course to include areas of riparian vegetation

The banks of rivers and other watercourses are liable to change naturally Where the site boundary is the river bank itself and where this changes over time the site boundary will vary in line with such changes Existing road bridges are excluded from the site
Large scale maps are available on request

Between Points A and B the water course crosses the border between Scotland and England For further information on this section please contact English Nature.

Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat

CITATION FOR RAMSAR SITE

(Kampala criteria, 2005)

FALA FLOW (UK13015)

Site Description:

Fala Flow Ramsar site is situated within the Lammermuir Hills in the Scottish Southern Uplands. The Flow is a blanket mire, unusual due to the presence of pools which seldom occur in blanket mires located at such low altitudes.

Interest Feature (marked in bold): N.B All bird figures relate to numbers at the time of designation:

Fala Flow Ramsar site qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds:

- **Pink-footed goose** *Anser brachyrhynchus* (an average peak of 2,400 individuals, 2% of the Eastern Greenland/Iceland/UK biogeographic population).

Area: 317.75 ha
National Grid Ref: NT436585
OS Sheet 1:50,000 – 66

Designated on 25 April 1990.

This (amended) citation adopted on 1 November 2021.

Other Designations that underpin the Ramsar Site:

These provide the statutory mechanisms for protection and management of the Ramsar site.

The boundary of the Ramsar site is coincident with Fala Flow Special Protection Area (SPA), which underpins the bird feature of the Ramsar site. It is also coincident with Fala Flow Site of Special Scientific Interest (SSSI).

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK
Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

2. Date this sheet was completed/updated:

Designated: 25 April 1990; updated 15 May 2005

3. Country:

UK (Scotland)

4. Name of the Ramsar site:

Fala Flow

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no*

b) digital (electronic) format (optional): Yes

6. Geographical coordinates (latitude/longitude)**:**

55 49 00 N 02 54 20 W

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Edinburgh

On the edge of the Lammermuir Hills, 20 km south-east of Edinburgh

Administrative region: Midlothian

8. Elevation (average and/or max. & min.) (metres)**:**

Min. 315
Max. 325
Mean 320

9. Area (hectares)**:** 318.04

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Fala Flow is in the Lammermuir Hills to the south-east of Edinburgh. It is a blanket mire, with some pools, developed at a lower altitude than most blanket mires in Midlothian. The vegetation comprises heather *Calluna vulgaris*/cottongrass *Eriophorum* spp., with other characteristic species including cowberry *Vaccinium vitis-idaea* and *Sphagnum* bog-mosses. Such mires are scarce and declining in Midlothian and this example is relatively undisturbed. The mire and pools support an internationally important goose roost.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

6

Secretariat comment: The RIS provides information requiring the application of Criterion 4. This needs to be included in the next update.

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in winter:

Pink-footed goose , *Anser brachyrhynchus*, Greenland, Iceland/UK	6719 individuals, representing an average of 2.7% of the population (5 year peak mean 1991/92-1995/96)

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Atlantic

b) biogeographic regionalisation scheme (include reference citation):

Council Directive 92/43/EEC

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	acidic, peat, nutrient-poor, sedimentary
Geomorphology and landscape	upland
Nutrient status	oligotrophic
pH	strongly acidic
Salinity	fresh
Soil	mainly organic

Water permanence	usually permanent
Summary of main climatic features	Annual averages (Edinburgh, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/edinburgh.html) Max. daily temperature: 12.2° C Min. daily temperature: 5.1° C Days of air frost: 54.5 Rainfall: 676.2 mm Hrs. of sunshine: 1405.8

General description of the Physical Features:

Fala Flow is located in the Lammermuir Hills. It is blanket mire, with some pools, developed at a lower altitude than most blanket mires in Midlothian. Such mires are scarce and declining in Midlothian, and this example is relatively undisturbed.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Fala Flow is blanket mire, with some pools, developed at a lower altitude than most blanket mires in Midlothian.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

No special values known

17. Wetland types

Inland wetland

Code	Name	% Area
O	Freshwater lakes: permanent	0.4
U	Peatlands (including peat bogs swamps, fens)	92.6
Other	Other	7

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

This site is a marginal upland blanket bog, dominated by *Calluna/Eriophorum* with significant *Sphagnum* cover. The periphery of the site is minerotrophic acid grassland. The site is relatively undisturbed and the lowest intact blanket bog in the Lothians. Open-water areas mostly dystrophic with fringing *Carex nigra* and *Carex rostrata*.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

None reported

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Birds

Species Information

None reported

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Livestock grazing
Non-consumptive recreation
Sport hunting

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Private	+	+

23. Current land (including water) use:

Activity	On-site	Off-site
Nature conservation	+	
Recreation	+	
Current scientific research	+	
Commercial forestry		+
Permanent arable agriculture		+
Rough or shifting grazing	+	
Permanent pastoral agriculture		+
Hunting: recreational/sport	+	+

24. Factors adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

Explanation of reporting category:

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

NA = Not Applicable because no factors have been reported.

Adverse Factor Category	Reporting Category	Description of the problem (Newly reported Factors only)	On-Site	Off-Site	Major Impact?
No factors reported	NA				

For category 2 factors only. What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?
Is the site subject to adverse ecological change? NO

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Site/ Area of Special Scientific Interest (SSSI/ASSI)	+	
Special Protection Area (SPA)	+	
Site management statement/plan implemented	+	

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

None reported

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

None reported

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Activities, Facilities provided and Seasonality.

A footpath runs through site and is used throughout the year, although mainly in the summer months.

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Scottish Executive, Environment and Rural Affairs Department

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Scottish Natural Heritage, 2 Anderson Place, Edinburgh, EH6 5NP

32. Bibliographical references:

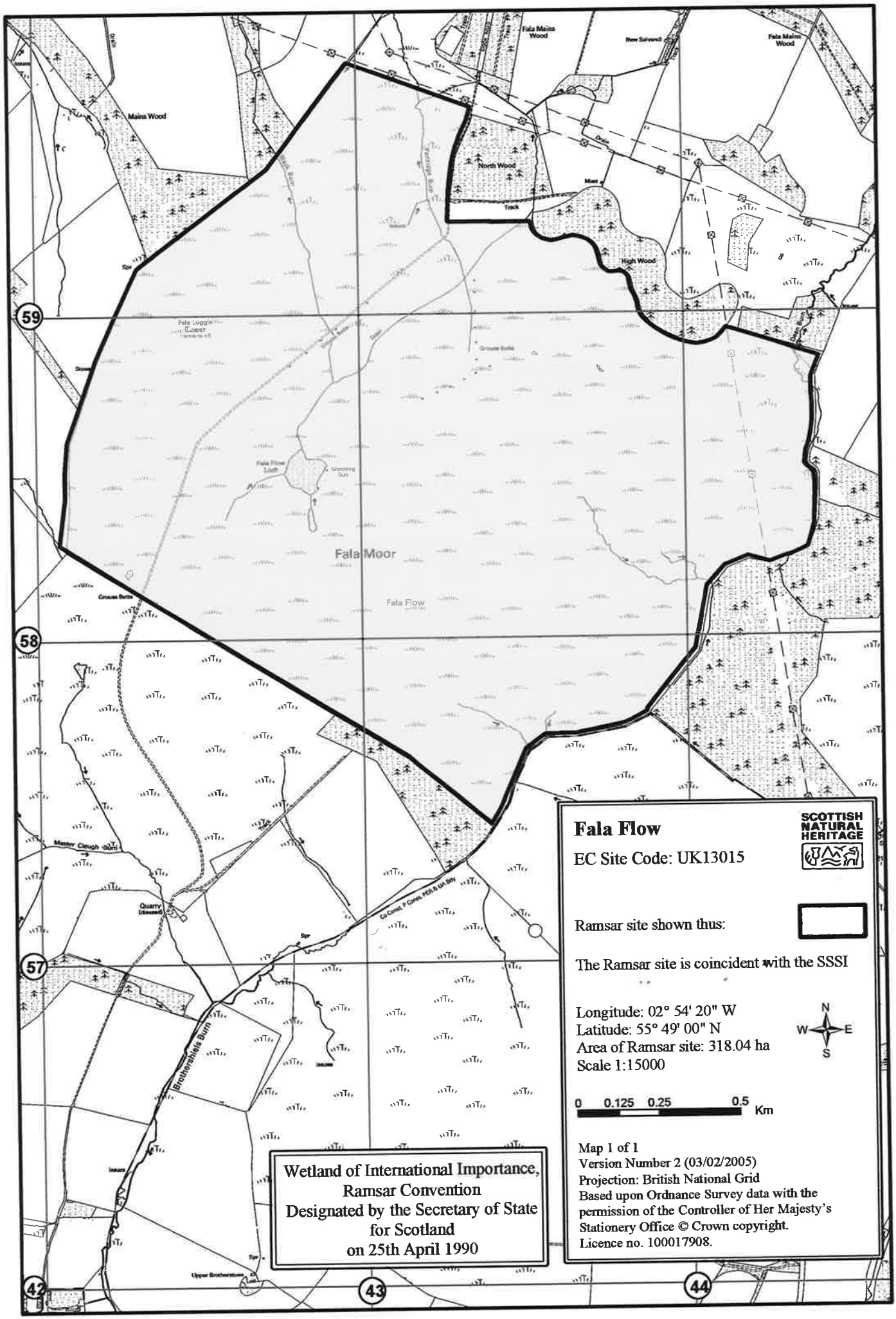
Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

Ratcliffe, DA (ed.) (1977) *A Nature Conservation Review. The selection of biological sites of national importance to nature conservation in Britain*. Cambridge University Press (for the Natural Environment Research Council and the Nature Conservancy Council), Cambridge (2 vols.)

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds.) (2001) *The UK SPA network: its scope and content*. Joint Nature Conservation Committee, Peterborough (3 vols.) www.jncc.gov.uk/UKSPA/default.htm

Please return to: **Ramsar Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
Telephone**: +41 22 999 0170** • Fax: **+41 22 999 0169** • email: **ramsar@ramsar.org**



Fala Flow

EC Site Code: UK13015

SCOTTISH NATURAL HERITAGE

Ramsar site shown thus:

The Ramsar site is coincident with the SSSI

Longitude: 02° 54' 20" W
Latitude: 55° 49' 00" N
Area of Ramsar site: 318.04 ha
Scale 1:15000

N
W E
S

0 0.125 0.25 0.5 Km

Map 1 of 1
Version Number 2 (03/02/2005)
Projection: British National Grid

Wetland of International Importance,
Ramsar Convention
Designated by the Secretary of State
for Scotland
on 25th April 1990

Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat

CITATION FOR RAMSAR SITE

(Kampala criteria, 2005)

GREENLAW MOOR (UK13022)

Site Description:

Greenlaw Moor Ramsar site is located in the southern Lammermuir Hills. The site includes two pools surrounded by an area of moorland.

Interest Feature (marked in bold): N.B All bird figures relate to numbers at the time of designation:

Greenlaw Moor Ramsar site qualifies under Ramsar Criterion 6 by regularly supporting 1% or more of the individuals in a population of waterbirds:

- **Pink-footed goose** *Anser brachyrhynchus* (1987/1988 to 1991/1992, an average peak of 14,200 individuals, 7% of the Eastern Greenland/Iceland/UK biogeographic population).

Area: 246.02 ha
National Grid Ref: NT712490
OS Sheet 1:50,000 – 74

Designated on 15 March 1996.

This (amended) citation adopted on 1 November 2021.

Measured site area corrected from 247.6 ha

Other Designations that underpin the Ramsar Site:

These provide the statutory mechanisms for protection and management of the Ramsar site.

The boundary of the Ramsar site is coincident with Greenlaw Moor Special Protection Area (SPA), which underpins the bird feature of the Ramsar site. It lies within Greenlaw Moor Site of Special Scientific Interest (SSSI).

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK
Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

2. Date this sheet was completed/updated:

Designated: 15 March 1996; updated 12 May 2005

3. Country:

UK (Scotland)

4. Name of the Ramsar site:

Greenlaw Moor

5. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no*

b) digital (electronic) format (optional): Yes

6. Geographical coordinates (latitude/longitude)**:**

55 44 06 N 02 27 06 W

7. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Berwick-upon-Tweed

Located in the southern Lammermuir Hills, in the Scottish Borders west of Berwick-upon-Tweed.

Administrative region: Scottish Borders

8. Elevation (average and/or max. & min.) (metres)**:**

Min. 229
Max. 232
Mean 231

9. Area (hectares)**:** 247.6

10. Overview:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

This area consists of heather moorland to the east, and raised mire to the west. The heather is the largest remaining example of moorland at mid-altitude in the Borders. There are two pools at Hule Moss which support an internationally important wintering population of pink-footed geese. The area of raised moss is well developed with a fairly typical flora, including some regionally uncommon bryophytes.

11. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

6

Secretariat comment: The RIS provides information requiring the application of Criterion 4. This needs to be included in the next update.

12. Justification for the application of each Criterion listed in 11. above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in spring/autumn:

Pink-footed goose, *Anser brachyrhynchus*, Greenland, Iceland (br)	8504 individuals, representing an average of 3.5% of the flyway population (5 year peak mean 1998/9-2002/3)

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Atlantic

b) biogeographic regionalisation scheme (include reference citation):

Council Directive 92/43/EEC

14. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	acidic, neutral, alluvium, peat, nutrient-poor, sandstone
Geomorphology and landscape	lowland, hilly, slope
Nutrient status	highly eutrophic
pH	circumneutral
Salinity	fresh
Soil	mainly mineral
Water permanence	usually permanent

Summary of main climatic features	Annual averages (Edinburgh, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/edinburgh.html) Max. daily temperature: 12.2° C Min. daily temperature: 5.1° C Days of air frost: 54.5 Rainfall: 676.2 mm Hrs. of sunshine: 1405.8

General description of the Physical Features:

Greenlaw Moor lies in the southern Lammermuir Hills. The site consists of heather moorland in the east and raised mire in the west. The heather *Calluna vulgaris* moorland is the largest remaining example of its type at mid-altitude in the Scottish Borders. There are two pools at Hule Moss.

15. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Greenlaw Moor consists of heather moorland in the east and raised mire in the west. The heather *Calluna vulgaris* moorland is the largest remaining example of its type at mid-altitude in the Scottish Borders. There are two pools at Hule Moss.

16. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

No special values known

17. Wetland types

Inland wetland

Code	Name	% Area
O	Freshwater lakes: permanent	96.8
U	Peatlands (including peat bogs swamps, fens)	3.2

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

This site consists of two lochans set within an area of heather moorland showing sparse representation of other typical moorland species. The west loch is 'perched' and very exposed with a thin marginal surround of *Juncus effusus* tussocks which merges into a fringe of *Deschampsia* and *Eriophorum* and the heather moorland with acid grassland patches. Other shoreline species are very limited and include *Carex rostrata*, *C. nigra*, and *Rumex obtusifolius*. The lochan shoreline and substrate are entirely mineral, unlike the east loch, which is more varied and deeper with a peaty substrate. This loch supports marginal poor-fen with *Sphagnum recurvum* with scattered *Salix cinerea* ssp. *oleifolia* with fringing *Carex rostrata*, *C. nigra*, *Juncus effusus* and *Agrostis stolonifera*. At the outer edges of the basin other *Sphagnum* species occur with *Eriophorum vaginatum*, *Calliergonella cuspidata*, *Carex echinata* and *Juncus articulatus*. Flushes around the outflow of the east loch at the south-east corner support *Ranunculus repens, R. flammula, Trifolium repens* with *Agrostis* and *Rumex*. *Callitriche* species also occur here. Around this outlet further species of aquatic and terrestrial zone *Sphagna* occur. There are no significant invasive or introduced species. The hydroseral development of particularly the east loch may be expected to proceed in the long term to more extensive poor-fen, limited only by the deeper water. There is no indication of rafting taking place.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

None reported

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Birds

Species Information

None reported

21. Social and cultural values:

e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Environmental education/ interpretation
Non-consumptive recreation
Scientific research
Sport hunting

22. Land tenure/ownership:

Ownership category	On-site	Off-site
Private	+	+

23. Current land (including water) use:

Activity	On-site	Off-site
Nature conservation	+	+
Tourism		+
Recreation	+	+
Current scientific research	+	+
Collection of non-timber natural products: (unspecified)		+
Commercial forestry		+
Cutting of vegetation (small-scale/subsistence)	+	+
Arable agriculture (unspecified)		+
Permanent arable agriculture		+
Livestock watering hole/pond	+	
Grazing (unspecified)	+	+
Rough or shifting grazing	+	+
Hunting: commercial	+	+
Hunting: recreational/sport	+	+
Military activities		+

24. Factors adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

Explanation of reporting category:

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

NA = Not Applicable because no factors have been reported.

Adverse Factor Category	Reporting Category	Description of the problem (Newly reported Factors only)	On-Site	Off-Site	Major Impact?
No factors reported	NA				

For category 2 factors only. What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?
Is the site subject to adverse ecological change? NO

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Site/ Area of Special Scientific Interest (SSSI/ASSI)	+	
Special Protection Area (SPA)	+	
Management agreement		+
Site management statement/plan implemented	+	

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

27. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Fauna.

Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.

PhD study involving site on 'Aspects of the ecology of the Lepidoptera associated with *Calluna vulgaris* on managed northern heath' (Haysom 1998; Haysom & Coulson 1998).

Miscellaneous.

Extensive bibliography available.

No other facilities.

28. Current conservation education:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

An informal moorland management demonstration. Local gamekeeping course is held on site.
A bird hide is situated on the site at Hule Moss.

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Activities, Facilities provided and Seasonality.

Walking, riding and bird watching.

Bird hide on Hule Moss only.

Bird watching principally takes place in winter.

30. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Scottish Executive, Environment and Rural Affairs Department

31. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Scottish Natural Heritage, 2 Anderson Place, Edinburgh, EH6 5NP

32. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **13** above), list full reference citation for the scheme.

Site-relevant references

[See separate list]

Haysom, K (1998) *Aspects of the ecology of the Lepidoptera associated with* Calluna vulgaris *on managed northern heath*. Unpublished PhD thesis, University of Durham, Department of Biological Sciences

Haysom, KA & Coulson, JC (1998) The Lepidoptera fauna associated with *Calluna vulgaris*: effects of plant architecture on abundance and diversity. *Ecological Entomology*, **23**(4), 377-***

Musgrove, AJ, Pollitt, MS, Hall, C, Hearn, RD, Holloway, SJ, Marshall, PE, Robinson, JA & Cranswick, PA (2001) *The Wetland Bird Survey 1999–2000: wildfowl and wader counts*. British Trust for Ornithology, Wildfowl and Wetlands Trust, Royal Society for the Protection of Birds & Joint Nature Conservation Committee, Slimbridge. www.wwt.org.uk/publications/default.asp?PubID=14

Ratcliffe, DA (ed.) (1977) *A Nature Conservation Review. The selection of biological sites of national importance to nature conservation in Britain*. Cambridge University Press (for the Natural Environment Research Council and the Nature Conservancy Council), Cambridge (2 vols.)

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds.) (2001) *The UK SPA network: its scope and content*. Joint Nature Conservation Committee, Peterborough (3 vols.) www.jncc.gov.uk/UKSPA/default.htm

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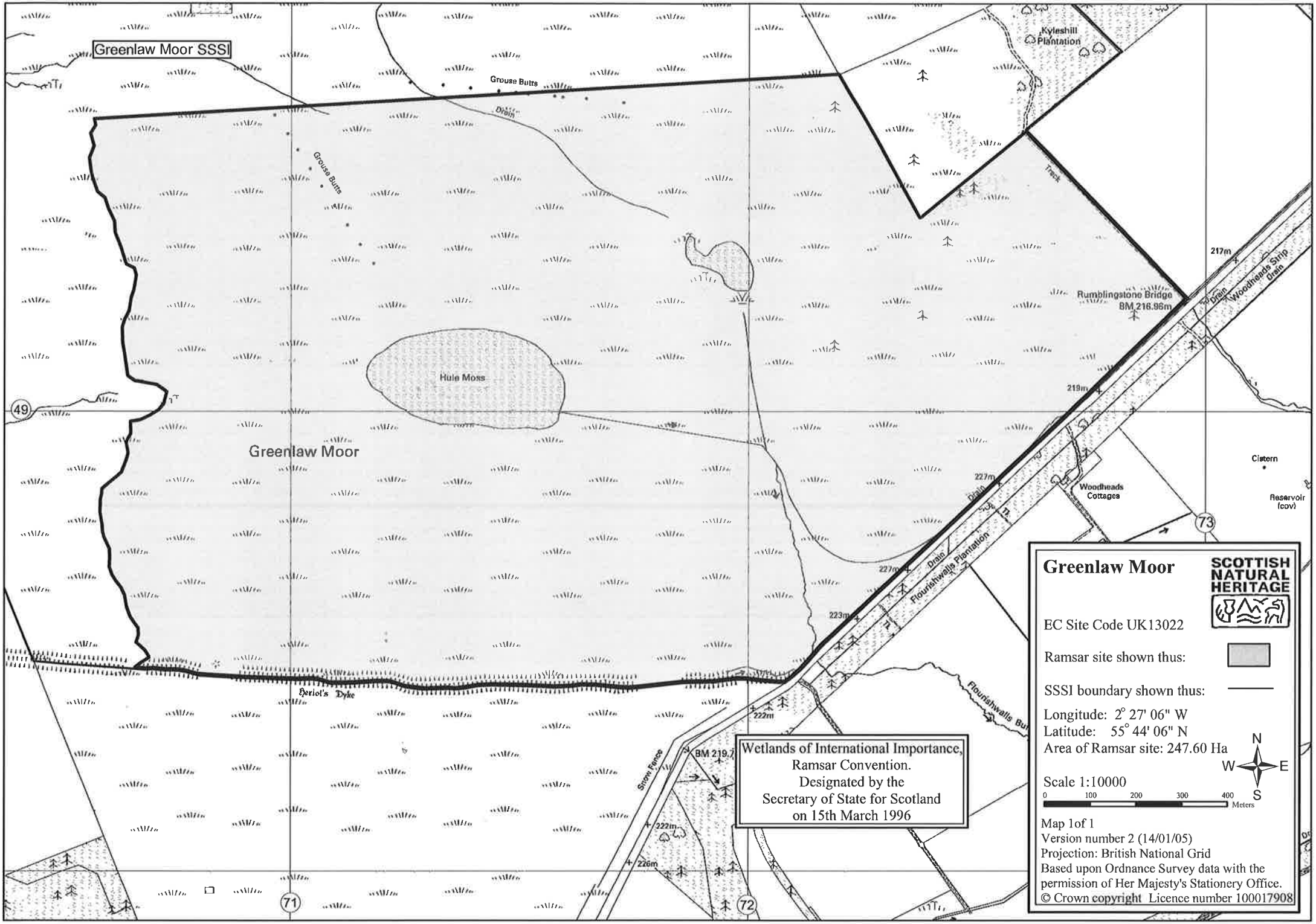
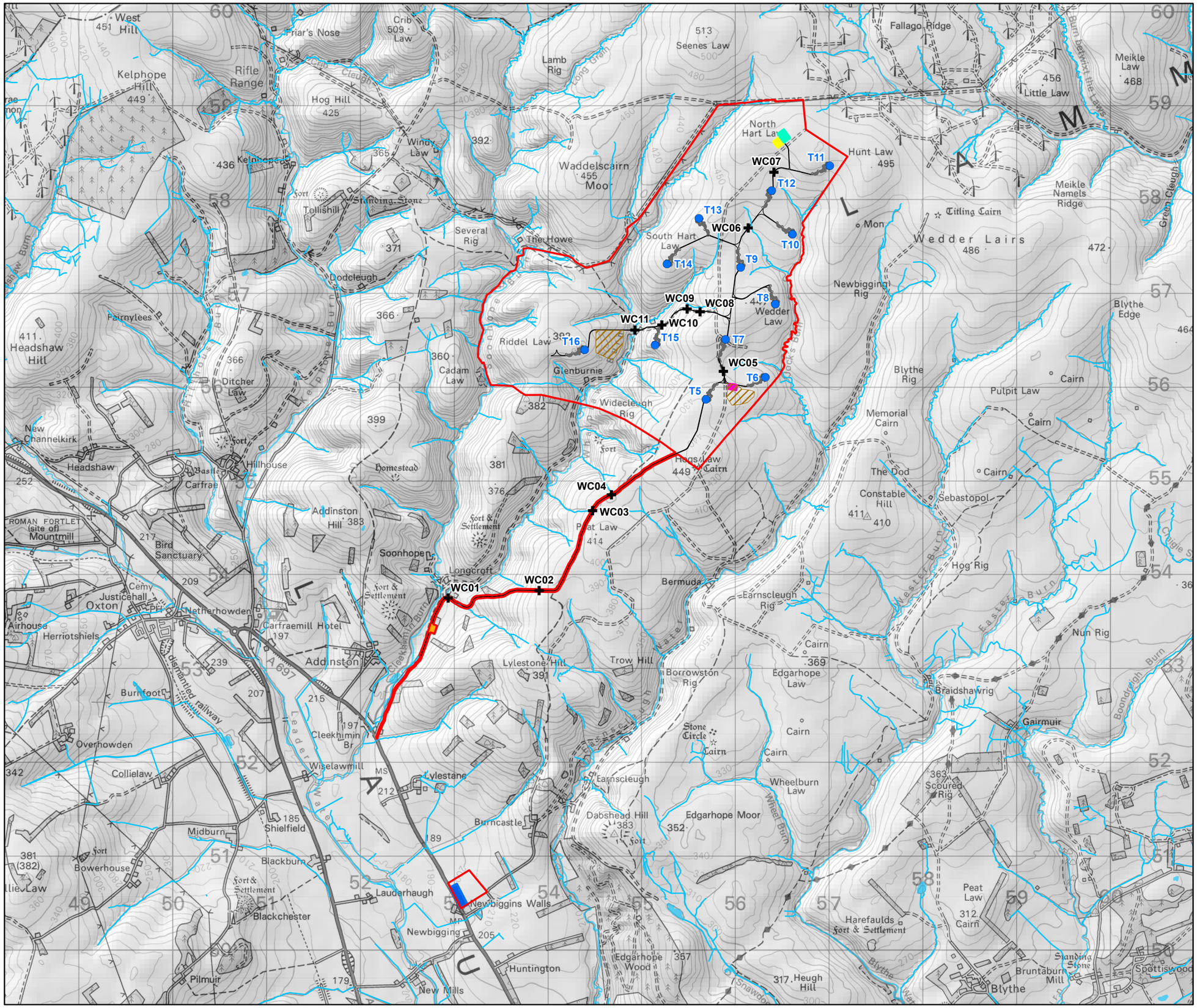
Telephone**: +41 22 999 0170** • Fax: **+41 22 999 0169** • email: **ramsar@ramsar.org**


Greenlaw Moor SSSI
Grouse Butts
Drain
Grouse Butts
Kyleshill Plantation
Track
217m
Rumblingstone Bridge
BM 216.96m
Woodheads Strip
Drain
Drain
219m
Hule Moss
49
Greenlaw Moor
227m
Drain
Cistern
Woodheads Cottages
Reservoir (cov)
73
227m
Drain
Flourishwells Plantation
223m
Flourishwalls Bu
Heriot's Dyke
222m
BM 219.7
Snow Fence
222m
226m
71
72
Greenlaw Moor
SCOTTISH NATURAL HERITAGE
EC Site Code UK13022
Ramsar site shown thus:
SSSI boundary shown thus:
Longitude: 2° 27' 06" W
Latitude: 55° 44' 06" N
Area of Ramsar site: 247.60 Ha
N
W
E
S
Scale 1:10000
0 100 200 300 400 Meters
Map 1of 1
Version number 2 (14/01/05)
Projection: British National Grid
Based upon Ordnance Survey data with the permission of Her Majesty's Stationery Office.
© Crown copyright Licence number 100017908
Wetlands of International Importance,
Ramsar Convention.
Designated by the
Secretary of State for Scotland
on 15th March 1996

Appendix B: Watercourse Crossing Schedule



RES

GLENBURNIE WIND FARM

AEI FIGURE 10.3

WATERCOURSE CROSSINGS

- Site Boundary
- Proposed Turbine Location
- Hardstanding
- Battery Storage Compound
- Substation Compound
- Temporary Concrete Batching Plant
- Temporary Construction Compound
- Borrow Pit Search Area
- Transfer Station
- Access Track
- Watercourse Crossing
- Watercourse (OS OpenMap Local)
- Waterbody (OS OpenMap Local)

LAYOUT DWG	T-LAYOUT NO.
04728-RES-LAY-DR-PE-003	PSCOLCF024

DRAWING NUMBER
405.065363.00001.0003.0

SCALE - 1:40,000 @ A3

ADDITIONAL ENVIRONMENTAL INFORMATION 2025

Appendix C: Aquatic plant communities for habitat H3260

Aquatic plant communities for habitat H3260[33]

- *Ranunculus fluitans* – River Water-crowfoot
- Ranunculus penicillatus ssp. pseudofluitans – Stream Water-crowfoot
- Potamogeton perfoliatus – Perfoliate Pondweed
- Potamogeton polygonifolius – Bog Pondweed
- *Callitriche hamulata* – Intermediate Water-starwort
- *Callitriche stagnalis* – Common Water-starwort
- Fontinalis antipyretica – Greater Water-moss
- *Fontinalis squamosa* – Water-moss species
- *Hygrohypnum luridum / ochraceum* – Lurid / Ochraceous Water-moss
- *Juncus bulbosus* – Bulbous Rush
- Littorella uniflora – Shoreweed
- *Myriophyllum alterniflorum* – Alternate-flowered Water-milfoil
- *Myriophyllum spicatum* – Spiked Water-milfoil
- Rhynchostegium riparioides – River Feather-moss
- *Scapania undulata* – Undulate-leaved Earwort

[33] Information extracted from "Supporting documentation for the Third Report by the United Kingdom uner Article 17 on the implementation of the Directive from January 2007 to December 2012 Conservation status assessment for Habitat: H3260 – Water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation" [Online] Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20180804112416mp_/http://jncc.defra.gov.uk/pdf/Article17Consult_20131010/H3260_SCOTLAND.pdf