Common Standards Monitoring Guidance

for

Lowland Wetlands Habitats

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1 Introduction

1.1 This guidance section encompasses the full range of notified mire types (bogs and fens) in the UK lowlands including lowland blanket bog. It is intended to complement the upland guidance section, which covers upland blanket bog and all upland fens except swamps. In this context 'lowland' is broadly defined as being below the functional limit of enclosure. In case of uncertainty over whether to use this guidance or the upland guidance, advice should be sought from country specialists.

1.2 The supply, movement and chemical attributes of water, subject to land-use pressures, determine the nature of a wetland. Wetlands can be broadly divided into those affected by ground and/or surface water and those (in the main) which are dependent on rainwater. Between these extremes, there is variation in the proportions of groundwater to rainwater, in water chemistry (as determined by soil and rock through/over which the water passes), in seasonality and water level fluctuation, and in degree of flow. Condition monitoring will in some instances need to take into account the level of hydrological complexity found in wetlands, both the broad landscape-level attributes of a wetland and its internal hydrological complexities.

1.3 Structure is more important in determining the quality of some wetlands than for others. For example, a raised bog has a characteristic structure, whereas seasonally inundated wetlands along the fringes of a river are variable, both in their relationship with the river and the degree to which other water sources (e.g. bank seepages) are involved. Where a wetland type has a characteristic structure it is fundamentally important in determining the biota and is a key element of quality. Hydrogeology, topography, land use and climate are the keys to the distribution and well-being of wetland types.

1.4 Lowland wetlands can be classified in various ways, based on for example topography, hydrological characteristics, water chemistry or floristics. This guidance is based around the classification adopted in *Guidelines for selection of biological SSSIs* (NCC, 1989). Specific guidance is provided for the following categories:

(i) lowland raised bog and blanket bog

(ii) lowland fen, including:

- flood-plain fen
- basin fen
- open-water transition fen
- valley fen
- springs and flushes
- fen woodland
- fen meadow

In addition, guidance has been provided for monitoring the Annex I habitat 'Depressions on peat substrates of the *Rhynchosporion*'. This habitat is very variable and can occur in a range of mire and bog types.

Fen woodland and fen meadow are also included in the woodland and grassland guidance chapters, which should be used in conjunction with this guidance (see section 8). For fen vegetation in coastal environments such as dunes, saltmarshes and coastal cliffs, the relevant coastal guidance chapter should be consulted alongside this chapter. For fen in freshwater and brackish ditches or canals use the relevant freshwater guidance, unless fen is a specific notified feature. Monitoring guidance for wet heath is given in the lowland heathland chapter.

1.5 For the purposes of this guidance, bogs are regarded as predominantly ombrotrophic (rain-fed), whereas fens (minerotrophic mires) occur in waterlogged situations where they receive nutrients from the surrounding surface and/or groundwater catchment as well as from

rainfall. Springs and flushes are also a type of fen and are included in the summary Table 4, however they have been dealt with separately in section 8.5 of this guidance to ensure coverage of those that are not part of a wider wetland or other habitat complex, and to cover those with particular importance through their vegetation communities.

1.6 There is considerable overlap between the SSSI categories in terms of hydrological functioning and vegetation. Thus wetland interest features with a common hydrology are sometimes listed separately in this guidance, but cross references are included where relevant. The wetland types on Annex I of the Habitats Directive do not divide neatly between the SSSI categories and may occur in several different categories. The relationship between lowland wetland Habitat Action Plan categories, Phase 1 Survey categories, SSSI interest features and Annex I habitat types is shown in Appendix 1 and is also described in section 2.2.

1.7 These guidelines discuss the generic attributes chosen for monitoring lowland wetlands, indicate general targets and suggest possible field methodologies. For each of the SSSI categories, a habitat description is given and key habitat components and vegetation types described. Two summary tables (Table 3 Lowland bogs & Table 4 Lowland fens) are provided, listing all the generic attributes and targets for each SSSI category. For fens the 'vegetation composition' attributes should also be used in conjunction with two further tables which outline the desirable (Table 5) and undesirable (Table 6) species for key NVC communities in each of the interest features and/or their component wetland types (see habitat details). For fen meadows and fen woodland cross reference to the relevant table(s) in the lowland grassland and woodland guidance is made. In practice, many wetland sites include elements of more than one of the SSSI categories and an appropriate suite of targets should be chosen from the tables, to cover the range of types present on the site.

1.8 Geographical and climatic variation results in regional variation in wetland structure and vegetation characteristics. For instance, in the wetter north and west of the UK raised bog is typically patterned and the predominant NVC community is M18 *Erica tetralix-Sphagnum papillosum* mire. In the drier south and east raised bog is generally flat and M20 *Eriophorum vaginatum* mire is more likely to be widespread. Regional variation should be taken into account when setting targets.

1.9 When setting conservation objectives for a site, the relative importance of all the interest features must be considered and targets may need to reflect a compromise. For instance, excessive scrub cover can damage a wetland but it may form an important habitat for certain birds and invertebrates, so a balance needs to be struck to accommodate both the general well-being of the wetland feature and that of its fauna. Consequently, suggestions here for threshold percentage cover are simply indicative.

2 Defining the interest feature

2.1 Lowland wetland SSSIs have normally been selected according to the fens and bogs chapters in the *Guidelines for the selection of biological SSSIs* (NCC, 1989) or the revised guidelines for bogs (JNCC 1994). ASSIs have been selected in a similar manner. The information as to why a particular site was initially selected may be more-or-less precisely documented. Criteria for selection include the presence of particular NVC types, structural variation, size and level of degradation.

2.2 Lowland wetland cSACs may qualify for a range of habitats on Annex I of the Habitats Directive, as listed in Table 1. To help with setting conservation objectives for these features the relevant lowland wetland categories used in this guidance are also indicated in the table; note that some of these Annex I types may occur in more than one of these categories.

Several of these Annex I types may also be found in the uplands, in which case the Upland habitats guidance chapter should be consulted instead. The table also indicates the typical NVC communities that these Annex I habitats correspond to (wholly or in part), but the correspondence is often not exact and the lists may not be comprehensive. The habitat 7150 *Depressions on peat substrates of the Rhynchosporion* may occur in a wide range of lowland bog and fen types, as indicated, but also occurs in wet heath; further guidance is given in section 9.

Table 1. Habitats Directive Annex I types included in the Lowland wetlands guidance section. Separate guidance is included in the Upland chapter for the asterisked feature types in upland situations i.e. above the limit of agricultural enclosure.

code	Annex I habitat	Relevant lowland wetland SSSI feature(s)	principal NVC communities present in lowland forms
H7110	Active raised bogs	Raised bog	M18, M19, M1, M2.
H7230	Alkaline fens*	Basin fen, Floodplain fen, Springs and flushes, Valley fen	M9, M10, M13
H7130	Blanket bogs*	Lowland blanket bog	M1-3, M15, M17-20, M25
H91D0	Bog woodland	Fen woodland	W2-W4
H7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	Floodplain fen, Open-water transition fen, Valley fen	S2, S24, S25, M9, M13, M14, M24, SD14, SD15
H7120	Degraded raised bogs still capable of natural regeneration	Raised bog	M3, M15, M16, M18, M20, M25
H7150	Depressions on peat substrates of the *Rhynchosporion**	Lowland blanket bog, Raised bog, Springs and flushes, Valley fen	M1, M2, M14-18, M21, M29
H6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	Fen meadow	M24, M26
H7220	Petrifying springs with tufa formation (*Cratoneurion*)*	Springs and flushes	M37-related
H7140	Transition mires and quaking bogs*	Basin fen, Floodplain fen, Valley fen	M4, M5, M9, S27

2.3 The boundary of wetland sites should ideally follow the surface and subsurface catchments of fens, and the complete extent of the peat body of bogs. Although in practice the extent to which this is achieved is often limited, many statutory sites do incorporate a buffer zone, often of 'improved' agricultural land. This land is fundamental to the viability of the wetland, however it does not constitute a part of the interest feature to be monitored, and the attributes and targets should not be applied to it. Activities on improved land are likely to play a major role in determining the condition of the wetland, and any potentially damaging activities in these areas should be noted during the condition assessment of the wetland, and used to help identify the likely trends in condition.

2.4 On SSSIs the complete extent of the wetland should in general be considered to be the interest feature and should be monitored, even if it is known that a site was selected because of the presence of a particular community that may be only a small component of the wetland feature. Conservation objectives should be set for the whole area, with the exception of land that was only included to ensure the hydrological integrity of the site. Some sites, particularly raised bogs, may have included areas that were degraded when the site was designated.

Conservation objectives should be set for the degraded parts, and these should include mire regeneration.

2.5 It may not be possible on all fen sites to define which of the SSSI fen categories (listed in sect. 1.4) make up the wetland interest feature. This is not essential since it is likely to be the whole wetland, not any particular component, which makes up the SSSI interest feature. It should be possible in these cases to produce a series of targets from the tables that are appropriate for the range of wetland types present on the site.

2.6 On SACs the interest feature is defined as the Annex I habitat type or types (listed in Table 1 and Appendix 1). This may not include the complete extent of the wetland on the site. In this case the extent and condition of the Annex I habitat type should be reported on separately in addition to the extent and condition of the complete wetland in the underlying SSSI.

3 Attributes and targets

3.1 General

3.1.1 A series of broad attributes has been defined that should normally be part of the conservation objectives for any site where lowland wetland habitats are an interest feature. The attributes are common to all lowland wetland interest features, but some targets, in particular for vegetation composition, will differ in nature between interest features. Detailed targets and suggested methodologies for individual features are given in the accompanying summary tables.

3.1.2 For all lowland wetlands the mandatory attributes are:

1. Habitat extent

2. Habitat composition

3. Habitat structure

4. Vegetation composition: positive indicator species

5. Vegetation composition: indicators of negative change
   - *Undesirable non-woody plant species*

6. Vegetation composition: indicators of negative change
   - *Undesirable woody species*

7. Indicators of local distinctiveness.
   Individual site-specific interest features, for example, structural features, notable species, transitions to other habitats, will have particular mandatory attributes.

3.1.3 There should normally be at least one target specified for each of the attributes. The targets set out here are for guidance only. They should be interpreted in terms of local knowledge of the site, its history and its surroundings. When a target is not applicable to a particular site it should not be incorporated, but a record of why the decision to exclude was taken should be made. Significant departures from the guidance should be agreed with country specialists.

3.1.4 While water and its attributes are key factors in determining wetland

condition, direct monitoring of water levels/flows and chemistry/quality are considered to be inappropriate for this generic UK guidance, although they may be critical to the feature condition. If problems are suspected, more detailed research of this kind may be needed. For monitoring purposes, it is the dependent biota which is taken as the prime indicator of wetland quality. For vegetation this is manifested in attributes such as extent, the presence of particular species and indicators of unwanted change, whether this results from natural succession or is the consequence of land use. However, while the biota may be used as a surrogate index for the condition of the supporting hydrological regime, it must be recognised that the speed of response to change is unknown. Furthermore, detecting species change in plant communities is notoriously equivocal.

3.1.5 A flow chart graphically illustrating the stages that need to be taken on each site is provided in Appendix 2.

3.2 Habitat extent

The extent of the lowland wetland feature is the total extent of wetland vegetation. The boundaries of the wetland interest feature may or may not coincide with that of the designated site, part of which might be extensively claimed for agriculture other than grazing or grass crop production. In determining the extent of the feature it is important to identify and exclude any claimed land included within the designated site boundary for hydrological reasons. The target is always that there should be no loss in area of the wetland feature.

3.3 Habitat composition

The possible component wetlands in each SSSI category are described in the Habitat Details, sects. 7-8. On some sites only one component wetland will be present, but on others there will be multiple components. If possible these components should be mapped such that their individual extents can be monitored. However, in some cases the components are in an intricate mosaic and the vegetation does not always provide sufficient indication of the boundaries. In complex cases, determining the continued presence of the various components on the site may be sufficient. A primary aim is to retain the *variety* and *extent* of these components. However, natural successional processes should be taken into account, which means that some change in the proportions of the component wetlands may be inevitable and/or desirable. Acceptable limits of change must be determined on a site-specific basis, bearing in mind national and local contexts and priorities, as well as management implications. For each wetland site a functional and spatial concept should be developed, placing interest features within a successional context and indicating where management intervention is required.

3.4 Habitat structure

Wetland interest features may include important structural elements, some of which may provide a hydrological function. Good examples include surface patterning (hummocks, hollows and pools) and exposed substrate. Deterioration in habitat or vegetation structure may be caused by activities such as drainage, burning, peat cutting, vehicle damage or over-grazing, which in some cases may result in loss of hydrological function. Structural deterioration caused by such activities could indicate unfavourable condition but care needs to be exercised on an individual site basis to be clear that either the structural element is part of the interest feature, or that it is inextricably linked to its condition. It may be that some bare ground (e.g. that created by cattle poaching) is important for the establishment of short plants, the feeding of birds, or the reproduction of invertebrates.

3.5 Vegetation composition: positive indicators

3.5.1 This attribute relates to floristic composition. It is focussed at plant

community (NVC) level for topogenous and soligenous fens and at supra-NVC level for ombrogenous mires. The application of this attribute is not dependent on the prior availability of comprehensive NVC survey information. Instead, the recommended approach is to focus effort on specific components of the overall vegetation cover of wetland interest features. Each of the sections covering bogs and fens provides guidance on how to do this.

3.5.2 NVC communities typically occurring in components of each fen type are indicated in Section 8. Those characteristic of the component are marked * and those that are rare, or indicative of an Annex I habitat are marked **. At least one (but preferably all) rare or Annex I communities should be monitored for each component wetland. This is especially critical for Natura 2000 sites where a very few NVC communities will generally comprise the bulk of an individual Annex I feature. Where rare or Annex I communities are absent, at least one characteristic community (drawn from the list marked *) should be monitored for each component wetland. Positive indicators associated with these NVC communities are presented in Table 5, with suggested measures of cover and/or frequency. Where monitoring at supra-community level is appropriate, positive indicators spanning two or more communities may be derived from Table 5 - an example could include the M4/M5 couplet.

3.5.3 The positive indicator species have been chosen to be as concise and taxonomically undemanding as possible. They do not necessarily portray an 'NVC table' concept for each community, but provide a basis for development of site-specific targets. While the latter may deviate substantially from the indicative thresholds presented in Table 5 (for example in order to accommodate high quality stands or local distinctiveness) the chosen suite of indicators should still reflect the underpinning rationale for the site's selection. In some cases this may include the presence of individual communities, in which case positive indicators should serve as a fairly precise 'definition' of the community in question. An initial reconnaissance visit will greatly aid the production of site-specific lists of positive indicators - existing NVC survey coverage may help to speed up this process.

3.5.4 Assessments of extent may be required for some individual or groups of communities. For example, it may be desirable to monitor the balance between a community which comprises the bulk of an Annex I feature at a site (e.g. M9 or M13) and one whose expansion might well indicate dereliction (e.g. M22) or enrichment (e.g. S25). Various methodologies may be employed for assessing change in extent, including (i) comparison against accurate baseline maps, (ii) assessments of whether a certain percentage of sample points laid out upon a grid conform to the community or not and (iii) shifts in the position of community interfaces along permanent transects. In other cases changes in the relative extent of individual communities may be largely immaterial to feature condition (e.g. M2 and M4, or M4 and M5).

3.6 Vegetation composition: indicators of negative change

3.6.1 These are indicators of unwanted trends, inappropriate to the interest features for which the site was notified. Thus, perfectly natural and desirable features may become 'negative' simply because they are in the wrong place. In particular, they indicate an unwanted change in trophic status, or of a succession that may cause the interest feature to be diminished or lost. Indices of deterioration are similar for many types of wetland but targets will need to be tailored for each site according to, for instance, trophic status relevant to favourable condition. Negative indicators for bogs are included in the summary Table 3, negative indicators for fens are shown in Table

6 for the various NVC communities that could be selected for monitoring the condition of the component wetlands. It will often be possible to set targets which encompass a range of vegetation types within a particular wetland.

3.6.2 Undesirable non-woody vascular plants species are mainly indicators of succession expressed through enrichment or drying out. These species may include *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica, Pteridium aquilinum, Rubus fruticosus* and *Molinia caerulea* (see Table 6 for fens), but the list will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. Invasive non-native species would also be included as negative indicators.

3.6.3 Although wet woodland may constitute an interest feature in some situations, scrub and trees on bogs and fens are sometimes regarded as detrimental because they are indicators and perpetrators of drying out and may cause damage to vegetation structure through shading effects. Birch, pine, willow and rhododendron (an invasive non-native species) are the main species of concern. The seeds of most invasive woody species are wind dispersed, so trees are able to establish on raised bog and fen surfaces. Where the surface is damaged hydrologically (e.g. by draining) or physically (e.g. where a bare peat surface is present as a result of fire or peat removal) the seedlings appear more successful. However, seedlings are also abundant on some surfaces that have a year round high water table if a seed source is close by.

3.6.4 Ongoing research on the effect of growing scrub and trees on raised bog surfaces suggests that the increased evapotranspiration rates from trees causes depression of the water table local to the tree itself. Although there is considerable evidence in the macrophyte and pollen record that birch and pine have grown for considerable periods on wetland surfaces in the past, the relationship of these periods of growth with past climatic conditions is unclear. Until further research is carried out, excessive and vigorous scrub growth is taken as a negative indicator on bogs and many fens. However, judgements may also take into account whether the scrub components are growing vigorously, or are scattered and stunted and thus not constituting a threat to the interest feature.[1]

3.7 Indicators of local distinctiveness

Indicators of local distinctiveness are features that make a site ‘special’ but which are not included in the other attributes. They should be apparent from SSSI citations or past surveys. This attribute may not be applicable to every site, but where local distinctiveness has contributed to the selection of the designated site it should be mandatory. Indicators of local distinctiveness are too numerous and diverse to list, and will already be identified for individual sites on all interest features. They may include:

- uncommon species that are not notified features in their own right (e.g. marsh gentian *Gentiana pneumonanthe*, particular orchids)
- structural features such as pools that may be important for species such as amphibia or dragonflies
- mosaics or transitions to wet variants of other habitats.

Targets should be tailored for each site, for instance based on the presence of uncommon species or the extent of a structural feature.

[1] This is particularly relevant in respect of bog woodland, a Habitats Directive Annex I type.

3.8 Mosaics and transitions

3.8.1 The targets for the attributes mentioned in the previous sections and listed in the tables are broad enough to accommodate some variation. However, if the targets do not seem applicable to the vegetation in the site, it may be necessary to develop a new attributes table that covers the specific habitats forming the mosaic. Some interest features are a mosaic of a number of different vegetation communities, indicative of a range of hydromorphological types (e.g. transition mires). Where this is the case, the monitoring should be based on component wetlands.

3.8.2 Basin fens, for instance, may exhibit considerable community heterogeneity. Many of the communities encountered may appear to be transitional in nature when compared with the published NVC descriptions, partly because of the relatively small number of samples upon which some of the published community descriptions are based. These and transitions between recognisable communities comprise part of the intrinsic interest of many basin fen sites. Transitional communities are catered for under the 'Habitat extent' attribute, which covers the sum extent of the likely range of communities present on statutory sites, rather than setting precise limits for the maintenance of individual communities. However, this is recommended for a few particularly notable communities (e.g. those indicative of base-rich groundwater seepages: M10 *Carex dioica-Pinguicula vulgaris* mire in the north and west, M13 *Schoenus nigricans-Juncus subnodulosus* mire in the south and east). Mosaics comprising low, sodden bryophyte-filled pools, hollows and soakways and taller sedge and forb-dominated vegetation are common and comprise a valuable element of basin fens. These are not specifically covered in this guidance; where deemed necessary, targets for the frequency of mosaic elements should be set on a site-specific basis and treated as 'Indicators of local distinctiveness'.

4 Recommended visiting period and frequency of visits

4.1 Generally the best time to carry out monitoring in wetland systems is between early June and the end of September, when sedges are flowering or fruiting and their identification is easiest. Tall vegetation is also prone to being flattened by wet Autumn weather. Other times of year may, however, be more appropriate for some investigations. The effects of eutrophication, for instance, are more obvious in April than later in the year because in the spring, when *Molinia caerulea* is still brown, green patches of the nutrient-tolerant grasses *Agrostis* species and *Holcus lanatus* are obvious.

4.2 At least one visit should be made to each site within a single six-year reporting cycle. If specific problems are identified, more frequent visits are desirable to check on the threat, any consequent management action and the outcome.

5 Skills requirements for monitoring

It is not possible to restrict the floristic attributes to those that can be recognised by untrained people. Certain sedges and bryophytes are unique indices of quality in many wetland types and communities, so botanical knowledge and experience with the NVC is essential. As well as botanical expertise, some knowledge of wetlands is required, so that the person carrying out monitoring can interpret structure and function and identify likely water sources. It is important to take heed of these requirements in securing the necessary resources for monitoring and training staff.

6 Methods of assessment

6.1 Monitoring protocols should be designed with the following aims in mind:

- to cover all the attributes indicating habitat quality
- to be able to find what is expected, where it is expected (providing it is still present)
- to monitor at 'wetland' and community levels, as appropriate for each attribute.

6.2 Baseline maps of the designated site should be produced, showing the boundaries of the interest features, the extent of the structural elements and the distribution of key vegetation communities and nationally rare/scarce or locally distinctive plant species. Aerial photography can help in the production of the maps. False colour and interpretation by spectral band may be useful. The use of GPS to determine the position of interfaces and notable species is recommended. These maps are subsequently used in monitoring to assess change.

6.3 During monitoring, aerial photography may be adequate for making a rapid determination of the extent of features and of component wetlands, although some ground-truthing may be necessary. Aerial photographs may also be useful for assessing the overall cover of trees and shrubs.

6.4 Visual assessment along a structured walk or transects is recommended for monitoring habitat and vegetation structure, and the presence of indicators of local distinctiveness. This method can also be used for assessing cover of woody species. The line of transects and the route of structured walks should be set using information from the baseline map, to make sure that all the necessary habitats, vegetation types, populations of notable species and other indicators of local distinctiveness can be examined.

6.5 Vegetation composition in the key NVC communities is monitored by visual assessment of the cover of previously selected positive and negative non-woody indicator species (see Section 3), taking samples along transects, on structured walks, at random, or on a grid. Sufficient samples to encompass all the observed diversity would be needed.

6.6 The final assessment of the wetland interest feature should be produced by combining the information from all of the component wetlands that have been monitored. The conclusion must be one of the following:

6.6.1 Favourable maintained. All attributes meet targets in current assessment and previous assessment favourable. All component wetlands should meet their targets.

6.6.2 Favourable recovered. All attributes meet targets in current assessment, and previous assessment unfavourable. All component wetlands should meet their targets.

6.6.3 Unfavourable recovering. At least one attribute does not meet target in current assessment. Guidance on when to consider a degraded raised bog as 'recovering' is given in sect. 7.3. The feature may be considered to be recovering if positive management is in place, even if no measured attributes are improving, as long as the assessor is confident that the management will eventually produce favourable status. Particular note should be made of the management of any buffer zones or 'improved' areas within the SSSI, as these can determine the trend in condition of the wetland area.

6.6.4 Unfavourable no change. At least one attribute does not meet target in current assessment. No clear evidence of recovery or decline.

6.6.5 Unfavourable declining. At least one attribute does not meet target in current assessment. This conclusion should be reached if the management of buffer zones or other 'improved' areas is causing continued damage to the wetland area.

6.6.6 Partially destroyed. This conclusion should be used if a part of the wetland area has been completely destroyed such that recovery is impossible. The remainder of the wetland area should be assessed separately.

6.6.7 Destroyed. This conclusion should be used if the entire wetland area has been completely destroyed such that recovery is impossible.

INTEREST FEATURES: Descriptions of wetland interest features and use of NVC communities as indicators of condition

7 Lowland raised bog and blanket bog

7.1 Raised bog

7.1.1 Definition

7.1.1.1 Raised bog is an ombrotrophic (rain-fed), peat-forming ecosystem that has developed through several thousand years of peat accumulation. The resulting dome of peat, which stands above the level of the surrounding land surface, effectively isolates the surface of the raised bog from the influence of groundwater. Being predominantly rain-fed, it has an acidic nature that is poor in nutrients. Typically these habitats support a restricted range of species that are otherwise abundant only in the cooler and wetter uplands of the UK.

7.1.1.2 The peat forming species found on these habitats include a number of *Sphagnum* moss species and cotton grass (*Eriophorum* spp.) species that can survive in nutrient-poor conditions. In addition, other common species include heather *(Calluna vulgaris*) on drier parts of the mire, in a mosaic formation with species which are associated with wetter conditions such as cross-leaved heath *(Erica tetralix)* and sundew *(Drosera* spp.). Many other species are also found within typical raised bog vegetation.

7.1.1.3 The majority of raised bog in the UK has been altered by human activity. Bog specialists distinguish between 'active' raised bog and 'degraded' raised bog surfaces. 'Active' raised bog has been affected less by human activity and still supports peat formation, as indicated by its vegetation. 'Degraded' raised bog has been altered so much by human activity that although some remnants of typical vegetation may be present, the peat forming ability has, at least temporarily, been lost. The broad conservation aim for all designated sites is to maintain and/or restore peat formation on the raised bog surface. A number of management techniques are currently being implemented to achieve this aim.

7.1.1.4 'Active raised bogs' and 'Degraded raised bogs still capable of natural regeneration', as included in Annex I of the Habitats Directive, are monitored to the same standard. 'Degraded raised bog capable of regeneration' is the only *Natura 2000* habitat included for its potential for restoration. This is because of the acknowledged scarcity of undamaged examples of the habitat in Europe.

7.1.1.5 A typical raised bog has a gently domed profile, with the peat deepest at the

centre. The mire expanse is the main bog surface. The edges are marked by a sloping mire margin, or rand. Undamaged raised bog is known in many cases to have been surrounded by lagg fen where it met more minerotrophic conditions at the margins of peatland. Lagg fen is now uncommon in British raised bogs because most have been highly modified at the edges. Where it still exists lagg fen should be considered a component part of the raised bog habitat. In some cases it may be a notified (fen) feature in its own right.

7.1.1.6 The surface of an active raised bog mesotope (its microtope) has a typical structure consisting of a pattern of hollows and ridges or pools and hummocks. Bog microform relates to single surface features such as pools. This patterning is of intrinsic interest and is important in SSSI selection (Joint Nature Conservation Committee, 1994).

7.1.2 Component wetlands and key vegetation types

7.1.2.1 The component wetlands of raised bog comprise the mire expanse, rand (although this may not always be mappable) and lagg fen, where it still exists. The mire expanse will be characterised by ombrotrophic NVC community types, the rand by communities of drier peat, lagg fen by other NVC types associated with more minerotrophic conditions, as listed below. If in doubt about classification of the lagg fen, contact your country specialist. A mapped distinction should be drawn between the 'active raised bog' surface and any area that is 'degraded but capable of natural regeneration'.

7.1.2.2 On active raised bog the vegetation should comprise an inter-mix of bryophytes (predominantly *Sphagnum* spp.), graminoids and dwarf shrubs, with no one group dominating at the expense of others. Natural zonation should be taken into account in assessing condition. For instance, *Myrica gale* is expected on the interface with the lagg and *Molinia caerulea* is occasionally abundant on the rand and in the lagg. Each of the 'major' ericaceous plants and Cyperaceae occurring on the mire expanse (*Calluna vulgaris, Erica tetralix, Eriophorum angustifolium, Eriophorum vaginatum, Trichophorum cespitosum*) inhabits a separate place on the eco-hydrological spectrum by merit of its individual ability to grow at a different point relative to, for example, the depth of the underlying water table. However, the dominance of a single species (e.g. heather) is likely to indicate problems on the surface of the mire (e.g. drying) and should be recorded through the monitoring process.

7.1.2.3 *Sphagnum* species are the most reliably indicative for peat forming activity on a raised bog especially in the north and west. The *Sphagnum* species present are dependent on the nutrient status of water within the bog and the position of the surface of the bog relative to the water table. The surface of an active raised bog has low nutrient, high water table conditions. *Sphagnum papillosum, S. capillifolium, S. tenellum* and *S. magellanicum* are commonly found on raised bogs as indicators of good surface condition. A well developed surface that has had little disturbance over time would be expected to have a mixture of these species.

7.1.2.4 Four NVC communities occur on the mire expanse, sometimes extending into the rand, of active and degraded raised bog:

- M17 *Scirpus cespitosus* (*Trichophorum cespitosum*)-*Eriophorum vaginatum* blanket mire
- M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire
- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire
- M20 *Eriophorum vaginatum* blanket and raised mire

M18 is the typical raised bog community of the west and north, but its representation is more limited in the south and east. M20 is typical of poor quality and degraded raised bog in the north and west, but may be more dominant in the drier south and east. M17 and M19 blanket mire communities may occur, especially on intermediate mires in northern Britain. Some wet and dry heath (e.g. M15 *Scirpus cespitosus* (*Trichophorum cespitosum*)-*Erica tetralix* wet heath) communities can also occur on degraded bogs. The *Sphagnum magellanicum-Andromeda polifolia* sub-community of M18 is likely to be found in the wetter areas (e.g. around pools) and the *Empetrum-Cladonia* sub-community of M18 may be prominent on the rand. If the *Empetrum-Cladonia* sub-community is extensive on the mire expanse it may indicate drying out and unfavourable condition, with *Sphagnum* being replaced by hypnoid mosses. See page 189 of Rodwell (1991b) to understand zonation and its implications.

7.1.2.5 Bog pools may occur in some sites, typically with:

- M1 *Sphagnum auriculatum* (*denticulatum)* bog pool community
- M2 *Sphagnum cuspidatum/recurvum* (*fallax*) bog pool community
- M3 *Eriophorum angustifolium* bog pool community

7.1.2.6 Lagg fen, where present, could include one or more of the following:

- M4 *Carex rostrata-Sphagnum recurvum recurvum* (*fallax*) mire
- M6 *Carex echinata-Sphagnum recurvum/auriculatum* (*Sphagnum fallax/denticulatum*) mire
- M22 *Juncus subnodulosus-Cirsium palustre* fen meadow
- M23 *Juncus effusus/acutiflorus-Galium palustre* rush pasture
- M24 *Molinia caerulea-Cirsium dissectum* fen meadow
- M25 *Molinia caerulea-Potentilla erecta* mire
- M27 *Filipendula ulmaria-Angelica sylvestris* mire
- S4 *Phragmites australis* swamp and reed-beds
- W4 *Betula pubescens-Molinia caerulea* woodland
- W5 *Alnus glutinosa-Carex paniculata* woodland
- W6 *Alnus glutinosa-Urtica dioica* woodland

7.1.2.7 The most characteristic vegetation type of raised bog is M18 *Erica tetralix-Sphagnum papillosum* mire. Species typical of this community have been chosen as positive indicators of the structural and functional naturalness of the mire expanse of raised bog. Relatively low cover or absence of these species indicates degradation of the bog, but realistic targets should be set for the extent of this vegetation type in drier situations in the south and east. Specialist advice may be needed to set these targets.

7.2 Regenerating bog

7.2.1 During restoration, degraded raised bogs may have a number of bryophytes present, but with only one or two species of sphagnum at first. As surfaces become more densely revegetated, more species of sphagnum would be expected to invade. The aim of raised bog restoration is to elevate and stabilise the water table, so the bog can grow and regain characteristic structural features (e.g. bog pools) and to enable plant assemblages on the mire expanse, similar to M18, to become re-established.

7.2.2 *Sphagnum cuspidatum* is a good indicator of high stable water table, and is often the first to colonise blocked drains and bare peat, where a high water table has been restored. The presence of *S. cuspidatum* is therefore used in monitoring as a surrogate to indicate the success of this process. *S. cuspidatum* at least occasional indicates ‘unfavourable recovering’ condition, where the other targets are not achieved; a similar cover of ‘M18’ sphagna also indicates this condition on sites where recovery relies on channelling of surface water flow to create damp conditions.

A site which fails on its target of *S. cuspidatum* should be referred to a specialist for advice on initiating hydrological monitoring, in order to identify problems and establish an improved hydrological regime. A degraded raised bog may be considered 'recovered' and in favourable condition when M18 (or a community as appropriate to location) is a prominent plant community and characteristic structural elements are present. However, some structural surrogates may suffice (e.g. old ditch lines for linear pools) and allowance must be made for geographical variation when considering how much of the mire surface should be dominated by M18.

7.3 Lowland blanket bog

7.3.1 Blanket bog is the primary peatland feature of the UK uplands, but more or less unconfined ombrogenous bogs also occur in the enclosed lowlands, particularly in the west and north-west. These lack the characteristic stratigraphy and topography of classic confined lowland raised bogs, and instead occur as thinner deposits of ombrogenous peat over gently sloping or flat ground. Lowland blanket bog may sometimes be associated with raised bog systems in contexts where peat growth has expanded well beyond the original focus of peat formation – these so called intermediate mires are notoriously difficult to identify and in terms of statutory features are always classified as either lowland raised bog or blanket bog – depending on which is the dominant element.

7.3.2 Lowland blanket bog is a concept best applied to enclosed lowland landscapes. The lowland character of this habitat and its often limited extent precludes application of the upland blanket bog condition assessment guidelines to such stands – for example, the upland guidelines 'accepts' a certain amount of peat erosion and drainage, neither of which are likely to be acceptable in the enclosed lowlands. Blanket bog within unenclosed contexts does descend to lowland altitudes in parts of Britain (particularly the extreme north-west) and such systems are commonly contiguous with extensive tracts of upland bog. It is for this reason that these systems are best assessed using the upland guidance for blanket bog.

7.3.3 Lowland blanket bog supports the same broad range of communities as lowland raised bog, although the representation of individual communities is somewhat different. M17 is often the pre-eminent vegetation type, commonly with M2 bog pools. The characteristic lagg fen and rand morphology of relatively intact raised mires is less marked in the case of lowland blanket bog, although peripheral streams often mark junctions between soligenous and ombrogenous mire. The concept of mire expanse developed above for raised bog is here taken to refer to that part of the mire surface supporting classic bog plant communities.

8 Lowland Fen

Fen sites may be divided into two major categories based upon water table characteristics: topogenous fens in which vertical water table fluctuations predominate because of impeded drainage, and soligenous fens where horizontal water movement is also important; but this distinction is rarely clear-cut.

Although the division between topogenous and soligenous fens broadly corresponds to differences in vegetation types, not all plant communities are strictly confined to one or the other topographical/hydrological category. Three main types of fen that are often predominantly topogenous are flood-plain fens, basin fens and open water transition fens. Flood-plain fens may be extensive and include soligenous areas. Basin and open water transition fens are very similar in essential characteristics but differ in the proportion of fen

area to that of open water. Topogenous fens are generally peat-forming systems, although flood-plain fen peats may show considerable mineral content close to the river, so sites in nutrient-rich catchments may be naturally eutrophic. Lowland fens that are predominantly soligenous include valley mires (often extensive), springs and flushes (see section 9), and laggs of raised bog (see 7.2). Soligenous fens may or may not be peat-forming.

Table 2. Summary of component wetlands of lowland fens. Adapted from Wheeler & Shaw (2000) Table 1-13.

	Basin wetlands (**Basin fen**)	Lakeside wetlands (**Open water transition fen**)	Coastal-/Flood-plain wetlands (**Flood-plain fen**)	Plateau-Plain wetlands (partly included in **Flood-plain fen**)	Valleyhead wetlands (**Valley fen**)	Hillslope wetlands (includes **Springs and flushes**)
Alluvial wetland			+++		+	
Waterfringe wetland	+++	+++	++			
Sump wetland	+++	+++	+++	+++	+	
Percolating wetland	+++	+	+++	+	+++	
Water track	+		++	+	++	
Spring-fed wetland	++	++	+	++	+++	+++
Run-off wetland	+	+	+	+	+++	+++
Soakway					++	+++
Topogenous bog	+++	++	+++	+++	+	
Hill bog	+	+	+	+	+	+++
+++: particularly characteristic of the wetland type ++: sometimes occurs within the wetland type +: of minor importance, or peripheral						

8.1 Flood-plain fen

8.1.1 Definition

8.1.1.1 Flood-plain fen is widely distributed throughout Britain, but there are only a few large expanses remaining, such as East Anglian Broads and the Insh Marshes in Scotland. In general this site type is represented by isolated patches of fen surrounded by drained fields. The sites occupy land that is mostly flat, as on coastal or river flood plains, but are not necessarily associated with either of these landforms.

8.1.1.2 Variety within the flood-plain fen is determined by water supply mechanism, hydroseral succession and land management practices. If left to its own devices, it would usually become fen woodland (see Section 8.6). However, many raised bogs have historically developed within flood-plain fens, where precipitation has become the major source of water at the surface. Therefore fen woodland is not necessarily the successional end-point on a longer time scale. Intervention is often required to maintain the desired range of habitats and dependent species.

8.1.1.3 Flood-plain fens are very vulnerable to drainage (interception of seepage) and interruption of their flooding regime, especially when fragmented by agricultural claim or affected by river engineering. The once vast tracts of ill-drained, flooded valley floors alongside mature rivers have been drained and reclaimed, largely for agricultural use. The management of flood-plain fens for grazing has given rise to various fen meadow communities (see Section 8.7). There is commonly a transition from flood-plain fen to wet grassland (as there is to wet woodland) and in coastal areas there may be a brackish transition to salt marsh.

8.1.1.4 Although classed as topogenous (alluvial wetland) in the SSSI Guidelines, soligenous sources (percolating wetland) can be important in floodplain fens. Topographic irregularity within them can also give rise to ponding (sump wetland) and run-off occurs via water tracks or soakways. The differences give rise to zonation within the vegetation, for example, to tall eutrophic fen, single species swamps or perhaps poor fen. The vegetation of flood-plain fen is varied. Reedbed (a type of open water transition) is common, as are other tall fen plant communities in which reed is a major component. The fens may be nutrient-enriched, nutrient-poor, base-rich or base-poor, and these factors are reflected within the vegetation.

8.1.2 Component wetlands and key vegetation types

Flood-plain fen components may include the area to be maintained as fen woodland (see Section 8.6), types produced by (agricultural) management (see Section 8.7) and the areas strongly influenced by each of the four hydrotopographical elements listed below. The key NVC communities in each component wetland are indicated below and those recommended for monitoring listed in Table 5 (see also NCC 1989 - SSSI Guidelines, Table 19, pages 152-154). Those that are chosen as characteristic of the habitat type are marked * and those that are chosen as rare or indicative of an Annex I habitat are marked **. At least one community should be chosen for each, but if some of these component wetlands or named communities do not occur on a particular site, substitutes should be chosen and new targets set. Unstarred communities should not normally be selected for monitoring. If necessary, specialist advice should be sought over the choice of communities and indicator species.

(i) Alluvial wetland

Description

Irrigated by overbank flooding of watercourses; substratum usually with a considerable fraction of mineral material (silts etc).

NVC types of interest

- *M27 *Filipendula ulmaria-Angelica sylvestris* mire
- **S2 *Cladium mariscus* swamp and sedge-beds
- *S5 *Glyceria maxima* swamp (nutrient-rich conditions)
- *S6 *Carex riparia* swamp
- *S8 *Scirpus lacustris* ssp. *lacustris* swamp
- *S12 *Typha latifolia* swamp
- *S14 *Sparganium erectum* swamp
- **S24 *Phragmites australis-Peucedanum palustre* fen
- *S25 *Phragmites-Eupatorium cannabinum* fen
- S28 *Phalaris arundinacea* fen

(ii) Sump wetland

Description

More or less flat-surfaced wetland, usually in depressions, where precipitation, drainage or run-off water collects or where water level is maintained by a high groundwater level, but with little net through-flow; often characterised by substantial water level flux.

Some NVC types of interest for base-poor sump wetland

- M1 *Sphagnum auriculatum* (*denticulatum*) bog pool
- M2 *Sphagnum cuspidatum/recurvum* (*fallax*) bog pool
- M3 *Eriophorum angustifolium* bog pool
- *M5 *Carex rostrata-Sphagnum squarrosum* mire
- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- *S3 *Carex paniculata* swamp
- *S9 *Carex rostrata* swamp
- *S10 *Equisetum fluviatile* swamp
- *S27 *Carex rostrata-Potentilla palustris* fen

Some NVC types of interest for base-rich sump wetland

- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- **S1 *Carex elata* sedge-swamps
- **S2 *Cladium mariscus* swamp and sedge-beds
- *S3 *Carex paniculata* swamp
- *S6 *Carex riparia* swamp
- *S9 *Carex rostrata* swamp
- *S13 *Typha angustifolia* swamp
- **S24 *Phragmites australis-Peucedanum palustre* fen
- *S27 *Carex rostrata-Potentilla palustris* fen

(iii) Percolating wetland

Description

Gently sloping wetland irrigated by groundwater percolating from marginal soligenous slopes, or by groundwater discharge into peat-mass; often situated between land margins and rivers or pools; sites range from small to very large.

NVC types of interest

- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- **M10 *Carex dioica-Pinguicula vulgaris* mire
- **M13 *Schoenus nigricans-Juncus subnodulosus* mire
- **M14 *Erica tetralix-Sphagnun compactum* mire
- **S1 *Carex elata* swamp
- **S2 *Cladium mariscus* swamp.

(iv) Soakway and water track

Description

Trackways of preferential water movement through topogenous wetlands.

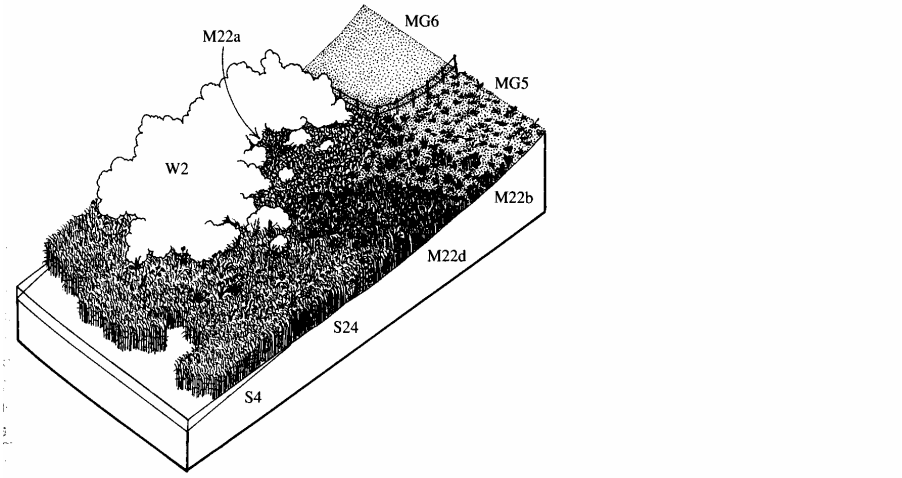
NVC type

- *M29 *Hypericum elodes-Potamogeton polygonifolius* soakway

8.1.2.1 There may be a dynamic interplay between over-bank flooding as marked by the presence of enrichment indicators such as nettles, reeds, reed canary grass and reed sweet grass, and the more diverse and possibly shorter communities associated with the other three hydrological categories and this needs to be ascertained from the communities present. N2K communities would take precedence. For each site a statement should be made about whether this is the case, and the key NVC communities chosen for monitoring should reflect any interplay.

8.1.2.2 The following figure (taken from Rodwell, 1991b) is indicative of the zonation arising from hydrological and land use factors.

Figure 18. Changes in fen and meadow zonation with improvement and neglect.
In the foreground is a traditional sequence in an open-water transition mire from *Phragmitetum* swamp (S4), through mown *Peucedano-Phragmitetum* (S24) and *Juncus-Cirsium* fen-meadow, *Iris* sub-community (M22d) to grazed *Juncus-Cirsium* fen-meadow, *Briza-Trifolium* sub-community (M22b) and *Centaureo-Cynosuretum* (MG5). With enclosure and improvement of the drier ground, the last is converted to *Lolio-Cynosuretum* (MG6), while neglect of the mowing marsh leads to spread of rank Typical *Juncus-Cirsium* fen-meadow (M22a) and secondary *Salix-Betula-Phragmites* woodland (W2).



8.2 Basin fen

8.2.1 Definition

8.2.1.1 Basin fens are predominantly peat-forming topogenous wetlands that develop within ill-drained depressions. They are of widespread occurrence, particularly in western and northern districts, and range in size and form from diminutive (<0.1 ha) features associated with ground-ice depressions (pingos), through to much larger examples located in major hollows within bedrock.

8.2.1.2 The term 'basin wetland' (Wheeler & Shaw, 2000) describes one of the main situation types in which wetlands occur in the United Kingdom and the category supports a correspondingly wide range of habitats, with variations in form and composition reflecting influences such as mode of origin and development, bedrock and drift characteristics, hydrology, hydrochemistry and management history.

8.2.1.3 Mires that have developed through the progressive colonisation of open-water bodies by vegetation rafts (*schwingmoors*), as well as wetlands developed on lacustrine and peaty sediments filling an original basin, are included within this category. Although ombrogenous nuclei are included (and they can occupy a substantial proportion of some basins), raised bogs developed within a basin context are specifically excluded from this section of the guidance. Raised bogs are distinguished by the presence of mire expanse, rand and lagg (see Section 7). A very wide range of fen and swamp communities are associated with basin fen.

8.2.1.4 Basin fens may receive water from a range of sources, including influent streams, surface runoff, groundwater discharge and rainfall. They may exist as more

or less closed systems with no obvious outflow of water, but examples with natural and man-made outwards drainage are widespread.

8.2.1.5 The principle floristic gradient within basin fens is summarised by the terms poor-fen and rich-fen and reflects the important influence of variations in base cation availability and pH. These terms do not necessarily relate to species-richness and many poor-fen and transitional rich-fen basin fens support a high diversity of species. Some basin fens support a relatively homogenous vegetation cover but others exhibit a more complex disposition of communities, reflecting patterns of nutrient availability and water flow (reflecting the water supply mechanisms) as well as management. In some cases a zonation of communities marks a hydroseral progression and/or the successional development of a vegetation raft. Accordingly, the extent and distribution of different communities varies enormously between sites.

8.2.1.6 Several community groupings listed under Annex I of the EC Habitats & Species Directive occur within a basin fen context. Chief among these is Transition mires and quaking bogs, but both Calcareous fen with *Cladium mariscus* and species of the *Caricion davallianae* and Alkaline fens are also represented. Elements of Depressions on peat substrates of the *Rhynchosporion* also occur within this wetland type, although few examples have been included in the UK SAC series for this feature.

8.2.2 Component wetlands and key vegetation types

8.2.2.1 As described above, the variety within basin fens is determined by the mix of water supply mechanisms, vegetational succession and management. Where fen woodland occurs as an interest feature it should be monitored separately from the other components of the basin fen wetland complex, using guidance given in Section 8.6. Some of the main NVC communities associated with each component wetland are indicated below and the key communities recommended for monitoring are shown in Table 5. Key communities chosen as characteristic of the habitat type are marked * below and those that are chosen as rare or indicative of an Annex I habitat are marked **.

8.2.2.2 Typically at least one community would be chosen to represent poor-fen, rich-fen, ombrogenous nuclei and base-rich springs where present, but if some of these component wetlands or named communities do not occur on a particular site, substitutes should be chosen and new targets set. Unstarred communities should not normally be selected for monitoring. If necessary, specialist advice should be sought over the choice of communities and indicator species.

8.2.2.3 The approach taken in this guidance is to assume that any loss of the more 'open' suite of communities, including those with a generally appreciable bryophyte component, constitutes an undesirable change as a result of dereliction, drainage or enrichment. Development of tree cover over more than the edge of the basin or expansion of M25 *Molinia caerulea-Potentilla erecta* mire at the expense of open communities are examples of negative trends.

(i) Waterfringe wetland

See Section 8.3.

(ii) Sump wetland

Some NVC types of interest for base-poor sump wetland

**M4 *Carex rostrata-Sphagnum recurvum* (*fallax*) mire

M5 *Carex rostrata-Sphagnum squarrosum* mire

*M6 *Carex echinata-Sphagnum recurvum* (*fallax*) */auriculatum* (*denticulatum*) mire
**M21 *Narthecium ossifragum-Sphagnum papillosum* mire
*S27 *Carex rostrata-Potentilla palustris* tall-herb fen

Some NVC types of interest for base-rich sump wetland

*M9 *Carex rostrata-Calliergon cuspidatum/giganteum* (*Calliergonella cuspidata*/*Calliergon giganteum*) mire
**S2 *Cladium mariscus* sedge swamp
*S27 *Carex rostrata-Potentilla palustris* swamp

Spanning the poor-/rich-fen gradient is a range of communities partly encompassed by M5 *Carex rostrata-Sphagnum squarrosum* mire.

(iii) Topogenous bog

Some NVC types of interest for ombrogenous nuclei

*M18 *Erica tetralix-Sphagnum papillosum* community of raised and blanket mires.

Some NVC types of interest for bog pools

M1 *Sphagnum auriculatum* (*denticulatum*) bog pool community
M2 *Sphagnum cuspidatum/recurvum* (*fallax*) bog pool community
M3 *Eriophorum angustifolium* bog pool community

(iv) Soakway and water track

M29 *Hypericum elodes-Potamogeton polygonifolius* soakway

(v) Spring-fed wetland

Some NVC types of interest in base-poor spring-fed wetland

*M6 *Carex echinata-Sphagnum recurvum* (*fallax*)/*auriculatum* (*denticulatum*) mire
**M21 *Narthecium ossifragum-Sphagnum papillosum* mire

Some NVC types of interest in base-rich spring-fed wetland

**M10 *Carex dioica-Pinguicula vulgaris* mire
**M13 *Schoenus nigricans-Juncus subnodulosus* mire
**M14 *Schoenus nigricans-Narthecium ossifragum* mire

Spanning the poor-/rich-fen gradient

M36 Lowland springs and streambanks of shaded situations

(vi) Percolating wetland

NVC types of interest

*M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*)/*giganteum* mire
**M10 *Carex dioica-Pinguicula vulgaris* mire
**M13 *Schoenus nigricans-Juncus subnodulosus* mire
**M14 *Erica tetralix-Sphagnum compactum* mire
**S1 *Carex elata* swamp
**S2 *Cladium mariscus* swamp

8.3 Open water transition fen

8.3.1 Definition

8.3.1.1 This part of the guidance is intended for use when emergent open-water vegetation is a notified feature in its own right, rather than being a minor component of the open water interest of a site, in which case the relevant freshwater guidance should be used. Very often sites are notified for both interests. Then both sets of guidance should be used and integrated where appropriate. For brackish swamps the

guidance for saline lagoons or saltmarsh may be more relevant, depending on the situation. Swamp vegetation in rivers, freshwater/brackish ditches and canals is covered by the appropriate parts of the freshwater section of this manual.

8.3.1.2 Extensive areas of swamp and fen may occur around standing waters in sheltered positions. Open water transition fens are here defined as those associated with significant areas of open water, and for which the water table is determined by vertical fluctuations of the open water body. Swamps may be defined as species-poor vegetation types, generally dominated by bulky emergent monocotyledons, with permanently or seasonally submerged substrates.

8.3.1.3 Open water transition fens are essentially similar to basin fens, but the proportion of open water is greater than that of fen rather than the converse for basin fen. Swamp vegetation often merges with tall-herb fen vegetation such as NVC types S24-26, for which reference should be made to the basin fen or flood-plain fen guidance. There may also be transition to fen woodland (see Section 8.6).

8.3.1.4 The transition from fen (with the summer water table generally at or below the surface) to open water through a range of swamp (with the summer water table at or above the surface) and aquatic communities is usually best developed where lakes display a shallow periphery gradually deepening towards the centre, a relatively stable water level and limited erosion along the shore. The fen/open water sequence is predominantly hydroseral, with colonisation by fen occurring from the shore into the lake. Colonisation may be in the form of rooted emergents and/or floating rafts of vegetation which are still attached to the main fen body. Particular fen and swamp communities tend to be associated with certain aquatic communities according to the trophic status of the water body (see SSSI guidelines C.6, Table 14). Often successional sequences are blurred or even truncated by management, disturbance and fluctuations in the level of the water body.

8.3.1.5 The water level of the lake generally represents the controlling level of the fen water table. Therefore, if the lake water level drops, the water table of the fen can be expected to do so also. Although floating fen rafts are able to compensate for fluctuations in lake level within limits, the structure of the raft and underlying substrate is not necessarily known. Though the raft is apparently floating, beneath it there may in fact be part-liquid peat or even submerged older rafts which will form a semi-solid mass if the lake level drops. Extreme draw-down will lead to the exposure of substrate. Though this may be colonised by fen plants, it is just as likely to be colonised by such species as *Juncus effusus* and *Bidens* spp. However, very occasionally this draw-down zone becomes colonised by an unusual combination of species, and target setting should take account of this.

8.3.2 Component wetlands and key vegetation types

8.3.2.1 Whilst the hydrological regime is critical to the ecological condition of an open-water transition fen, target setting and direct monitoring for this is considered to be beyond the scope of this guidance.

8.3.2.2 Component wetlands are often indistinguishable, as this is *per se* a transition habitat. Swamp communities occur at the open water margin and these grade into tall-herb fen communities marking the transition to drier conditions. Springs may occur within the feature and can be distinguished as indicators of local distinctiveness, provided they are obvious. A marked expansion of tall-herb fen communities at the expense of swamp communities may indicate lowering of water level. Conversely, a landward expansion of swamp communities may be caused by raised water level, which may or may not be of benefit to the site.

8.3.2.3 Some swamp and tall-herb fen vegetation types are ubiqitous, some are associated with nutrient- or base-poor conditions, others with nutrient- or base-rich conditions. A few are associated with brackish conditions.

8.3.2.4 Key NVC communities (Rodwell, 1995) should be chosen on an individual site basis, but should include

- either S4 *Phragmites australis* swamp or S8 *Scirpus lacustris* ssp *lacustris*, where present
- swamp communities characteristic of the nutrient status or salinity of the fen (e.g. those marked * below)
- all rare communities, including those indicative of a priority Annex I habitat (marked ** below)
- at least one characteristic tall-herb fen community (e.g. those marked * below).

8.3.2.5 NVC swamp communities characteristic of more nutrient- or base-poor conditions:

*S9 *Carex rostrata*
**S11 *Carex vesicaria*
S19 *Eleocharis palustris*
*S27 *Carex rostrata-Potentilla palustris*

8.3.2.6 NVC swamp communities characteristic of more nutrient- or base-rich conditions:

**S2 *Cladium mariscus*
*S3 *Carex paniculata*
S5 *Glyceria maxima*
*S6 *Carex riparia*
S7 *Carex acutiformis*
*S12 *Typha latifolia*
*S13 *Typha angustifolia*
*S14 *Sparganium erectum*
S16 *Sagittaria sagittifolia*
S17 *Carex pseudocyperus*
S18 *Carex otrubae*

8.3.2.7 NVC swamp communities characteristic of brackish or saline conditions
*S20 *Scirpus lacustris* ssp *tabernaemontani*
*S21 *Scirpus maritimus*

8.3.2.8 Widespread but rare NVC swamp community
**S1 *Carex elata*

8.3.2.9 NVC tall-herb fen communities
**S24 *Phragmites australis-Peucedanum palustre*
*S25 *Phragmites australis-Eupatorium cannabinum*
S26 *Phragmites australis-Urtica dioica*
S28 *Phalaris arundinacea*
OV26 *Epilobium hirsutum community*

8.4 Valley fen

8.4.1 Definition

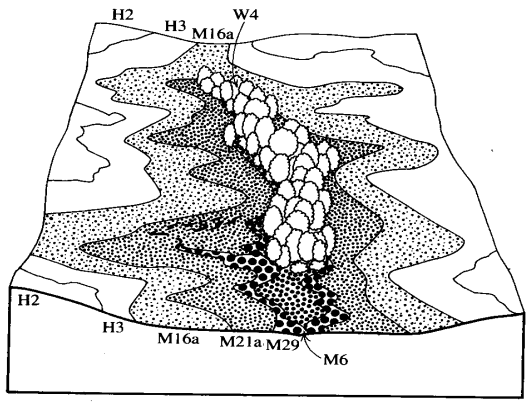
8.4.1.1 Valley fens are usually described under soligenous mires (NCC 1989 - SSSI Guidelines, p. 142), although they may be fed by overbank flooding as well as surface

flow and groundwater seepage. Valley fens lie in steep or shallow linear depressions that are often drained by an axial stream. Consequently, they are common in hilly areas and in gently undulating topography, such as the New Forest, the south west of England, parts of Norfolk and Wales.

8.4.1.2 Given the undulating topography, it may seem easy to define the surface water catchment (run-off wetland). Such simplicity obscures the complexity beneath, in which layers of differing porosity and mineralogy can give rise to several different patterns of water supply. While some of the groundwater sources may be visually obvious, such as from springs on the confining slopes (springs and flushes), there will also be inputs from surface water and from groundwater seepage that cannot easily be seen (percolating wetland). In larger valleys it may be that peat accumulation has given rise to ombrotrophic surfaces fed by rain water, akin to small raised bogs (topogenous bog), such as on Crane Moor in the New Forest. Sequences of peat cutting may have removed this in part or completely, obscuring the degree to which this has taken place in the past. As in topogenous fens, there will also be water tracks and soakways.

8.4.1.3 Each valley mire may contain a range of wetland types, from base-rich to base-poor, from oligotrophic to eutrophic. There may be other patterns arising from land use such as grazing, mowing (harvesting), and peat cutting. It is usual to find a band of scrub or woodland with taller, more eutrophic fen around the axial stream, and poor fen or bog between this and the soligenous margins. The following figure, taken from Rodwell (1991b) shows the typical zonation of a valley fen.

Figure 17. Zonation around a typical lowland valley bog in southern England.
M6 *Carex echinata-Sphagnum* mire
M16a *Ericetum tetralicis* wet heath, Typical sub-community
M21a *Narthecio-Sphagnetum* valley bog, *Sphagnum-Rhynchospora* sub-community
M29 *Hyperico-Potametum* soakway
W4 *Betula-Molinia* woodland
H2 *Calluna-Ulex minor* heath
H3 *Ulex minor-Agrostis* heath



8.4.1.4 Valley mires typically interface with heathland and it may be difficult to draw a dividing line. Common Standards Guidance for lowland heath also includes some of the same NVC plant communities, such as M21, the *Narthecium ossifragum-Sphagnum papillosum* valley mire and decisions will need to be made on an individual site basis.

8.4.1.5 The zonation arising from water table fluctuation in valley mires can provide niches for particular species. For example, the upper limit of flooding on some New Forest bogs, often marked by the position of footpaths and tracks, is particularly attractive to the brown beak sedge (*Rhynchospora fusca*) and the marsh club moss

Lycopodiella inundata (*Lycopodium inundatum*). It is important to take the condition of these into account when assessing valley mires.

8.4.2 Component wetlands and key vegetation types

8.4.2.1 The valley fen component wetlands include the area to be maintained as fen woodland, the types produced by (agricultural) management and the areas strongly influenced by each of the hydrotopographical elements listed below. The NVC communities associated with each component wetland and the key communities recommended for monitoring are indicated below and in Table 5. Key communities chosen as characteristic of the habitat type are marked * and those that are chosen as rare or indicative of an Annex I habitat are marked **. At least one community should be chosen for each component wetland, but if some of these or the named communities do not occur on a particular site, substitutes should be chosen and new targets set. Unstarred communities should not normally be selected for monitoring. If necessary, specialist advice should be sought over the choice of communities and indicator species.

(i) Spring-fed wetland

Description

Irrigated primarily by groundwater discharge; often sloping and frequently small.

NVC types of interest for base-poor spring-fed wetland

**M14 *Schoenus nigricans-Narthecium ossifragum* mire
**M21 *Narthecium ossifragum-Sphagnum papillosum* valley mire

NVC types of interest for base-rich spring-fed wetland

**M10 *Carex dioica-Pinguicula vulgaris* mire
**M13 *Schoenus nigricans-Juncus subnodulosus* mire
*M22 *Juncus subnodulosus-Cirsium palustre* fen meadow

(ii) Run-off wetland

Description

Hillslope wetland irrigated primarily by surface run-off is principally found in the wetter regions of Britain where low-permeability bedrock coupled with high precipitation permits the development of sometimes extensive wetlands fed primarily by run-off and rainfall. Most base-rich wetlands on slopes seem to be spring-fed because limestone has fissures which swallow the surface water, so the guidance for base-rich spring-fed wetland should be used.

NVC types of interest for base-poor run-off wetland

*M6 *Carex echinata-Sphagnum recurvum/auriculatum* (*fallax/denticulatum*) mire
M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture
*M25 *Molinia caerulea-Potentilla erecta* grassland

(iii) Soakway and water track

Description

Trackways of preferential water movement through sloping wetlands.

NVC typees of interest for base-poor water track or soakway

**M4 *Carex rostrata-Sphagnum recurvum* (f*allax*) mire
*M29 *Hypericum elodes-Potamogeton polygonifolius* soakway

(iv) Percolating wetland

Description

Gently sloping wetland irrigated by groundwater percolating from marginal soligenous slopes, or by groundwater discharge into peat-mass; resembles spring-fed wetland but covers a larger area and is not so obviously spring-fed. Communities listed as for flood-plain fen.

NVC types of interest

- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- **M10 *Carex dioica-Pinguicula vulgaris* mire
- **M13 *Schoenus nigricans-Juncus subnodulosus* mire
- **M14 *Erica tetralix-Sphagnun compactum* mire
- **S1 *Carex elata* swamp
- **S2 *Cladium mariscus* swamp.

(v) Sump wetland

Description

More or less flat-surfaced wetland, usually in depressions, where precipitation, drainage or run-off water collects or where water level is maintained by a high groundwater level, but with little net through-flow; often characterised by substantial water level flux; range from small stagnant sumps with rafts of vegetaion to large areas verging on basin fen. Communities listed as for flood-plain fen.

NVC types of interest for base-poor sump wetland

- M1 *Sphagnum auriculatum* (*denticulatum*) bog pool
- M2 *Sphagnum cuspidatum/recurvum* (*fallax*) bog pool
- M3 *Eriophorum angustifolium* bog pool
- *M5 *Carex rostrata-Sphagnum squarrosum* mire
- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- *S3 *Carex paniculata* swamp
- *S9 *Carex rostrata* swamp
- *S10 *Equisetum fluviatile* swamp
- *S27 *Carex rostrata-Potentilla palustris* fen

NVC types of interest for base-rich sump wetland

- *M9 *Carex rostrata-Calliergon cuspidatum* (*Calliergonella cuspidata*) */giganteum* mire
- **S1 *Carex elata* sedge-swamps
- **S2 *Cladium mariscus* swamp and sedge-beds
- *S3 *Carex paniculata* swamp
- *S6 *Carex riparia* swamp
- *S9 *Carex rostrata* swamp
- *S13 *Typha angustifolia* swamp
- **S24 *Phragmites australis-Peucedanum palustre* fen
- *S27 *Carex rostrata-Potentilla palustris* fen

(vi) Topogenous bog

Description

An extensive area, showing the structural features of raised bog, should be treated as a separate interest feature and monitored as raised bog (see guidance in Section 6). Smaller ombrogenous nuclei are monitored as part of the valley mire or basin mire complex.

NVC types of interest for ombrogenous nuclei

- *M18 *Erica tetralix-Sphagnum papillosum* community of raised and blanket mires
- M1 *Sphagnum auriculatum* bog pool community
- M2 *Sphagnum cuspidatum/recurvum* bog pool

M3 *Eriophorum angustifolium* bog pool community

(vii)Fen woodland and fen meadow

Fen woodland and fen meadow, where present in valley fen, should be monitored as separate interest features (see Sections 8.6 and 8.7).

8.4.2.2 Valley fens, like flood-plain fens, are dynamic systems and targets need to be set on a site-specific basis, to accommodate natural dynamism but at the same time recognise signs of degradation. Deterioration of valley mires is often marked by the expansion of one community to the exclusion of others. For example, M25 *Molinia caerulea-Potentilla erecta* grassland, typified by dense tussocky purple moor grass, is species-poor and often extends over much of the valley mire. This may exclude more diverse communities such as M21. The causes for this are unclear, but may relate to nutrient enrichment (from air or water), excessive surface water fluctuation, and under-grazing. Such a condition is definitely unfavourable, but judgements will need to be made on individual sites as to what extent of M25 is natural and to be expected.

8.5 Springs and flushes

8.5.1 Definition

8.5.1.1 Springs (point-sources of water) and their associated flushes are features that occur when water wells up to the surface from underground aquifers or reaches the surface at seepage slopes. Where the spring emerges onto a sloping terrestrial surface and the drainage is impeded but not pooled on the surface, the water then feeds flush communities. Spring fens are usually very small, but may form a small part of an otherwise extensive wetland complex.

8.5.1.2 Springs and flushes in the lowlands are usually associated with soligenous fens, and often with peat-accumulating systems. Lowland springs often also contain a considerable calcareous input, particularly in England and Wales, which may cause an interesting juxtaposition of acid and basic mire plant types. Peat deposits associated with calcareous springs are often mixed with tufa (precipitated calcium carbonate).

8.5.1.3 When springs and flushes are not within a lowland wetland site, they may be selected in conjunction with habitat complexes that primarily have upland, grassland or freshwater interests. Where this is the case, monitoring guidance should be sought within the appropriate Common Standards Monitoring Guidance chapters.

8.5.1.4 Springs and flushes associated within fen and bog habitats are poorly defined within the *Guidelines for selection of biological SSSIs* (NCC, 1989). However, for lowland wetlands, “boundaries [of the SSSI] should encompass all springs and flushes on which the fen is dependent”. For monitoring purposes, springs and flushes should be monitored where possible as an integral part of a wetland complex, using guidance for the wider lowland wetland interest features.

8.5.1.5 Springs that flow into water bodies often provide an important water source to swamps. Their continued favourable condition is therefore in part a determinant of the good quality of the wider wetland. The flow of spring water into standing water is determined by the nature of each water body. Often density and temperature differences constrain the movement of water. This results in discrete bodies of water within a fen, characterised by specific swamp communities. These may be different

from the surrounding swamp vegetation, as they are affected by temperature and nutrient influences from the different water sources. Springs within fens should be monitored as an integral part of the open water transition fen habitat under the attribute 'Indicators of local distinctiveness' (see Section 8.3).

8.5.1.6 Where the water level is fluctuating above and below the surface, the spring predominantly feeds fen communities. Springs that are associated with fen communities may also provide an important source of water. Incoming water in these cases may be partly distributed underground at certain times of the year. However, unless a fast flow is present (which is unusual in fen systems) springs will show a discrete difference in vegetation type from the surrounding fen vegetation as a result of the temperature and nutrient influences from the different water sources. These springs may be monitored as an integral part of basin fen or under the attribute 'Indicators of local distinctiveness' in fen meadow or fen woodland habitats (see Sections 8.2, 8.6, 8.7).

8.5.2 Component wetlands and key vegetation types

8.5.2.1 Springs and flushes are generally small features. They tend to be bryophyte dominated, but sedges and dicotyledonous plants do play an important role in these diverse habitats. Their function is generally to supply water to a wider wetland complex and they cannot easily be split into functional units, but are of different types. The key NVC communities recommended for monitoring are indicated below. Key communities chosen as characteristic of the habitat type are marked * and those that are chosen as rare, local or indicative of an Annex I habitat are marked **. At least one community should be chosen for each spring/flush type, but if the named communities do not occur on a particular site, substitutes should be chosen and new targets set. Table 5 reflects the importance of the different higher plants and bryophytes expected in each type of spring.

(i) Petrifying springs with tufa formation (Cratoneurion)

NCV types of interest:

**M37 *Cratoneuron commutatum* (*Palustriella commutata*)*/filicinum-Festuca rubra* spring

Palustriella commutata is a species indicative of very base-rich conditions. This is often demonstrated by the deposition of calcium carbonate (tufa) amongst its shoots. As a result, formation of bryophyte mounds and mats with a crunchy texture is often observed. Petrifying springs with tufa formation (*Cratoneurion*) is an Annex I priority habitat.

(ii) Neutral flushes

NVC types of interest:

*M32 *Philonotis fontana-Saxifraga stellaris* spring
*M35 *Ranunculus omiophyllus-Montia fontana* rill
*M36 Lowland springs and streambanks of shaded situations

These communities are bryophyte dominated, and often have a striking visual appearance. They are associated with springs and rills where there is continuous irrigation with circumneutral and oligotrophic water. Although common and widespread in the uplands of north west Britain, neutral flushes can also be found as fragmentary stands at lower altitudes, where they have no montane element to their vegetation, particularly at the southern limit.

(iii) *Sphagnum* dominated acid flushes

NVC types of interest:

**M4 *Carex rostrata- Sphagnum recurvum* (*fallax*) mire
*M6 *Carex echinata- Sphagnum recurvum* (*fallax*)*/auriculatum* (*denticulatum*) mire

Acid flushes are often found on hill-slopes and on ground of low intensity land use in the lowlands. In both instances, the CSM Upland Guidance for these features can be used. Often acid flushes also form a part of bog systems or basin fens. Where this is the case, the lowland wetland guidance for raised bog or basin fen will be more appropriate.

(iv) Base rich springs (and those associated with alkaline fens)

NVC types of interest:

**M10 *Carex dioica-Pinguicula vulgaris* mire
**M13 *Schoenus nigricans-Juncus subnodulosus* mire
**M14 *Schoenus nigricans-Narthecium ossifragum* mire

Alkaline fens are an Annex 1 habitat. They have a calcareous water supply and are characteristic of sites where there is tufa and/or peat formation. Guidance for base-rich springs is covered under the Basin fens interest feature (see Section 8.2).

8.6 Fen woodland

8.6.1 Definition

8.6.1.1 This can be regarded as fen habitat when it is in association with open fen. The main fen woodland communities (NVC communities W1-W6) tend to be associated with topogenous sites, but are not restricted to them.

8.6.1.2 The *Natura 2000* term 'bog woodland' and the BAP category 'wet woodland' were not coined at the time 'fen woodland' was described in the SSSI Guidelines. Although bog woodland primarily refers to ecologically stable open woodland on a raised or blanket bog, it also includes an extremely rare variant in which birch *Betula,* willow *Salix* or alder *Alnus* species occur in long-term stable combinations with bog vegetation. Fragments of this variant have been recorded only on the New Forest valley bogs. The bog woodland *Natura 2000* category is not applied to opportunist stands of birch invading recently drained or cut-over raised bogs, though they could be classed as wet woodland or fen woodland where they give rise to NVC communities W1-W6.

8.6.1.3 Woodland communities may occupy distinct zones within valley mires, flood-plain fens, basin fens and open water transition fens, and readily invade open fen areas. The previous fen community often remains in the field layer. Invasion often follows a cessation of management or disturbance, or it can be a spontaneous development, as in the invasion of *Carex paniculata* tussock tops by *Salix cinerea*. Fen woodland includes the woodland or scrub bordering the central stream of many valley mires.

8.6.2 Key vegetation types

8.6.2.1 Fen woodland is a single component of the parent fen type (flood-plain, basin, valley fen). Some fen woodland communities are particularly scarce and contain rare species. As such, the conservation importance of the fen woodland needs to be carefully balanced with that of the open fen when defining relative extent. It should be remembered that a stand of scrub or trees may lose more water by evapotranspiration than open fen and the desirability of maintaining its extent needs to be considered carefully if there are signs of the site drying out.

8.6.2.2 The key NVC communities (Rodwell, 1991a) included in fen woodland are indicated below. Communities characteristic of the habitat type are marked * and those that are rare or indicative of priority Annex I habitats (Bog woodland and Residual alluvial forests (*Alnion glutinoso-incanae*)) are marked **.

*W1 *Salix cinerea-Galium palustre* woodland
**W2 *Salix cinerea-Betula pubescens-Phragmites australis* woodland
**W3 *Salix pentandra-Carex rostrata* woodland
*W4 *Betula pubescens-Molinia caerulea* woodland
**W5 *Alnus glutinosa-Carex paniculata* woodland
**W6 *Alnus glutinosa-Urtica dioica* woodland
**W7 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland

8.6.3 When the fen woodland constitutes an interest feature in its own right it should be monitored according to the guidance given in the woodland chapter. When it is a component of the wetland site, but not an interest feature in its own right, then targets should be set for its extent, but its vegetation composition should not normally be monitored. If there are rare or scarce species associated with the woodland then these should be considered as indicators of local distinctiveness for the wetland feature.

8.7 Fen meadow

8.7.1 Description

8.7.1.1 Fen meadows do not show a close association with a particular fen hydromorphological type and are therefore considered separately. Fen-meadows may occupy two sorts of location: peripheral to other fen vegetation, usually on drier land (though in some cases the adjacent fen vegetation may have been lost, thereby isolating the fen-meadow) or intermixed with other fen communities. In both situations the fen-meadow has been produced by management (grazing, mowing and/or burning) and is dependent upon the maintenance of management for its continued existence. Neglect results in dominance by tall herbaceous species and/or invasion by woody plants.

8.7.2 Key vegetation types

The NVC communities (Rodwell, 1991b) associated with fen meadow are listed below. Communities that are widespread and characteristic of the habitat type are marked *; those that are more localised are marked **.

*M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow
*M23 *Juncus effusus/acutiflorus-Galium palustre* rush pasture
**M24 *Molinia caerulea-Cirsium dissectum* fen-meadow
*M25 *Molinia caerulea-Potentilla erecta* mire
**M26 *Molinia caerulea-Crepis paludosa* mire

8.7.3 When the fen meadow constitutes an interest feature in its own right it should be monitored according to the guidance given in the grassland chapter. When it is a component of the wetland site, but not an interest feature in its own right, then targets should be set for its extent, but its vegetation composition should not normally be monitored. If there are rare or scarce species associated with the meadow then these should be considered as indicators of local distinctiveness for the wetland feature.

9 Depressions on peat substrates of the *Rhynchosporion*

9.1 *Depressions on peat substrates of the Rhynchosporion* (H7150) occur in complex mosaics with lowland wet heath and valley mire vegetation, in transition mires, and on the margins of bog pools and hollows in both raised and blanket bogs. The vegetation is typically very open, usually characterised by an abundance of white beak-sedge *Rhynchospora alba*, often with well-developed algal mats, the bog moss *Sphagnum denticulatum*, round-leaved sundew *Drosera rotundifolia* and, in relatively base-rich sites, brown mosses such as *Drepanocladus revolvens* and *Scorpidium scorpioides*. The Nationally scarce species brown beak-sedge *Rhynchospora fusca* and marsh clubmoss *Lycopodiella inundata* also occur in this habitat.

9.2 On lowland heaths in southern and eastern England this habitat occurs on humid, bare or recently exposed peat in three distinct situations:

1. in and around the edges of seasonal bog pools, particularly on patterned areas of valley mire,
2. in flushes on the edges of valley mires in heathlands, and
3. in areas that are artificially disturbed, such as along footpaths and trackways and in old peat-cuttings and abandoned ditches.

In these southern localities, Depressions on peat substrates of the *Rhynchosporion* are often associated with NVC type M21 *Narthecium ossifragum – Sphagnum papillosum* mire.

9.3 In the north and west, within raised and blanket bogs, this habitat type is usually part of the transition between bog pools (NVC types M1 *Sphagnum auriculatum* bog pool community and M2 *Sphagnum cuspidatum/recurvum* bog pool community) and the surrounding bog vegetation (mainly M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire and M18 *Erica tetralix – Sphagnum papillosum* raised and blanket mire). For monitoring this habitat in upland blanket bogs the guidance chapter for Upland habitats should be consulted.

9.4 The guidance in Tables 3 and 4 can be applied to this habitat in lowland bogs and fens respectively, taking account of any specific comments in each table. In setting targets for this habitat, because it is so variable, it is essential to take site-specific factors into account; these include the wider habitat context and the local species composition. For its occurrence in fens, when setting targets for positive indicator species, the guidance on targets for relevant NVC types (M14, M21, M29) should be used, taking into account the local species composition. For raised bogs, H7150 usually occurs as a minor component of the bog expanse and so its condition generally reflects that of the surrounding bog. The targets for the mire expanse should therefore be used, with additional targets under *Indicators of local distinctiveness* for key species of this habitat such as *Rhynchospora alba* and *R. fusca*.

9.5 As with springs and flushes, the small extent and fragmented nature of this habitat type may need to be taken into account when setting targets and undertaking monitoring.

10 References

Joint Nature Conservation Committee. 1994. *Guidelines for selection of biological SSSIs: bogs.* Joint Nature Conservation Committee, Peterborough.

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Table 3. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: **Lowland raised bog and lowland blanket bog**

Includes NVC types: M1-3, M17, M18-21 together with intermediates. These types also occur in fens and upland valley bogs (see Upland guidance section). Degraded raised bog may also support M15, M16, M25 or dry heath types.
Where a lagg fen exists it should be considered a component part of the habitat, unless it is a notified feature in its own right (see lowland fens). Relevant NVC types may include M4, M6, M22-25, M27, S4, W4-6, and possibly others, together with their intermediates.

Corresponding Phase 1 types: E1.6.2 Raised bog, E1.7 Wet modified bog, E1.8 Dry modified bog. The lagg may correspond with E3 Fen or other types.

Includes Annex I types: Active raised bogs (7110), Blanket bogs (7130), Degraded raised bogs still capable of natural regeneration (7120), Depressions on peat substrates of the Rhynchosporion (7150).

Reporting category: **Bogs**

Note: Attributes and targets concerning lagg fen relate mainly to lowland raised bog only.

Frequency classes for species should be as follows: 1-20% rare, 21-40% occasional, 41-60% frequent, >60% constant. Frequency is defined as the chance of finding a species at a point positioned at random in a stand. Cover is dealt with separately.

All attributes are mandatory except where indicated *

Attribute	Targets	Method of assessment	Comments
Habitat extent	There should be no reduction in the total extent (area) of bog, including any associated pools and lagg fen, in relation to the established baseline.	A baseline map, showing the boundary of the bog and any associated lagg fen, should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent.	'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition.

Attribute	Targets	Method of assessment	Comments
Habitat composition	Targets should be set for specific components of the wetland (mire expanse, lagg fen, bog pools) where relevant and appropriate (see sect. 7.1).	A baseline map, showing the boundary of the bog and any associated lagg fen, should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent.	'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition.
Habitat structure	There should be no obvious modification to structural features (e.g. vegetation cover, surface patterning and natural drainage), in relation to the established baseline. See Sect. 7.1.1.6. Targets should be set to register too much or too little exposed substrate (see comments). As a generic standard, total extent across the area assessed should be no more than 10%.	Aerial photographs can offer a convenient means of rapidly assessing these. It may also be necessary to make a visual assessment using a structured walk or transects.	Active raised bogs in particular show varying degrees of structural variation and surface patterning reflecting hydrological gradations. These can be disrupted by activities such as drainage, burning, grazing, vehicular access and peat digging. A high frequency and cover of exposed substrate will usually be undesirable and may indicate, *inter alia*, over-grazing, and water scour.

Attribute	Targets	Method of assessment	Comments
Vegetation composition: positive indicators - vascular plants	Targets for the **mire expanse only**: (1) At least 3 of *Calluna vulgaris*, *Erica tetralix*, *Eriophorum angustifolium*, *E. vaginatum* & *Trichophorum cespitosum* constant, with a combined cover not exceeding 80%; (2) no single species > 50% cover; (3) At least one of *Andromeda polifolia*, *Drosera rotundifolia*, *Empetrum nigrum*, *Narthecium ossifragum* and *Vaccinium oxycoccos* at least frequent	Visual assessment of cover and frequency, using structured walk or transects and recording quadrats	The vegetation of the mire expanse should comprise an inter-mix of bryophytes (predominantly *Sphagnum* spp), graminoids and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. Although *Sphagnum* may predominate on hyper-oceanic sites. *Molinia* may be abundant on the bog margin (rand) of active sites and more widely on degraded sites. Where lagg fen is an important element, refer to guidance for Lowland fen for appropriate positive indicator species targets.
Vegetation composition: positive indicators - bryophytes	Targets for the **mire expanse only**: (1) At least 2 of the following spp. constant, with a combined cover > 20%: *Sphagnum capillifolium, S. magellanicum, S. papillosum, S. tenellum* (2) *Sphagnum cuspidatum* and/or *S. pulchrum* at least occasional	Visual assessment of cover, using structured walk or transects and recording quadrats	Expectations for Sphagnum **cover** vary widely across the country, but **some** *Sphagnum* should be scattered across all sites. *S.cuspidatum* cover is a surrogate indicator for year-round high water table position. *Sphagnum cuspidatum* present in at least 10% of quadrats, or at least occasional indicates 'unfavourable recovering' condition, where the other targets are not achieved (particularly important for degraded bogs).

Attribute	Targets	Method of assessment	Comments
Vegetation composition: indicators of negative change - non-woody vascular plant species	(1) No more than 1% cover of the following on the bog surface (subject to exceptions in comments column): *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica, Pteridium aquilinum, Rubus fruticosus, Juncus effusus, Deschampsia cespitosa, Cirsium* spp. (2) Invasive non-native plant species should be absent or no more than rare (if present at baseline)	Visual assessment of cover, using structured walk or transects and recording quadrats	This target applies to the whole bog, not just the mire expanse. The plants listed are indicators of enrichment or of drying out of the bog. *Phragmite*s is acceptable around upwellings or their equivalent on ditched bogs.
Vegetation composition: indicators of negative change - bryophytes	*Polytrichum* spp. Other than *P. alpestre* no more than occasional	Visual assessment of cover, using structured walk or transects and recording quadrats	
Vegetation composition: indicators of negative change – undesirable woody species	On the mire expanse, trees and shrubs (*Betula, Salix, Rhododendron, Pinus* species, other gymnosperms no more than rare and < 5% cover On the bog margin (rand) woody species < 10% cover	Visual assessment of cover of the whole feature, using structured walk or transects Aerial photography may be a useful aid though not for seedlings.	Invasion by woody species and their development to healthy maturity may indicate drying out and/or enrichment. Trees and shrubs will exacerbate drying out. *Salix* spp. and *Myrica gale* can occur on raised bogs, but scrub generally constrains itself to areas where it receives a source of nutrients (e.g. near water that has passed through or over a mineral soil). As a result, it often is found close to or on the 'rand' of the raised bog, where it is more acceptable.

Attribute	Targets	Method of assessment	Comments
Indicators of local distinctiveness – micro-topography*	No reduction in extent of microtopographic features (e.g. bog pools).	% length of transects intersecting bog pools or other microtopographic features.	The quality of microtopographic features may also be assessed by providing a definition of target composition – for example, for a bog pool to count as such it could be defined as having little cover of living dwarf shrubs or *Eriophorum vaginatum*; a complete or extensive cover of sphagna with *S. pulchrum* and/or *S. cuspidatum* predominant. Some open water or bare peat may be present.
Indicators of local distinctiveness* *e.g.rare/scarce spp*	There are no generic targets for this attribute. Local targets should be set to ensure: - existing populations of rare/scarce species[2] are maintained - community and habitat transitions are maintained at current levels and in current locations Additional targets may be set for other attributes as appropriate.	Visual assessment of frequency/cover of rare/scarce/local species in sample points chosen to represent their known distribution. Aerial photographs may offer a convenient means of rapidly assessing these.	This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for notification) which are not covered adequately by the previous attributes, or by separate guidance (e.g. for notified species features). Targets to be determined locally.

[2] e.g. *Sphagnum fuscum, S. imbricatum, Rhynchospora fusca, Drosera intermedia*

Table 4. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: **Lowland fens (including basin, flood-plain, open-water transition and valley fens, springs and flushes)**

Includes NVC types: M1- 6, M9, M10, M13, M14, M21-29, M32, M35-37, S1-28 (some pp). Various wet woodland (W1-W7) and wet grassland communities may also be included (see Sections 12 and 13). Specific guidance for types M22-26 is given in the *Lowland grassland* guidance section (see *Lowland purple moor-grass and rush pasture* table) and should be used in conjunction with this guidance where appropriate.

Corresponding Phase 1 types: E2 Flush and spring (pp), E3 Fen (pp), F1 Swamp (pp)

Includes Annex I types: **Depressions on peat substrates of the** *Rhynchosporion* (7150), Petrifying springs with tufa formation (*Cratoneurion*) (7220), Alkaline fen (7230), Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (7210)

Reporting category: **Fen, marsh and swamp**

Frequency classes for species should be as follows: 1-20% rare, 21-40% occasional, 41-60% frequent, >60% constant. Frequency is defined as the chance of finding a species at a point positioned at random in a stand. Cover is dealt with separately.

All attributes are mandatory unless indicated *

Attributes	Targets	Possible Method of assessment	Comments
Habitat extent	There should be no reduction in the total combined extent of wetland in relation to the established baseline.	A baseline map showing the boundary of the habitat should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent in some cases.	

Attributes	Targets	Possible Method of assessment	Comments
Habitat composition	Targets should be set for key components of the wetland where relevant and appropriate (see descriptions in sect. 8). As a generic target there should be no loss of the component types, and in some instances target extents should be set for key elements. (For lowland fens the balance between open fen and wet woodland/ dense scrub should always be addressed as part of this.)	A baseline map showing the boundary of the components (where appropriate), should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent in some cases.	**Lowland fens:** Variety within fens is determined by water supply mechanism, hydroseral succession and land management practices. Account should be taken of successional processes and management aims/priorities (i.e. what a particular site is important for) in setting limits on extent of fen components. Intervention is often required to give the desired range of habitats and dependent species. The practicality of mapping certain vegetation types may also be a consideration. For Fen woodland and scrub see comments under Negative indicators (woody species) in Table 6 **Lowland springs & flushes:** These features are often small in extent and their boundaries may be difficult to determine. Their extent may also vary in relation to season and/or recent rainfall events. These should be taken into account when making an assessment.

Attributes	Targets	Possible Method of assessment	Comments
Habitat structure	Targets should be set to register too much or too little exposed substrate (see comments). As a generic standard, total extent across the area assessed should be no more than 10%. Higher covers of between 5% (min.) and 25% (max.)_should be considered for those communities listed under comments. Higher upper thresholds may be appropriate locally. Discretionary attribute: Targets should be set to register high or increasing litter cover as unfavourable. As a generic standard, total extent across the area assessed should be no more than 25% cover. Lower thresholds may be appropriate for some communities – e.g. short-sedge mires (M9, M13, etc.).	Visual estimate of % cover.	A high frequency and cover of exposed substrate will usually be undesirable and may indicate, *inter alia*, over-grazing, and water scour. Patches of exposed substrate are likely to be more typical/desirable for M10, 13-14, 37, S1-23 and some examples of M1-3 and M6. M29 is often based on unconsolidated sloppy peat exposed beneath a water film. More than 25% litter cover indicates insufficient removal of biomass by grazing.

Attributes	Targets	Possible Method of assessment	Comments
Vegetation composition: positive indicators	For each component wetland other than fen woodland and fen meadow that has been identified on the site (according to the descriptions given in sect.8), one characteristic NVC community should be selected, any rare NVC communities present should also be monitored. Targets should be set for each of these NVC communities according to the generic limits set out in Table 5. As a generic standard, the frequencies of positive indicators should at the very least, confirm the presence of the target community. Local targets could also be set for site-specific positive indicator species, to register a decrease in frequency of 20% or more as unfavourable.	Visual assessment of cover, using structured walk or transects and recording quadrats.	The suite of key communities to be monitored is chosen on a site-specific basis. Characteristic and rare communities would be chosen, e.g. those indicative of Annex I habitat types where these are SAC interests (although note that these must be reported on separately). Site-specific targets should be set using Table 5 as a framework.
	Targets should be set locally to register an increase or decrease in the extent of key communities.	Comparison against accurate baseline maps, assessments of whether a certain percentage of sample points laid out upon a grid conform to the community or not, shifts in the positionof community interfaces along permanent transects.	See text (section 3.5) for examples of instances where this attribute is critical.

Attributes	Targets	Possible Method of assessment	Comments
Vegetation composition: indicators of negative change - undesirable non-woody species	(a) Invasive non-native species[3] should be absent, or no more than rare if present (b) Target should be set to register high or increasing frequency/cover of other undesirable spp.[4] as unfavourable. See Table 6 for negative indicators for each of the key vegetation communities that were monitored for positive indicators, and adapt as relevant.	Visual assessment of cover, using structured walk or transects and recording quadrats	Spread of invasive alien spp. can often be very rapid once established. Other negative indicator species have been chosen as indicative of dereliction, drainage, eutrophication or disturbance, although in some vegetation types on some sites these spp. may be acceptable components, even as dominants. Individual site circumstances must be considered. The dynamics are important, as is the apparent health of the indicators. A weak stand of moribund *Typha latifolia*, for example, among poor fen (sump wetland) with healthy invasive *Sphagnum* would not mean unfavourable condition. Conversely, an aggressive healthy front of invading *Typha* would indicate a negative trend in these circumstances.

[3] Invasive aliens within lowland fens may include *Crassula helmsii*, *Acorus calamus*, *Mimulus* spp., *Impatiens glandulifera*, *Fallopia japonica*, *Heracleum mantegazzianum.*

[4] May include graminoids such as *Phragmites australis*, *Phalaris arundinacea*, *Glyceria maxima*, *Typha latifolia*, *Juncus* spp., *Molinia caerulea*; tall herbs such as *Epilobium hirsutum*, *Urtica dioica*, *Pteridium aquilinum*, *Rubus fruticosus*; and bryophytes such as *Brachythecium rutabulum*, *Eurhynchium praelongum*, *Sphagnum recurvum.*

Attributes	Targets	Possible Method of assessment	Comments
Vegetation composition: indicators of negative change - woody species	As a generic target for open fen (excluding wet woodland), woody species (including *Betula, Salix, Rhododendron, Pinus*, other gymnosperms) should be no more than scattered, predominantly <1.5m high. Cover should be <10% on open fen Saplings/seedlings should be no more than rare. None of these species should be present on flushes & springs, although *Salix* is acceptable at least 5m from petrifying springs.	Visual assessment of cover of the whole feature, using structured walk or transects. Aerial photography may be a useful aid though will not pick up small saplings and seedlings.	Scrub and woodland are integral components of many fen systems and may be particularly important for invertebrates. However invasion by woody species and their development to maturity may indicate drying out, dereliction, disturbance and/or enrichment for both fen. Trees and shrubs may also exacerbate drying out.
Indicators of local distinctiveness* *e.g. notable spp., transitions to other habitats, presence of pools or other structural features*	There are no generic targets for this attribute. Local targets should be set to ensure: - existing populations of rare/scarce species are maintained at least at current levels and often local distribution characteristics - community and habitat transitions are maintained at current levels and in current locations[5] - other locally distinctive features e.g. pools are maintained. Additional targets may be set for other attributes as appropriate.	Visual assessment of frequency/cover of rare/scarce/local species in sample points chosen to represent their known distribution. Structured observation or sampling. Aerial photos may offer a convenient means of rapidly assessing these.	This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for notification) which are not covered adequately by the previous attributes, or by separate guidance (e.g. for notified species features). Targets to be determined locally.

[5] Transitions from fen to other habitats e.g. grassland, heath are often important and vulnerable features.

Table 5 Desirable species for key NVC communities of lowland fens (see Table 4). The targets and species listed are for guidance and it may be appropriate to substitute other species or adjust thresholds in some situations. Targets may also be combined for mixtures of NVC types. Further guidance may be sought from country agency wetland specialists. Frequency classes for species should be as follows: 1-20% rare, 21-40% occasional, 41-60% frequent, >60% constant. Frequency is defined as the chance of finding a species at a point positioned at random in a stand. Cover is dealt with separately.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
M4	**Basin fen**: base-poor sump wetland **Valley fen**: soakway/water track **Springs & flushes**: *Sphagnum* dominated acid flushes	*Carex rostrata, C. lasiocarpa*: either or both, combined cover >10% *Sphagnum cuspidatum, S. fallax, S. denticulatum*: individually or together combined cover >50% Associated species *Potentilla erecta, Galium palustre, Rumex acetosa, Viola palustris, Stellaria uliginosa*: at least 2 species at least occasional	The whole should form a floating raft of sphagna and sedges. The list of associated species needs to be defined locally.
M5	**Flood-plain fen**: base-poor sump wetland **Valley fen**: base-poor sump wetland	*Carex rostrata, C. lasiocarpa, C. nigra, Eriophorum angustifolium*: combined cover >10% *Sphagnum subnitens, S. squarrosum, S. teres, S. palustre, S. fallax, Aulacomnium palustre*: individually or together combined cover >25% Associated species *Potentilla palustris, Menyanthes trifoliata, Galium palustre, Succisa pratensis ,Viola palustris ,Ranunculus flammula, Epilobium palustre, Lychnis flos-cuculi*: at least 4 species constant	The whole should form a floating raft of sphagna and sedges. The list of associated species needs to be defined locally and may in some areas include acidophiles such as *Vaccinium oxycoccos*.
M6	**Basin fen**: base-poor sump wetland and spring-fed wetland **Valley fen**: run-off wetland **Springs & flushes**: *Sphagnum* dominated acid flushes	*Carex echinata*: cover >10% *Carex panicea, C. nigra, C. viridula* ssp. *oedocarpa*: at least one species present *Sphagnum fallax, S. denticulatum, S. palustre*: at least 2 present; combined cover >30% Associated species *Viola palustris, Potentilla erecta, Galium saxatile, G. palustre, Cirsium palustre, Epilobium palustre, Succisa pratensis, Ranunculus*	*Juncus effusus* and/or *J. acutiflorus* will be dominant in their respective sub-communities. The sphagna form a matrix between the sedges and rushes. The list of associated species needs to be defined locally.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		flammula, Cardamine pratensis: at least 3 constant	
M9	**Flood-plain fen**: base-poor and base-rich sump wetland, percolating wetland **Basin fen**: base-rich sump wetland and percolating wetland **Valley fen**: base-poor and base-rich sump wetland, percolating wetland	*Carex diandra, C. lasiocarpa, C. rostrata, C. limosa, C. panicea, C. nigra, Eriophorum angustifolium*: at least 2 constant, one of which must be *C. diandra, C. lasiocarpa or C. rostrata* *Calliergonella cuspidata, Calliergon giganteum*: either or both, combined cover >20% *Campylium stellatum, Scorpidium scorpioides, Drepanocladus revolvens, Bryum pseudotriquetrum, Palustriella commutata, Cratoneuron filicinum, Ctenidium molluscum*: at least one species present Associated species *Menyanthes trifoliata, Mentha aquatica, Pedicularis palustris, Epilobium palustre, Potentilla palustris, Cardamine pratensis, Potamogeton* spp. *Caltha palustris*: at least 3 locally characteristic species constant	For the purposes of identification, *Carex diandra* and *C. lasiocarpa* can be lumped together as 'fine-leaved sedges'. A prominent bryophyte carpet is a feature of all but the very wettest stands.
M10	**Flood-plain fen**: percolating wetland **Basin fen**: base-rich spring-fed wetland and percolating wetland **Valley fen**: base-rich spring-fed wetland and percolating wetland	*Carex hostiana, C. dioica, C. viridula* (all ssp.), *C. flacca, C. panicea*: at least 2 species or subspecies constant	A highly variable vegetation type, additional local targets may be necessary to reflect the richness of particular sites
M13	**Flood-plain fen**: percolating wetland **Basin fen**: base-rich spring-fed wetland and percolating wetland **Valley fen**: base-rich spring-	*Schoenus nigricans* constant, cover <80% in at least 40% of samples. *Carex hostiana, C. dioica, C. viridula* (all ssp.), *C. flacca, C. panicea*: at least 2 species or subspecies constant	Very high cover of *Schoenus* may indicate lack of grazing.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
	fed wetland and percolating wetland		
M14	**Flood-plain fen**: percolating wetland **Basin fen**: base-rich spring-fed wetland and percolating wetland **Valley fen**: base-poor spring-fed wetland and percolating wetland	*Schoenus nigricans, Molinia caerulea*: tussock cover between 10% and 70% with *Schoenus* predominating *Sphagnum subnitens, S. denticulatum, Campylium stellatum, Aneura pinguis, Scorpidium scorpioides*: at least one *Sphagnum* and one 'brown' moss constant, combined cover >20% Associated species *Narthecium ossifragum, Anagallis tenella, Drosera rotundifolia, Eriophorum angustifolium, Rhynchospora alba, Eleocharis multicaulis, Erica tetralix*: at least 3 species constant	Both *Schoenus* and *Molinia* are likely to be present, but *Molinia* should not increase at the expense of *Schoenus*.
M18	**Basin fen**: ombrogenous nuclei (topogenous bog) **Valley fen**: ombrogenous nuclei (topogenous bog)	Use the vascular plant and bryophyte positive indicators given in Table 3 Lowland raised bog.	
M21	**Valley fen**: base-poor spring-fed wetland **Basin fen**: base-poor sump wetland and spring-fed wetland	*Sphagnum papillosum* and/or *S. magellanicum*: cover >70% in 80% of samples *Sphagnum denticulatum, S. cuspidatum,, S. fallax, Odontoschisma sphagni*: at least one species at least occasional Associated species *Calluna vulgaris, Drosera rotundifolia, Erica tetralix, Eriophorum angustifolium, Molinia caerulea, Narthecium ossifragum, Rhynchospora alba, Vaccinium oxycoccos*: at least 3 species constant	The cover attribute is vital. To pick up the other sphagna it is necessary to sample over the whole area occupied by the community; there is geographical and zonal variability. The associated species vary with the sub-community and will be site-specific.
M22	**Valley fen**: base-rich spring-fed wetland **Fen meadows**	In most instances this component will not need to be monitored for positive indicators. When it appears from the citation that it is an important component of the wetland feature, targets for positive indicators should be selected from the lowland grassland guidance	

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		chapter. When it is a feature in its own right, the lowland grassland guidance should be used.	
M25	**Valley fen**: run-off wetland **Fen meadows**	In most instances this component will not need to be monitored for positive indicators. When it appears from the citation that it is an important component of the wetland feature, targets for positive indicators should be selected from the lowland grassland guidance chapter. When it is a feature in its own right, the lowland grassland guidance should be used.	
M27	**Flood-plain fen**: alluvial wetland	*Filipendula ulmaria*: constant *Angelica sylvestris, Valeriana officinalis, Rumex acetosa*, other locally abundant dominants: at least 3 species constant *Valeriana officinalis-Rumex acetosa* sub-community: *Lychnis flos-cuculi, Succisa pratensis, Geum rivale, Galium palustre, Urtica dioica*: at least 2 species at least frequent *Urtica dioica-Vicia cracca* sub-community: *Urtica dioica, Epilobium hirsutum, Eupatorium cannabinum, Vicia cracca*: at least 2 species at least frequent *Juncus effusus-Holcus lanatus* sub-community: *Juncus effusus, Holcus lanatus*: both species constant	This is a very heterogeneous community and examples will vary locally. Towards the west, *Iris pseudacorus* and *Oenanthe crocata* become prominent, and compositionally close to M28. Regular grazing is detrimental to the species assemblage (and also its structure for invertebrates), though sporadic grazing or other type of litter removal is necessary for plant species diversity.
M28	**Flood-plain fen**: alluvial wetland	*Filipendula ulmaria, Iris pseudacorus, Oenanthe crocata, Poa trivialis*: at least two spp. constant. *Lycopus europaeus, Rumex crispus, Scutellaria galericulata*: at least one sp. constant. *Juncus effusus-Juncus acutiflorus* sub-community: *Juncus effusus, Juncus acutiflorus, Rumex acetosa, Ranunculus acris*: at	This is a very heterogeneous community and examples will vary locally. It merges eastwards with M27 from its western stronghold. It is a focus for *Lythrum salicaria* and *Stachys palustris*. Many

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		least 2 spp. at least frequent. *Urtica dioica-Galium aparine* sub-community: *Urtica dioica, Galium aparine, Cirsium arvense*: at least 2 spp. at least frequent. *Atriplex prostrata-Samolus valerandii* sub-community: *Atriplex prostrata* and *Samolus valerandi* both at least frequent.	other plants may be locally abundant and dominant, such as *Rumex acetosa, Lychnis flos-cuculi, Angelica sylvestris, Valeriana officinalis* and *Urtica dioica*. Regular grazing is detrimental to the species assemblage (and also its structure for invertebrates), though sporadic grazing or other type of litter removal are necessary for plant species diversity. The community is dependent on nutrient-rich water, and those species indicative of enrichment are expected. It merges with saline communities, via the *Atriplex -Samolus* sub-community.
M29	**Flood-plain fen**: soakway/water track **Valley fen**: soakway/water track and percolating wetland	*Hypericum elodes, Potamogeton polygonifolius*: combined cover >50% with neither species less than 5% cover *Ranunculus flammula, Juncus bulbosus*: both species present, combined cover <10% Associated species *Hydrocotyle vulgaris, Anagallis tenella, Drosera rotundifolia, Narthecium ossifragum, Galium palustre, Carex viridula* ssp.	Each site will have its own list of low cover associated species. For 'Depressions in peat substrates (Rhynchosporion)', *Rhynchospora alba* cover must be >1%.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		oedocarpa, C. echinata, C. panicea, C. nigra, Rhynchospora alba: at least 3 species present, combined cover <10%	
M32, M35, M36	**Springs & flushes**: neutral flushes	*Ranunculus omiophyllus, Montia fontana, Saxifraga stellaris*: at least one species present *Agrostis stolonifera, Saxifraga stellaris*: at least one species at least frequent *Sphagnum denticulatum, Philonotis fontana*: both species present with a combined cover >50%	
M37	**Springs & flushes**: Petrifying springs with tufa formation (Cratoneurion)	*Festuca rubra, Carex nigra, C. panicea, Cardamine pratensis, Leontodon autumnalis*: at least one species present *Saxifraga aizoides, Carex viridula, C. panicea, C. nigra, C. dioica, Agrostis stolonifera, A. canina, Deschampsia cespitosa, Equisetum palustre, Epilobium alsinifolium, Chrysosplenium oppositifolium, Poa trivalis, Trifolium repens*: at least one species at least frequent *Bryum pseudotriquetrum, Palustriella commutata* and/or *Cratoneuron filicinum, Selaginella selaginoides, Philonotis fontana*: at least 2 species present with a combined cover >50%	Tufa-type springs in the lowlands may have a rather different species composition and other species with similar ecological characteristics may be more appropriate indicators at some sites
S1	**Flood-plain fen**: base-rich sump and percolating wetlands **Basin fen**: percolating wetland **Open water transition fen** **Valley fen**: base-rich sump wetland	*Carex elata*: dense tussocks constant, cover >40% Associated species *Ranunculus lingua, Cirsium palustre, Eupatorium cannabinum, Lycopus europaeus*: at least 2 species present	The list of associated species needs to be defined locally.
S2	**Flood-plain fen**: alluvial, base-rich sump and percolating wetland **Basin fen**: base-rich sump and percolating wetland **Open water transition fen** **Valley fen**: base-rich sump	*Cladium* sub-commmunity: *Cladium mariscus*: constant in dense stands *Menyanthes trifoliata* sub-community: *Cladium mariscus*: open stands, less than 1m tall, with pools of open water *Menyanthes trifoliata, Potentilla palustris, Carex lasiocarpa,*	The *Menyanthes* sub-community is more valuable than the *Cladium* sub-community, and this should be reflected in target setting for the site. The *Menyanthes* sub-community may be

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
	wetland and percolating wetland	*Scorpidium scorpioides, Utricularia vulgaris, Phragmites australis, Juncus subnodulosus*: at least 3 species present, combined cover <50% with *Phragmites* <20% cover	placed within 'Cladium fen with species of the Caricion davallianae'.
S3	**Flood-plain fen**: base-poor and base-rich sump wetland **Open water transition fen Valley fen**: base-poor and base-rich sump wetlands	*Carex paniculata*: healthy tussocks with bare peat or water between, plus a few scattered associates (e.g. *Angelica sylvestris, Filipendula ulmaria, Galium palustre, Rubus fruticosus, Solanum dulcamara*) between and as epiphytes	The associated species will be site-specific and reflect adjoining communities.
S4	**Open water transition fen**	*Phragmites australis* sub-community: *Phragmites australis* forming a closed or open stand; >90% cover Associated species e.g. *Typha latifolia, T. angustifolia, Carex riparia, Cladium mariscus, Berula erecta*: can be locally prominent, but should be about 5% cover overall *Galium palustre* sub-community: *Phragmites australis* forming a closed or open stand; >70% cover Associated species e.g. *Galium palustre,, Mentha aquatica, Lythrum salicaria, Iris pseudacorus*: can be locally prominent, but should be about 10% cover overall *Menyanthes trifoliata* sub-community: *Phragmites australis* forming a closed or open stand; >50% cover Associated species e.g. *Menyanthes trifoliata, Equisetum fluviatile, Carex rostrata, Potentilla palustris*: can be locally prominent, but should be about 10% cover overall *Atriplex prostrata* sub-community: *Phragmites australis* forming a closed or open stand; > 80% cover	The reedbed may be important for birds and invertebrates. It is important to set targets which reflect the structure required for e.g. bitterns, sedge and reed warblers, bearded reedlings and various moths. Targets should also reflect the greater value of the more species-rich sub-communities. The *Atriplex* sub-community is a brackish water transition sub-community.
S5	**Flood-plain fen**: alluvial wetland	*Glyceria maxima* sub-community: *Glyceria maxima*: constant	Both of these sub-communities are of low

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		Associated species e.g. *Lemna minor, Solanum dulcamara*: at least 2 species present *Alisma plantago-aquatica, Sparganium erectum* sub-community: *Glyceria maxima*: patchy and fragmentary stands not total cover Associated species e.g. *Alisma plantago-aquatica, Sparganium erectum, Rorippa nasturtium-aquaticum*: at least one species forming a patchy understorey	plant species richness, although the *Alisma-Sparganium* sub-community is slightly richer. Any value is more likely to lie in the invertebrates.
S6	**Flood-plain fen**: alluvial and base-rich sump wetland **Open water transition fen** **Valley fen**: base-rich sump wetland	*Carex riparia*: cover >70% Associated species *Phragmites australis, Equisetum fluviatile, E. palustre, Phalaris arundinacea, Epilobium hirsutum, Filipendula ulmaria*: at least 2 species present, combined cover <30%	
S8	**Flood-plain fen**: alluvial wetland **Open water transition fen**	*Scirpus lacustris* ssp. *lacustris* (*Schoenoplectus lacustris*) sub-community: *Schoenoplectus lacustris*: open, can share up to 50% cover with *Phragmites* and grow up to 3m tall. *Sparganium erectum* sub-community: *Schoenoplectus lacustris*: <2m in height *Sparganium erectum*: present *Equisetum fluviatile* sub-community: *Schoenoplectus lacustris*: <2m in height Associated species e.g. *Equisetum fluviatile, Carex rostrata, Menyanthes trifoliata*: at least one species present, combined cover <50%	A wide variety of other aquatic and fen species can occur. The *Sparganium* and *Equisetum* sub-communities are more species-rich and of greater conservation interest.
S9	**Flood-plain fen**: base-poor and base-rich sump wetland	*Carex rostrata* sub-community: *Carex rostrata*: constant	The *Menyanthes-Equisetum* sub-community is more

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
	Open water transition fen **Valley fen**: base-poor and base-rich sump wetland	*Menyanthes trifoliata–Equisetum fluviatile* sub-community: *Carex rostrata*: <70% cover Associated species e.g. *Equisetum fluviatile, Menyanthes trifoliata, Potentilla palustris*: at least one species present, combined cover <30%	species-rich and of greater conservation interest.
S10	**Flood-plain fen**: base-poor sump wetland **Valley fen**: base-poor sump wetland	*Equisetum fluviatile* sub-community: *Equisetum fluviatile*: constant *Carex rostrata* sub-community: *Equisetum fluviatile*: forming an open stand, < 80% cover. Associated species e.g. *Carex rostrata, Menyanthes trifoliata, Potentilla palustris*: at least one species present, combined cover >20%	The *Carex* sub-community is more species-rich and of greater conservation interest. The associated species in the community may intermix and even dominate.
S11	**Open water transition fen**	*Carex vesicaria* sub-community: *Carex vesicaria*: constant *Veronica scutellata* sub-community: *Carex vesicaria*: <90% cover Associated species e.g. *Mentha aquatica, Myosotis scorpioides, Galium palustre, Veronica scutellata*: at least 3 species present *Carex rostrata* sub-community: *Carex vesicaria*: <90% cover Associated species e.g. *Mentha aquatica, Myosotis scorpioides, Galium palustre, Veronica scutellata, Carex rostrata, Potentilla palustris, Menyanthes trifoliata*: at least 2 species present forming a scattered understorey	The *Veronica* and *Carex rostrata* sub-communities are more species-rich and of greater conservation interest.
S12	**Flood-plain fen**: alluvial wetland **Open water transition fen**	*Typha latifolia* sub-community: *Typha latifolia*: constant Associated species e.g *Lemna minor, Solanum dulcamara, Aster tripolium:* at least one species present	The *Mentha* and *Alisma* sub-communities are more species-rich and of greater conservation interest. The

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		Mentha aquatica sub-community*:* *Typha latifolia*: <90% cover Associated species e.g. *Mentha aquatica, Galium palustre, Juncus effusus*: combined cover >10% *Alisma plantago-aquatica* sub-community*:* *Typha latifolia*: <90% cover Associated species e.g. *Sparganium erectum, Eleocharis palustris, Alisma plantago-aquatica*: combined cover >10%	overall aim should be to produce an open sward of *Typha* not more than 1.5m tall, and with associated species. The sub-communities are likely to be zoned around open water.
S13	**Flood-plain fen**: base-rich sump wetland **Open water transition fen** **Valley fen**: base-rich sump wetland	*Typha angustifolia*: constant Associated species e.g. *Phragmites australis, Typha latifolia, Glyceria maxima*: at least one species present	This is an extremely species-poor community, usually forming rafts.
S14	**Flood-plain fen**: alluvial wetland **Open water transition fen**	*Sparganium erectum* sub-community: *Sparganium erectum*: constant *Alisma plantago-aquatica* sub-community: *Sparganium erectum*: constant Associated species e.g. *Alisma plantago-aquatica, Callitriche stagnalis, Rorippa nasturtium-aquaticum, Apium nodiflorum*: at least one species present *Mentha aquatica* sub-community: *Sparganium erectum*: constant Associated species e.g. *Mentha aquatica, Myosotis scorpioides, M. laxa, Juncus effusus, Carex otrubae*: at least 2 species present *Phalaris arundinacea* sub-community:	The *Alisma* and *Mentha* sub-communities are more species-rich and of greater conservation interest. The overall aim is to produce an open sward of *Sparganium*, <1m tall and with associated species. The sub-communities may be zoned around open water.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		Sparganium erectum: constant *Phalaris arundinacea* at least thinly distributed throughout	
S19	**Open water transition fen**	All sub-communities: *Eleocharis palustris* constant *Littorella uniflora* sub-community: *Littorella* at least occasional Associated spp. e.g. *Lobelia dortmanna, Equisetum fluviatile, Juncus bulbosus, Potamogeton natans,* present forming a scattered understorey *Agrostis stolonifera* sub-community: Associated spp. e.g. *Potentilla anserina* present as a low mat	The *Littorella* and *Agrostis* sub-communities are more species-rich and of greater conservation interest than the *Eleocharis palustris* sub-community.
S20	**Open water transition fen**	*Scirpus lacustris* ssp. *tabernaemontani* sub-community: *Schoenoplectus tabernaemontani*: constant *Agrostis stolonifera* sub-community: *Schoenoplectus tabernaemontani*: constant *Agrostis stolonifera* an open mat beneath *Schoenoplectus*	The *Agrostis* sub-community is more species-rich and of greater conservation interest.
S21	**Open water transition fen**	*Scirpus maritimus* sub-community: *Bolboschoenus maritimus*: constant *Atriplex prostrata* sub-community: *Atriplex prostrata*: constant, ground cover Associated saltmarsh species: at least one present, scattered *Agrostis stolonifera* sub-community: *Agrostis stolonifera*: constant, ground cover Associated saltmarsh species: at least one present, scattered *Potentilla anserina* sub-community: *Potentilla anserina* constant, scattered	The *Atriplex, Agrostis,* and *Potentilla* sub-communities are more species-rich and of greater conservation interest.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
		Agrostis stolonifera: present, scattered	
S24	**Flood-plain fen**: base-rich alluvial and sump wetland **Open water transition fen** **Valley fen**: base-rich sump wetland	*Calamagrostis canescens, Cladium mariscus, Eupatorium cannabinum, Filipendula ulmaria, Galium palustre, Juncus subnodulosus, Lysimachia vulgaris, Mentha aquatica, Lythrum salicaria, Peucedanum palustre, Phragmites australis*: at least 5 species constant, one of which must be *Phragmites*, combined cover >80% *Carex paniculata* sub-community: *Carex paniculata*: tussocks present in stand *Calliergonella cuspidata, Brachythecium rutabulum, Lophocolea bidentata*: at least one species constant *Glyceria maxima* sub-community: *Glyceria maxima* prominent in stand *Symphytum officinale* sub-community: *Symphytum officinale, Iris pseudacorus, Lycopus europaeus, Angelica sylvestris, Cirsium palustre, Thalictrum flavum, Stachys palustris*: at least 4 species constant, one of which must be *Symphytum* *Cicuta virosa* sub-community: *Typha angustifolia, Sium latifolium, Berula erecta, Cicuta virosa*: at least one species constant *Schoenus nigricans* sub-community: *Schoenus nigricans, Carex elata, Juncus subnodulosus*: at least *Schoenus* constant *Myrica gale* sub-community: *Myrica gale, Cladium mariscus*: at least one species constant	The community is dependent on winter flooding and a high summer water table. The first target applies to all sub-communities, whilst further targets are additional to this.

NVC community	Relevant component wetland type(s)	Positive indicators (major, desirable and associated vascular plants and bryophytes)	Comments
S25	**Flood-plain fen**: alluvial wetland **Open water transition fen**	*Phragmites australis, Eupatorium cannabinum, Filipendula ulmaria, Angelica sylvestris, Juncus subnodulosus, Cirsium palustre, Mentha aquatica, Lythrum salicaria, Valeriana officinalis, Iris pseudacorus, Epilobium hirsutum*: at least 5 species constant, one of which must be *Phragmites australis*, combined cover >80% *Carex paniculata* sub-community: *Carex paniculata*: tussocks within the stand, frequently with seedings of *Salix cinerea* growing in the tops *Cladium mariscus* sub-community: *Cladium mariscus* prominent in stand	The community is dependent on winter flooding and a high summer water table, usually with base-rich waters. There is a moderate degree of nutrient enrichment. The first target applies to all sub-communities, whilst further targets are additional to this.
S27	**Flood-plain fen**: base-poor and base-rich sump wetland **Basin fen**: base-poor and base-rich sump wetland **Valley fen**: base-poor and base-rich sump wetland	EITHER *Carex rostrata, C. vesicaria, C. nigra, C. elata, C. aquatilis, C. appropinquata, Eriophorum angustifolium*: combined cover >25% OR *Phragmites australis, Juncus effusus*: combined cover >25% *Potentilla palustris, Menyanthes trifoliata, Equisetum fluviatile*: individually or together combined cover >25% *Calliergonella cuspidata, Calliergon cordifolium, C. giganteum*: at least one species at least rare Associated species *Galium palustre, Cardamine pratense, Epilobium palustre, Mentha aquatica, Myosotis laxa, Caltha palustris, Hydrocotyle vulgaris, Veronica scutellata, Lysimachia vulgaris*: at least 3 species constant	The balance between sedges and rushes and reeds is variable, changes from sedge domination to reed or rush may be undesirable on some sites. The bryophyte mat is sometimes extensive, other species may need to be substituted locally.

Table 6. Undesirable species for key NVC communities in lowland fens (see Table 4)

	Negative Indicators (non-woody species)																				**Target for species marked as:** (some NVC community types have individual targets for different habitat types)	
NVC Community	*Phragmites australis*	*Phalaris arundinacea*	*Glyceria maxima*	*Typha latifolia*	*Epilobium hirsutum*	*Urtica dioica*	*Pteridium aquilinum*	*Rubus fruticosus*	*Juncus spp*	*Brachythecium rutabulum*	*Eurhynchium praelongum*	*Molinia caerulea*	*Menyanthes trifoliata*	*Potentilla palustris*	*Equisetum fluviatile*	*Carex rostrata*	*Glyceria fluitans*	*Ulex europaeus*	*Galium aparine*	*Impatiens glandulifera*	**X**	**O**
M4, M5, M6 (see note)	**X**	**X**	**X**	**X**	**X**	**X**	**O**	**O**	**X**												Not more than one of the 'X' group of species and that <5% cover	Not more than one of the 'O' group of species and that <5% cover
M9	**X**	**X**	**X**		**X**	**X**	**O**	**O**		**X**	**X**	**O**										
M10, M13	**X**											**O**									No more than rare, <20 shoots in any sample	Cover <25%
M14	**X**	**X**	**X**		**X**	**X**	**X**	**X**		**X**	**X**	**X**									Not more than one species and that no more than rare and <5% cover	
M18 + sc*	**O**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**										Indicators of enrichment or of drying out: None of these should occur	Acceptable around upwellings or their equivalent on ditched bogs
M21	**X**	**X**	**X**		**X**	**X**	**O**	**O**		**X**	**X**	**O**									Not more than one of the 'X' group of species and that <5% cover	Not more than one of the 'O' group of species and that <5% cover
M22 + sc*, M25 + sc*	**X**	**X**	**X**		**X**	**X**	**X**	**X**		**X**	**X**										Singly or in combination <5% cover	
M27 + sc*, M28							**X**	**X**													<5% cover	
M29	**X**	**X**		**X**		**X**	**X**			**X**			**X**	**X**	**X**	**X**	**X**	**X**			Joint cover <5%	
S1																					Invasion of inter-tussock space by few large dominant species or >4 or 5 smaller ones	
S4 + sc*						**X**													**X**	**X**	No more than rare	

	Negative Indicators (non-woody species)																				**Target for species marked as:** (some NVC community types have individual targets for different habitat types)	
NVC Community	*Phragmites australis*	*Phalaris arundinacea*	*Glyceria maxima*	*Typha latifolia*	*Epilobium hirsutum*	*Urtica dioica*	*Pteridium aquilinum*	*Rubus fruticosus*	*Juncus spp*	*Brachythecium rutabulum*	*Eurhynchium praelongum*	*Molinia caerulea*	*Menyanthes trifoliata*	*Potentilla palustris*	*Equisetum fluviatile*	*Carex rostrata*	*Glyceria fluitans*	*Ulex europaeus*	*Galium aparine*	*Impatiens glandulifera*	**X**	**O**
S9 sc*, S10 sc*, S19, S20 sc*	**X**	**X**	**X**	**X**																	No more than rare and <25% cover	
S12 sc*	**X**	**X**	**X**																		No more than rare and <25% cover	
S24 + sc*, S25 + sc*						**X**		**X**													<5% cover	
S27 (see note)	**X**	**X**	**X**		**X**	**X**	**O**	**O**				**O**									Not more than one of the 'X' group of species and that <5% cover	Not more than one of the 'O' group of species and that <5% cover

Note. For M6 sub-communities c and d, *Juncus acutiflorus* and/or *J. effusus* would not be appropriate negative indicators. Likewise for S27, *Phragmites* would not be appropriate as a negative indicator for some stands (usually S27b). See relevant targets and comments in Table 5.

Appendix 1: Relationship between bog and fen classifications for site designation and Habitat Action Plan programmes.

Fen/bog woodland and exclusively upland wetland types are omitted. The correspondences are rarely exact and usually not exclusive. See Table 1 for more detail of Annex I types.

Broad Category	**HAP Category**	**Phase 1 Survey Category**			**SSSI Interest Feature**	**Natura 2000 Interest Feature***
Fen, marsh & swamp	Coastal & floodplain grazing marsh[6]	Marsh/marshy grassland			Fen-meadows; transition to grassland; topogenous fens (flood-plain)	Grassland types
	Fen	Flush & spring	Acid/neutral		Soligenous fens (springs & flushes)	Rhynchosporion
			Basic			Petrifying springs with tufa formation (*Cratoneurion*); Alkaline fen
			Bryophyte dominated			Petrifying springs with tufa formation (*Cratoneurion*)
		Fen	Valley mire	Acid/neutral	Soligenous fens: valley fens; trackways (blanket bogs)	*Rhynchosporion*; Transition mires and quaking bogs
				Basic	Soligenous fens: valley fens	Alkaline fen; *Cladium* vegetation
			Basin mire	Acid/neutral	Topogenous fens: basin fens	Transition mires and quaking bogs
				Basic	Topogenous fens: basin fens	Transition mires and quaking bogs; Alkaline fen; *Cladium* vegetation
			Floodplain mire	Acid/neutral	Topogenous fens: floodplain fens	*Cladium* vegetation; Transition mires and quaking bogs
				Basic	Topogenous fens: floodplain fens	*Cladium* vegetation; Alkaline fen
	Fens, Reedbeds	Swamp			Topogenous fens: open water transition fens	*Cladium* vegetation
Bogs	Lowland raised bog	Raised bog			Raised bogs: floodplain, estuarine, basin; includes some intermediate mires	Active raised bogs; *Rhynchosporion*
		Wet modified bog			Damaged raised bog	Degraded raised bogs still capable of natural regeneration
		Dry modified bog				
	Blanket bog	Blanket bog			Blanket bog (includes some intermediate mires)	Blanket bogs
		Wet modified bog				
		Dry modified bog				

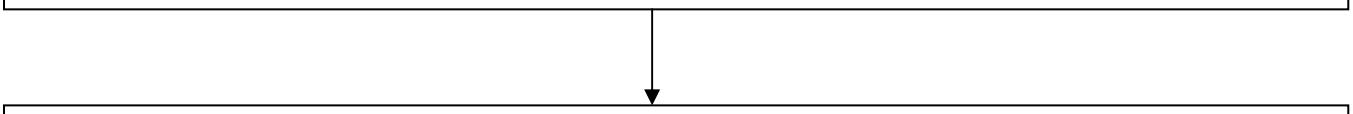
* Full titles: *Cladium* vegetation – Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Rhynchosporion* – Depressions on peat substrates of the *Rhynchosporion*

[6] Includes numerous Phase 1 categories as well as Marsh/marshy grassland

Appendix 2. Flow chart illustrating key elements of feature monitoring on lowland wetlands.

Desk-based

- Confirm identity and baseline extent (where already determined) of interest feature/s represented on site.
- Undertake file search to determine site-specific character of wetland feature/s (e.g. a basin mire might have been selected as the best example in the AoS for M4 & M5 mire).
- Obtain latest aerial photography and vegetation / habitat map where available.
- Indicators of local distinctiveness. Examine files for indication of site-specific features not specifically covered by generic attributes tables.



Site-based

- *Habitat extent*. Determine current habitat extent against last assessment.
- *Habitat extent*. Assess and record any alterations to physical site infrastructure - e.g. new drainage, recently cleared existing drainage, river bank alteration etc.
- *Habitat composition – component wetlands*. Determine identity of those key component wetlands within site which reflect nature of interest features. As a generic rule, there should be no loss in the extent of key herbaceous wetland components. Established wet woodland should always figure as a habitat component and targets should be set for its extent.
- *Habitat composition – structure.* Attribute only applies to certain situations where nature of patterning relates directly to feature condition – e.g. surface patterning on bogs.
- *Vegetation composition – positive indicators.* For **Bogs** see Table 3. For key herbaceous component wetlands of **fens**, select individual or groups of NVC for more detailed compositional monitoring. Determine sets of site-specific compositional indicators from the examples provided in Table 5. Extent of some communities/community groups may require monitoring – as for example one where or a few communities comprise the bulk of a Annex I feature.
- *Vegetation composition - indicators of negative change – non-woody species.* Non-native species target applies across whole feature. Targets for undesirable native species on **fens** vary between NVC communities – see Table 6.
- *Vegetation composition – indicators of negative change – woody species*. This attribute applies to woody species occurring beyond the defined limits of established wet woodland and should be applied to all key herbaceous wetland components.
- *Indicators of local distinctiveness*. Apply on a discretionary basis.