



European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

**South Solway Mosses Special Area of Conservation (SAC)
Site code: UK0030310**



Wedholme Flow looking towards the Lake District Fells ©Natural England

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About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to South Solway Mosses SAC. This advice should therefore be read together with the SAC Conservation Objectives available [here](#).

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email

HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	South Solway Mosses Special Area of Conservation (SAC)
Location	Cumbria
Site Maps	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	April 2005
Qualifying Features	See section below
Designation Area	1956.23 ha
Designation Changes	None
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Bowness Common SSSI, Wedholme Flow SSSI, Glasson Moss SSSI and Drumbrugh Moss SSSI (part)
Relationship with other European or International Site designations	Adjacent to Solway Firth SAC and Upper Solway Flats and Marshes SPA
Other information	Natura 2000 Standard Data Form for South Solway Mosses SAC

Site background and geography

Situated in the low-lying area of the [Solway Basin National Character Area](#) (NCA), the South Solway Mosses are a complex of estuarine raised bogs that formed on the low-lying ground to the south of the Solway estuary. The extensive domes of accumulated peat gradually grew from lakes in impermeable hollows left between shallow ridges after the glaciers retreated from this area approximately 12,000 years ago. In raised bogs, peat accumulation over thousands of years results in such a depth of peat that it becomes isolated from the influence of groundwater, creating a dome of peat that only receives rainwater.

The Mosses have all been heavily impacted by drainage, domestic and industrial scale peat cutting, heavy access and improvement for agriculture. Cutover areas along the bog edges have typically removed approx 2m of peat, with associated drainage to help accessibility. All four Mosses have historically suffered from industrial scale extractions, but Wedholme Flow to the greatest extent, where up to 5m depth of peat has been removed from large areas, coupled with significant drainage.

The Mosses still suffer from the de-watering effects of boundary drains, often dug into the clay and now maintained to protect the adjacent agricultural land. Most of the lagg components of the mosses no longer exist, due to improvements for more productive land use. This tends to create a very hard boundary in the landscape, with an abrupt line between the designated bog and the improved agricultural land, with no hydrological buffer. It is likely from the surrounding topography and geology that the raised bog complex and associated habitat once occupied an area at least three times the current designated extent.

All these impacts lead to the gradual drying out, shrinkage and gradual erosion of the peat bodies themselves, resulting in the loss of the water holding, peat forming and carbon locking benefits that peatlands provide.

95% of the UK's lowland raised bog habitat has been lost, and Bowness Common is one of the largest active bogs remaining. 77% of the SAC is identified as active raised bog, and still supports typical raised mire vegetation. The remaining 23% is degraded raised bog capable of recovery within the next 30 years, and restoration work is focussing on repairing the hydrology so that peat-forming vegetation is re-established.

The thickness of the peat is very variable, probably due to the undulating floor upon which it sits. Bowness Common currently has a maximum depth of 16.6 metres (reported from when the Bowness Railway was constructed) with an average depth of around 8 metres. Wedholme Flow has recorded depths up to 12 metres with an average around 6 metres and Glasson Moss and Drumbrugh Moss have depths up to 11 metres, but averages around 6 metres.

The yearly average rainfall based on measurements from Drumbrugh Moss (1991-2016) is 908 mm. March and April are on average the driest months and Sept to Jan the wettest. Rainfall averages over the last 25 years suggest the trend is an increase in annual rainfall, eg 1040mm average for 2011 – 2016.

Calculations that account for rainfall in relation to evaporation conclude there is still a surplus of rainfall in our current climate. This means that there is an appropriate level of rainfall to support bog-forming vegetation on the South Solway Mosses.

Restoration works (carried out by Natural England, Partner Conservation organisations such as RSPB and CWT, and local landowners) are designed to reverse past impacts of drainage and to raise water levels, so that peat-forming vegetation can re-establish. There are places where important lagg habitat has been re-created, and semi-natural habitats brought under sympathetic management.

The SAC forms part of a [National Nature Reserve](#) (NNR).

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H7110 Active raised bogs* (Priority feature)**

Active raised bogs are peat-forming ecosystems that have developed during thousands of years of peat accumulation, to such an extent that the depth of peat isolates them from the influence of groundwater. Typically, lowland raised bogs form a raised dome of peat irrigated solely by precipitation (rainfall, snow, fog).

This is a complex of estuarine raised bogs to the south of the Solway, and is comprised of Wedholme Flow, Bowness Common, Drumburgh Moss and Glasson Moss. At 759 ha, Bowness Common is one of the largest Active raised bogs remaining in the UK. Although affected by past drainage and peat-cutting, much of these sites support typical bog vegetation, including bog rosemary *Andromeda polifolia*, cranberry *Vaccinium oxycoccos* and great sundew *Drosera anglica*. Wedholme Flow contains the largest area of almost-intact active raised bog in England, but also some H7120 degraded raised bog in which peat-cutting has recently ceased. The central part of Glasson Moss displays some of the most diverse raised bog vegetation in the UK today, with bog-moss species including abundant *Sphagnum pulchrum* as well as *S. fuscum*.

The vegetation within this SAC mainly corresponds with National Vegetation Classification type M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire, with occasional M2 *Sphagnum cuspidatum/Sphagnum recurvum* bog pool community. Lagg communities include M4 *Carex rostrata – Sphagnum recurvum* mire, M6 *Carex echinata – Sphagnum recurvum/auriculatum* mire, M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture, M25 *Molinia caerulea – Potentilla erecta* mire, M27 *Filipendula ulmaria – Angelica sylvestris* mire, S4 *Phragmites australis* swamp and reed-beds *Phragmitetum australis*, S27 *Carex rostrata-Potentilla pallustris* tall herb fen, W5 *Alnus glutinosa – Carex paniculata* woodland, W6 *Alnus glutinosa – Urtica dioica* woodland.

- **H7120 Degraded raised bogs still capable of natural regeneration**

Degraded raised bogs occur where there has been widespread disruption to the structure and function of the peat body. This can involve changes to the hydrology, vegetation, and physical structure of the bog, leading to peat desiccation and oxidation, loss of species or changes in the balance of the species composition, erosion and shrinkage of the peat body itself. In contrast to 7110 Active raised bogs, peat is not currently forming in degraded bog. These examples are however considered capable of natural regeneration through repair and management.

The 23% of the site classed as Degraded is mainly located at the edges of the designated boundary, where hydrology has been disrupted by peat removal, drainage and the interception of rainfall from tree and scrub encroachment. Degraded bog is largely dominated by purple moor-grass *Molinia caerulea* and birch *Betula spp.*, and bracken. These species further the degradation of the peat, and left unaddressed the negative hydrology here threatens adjacent active bog.

The degraded vegetation at this SAC mainly corresponds with National Vegetation Classification type W4c *Betula pubescens-Molinia caerulea* woodland, *Sphagnum* spp. sub-community woodland (with varying cover of trees). The objective of restoration is to recover these communities to M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire.

Qualifying Species:

Not applicable

References:

RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 1. Woodlands and scrub*. Cambridge University Press.

RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 2. Mires and heath*. Cambridge University Press.

Table 1: Supplementary Advice for Qualifying Features: H7110. Active raised bogs *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the H7110 feature at approximately 1504 hectares	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. For this feature, the term 'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition.	Site extent taken from the Natura 2000 Standard Data Form
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the H7110 feature are referable to and characterised by the following National Vegetation Classification types: M18 <i>Erica tetralix-Sphagnum papillosum</i> raised and blanket mire M2 <i>Sphagnum cuspidatum/Sphagnum recurvum</i> bog pool community	This Annex I feature comprises a number of characteristic naturally occurring vegetation types that form a wetland complex. Maintaining or restoring these distinctive vegetation types, and the range of types as appropriate, will be hydrologically important to sustaining the overall habitat feature. The lagg (or marginal fen) is currently mainly absent but could include the following vegetation communities; M4 <i>Carex rostrata-Sphagnum recurvum</i> mire M6 <i>Carex echinata-Sphagnum recurvum/auriculatum</i> mire M23 <i>Juncus effusus/acutiflorus-Galium palustre</i> rush-pasture M25 <i>Molinia caerulea-potentilla erecta</i> mire M27 <i>Filipendula ulmaria-Angelica sylvestris</i> mire S4 <i>Phragmites australis</i> swamp & reedbeds S27 <i>Carex rostrata-Potentilla palustris</i> fen W5 <i>Alnus glutinosa – Carex paniculata</i> woodland W6 <i>Alnus glutinosa – Urtica dioica</i> woodland	The Natura 2000 Bog Woodland interest feature has been recognised on Bowness Common, Roger Meade March 2014 'Occurrence of Natura Code 91D0 Bog Woodland within 7110 active raised bog'.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Bog Woodland as described by nvc communities: W18 <i>Pinus sylvestris</i> – <i>Hylocomium splendens</i> woodland and W4c <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland, <i>Sphagnum</i> sub-community		
Structure and function (including its typical species)	Structural diversity	Maintain the full range of typical structural features associated with the H7110 feature at this site, e.g. vegetation cover, surface patterning, pools and hydrological zonations	A raised bog with appropriate hydrology will possess a domed structure comprising mire expanse (the centre), rand (sloping edge) and lagg (marginal fen with groundwater influence). The area of rand is very limited within this SAC. Active raised bogs in particular show varying degrees of structural variation and surface patterning reflecting hydrological gradations (which may be natural or the result of previous damage). These can occur at macro and micro scales across the habitat and include alternative aquatic and terrestrial surface features, such as pools and hummocks, and terrestrial features such as ridges and hollows. These features will support distinctive patterns of bog vegetation, and so will be sensitive to changes in topography and hydrology. These can be modified or disrupted by activities such as drainage, burning, grazing, vehicular access and peat digging.	
	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the H7110 feature	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest. The invasive Pitcher Plant <i>Sarracenia purpurea</i> is still present on Wedholme Flow, though this is now much limited as a result of annual control, intensified since 2013.	WALKER, K.J. et al. 2016. Effectiveness of methods to control the invasive non-native pitcherplant <i>Sarracenia purpurea</i> on a European mire <u>Journal for Nature Conservation</u> Volume, 31, pages 1–8

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Supporting off-site habitat	Maintain the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the H7110 feature	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. For this feature the protection and management of peripheral peat and the land immediately around the peat body will be of critical functional importance to the restoration or maintenance of the hydrology of active bog and its management must also be compatible with long-term maintenance of the bog. Hydrological Protection Zones have been identified around each of the four bogs, which along with other information such as peat depth, topography and geology/soil information can help identify this important peripheral land.	ENVIRONMENT AGENCY, 2006. Definition of Hydrological Protection Zones at the margins of the South Solway Mosses. Environment Agency Contract Ref 15088 Final Report: June 2006
	Hydrology	At a site level, restore natural hydrological processes to provide the conditions necessary to sustain the H7110 feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the peat body and the assemblage of characteristic plants and animals present. Raised bogs require a high and stable water table within the peat body. Artificial drainage and peat removal, compaction or disturbance all increase the rate of water loss from the bog. Historic hydrological damage should be repaired and new activities that lower the water table, compact or expose peat to aerobic conditions should be avoided. In active bogs, the rate of accumulation of dead plant remains exceeds the rate of decay. This is only possible when the water table (derived from precipitation only) is at the surface for most of the year.	MORGAN-JONES, W. POOLE, J.S, GOODALL, R, 2005. Characterisation of Hydrological Protection Zones at the Margins of Designated Lowland Raised Peat Bog Sites, JNCC Report 365. Available at http://jncc.defra.gov.uk/page-3495.
	Water chemistry	Maintain the surface water and groundwater supporting the hydrology of the rain-fed bog at a low nutrient status.	This habitat type is predominantly rain-fed and should be naturally low in nutrients to sustain its characteristic bog communities and associated typical species. Any sources of water which contributes to supporting the bog habitat, including the margins of the bog and the 'lagg' (the peripheral zone around the bog), should similarly be lacking in nutrients.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, to within typical values for the H7110 habitat.	Changes to natural soil properties may affect the ecological structure, function and processes associated with this Annex I feature. The typical substrate for this feature is acidic and nutrient-poor peat. Peat is distinguished from other soil types by its high content of organic matter, which results from plant growth and waterlogging combining to reduce decomposition rates and allow a build-up, over time, of semi-decomposed plant material to form peat. Peat is naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. The peat-forming vegetation and zone of peat deposition ('acrotelm') overlies metres of consolidated peat ('catotelm'). To maintain the catotelm/peat body, the peat should be waterlogged, anaerobic, acidic and nutrient-poor and water movement should be minimal. Any activity that lowers the water table in the peat, exposes peat to oxygen, increases nutrient levels or decreases acidity (or increases it greatly) will be detrimental.	
	Adaptation and resilience	Restore the H7110 feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SAC to climate change has been assessed by Natural England as being <i>high</i>, taking into account the sensitivity, topography and management of its habitats. This means that some adaptation action for specific issues may be required, such as creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. In many cases, change will be inevitable so appropriate monitoring would be required. The H7110 feature will be most resilient when the hydrology and topography approach that found on undamaged sites, vegetation is actively peat-forming and the bog is unconstrained to spread or contract vertically or laterally.	NATURAL ENGLAND, 2015. Climate Change Theme Plan and National Biodiversity Climate Change Vulnerability Assessments (NBCCVAs). Available at http://publications.naturalengland.org.uk/publication/4954594591375360
Supporting processes (on which the feature relies)	Air quality	Maintain the concentrations and deposition of air pollutants at or	This habitat type is considered sensitive to changes in air quality. Exceedance of critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. On raised bog it is likely to increase the	More information about site-relevant Critical Loads and Levels for this SAC

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		below the site-relevant Critical Load or Level values given for the H7110 feature of the site on the Air Pollution Information System (www.apis.ac.uk).	growth of vascular plants and affect the species composition and growth of bryophytes, in particular <i>Sphagnum</i> species. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH₃), oxides of nitrogen (NO_x) and sulphur dioxide (SO₂), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the H7110 feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	NATURAL ENGLAND 2014. South Solway Mosses Site Improvement Plan (SIP 226). Available at http://publications.naturalengland.org.uk/publication/6542037868347392 NATURAL ENGLAND, 2016. South Solway Mosses NNR Management Plan 2017- 2022.
Structure and function (including its typical species)	Key structural, influential or distinctive species	Restore the abundance of the species listed below to enable each of them to be a viable	Some plant or animal species (or related groups of such species) make a particularly important contribution to the structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; – <i>Structural</i> species which form a key part of the habitat's structure or help to define an Annex I habitat on a site (see also the attribute for 'vegetation community	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		component of the H7110 Annex 1 habitat; Peat-forming species including bryophytes (predominantly <i>Sphagnum</i> spp), Cyperaceae (cotton grasses) and dwarf shrubs (mainly Ericaceae), Bog rosemary <i>Andromeda polifolia</i>, common and intermediate sundew <i>Drosera rotundifolia</i> and <i>Intermedia</i> <i>Empetrum nigrum</i>, Bog Asphodel <i>Narthecium ossifragum</i> and Cranberry <i>Vaccinium oxycoccos</i> Underlying SSSI Breeding bird Assemblage large heath butterfly <i>Coenonympha tullia</i>	composition’). – <i>Influential</i> species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). – <i>Site-distinctive</i> species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular site. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. For this feature, the vegetation of the mire expanse should comprise an inter-mix of typical bryophytes (predominantly <i>Sphagnum</i> spp of which <i>Sphagnum capillifolium</i>, <i>S. magellanicum</i>, <i>S. papillosum</i>, <i>S. tenellum</i> and key), graminoids and dwarf shrubs, with no one group dominating at the expense of others on ‘active’ sites.	

Version Control

Advice last updated: n/a

Variations from national feature-framework of integrity-guidance:

The Attribute ‘Extent and Distribution of the Feature’ has been deleted as not applicable to this site. This is because the feature should be considered across the site as a

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
whole, and spatial change in distribution is not relevant. The Attribute ' <i>Functional Connectivity with the wider landscape</i>' has been deleted as this is covered by Hydrology and 'Supporting Off-site habitat'			

Table 2: Supplementary Advice for Qualifying Features: H7120. Degraded raised bogs still capable of natural regeneration

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Restrict the further degradation of the extent of the H7120 feature, whilst restoring 452 hectares of the H7120 feature to H7110 Active Raised Bog	The <i>Interpretation Manual of European Habitats</i> states that 'Degraded raised bogs' only includes examples which are 'capable of natural regeneration', i.e. "<i>where the hydrology can be repaired and where, with appropriate rehabilitation management there is a reasonable expectation of re-establishing vegetation with peat-forming capability within 30 years</i>". There should be no measurable net increase in the extent and area of this feature, and in most cases, the full extent of the feature should be restored to H7110 Active Raised Bogs. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. For this feature, 'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition	EUROPEAN COMMISSION, 2013. Interpretation Manual of European Habitats. EUR 28 p84
Structure and function (including its typical species)	Soils, substrate and nutrient cycling	Restrict further degradation of the peat substrate of the H7120 feature and restore the properties of the underlying peat type, including its structure, bulk density, total carbon, pH, soil nutrient status and fungal/bacterial ratio, to within typical values for H7110 Active Raised Bog habitat.	Changes to natural properties of the bog's peat body may affect the ecological structure, function and processes associated with this Annex I feature. The typical substrate for this feature is acidic and nutrient-poor peat. Peat is distinguished from other soil types by its high content of organic matter, which results from plant growth and waterlogging combining to reduce decomposition rates and allow a build-up, over time, of semi-decomposed plant material to form peat. Peat is naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. The surface of an active raised bog should be made up of two distinct layers; an acrotelm and a catotelm. The thin upper layer, or 'acrotelm', is typically up to 30cms deep and consists of living plant material and is a zone of fluctuating water table, where relatively rapid plant decomposition occurs. Below this is the 'catotelm', a much thicker layer of peat (typically up to 10 metres), which comprises broken down plant material and is always below the water table. The surface acrotelm layer of degraded raised bogs affected by past drainage, compaction or burning may be	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Vegetation community composition	Restore the component vegetation communities of the H7210 feature to those resembling and characterised by the following National Vegetation Classification type(s) typical of H7110 Active Raised Bog as listed above	replaced with a single layer of damaged catotelm ('haplotelm'). This habitat feature when restored will comprise a number of associated semi-natural and natural vegetation types associated with H7110 Active Raised Bog and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and hydrology) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Restoring degraded bog vegetation to characteristic and distinctive H7110 active bog vegetation types will be important to restoring the overall habitat feature. This will also help to conserve their typical plant species (including the constant and preferential species of a vegetation community), and therefore those of the SAC feature, at appropriate levels (recognising natural fluctuations). The component wetland types of active raised bog will comprise the bog expanse, the sloping margins of the bog (or 'rand') (although this may not always be mappable) and lagg fen. The bog expanse will comprise an intimate mix of typical bryophytes (predominantly <i>Sphagnum</i> spp), grasses/sedges and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. <i>Sphagnum</i> should predominate on hyper-oceanic sites, while its cover may be slightly lower on eastern sites with lower rainfall. The bog rand will typically consist of communities of drier peat and the lagg fen by vegetation associated with swamp and fen habitats.	
	Structural diversity	Restore the full range of structural features (e.g. vegetation cover, surface patterning and hydrological transitions) typically associated with H7110 Active Raised Bog to the H7120 feature at this site.	Active raised bogs in particular show varying degrees of structural variation and surface patterning reflecting hydrological gradations (which may be natural or the result of previous damage). These can occur at both macro and micro scales across the habitat and include alternative aquatic and terrestrial surface features, such as bog pools and hummocks, ridges and hollows. These features will support distinctive patterns of bog vegetation, and so will be sensitive to changes in topography and hydrology. These can be modified or disrupted by activities such as drainage, burning, grazing, vehicular access and peat digging. Structural features may occur as the result of restoration works, and these can enhance the macro and micro-topography of the bog surface in readiness for typical active raised bog vegetation.	
	Key structural, influential or distinctive species	Restore the abundance of the species listed below to enable each of them to become a viable component of the H7110	See the supporting and explanatory notes for this attribute above in Table 1. Degraded raised bog on this site is currently characterised by an impoverished vegetation mainly dominated by purple moor-grass <i>Molinia caerulea</i> with dense to sparse cover of birch <i>Betula</i> spp, <i>Molinia</i> and bracken, and lacking significant cover	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		active rather than degraded Annex 1 habitat; Peat-forming species including typical bryophytes (predominantly <i>Sphagnum</i> spp), Cyperaceae (cotton grasses) and dwarf shrubs (mainly Ericaceae), Willow tit <i>Poecile montanus</i>, White faced darter dragonfly <i>Leucorrhinia dubia</i> Marsh fritillary butterfly <i>Euphydryas aurinia</i> Underlying SSSI Breeding bird Assemblage	of any bog mosses <i>Sphagnum</i> spp. These communities will have low representation when the site is restored to H7110 Active Raised Bog. Total <i>Sphagnum</i> cover on a mire expanse in good hydrological order is likely to be 70-90%, but positive indicator targets such as this and the others in Table 1 are well below target on damaged or newly-restored sites. <i>Sphagnum cuspidatum</i> cover is a surrogate indicator for year-round high water table position and its frequency can help indicate recovering condition on degraded areas. The SSSI breeding bird assemblage at designation included a range of species that is shifting as the drier habitats of the degraded bog edges are restored to active bog and wetter lagg communities. Restoration work on the mire expanse and lagg, and management proposals on the bog edge, should support habitat opportunities for the breeding bird assemblage, and create new habitat for important declining species such as willow tit, wading birds, dragonflies and species such as marsh fritillary butterfly on the peat/mineral interface. The lagg and potential lagg habitats of the Mosses can be important as Functionally Linked Land for protected bird species from the adjacent Solway Flatts and marshes SPA, for example as winter feeding ground for Pink Footed Anser <i>brachyrhynchus</i> and Barnacle Geese <i>Branta leucopsis</i>.	
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, and if present are not undermining the restoration of the H7120 feature	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (eg use of broad spectrum herbicides). <i>Rhododendron ponticum</i> is confined to occasional small pockets on the degraded fringes of the site, and any signs of expansion and encroachment would be negative.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Supporting off-site habitat	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the restoration of the H7120 raised bog feature	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. For example to prevent/reduce/absorb damaging impacts from adjacent land uses such as drainage, compaction or nutrient inputs. The protection and management of peripheral peat and the land immediately around the peat body will be of critical functional importance to the restoration of the H7120 feature to active bog and lag. The hydrology and ongoing management of this land must also be compatible with the long-term recovery and maintenance of the bog. The nature of the wider landscape within which the bog sits will determine the extent of the functionally important off-site habitat, and will need site-by-site assessment. Hydrological Protection Zones have been identified around each of the four bogs, which along with other information such as peat depth, topography and geology/soil information can help identify this important peripheral land.	ENVIRONMENT AGENCY, 2016.
	Hydrology	At a site level, restore natural hydrological processes to provide the water levels and conditions necessary to prevent further degradation of the H7120 feature within the site and to enable its restoration to H7110 active raised bog	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site. The restoration of this structural attribute of the H7120 degraded bog feature will be a key element of its recovery to H7110 active raised bog. The hydrology of degraded raised bog fails to support the processes and vegetation of active raised bog, which is the desired feature on this part of the site. Low and/or fluctuating water levels in the peat leads to oxidation and loss (wastage) of the peat along with loss of ability of the peat body to retain rainwater and accumulate peat. Bog species adapted to waterlogged, acidic and nutrient-poor conditions will be lost. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. The surface of an active raised bog has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses <i>Sphagnum papillosum</i>, <i>S. capillifolium</i>, <i>S. tenellum</i> and <i>S. magellanicum</i> will often indicate good surface conditions. Typically, the hydrology of the H7120 habitat feature has already been degraded but is considered capable of recovery. Further detrimental impacts to the hydrology of degraded peat can lead to further desiccation, oxidation, compaction, shrinkage and erosion. This will undermine the aims to restore this feature to active raised bog, and to maintain adjacent active bog.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Water chemistry	Maintain the surface water and groundwater supporting the hydrology of the rain-fed bog at a low nutrient status.	Due to its raised character above the ground water table, the mire expanse of an active raised bog obtains its water from precipitation, and has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses <i>Sphagnum papillosum</i>, <i>S. capillifolium</i>, <i>S. tenellum</i> and <i>S. magellanicum</i> will often indicate good surface condition. Any sources of water which contribute to supporting the bog habitat, including the margins of the bog and the lagg (the peripheral zone around the bog), should similarly be low in nutrients.	
	Adaptation and resilience	Restrict the further degradation of the H7120 feature's ability, and that of its supporting processes, to ensure that the feature can adapt or evolve to wider environmental change, either within or external to the site	See supporting and explanatory notes for this feature in Table 1 above. The Hydrologically Effective Rainfall / Runoff (mm) and Excess rainfall calculations indicate that after taking into account water loss from the bog by all means, there is still a surplus of rainfall in the supporting catchments of the SAC. This means that there is an appropriate level of rainfall to support bog forming vegetation on the South Solway Mosses and that rehabilitation works to restore moss forming vegetation should be effective as long as a high, stable water table can be maintained throughout the year.	Rainfall figures detailed in the South Solway Mosses NNR Management Plan 2017
Supporting processes (on which the feature relies)	Air quality	Maintain as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See notes for this attribute under table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes for restoration to H7110 Active Raised Bog	Active and ongoing conservation management is needed to prevent further degradation of the H7120 Degraded Raised Bog feature at this site, and, more importantly, to restore it to H7110 Active Raised Bog habitat. Usually, raised bog restoration measures will aim to elevate and stabilise the underlying water table and re-establish waterlogged conditions, so the bog can re-grow and regain its characteristic structural features (e.g. bog pools) and its typical plant assemblages. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site	NATURAL ENGLAND 2014. South Solway Mosses Site Improvement Plan SIP 226, available at http://publications.naturalengland.org.uk/publication/6542037868347392 NATURAL

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	ENGLAND, 2016. South Solway Mosses NNR Management Plan 2017- 2022.
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: The Attribute 'Extent and Distribution of the Feature' has been deleted as this not applicable to this feature. This is because we are aiming for a reduction in extent of degraded raised bog, towards active raised bog. The Attribute ' Functional Connectivity with the wider landscape' has been deleted as this is covered by Hydrology and 'Supporting Off-site habitat'				

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