



TWEED  
FORUM



# **Tweed** Wetland Strategy

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# Tweed Wetland Strategy

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The **Tweed Wetland Strategy** is aimed at a broad spectrum of individuals and organisations who are actively involved in making decisions which affect wetland systems. This may range from members of government bodies to charitable groups and land managers, all of whom should use this document to facilitate further discussion and specific action towards more coordinated wetland management in the Tweed catchment.





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The need for integrated wetland management is clearly acknowledged by many organisations, legislation, plans and processes. The need for a freshwater wetland strategy for the Tweed catchment was highlighted during a recent review of the Tweed Catchment Management Plan in 2009-10, where gaps in the relevant national legislative framework and a need for greater coordination of local wetland conservation activity were identified. The three major EU Directives (Water Framework, Floods and Habitats), and the cascade of legislation that flows from them, address wetlands to varying degrees. However, a strategic document that explores the multi-functionality of wetlands (and the need to balance these multiple functions), values smaller scale wetland features (which are often overlooked), and crucially, provides strategic focus for future practical work at the local level was clearly required. The Tweed catchment enjoys a long history of partnership working, through the work of the Tweed Forum<sup>1</sup> and it is by the consensus of this group of stakeholders that this Strategy has finally come to fruition.

### The broad aims of this Strategy are to:

- Protect, enhance and, where appropriate restore wetland habitats across the Tweed catchment
- Promote habitat connectivity to support the spread of species between wetlands at different hydroseral stages<sup>2</sup>
- Identify any existing or potential threats to wetland habitats and possible actions to reduce these
- Identify the benefits and opportunities that wetlands can bring to landowners and communities and possible actions to achieve these
- Support sustainable wetland use by acknowledging the need to balance negative impacts against derived benefits
- Illustrate linkages between wetland habitat management and current legislative processes

### The aims of the Strategy will be supported by a central information source which will include:

- A live 'inventory' of Tweed wetlands which can be reviewed and updated and is accessible by all land users, legislators, and managers
- A central database of wetland related information, e.g. species lists
- A clear statement of the major threats and opportunities for wetland habitats
- A prioritised action plan, including those actions set out within this document, which will be prioritised by stakeholders

*This Strategy is seen as an integral part of the future management process for Tweed wetlands*

<sup>1</sup> Tweed Forum is Borders Forest Trust, Environment Agency, Federation of Border Angling Associations, Forestry Commission Scotland, Natural England, Northumberland County Council, Northumberland National Park Authority, Northumbrian Water, Northumberland Wildlife Trust, Royal Society for the Protection of Birds, River Tweed Commission, Scottish Agricultural College, Scottish Borders Council, Scottish Environment Protection Agency, Scottish Government, Scottish Natural Heritage, Scottish Rural Property & Business Association, Scottish Water, Southern Upland Partnership, Tweed Foundation, Visit Scotland Borders

<sup>2</sup> Wetlands will often naturally progress over time from one wetland habitat type to another due to vegetation growth and changes in water levels. This process is called hydroseral succession and is an important concept in wetland management. See section 2.1 and the glossary for further information

The Tweed Wetland Strategy is aimed at a broad user group

This guide will help you to find the information relevant to your interests:

Do you want to gain an overall impression of what the Strategy hopes to achieve?  
*read the aims:*

page  
**6**

Do you want to see how the Strategy fits with current legislation and other processes? *Look at section 2.2.4*

page  
**12**

Do you want to know about the key wetland sites in the Strategy area?  
*look at Figure 2 and read Appendix 4 which shows the designated sites and Scottish Borders local wildlife sites*

pages  
**12  
A20**

Do you want an overview of the threats and opportunities associated with wetlands? *see section 3.3 and 3.4*

pages  
**16  
24**

Do you have an interest in a specific wetland type? *Look at the table in section 2.2.2, Appendix 2 which gives detail on each wetland type and Appendix 4 which lists the designated sites by habitat type*

pages  
**10, A10  
A20**

If you want to take a specific action e.g. *restore a wetland* Look at section 3.4 for some of the opportunities wetlands can provide and refer to the key wetlands sites as per Figure 2 and Appendix 4. Contact Tweed Forum [www.tweedforum.com](http://www.tweedforum.com) for details of the forthcoming central information source, to ensure your actions will be coordinated and strategic.

# 1. Aims of the Tweed Wetland Strategy

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## THE SPECIFIC AIMS OF THIS STRATEGY ARE TO:

- **Create an adaptable framework to enable integrated management of wetland sites**

This will bring together available data on wetland habitats, legislation, initiatives, projects and the organisations involved in these activities to work together towards agreed targets. This will facilitate discussion on the main issues, enable those involved in wetland management to make informed decisions and lead to increased opportunities for creating, maintaining and enhancing wetland habitat networks. An integral part of this will be to identify/quantify the water resource of Tweed and identify any special features and their contribution to the water resource as a whole.

- **To identify and assess the potential for wetland creation**

The Borders Wetland Vision and the North East Wetland Feasibility Study have assessed the potential for wetland creation through habitat modelling techniques. Phase 1 habitat survey work has provided practical complementary information but there is potential to apply Phase 1 surveys to all wetlands and further develop the available data to provide practical advice on the best sites for wetland creation.

- **To identify existing or potential threats to wetland habitats and actions to reduce these**

Human activity, through agriculture, forestry, industry and development, represents the main threat to wetland habitats, though it should be noted that there are various mechanisms in place to regulate much of this activity e.g. the Controlled Activities Regulations (CAR) in Scotland. These activities may affect water quality through pollution and sediment load and habitats and species are affected by changes to drainage, grazing management or by development and infill. Natural hydrosereal succession (see glossary) will lead to a loss in diversity of wetland species as will fragmentation of wetland sites if species cannot move to or colonise other sites. Invasive species are problematic and may increase in range with climate change effects. Abstraction for public water supply, agriculture or industry may deplete the resource and increased tourism and recreation may be a threat if the resource is overused and ill managed. There is a general lack of awareness of the importance of wetlands and this can result in decisions being taken which are detrimental to the habitat. Actions to address these threats will be presented, however, it should be noted that these will, of necessity reflect current knowledge and management trends.

- **To identify the benefits and opportunities that wetlands can bring to landowners and communities and possible actions to achieve these**

Wetlands are one of our most diverse habitats and are home to many rarer species as well as providing a wide range of benefits to society i.e. ecosystem services. These include the ability to filter dirty water through the action of vegetation in reedbeds or other wetland systems, blanket bog acting as a carbon sink and also slowly releasing water from the hills and flood plain wetlands thereby alleviating flooding downstream. These properties are particularly important in relation to potential effects of climate change with increased rainfall and storms. Wetlands can also be an attraction for recreation and tourism, if well managed to avoid overuse as noted above. It is this multiple range of benefits that wetlands have the potential to provide that must be highlighted.





Everett Moss

#### ■ To raise awareness of wetlands as an increasingly important natural resource

Key decision-makers, land managers, organisations, schools and the public should have access to information and interpretation on wetlands, highlighting the importance of wetlands as a resource to be protected, restored and expanded. This information and interpretation could be used, for example, in the development of demonstration sites, targeted farm walks, publications and in the school curriculum. Access to an updated database which identifies wetlands and potential sites for wetland creation would be an asset for local policymakers, projects and schemes to ensure integrated management.

#### ■ To prioritise action

Stakeholders from across the Tweed catchment will be asked to prioritise a set of actions, including those described within this Strategy, though it will be important to ensure that the actions remain current and relevant. Priorities will likely include actions to safeguard the condition of existing sites, integrate modelled data with actual data (e.g. Borders Wetland Vision) and expand wetlands. These actions should support the creation of a series of linked habitat networks, a clear priority, as it is widely acknowledged that habitat networks provide a more robust system able to cope with and adapt to demands from users and a changing climate. Where possible, a comparison of the costs of wetland loss/absence, and the associated decline in ecosystem services, against the costs of effective conservation/reinstatement and sustainable use will assist in determining where priorities lie.

## 2. Introduction

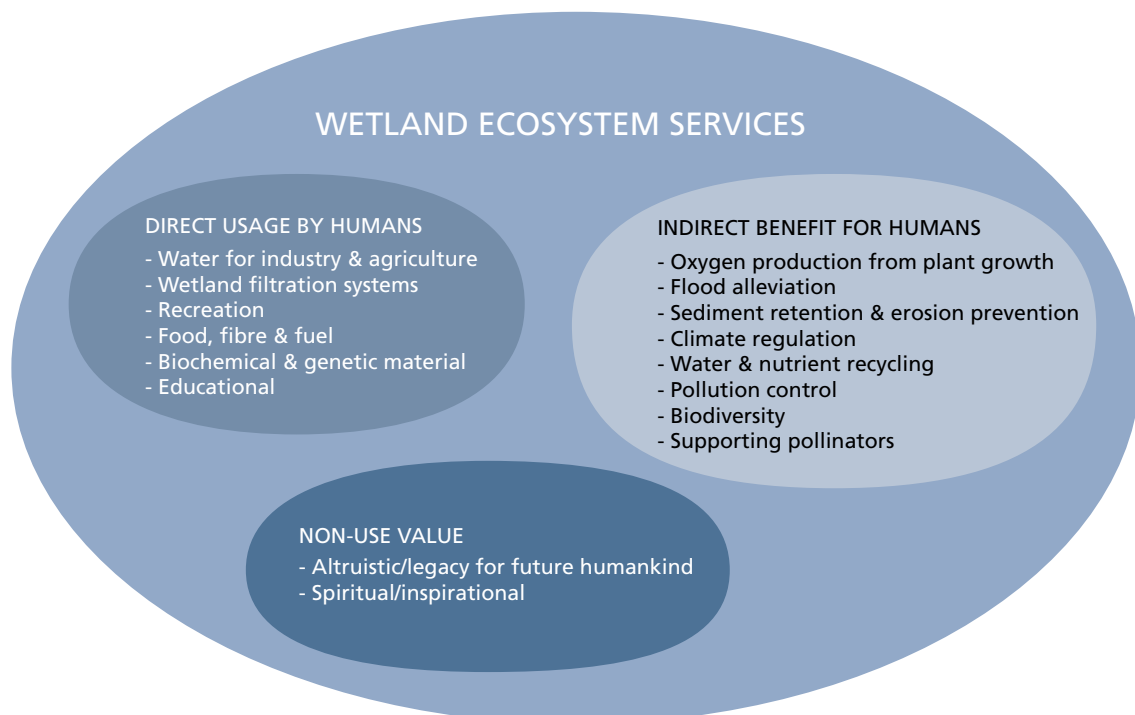
### 2.1 Why are wetlands important habitats?

Wetlands, including springs, ponds, mires, swamps, burns and rivers, have for centuries been an essential resource; supplying clean water for human consumption and meeting the needs of agriculture, forestry and industry.

This provision of ecosystem services, i.e. services essential to life, such as water provision, providing habitats for plants to grow and produce oxygen, plus the aesthetic and cultural benefits of our habitats, is generally taken for granted by much of the population (Figure 1). Other ecosystem services provided by wetland systems include the retention of sediments and reduction in the levels of silt, nutrients and toxins entering other water systems and providing improvements in water quality for human consumption and for all aquatic life. Peatlands and bogs can also absorb and store carbon and maintaining them in good condition prevents the release of locked up carbon dioxide to the atmosphere (a major contributor to climate change). Wetlands also play a vital role in storing water and then slowly releasing it during drier periods and this is a major contribution to maintenance of stream and river flows, as well as a primary control of run-off and potential flooding downstream.

Wetlands are also vitally important habitats for biodiversity and host a great number of plant and animal species. Wetlands encompass the entire ecological range from open waters to wet woodland. Indeed, under the right conditions, various wetland types will gradually transform into another wetland type e.g. by gradual siltation and

**Figure 1** Wetland ecosystem services



vegetative growth before perhaps completely drying out i.e. hydrosere succession. This variety/mosaic of habitat types and associated flora and fauna constitutes a major genetic resource, but one that is highly susceptible to detrimental impacts from human activity such as drainage, water abstraction and cultivation activities.

Wetlands feature strongly in the landscape of the Tweed catchment, particularly larger open waters and fenland e.g. St Mary's Loch and Loch of the Lowes, Yetholm Loch, Threepwood and Whim mosses. They create many opportunities for recreational activities, including many that are economically important. There can also be strong historical and social connections with wetlands, where past communities used them as a natural resource for building materials and fuel, making them rich in archaeological finds such as plant remains, molluscs, fish, bird and mammal skeletons and pollen records, all of which may provide information on climate change when analysed.

Climate change and the related issues of global drought, increasing demand for water in tandem with a potentially increasing human population and more frequent flash floods during periods of rainfall, all point to wetlands as an increasingly important component of ecosystem services vital to human needs.

## 2.2 Tweed Wetlands

### 2.2.1 Definitions

This strategy encompasses the cross-border Tweed catchment plus the Eye Water catchment in Berwickshire (see Figure 2). The Eye Water catchment has been included as it has been historically incorporated into previous catchment-wide initiatives such as the Tweed Catchment Management Plan and therefore, where the term "Tweed catchment" is used, inclusion of the Eye should be assumed. Some data for the Liddel Water catchment has been collated during the preparation of the wetland site inventory and this will be located in the Tweed wetlands central information source.

The definition of wetland under the Convention on Wetlands (Ramsar, Iran, 1971) states:

*"Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres."*

The following wetland types are acknowledged to exist within the Tweed catchment<sup>3</sup> :

- |   |   |
|---|---|
| <b>1</b> Blanket bog  | <b>8</b> Wet soils  |
| <b>2</b> Raised bog   | <b>9</b> Rivers and burns   |
| <b>3</b> Fens and basin mires   | <b>10</b> Underground rock basin reservoirs, water in rock strata, water layers between underlying rock and soil, groundwater |
| <b>4</b> Flushes  | <b>11</b> Coastal lagoons, rock pools, bays and estuaries, salt marsh   |
| <b>5</b> 'Schwingmoor'/floating mire  | <b>12</b> Temporary or seasonal wetlands  |
| <b>6</b> Swamp  |   |
| <b>7</b> Open waters (ponds, lochans, lochs, lakes, reservoirs – natural, impounded, excavated) |   |

This strategy will not include marine elements or the main river systems, the latter of which features heavily within the Tweed Catchment Management Plan, Solway Tweed River Basin Management Plan and Local Biodiversity Action Plan processes. Some types such as the underground resource are not technically wetlands, but as an important resource should be borne in mind throughout.

This strategy will focus mainly on 1-8 above, marked in **bold**

<sup>3</sup>For the purposes of this strategy, a full spectrum of wetland sites are included, from permanently open or standing waters (which have submerged vegetation) through to land where the water table is at (or around) the soil surface, to peats which are dependent on incoming precipitation.

## 2.2.2 Classification of Tweed Wetlands

The classification methodology for wetlands can vary enormously according to current technical knowledge, as well as the aims of the classifiers. In this Strategy a deliberate decision was made to refer to the ecological status of wetlands, as defined by their vegetation and nutrient status. Therefore, the wetland types considered here may not fit directly with other classifications, developed for other purposes, e.g. the current SEPA “A Functional Wetland Typology for Scotland” which allows SEPA staff (who may be non-ecologists) to “identify different wetland types quickly and accurately to provide general risk screening”. However, as the SEPA typology will be used in building a national inventory of Scottish wetlands, we have mapped the main wetland types used in this Strategy against those of the SEPA typology; this information may be found in Appendix 1. A full technical description of the classification methodology used for the major wetland types in the Tweed Wetland Strategy is also given in Appendix 1. Table 1 below summarises the main characteristics of the Strategy wetland types:

Appendix 2 lists the plant communities present in Tweed catchment wetlands as well as diagrams showing the relationships between the main community types.

**Table 1** Main characteristics of wetland types, as defined in this Strategy

WETLAND TYPE	CHARACTERISTICS
<b>Blanket Bog</b>	Dependent upon incoming precipitation falling, in a cooler climate, on level or gently sloping ground at levels which engender wet vegetation and the accumulation of <i>Sphagnum</i> , bog mosses and their associates. In the flat-summits plateaux of the Tweed catchment these conditions tend to occur above approx. 500m.
<b>Raised Bog</b>	Development of <i>Sphagnum</i> vegetation, as for blanket bog, but usually developed upon sedge swamp or fen peats, raised above surrounding groundwater in discrete topographic hollows.
<b>Fens &amp; basin mires</b>	Found in topographic hollows; peat accumulation may be variable. Vegetation depends upon current and past uses.
<b>Flushes</b>	Soligenous mires of all types which depend upon a throughput of water.
<b>Schwingmoor/Floating mire</b>	Raft of floating moss and short sedge based vegetation, ‘quaking’ when walking across it.
<b>Swamps</b>	Usually situated between open-water and mire with standing water less than 15 cm and emergent vegetation present.
<b>Open Water</b>	Permanent static (without flow) water bodies.
<b>Wet Soils</b>	Contains standing water, at least seasonally. Upper soil layers saturated or imperfectly draining. Occurs under a range of habitats including grazed grasslands with common grass species often present (e.g. creeping bent) and with/without rush, poor arable ground, woodland and plantations.

Haas Sike, Bonchester Bridge



### 2.2.3 Key Tweed Wetlands

There are a number of important designated wetland sites within the Tweed catchment (Figure 2 and Appendix 4). These include the Central Borders basin mires e.g. the Whitlaw Mosses National Nature Reserve (NNR). There are a greater proportion of basin mires in the Tweed area than in any other area of comparative rainfall in Scotland and Northern England with over 200 sites identified, though not all designated sites, some small in scale although located in close proximity and ranging in type from nutrient poor to nutrient rich. This makes them a distinctive feature of the area.

The Tweed wetland sites are designated for their diverse habitats and plants (Appendix 3) and the presence of breeding and overwintering birds (Appendix 5). These designations may be for regional, national or international importance (see Table 2). For example, Hoselaw Loch-Din Moss, is a designated Site of Special Scientific Interest (SSSI) as a natural open water body, with associated fen and relatively unmodified raised bog, used by breeding, passage and wintering wildfowl. This site is also designated a Special Protection Area (SPA) under the Wild Birds Directive and RAMSAR as an internationally important site for greylag and pink-footed geese. Dodgen and Threepwood mosses are also internationally important designated sites, each a Special Area of Conservation (SAC) for active raised bogs.

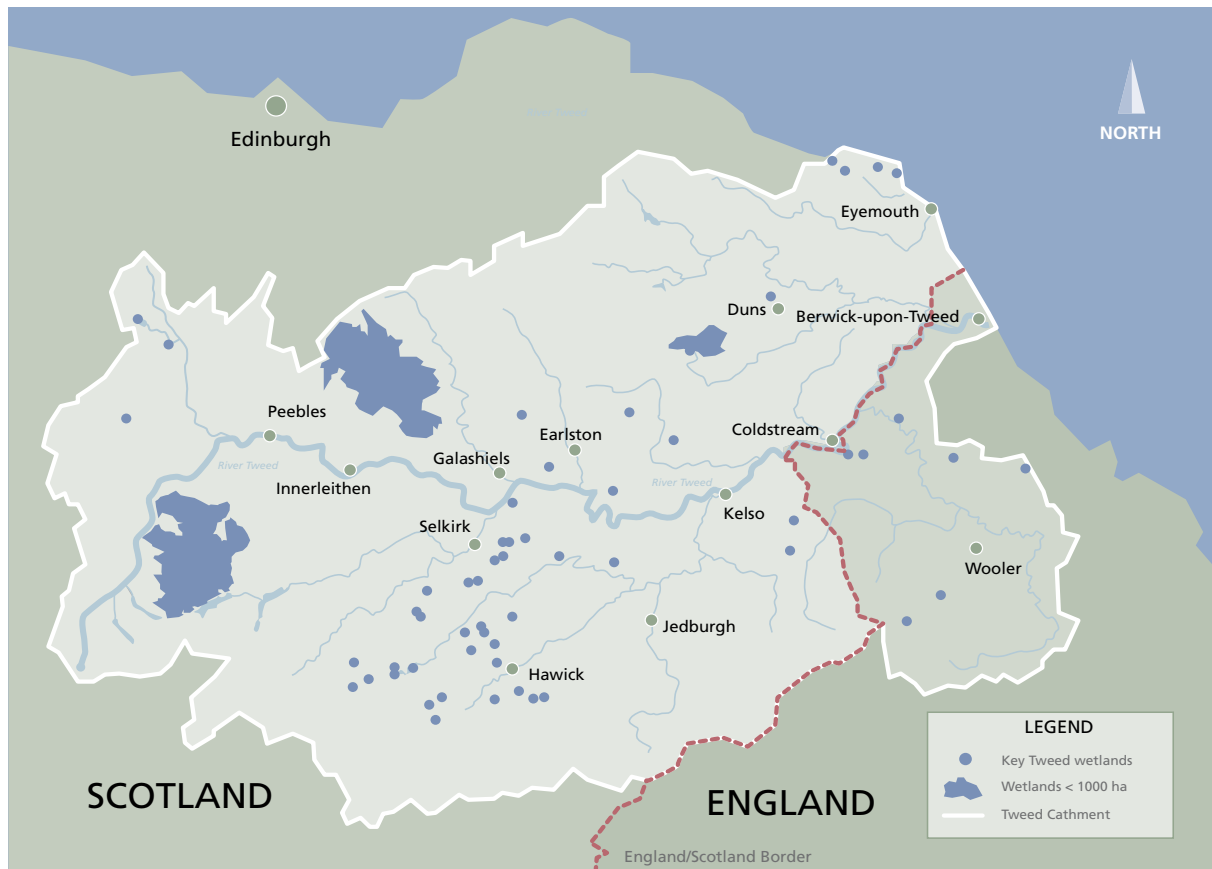
Designated sites should have monitoring and management plans in place that include operations requiring consent to ensure their continued good or improving condition. Outwith the designated sites there are many wetlands that have not been subject to recent management or maintenance grants through government schemes. These may be rare or degraded wetland habitats which could benefit from work to restore or improve them. 'A Borders Wetland Vision' (2006) identified sites where there was potential for wetland restoration or creation. Some of these may have historical and social associations e.g. at Philhope where wetland was created as a reservoir of water to power several mills downstream in Hawick. Other sites may be fragmented or of small size and an integrated approach with landowners on a wider catchment scale would help create a network of linked wetlands to achieve some of the benefits described in section 2.1 i.e. biodiversity, water quality, flood management, recreational opportunities.

**Table 2** Key designation types for Tweed Wetlands

DESIGNATION	LEVEL	DESCRIPTION
<b>SAC</b>	EU, statutory	<ul style="list-style-type: none"> <li>designated under the Habitats Directive</li> <li>best represent the range and variety, within the European Union, of habitats and (non-bird) species listed on Annexes I and II to the Directive</li> <li>terrestrial areas and territorial marine waters out to 12 nautical miles are included</li> </ul>
<b>SPA</b>	EU, statutory	<ul style="list-style-type: none"> <li>designated under the Birds Directive</li> <li>identify and classify the most suitable territories, in size and number, for certain rare or vulnerable species (listed in Annex I of the Directive) and for regularly occurring migratory species</li> <li>safeguard the habitats of the species for which they are selected and protect birds from significant disturbance</li> </ul>
<b>RAMSAR</b>	International, statutory	<ul style="list-style-type: none"> <li>designated under the Convention of Wetlands of International Importance</li> <li>conservation and wise use of wetlands of international importance by national action and international cooperation as a means to achieving sustainable development throughout the world</li> </ul>
<b>SSSI</b>	National, statutory	<ul style="list-style-type: none"> <li>'special' for their plants, animals or habitats, their rocks or landforms, or a combination of such natural features</li> <li>a network of the best examples of natural features throughout UK, and support a wider network across the EU</li> </ul>
<b>NNR</b>	National, statutory	<ul style="list-style-type: none"> <li>important natural and semi-natural terrestrial and coastal ecosystems</li> <li>conserve habitats or provide special opportunities for scientific study of the habitats communities and species represented within them</li> </ul>
<b>Local Wildlife Sites*</b>	Local	<ul style="list-style-type: none"> <li>significant site for local wildlife features</li> <li>criteria for designation include habitat and species diversity, habitat and species rarity, naturalness and typicalness and size</li> </ul>

\*Soon to be redesignated as "Local Biodiversity Sites"

**Figure 2** Map of key (designated) Tweed wetlands. Please note where area is greater than 1000ha, entire wetland area is shown.



#### 2.2.4 How does the strategy link with current legislation and other related work?

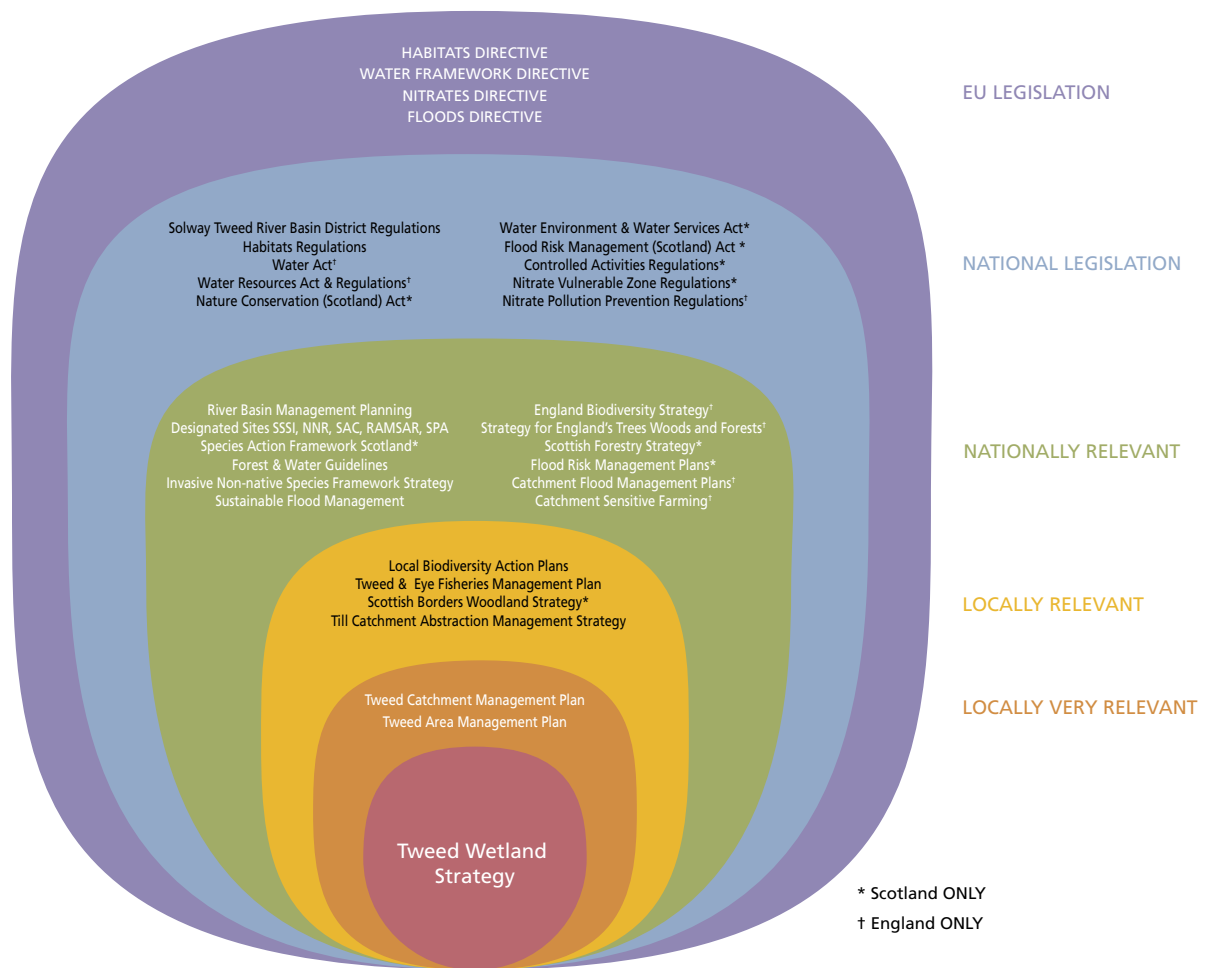
The Tweed Wetland Strategy aims to link with all legislations, plans and processes that directly affect or influence wetland habitats (see Figure 3). Foremost is the need to consider current legislation, in light of all the wetland types as described in 2.2.1, and in particular the information, aims and scope of the Solway Tweed River Basin Management Plan<sup>4</sup>, especially with reference to smaller water bodies and standing waters.

The strategy will also link with the wetland habitats outlined in the UK and regional Biodiversity Action Plans (BAP). This process arose from the government's response to the Convention on Biological Diversity signed in 1992. The UK BAP describes the overall biological resources and commits to a detailed plan for the protection and enhancement of its habitats and species. At the national level this is managed by the UK Biodiversity Partnership which brings together a wide range of people including amateurs and professionals, individuals and organisations. Local BAP groups produce action plans to target key habitats and issues, with partnership meetings to exchange and update information. In the Tweed catchment, the local BAP groups are led by Scottish Borders Council and the Northumberland Biodiversity Partnership who host the published action plans. The latter includes Habitat Action Plans (HAP) for blanket bog, lowland raised bog, fens, marsh, swamp and reedbeds, rivers and burns, standing open water in the Scottish Borders and pond, lakes and reservoirs, fens, marsh and swamps, reedbeds, rivers and streams in Northumberland. These are currently used to help influence best practice for planners and land management to conserve and enhance habitats and species. Links to the BAP information for the Tweed catchment are given in Appendix 6.

Figure 3 also highlights other relevant local plans such as the Tweed Catchment Management Plan, a dynamic, operational document, which identifies various issues relating to the utilisation, conservation, and protection of the Tweed's water resources in conjunction with clear objective setting, where various organisations have agreed to be responsible for meeting those objectives.

<sup>4</sup>Solway Tweed River Basin Management Plan [http://www.sepa.org.uk/water/river\\_basin\\_planning.aspx](http://www.sepa.org.uk/water/river_basin_planning.aspx)

**Figure 3** Legislation, plans and processes relevant to the Tweed Wetland Strategy



Gordon Moss

## 3. How do we Achieve These Aims?

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### 3.1 Create an adaptable framework to enable integrated management of wetland sites

There are various mechanisms through which wetland habitats may be recorded, assessed or enter a management scheme. These include:

- statutory processes e.g. Controlled Activities Regulations (CAR)
- monitoring of the designated sites (SSSI, SAC, NNR, RAMSAR)
- project work such as Ponds for Biodiversity and Wetland Filtration Systems (Tweed Forum, FWAG, SNH)
- Scottish Wildlife Trust and Northumberland Wildlife Trust work
- agri-environment scheme applications
- records from individuals sent to the Biological Records Centre and BSBI surveys
- farm conservation plans
- SEPA Wetland Inventory (forthcoming)

In addition there have been other actions which have highlighted the importance of Tweed wetlands and made recommendations on future work programmes:

- Scottish Borders and Northumberland Biodiversity Action Plans and specific Habitat Action Plans
- Tweed Catchment Management Plan
- The Borders Wetland Vision
- The North East Wetland Feasibility Study
- Phase 1 habitat survey

The Wetland Strategy Working group is currently preparing a full inventory and database of wetland sites at the local scale as this is an essential element of integrated management. The identification of wetland sites can be brought together through the different agencies noted above. The total water resource of Tweed is more difficult to quantify due to the many small wetlands which, whilst individually small, still have a large capacity to store and slowly discharge water into the main systems downstream (a particularly important point for flood alleviation). The mires and peatlands, which occur in relatively discrete sub-catchment areas like lower Ettrick–Teviot, and the vast areas of blanket peats which occur on the high ground of Tweedsmuir, Ettrickhead, Teviothead, Moorfoots, Lammermuir and the Border ridge contribute to this resource. There is a deficiency of data on water volumes, return times, and discharge rates for open water bodies and other wetlands over the whole Tweed catchment. This may have relevance for future water resource management if demand increases. A baseline figure would be a useful tool in determining where over abstraction would be detrimental to the ecosystem and will ultimately be required from 2027 onwards to properly fulfil the requirements of the WFD.

Nationally, the Scotland & Northern Ireland Forum for Environmental Research (SNIFFER) WFD 95 project has produced a basic wetland typology “A Functional Wetland Typology for Scotland” as described in 2.2.2 to enable non ecologists to identify wetland categories in the field in order to determine the risk from proposed regulated activities. The typology is required to support SEPA and the Environment Agency in their regulatory duties under the

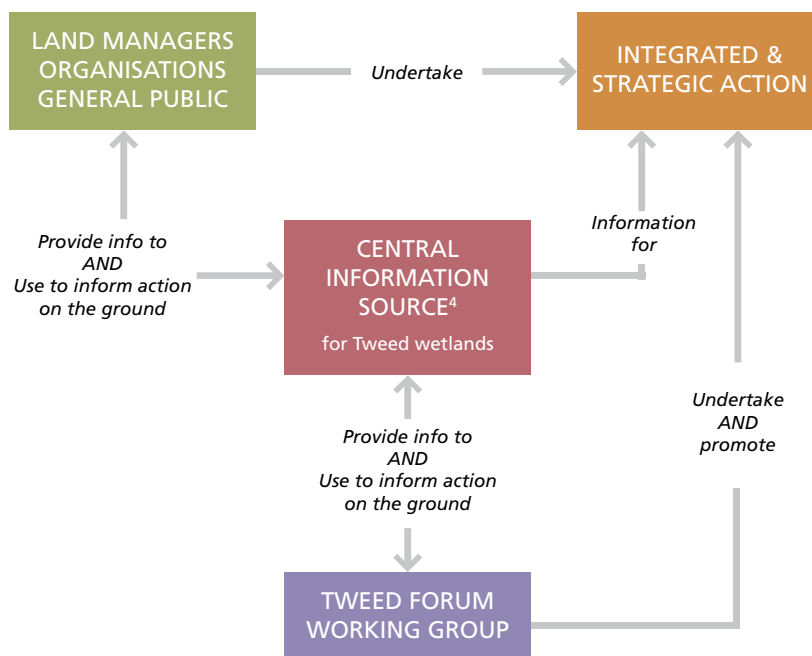


Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations. See Appendix 7 for links to many of the documents and processes mentioned above.

An adaptable framework is required to enable integrated wetland management in the Tweed catchment, including a facility for individuals and organisations to provide and gain access to a central information source. Figure 4 outlines such a framework and this will support integrated wetland management in the Tweed catchment, following the publication of this Strategy. It is likely that this central information source will include:

- a live “inventory” of Tweed wetlands which can be reviewed and updated and is accessible by all land users, legislators and managers
- a central database of wetland related information, e.g. species lists
- a clear statement of the major threats and opportunities for wetland habitats
- a prioritised action plan, including those actions set out within this document

**Figure 4** An adaptable framework for integrated wetland management in the Tweed catchment



### 3.2 To identify and assess the potential for wetland creation

The Borders Wetland Vision and North East Wetland Feasibility Study have provided planning tools for identifying potential wetland creation sites. These studies have taken into account available information on hydrology, geology and wet soil types i.e. restricted drainage, peat or gleyed soils, boulder clay and on site topography and vegetation type. The vision maps show potential for wetland sites by habitat type which can be verified by Phase 1 survey work.

Current land management must be considered, as many of the potential sites will be on historic wetland sites. Many wetlands were drained with the push for agricultural improvements in the 18th century. This, combined with the gradual silting-up of natural wetlands, contributed to the decline in many sites. It is evident from common farm or field names still in use e.g. Billiemire, Cowbog, the bog or pond field where neither habitat now exists, that wetlands were once more widely distributed. The ‘mosstroopers’ (or reivers) of the Border country from the 17th century also give an indication of the territory they occupied, moss being a broad description for any wet place. As these historic wetland sites may have produced some of the best fields on a farm holding, it may be challenging to promote wetland (re-)creation here, especially if combined with a reluctance to ‘turn the clock back’ amongst farmers and

<sup>4</sup>Please contact Tweed Forum for details of this “central information source”, info@tweedforum.com, 01896 849723, www.tweedforum.com

landowners. However, if climate change, water quantity and flooding concerns continue to be of prime importance, wetland creation may receive much more attention and support than it has to date, even in the face of increasing concerns regarding food security.

Wetland creation sites may also be chosen for their proximity to existing "good quality" wetlands. These sites will have greater value, in biodiversity terms, by potentially expanding the "good quality" habitat for rare or endangered species, thereby creating habitat networks. Another consideration for wetland creation might be whether the new wetland creates a more suitable habitat for an important species than the habitat it currently resides in, due to changes, natural (hydrosere succession) or artificial, in that existing habitat. Indeed, this natural succession of wetlands from one type to another, as vegetation takes hold, is a major consideration in strategic wetland management at both a local and regional scale – see section 3.3.3.

An assessment of ecosystem services, where appropriate, may also inform wetland creation site selection in incorporating many of the issues outlined above.

### 3.3 To identify existing or potential threats to wetland habitats and actions to reduce these

#### 3.3.1 Pollution

For wetlands, pollution from farming, forestry, land development and industry is the main cause of reduced water quality. The addition of excess nutrients, mainly nitrogen and phosphorous from livestock grazing (in or by wetland sites) and silage or slurry run-off, can cause increased nutrient concentrations, or eutrophication, which leads to many negative impacts such as increased algal growth and a lowering of available oxygen. This can be highly detrimental to aquatic life and drinking waters. Sewage or septic tank run-off from development and housing sites can similarly increase nutrient levels in wetlands. Application of pesticides to crops and application of manures, slurry and artificial fertilisers in farming and forestry surrounding wetlands can all potentially cause pollution. Industrial processes in electronics or, for example, wood tanning may release heavy metals into wetland systems.

Field drainage, infill and erosion are activities which can have a negative impact on water quality. Drainage and infill can directly reduce the ability of the wetland to function. Infill is less likely to occur due to regulatory control of waste products during developments or old style farm tips but some sites will have been lost or are now in poor condition. Drainage affects the water levels in wetlands and leads to succession of species and a reduction in diversity over time. Erosion can begin as a result of drying of the soil surface due to drainage or road building, on peat bogs for example. This may increase the volume of sediment reaching open waters and be detrimental to water quality as described earlier.

Other activities may affect water quality indirectly such as ploughing, harvesting and development activities, which cause erosion on susceptible soil types and increase the amount of silt reaching open waters. Acid rain (acidification) industrial outputs of sulphates and nitrates in cloud droplet form, is most damaging around afforested sites and affects water chemistry, plant and animal life and drinking water quality. Climate change effects, if higher temperatures are realised, could increase surface evaporation and thereby reduce the volume of water in wetlands, potentially accentuating pollution inputs. The key catchments affected by pollution in the Tweed catchment are the Till, Leet and Eye Water, mainly through diffuse pollution from land use activities.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Statutory action</b>		
Controlled Activities Regulations (CAR)	Requirement to register and maintain private sewage treatment systems should reduce pollution incidents.	Property owners SEPA
GAECs/ cross compliance (Single Farm Payment)	To be eligible for the Single Farm Payment Scheme and other direct support payments, participants must adhere to statutory management requirements (SMRs) and maintain land in good agricultural and environmental condition (GAECs). This includes protection of groundwater, use of sewage sludge and water in NVZ areas.	Land managers RPA SEPA SGRPID
Nitrate Vulnerable Zones (NVZs)	To restrict levels and timing of nitrogen applications in order to reduce nutrient enrichment through run-off.	EA Land Managers SEPA SGRPID
Solway Tweed RBMP objectives	Solway Tweed River Basin Management Plan requires a level of improvement in good ecological status plus no deterioration.	All partners
Sustainable Urban Drainage (SUDS)	Wetland systems will filtrate pollutants, toxins and act as a trap for sediment.	Developers Local authorities SEPA
Waste Management Licensing Regulations Controlled Activities Regulations (CAR)	Ensure no waste disposal /tipping activities take place which might adversely impact on wetland sites.	EA , SEPA
<b>Voluntary action</b>		
Awareness raising	Highlight main issues to all users of water, update information in relation to potential effects of climate change and how to make better use of current research and best practice guidelines.	All partners
Buffer strips	Create and manage buffer strips in and around field edges, woodlands and forestry through agri-environment and forestry schemes to reduce effects of potential contaminants on water quality.	Forestry Commission Land managers NE , SEPA , SGRPID
Farm Soils Plan	Target sensitive areas to reduce pollution and soil erosion including a Risk Assessment for manures and slurries (RAMS) and making use of the best practice advice in the 4 Point Plan.	Land managers
Forest and Water Guidelines	Provide best practice to be followed for road building, drainage, harvesting operations to preserve water quality.	Forestry Commission SEPA Woodland managers
Nutrient budgets	Optimise manure, slurry and other fertiliser applications to minimise runoff.	Land managers
Prevention of Environmental Pollution from Agricultural Activity (PEPFAA) code and Voluntary Initiative	Give advice for the safe use and storage of herbicides and pesticides in relation to water resources.	EA Land managers SEPA
Wetland filtration systems	Create reedbeds and constructed wetlands to reduce pollution from farm steading run-off.	EA, Land managers, SEPA , SGRPID
Silvicultural practices	Buffer strips and continuous cover forestry should reduce run-off including potential causes of acidification of water bodies. Industry regulations gradually reducing source emissions.	Forestry Commission SEPA Woodland managers
<b>Other local strategic plans</b>		
Tweed CMP	Promote the use of Constructed Farm Wetland systems.	All partners

### 3.3.2 Water Abstraction

As well as being a diverse habitat that supports a wide range of species, wetlands are also an important physical resource which can be used for public water supply or to meet the demands of agriculture and industry. Elsewhere, electricity generation may also create a demand for water resources, but in Tweed the main uses are water supply for the Borders and Edinburgh and for agricultural irrigation, particularly in the eastern Borders. This resource is perhaps taken for granted but with increasing population, housing and industrial developments and the potential effects of climate change on rainfall, and in turn on agricultural production, there is an ever greater need to look at the demand for water and the capability of the resource to meet that demand.

The main threats to the wetland water resource come from over-abstraction of water or changes in rainfall and temperature (which affects evaporation rates) which could result in drying out and erosion of smaller sites. River basin management planning as required by the WFD only relates to water bodies greater than 0.5km<sup>2</sup> in size and most of the Tweed sites are well below this but may contribute to well over half of the total resource (Badenoch, *pers. comm.*) Wetland vegetation will change if water levels are consistently low and scrub and trees will eventually take root. Lower water levels can also encourage algal growth affecting aquatic life, which in turn impacts on water quality. The amenity and tourism value of open waters could also be affected in the longer term and this may be an important source of income for the area. It is therefore important to be able to quantify the water resource in Tweed and to be aware of the effects of increasing demands on it.



DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Statutory action</b>		
Abstraction regulations for crops and livestock	Efficient use of water is now required by the regulatory authorities – see WEWS below. Sustainable farming, land use and suitable choice of crops are promoted. Links to food security issues.	EA Research SEPA
Habitats Directive	EU regulation that provides robust protection for those habitats and species of European importance. Abstraction is not allowed if negative impact can be proven.	SNH
Solway Tweed RBMP objectives	Solway Tweed River Basin Management Plan requires a level of improvement in good ecological status plus no deterioration.	All partners
Solway Tweed River Basin District Regulations 2004 (River Basin Management Planning)	Promote sustainable water use for agriculture, public water supplies and hydropower.	EA SEPA
Water Environment & Water Services Act (WEWS)	This legislation helps deliver elements of the WFD in Scotland and outlines river basin planning, the Controlled Activities Regulations and duties to provide water and sewerage services (incl. requirement for SUDS).	EA SEPA
<b>Voluntary action</b>		
Awareness raising	Highlight the practical points that can help reduce demand and alleviate the negative impact on wetlands. Raise awareness of climate change and effects on food production if wetland resource compromised.	All partners Tweed Forum Working group
Quantification of water resource	Quantification will enable future demand to be balanced against the protection of biodiversity of wetland habitats. Adds to existing legislation e.g. WFD only considers water bodies over 0.5km <sup>2</sup> size.	Tweed Forum Working Group
Water saving and recycling	Reduced demands on resource by use of rain collectors for household use, offices, industry and installing water saving toilets, washing machines etc.	All partners
<b>Other local strategic plans</b>		
Tweed CMP/AMP	<ul style="list-style-type: none"> <li>Reduce the impact of surface and groundwater abstractions on riverine, riparian and wetland ecology</li> <li>Ensure flows in the rivers and burns of the Tweed catchment meet the requirements of riverine, riparian and wetland species and habitats.</li> </ul>	All partners

### 3.3.3 Loss of Habitats and Species

Wetlands are one of our most diverse habitats, supporting a wide range of species including rare and endangered plants and wildlife (Appendices 3 and 5). Wetlands are vulnerable to changes in management and in the past, as well as being used as a source of grazing, late-hay and animal bedding, wetlands have been drained, infilled and improved for more intensive agricultural use. Wetlands were seen in the past as hosts for diseases of humans and livestock and as hazardous places. Indeed, even in modern times, the potential for increased incidences of liver fluke, foot rot in sheep, clostridial disease and the potential for insects carrying the Bluetongue virus can cause negative feelings from farmers with regards to wetland conservation and restoration. Grazing in particular can be important in maintaining wetland sites in good condition and changes in farming practice can have detrimental effects. Overgrazing can cause damage by poaching, while undergrazing allows the more competitive plant species to dominate at the expense of species which require a short grass sward to thrive. Inputs of nutrients from any of the same sources that affect water quality will also affect plants and wildlife. Removal of a proportion of the annual vegetation production by mowing or grazing was advantageous in fens, swamps and wet-grassland in reducing the overall nutrient "store". Coarse grasses (Common reed, Creeping Bent, Canary Grass) will come to dominate the sward, along with nettles and docks, in areas with higher nitrogen and phosphorous content, whereas open waters will experience eutrophication, which may lead to loss of diversity in aquatic life.

A "wetland" exists only as a point in the ecological journey of succession between open water and wet woodland (hydroseral succession). Raised bogs are particularly susceptible to changes in water levels which allow the peat to dry and colonisation by birch, willow and Scots pine to occur. Drying and erosion of peatlands may also lead to a reduction in the ability of the bog to retain water and slowly release it to the downstream system, in turn leading to a reduction in flood alleviation. Small ponds and mires may gradually fill in towards the centre with vegetation, particularly if species such as *Phragmites* (common reed) are present, however these situations may be reversed by appropriate management, where wetland retention is intended.

The management of wetlands may include the creation or restoration of habitats for flood alleviation, however, in some situations there may be conflicts with existing habitats, for example, tree planting on wet soils in the flood plain which may be a useful habitat for birds, or the creation of wetlands on fields that are well used in-by fields for livestock.

One of the main threats to Tweed wetlands, which cannot be over-emphasised, is their small size and fragmentation, e.g. the Central Border mire sites. This makes them extremely vulnerable to changes in surrounding farming or forestry practice and reduces the likelihood of species (genetic) exchange and colonisation between wetlands. Identifying Tweed wetlands down to this scale will allow them to be linked into a series of habitat networks, creating connections between different habitats and species in an ecosystem or across landscapes. This benefits the movement of species between sites and maintains genetic variability. This approach can help link wetlands and the major river systems, e.g. the Ettrick Habitat Restoration project, which also serves as an educational resource.

There are a number of non-native species of plants and animals which are invasive in the Tweed wetlands and can lead to a reduction in wetland diversity and function. Invasive species will out-compete, due to the absence of any predator to control their growth and, in the case of invasive animals, may directly consume native species. Invasive plant species are listed in Appendix 8 and include Japanese knotweed or Giant Hogweed, both of which form dense clumps that shade out the existing flora and exacerbate soil erosion. Canadian pondweed and New Zealand Pygmy Weed are submerged pond plants which can rapidly take over, smothering more desirable water plants. Some non-natives originate in gardens and can be spread by indiscriminate dumping of waste. The main animal threat is from American Signal Crayfish whose presence is a serious threat to freshwater systems such as ponds, open water, rivers and burns. This alien species will consume juvenile fish and eggs, beetles, amphibians and is very destructive to native species as well as a threat to the region's world renowned salmon fisheries. Raising awareness of this problem and work to eliminate invasive species is ongoing.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Statutory action</b>		
Designated sites	Protection of the habitat and help maintain sites in good condition or improve condition through management. Enables discussion. Habitats Directive gives additional protection of specific sites with SAC & Natura 2000 designations.	Land managers NE SNH
Flood Risk Management	To ensure new habitat creation for flood alleviation objectives do not have a negative impact on existing habitats.	Advisors, EA/SEPA Land managers Local Authorities/Planners
Solway Tweed RBMP (American signal crayfish)	The eradication of American Signal Crayfish where technically and economically feasible is highlighted as an issue in the RBMP.	EA SEPA
Solway Tweed RBMP (American signal crayfish)	Solway Tweed River Basin Management Plan requires a level of improvement in good ecological status plus no deterioration.	All partners
Wetland Typology for Scotland	To assist recognition of wetland types in the field, mainly for the purposes of CAR and the requirement for a Scottish Wetland Inventory.	SEPA
<b>Voluntary action</b>		
Agri-environment & forestry schemes	To create, manage and restore habitats. Potential for creation of habitat networks if information available at planning stage.	Land managers SAC (advisory), SEARS
Animal health plans	Will assist farmers to manage wetlands for biodiversity in the confidence that animal health will not be compromised through increased incidence of disease.	Animal Health Defra Land managers SAC & farm advisors, Vets
Awareness raising	Farm walks, demonstration sites, local community projects to highlight main issues for wetland habitats and important species and management which will help maintain and restore sites.	BFT NWT SWT Tweed Wetlands group
BEETLE (Biological & Environmental Evaluation Tools for Landscape Ecology)	To examine if and how species can move between habitats and assist with management to create habitat networks at a landscape scale. Potential for use as a tool with the Tweed database.	Forest Research Tweed Forum Working Group
Habitat networks	Create linked systems and allow species to move and expand, increasing diversity to create robust systems more able to withstand change.	Land managers Partners in project work Tweed Forum Working Group
Local Biodiversity Action Plans & Habitat Action Plans	Highlights priority habitats and species to maintain and enhance biodiversity.	Northumberland Biodiversity Partnership Scottish Borders LBAP partnership
Project work	Target specific habitats or species where restoration is needed and link networks e.g. Ponds for Wildlife (ponds for great crested newts in central Borders). Scope for education and awareness raising alongside practical work.	Land managers Tweed Forum Working Group
Tweed Invasives Project	Continuation of control and eradication of non-native invasive species. Renew awareness of target species.	Land managers Tweed Forum
Tweed Wetland database/ central information source	To make available an updated site list for consultation, planning and linking management.	Tweed Forum Working Group & Framework
<b>Other local strategic plans</b>		
Northumberland LBAP	<ul style="list-style-type: none"> <li>Maintain the current number of ponds in Northumberland by 2015</li> <li>Increase the number of ponds in Northumberland by 50 by 2015</li> <li>Maintain the current extent of fen, marsh, swamp and reedbed in Northumberland by 2015</li> </ul>	Northumberland Biodiversity Partnership
Scottish Borders LBAP	<ul style="list-style-type: none"> <li>Determine status of wetland habitat in Scottish Borders</li> <li>Ensure no further loss of raised bog habitat in Scottish Borders</li> <li>Restore and where appropriate enhance existing habitat and enhance habitat integrity</li> <li>Maintain an appropriate range of seral stages</li> </ul>	LBAP partnership
Scottish Borders Woodland Strategy	<ul style="list-style-type: none"> <li>Integrate wetland management with new planting or restructuring</li> <li>Identify sites at the planning stage to be kept as open space</li> <li>Links with wet woodland habitat</li> </ul>	All partners
Tweed CMP/AMP	<ul style="list-style-type: none"> <li>Improve knowledge of the extent, status and distribution of riverine, riparian and wetland habitats</li> <li>Encourage the strategic development of habitat networks throughout the catchment, linking riparian, floodplain, wetland, upland and native woodland habitats</li> <li>Improve knowledge, understanding and awareness of the potential threats of non native riverine and riparian species and the need to prevent their introduction</li> <li>Control and where possible eradicate priority non-native species</li> </ul>	All partners



### 3.3.4 Pressures from Tourism and Recreation

The larger ponds and lochs of the Tweed catchment are particularly attractive to visitors who may use the sites for a variety of recreational activities. These include walking and birdwatching, fishing, sailing, swimming, camping and educational visits. Some of these activities such as fishing, in stocked trout ponds or coarse fishing ponds, may be important for the local economy. Smaller sites may have regular visits from specialist interest groups including botanists and lepidopterists. The peatland and hills are well used by hikers and mountain bikers in the area, including long distance paths such as the Southern Upland Way and St Cuthbert's Way which run across the major hills. Many villages and towns have a local pond or wetland which is used for walking or activities such as pond dipping for schoolchildren.

High levels of recreational use can impact wetlands. Large numbers of walkers, horse riders, cyclists, off-road vehicle users and new road access on upland wet soils can cause erosion and drying out on peaty grounds. Wildfowl and other birds and animals may be disturbed by people and dogs and, the ground flora may be trampled and pollution created. Increases in boat fishing may result in trees at the edges of lochs not being cut back, leading to a reduction in fen habitat as the trees shade out the fen vegetation. Appropriate planning is essential to ensure that tourism and recreation activities do not have a negative impact on wetland sites.



DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Statutory action</b>		
Scottish Outdoor Access Code Countryside and Rights of Way Act Core Path Network	To encourage responsible access in the countryside for all activities and avoid disturbance or damage to sites.	Defra Land managers Local Authorities Public SNH
<b>Voluntary action</b>		
Activity and specialist groups	Could provide advice on best practice to avoid impact on wetlands.	Defra Land managers Public SNH
Awareness raising	Use guided walks, demonstration sites, and the eco-schools curriculum to show how recreation and management of sites such as the Ettrick Habitat Restoration project can work together.	BFT Land managers Public SNH Tweed Forum
Borders Access Forum	Can work with land managers to route paths and access around sensitive sites.	Community groups Land managers Public SBC
Scottish and Northumberland Wildlife Trusts	May allow routed access onto sites at certain times of year with advisory noticeboards.	Land managers Public

### *A Balancing Act*

*There may be a fine line between drawing benefits from some of the activities described in section 3.5 below and the threats to wetland habitats, as described above. Careful planning is essential in balancing these activities, in considering benefit against threat and determining the best possible course of action. For example, wetland creation may be used as a tool in controlling flooding, however creating that habitat may have a detrimental effect on an existing wetland. Linking wetlands through habitat networks may benefit desirable species but other alien invasive or undesirable species may use this same network to further infiltrate the catchment. It requires background knowledge of each of the activities at the planning stage to ensure any seemingly positive action does not have a strongly negative impact on another wetland feature (or other habitat).*

### 3.4 To identify the benefits and opportunities that wetlands can bring to landowners and communities and possible actions to achieve these

One of the key properties of wetlands is their ability to provide multiple benefits from the same resource. For example, the action of reedbeds can provide improved water quality as well as wildlife habitat; lochs may act as a public water supply and also a popular recreational area. This is where integrated management of differing interests is needed to maintain a balanced approach. This is particularly true when considering the potential impact of climate change and the potential for damaging storms and heavier rainfall. Raised bogs and blanket bog have an enormous capacity within the peat layers to store water. Within Tweed this is a huge resource and, if maintained in good ecological condition, could have valuable benefits to the human population in flood alleviation whilst enhancing the habitat for plant communities and associated birds and wildlife. In contrast, climate change could also lead to issues of water shortage and wetlands could become a much needed water storage resource.

#### 3.4.1 Safeguarding and Enhancing Water Quality

Good water quality is important for human health as well as aquatic life. Drinking water, in some cases, can be treated at source and dirty water may be addressed by septic tanks, SUDs, constructed wetlands and the use of best practice guidelines for agriculture, forestry and renewable energy. Reducing potential pollutants brings benefits to all, either by reducing the costs involved in treating the water or by improving the habitat for plants and wildlife and thereby maintaining and enhancing biodiversity.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Voluntary action</b>		
Awareness raising	Further highlight the importance of good water quality (incl. cost savings) and practical methods of how to achieve this through demonstration and site visits.	Tweed Forum Working Group
Catchment Sensitive Farming Delivery Initiative (England)	Highlight economic savings to be made in reductions in diffuse water pollution from agriculture by encouraging Catchment Sensitive Farming.	CSF partnership (Defra, EA, NE)
Wetland filtration systems and reedbeds	Habitat creation and enhancement of biodiversity, cleaner water for use by agriculture/industry, lower tech/lower cost solution.	EA Householders Industry Land managers SEARS SEPA (SUDS)
<b>Other local strategic plans</b>		
Tweed CMP/AMP objectives	<ul style="list-style-type: none"> <li>Promote the use of Constructed Farm Wetland systems</li> <li>Increase awareness and promote action amongst farmers of practical ways to reduce diffuse pollution, highlighting the potential economic savings that can be made</li> <li>Continue to address priority catchments and encourage take-up of relevant Rural Development Contracts</li> </ul>	All partners



### 3.4.2 Sustainable Water Resources

Wetlands may become even more important as a water resource with an increasing human population and demands for agricultural irrigation due to climate change. Maintaining water quantity as well as quality is important. There may be scope for the creation of new wetland sites to meet these demands or act as back-up, though the ultimate volume available will partly depend on rainfall. Recycling of water in households and industry and optimal use of water for food production/livestock may become more critical. Many of the Tweed wetlands are small in scale but form a large part of the total water resource for the catchment and there is potential to increase and link these sites with new wetlands across the catchment thereby providing local water supplies. Peatlands and bogs also provide a large water and carbon storage system and there is an opportunity to restore sites to improve their capacity with benefits for associated plants and wildlife. Hydropower, especially small scale, is also gaining in popularity with a clear steer from government towards renewable energy generation from the water resource. SEPA and the EA have individually produced guidance for small-scale hydropower schemes recognising “the importance of renewable energy generation as a contribution to reducing global warming. They can, however, have a significant impact on the water environment if not managed properly” (SEPA) and that whilst “hydropower schemes can help meet renewable energy and greenhouse gas reduction targets... ..we have to ensure that hydropower schemes do not increase flood risk, damage ecology, damage the fish population or obstruct fish migration” (EA).

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Voluntary action</b>		
Awareness raising	Illustrate connection between wetlands and water we use. Opportunities within schools and eco-school programme.	Tweed Forum Working Group
Hydropower	Renewable energy projects may lead to habitat creation, in addition to income generation, decreasing reliance on fossil fuels etc.	EA Householders Industry SEPA
Sustainable farming	Optimising use of water for food production and livestock which may lead to different crops and land uses in future, if climate change results in less rainfall. Water and food security easier to achieve.	Land managers Researchers
Sustainable water use by households and industry	Recycling, minimising use and promotion of water as a resource not to be taken for granted.	Householders Industry
Availability of fire ponds	Locally important water resource in conjunction with habitat creation.	Householders Industry Land Managers

### 3.4.3 Safeguarding and Enhancing Biodiversity

Wetlands are some of our most diverse habitats and are important for species conservation and maintaining genetic diversity, indeed many of our rarest species in Tweed are found in wetlands. If the wetland habitat is in good condition then it is more robust and better able to adapt to a changing environment, including climate change. The diversity of wetlands attracts visitors with an interest in wildlife and they are places which people are drawn to for aesthetic reasons. There is also potential for the creation and restoration of wetlands where appropriate. Agri-environment and project funding can help land managers create ponds and scrapes or manage existing wetlands to benefit plants and wildlife.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Voluntary action</b>		
Agri-environment and forestry grant schemes	Create new wetlands. Positive management of existing sites.	Farm advisers Land managers NE SEARS
Awareness raising	The importance of all wetlands, how they maintain biodiversity and provide further benefits (e.g. ecosystem services). Encourage local interest.	All partners
Borders Wetland Vision; NE Wetland Feasibility Study Phase 1 Habitat Inventory	Will assist with project planning and information needs.	EA RSPB SBC
Forest restructuring	Management of wetland open space within woodland. Leave unplanted with a buffer area to benefit wetland sites and species.	Forestry Commission Woodland managers
Projects	To target specific species, habitat types or geographical area for biodiversity gains. Work with communities, farmers and other land managers.	BFT FWAG England Land managers SEARS SUP Tweed Forum
Tweed Forum Working Group and Cross Border Wetlands Group	Enable further discussion and progression of wetland habitat creation projects and methods to integrate management and support biodiversity.	All partners
Tweed Wetlands database and inventory	Will inform land managers and partner organisations to help target project work and create habitat networks. Receive updates and information from individuals and organisations for practical use.	All Database Host to update database
<b>Other local strategic plans</b>		
Tweed CMP/AMP	<ul style="list-style-type: none"> <li>Encourage the retention and expansion of wetlands and natural ponds to safeguard and enhance ecosystem services</li> <li>Promote and encourage agricultural practices, which maintain, enhance and create wetland areas and ponds</li> <li>Continue to address priority catchments and encourage take-up of relevant Rural Development Contracts</li> <li>Encourage the strategic development of habitat networks throughout the catchment, linking riparian, floodplain, wetland, upland and native woodland habitats;</li> </ul>	All partners

### 3.4.4 Flood Alleviation

One of the wider public benefits of wetlands is their increasingly important role in flood alleviation. Natural wetland habitats, including peatlands, ponds and other wet soils, have the potential to store water and release it slowly into the system, thereby reducing immediate flooding effects after heavy rainstorms as well as sustaining flow through the year. Strategic siting of wet woodlands on flood plains can also be beneficial through the action of physically blocking and slowing the flow of water.

For example, the Till Wetland Restoration Project has been working on the creation and restoration of wetland habitats in the Wooler area since 2003, in order to reconnect the River Till with its natural floodplain and create a series of interconnected habitats. This has involved the removal of built flood defences to allow the river to inundate adjacent fields at high flows. There will be great benefits for the species associated with the wetland habitats and also as a demonstration site to inform sustainable flood management best practice. Another example, the Craik Natural Flood Management Demonstration Project is looking at remedial techniques to help increase flood storage and slow the rate of run-off via habitat creation and restoration at Craik in the upper Borthwick catchment.

The Floods Risk Management (Scotland) Act 2009 and Catchment Flood Management Plans in England seek to bring together all organisations involved in flood management to cooperate and coordinate their work. Sustainable flood management was adopted within the Water Environment & Water Services Act 2003 and encourages the use of natural flood management techniques to reduce flood risks in the future. It is likely that the Floods Act will become a significant driver for wetland work in Scotland in the future.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Statutory action</b>		
Flood Risk Management (Scotland ) Act 2009	Encourage adoption of sustainable flood management which includes creation and restoration of wetland habitats. Craik and Till projects as working examples for demonstration.	EA Natural England Project partners SBC SEARS SEPA
<b>Voluntary action</b>		
Habitat management	Ponds, fens, floodplain wetlands, upland peatlands, wet woodlands, other wet soils – encourage further creation and management in upper regions within flood risk catchments.	Land managers Natural England SEARS
Borders Wetland Vision	Maps sites for potential wetland expansion and target natural flood management habitat creation for catchments where flood risk is highest.	Tweed Forum Working Group
<b>Other local strategic plans</b>		
Tweed CMP	Disseminate and, where appropriate, implement NFM approaches that exploit rather than resist the natural dynamics of rivers and wetlands.	CMP partnership

### 3.4.5 Tourism and Recreation

The diversity of wetlands and the aesthetics of ponds and lochs make them attractive places for visitors undertaking a range of activities from walking and wildlife tourism to fishing and sailing. Wetlands can also be a place to teach people about social and rural history, e.g. peat would have been cut from bogs for fuel and ponds would have supplied the power for mill wheels. These activities may have prevented some wetlands from becoming woodlands and preserved their diversity for several centuries. Historical interpretation and information on the plants and wildlife of wetlands can be of interest to specialist groups as well as the general public. Local communities can become involved in wetland restoration, e.g. reedbed planting by Glendale school pupils at Fenton as part of the Till Wetland Restoration Project. Other sites have recreational potential such as the Ettrick Marshes, enhanced through management work between Borders Forest Trust, Forestry Commission and the local community, which is a popular orienteering site. It is the varied landscape and range of outdoor activities that brings many visitors to the area and wetlands may play an important role in the local tourism economy. As with all potential benefits derived from wetlands, it requires careful planning to ensure recreational wetland use does not have a negative impact on the wetland itself.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Voluntary action</b>		
Fishing practices	Management of existing or new fishing ponds within larger wetland systems.	Fishing associations Land managers RAFTS
Sport and recreation	Training courses, schools, clubs , associations - liaison through a project officer to encourage feedback and beneficial management through users of wetland for recreation.	Local initiatives
Wetland visitor sites	For demonstration, education, recreation with funded support.	Local business Land managers Public
Wildlife tourism	Focus on organised site visits and specialist input.	Local business Land managers Public
Tourism datasets	Assess current value of wetland recreation to local economy	Tweed Forum Working Group
<b>Other local strategic plans</b>		
Tweed CMP	Conserve and enhance the fisheries of the Tweed catchment.	CMP partnership

### 3.5 To raise awareness of wetlands as an important natural resource

Wetlands can provide multiple benefits, such as supporting a diverse range of plants and animals (biodiversity), a water resource, a mechanism for flood alleviation and mitigating the effects of climate change, field sites for education and as places to enjoy. It is important to consider how to broadcast this message to the general public and also to the organisations whose work concerns wetland management, to enable them to understand the importance of integrating their ideas and actions for the benefit of all.

DELIVERY MECHANISM	OBJECTIVES RELEVANT TO THIS STRATEGY	ACTION BY
<b>Voluntary action</b>		
Demonstration sites	Walks, events, open days, for farmers, organisations, local community and school visits.	Land managers Project partners Tweed Forum Working Group
Eco-school programme	Highlight how wetlands work, visits, school ground ponds, bog gardens.	BFT LBAP SBC
Information and interpretation	Good information, updates and interpretation readily available at accessible sites. Produce a general information leaflet available at public places e.g. libraries and visitor centres.	Linking to a project
Local ponds and wetlands	Encourage restoration and enhancement of local sites with community involvement, safe access.	BFT Land managers SUP Tweed Forum
Policy	Prioritise as a resource for management within local policy, planning, projects and schemes.	Defra EA Local government SEARS
Tweed Forum Working Group, LBAP Partnership	Exchange of information and working together on projects.	All partners
<b>Other local strategic plans</b>		
Scottish Borders LBAP	Promote the value of wetland through education and awareness	LBAP partnership
Tweed CMP	Raise awareness of the importance of wetland sites with appropriate interpretation and guided walks for the public and schools.	

### 3.6 To prioritise actions

Accepting that the resources of those organisations identified as potentially delivering Strategy actions are finite, we must prioritise those actions to ensure that, as far as possible, those of vital importance take place. By a process of consultation, consensus will be sought amongst Tweed catchment stakeholders to arrive at a prioritised “action plan” which will be delivered via the recognised the Tweed Forum Working Group structure (which currently delivers “priority” actions from the Tweed Catchment Management Plan). This strategy has been written in partnership with the Tweed catchment stakeholdership and has sought to highlight the main issues throughout and suggest routes for action. However, it must be recognised that priorities will change over time in response to changing circumstances and we therefore would direct interested parties to the online resource for up-to-date information on “priority” actions.

One of the key actions will be the compilation of a wetland database/central information source for the Tweed catchment and an adaptable framework to allow this to be updated and of practical use. Secondly, consensus on which sites are in most need of attention and what form this should take must be sought. This will underpin all other actions to inform and raise awareness of wetlands to help maintain and enhance biodiversity and safeguard the ecosystem services wetlands provide.

OBJECTIVE	ACTION BY
Ecosystem services valuation for Tweed wetlands	Tweed Forum Working Group
Prioritise Wetland Strategy actions and deliver via Tweed Forum Working Group structure	Tweed Forum/Wetland Strategy Steering Group
Disseminate priority Wetland Strategy action	Tweed Forum/Wetland Strategy Steering Group



Yetholm Loch



## 4. Conclusions

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The Tweed Wetland Strategy sets out an adaptable framework for the integrated management of wetland habitats (as defined within this document) and facilitates linkages with other strategies and project work. Successful delivery of the Strategy's aims will involve input from a broad range of interests from land managers, government and non-government organisations to community and recreational groups.

The Strategy identifies the need for an accessible inventory and database of wetlands to help stakeholders make management decisions based on hard facts. This will benefit all aspects of our wetland resource including water quality, habitat and species conservation, flood alleviation, tourism and recreation, as well as encouraging a network of habitats better able to adapt to climate change.

The Strategy also highlights the threats to wetlands, particularly regarding species diversity and water quality. Some of the threats may exist alongside the potential opportunities wetlands can bring to all of us. It is this fine line between achieving benefits and avoiding potential detrimental impact which makes the Strategy an essential tool for future wetland management. Current thinking, policies and legislation will have influenced this Strategy but the process of reviewing the aims and objectives through discussion within the Tweed Forum Working Group and maintaining access to updated information will help ensure integrated and sustainable management of the Tweed wetlands in the future.

Ultimately, this Strategy, plus the accompanying central information source, should inform current wetland conservation/management processes as well as introducing new concepts to key decision-makers. It should form the starting point for the next phase of strategic wetland conservation in the area, supporting the Tweed Forum Working Group in the delivery of coordinated action throughout the Tweed catchment.



## GLOSSARY

<b>Biodiversity</b>	The diversity of life in any habitat or geographical area.
<b>Carbon sink</b>	Accumulates and store a carbon-containing chemical compound for an indefinite period (may be natural or manmade).
<b>Dystrophic</b>	A pond or lake containing high levels of humus, tending to dark coloured water, lacking in oxygen, and unable to support much plant or animal life.
<b>Ecology</b>	The science of the interactions between plants and animals and the environment they live in.
<b>Ecosystem</b>	The complete unit and set of relationships between people, all plants and animals and the habitats they occupy.
<b>Ecosystem Services</b>	Benefits to human populations from natural resources and processes in an ecosystem e.g. clean drinking water, waste decomposition, see Figure 1.
<b>Eutrophic/ eutrophication</b>	An increase of nutrients into an ecosystem, which increases algal or plant growth such that the concentration of oxygen in the water is decreased to the detriment of water quality, fish and other animal life.
<b>Evapo-transpiration</b>	The total discharge of water from the earth's surface to the atmosphere by evaporation from lakes, streams, and soil surfaces and by transpiration from plants through their leaves.
<b>Habitat</b>	The area where an organism, or community of organisms, normally lives or occurs.
<b>Habitat network</b>	A configuration of habitat that allows species to move and disperse through a landscape.
<b>Hydroseral succession</b>	The progression of wetland habitat type from one to another as vegetation growth and changing water levels takes effect. This leads from open water to wet woodland with various stages between.
<b>Integrated management</b>	Planned action incorporating any physical, technical, administrative, and legal issues in a manner designed to increase combined benefits or achieve a more equitable apportionment of benefits.
<b>Land Managers</b>	In the context of the Strategy this includes farmers, landowners and agents acting to advise and manage the land.
<b>Mesotrophic</b>	Reservoirs and lakes which contain moderate quantities of nutrients and are moderately productive in terms of aquatic animal and plant life. Between oligotrophic and eutrophic status.
<b>Mineralisation</b>	The breakdown of organic matter in the soil to form soluble inorganic compounds.
<b>Minerotrophic</b>	Soils and vegetation whose water supply comes mainly from streams or springs. The base rock or minerals the water runs over will influence its chemical make-up.
<b>National Vegetation Classification (NVC)</b>	One of the key common standards aimed at producing a comprehensive classification and description of the plant communities of Britain, each systematically named and arranged and with standardised descriptions for each.
<b>Natura 2000</b>	A network of ecological sites (natural or semi-natural) with high heritage value because of the natural habitats or exceptional flora and fauna formed under the European Union with two categories SPA (Special Protection Area) relative to the 1979 Birds Directive and SAC (Special Area of Conservation) relative to the 1992 Habitats Directive.
<b>Natural Flood Management</b>	Flood alleviation techniques that aim to work with natural processes to reduce flood risk e.g. replanting upland forests, reconnecting rivers to their flood plains and restoring wetlands to act as natural sponges for flood waters.
<b>Natural Succession</b>	Changes in the composition or structure of an ecological community, progressing from one state into another e.g. from open water to wet woodland.
<b>Oligotrophic</b>	Lake or pond which is poor in plant nutrient minerals and organisms and usually rich in dissolved oxygen at all depths.
<b>Ombrotrophic</b>	Soil or vegetation which receive all of their water and nutrients from precipitation, rather than from streams or springs ('cloud fed').
<b>Oxidation</b>	The combination of a substance with oxygen e.g. iron oxide in soils giving them their distinctive rusty red appearance.
<b>RAMSAR</b>	International convention on wetlands of international importance, signed in Ramsar, Iran in 1971. Provides a framework for action and co-operation for the conservation and wise use of wetlands and their resources.
<b>Single Farm Payment</b>	A central objective of the 2003 reform of the Common Agricultural Policy was the decoupling of direct payments. The Single Payment Scheme was introduced under which farmers receive a decoupled Single Farm Payment which is not directly linked to production.
<b>Soligenous mire</b>	The wetness of the ground is maintained by slow lateral gravitational seepage of water through the substrate or the peat.
<b>Topogenous mire</b>	Marsh, swamp, or fen that develops as a result of a high local ground water table caused by local relief such as a poorly drained basin or underlying impervious rock strata.
<b>Wetland</b>	Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.

ACRONYMS	
AMP	Area Management Plan
BAP	Biodiversity Action Plan
BFT	Borders Forest Trust
BSBI	Botanical Society of the British Isles
CAR	Controlled Activities Regulations
CMP	Catchment Management Plan
CSF	Catchment Sensitive Farming
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FWAG	Farming and Wildlife Advisory Group
GAEC	Good Agricultural and Environmental Condition (cross compliance)
HAP	Habitat Action Plan
LBAP	Local Biodiversity Action Plan
NE	Natural England
NNR	National Nature Reserve
NVC	National Vegetation Classification
NVZ	Nitrate Vulnerable Zones
NWT	Northumberland Wildlife Trust
RBMP	River Basin Management Plan
RPA	Rural Payments Agency
RAMSAR	Designation for wetlands of international importance
RSPB	Royal Society for the Protection of Birds
SAC	Scottish Agricultural College
SAC	Special Area of Conservation
SBC	Scottish Borders Council
SEARS	Scotland's Environmental and Rural Services
SEPA	Scottish Environment Protection Agency
SGRPID	Scottish Government Rural Payments and Inspections Directorate
SNH	Scottish Natural Heritage
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Drainage Systems
SUP	Southern Uplands Partnership
SWT	Scottish Wildlife Trust
WFD	Water Framework Directive

*Note – Appendix 7 gives links to documents and websites for some of the items listed above*



## Appendix 1. Classification and description of major wetland types

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Wetlands types are dictated by their water levels, their water throughput, their water origins and chemistry, and the impinging climatic regimen (rainfall, evapo-transpiration etc.)

The main focus is on the 8 types listed in section 2.2.1 which are:

1. Blanket bog
2. Raised bog
3. Fens and basin mires
4. Flushes
5. 'Schwingmoor'/floating mire
6. Swamp
7. Open waters (ponds, lochans, lochs, lakes, reservoirs —natural, impounded, excavated)
8. Wet soils

### Classification Within the Major Types

The most meaningful way of classifying wetlands, so that they can be compared is probably by their fundamental chemical character. Such a classification affects the primary (vegetation) production as well as determining what dependent animals, invertebrates, fish and, to a much lesser extent, birds, mammals, will occur.

Within the major types, the simplest basic classification must be made on water chemistry. This relates to:

- the individual water source
- upper layers of muds/sands/gravels
- chemistry of the underlying water capsule, and the degree to which it affects vertical layers and vegetation
- organisms in the bottom soil layer
- microscopic aquatic organisms
- submerged/ floating/ emergent/ bankside vegetation
- invertebrates, amphibians and birds which during at least part of their life cycle leave the wetland of their origin and fly/crawl/ swim to other wetlands, including the sea, taking with them some chemical components. (This may seem to be extreme but in the case of open waters and mires with a very slow return time, i.e. where incoming water is held for a long period, Chironimids and Oligochaetes, for example, may account for the main loss of available phosphate, which is, with silicate and nitrate one of three usually limiting chemical components in wetland systems. A local example of this would be Coldingham Loch which has a return time in excess of three years).

Subsets within this chemical classification are :

- wholly natural wetlands at any stage from open water to wet woodland – in Tweed probably no open water except remote sites such as Gameshope Loch is fully "natural".
- wetlands altered by natural events – river capture; landslip, channel changes e.g. Yetholm Loch, Billie Mire
- wetlands partially altered by human activity to raise water levels by damming e.g. Hoselaw Loch, Lindean Reservoir
- wetlands partially altered by anthropogenic activities to lower water tables such as drainage/peat digging/ marling e.g. Lindean Reservoir, Linton Loch
- wetlands which are almost entirely artificial e.g. The Hirsell, Megget and Talla Reservoirs
- wetlands which remain after drainage/dam removal e.g. Philhope Reservoir
- wetlands routinely used by large quantities of wintering or breeding wildfowl/gulls as a daytime roost, night-time roost or feeding site which significantly changes total and available phosphorus and other chemical values e.g. Hoselaw Loch, The Hirsell
- open-waters which are of a volume and conformation to routinely stratify in winter e.g. Coldingham Loch
- wetlands which have suffered such serious 19th/20th century enrichment, usually by agricultural fertilisers, as to alter their nutrient state and typical flora/fauna e.g. Yetholm Loch, Hirsell, Coldingham Loch

Within individual habitats there may be variations in water chemistry due to, for example, flushes from other habitats or mineral sources or 'well-eyes' (upwelling springs from underlying till and rock such as at the Whitlaw Mosses).

Strategy Type	Defined as:
Blanket Bog	Masses of accumulated, ombrotrophic Peat, between 30 – 400cm. deep, found usually above 500m in Strategy area, on gentle slopes/plateaux lying within c.160 wet-days precipitation. Acid, species poor vegetation.
Raised Bog	Deep (to 10m. +) accumulated ombrotrophic peat of topogenic origin on (usually) poor-fen base. Steep sloping sides (rand) with peripheral burn (lagg) which often has poor-fen and birch/willow carr. With or without underlying water capsule. Acid, species-poor vegetation. Drying surface can lead to scrub regeneration (Scots Pine, Birch, Willow, Juniper etc.)
Poor Fen	Topogenous basin mire influenced by nutrient-poor groundwater which is often acid-neutral. Usually mid-altitude Usually permanently wet. Moss-sedge dominated, with typical forbs, succeeding to Birch/Willow carr. Can include valley mire. Vegetation circum. neutral With or without water capsule.
Rich Fen	Topogenous basin mire influenced by nutrient-rich groundwater, neutral – basic. Usually at mid-lower altitudes. Sedge & Herb-rich vegetation., succeeds to Alder-Bay Willow carr with Ash. Can include valley-mire. Rich in invertebrates With or without water capsule.
Flush	Linear or lateral down-slope soligenous seepage often originating where underlying rock is near the surface. Hence usually moss- sedge dominant but with tall-herb variants. Usually permanently wet with downslope percolation on mineral soil which has high organic matter but little peat accumulation. Close affinities with fens. Sparse willow scrub can occur.
Schwingmoor/ Floating Mire	Raft of floating moss and sedge-based vegetation, but also with characteristic broad- leaved species. To 2m. deep. Often continuous with poor fen – to landward – and swamp/open water to loch. Some have limited scrub birch and willow.
Swamp	Almost synonymous with Open Water Transition. Continuously wet, and dominated by bulky, emergent sedges, reeds, and forbs. Usually continuous with open waters and drier wetlands, so that their absolute area is not well-defined by mapping or air-photographs
Open Water	Self-evident. Often in continuum from swamp, Mapped open waters may also include portions of swamp.
Wet soils	As stated in section 2.2.2 of the main document, may occur under different habitats e.g. grasslands and woodland. Wet soils exist in the B & C soil horizons as gleying without surface water-logging and hence any obvious vegetation change.

	SEPA Type	Typologytypes which may occur within (W) or merge (M) with strategy types
	8a- Peat Bog	2a - Wet grassland (M) 2b - Montane grassland (W/M) 3a - Montane flushes (W/M) 3c - Other springs (W/M) 3d - Seepage/flushes (W/M) 4 - Poor fen 5 - Sedge swamp 7 - Wet heath
	8b Peat bog	1a - Bog Woodland (W) 2a - Marshy grassland (M) 3c - Other springs (M) 3d - Seepage flushes (M) 4 - Poor fen (W/M) 5 - Swamp (M) 6 - Reedbed (M) 7 - Wet Heath (M) 8 - Schwingmoor (W/M)
	4 Fen	1b - Other wet woodland/carr (W/M) 2a - Marshy grassland (W/M) 3a - Montane flushes/seepages 3c - Other springs (W/M) 3d - Seepages/flushes (W/M) 4 - Rich fen (M) 5 - Swamp (W/M) 6 - Reedbed (W/M) 7 - Wet Heath (M) 8a - Raised Bog/Blanket Bog (M) 8b - Schwingmoor
	4 Fen	1b - Other wet woodland/carr(W/M) 2a - Marshy grassland (W/M) 3a - Montane flushes/seepages 3b - Tufa (W/M) 3c - Other springs (W/M) 4 - Poor fen (M) 5 - Swamp (W/M) 6 - Reedbed (W/M) 7 - Wet Heath (M) 8a - Raised Bog/Blanket Bog (M) 8b - Schwingmoor (W/M)
	3 Springs/flushes & seepages.	1b - Other wet woodland/carr (M) 2a - Marshy grassland (M) 2b - Montane grassland (M) 4 - Rich and Poor Fen (W/M) 5 - Swamp (W/M) 6 - Reedbed (rarely) (M) 7 - Wet Heath (M) 8 - Peat bog (M)
	8b Quaking Bog	2a - Marshy grassland(M) 3 - Flushes (rarely) (M) 4 - Poor fen (M) 5 - Swamp (M) 6 - Reedbed (rarely) (M) 8 - Peat bog ( if water-level rise)(M)
	5 Swamp 6 Reedbed	1b - Other wet woodland/carr 2a - Marshy grassland 3 - Springs/flushes/seepages (rarely) 4 - Poor and Rich Fen 7 - Wet Heath (rarely) 8b - Schwingmoor (rarely)
		1b - Other wet woodland/carr (M) 2a - Marshy grassland (M) 3 - Flushes etc. - impingent (M) 4 - Poor and Rich Fen (M) 5 - Swamp/open-water transition (M) 6 - Reedbed (M) 7 - Wet Heath (rarely after water level rise)(M) 8a - Peat Bog (If water level rise)(M) 8b - Schwingmoor

Note – the Typology includes 10. dune slacks and 11. machair which are not present in the Strategy area. There is one small area of type 9. salt marsh

# Overview Descriptions of Wetland Types Within the Strategy Area

## 1. Blanket Bog

Blanket Bog is dependent upon incoming precipitation, such as snow, hail, rain, mist or haar, a cooler climate, level or gently sloping ground at altitudes which engender wet vegetation and the accumulation of *Sphagnum*, bog mosses and their associates. In the flat-summits plateaux of the Strategy area these conditions tend to occur above approx. 500m. Blanket Bogs are therefore both topogenic and ombrotrophic, relying little upon mineral groundwater. The origins of such bogs give rise to continued argument. They may have arisen as the climate cooled and precipitation increased during the Atlantic period, when tree and scrub growth became more limited, and this development may have been confounded by the concomitant effects of deforestation through grazing and burning by early settlers who undoubtedly utilised the more lightly-wooded Southern Upland hill ridges, as opposed to the dense wet woodland of the valleys.

It is important to realise that Raised Bog and Basin Mire elements occur within Blanket Bog, since bog and fen lenses developed to varying extents in uneven hollows of the glacial till, prior to the spread or coalescence of Blanket Bog. Except where these are still at the surface, such lenses are usually completely obscured by overlying blanket peat. Equally, the issue of more nutrient-rich and basic water from underground springs in underlying rock, often result in more basic Flush communities. But the essence of active Blanket Bog is ombrotrophic.

The prevalence of Blanket Bog on the hill ridges, spurs and plateaux of the Tweed catchment is evident, despite linguistic differences across the Strategy area, by names on the upper ridges and slopes such as Peat Hill, Peat Rig, Hag Dod, Haggie Slack, Haggie Knowe, Black Hagg, Burrowstown Moss, Dinley Moss, Dun Moss, Byhass Fell, Hawkshass, Moss Law, the Queen's Mire, Foulmire Heights, Reedy Edge, etc. Such Blanket Bog has been an evolving part of the hill landscape of the Strategy area for at least 3500 years, accumulating between one and twelve centimetres of peat depth per hundred years (Tallis, 1995). Always subject to climatic change, the hill peats of the Border were, in many cases, too far removed from centres of human settlement to have been much used as fuel although few escaped the prevalent heather burning and extensive grazing. Most are now degraded and damaged to a greater or lesser extent with gully and edge erosion widespread.

Blanket Bog can be prone to over-saturation by incoming deluge whereupon they "flow", an eponymous title found elsewhere in the U.K. but seldom in Tweed catchment, probably due to the relatively dry climate. But there are Hobbs Flow; Roan Fell Flow; Flowesware Rig, Hartsgarth Flow, Sundhope Flow, Hawklee Flow, Broad Flow and other similar names scattered especially across the south and west of the area. Such "flowing" occurred after a cloud-burst at Tudhope in Liddesdale and towards Great Moor in upper Teviotdale in the 1980s. Increasing rainfall events as a result of climatic change may increase the frequency of such "flows".

Blanket Bogs play a highly significant role in water quantity, its absorption, storage and seasonal release. They absorb a degree of incoming precipitation on the hill summits and plateaux, modifying run-off and so reducing downstream flooding. Their peat-mass is raised above the level of the rock/drift/mineral substrate and so a considerable volume of water is held which would not otherwise be there. Thus they provide steady release of drainage-water from the mass. Blanket Bog peat is of considerable importance in maintaining adequate discharge to stream headwaters throughout the season. Blanket Bogs also have a peat mass which lends itself to stratigraphical studies, although most stratigraphy in the Strategy area has been carried out on Raised Bogs (see below).

The species of Blanket Bog in the Strategy area are not usually atypical or rare. They share many invertebrate and plant communities with adjacent wet heaths, flushes and peaty podsols, as well as with Raised Mosses (which are usually at lower levels). The peat of such blanket mire, grades in thickness gradually into adjacent minerotrophic soils (wet heaths, wet and flushed grassland etc.) which have a greater or lesser degree of peaty top. Centuries of burning and grazing has oxidised and re-distributed peat round the edges of eroding Blanket Bogs, especially obvious in the drier hills of the Moorfoots, Lammermuir and Cheviots, and this is invaded by forms of *Nardetum sub-alpinum*, first recorded in the Moorfoot Hills by Smith, (1918). The burning and grazing of the last four hundred years or so has also changed the dominance of much of the Scottish Borders Blanket mire from one dominated by *Sphagnum* species, *Calluna*, *Erica tetralix* etc. to a co-dominance of *Eriophorum vaginatum* (towards the "Pennine Bog" of Tansley), and severe reduction of active *Sphagnum*, its place being taken in large parts by *Polytrichum commune*.



**Characteristic Species:**

<i>Sphagnum compactum</i>	<i>Sphagnum imbricatum</i>	<i>Sphagnum magellanicum</i>
<i>Sphagnum russowei</i>	<i>Rubus chamaemorus</i>	<i>Erica tetralix</i>
<i>Calluna vulgaris</i>	<i>Vaccinium uliginosum</i> (Liddesdale only)	<i>Eriophorum angustifolium</i>
<i>Trichophorum caespitosum</i>	<i>Eriophorum vaginatum</i>	
Dunlin	Fox Moth	
Golden Plover	Oak Eggar	
Black Grouse	Golden Ringed Dragonfly	

Table 1 gives a breakdown of the areas of Blanket Bog in the Strategy Area. These are taken from Soils Survey Scotland maps: Muir (1956); Ragg (1960); Ragg & Fuddy (1965); Bown (1985) and Soils Survey and Land Research Centre (1984). "Hill Peat", the classification for mapping, has been taken as ca. 30 cm and above. The depths are variable depending upon the underlying topography with depths of up to 4m in the Moorfoots. More usually it is between 1- 2m although erosion (hagging) at the edges, oxidation due to bad muirburn practice and surface wind-blow alters depths considerably, as has previous peat-cutting and turf removal for fuel and roofing material.

Most Blanket Bog in the Strategy area has had its hydrological integrity broken by drainage, bad muirburn practice, bad winter-feeding practice, sheep lair "scars" and by major damage such as road cutting and celebration bonfires. Peat cutting did occur in places, e.g. Lauder Common, Roan Fell, but this traditionally has been done by cutting and removing the surface vegetation to one side of the peat extraction and then replacing the turf so that active bog growth could continue.

Within the Strategy area Blanket Bogs are usually either inactive, i.e. without an actively accumulating Sphagnum complex due to drainage or fragmentation of the hydrological unit, and/or still subject to inimical management, i.e.

- muirburn above 600m, leading to edge and surface oxidation/erosion;
- excessive grazing and localised trampling/ sheep "lairs" leading to erosion problems as in muirburn;
- repeated surface, "sheep" drainage/ "gripping";
- forestry drainage;
- forestry ploughing;
- forestry planting;
- progressive erosion from recreational access;
- progressive erosion from vehicular tracks/forestry extraction/ roading.;
- poorly executed peat cutting (very local);
- wind farm/electricity access roading/cable laying/ pylon bases etc.

All these can apply to any Blanket Bog unit, to varying degrees. They are likely to be exacerbated by changes in climate (increasing rain events; rainfall droplet size; impact strength; wind speeds etc.). Massive peat slips occurred, as at Duntae, Kielderhead in the early part of the millennium as progressive isolation of peat areas takes place.

**Table 1** Approximate Areas of Blanket Bog: (see text for sources)

BLANKET BOG UNIT	APPROX. AREA (HA.)	OF WHICH AFFORESTED (HA.)	COMMENTS
Lammermuir: (East of A7)	4471	287	Contiguous with East Lothian. Main outliers are on Hartside, (east of A68) Soutra, Kelfhope. Spartleton Edge; Gamelshiel etc. Much edge wastage and agricultural improvement.
Moorfoots (West of A7 as far as Eddleston Water South to Tweed)	5252	217	Contiguous with Midlothian. Main outliers are: Scroof-Yardsstone Hills; Town Law; Wull Law; Torphichen Hill Woolly Law; Dundreich Plateau. Much wasted and oxidised due to poor muirburn and overgrazing.
Pentlands (Tweed) (includes Kelly Heads/Cloich Hills) Pentlands (N. Esk)	1806/119	63	Contiguous with Lothians & Lanarkshire. Main outliers are: Baddinsgill East; Wether Law; Faw Mount.  Much eroded and oxidised due to poor muirburn, overgrazing and agric improvement.
Glenholm/Broughton	514	71	Mostly a thin strip contiguous with Lanarkshire & Dumfries and Galloway. Main outliers are Middlehead; Glenlood Hill; Cockle Rig; Broomy Law
Tweedsmuir	4578+*	222+*	*Missing data east of grid line 15. (c.3200ha.)  Main outliers are Cairn Head; Muckle Side; Tods Knowe; Pykestone Hill; Megget Stane; Dead for Cauld.
Yarrow/Ettrick/Ale/Borthwick	3329+*	107 + *	*Missing data west of grid line 27; north of grid line 16 to District Boundary. (c.5700 ha.)  Main outliers are Altrieve Rig-Peat Law-The Wiss; Hawkshaw Rig;
Teviotdale	1040+	412+	* Missing data south of grid line 16; west of grid line 26 (est. 2150 ha. total of which 70 afforested).
Cheviot (Scotland)	2300	893	Contiguous with Northumberland/Cumbria/ Liddesdale. Main outliers are The Curr, Schil, Dodd Hill, Crook law; The Bank; Calroust Hopehead; Churchope-Cowie Law; Coquet Head; Peat Shank; Lamblair Edge; Tamshiel Rig; Windburgh Hill.
Cheviot (Till)	<i>forthcoming</i>	<i>forthcoming</i>	Contiguous with Cheviot (Scotland) - above - and other Northumberland. Data awaited.
Liddesdale	6495	1363	Contiguous with Cheviotdale/Cheviots.

The long-term prognosis for such mires is largely unknown since they have been severely modified by surface “sheep” drains extensive grazing and, more importantly by burning, and have developed open peat edges currently susceptible to winter frost-heave and summer oxidation of their eroding edges, exacerbated now by the developing pattern of increased heavy rainfall events.

## 2. Raised Bog

As for Blanket Bog, Raised Bog is dependent upon the ombrotrophic growth of *Sphagnum* mosses which have developed usually upon sedge swamp or fen peats in discrete topographic hollows. They have developed at any altitude, their requirement being a suitable basin and moderate precipitation, but they remain more obvious within lowland areas since they have generally resisted agricultural improvement. Indeed in some examples in the catchment the “residual” originating fen vegetation is sometimes apparent in what has been termed “ecological lag” e.g. at Wester Branxholme Loch Bog.

It is estimated from the summarised wetland inventory (prepared for the Tweed CMP in 2006) that there are around 42 remaining Raised Bog lenses within the Strategy area, ignoring those which have been partly or wholly occluded by overlying Blanket Mire. At least 40 of these are estimated to be over 2 ha and so demand management attention within this Strategy. Their shape is defined by their topographic origins (see for example Ingram, 1982) and they will expand to fill the available basin, until of such a height as to physically limit their growth, the surface in apparent equilibrium with the evapo-transpiration, when they are often invaded by scrub, or else “flow” beyond their topographic boundaries as with Blanket Bogs. In contrast to Blanket Bog (see above) there are no recorded instances of Raised Bog “flows” in the Strategy area.

A peculiarity within the Strategy area is the common occurrence of Raised Bog and intermediate Blanket Bog to the east of Berwickshire (Drone Moss, Old Cambus Moss, Penmanshiel Moss, Broad Bog, Coldingham Common, Lamberton Moor etc.) where the rainfall at around 650mm is less than would normally be associated with ombrotrophic development. Snowfall along this coast is more common than elsewhere in the lowlands but there is still not enough to explain such *Sphagnum* growth. It is now suggested that this oddity is due to the phenomenon of North Sea “haar”, when onshore winds carry heavy mist onto this part of the country during May and June, when otherwise evapo-transpiration would be at its annual highest.

As with Blanket Bog, Raised Bogs are then both topogenic and ombrotrophic, little influenced by mineral groundwater, except around their periphery where the peat dome steeply descends (the rand) to a circumferential flush (the lagg burn) in which there is often poor, but sometimes rich fen, and Alder or Willow carr. Such carr development is often obscured by peat-cutting or later landuse, but vestigial examples occur at Drone Moss, Din Moss and Threepwood Moss. Occasionally there are more basic flushes emanating, presumably from buried springs, within Raised Bogs and, as with Fen, peripheral springs may result in “well eyes” on parts of the lagg burn (e.g. at Wester Branxholme Loch Moss). Crucially, in terms of their water-holding capacity, because they are “raised” above the surrounding groundwater, the water-content (of the *Sphagnum* dome), the ellipsoid “acrotelm” is considerably greater than the mere volume of their containing basin (“catotelm”). This means, of course, that their discharge rate for downstream stream channels is of considerable importance during low summer/drought flows.

### Characteristic Species

The basis of the Raised Bog are *Sphagnum* species, the predominant types shared with Blanket Bog, although more lowland/minerotrophic species occur:-

- *Sphagnum imbricatum*
- *Sphagnum papillosum*
- *Sphagnum palustre* (increasing groundwater influence/ basicity and often under carr)
- *Sphagnum magellanicum*
- *Sphagnum squarrosum* (as for *S. palustre*)
- *Sphagnum capillefolium*
- *Sphagnum fuscum*
- Dwarf shrubs and Cotton-grasses as for Blanket Mire
- Adder
- Large Heath butterfly
- Small Copper butterfly

There are several well tried and successful regeneration schemes for the recovery of active *Sphagnum* growth and retention of the acrotelm. In the Strategy area Threepwood Moss has shown the best recovery (A. J. Panter, pers comm.) and within Blawhorn Moss, West Lothian Management Plan, SNH; also see Brookes and Stoneman (1997). These usually depend upon stopping excessive drainage from the surface, slowing peripheral drainage, and in reducing erosion from bare peat faces and from peripheral lagg streams.

## 3. Fens

It is estimated from the summarised wetland inventory (Tweed CMP) that there are around 214 remaining identifiable fens within the Strategy Area, ignoring those which are partly or wholly included within overlying Blanket Mire. Of these some 130 are over 2 ha and must represent a considerable volume of water. With “schwingmoor” they are perhaps the most difficult wetlands to manage since the quantity, quality and directional throughput of water-supply is sourced from their topographic basin with its springs and flushes and is subject to all the impinging chemical changes undertaken within the catchment.

Changes have occurred via general agricultural improvement throughout the last three centuries. Differences in productivity and composition of fen vegetation can be related to the amounts of, especially, nitrogen and phosphorous taken up by the vegetation. Differences in the mineralization of the upper peat layer are responsible. Groundwater upwelling from the mineral substrate (rock, boulder clay or later fluvial deposition) is often influenced by incoming water from the catchment. Werhoeven et al. (1983) noted

increasing concentrations of ammonia (at 3-5ppm) in such upwellings, and suggested that there was considerable evidence of a build-up of nitrogen between the mineral substrate and the peat, not always evident in the vegetation, i.e. below rooting depths. They go on to say, "within a period of decades however, the continuous inflow of ammonia may eventually cause an increase in the productivity and a change in the species composition of the fens." Wheeler (pers comm.) has suggested that this may also be true of other ions and nutrients, e.g. phosphate. If these are "trapped" in the topography of the basin, with limited sub-fen throughput to the outflow streams, then the prognosis for the long-term maintenance of critical communities and species of fen vegetation is bleak, and will demand extreme care in any major excavation works which might otherwise have restored the hydrosere to an earlier phase.

Crucially, a management distinction has to be made between fen left to its own devices, which will proceed successionaly though tall-herb fen to a type of Carr woodland, and fen which is regularly cut and/or grazed. Many of the fens in the area have also been used for "deal" (small timber supply), turf (building and fuel) as well as for the more usual turbarry or peat-cutting (fuel). These show a definite "hiatus" in the peat column, picked up in stratigraphical studies. The cutting of peat has been variably documented in the area and is characterised by the surrounding area, carefully designated in rentals and permissions, termed the "spreading ground".

The main environmental parameters are given by Fojt (1993) and these set desirable limits for each fen type. It should be noted that within these, the same author has also identified environmental variables which are present in some 18 of the fen vegetation communities present in the Strategy area. Table 2 sets out Fojt's values which have been obtained from over three hundred fens sampled across the U.K. They illustrate the real differences between "poor" and "rich" fen separated originally by their vegetation types alone. They also give defined "limits" towards which fen management should be aimed.

The above complexities of water chemistry raise many problems in arriving at a suitable management regime. Catchment size, however, may also add to this complexity since the actual topographic catchment, which has been used in the preparation of the CMP inventory, may only be an indicator of a far wider or more complicated drainage and seepage regime. Hence the existing wetland size may not relate clearly to a catchment which has been successively modified in these ways. Obvious topographic catchment size assessment is therefore not usually possible for spring fed mires, soligenous flushes nor for (most) floodplain/valley mire systems. Many of the open waters, basin and valley mires in the Scottish Borders are known to be spring-fed. This is apparent in non-freezing holes, (e.g. Yetholm, Lindean, Easter Branxholme), disturbance up-welling in softer peats/sediments (locally known as "well eyes") (as at Alemoor, Boghall Moss, Hummelknowes and the Whitlaw Mosses) and by the presence of invertebrate communities characteristic of running-water in otherwise still-water fen pools (e.g. Wester Branxholme). This groundwater often may be additional to that of the apparent topographic catchment and may "muddy" the effects of the landuse in the immediate catchment. Given the present state of local hydrogeological detail, it is considered that pragmatism should prevail in basin mire management, and the effects of the immediate visible catchment be addressed as an important first stage.

This also applies where there has been modification of drainage either by fairly major mining/tunnelling, which was relatively commonplace at the time of agricultural improvement around 1800, (e.g. at Woolaw Moss; Lindean Reservoir; Whitrig Bog) or by successive generations of quite deep agricultural under-drainage, e.g. in the drumlin field of the Merse of Berwickshire round Swinton. This is a rather different problem which under considered management may be reversed, wholly or partly.

#### 4. Flush

This term embraces all soligenous mires which depend upon some water-movement through their peat/mineral rooting layer. As such it is widely variable covering everything from minor spring heads upwelling into basin mires or blanket bog, to long linear systems following declivities and water-flow through other, non-wetland habitats, dwarf-shrub heath, acid and neutral grassland, tall-herb cliff grasslands etc. The most extensive areas of flush also occur beneath water seepage from outcropping or thinly buried horizontal rock strata and these may affect whole hillsides. Such seepage lines are common in the Ordovician and Silurian shales, as well as locally in the sediments of the Old Red Sandstone and Carboniferous eras. There are over 80 flushes recorded in the CMP inventory however, this figure is a grossly misleading underestimate which will demand aerial and ground truth surveys to adequately record this habitat for the Strategy area.

#### 5. Schwingmoor/Floating mire

This category was not picked up in the Tweed CMP inventory, since it demands a ground survey of sites. Floating mire consists of a raft of floating moss, sedges, cottongrass and characteristic broadleaved species with a depth of up to 2m. It can merge with poor fen on the landward side of a site or into swamp and open water. Limited amounts of scrub birch and willow are occasionally present.

#### 6. Swamp/Open water Transition

The CMP inventory has recorded over fifty-four of these emergent communities in the Strategy area, with some 20 over 2 ha. There will undoubtedly be some overlap with floating vegetation rafts of "schwingmoor" and also minor areas may have been missed and grouped within Open Waters.

#### 7. Open Water

The provisional inventory of open water sites is not yet completed for the Tweed CMP database. For those of any size there is a strong clustering, which mirrors that of basin mires, especially north and west of Hawick, and on the corrugated hills of the Ettrick plateau.

**Table 2** Mean values of the main environmental variables associated with fens sampled in the U.K. (after Fojt, 1993).

VARIABLE	POOR FEN	RICH FEN	UNSPECIFIED FEN
Water depth	0.2	-4.5	-2.5
Redox potential	256	283	274
Ionic strength	142	494	336
pH of substrate	5.1	6.3	5.7
pH of water	5.0	6.2	5.6
Bicarbonate (mg1 <sup>-1</sup> )	27.5	228.8	135.5
Calcium (mg1 peat <sup>-1</sup> )	323	1420	931
Sodium (mg1 peat <sup>-1</sup> )	27.7	43.2	36.7
Magnesium (mg1 peat <sup>-1</sup> )	71.8	88.4	82.6
Manganese (mg1 peat <sup>-1</sup> )	25.4	19.4	24.1
Iron (mg1 peat <sup>-1</sup> )	166.8	36.8	106.3
Aluminium (mg1 peat <sup>-1</sup> )	47.3	8.9	26.3
Nitrogen (mg1 peat <sup>-1</sup> )	8.4	5.41	6.86
Phosphate (mg1 peat <sup>-1</sup> )	0.41	0.59	0.50
Potassium (mg1 peat <sup>-1</sup> )	24.8	22.6	24.0

Many open waters in the Tweed catchment have been drained post 1700 as evinced from, for example Blaué's Atlas Novum. Some of these, e.g. at Greenlees-Ferretburn (NT 72) and in the Merse on the Upper Leet catchment: Ramrig (NT84) and Whinfield (NT85), were quite substantial. In some of these, e.g. at New Smailholm, Girnick (Rachelfield), Whitehouse (St Boswells), and the Luckenhaugh Meadow at Bowden Toll (Hillview) and areas which regularly flood, the groundwater table is not far below surface, despite centuries of attempted drainage. The sizes given are approximate as most have water-level fluctuation. Many have been artificially dammed from previous wet hollows, ponds and fens. Still others have suffered serious siltation, especially when they have been the result of on-stream dams, e.g. old mill ponds. Since the 1970's, many ponds have been built for game, wildlife and amenity. This is continuing and several are known to have been established since 2000 and will not be included in the inventory.

Thus, between the original survey of the 1970's and the maps of 2000, there has been considerable "pond creation" either on old, partly silted, re-excavated sites or as a result of new excavation/damming. This has been done in recognition of the resultant increases in capital values of farms and estates which accrue from realising wildfowling (encouraged by the Game Conservancy Trust) or landscape and amenity potential, together with their inherent wildlife value (encouraged by NCC/SNH, RSPB, SWT and the Farming and Wildlife Advisory Group.). It is also important to recognise that many ponds may have been constructed/renovated without the input of any of these bodies.

## Appendix 2. Plant communities present in Tweed wetlands (provisional). From National Vegetation Classification (NVC)

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Survey sources from Daniels (1978); Wheeler (1980); Tratt (1997) and various records from Badenoch, Birdsall, Eno, Meade, Panter, etc. (NC/NCC/NCCS/SNH internal reports) using the National Vegetation Classification of Rodwell (1991a, 1991b, 1992, 1995).

Those communities given in brackets are probable but are not mentioned in Rodwell's distribution maps, or occur as variants and/or in very small stands. Some need verification. In all cases the typical community is present as well as (some of) the sub-communities.

### Generalised relationships of the main community types within the main wetland types are given here:

#### WOODLAND:

- W1 *Salix cinerea* – *Galium palustre* woodland
- (W2 *Salix xinerea* – *Betula pubescens*-*Phragmites australis* woodland)
- W3 *Salix pentandra* – *Carex rostrata* woodland
- W4 *Betula pubescens* – *Molinia caerulea* woodland
  - a. *Dryopteris dilatata* – *Rubus fruticosus* sub-community
  - (b. *Juncus effusus* sub-community)
  - c. *Sphagnum* sub-community
- (W5 *Alnus glutinosa* – *Carex paniculata* woodland)
- W6 *Alnus glutinosa* – *Urtica dioica* woodland
- W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemorum* woodland

#### MIRES & HEATHS:

- M1 *Sphagnum auriculatum* bog pool community
- M2 *Sphagnum cuspidatum/recurvum* community
- M3 *Eriophorum angustifolium* bog pool community
- M4 *Carex rostrata* – *Sphagnum recurvum* mire
- M5 *Carex rostrata* – *Sphagnum squarrosum* mire
- M6 *Carex echinata* – *Sphagnum recurvum/auriculatum* mire
  - a. *Carex echinata* sub-community
  - b. *Carex nigra*-*Nardus stricta* sub-community
  - c. *Juncus effusus* sub-community
  - d. *Juncus acutiflorus* sub-community
- (M7 *Carex curta*- *Sphagnum rusowii* mire)
- (M8 *Carex rostrata*-*Sphagnum warnstorffii* mire)
- M9 *Carex rostrata*-*Calliergon cuspidatum/giganteum* mire
- M10 *Carex dioica*-*Pinguicula vulgaris* mire
  - a. *Carex demissa*-*Juncus bulbosus/kochii* sub-community:  
(*Carex hostiana*-*Ctenidium molluscum* variant)
  - b. *Briza media* – *Primula farinosa* sub-community  
(*Molinia caerulea*-*Eriophorum latifolium* variant)
- (M13 *Schoenus nigricans* – *Juncus sub-nodulosus* mire)
- M15 *Scirpus caespitosus*-*Erica tetralix* wet heath
  - a. *Carex panicea* sub-community
  - d. *Vaccinium myrtillus* sub-community
- M16 *Ericetum tetralicis* wet heath
  - b. *Succisa pratensis*- *Carex panicea* sub-community
  - d. *Juncus squarrosus*-*Dicranium scoparium* sub-community
- M17 *Scirpus caespitosus*-*Eriophorum vaginatum* Blanket Mire
  - c. *Juncus squarrosus*-*Rhytidadelphus loreus* sub-community
- M18 *Erica tetralix* – *Sphagnum papillosum* Raised and Blanket Mire
  - a. *Sphagnum magellanicum*-*Andromeda polifolia* sub-community
  - b. (*Empetrum nigrum*-*Cladonia* species sub-community)
- M19 *Calluna vulgaris* – *Eriophorum vaginatum* Blanket Mire
  - a. *Erica tetralix* sub-community
  - b. *Empetrum nigrum ssp nigrum* sub-community
  - c. *Vaccinium vitis-idaea*-*Hylocomium splendens* sub-community
- M20 *Eriophorum vaginatum* Blanket and Raised mire
- M21 *Narthecium ossifragum* – *Sphagnum papillosum* valley mire
- M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush pasture
  - a. *Juncus acutiflorus* sub-community
  - b. *Juncus effusus* sub-community
- (M24 *Cirsio-Moliniatum caeruleae* fen meadow)
- M25 *Molinia caerulea*-*Potentilla erecta* mire
  - a. *Erica tetralix* sub-community
  - b. *Anthoxanthum odoratum* sub-community

- M26 *Molinia caerulea* – *Crepis paludosa* mire  
 M27 *Filipendula vulgaris* – *Angelica sylvestris* mire  
 a. *Valeriana officinalis* – *Rumex acetosa* sub-community  
 M32 *Philonotis Fontana-Saxifraga stellaris* spring  
 M37 *Cratoneuron commutatum* – *Festuca rubra* spring  
 (M38 *Cratoneuron commutatum* - *Carex nigra* spring)

#### SWAMPS etc:

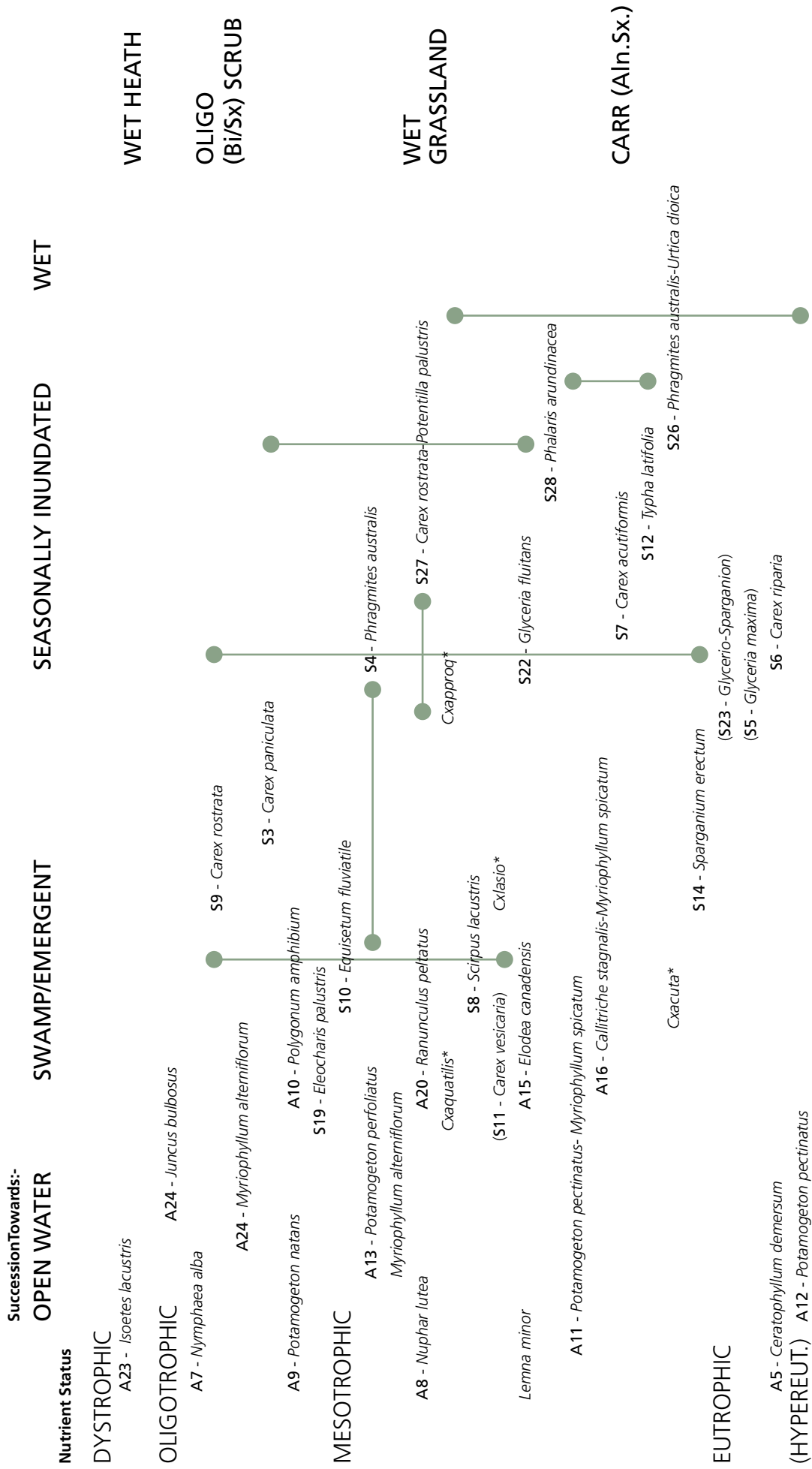
- S3 *Carex paniculata* sedge swamp  
 - *Carex appropinquata* in fens (Nationally rare: Dunhog; WBranchholme etc)  
 S4 *Phragmites australis* swamp and reed-beds  
 (Menyanthes trifoliata sub-community)  
 (S5 *Glyceria maxima* swamp)  
 S6 *Carex riparia* swamp  
 (- *Carex acuta* in swamps and fens)  
 S7 *Carex acutiformis* swamp  
 S8 *Scirpus lacustris* ssp *lacustris* swamp  
 S9 *Carex rostrata* swamp  
 a. *Carex rostrata* sub-community  
 b. *Menyanthes trifoliata* – *Equisetum fluviatile* sub community  
 - *Carex lasiocarpa* in swamps and fens (WBranchholme)  
 - *Carex aquatilis* in swamps and fens  
 S10 *Equisetum fluviatile* swamp  
 a. *Carex rostrata* sub-community  
 S11 *Carex vesicaria* swamp  
 S12 *Typha latifolia* swamp  
 S14 *Sparganium erectum* swamp  
 b. *Alisma plantago-aquatica* sub-community  
 c. *Mentha aquatica* sub-community  
 d. *Phalaris arundinacea* sub-community  
 S19 *Eleocharis palustris* swamp  
 a. *Eleocharis palustris* sub community  
 S22 *Glyceria fluitans* water-margin vegetation  
 b. *Sparganium erectum* – *Mentha aquatica* sub-community  
 (S23 *Glycerio-Sparganion* water margin vegetation)  
 S26 *Phragmites australis* – *Urtica dioica* tall-herb fen  
 a. *Filipendula ulmaria* sub-community  
 S27 *Carex rostrata* – *Potentilla palustris* tall-herb fen  
 a. *Carex rostrata* – *Equisetum fluviatile* sub-community  
 S28 *Phalaris arundinacea* tall-herb fen

#### AQUATIC:

- A2 *Lemna minor* community  
 (A5 *Ceratophyllum demersum* community)  
 (A7 *Nymphaea alba* community)  
 A8 *Nuphar lutea* community  
 A9 *Potamogeton natans* community  
 A10 *Polygonum amphibium* community  
 A11 *Potamogeton pectinatus* – *Myriophyllum spicatum* community  
 A12 *Potamogeton pectinatus* community  
 (A13 *Potamogeton perfoliatus* - *Myriophyllum alterniflorum* community)  
 A14 *Myriophyllum alterniflorum* community  
 A15 *Elodea canadensis* community  
 A16 *Callitriche stagnalis* community  
 A17 *Ranunculus penicillatus* ssp *pseudoflutians* community  
 A18 *Ranunculus fluitans* community  
 (A19 *Ranunculus aquatilis* community)  
 A20 *Ranunculus peltatus* community  
 (A21 *Ranunculus baudotii* community (Tweed estuary?))  
 (A23 *Isoetes lacustris/setacea* community)  
 (A24 *Juncus bulbosus* community)

cob:Nov 2009

Generalised schema for the main NVC community types by trophic status of Tweed aquatic/swamp wetlands



N.B.  
1. Communities given in brackets are unusual or of very small extent in Tweed catchment.  
2. Species are given where stands occur but are not part of recognised communities in NVC.

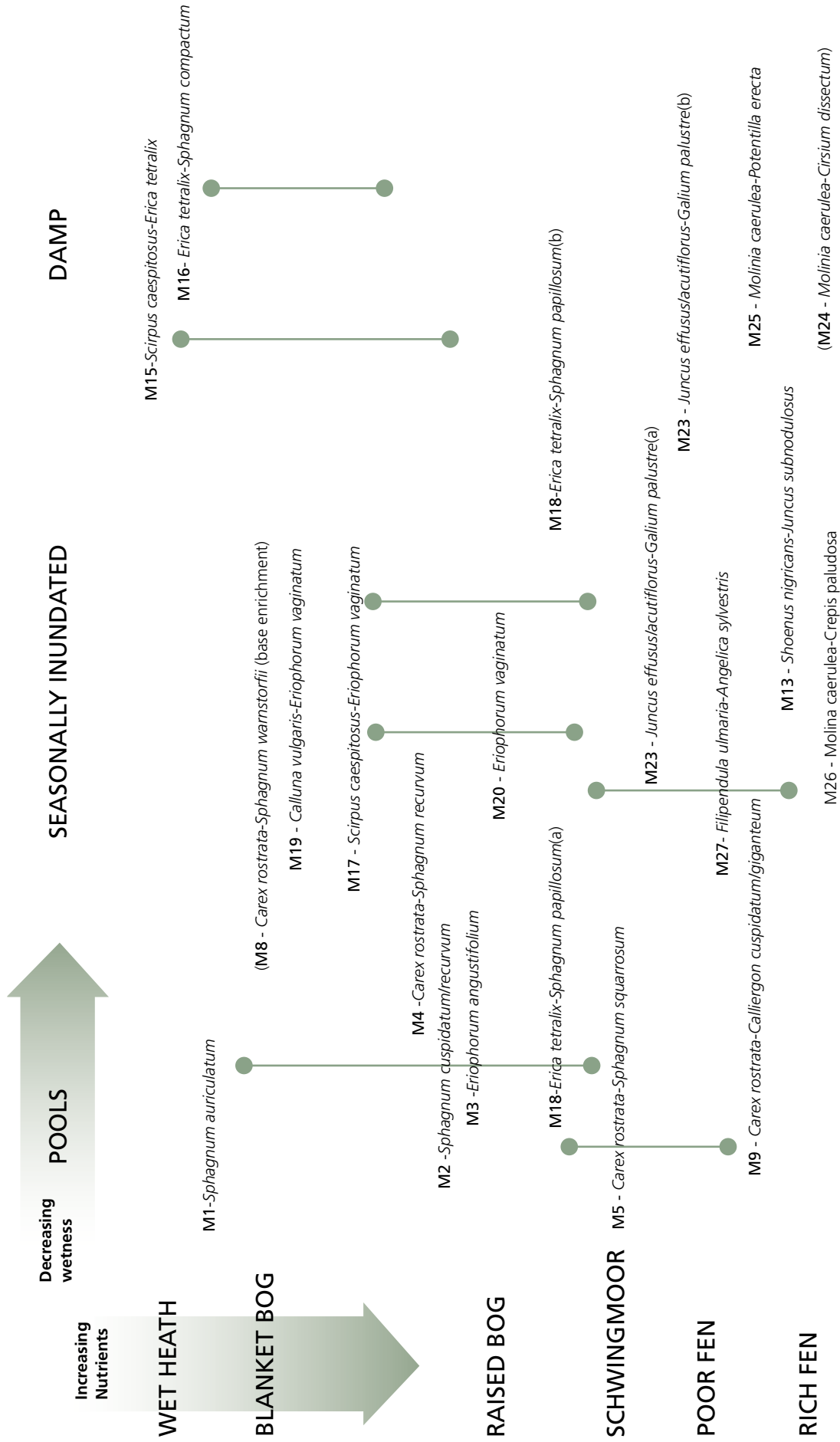


Generalised schema for soligenous (flush) mire systems in Tweed wetlands  
 (See also schema for peat systems with which there is inevitable overlap depending upon impingent drainage.)



N.B.  
 1. Communities given in brackets are unusual or of very small extent in Tweed catchment.

Generalised schema for the main NVC community types by trophic status of Tweed aquatic/swamp wetlands



N.B.  
1. Communities given in brackets are unusual or of very small extent in Tweed catchment.

## Appendix 3. Rare and Endangered Species

### Alphabetical List of Rare and Endangered Species of Flowering Plants, Grasses & Ferns in Border Wetlands. (Native species only.)

Abbreviations: Number of 10 km square in Borders; UKR= Nationally Rare (1-15x 10km.sq.; SR = 5 or less 10km.sq. or sites; BR=Borders Rare (less than 10 x 10km.grid squares); BR=Borders Local (less than 30 x 10km.grid squares); UKLBAP= UKBAP/ Scottish Borders LBAP.

Note there are circa sixty one 10km squares and part squares in the Strategy Area.

SPECIES	NAME	No/10kmsq	UKR	SR	BR	BL	UK/LBAP
Anagallis tenella	Bog Pimpernel	2			•		
Andromeda polifolia	Bog Rosemary	?*					
Apium nodiflorum	Fool's Water Cress	3			•		
Apium inundatum	Lesser Marshwort	11				•	
Hydrocotyle vulgaris	Marsh Pennywort	20				•	
Berula erecta	Lesser Water Parsnip	12				•	
Blysmus compressus	Flat Sedge	11				•	
Calamagrostis canescens	Purple Small Reed	4	•	•		•	
Calamagrostis stricta	Narrow Small Reed	3	•			•	
Callitriche hermaphroditica	Autumnal Water Starwort	16				•	
Callitriche platycarpa	Various-leaved Water-Starwort	10				•	
Cardamine raphanifolia	Greater Cuckoo Flower	5			•		
Carex acuta	Tufted Sedge	10				•	
Carex appropinquata	Fibrous Tussock Sedge	4			•		
Carex aquatilis	Water Sedge	7				•	
Carex bigelowii	Stiff Sedge	11				•	
Carex capillaris	Hair Sedge	1			•		
Carex diandra	Tussock Sedge	12				•	
Carex laevigata	Smooth-stalked Sedge	16			•		
Carex hostiana x C. viridula (= C. x fulva)		10		•			
Carex lasiocarpa	Slender Sedge	9		•			
Carex limosa	Bog Sedge	6		•			
Carex magellancia	Tall Bog Sedge	3		•			
Carex paniculata	Greater Tussock Sedge	29			•		

\*possibly extinct

SPECIES (cont.)	NAME	No/10kmsq	UKR	SR	BR	BL	UK/LBAP
<i>Carex paniculata</i> x <i>C. remota</i> (= <i>C. x boennighausiana</i> )		5		•			
<i>Carex riparia</i>	Greater Pond Sedge	12 x			•		
<i>Carex rostrata</i> x <i>C. vesicaria</i> (= <i>C. involuta</i> )		2x		•			
<i>Carex vaginata</i>	Sheathed Sedge	3		•			
<i>Carex vesicaria</i>	Bladder Sedge	18			•		
<i>Catabrosa aquatica</i>	Whorl Grass	10		•			
<i>Ceratophyllum demersum</i>	Rigid Hornwort	7		•			
<i>Cicuta virosa</i>	Cow Bane	5		•			
<i>Coeloglossum viridide</i>	Frog Orchid	7		•			
<i>Coralorhiza trifida</i>	Coral-root Orchid	7		•			
<i>Dactylorhiza fuchsii</i> x <i>G. conopsea</i> (= <i>Dactylodaenia st. quintinii</i> )		2		•			
<i>Dactylorhiza fuchsii</i> x <i>D. maculata</i> (= <i>D. x transiens</i> )1x		1		•			
<i>Dactylorhiza fuchsii</i> x <i>D. purpurella</i> (= <i>D. venusta</i> )7x		7		•			
<i>Dactylorhiza incarnata</i> Subsp. <i>incarnata</i>	Early Marsh Orchid	10		•			
<i>Dactylorhiza incarnata</i> Subsp. <i>pulchella</i>	Early Marsh Orchid	3		•			
<i>Dactylorhiza maculata</i> x <i>D. purpurella</i> (= <i>D. x formosa</i> )	Various-leaved Water-Starwort	5		•			
<i>Drosera anglica</i>	Greater Sundew	2		•			
<i>Eleocharis austriaca</i>	Northern Spike Rush	3		•			
* <i>Eleoigiton fluitans</i>	Floating Club Rush	1		•			
<i>Equisetum hyemale</i>	Rough (Dutch)Horsetail	2		•			
<i>Equisetum telmateia</i>	Greater Horsetail	5		•			
<i>Epilobium anagallidifolium</i>	Alpine Willow Herb	2		•			
<i>Epilobium alsinifolium</i>	Chickweed Willow Herb	7		•			
<i>Epipactis palustris</i>	Marsh Helleborine (Till only)	2		•			
<i>Eriophorum latifolium</i>	Broad-leaved Cotton Grass	30+			•		
<i>Euphrasia arctica</i> subsp. <i>borealis</i>	Eyebright	13			•		
<i>Euphrasia scottica</i>	Eyebright	18			•		

SPECIES (cont.)	NAME	No/10kmsq	UKR	SR	BR	BL	UK/LBAP
<i>Filipendula vulgaris</i>	Dropwort	3	•	•			
<i>Gagea lutea</i> Yellow	Star of Bethlehem	3		•			
<i>Glyceria maxima</i>	Reed Sweet Grass	7		•			
<i>Glyceria fluitans</i> x <i>G. notata</i> . (= <i>G. pedicellata</i> )	Hybrid Sweet Grass	4			•		
<i>Gymnadenia conopsea</i> Subsp. <i>conopsea</i>	Fragrant Orchid	9		•			
<i>Gymnadenia conopsea</i> Subsp. <i>borealis</i>	Northern Fragrant Orchid	6		•			
<i>Hierochloa odorata</i>	Holy Grass/Lady Grass	2	•	•			
<i>Hippuris vulgaris</i>	Mare's Tail	14			•		
<i>Isoetes lacustris</i>	Quill Wort	5		•			
<i>Juncus alpinoarticulatus</i>	Alpine Rush	9		•			
<i>Juncus compressus</i>	Round-fruited Rush	1†	•	•			
<i>Juncus inflexus</i> x <i>Juncus effusus</i> ( <i>Juncus</i> x <i>diffusus</i> )	No name	4		•			
<i>Juncus subnodulosus</i>	Blunt-flowered Rush	2		•			
<i>Lemna trisulca</i>	Ivy-leaved Duckweed	10		•			
<i>Listera cordata</i>	Lesser Twayblade	17			•		
<i>Luzula forsteri</i>	White Wood Rush						
<i>Lychnis flos-cuculi</i>	Ragged Robin						
<i>Lycopus europaeus</i>	Gypsywort	5		a			
<i>Lythrum salicaria</i>	Purple Loosestrife	7			•		
<i>Lythrum portula</i>	Water Purslane	9			•		
<i>Mentha aquatica</i> x <i>M. arvensis</i> (= <i>M. x verticillata</i> )	Whorled Mint	17				•	
<i>Mentha spicata</i>	Spearmint	24				•	
<i>Myosotis stolonifera</i>	Pale Forget-me-Not	11					•
<i>Myrica gale</i>	Bog Myrtle	5			•		
<i>Nuphar lutea</i>	Yellow Water Lily	6				•	
<i>Nymphaea alba</i>	White Water Lilly	9				•	
<i>Oenanthe crocata</i>	Hemlock Water Dropwort	11				•	
<i>Persicaria mitis</i>	Tasteless Water-pepper	1			•		
<i>Persicaria vivipara</i>	Alpine bistort	6				•	

† only 1 Scottish record

SPECIES (cont.)	NAME	No/10kmsq	UKR	SR	BR	BL	UK/LBAP
<i>Populus nigra</i>	Black Poplar	3		•			
<i>Potamogeton coloratus</i>	Fen/Net-veined Pondweed	5		•			
<i>Potamogeton lucens</i>	Shining Pondweed	6				•	
<i>Potamogeton lucens</i> x <i>P.perfoliatus</i> (=P.x <i>salicifolius</i> )	Willow-leaved Pondweed	5		•			
<i>Potamogeton gramineus</i>	Various-leaved Pondweed	5		•			
<i>Potamogeton gramineus</i> x <i>P.lucens</i> (= <i>P.x zizii</i> )	Long-leaved Pondweed	2		•			
<i>Potamogeton gramineus</i> x <i>P.perfoliatus</i> (=P: x <i>nitens</i> )	Bright-leaved Pondweed	3		•			
<i>Potamogeton alpinus</i>	Red Pondweed	8				•	
<i>Potamogeton praelongus</i>	Long-stalked Pondweed	4		•			
<i>Potamogeton perfoliatus</i>	Perfoliate Pondweed	11				•	
<i>Potamogeton friesii</i>	Flat-stalked Pondweed	1		•			
<i>Potamogeton pusillus</i>	Lesser Pondweed	21				•	
<i>Potamogeton obtusifolius</i>	Blunt-leaved Pondweed	15				•	
<i>Potamogeton filiformis</i>	Slender-leaved Pondweed	6		•			
<i>Potamogeton pectinatus</i>	Fennel Pondweed	5				•	
<i>Pulicaria dystenterica</i>	Common Fleabane	3		•			
<i>Pyrola minor</i> Common	Wintergreen	16				•	
<i>Pyrola rotundifolia</i>	Round-leaved Wintergreen	6		•			
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup	15				•	
<i>Ranunculus lingua</i>	Greater Spearwort	13				•	
<i>Ranunculus omiophyllus</i>	Round-leaved Crowfoot	5		•			
<i>Ranunculus trichophyllus</i>	Thread-leaved Crowfoot	14				•	
<i>Ranunculus fluitans</i>	River Water Crowfoot	6				•	
<i>Ranunculus circinatus</i>	Fan-leaved Water Crowfoot	3		•			
<i>Rubus chamaemorus</i>	Cloudberry	27				•	•†
<i>Rumex maritimus</i>	Golden Dock	4		•			
<i>Salix capraea</i> subsp. <i>sphaecelata</i>	Goat Willow subsp.	9				•	
<i>Salix capraea</i> x <i>cinerea</i> ( <i>S.x reichardtii</i> )		14				•	
<i>Salix myrsinifolia</i> x <i>phylicifolia</i> (=S.x <i>tetrapla</i> )		4		•			

†Blanket bog

SPECIES (cont.)	NAME	No/10kmsq	UKR	SR	BR	BL	UK/LBAP
<i>Salix cinerea</i> xviminalis ( <i>S. x smithiana</i> )		8				•	
<i>Salix aurita</i> x cinerea ( <i>S. x multinervis</i> )		11				•	
<i>Salix aurita</i> x repens ( <i>S.x ambigua</i> )2 x		2			•		
<i>Salix herbacea</i>	Dwarf Willow	1			•		
<i>Salix myrsinifolia</i>	Dark-leaved Willow	20				•	
<i>Salix myrsinifolia</i>	Whortle-leaved Willow	1			•		
<i>Salix phylicifolia</i>	Tea-leaved Willow	22				•	
<i>Sanguisorba officinalis</i>	Greater Burnet	6			•		
<i>Saxifraga hirculis</i>	Yellow Marsh Saxifrage	1	•				•
<i>Schoenoplectus lacustris</i>	Common Club Rush	11				•	
<i>Schoenoplectus tabernaemontani</i>	Grey Club Rush	2			•		
<i>Scirpus sylvaticus</i>	Wood Club Rush	15				•	
<i>Scutellaria galericulata</i>	Skullcap	16				•	
<i>Sedum villosum</i>	Hairy Stonecrop	17				•	
<i>Solanum dulcamara</i>	Woody Nightshade	22				•	
<i>Sparganium emersum</i>	Unbranched Burr-reed	12				•	
<i>Sparganium natans</i>	Least Burr-reed	5			•		
<i>Stellaria palustris</i>	Marsh Stitchwort	3			•		
<i>Subularia aquatica</i>	Awlwort	1			•		
<i>Tolmiea menziesii</i>	Pick-a-Back Plant	8				•	
<i>Tellima grandiflora</i>	Fringe Cups	7				•	
<i>Trollius europaeus</i>	Globeflower	19				•	
<i>Typha angustifolia</i>	Lesser Bulrush	2*			•		
<i>Utricularia vulgaris</i> (agg).	Bladderwort (unspecified)	4			•		
<i>Utricularia australis</i>	Bladderwort	2				•	
<i>Utricularia minor</i>	Lesser Bladderwort	7				•	
<i>Vaccinium uliginosum</i>	Bog Bilberry	1			•		
<i>Veronica catenata</i>	Pink Water Speedwell	7				•	

\*One may be an introduction

## Appendix 4. Designated Sites

### A. Statutorily designated sites (Till catchment marked green)

Habitat Type						
BLANKET BOG	RAISED BOG	SWAMP	POOR FEN	RICH FEN	FLUSHES	OPEN WATER
Moorfoot Hills SSSI (part) Tweedsmuir Hills SSSI (part) Langholm-Newcastleton Hills SSSI (part) Kielderhead Moors SSSI (part) (SAC in Northumberland) Cheviot SSSI & part NNP (part Till catchment)	Drone Moss SSSI Dogden Moss (part of Greenlaw Moor SSSI) Din Moss (part Din Moss - Hoselaw Loch RAMSAR SPA SSSI) Threepwood Moss SSSI Alemuir West Loch and Meadow SSSI (2 parts) Wester Branxholme Loch SSSI (part) Whim Bog & Wood SSSI (part of larger intermediate bog – raised bog complex.) Holborn Moss SSSI RAMSAR SPA	Bernersyde Moss SSSI Gattonside Moss SSSI (part) Adderstonlee Moss SSSI (part) Bucksruther Moss SSSI Woodhead Moss SSSI (part) Blind Moss SSSI (part) Selkirk Racecourse Moss SSSI Kingside Loch SSSI (part) Mount Bog NNR SSSI Ford Moss SSSI (Till catchment)	Coldingham Common, Long Moss SSSI Gordon Moss SSSI / SWT Reserve Din Moss - Hoselaw Loch SSSI / SWT Reserve (part) Gattonside Moss SSSI (part) Adderstonlee Moss SSSI (part) Dunhog Moss SSSI / Part SWT Reserve Woodhead Moss SSSI (part) Bearrig Moss (part) – Part of Whitlaw Mosses SSSI / NNR / SAC Murder Moss (part) – Part of Whitlaw Mosses SSSI / NNR / SAC Whitmuirhall Loch SSSI (part) Faldonside Loch SSSI (part) Lindean Reservoir SSSI (part) Long Moss – Drinkstone Hill SSSI (part) Selkirk Racecourse Moss SSSI Blind Moss SSSI (part) Slaidhills Moss SSSI / SAC Rickenhope SSSI Mount Bog SSSI	Lurgie Loch SSSI Yetholm Loch SSSI / SWT Reserve (part) Blackchester Moss (part of Cianlaw Grasslands SSSI) Blackpool Moss – Part of Whitlaw Mosses SSSI / NNR / SAC Bearrig Moss (part) – Part of Whitlaw Mosses SSSI / NNR / SAC Murder Moss (part) – Part of Whitlaw Mosses SSSI / NNR / SAC Whitmuirhall Loch SSSI (part) Faldonside Loch SSSI (part) Lindean Reservoir SSSI (part) Long Moss – Drinkstone Hill SSSI (part) Alemuir West Loch and Meadow SSSI (part) Hummelknowes Moss SSSI Kippilaw Moss SSSI Wester Branxholme Loch SSSI (part) Ashkirk Loch SSSI (part) Aker Moor Loch SSSI (Part)	Many small inclusions in: Moorfoot Hills SSSI Tweedsmuir Hills SSSI Langholm Newcastleton Hills SSSI. Aker Moor Loch SSSI (parts) Copshawholm Meadows (part of Langholm Newcastleton Hills SSSI) Other: Till River Banks SSSI (re floodplain) Harthope Burn SSSI (floodplain)	Coldingham Loch SSSI Mire Loch (part of St Abbs Head SSSI / SAC / SWT & NTS Reserve. The Hirsell Lake (part of The Hirsell SSSI) Din Moss - Hoselaw Loch SSSI / SWT Reserve (part) Yetholm Loch SSSI / SWT Reserve (part) Faldonside Loch SSSI Lindean Reservoir SSSI (part) highly modified water body Whitmuirhall Loch SSSI (part) Ashkirk Loch SSSI (part) Aker Moor Loch SSSI (Part) Alemuir West Loch and Meadow SSSI (part) Kingside Loch SSSI Wester Branxholme Loch SSSI (part) Easter Branxholme Loch SSSI St Mary's Loch SSSI Westwater Reservoir SSSI / SPA highly modified water-body Barelees Pond SSSI Campfield Kettle Hole SSSI Holborn Lake SSSI Quarryhouse Moor Ponds SSSI



**B. Sites meeting SSSI selection criteria but not designated**

Habitat Type						
BLANKET BOG	RAISED BOG	SWAMP	POOR FEN	RICH FEN	FLUSHES	OPEN WATER
	White Moss, West Linton		Tandlaw Moss <i>Hutlorn Loch</i> Hobbs Flow (would be incorporated in Northumberland <b>Border Mires SSSI/SAC</b> )	Muirfield Moss <i>Woolaw Moss</i> Essenside Loch (part)	Whithaugh – Tandlaw slopes	Clearburn Loch <i>Crooked Loch</i> Essenside Loch (part) <i>Williestruther Loch</i> - highly modified water body

**C. Other designated sites**

**SWT Reserves**

- Hare & Dunhog Moss SWT Reserve ( part SSSI)
- Duns Castle Loch SWT Reserve (denotified SSSI)

## LOCAL WILDLIFE SITES

(due to become Local Biodiversity Sites in 2010/11)

Acreknowe Reservoir	Fethan Wood	Newhall Loch
Amazondean	Flesh Cleuch	Northwood Moss
Ancrum Common	Gameshope Burn	Pipershole Burn
Baddingsgill Bog	Gameshope Loch	Rachan Fish Pond
Bishop's Bog	Glenmuck Bog	Rachan Mill Hall Pond
Bitchlaw Moss	Glensax Burn	Richard's Cleuch
Blackadder Cottage Wood	Groundistone Moss	Rough Cleuch
Blackcraig Moss	Harelaws Pond	Scroggie Brae
Blyth Muir Moss & Blyth Dean	Hawkshaw Bog	Seacroft & St Leonards Moss
Bog Wood	Headshaw Loch	Shaws Under Loch
Bold Burn / Glenmead Burn	Hundleshope	Shaws Upper Loch
Bowden Glen	Hutlerburn Loch	Silverwells/Abbeyburn
Brockholes Dean	Kill Burn	Stichill Linn
Brotherstone Moss	Kiln Burn	Stobs Castle Meadow
Burnside Moss	Lilliesleaf Moss DSSSI	Talla Craigs & Marsh
Candyburn	Little & Muckle Thairn	Talla East Side
Cauldshiels Loch	Loch of the Lowes	Talla Reservoir
Cavers Knowes (Little Moss)	Longstruther Burn	Tandlaw Moss
Cavers Knowes (Long Moss)	Lyne Water/Broomlee	The Linn, Carlops Dean
Clearburn Loch	Lynne Burn Marsh	Waddenshope Burn
Cloich Bog	Malcolm's Moss	Whitmuir Hall Moss
Denholm Dean	Marlside Hill Moss	Woodcastle Cleuch
Easter Housebyres Moss	Moss Cleuch / Dunslair Hope	Wooden Loch
Everett Moss	Mossburnford Mill	Woolaw Moss
Faw Mount	Nether Pirn	

### D. Other wetland sites of local importance

Baillieknowe	Hermiston Moss	Lyne Burn Marsh
Big Dod	Highchesters Moss	NT 6242 (adjacent Gordon Moss)
Broadlee Loch	Huntly Covert Moss	Pauls Well
Cowbog-Kale Water	Hutlerburn Loch	Primside Bog
Craighopehead Bog	Ingraston Moss	Romany House Marsh/Duncanhaugh
Dere Street (Ancrum Moor) Moss	Lambden Burn	Sheephouse Bog
Dowlaw Moss	Lightfield Meadow	Sloethorn Bank/E.Housebyres Haugh St
E.Housebyres Haugh North	Linton Loch	Stichill Linn grassland
Harden Moss	Little and Muckle Thairn	Threepwood Bridge West
Hareford	Longmuir Moss	Whitehaughmoor Moss

## Appendix 5. Bird species associated with Tweed wetlands

The list of species which is restricted solely to Tweed wetlands is modest, birds usually having fairly wide habitat tolerances. For this list, species which predominantly inhabit Tweed wetlands are marked in bold, with those species which are often found on Tweed wetlands but frequently occupy other habitats marked in normal type.

BIRD SPECIES	Breeding	Migrant	Wintering	Notes
American Wigeon				Occasional escape from collections; esp Berwickshire
<b>Barnacle Goose</b>			✓	Some local increase since 1990s. International obligations
<b>Bean Goose</b>			✓	Extremely rare
Black Grouse	✓			UK BAP
<b>Black-headed gull</b>	✓			
<b>Canada Goose</b>			✓	Plus variable local breeding. Numbers fluctuate
<b>Common Coot</b>	✓			
Common Crane		✓		Very rare
<b>Common Goldeneye</b>	✓		✓	Possibly increasing
<b>Common Grasshopper Warbler</b>	✓			
<b>Common Kingfisher</b>	✓			Usually rivers
<b>Common Moorhen</b>	✓			
<b>Common Pochard</b>	✓*	✓		Declining
<b>Common Redshank</b>	✓			Usually rivers
<b>Common Sandpiper</b>	✓			Usually rivers
<b>Common Shelduck</b>	✓			Usually rivers
<b>Common Snipe</b>	✓			
<b>Dunlin</b>	✓			International obligations
Eurasian Curlew	✓			
<b>Eurasian Marsh Harrier</b>		✓		Rare. International obligations
<b>Eurasian Reed Warbler</b>		✓		Extremely rare
Eurasian Reed Warbler		✓		Rare
<b>Eurasian Teal</b>	✓			
<b>Eurasian Wigeon</b>	✓			Occasional
Eurasian Woodcock	✓	✓	✓	
European Golden Plover	✓			International obligations
<b>Gadwall</b>	✓†	✓		Occasional
<b>Garganey</b>		✓		Very occasional
<b>Goosander</b>	✓	✓	✓	Major early winter roosts of Fenno-Scandinavian birds
<b>Great Bittern</b>		✓		Once locally common; now very rare
<b>Great Cormorant</b>		✓		
<b>Great Crested Grebe</b>	✓			Local
<b>Green Sandpiper</b>		✓	✓	Rare (probably overlooked on migration)
<b>Grey Heron</b>	✓			Usually rivers
<b>Grey Wagtail</b>	✓			Usually rivers
<b>Greylag Goose</b>			✓	But local, feral population building since 2000
<b>Hen Harrier</b>		✓	✓	Winter roosts
<b>Jack Snipe</b>		✓	✓	

†possible \*unsure

BIRD SPECIES	Breeding	Migrant	Wintering	Notes
Lesser White-fronted Goose			✓	Extremely rare
Little Grebe	✓			
Mallard	✓			
Mandarin Duck				Occasional escape from collections; esp Berwickshire
Marsh Tit	✓			
Meadow Pipit	✓			
Mute Swan	✓			
Northern Lapwing	✓			
Northern Pintail		✓	✓	
Northern Shoveler	✓			Declining
Osprey	✓			Wetlands only used for hunting. International obligations
Pink-footed Goose			✓	Declining
Red Grouse	✓			Endemic
Red-breasted Merganser		✓	✓	Usually rivers
Red-necked Grebe	✓			Rare. UK rare; Scottish rare
Reed Bunting	✓			Widespread but local UK BAP
Sedge Warbler				Usually riversides/fens
Skylark	✓			UK BAP
Slavonian Grebe	✓			Very rare. International obligations
Smew			✓	Singles each winter. Occasional. International obligations
Snow Goose			✓	Occasional singles every winter
Tufted Duck	✓			
Water Rail	✓			Local
White-throated Dipper	✓			Usually rivers
Whooper Swan			✓	International obligations
Willow Tit	✓			Rare
Yellow Wagtail	✓			Usually rivers and floodplains

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## Appendix 6. Links to Local Biodiversity Action Plans

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### ■ SCOTTISH BORDERS

#### Scottish Borders Council Local Biodiversity Action Plan (2001)

<http://www.scotborders.gov.uk/pdf/2711.pdf>

Published Habitat Action Plans (HAPs)

- Fens, Marsh, Swamp and Reedbed
- Blanket Bog
- Lowland Raised Bog
- Standing Water
- Rivers and Burns

<http://www.scotborders.gov.uk/life/environment/naturalheritage/2708.html>

### ■ NORTHUMBERLAND

#### Northumberland Biodiversity Partnership

<http://www.northumberlandbiodiversity.org.uk/index.asp>

Published Habitat Action Plans (HAPs)

- Fen, Marsh, Swamp
- Ponds, Lakes, Reservoirs
- Rivers, Streams
- Reedbeds

## Appendix 7. Useful links

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#### Biological and Environmental Evaluation Tools for Landscape Ecology BEETLE

<http://www.forestresearch.gov.uk/fr/INFD-69PF6U>

**Birds Directive EC 79/409/EEC 1979** [http://ec.europa.eu/environment/nature/legislation/birdsdirective/index\\_en.htm](http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm)

**Borders Wetland Vision 2006** <http://www.scotborders.gov.uk/pdf/15388.pdf>

#### Catchment Flood Management Plans – related to Till and Breamish catchment boundary

[http://www.pml.ac.uk/pdf/Ports\\_EA\\_flood\\_management.pdf](http://www.pml.ac.uk/pdf/Ports_EA_flood_management.pdf)

**Countryside and Rights of Way Act 2000** [http://www.opsi.gov.uk/acts/acts2000/ukpga\\_20000037\\_en\\_1](http://www.opsi.gov.uk/acts/acts2000/ukpga_20000037_en_1)

**Defra (2008). The Invasive Non-Native Species Framework Strategy for Great Britain: Protecting our natural heritage from invasive species** <https://secure.fera.defra.gov.uk/nonnativespecies/downloadDocument.cfm?id=99>

#### England Biodiversity Strategy; Working with the Grain of Nature, 2002

<http://www.defra.gov.uk/environment/biodiversity/documents/biostrategy.pdf>

**Farm Soil Plans** <http://www.scotland.gov.uk/Resource/Doc/47121/0020243.pdf>

**The Floods Risk Management (Scotland ) Act 2009** <http://faolex.fao.org/docs/pdf/uk89857.pdf>

**Floods Directive 2007/60/EC** [http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm)

**Forests and Water Guidelines 2003** [http://www.forestry.gov.uk/pdf/FCGL002.pdf/\\$FILE/FCGL002.pdf](http://www.forestry.gov.uk/pdf/FCGL002.pdf/$FILE/FCGL002.pdf)

**A Functional Wetland Typology for Scotland, Scotland & Northern Ireland Forum for Environmental Research (SNIFFER), Project WFD95** <http://www.sniffer.org.uk/>

**Habitats Directive, Council Directive 92/43/EEC 1992** Environment - Nature & Biodiversity - Habitats Directive

**Multi-Agency Geographic Information for the Countryside** <http://www.magic.gov.uk/>

**Natura 2000** <http://www.natura.org/>

**Natural England, Nature on the Map** <http://www.natureonthemap.org.uk/>

**Nature Conservation (Scotland) Act 2004** [http://www.opsi.gov.uk/legislation/scotland/acts2004/asp\\_20040006\\_en\\_1](http://www.opsi.gov.uk/legislation/scotland/acts2004/asp_20040006_en_1)

## Appendix 7. Useful links (cont.)

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**Nitrate Vulnerable Zones (England)**

<http://www.defra.gov.uk/environment/quality/water/waterquality/diffuse/nitrate/help-for-farmers.htm>

**Nitrate Vulnerable Zones (Scotland)** [http://www.oqps.gov.uk/legislation/ssi/ssi2008/ssi\\_20080298\\_en\\_1](http://www.oqps.gov.uk/legislation/ssi/ssi2008/ssi_20080298_en_1)

**North East Wetland Feasibility Study 2007** <http://www.nebiodiversity.org.uk/docs/170.pdf>

**Northumberland Biodiversity Partnership**

<http://www.northumberlandbiodiversity.org.uk/>

**Prevention of Environmental Pollution from Agricultural Activity - PEPFAA code**

<http://www.scotland.gov.uk/Publications/2005/03/20613/51366>

**River Basin Management Planning – Solway Tweed**

[http://www.sepa.org.uk/water/river\\_basin\\_planning/early\\_basin\\_planning\\_work.aspx](http://www.sepa.org.uk/water/river_basin_planning/early_basin_planning_work.aspx)

**Rivers and Fisheries Trusts of Scotland – RAFTS** <http://www.rafts.org.uk/home/home.asp>

**Scottish Advisory & Implementation Forum on Flooding – SAIFF**

<http://www.scotland.gov.uk/Topics/Environment/Water/Flooding/advisory-groups/saif>

**Scottish Borders Woodland Strategy 2005** <http://www.scotborders.gov.uk/life/planningandbuilding/plansandresearch/5660.html>

**Scottish Forestry Strategy and Implementation Plan 2009-12** <http://www.forestry.gov.uk/forestry/INFD-6AGGZW>

**Scottish Outdoor Access Code** <http://www.outdooraccess-scotland.com/default.asp>

**SNH Sitelink** <http://www.snh.org.uk/snh>

**Species Action Framework Scotland** <http://www.snh.org.uk/speciesactionframework>

**Strategy for England's Trees, Woods and Forests 2008-12**

[http://www.forestry.gov.uk/pdf/eng-etwf-delivery-plan.pdf/\\$FILE/eng-etwf-delivery-plan.pdf](http://www.forestry.gov.uk/pdf/eng-etwf-delivery-plan.pdf/$FILE/eng-etwf-delivery-plan.pdf)

**Sustainable drainage Systems – SUDS** <http://www.environment-agency.gov.uk/business/sectors/36998.aspx>

**The RAMSAR Convention on Wetlands**

<http://www Ramsar.org/>

**Till & Breamish CAMS**

<http://publications.environment-agency.gov.uk/pdf/GENE1109BRCI-e-e.pdf>

**The Till Wetland Restoration Project**

<http://www.tweedforum.com/projects>

**Tweed Catchment Management Plan 2003** <http://www.tweedforum.com/cmp>

**UK Climate Impacts Programme – UKCIP** <http://www.ukcip.org.uk/>

**UK Forestry Standards 2004** [http://www.forestry.gov.uk/pdf/fcfc001.pdf/\\$FILE/fcfc001.pdf](http://www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf)

**Voluntary Initiative** <http://www.voluntaryinitiative.org.uk/>

**The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR)**

<http://www.opsi.gov.uk/legislation/scotland/ssi2005/20050348.htm>

**The Water Environment and Water Services (Scotland) Act 2003 (WEWS)**

<http://www.scotland.gov.uk/Topics/Environment/Water/WFD/WEWSAct>

**Water Framework Directive 2000/60/EC** [http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

**Wildlife and Countryside Act 1981** <http://www.jncc.gov.uk/page-3614>

## Appendix 8. Invasive alien naturalised flowering plant species list

SPECIES	Name	Notes
<i>Acorus calamus</i>	Sweet Flag	(Only seven records)
* <i>Alnusincana</i>	Grey Alder	
<i>Aster</i> (N.American taxa)	Michaelmas Daisy	
<i>Butomus umbellatus</i>	Flowering Rush	(Native in south)
<i>Cardamine raphanifolia</i>	Greater Cuckoo Flower	
<i>Ceratophyllum demersum</i>	Rigid Hornwort	(2 records as alien)
<i>Cornus sericea</i>	Red-osier Dogwood	(Widely planted)
* <i>Crassula helmsii</i>	New Zealand Pygmy Weed	
<i>Dicentra formosa</i>	Bleeding Heart	
* <i>Elodea canadensis</i>	Canadian Pond-weed	(First UK record in Borders.)
* <i>Epilobium brunnescens</i>	New Zealand Willow Herb	
* <i>Fallopia japonica</i>	Japanese Knotweed	
* <i>Fallopia sachalinensis</i>	Giant Knotweed	
* <i>Heracleum mantegazzeanum</i>	Giant Hogweed	
<i>Impatiens noli-tangere</i>	Touch-Me-Not Balsam	(Native in south)
* <i>Impatiens glandulifera</i>	Himalayan Balsam	
<i>Iris spuria</i>	Blue Iris	
<i>Lagarosiphon major</i>	Curly Waterweed	Few records lower Tweed.
* <i>Lysichiton americanus</i>	American Skunk Cabbage	Only three 10km sq.records but an aggressive coloniser.
<i>Lythrum hyssopifolium</i>	Grass Poly	
<i>Matteuccia struthiopteris</i>	Ostrich Fern	
<i>Mentha suaveolens</i> R	ound-leaved Mint	
<i>Mimulus cupreus</i> x <i>M. guttatus</i> (= <i>M. x burnetii</i> )	Coppery Monkey Flower	
* <i>Mimulus guttatus</i>	Monkey Flower	
* <i>Mimulus guttatus</i> x <i>M. luteus</i> (= <i>M. x robertsii</i> )	Hybrid Monkey Flower	
<i>Mimulus luteus</i>	Blood-drop Emlets	
<i>Mimulus moschatus</i>	Musk	
<i>Myoston aquaticum</i>	Water Chickweed	
<i>Nymphoides peltata</i>	Fringed Water Lily	
<i>Osmunda regalis</i>	Royal Fern	
<i>Petasites japonicus</i>	Greater Butterbur	
<i>Petasites alba</i> White	Butterbur	
<i>Petasites fragrans</i>	Winter Heliotrope	
<i>Peucedanum ostruthium</i>	Masetwort	
<i>Poa palustris</i>	Swamp Meadow Grass	(Extinct?)
<i>Rumex hydrolapathum</i>	Water Dock	(Some records apparently alien)
* <i>Salix fragilis</i>	Crack Willow	
<i>Salix alba</i>	White Willow	
<i>Salix alba</i> x <i>fragilis</i> ( <i>S. rubens</i> ) Hybrid	White Willow	(Widely planted)
<i>Salix triandra</i>	Almond-leaved Willow	
<i>Salix triandra</i> x <i>S. viminalis</i> (= <i>S.x mollissima</i> )	Sharp-stipuled Willow	
<i>Salix viminalis</i>	Osier	
<i>Salix elaeagnos</i>	Olive Willow	
<i>Sasa palmata</i>	Broad-leaved Bamboo	

Asterisk (\*) denotes apparent/major capacity for invasion/spreading in Tweed.

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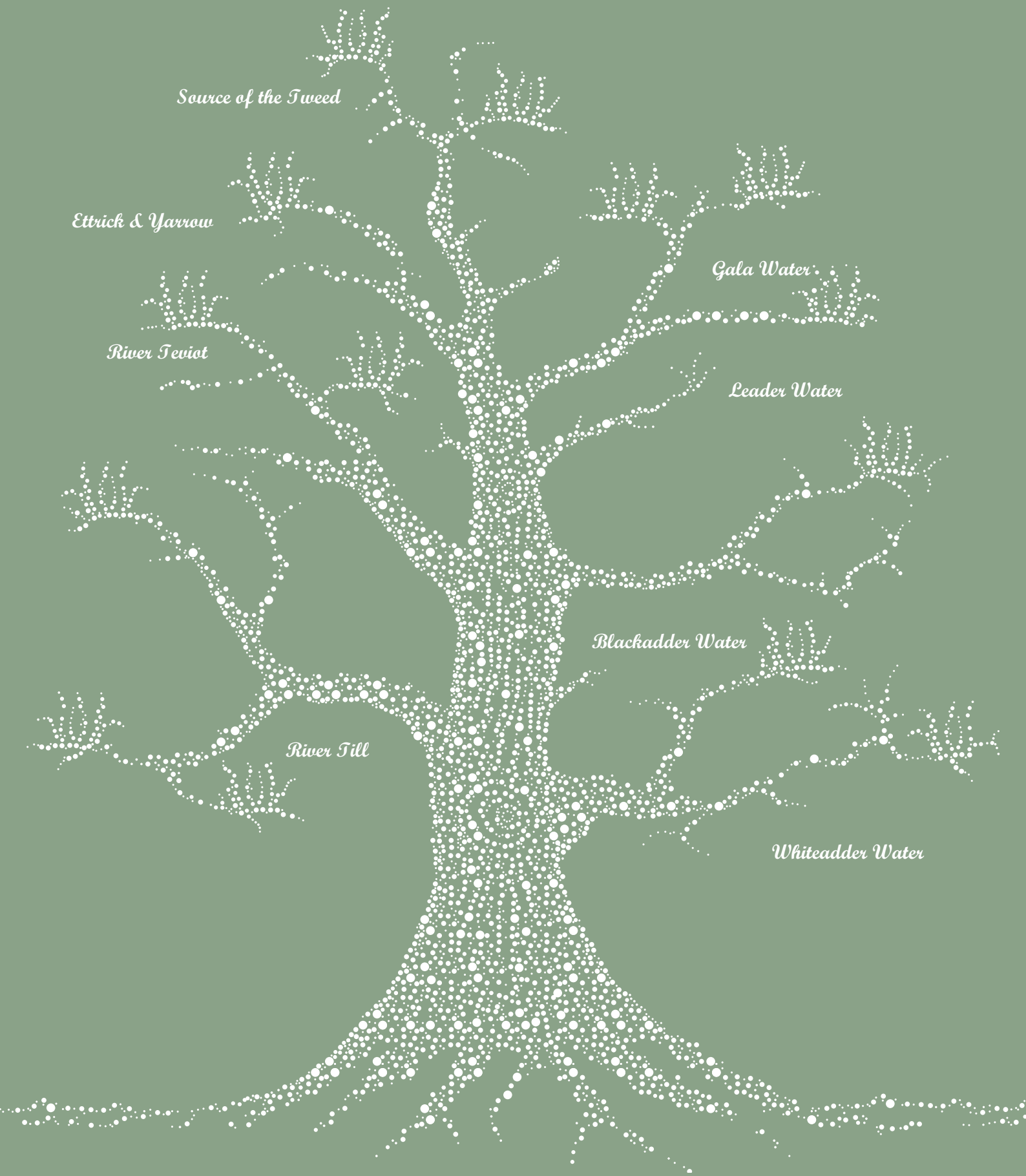
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*Source of the Tweed*

*Ettrick & Yarrow*

*Gala Water*

*River Teviot*

*Leader Water*

*Blackadder Water*

*River Till*

*Whiteadder Water*

