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

## Wast Water Special Area of Conservation (SAC)
## Site Code: UK0030063

Image: Wastwater: Simon Webb

**Date of Publication**: 25 January 2019

# About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Wast Water SAC.

This advice should therefore be read together with the SAC Conservation Objectives available here.

Where this site overlaps with other European Sites, you should also refer to the separate European Site Conservation Objectives and Supplementary Advice (where available) provided for those sites.

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

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

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

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

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

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

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

**If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk**

# About this site

## European Site information

| | |
|---|---|
| **Name of European Site** | Wast Water Special Area of Conservation (SAC) |
| **Location** | Cumbria |
| **Site Map** | The designated boundary of this site can be viewed here on the MAGIC website |
| **Designation Date** | 1 April 2005 |
| **Qualifying Features** | See section below |
| **Designation Area** | 286.21 Ha |
| **Designation Changes** | None |
| **Feature Condition Status** | Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System |
| **Names of component Sites of Special Scientific Interest (SSSIs)** | Wast Water SSSI |
| **Relationship with other European or International Site designations** | Adjacent to the Lake District High Fells SAC |

## Site background and geography

Wast Water (or Wastwater) is a large and deep nutrient-poor lake in the western part of the English Lake District which resides within the Cumbria High Fells National Character Area. The Cumbria High Fells covers the north and central Lake District and is largely within the Lake District National Park. It is a dramatic upland landscape, carved by past glaciations, with rugged peaks, ridges and open fells, separated by U shaped valleys with a radiating pattern of lakes and rivers. The lake catchment is of hard volcanic rocks and the shoreline is rocky with the spectacular Wasdale Screes dominating the south east shore.

The aquatic plant communities are typical of oligotrophic lakes. Species such as, quillwort *Isoetes lacustris,* shoreweed *Littorella uniflora* and water Lobelia *Lobelia dortmanna* are frequent. Rarer species such as awlwort *Subularia aquatica*, smooth stonewort *Nitella flexilis* and blunt-leaved pondweed *Potamogeton obtusifolius* are found on gravelly substrates.

At the head of the lake, and in the boat-house pool at the outfall, there are more sheltered bays with a greater range of aquatic plants. This includes bur reeds, bladderwort and water milfoil. There are rich and colourful transitions to marginal vegetation communities.

The fish, Arctic charr occurs in the lake and is reliant on cool deep water and clean marginal gravels for spawning.

# About the qualifying features of the SAC

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

## Qualifying habitats:

- ***H3130.*** **Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea;* Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels**

Wast Water supports a plant community which is characteristic of freshwater lakes with low levels of nutrients: This plant community contains two classes of plants: the *Littorelletea uniflorae* and the *Isoëto-Nanojuncetea* although these grow together in close association. These plants, collectively known as aquatic macrophytes, are rooted on the base of the lake and grow in the water column.

There is a distinctive transition in these communities from plants characteristic of shallow water such as *Littorella uniflora* Shoreweed), through to the deep water stands of *Isoetes lacustris,* Quillwort which can grow in 9 metres depth of water. Plants such as *Lobelia dortmanna Water Lobelia and Elatine hexandra* Six-stamened Water-wort grow in the zone between the shallow lawns of *Littorella* and the deeper waters. The tiny plant *Subularia aquatica*, Awlwort is of note due to its rarity. It grows on gravels in shallow water at the outfall of the lake.

A fish called Arctic Charr *Salvelinus alpinus* is also characteristic of this type of lake. It relies on deep cool waters and clean marginal gravels when it spawns. This fish is restricted to 8 lakes in England.

## Qualifying species:

There are no SAC qualifying species within this site

**Table 1: Supplementary Advice for Qualifying Features: H3130. Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea; Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels**

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| **Extent and distribution of the feature** | **Extent of the feature within the site** | Maintain the total extent of the feature of 286.21 hectares. | There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information.<br><br>The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations.<br><br>Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. | The figure stated in target reflects the cartographic area of the lake. The surveys below detail the distribution of the feature within this area and its nature in different areas.<br><br>Newbold 2000<br>Webb 2014<br>Darwell 2012<br><br>(Full reference details at the end of this document) |
| **Extent and distribution of the feature** | **Spatial distribution of the feature within the site** | Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site | A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat.<br><br>Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, | The surveys below detail the distribution of the feature within the lake and its nature in different areas.<br><br>Newbold 2000<br>Webb 2014<br>Darwell 2012 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
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| | | | temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. | |
| **Structure and function (including its typical species)** | **Invasive, non-native and/or introduced species** | Non-native species categorised as 'high-impact' in the UK under the Water Framework Directive should be absent. | All survey to date shows no high impact non-natives are present on site and the targets therefore are to maintain this status.<br><br>Non-native species constitute a major threat to many open water systems. Impacts may be on the habitat itself (e.g. damage to banks and consequent siltation) or directly on characteristic biota (through predation, competition and disease), or a combination of these. For example, species such as signal crayfish have been responsible for much of the decline of native crayfish through competition, habitat damage and the introduction of crayfish plague.<br><br>The UK Technical Advisory Group of the Water Framework Directive produces a regularly updated classification of aquatic alien species (plants and animals) according to their level of impact. In general high impact species are of greatest concern but low or unknown impact species may be included in the target on a site-specific basis where there is evidence that they are causing a negative impact (for example high cover values or abundances).<br><br>Those taxa considered likely to colonise lakes, are indicated by an 'L' in the UKTAG guidance. Examples of such high-impact species may include Water Fern, New Zealand pygmyweed and the zebra mussel. | Newbold 2000<br>Webb 2014<br>Darwell 2012<br>Stokoe 1978/9<br>Webb 2018 |
| **Structure and function (including its typical species)** | **Macrophyte community structure** | Restore a characteristic zonation of macrophytes, with increasing depth, represented by *Littorella uniflora* then with overlapping zones of *Littorella uniflora* with *Lobelia dortmana* then *Isoetes* spp. | This is a strongly characteristic structural aspect of this habitat feature. It will be a response to water transparency, sediment type and disturbance.<br><br>Issues with water quality and sedimentation indicate that the characteristic zonation of macrophytes is degraded and that restoration is necessary | Newbold 2000<br>Webb 2014<br>Darwell 2012<br>Stokoe 1978/9<br>Webb 2018<br>Environment Agency 2009 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| **Structure and function (including its typical species)** | **Macrophyte community structure** | Maintain the maximum depth of plant colonisation to at least 9 metres. This will often be the maximum depth colonised by Isoetes, but in richer waters maximum depth of Potamogeton spp. is also important. | This is a strongly characteristic structural aspect of this habitat feature. It will be a response to water transparency, sediment type and disturbance.<br><br>Stokoe recorded a depth of 6 metres for *Isoetes lacustris* in Wastwater. Darwell and Lambert found *Isoetes* growing to a depth of 9 metres. Secchi disk depths exceed 10m (see below) and there is good water transparency. | Stokoe 1978/9<br>Darwell and Lambert 2000 |
| **Structure and function (including its typical species)** | **Macrophyte community structure** | Restore a characteristic and well defined hydrosere associated with the water body where this is present | A hydrosere is a naturally-occurring plant succession which occurs in an area of standing fresh water. Over time, an area of open freshwater will naturally dry out, ultimately becoming woodland. During this change, a range of different wetland habitat types such as swamp and marsh, will succeed each other. This structure around the margins of the lake creates a buffer zone that can help protect the lake from a limited amount of sediment and nutrient inputs. It also increases habitat heterogeneity providing additional food sources and refugia.<br><br>The south eastern and north-western shorelines have poorly developed hydroseres as there is little shelter and the shorelines are both grazed and steeply shelving. The head of the Lake shows the richest development of transitions to fen and swamp communities where a series of inlets, lagoons and gravel bars have developed. The area around boat house pool has some development of hydrosere but these are poorly developed due to the steeper banks and probably the grazed nature of the shoreline here.<br><br>Restoration of these hydroseres would involve reduction of grazing pressure. | These communities are poorly described and have not been comprehensively surveyed. The survey data held relates to visits by Newbold 2000 Kirkham 2009 and Webb 2018 |
| **Structure and function (including its typical species)** | **Physical structure - lake shoreline** | Restore the natural shoreline of the lake. | Inclusion of hard engineering solutions to lake management may have detrimental effects on lake ecology, replacing near-natural substrates with man-made materials. Alteration of the shoreline may also result in changes in water movements within the lake, which would have effects on patterns of sediment deposition.<br><br>There is little modification of the substrate or hydrology of the | There are no formal record of the naturalness of the shoreline. This document records the best available data. |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
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| | | | shorelines. A review by Webb in 2018 associated with production of this document identified the following four modifications:<br>1. The gabions and physical modification on the northern side of the Sellafield pump-house near the outfall of the lake.<br>2. The protection of the track to Wasdale Head Hall Farm. This is set back from the actual lake shore and is relatively minor.<br>3. The protection of the road 500m NE of the Overbeck Bridge. Here small revetment walls run alongside the road in several locations<br>4. The footings for the bridge to the NT campsite. This is outwith the site but is constraining the river and may be having impacts on the morphology at the head of the lake | |
| **Structure and function (including its typical species)** | **Physical structure - lake substrate** | Maintain the natural and characteristic substrate for the lake. Substrate is typically sand, gravel, stones and boulders with low organic content, but there may be a locally high peat content. | The distribution of sediment particle size and organic content influences the biology of the lake and will affect the suitability of within-lake habitats for invertebrates and macrophytes, and fish spawning grounds. Increases in sediment loading from activities in the catchment area, including those on the lake shore, may result in the smothering of coarse sediments such as sand and gravel. | See comment above relating to natural shoreline of the lake |
| **Structure and function (including its typical species)** | **Water quality - phosphate** | Restore stable nutrient levels appropriate for lake type. The maximum annual mean concentration of TP is 5 µg P l-1 This low target reflects the low productivity of the lake and to prevent deterioration from present state | There is evidence of increasing productivity within the lake as detailed within Maberly, S *et al*. 2016. This is associated with both agricultural management and septic tanks in catchment.<br><br>If palaeolimnological techniques or hindcast modelling have been employed to reconstruct natural background phosphorus concentrations for a particular lake, these can be used to set targets, although it may be necessary to accept a small deviation from these background conditions. Alternatively, historical water chemistry data may exist for individual lakes. Where existing, site-specific water column TP concentrations are consistently lower than the standard appropriate for the habitat type, a lower target should be applied to prevent deterioration from current status. Increased loadings of P to a | Thackeray *et al* 2004<br>Webb 2014<br>Darwell 2012<br>Winfield 2012<br>Webb 2018<br>Maberly, S *et al*. 2016<br>Natural England 2014 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| | | | water body are likely to lead to higher algal biomass in the water column, which in turn can have significant impacts on the standing water ecosystem through, for example, competition with vascular plants for nutrients and light, changes in pH, oxygen depletion and production of toxins. Decreasing dissolved oxygen and increasing ammonia levels are associated with death and decay of algal blooms, as is a release of toxins from toxin-producing species. | |
| **Structure and function (including its typical species)** | **Water quality - nitrogen** | Restore a stable nitrogen concentration of less than 1.5mg/l and no deterioration from baseline. | There is an increasing understanding that some standing waters are sensitive to nitrogen (N) enrichment and eutrophication may be driven by increases in N, but site-specific information is usually required to determine whether N or P is more important. Where P levels are significantly above their target values and there is evidence that the lake is N limited (for example by N levels falling to negligible levels in summer), N targets should be set in addition to P targets.<br><br>We recommend that such targets should preferably be developed using site-specific information, but should be based around the threshold of 1.5mg/l identified by Barker *et al* 2008. In this situation N targets should be used in combination with P targets to drive a management strategy for the lake that reduces all nutrient inputs. | Barker *et al* 2008<br>Maberly, S *et al*. 2016 |
| **Structure and function (including its typical species)** | **Water quality - acidity** | Acidity levels should reflect un-impacted conditions, typically a pH of 5.5-7.0 for oligotrophic lakes. | Changes in pH can alter the entire freshwater community present within a water body affecting all trophic levels. Potential causes of a shift in pH include air pollution and direct application of lime to the water column as an acidification amelioration strategy (this should not be carried out). Acidity levels should reflect un-impacted conditions - values of Acid Neutralising Capacity (ANC) considered to avoid significant impact on characteristic biota are laid out in the site's Favourable Condition Table (B) (these are the same numerical values as used to protect high ecological status under the WFD in the UK). As a guide, pH 5.5-7.0 for oligotrophic lakes and 7.0-8.0 for mesotrophic lakes.<br><br>Although, pH naturally fluctuates throughout the year, e.g. snow melt may lead to pulses of acid water, and increased | Maberly, S *et al*. 2016<br>Natural England (2015) Favourable Condition Table. Data may be available upon request. |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| | | | plant biomass in summer may result in large fluctuations in pH, including daytime increases in pH values. Therefore pH is not used as a monitoring target, however its importance in affecting many in lake processes means that the pH of a water body should not be artificially altered. | |
| **Structure and function (including its typical species)** | **Water quality - other pollutants** | Maintain Good chemical status (i.e. compliance with relevant Environmental Quality Standards). | A wide range of pollutants may impact on habitat integrity depending on local circumstance. Good chemical status includes a list of EQSs for individual pollutants that are designed to protect aquatic biota with high levels of precaution. | Maberly, S *et al*. 2016 |
| **Structure and function (including its typical species)** | **Water quality - dissolved oxygen** | Adequate dissolved oxygen levels for health of characteristic fauna. DO>9mg/l f throughout the year. | As for species in terrestrial environments, dissolved oxygen (DO) is required for respiration by aquatic organisms. Anthropogenic activities leading to phytoplankton blooms and increased loadings of organic matter to lakes can cause decreases in the concentration of dissolved oxygen available to support the species present. Mean dissolved oxygen refers to DO being measured at 0.5m intervals throughout the entire water column where the water column is not stratified and measurements taken at 0.5 m intervals below the thermocline only where stratification occurs.<br><br>Summer deep-water anoxia has not been recorded at Wastwater. | Maberly, S *et al*. 2016 |
| **Structure and function (including its typical species)** | **Water transparency** | Restore the clarity of water at or to at least a depth of 14metres | Water clarity or transparency is the major determinant of the depth of colonisation by macrophytes, therefore, it should not be reduced. This should allow plant colonization to at least 9m- see target above. A Secchi depth of 10m was recorded in 2014 by Webb and a figure of 9.6 m was recorded by Maberley *et al* in 2015 The transparency of Wast Water has been in slow decline since1980 when the depth was 14m. The target is to restore to the 1980 level.<br><br>Increased nutrient loads leading to increased algal growth will reduce water transparency, disturbance of the sediment by water sports and bottom feeding fish such as carp and bream also increase turbidity and reduce water transparency. Increased sediment loads to a lake would also have this effect. | Webb 2014<br>Maberly, S *et al*. 2016<br>Stokoe 1978/9 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| **Structure and function (including its typical species)** | **Water quality - algae** | Chlorophyll a concentration should comply with WFD high ecological status and not have a negative impact on the ecosystem. Blooms of blue-green or green algae should not occur in low nutrient waters. | Chlorophyll is the pigment used for photosynthesis by plants, and the concentration of chlorophyll in the water column during the growing season therefore provides a good measure of the abundance of phytoplankton. Phytoplankton is an important driver of structure and function in lakes and high phytoplankton levels (algal blooms) are usually associated with nutrient enrichment.<br><br>Dense growths of tufted algae may grow on hard substrates where other plants have difficulty establishing, such as on boulders or cobbles. On the whole this is not a cause for concern. However, formation of floating algal rafts or macrophytes being overgrown with filamentous algae is a cause for concern. | Thackeray *et al* 2004<br>Winfield 2012<br>Webb 2014<br>Webb 2018<br>Maberly, S *et al*. 2016<br>Environment Agency 2009 |
| **Structure and function (including its typical species)** | **Hydrology** | At a site, unit and/or catchment level (as necessary), restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site | Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts.<br><br>Hydrology influences lake ecosystem functioning in two ways: determining residence time (flushing) and water level fluctuations. Flushing of lakes is important for dilution and removal of nutrients and phytoplankton, and for reduction in sedimentation. The timing of different flushing rates within the year influences the biology of the lake. For example, reduced flushing in summer would encourage bloom conditions. Modifications of inflows and outlets or changes in hydrology, e.g. from flood control regimes, abstraction and gravel removal can lead to unnatural changes in lake levels.<br><br>The impact of the Sellafield abstraction was reviewed by the Environment Agency in 2007. The conclusion of the review of the existing consent was that the integrity of the SAC would not | Environment Agency 2007 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| | | | be adversely affected by continuing abstraction. However further development should not increase abstraction or drawdown and any opportunity to re-naturalise the hydrology of Wast Water should be taken. | |
| **Structure and function (including its typical species)** | **Sediment load** | Restore the natural sediment load | Increased sediment loadings may result in clogging of the lake bed, increased siltation in the basin and deoxygenation of sediments. Blockage of coarser substrates with finer sediment restricts water flow-through, whilst increases in organic matter increase biochemical oxygen demand. Examples of causes of increases in siltation include: increased lake productivity, changes in catchment land-use (particularly over-grazing), lake level fluctuations or climatic fluctuations. | Thackeray *et al* 2004<br>Winfield 2012<br>Webb 2014<br>Webb 2018<br>Maberly, S *et al*. 2016<br>Johnston 2013 |
| **Structure and function (including its typical species)** | **Supporting off-site habitat** | Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature.<br><br>. | The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the typical species of the feature to support their feeding, breeding, roosting, population dynamics ('metapopulations'), pollination or to prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment.<br><br>This target includes the rich mosaic of lagoons, inlets, gravel bars, fen and scrub at the head of the lake. It also covers the farmland adjacent to the lake and the broader lake catchment which is heavily grazed. Both the grazed catchment and the agriculture close to the lake has increased sediment loading. The restoration of clean gravel substrate for Charr spawning and macrophyte colonisation is critical. | Thackeray *et al* 2004<br>Winfield 2012<br>Webb 2014<br>Webb 2018<br>Newbold 2000<br>Kirkham 2009 |
| **Structure and function (including its typical species)** | **Functional connectivity/ isolation** | Maintain the natural connectivity of the water body to the lagoons and inlets at the head of the lake and to its inflow and outflow rivers<br><br>Maintain the natural lack of | The natural isolation of some standing water bodies can provide some protection from threats such as pollution and invasive species. Hydrological isolation can also lead to unique or diverse species assemblages this may be due to genetic isolation or the absence of predators. These water bodies should have their isolated state maintained. In contrast other standing water bodies naturally rely on hydrological connectivity to other freshwater systems for water supply, and | Webb 2014<br>Webb 2018<br>Newbold 2000 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| | | connectivity of the water body to other water bodies | can support migratory species. Hydrological connectivity may also be important for geneflow, and habitat and species resilience. These water bodies should have their hydrological connectivity maintained | |
| **Structure and function (including its typical species)** | **Key structural, influential and/or distinctive species** | Restore the abundance of the species listed below to enable each of them to be a viable component of the Annex 1 habitat;<br><br>*Littorella uniflora*<br>*Isoetes lacustris,*<br>*Lobelia dortmanna*<br>*Subularia aquatica*<br>*Myriophyllum alternifloru,*<br>*Callitriche hamulata*<br>*Elatine hexandra*<br>*Juncus bulbosus*<br>*Nitella spp*<br>*Utricularia spp*<br>*Eleogiton fluitans*<br>*Potamogeton obtusifolius,*<br>*Potamogeton polygonifolius*<br><br>Arctic Charr *Salvelinus alpinus* | The baseline survey data from Stokoe and Newbold indicates that there has been some declines in Macrophyte abundance. This is backed up by more recent surveys focussing on the head of the Lake where sedimentation is most marked.<br><br>In addition it is thought that there is a marked reduction in the abundance of Arctic Charr.<br><br>Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include;<br><br>• **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition').<br><br>• **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat)<br><br>• **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC.<br><br>There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, | Thackeray *et al* 2004<br>Winfield 2012<br>Webb 2014<br>Webb 2018<br>Newbold 2000<br>Kirkham 2009<br>Maberly, S *et al*. 2016<br>Stokoe 1978/9<br>Darwell and Lambert 2000<br>Darwell 2012<br>Environment Agency 2009 |

| Attributes | | Targets | Supporting and Explanatory Notes | Sources of site-based evidence (where available) |
|---|---|---|---|---|
| | | | and species may be added or deleted, as new information about this site becomes available. | |
| **Structure and function (including its typical species)** | **Fisheries** | Maintain a total projected estimate for biomass of total fish production at less than 200kg/ha. In view of the limited productivity of the site the biomass is likely to be significantly less than this maximum target figure. | Fish communities may exert a strong influence on overall lake ecology and may cause or exacerbate eutrophication symptoms.<br>The FCT sets a target for Charr abundance of 37 individuals per Ha or 11,000 individual fish on site.<br>The FCTs set targets for no introduction of fish, no fish farming, no fish stocking and no use of live bait. | Natural England (2015) Favourable Condition Table. Data may be available upon request.<br>Maberly, S *et al*. 2016<br>Winfield 2012 |
| **supporting processes (on which the feature relies)** | **Air quality** | Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk). | This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. | More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). |
| **Version Control**<br>Advice last updated: N/A | | | | |
| **Variations from national feature-framework of integrity-guidance**: Target for Non-natives, Dissolved oxygen and Phosphate adjusted to reflect no deterioration on existing level. | | | | |

# References:


Barker T., Hatton K., O'Connor M., Connor L. and Moss B. (2008) Effects of nitrate load on submerged plant biomass and species richness: results of a mesocosm experiment. *Fundamental and Applied Limnology,* 173, 89-100.

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**Footnote:**
The Newbold survey and the Darwell and Lambert report are missing from the Scanned Natural England files but are reproduced in full (along with the Stokoe file notes) as an appendix to the Thackeray 2004 report cited above.