UK Technical Advisory Group on the Water Framework Directive
Draft Report on UK Environmental Standards and Conditions (Phase 1)

Joint response from Wildlife and Countryside Link, Scottish Environment LINK, Northern Ireland Environment Link and Wales Environment Link

April 2006

1.0 Introduction

14 voluntary organisations concerned with the conservation, enjoyment and protection of wildlife, countryside and the marine environment have joined forces under the umbrella of the four UK Link organisations (Wildlife and Countryside Link, Scottish Environment LINK, Northern Ireland Environment Link and Wales Environment Link) to welcome the opportunity to respond to the UK Technical Advisory Group on the Water Framework Directive Draft Report on UK Environmental Standards and Conditions (SR1-2006).

Wildlife and Countryside Link brings together 36 environmental voluntary organisations in the UK united by their common interest in the conservation and enjoyment of the natural and historic environment.

Scottish Environment LINK is the forum for Scotland's voluntary environment organisations - 36 member bodies representing a broad spectrum of environmental interests with the common goal of contributing to a more environmentally sustainable society.

Northern Ireland Environment Link's 37 Full Members work together to promote the care and protection of the natural and built environment of Northern Ireland.

Wales Environment Link is a network of 26 voluntary environmental and countryside non-governmental organisations with an all-Wales remit.

2.0 Summary

While the proposed Standards and Conditions display considerable progress, we believe a number of important revisions need to be made before they can be accepted as final. The relationship between these standards and the broader classification and objective-setting process for the WFD also needs to be made clearer. We believe that the Standards and Conditions should be revised and re-issued as part of a broader consultation on the entire WFD classification system.

The Standards and Conditions that will be required to meet Good Ecological Status (GES) are an essential part of the Water Framework Directive (WFD). We welcome the very considerable effort that has been put into the development of these standards, and recognise the difficulties in developing new environmental standards from scratch across the UK in a context where the relationships between pressures and ecological impacts are often poorly understood. We also recognise the difficulties in developing standards and conditions before the completion of the WFD intercalibration process.

Given these challenges, we nevertheless have some concerns over the draft standards and conditions and the envisaged future work. Some of these relate to particular methodologies that have been adopted, and we hope our comments can be considered in drawing up the final standards. On other occasions, however, we are concerned over an apparent lack of ambition, and the suggestion that standards may have been proposed on the basis of expediency rather than science.

In our detailed comments below, we highlight the following concerns:

- The final document needs to make clearer the role that these Standards and Conditions will play in objective setting for the WFD. Greater clarity is required both on how these Standards and Conditions relate to standards for the biological quality elements and how they relate to existing standards within other directives.
- Some of the methods used to derive water quality standards need to be reviewed, in particular the use of appropriate reference conditions and the selection of the taxa against which to judge sensitivities.
- Consideration needs to be given as to how strong across-the-board standards can be supplemented by risk-based approaches to, for example, water quality spikes or morphological improvement.
- Expert views on water resource standards have been rejected on the grounds of expediency. We do not find this acceptable.
- The proposed morphological standards address the issues only partially and the proposed approach is in itself inadequate and requires further development.
- Standards on turbidity and nitrogen must be developed in time for the first river basin plans.

We regret that UKTAG have chosen to develop these Standards and Conditions without discussion with wider stakeholders. This has resulted in the omission of important sources of information and expertise, and means that the very many challenges inherent in an undertaking on this scale can only be reviewed at this relatively late stage in proceedings.

Given the considerable importance of these standards and conditions for the future management of the freshwater of the UK, we believe that it is vital that they be subject to widespread discussion in order to ensure that they are based on the strongest possible scientific consensus.

We recommend that a further consultation process be undertaken that reviews the entirety of the WFD classification process, including revised standards and conditions in the light of the comments received on this draft and a description of the process for translating the proposed Standards and Conditions into a legal instrument. Without being able to see the whole picture, it is difficult to comment on the current proposals.

3.0 General points

In addition to the discussion below of the specific proposed Standards and Conditions, we have a number of general concerns with the approach taken as a whole.

3.1 The relationship between the proposed Standards and Conditions and the WFD biological quality elements

The relationship between these proposed standards and conditions and the wider assessment of ecological status, including the ongoing intercalibration process, must be made clear. The proposed standards and conditions must not be used as a substitute for biological parameters in the future assessment of good status; nor, where the WFD requires the independent classification of chemical and physical standards should biological monitoring results be used to override the requirement for action to address deviation from good status for physico-chemical conditions.

It is difficult to understand where this consultation fits into the wider framework for the development of standards for the WFD. The foundation for the Standards and Conditions should be a classification of the biological quality elements, from which associated chemical and physical parameters are derived. Yet this consultation, the only formal one so far on classification systems, refers to the biological elements of the WFD only obliquely. This makes it very difficult to determine whether an adequate reference condition was used to benchmark GES standards for the relevant biological quality elements, and hence whether the derived chemical and physical standards are appropriate to meet the needs of the Directive.

Water body status should be decided by looking at a combination of the biological quality elements and the physico-chemical and hydro-morphological standards required to support high status. It is vital that that both the condition of biota and the condition of supporting physico-chemical elements are monitored and used to determine status as implementation progresses. As well as achieving the appropriate physico-chemical standards, the fish, plants and insects to be measured under WFD must achieve Good Status by 2015.

We strongly propose that the position adopted by the UK Government in endorsing the CIS guidance on ecological status is reflected in the approach taken in the classification of good status. The CIS guidance proposes that physico-chemical standards, derived from our best understanding of the relationship between these and the relevant biological quality elements, must form an independent and additive component of the classification system, and must be subject to the one-out-all-out principle. This is not compatible, for example, with the proposal in the current document that action to address water quality issues in rivers will only be triggered where biological monitoring results suggest that impacts on biota are already visible.

We recognise that there is a need to start the process of development of standards and conditions before the completion of the EU-wide intercalibration process. However, this does not present a barrier to presenting a full consultation on the suite of proposed standards and conditions for WFD, which can then be revised as more information becomes available.

3.2 The relationship between proposed standards and conditions and standards in existing Directives.

The relationship between the Standards and Conditions in the draft and standards in existing Directives needs to be made far clearer.

According to the draft Standards and Conditions, some of the standards from existing Directives will be incorporated for use in the WFD:

> "The standards and procedures used in other Directives will, after review, transfer to the Water framework Directive either directly, or as the equivalent." (p.10)

It is entirely unclear which standards are to be covered by this, how and when they will be transferred, and what process of 'review' will be undertaken.

For example, the Freshwater Fish Directive contains standards for a range of substances, including nitrites, suspended solids, and zinc. Some of these standards are "Imperative", while others are "Guideline". It needs to be made clear whether all of these standards will be transferred directly over and whether they will apply to both "Imperative" and "Guideline" standards.

3.3 The need for a risk-based approach to *supplement* strong across-the-board standards and conditions

The achievement of GES will require that risk-based approaches to particular issues, such as water quality spikes, be developed to supplement strong across-the-board standards.

In each of the main areas in which standards must be set (quality, hydrology and morphology) it is apparent that a single approach to standards will not suffice. While a strong set of across-the-board standards must be put in place, these should be *supplemented* by additional standards and conditions that can be applied under particular circumstances on a risk-based approach. Such risk-based approaches should under no circumstances replace strong, generally applicable standards, but be additional in particular circumstances.

There is a need for such an approach in each of the key areas. In the case of water quality, 'spikes' of short duration and high intensity can have very significant ecological impacts, but may not be picked up under the proposed annual average approach. Standards should reflect the potentially negative impact of water quality spikes. This could be achieved by *supplementing* annual average standards with a limit on the number and depth of water quality spikes allowed within fixed periods of time.

In the case of hydrology, the draft standards propose the use of a 'read-off table' for establishing environmental flow requirements. While we make a number of detailed comments on the approach proposed, we recognise that a sophisticated environmental flow assessment may not be appropriate for each and every water body in the country. We therefore suggest that the use of an appropriate read-off table be supplemented by the use of more sophisticated assessments where a particular need is identified.

Lastly, the need to supplement quantitative standards with a risk-based approach is most marked in assessing morphology. The complexity of the relationships between morphological pressures and ecological impact are complex and remain at an early stage of understanding. There seems, therefore, to be a case to be made for developing a strong quantitative standard for use in assessing any future modifications, and supplementing this with the development of a strong risk-based approach to the identification of key morphological pressures.

3.4 Has an appropriate methodology been used to assess reference conditions?

The proposed standards and conditions should be refined once appropriate reference conditions have been satisfactorily defined.

The identification of appropriate Standards and Conditions depends critically upon an understanding of the reference conditions against which environmental quality can be classified. The identification of appropriate high status sites is vital in setting the benchmark on which classifications can be based and against which appropriate standards and conditions can be set. However, following previous deterioration and under conditions of pervasive environmental impoverishment, as in much of the UK's freshwater environment, there is a danger that significantly degraded environments may be taken for high or good status waters, leading to inappropriately low standards being established. Where sites do not exist on which to base reference conditions, the Directive calls for modelling and expert judgement instead of a lowering of standards.

Under the current proposals, the rivers and lakes standards have been derived using procedures which do not follow REFCOND guidance for the identification of reference sites. In the case of river ammonia, BOD and phosphorus it is possible that this has contributed to the adoption of lower standards for some river types than would otherwise have been the case. We recommend that all standards proposed here are revisited once REFCOND compliant sites have been identified, or where this is not possible, alternative procedures should be used. Until this has been completed the standards proposed can only be regarded as provisional.

Our understanding is that the identification of reference conditions for each water body type should already have taken place as a legal requirement of the WFD implementation timetable (see Article V, Annex II). If this work has been undertaken, we can see no reason why it is not included more explicitly in the current consultation, as part of the classification system upon which comment is sought from stakeholders. We would welcome further clarification on this issue.

3.5 Implicit judgements concerning the expediency of standards and conditions

The level at which the standards and conditions are set must not pre-judge what is socially feasible or acceptable. CIS guidance on environmental objectives clearly states that they must be based purely on technical consideration: "The translation of the WFD's normative definitions into numeric class boundaries for good status is driven by a scientific-based approach."

The WFD is absolutely clear that the scientific definitions of high, good and moderate status should be completed prior to the assessment of the socio-economic implications of achieving these standards. Article 4 of the Directive sets out a clear procedure for the setting of alternative objectives under conditions where the achievement of GES is considered to be infeasible or

disproportionately expensive, or the water body qualifies as Heavily Modified. These socio-economic assessments must not be allowed to influence the prior scientific establishment of the good status objectives.

There is, however, evidence in the document that considerations of cost and feasibility have been allowed to influence the definition of standards and conditions. This is most marked in the consideration of water resources, where it is explicitly stated that the standards for the achievement of good status will be applied dependent on whether "*an abstractor has sufficient flexibility, or where the water supply infrastructure can accommodate them*" (p.55). We are further dismayed by the sentence that "*careful consideration must be given to the implications of changing standards*" (p.57). We believe such an approach is incompatible with European guidance which the UK Government has already endorsed.

3.6 Safeguarding high status sites

Much greater clarity is required over how high status sites are to be protected in the light of the proposed standards and conditions.

The proposed standards and conditions for good status must not be enshrined as an acceptable level of ambition across the entirety of the UK's water bodies. The maintenance of high status sites is also legally required, and must be a priority. However, the proposed standards and conditions operate on the principle that there is an acceptable level of deterioration that can take place *within* classes (e.g. high, good) without causing a significant deterioration in ecological status. This approach is particularly concerning in the context of high status sites, where the proposed system of permissible migration within standards may lead to activities such as abstraction and morphological change being permitted on high status water bodies. The establishment of WFD standards and conditions should not be allowed to undermine the no deterioration requirement and the no net loss principle enshrined in PPS9.

3.7 Standards and conditions for Heavily Modified Water Bodies

Further clarification is required as to how the proposed Standards and Conditions will be applied to heavily-modified water bodies.

We have very significant concerns over the way in which it is envisaged that the standards will be applied to Heavily Modified Water Bodies. In particular, the document states that Good Ecological Potential can be equated to Moderate Ecological Status as specified by these standards and conditions (p.50). This is entirely contrary to the definition of Good Ecological Potential in the Directive, and must be revised.

3.8 The need for effective monitoring

The proposed standards and conditions will only be as effective as the monitoring programmes that support them.

For water quality monitoring (chemistry and nutrients), sampling frequency and timing is crucial to the precision of estimates of diffuse pollutant loadings. The current GQA does not give the required precision and future monitoring under the WFD will have to have greater sampling frequency, and ideally automated for flow-related or storm event based sampling.

3.9 Application of the standards to other standing water bodies

Greater clarity is required on the extent to which the proposed standards and conditions will be extended to other water bodies.

The proposed standards and conditions for lakes will only be applied to a small percentage of the standing water bodies of the UK. Less than 7% by area of lakes in England are identified as water bodies and covered by WFD objectives. Consideration should be given as to how they will be applied to the very many remaining water bodies currently outside the scope of the Directive as defined in the UK.

4.0 Water Quality for rivers

We welcome the thorough approach that has been made to interpret the standards and conditions that will be required to achieve WFD objectives, and recognise the complexity of the task. However, we remain concerned that due to methodological errors, a number of standards have been set too low. We urge that the proposed standards be revisited in the light of the comments below.

4.1 The need for additional standards and conditions to assess water quality spikes

Water quality standards covering short duration spikes must be developed to supplement annual average standards.

International scientific opinion is increasingly focusing on the importance of water quality incidents of short duration and higher intensity. These water quality 'spikes' can have very significant ecological impacts, but may not be picked up under the proposed annual average approach. Average annual water quality standards that are 'aimed off' to allow for spikes could trivialise short term troughs in quality which may, nonetheless, have a harmful effect on the ecological status of a water body. Standards should reflect the potentially negative impact of water quality spikes. This could be achieved by *supplementing* annual average standards with a limit on the number and depth of water quality spikes allowed within fixed periods of time. Potentially costly monitoring for such spikes might then be undertaken under circumstances where the risk is assessed as being highest.

4.2 Use of inappropriate reference conditions

The proposed quality standards must be revised once sites selected against the REFCOND criteria are identified.

The water quality standards have been devised on the basis of assessment of current water quality in sites believed to represent high status. This process depends crucially on the reference sites selected. However, the recognised REFCOND criteria have not been used, and as a result current values must be regarded as provisional.

BOD, dissolved oxygen and ammonia

The reference values for river BOD, dissolved oxygen and ammonia were derived from analysis of the RIVPACS sites[1]. About half of the RIVPACS sites are now recognised as being only Good status i.e, they are classified by RIVPACS as 'Good', and for this reason an adjustment was applied to invertebrate EQIs to correct for this. This procedure is not compliant with the approach being used to establish reference conditions within Intercalibration (i.e. basing reference criteria on the REFCOND guidance).

The main difficulty with such an approach to finding the High/Good boundary is that it does not properly screen sites to determine whether they are reference sites. As Guthrie *et al. (2006)*[2] note in the standards development technical report:

> "It is likely that in many instances.....the chemistry parameter (e.g. BOD) is a strong correlate with other stresses not accounted for in the data (e.g. hydrological or morphological stress)"

This is the reason why the REFCOND reference criteria must be followed. Therefore the correct procedure, which is now being applied by the environment agencies and in Intercalibration, will be to check that RIVPACS sites fulfilled the REFCOND criteria, devise appropriate High/Good and Good/Moderate boundaries and then calculate the chemical standards from the environment agencies monitoring data. Sites which are not at reference conditions should be removed from the database and alternatives selected.

Phosphorus

The phosphorus standard is unacceptable because it is not based on REFCOND compliant procedures for reference site selection. Specifically, Kelly *et al.* [3] note that;

> "The approach adopted in this project has been to concentrate on establishing an absence of physico-chemical impacts coupled with assessment of the biology. We infer that land use impacts will be manifested in changed physico-chemical conditions, whilst the impact of hydromorphology on phytobenthos has not been considered."

Kelly *et al*. also note in their discussion that;

> "....sites defined as 'reference' solely on the basis of low N and P contained a wide variety of diatom communities, some of which suggested human impact exceeding that implied by the ND and the REFCOND guidance".

We therefore recommend that sites used for defining diatom assemblages are reviewed using the REFCOND criteria to identify those sites which do not meet the criteria. These sites should not be used to calculate reference conditions.

Where there are too few sites to propose reference conditions we suggest the following options;

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[1] Guthrie, R. *et al* (2006). The development of oxygenation condition and ammonia regulatory values in UK rivers.
[2] ibid
[3] Kelly *et al* in undated Appendix of Duncan *et al.* (2006) *The Development of Soluble Reactive Phosphorus Regulatory Values in UK Rivers*, SEPA

- Suitable analogues are identified elsewhere on the European continent.

Kelly *et al*. note that "All of the taxa listed...are common not just in rivers, but also in standing waters...and are found across a wide climatic range from Boreal to Mediterranean and tropical environments". This suggests that clean rivers on the continent, e.g. in Central or Eastern Europe, would be satisfactory analogues for the UK.

- Values are adjusted as has been done for the substandard RIVPACS sites.

Haygarth et al. (2003)[4] reported that, for rivers in Ireland, P concentrations (here measured as an unfiltered reactive P (RP)) of unpolluted rivers supporting healthy salmon populations, tended to be less than 20 µg P L^{-1} (McGarrigle 1998)[5]. Water that was significantly degraded had a median RP of 50 µg P L^{-1}. Thus for rivers, the threshold *for P in rivers is not substantially different from lakes*. This is supported by other studies, which note a low threshold of 5 µg P L-1 for increased abundance of benthic algae in streams[6].

4.3 Sensitivity of macroinvertebrates and fish to oxygen and ammonia stress

A review must be undertaken which demonstrates that macroinvertebrates are the most sensitive biotic group to ammonia and oxygen stress. Where they are not, the standards for BOD, dissolved oxygen and ammonia should be adjusted to ensure that fish are protected.

Standards for river BOD, dissolved oxygen and ammonia have been derived from sites of High and Good quality in terms of their macroinvertebrate assemblages. The intention appears to be that by protecting macroinvertebrates (because they are 'most sensitive') all aquatic biota will be protected (see p.19 & 23). However, in the study specifically undertaken to develop the oxygen and ammonia regulatory values on which the standards are based, the objectives are described as;

> "to develop regulatory standards ... to protect river *macroinvertebrates* at high and good status" [7]

In other words, the standards were specifically not based on a study designed to assess standards to support all biota. For ammonia, there is a large body of technical evidence which shows that fish are generally more sensitive to acute exposure to ammonia than invertebrates, although the picture is more complex for chronic, long-term exposure. For oxygen, few data exist with which to assess the sensitivity of invertebrates compared to fish but most biologists would

[4] Haygarth *et al* (2003) *Land use for achieving 'good ecological status' of waterbodies in England and Wales: a theoretical exploration for nitrogen and phosphorus*, DEFRA

[5] McGarrigle, M. L. (1998). Impact of eutrophication on Irish river quality. In *Eutrophication in Irish Waters* (J. G. Wilson, ed.), pp. 82-90. Royal Irish Academy, Dublin.

[6] See Dodds, K. *et al* (1998) *Suggested classification of stream trophic state: Distribution of temperate stream types by chlorophyll, total nitrogen and phosphorus*. Water Research 32, 1455-1462. Also, Dodds, K. *et al* (2002) *Nitrogen and phosphorus relationships to benthic algal biomass in temperate streams*. Canadian Journal of Fisheries and Aquatic Sciences 59, 865-874.

[7] Guthrie R. *et al* (2006). The development of oxygenation condition and ammonia regulatory values in UK rivers, p.10, para 2. Note: italics added for emphasis.

probably regard the most sensitive life stages of fish as more vulnerable to dissolved oxygen stress than the most sensitive invertebrates.

If it is intended that standards based on macroinvertebrate assemblages should be protective of all aquatic life, then references should be given to relevant technical literature which summarises data on fish and invertebrate sensitivity to oxygen/BOD and ammonia stress. It should also be noted that in lakes, fish have been selected as the BQE on which to base the dissolved oxygen standard. It is not clear why this inconsistency has arisen.

4.4 Standards for BOD and ammonia

More evidence is required to support the lowering of current standards of BOD and ammonia.

We are concerned that the standards for BOD and ammonia proposed are lower than those currently used. For oxygen there is a slight lowering in Good status dissolved oxygen standards in lowland rivers (Table 5). More seriously, for BOD (the value against which regulation occurs), there appears to be a lowering of standards for High status rivers in both uplands and lowlands. The lowering of standards appears to be particularly significant for lowland and high alkalinity rivers (from a BOD of 2.5 to 4 mg/l at High status).

For ammonia, there also appears to be a proposed lowering of standards for High status rivers, from 0.25 mg/l to 0.3 mg/l Total Ammonia. Although this may appear to be a very small difference, ammonia is toxic in very small amounts (particularly the unionised component) and the figures presented appear to imply a 20 percent worsening of standards for ammonia in lowland rivers. The argument that figures may be rounded to one decimal place should not be applied to ammonia as small increases in ammonia concentrations can cause significant impacts on aquatic biota.

If national standards must reflect Water Framework Directive standards (p.10, para 3) this implies a widespread lowering of standards for oxygen and ammonia. If this is the case there should be a more detailed analysis presented to justify this change. It is possible that the lower standards being proposed are a result of using a less sensitive biotic group e.g. macroinvertebrates rather than fish, to derive the standard. Furthermore, the establishment of WFD standards and conditions should not be allowed to undermine the no deterioration requirement.

4.5 Availability of reference datasets

The datasets for river invertebrates must be made publicly available.

We are concerned that the reference dataset for river invertebrates is not in the public domain. If this dataset is to be used to set standards, it must be available for independent scrutiny. The RIVPACS dataset was due to be available in the public domain this summer; this should be a high priority and is particularly important given that RIVPACS reference sites are now regarded as spanning two WFD quality classes, i.e. from the top of High to the bottom of Good.

4.6 Unacceptably high levels of phosphorus for lowland rivers?

We believe that the phosphorus concentrations proposed for high and good status in lowland rivers are insufficiently stringent.

It is our belief that, for high status, values closer to those being used for the Habitats Directive would be more realistic for phosphorus levels for lowland rivers[8]. However, other Habitat Directives values seem muddled with extensive overlaps between classes, and should not be applied. It is worth noting that in Ireland it is proposed that for rivers at the High/Good boundary mean annual Total Phosphorus should be between 18 and 30 µg/l as opposed to the good status value of 50 µg/l soluble reactive phosphorus (which is approximately equivalent to 100 µg/l TP) proposed for the UK.

Evidence for reference phosphorus levels is available for some stream types in lowland Britain. For example, considering only the work of Pond Conservation, the SOWAP LIFE project shows that in woodland headwater streams annual mean Total Phosphorus levels are around 20 µg/l, in line with the values used for the Habitats Directive. This is less than half the concentration proposed as representing the High/Good boundary in lowland rivers (given that this is a TP rather than SRP value).

We recommend the following steps to establish more reliable estimates of lowland phosphorus reference concentrations;

1. Find streams with catchments which fulfil REFCOND criteria and base standards on P values seen in these streams/rivers.

If there are insufficient sites to use this approach then:

2. Attempt to locate suitable analogues in less developed areas of continental Europe.

If no suitable real existing sites can be found:

3. Apply modelling approaches to estimate P concentrations. These are being widely applied in the WFD Intercalibration and would be able to give better estimates of expected P concentrations than those being proposed.

4.7 The Good/Moderate boundary for phosphorus

The good/moderate boundary for phosphorous needs to be based on more rigorous criteria.

We are concerned about the arbitrariness of the definition of the Good/Moderate boundary - “the ‘crossover’ point where nutrient sensitive and nutrient tolerant taxa are equal in abundance”. The report does not present any evidence that this crossover point has any functional significance. Compare this with the approach to identifying thresholds for phytoplankton in lakes, where a boundary has been set to reflect changes in macrophyte biomass, an important functional change in the ecosystem.

[8]To avoid misleading comparisons being made, the phosphorus terminology in Table 11 should be checked as Total Reactive Phosphorus is different to Total Phosphorus and/or Soluble Reactive Phosphorus.

4.8 Concerns of the nature conservation agencies

It is disturbing to note that UK conservation agencies disagreed with the approach proposed by the environment agencies to standard setting, but were over-ruled.

> "Within the Rivers Task Team, UK conservation agency representatives generally favoured more stringent interpretations of the normative definitions than did representatives of the environment agencies" [9]

> "Conservation Agency representatives considered that the estimated loss of typically circa 4.6 sensitive families at the Good/Moderate boundary was probably too high, as was a reduction in the ratio of sensitive to insensitive taxa of 50%" [10]

> "The UK conservation agencies have pointed out judgments made in the analysis that appear non-precautionary to them. It is, however, the view of the environment agencies that the standards will prove adequate in most instances to protect ecological status" [11]

No additional scientific evidence is presented to support the comments of the environment agencies contradicting the conservation agencies views.

5.0 Water Quality for lakes

5.1 Reference sites

Clear information is required on the reference sites used.

No information is available about the reference sites on which the lake standards are based. As far as we can tell, none of the reference sites used to derive these standards is compliant with the REFCOND procedure. We recommend that all reference site datasets from which these standards are derived are placed in the public domain to enable a proper assessment of the standards to be made.

5.2 Acidification

The standards given are those proposed by Monteith *et al*. (2005)[12]. These authors 'tentatively' proposed the values shown. We recommend that they should be regarded as provisional until necessary confirmatory studies are completed.

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[9] Guthrie R. *et al* (2006). The development of oxygenation condition and ammonia regulatory values in UK rivers, p.2, para 2.
[10] Ibid, p.3, para 5
[11] Ibid. p.3, para 1
[12] Monteith, D. *et al* (2005). Acidity-based regulatory physico-chemical standards for the "high-good" and "good-moderate" boundaries of UK lakes. Unpublished report for SNIFFER R&D WFD60

5.3 Lake Salinity

We are concerned that too simplistic a scheme is being proposed for salinity. The boundary between Good and Moderate Status is set at 1000 micro Siemens per cm (µS/cm) for all types of lake, apart from naturally brackish systems. Naturally brackish lakes should be defined in terms of both conductivity and NaCl concentration, so that it is clear which lakes are to be regarded as naturally fresh.

Furthermore, there is a natural range of salinity in lakes depending on proximity to the coast and season. For example, some natural coastal lakes verge on being brackish. Conductivity is simply an indication of total ion concentration and calcareous lakes can often have a background conductivity of 600 µS/cm in the absence of any saline influence. Soft water lakes would be expected to have conductivities more in the range of 50 to 200 µS/cm if they were fresh. All this makes the simple use of conductivity problematic.

We propose three possible solutions;

- Measure NaCl concentrations directly.
- If the simpler method of using conductivity measurements is preferred, the typology that is proposed for phosphorus could be used and a sliding scale of conductivity thresholds applied. A correction factor for proximity to the coast would be needed for both these approaches.
- Use conductivity measurements as routine with salinity being measured in cases where high conductivity values gave rise to suspicion that something was wrong.

5.4 Dissolved oxygen in lakes

A more sophisticated approach needs to be developed for the assessment of DO in lakes.

The use of DO will help assess the quality of lake water in relation to populations of fish. The proposed 1 sample per year for DO which will be averaged over a 3 to 5 year period to provide a standard is not considered to be suitable. If we lack data on this environment then a concerted effort should be made to establish the true level of DO in lakes and its variation on an annual basis. Although the proposed sample is to be taken when the DO concentrations are likely to be at their lowest (July/August) events that affect DO, such as algal blooms, can occur earlier or later in the year and thus an improved sampling procedure is required that takes into account annual variations in DO levels.

6.0 Hydrology

The standards for hydrology are in many ways the most disappointing area of the draft report. There is a complete lack of ambition in the standards being proposed and prima facie evidence of rejection of expert opinion on the basis of expediency and feasibility.

6.1 The unjustified rejection of expert opinion

It is unacceptable that the expert opinion offered in assessing water resources standards has been thrown out with little to no justification.

We are dismayed by the clear evidence that the attempts to identify scientifically the necessary water resource standards to support GES have been undermined by political expediency and concerns over feasibility. This flies in the face of the fundamental principles of the WFD, which require a clear distinction between the establishment of scientifically derived standards, and the assessment of economic and social considerations through the Directive's exemption mechanisms.

Most alarmingly, the expert opinion that sought to inform the construction of these standards appears to have been thrown out with little or no justification. This appears to have occurred repeatedly throughout the derivation of the proposed water resource standards.

The process for the assessment of water resource standards suggested by the expert workshops was rejected in favour of a simple read-off table based on the existing RAM methodology. No more justification for the rejection of the processes suggested by expert opinion is offered other than "the lack of existing field data to support a more complex regime of water resource standards." (p.51)

The experts consulted proposed that 'hands-off' flow restrictions be applied below Q95.[13] These expert standards were rejected by the project team on the basis that they were excessively precautionary and not practical. No further evidence is presented in rejecting expert opinion. The standards ultimately proposed were derived on the basis of a 'risk-based' approach which "accepts that with more relaxed standards, some river water bodies may fail to achieve the desired ecological status, but these would be identified by appropriate monitoring."[14]

The document also suggests that even the weakened standards proposed should not be applied in all cases, but where "local environmental conditions dictate, or where an abstractor has sufficient flexibility, or where the water supply infrastructure can accommodate them" (p.55). Such qualifications are entirely out of place in a document designed to set out scientifically derived standards.

This rejection of the expert opinion provided without reference to supportive evidence is unacceptable. We find it particularly surprising, given the heavy emphasis placed on the use of expert opinion in the development and justification of morphological standards.

6.2 The use of daily flows to assess permitted abstraction level

There appears to be an important confusion over what levels of abstraction are actually being proposed under the standards. The supporting technical documents propose assessment of permitted abstraction as a proportion of daily flows. This should be adhered to.

The supporting technical documents are absolutely clear that the percentage of the flow that can be abstracted should be "defined in terms of percent of flow on the day of abstraction"[15]. However, the draft Standards and Conditions imply a different approach, appearing to propose that where 15 percent of the flow is permitted to be abstracted at flows below the Q95, the 15

[13] SNIFFER WFD48 Development of Environmental Standards (Water Resources) Stage 3 draft Jan '06, p. iv
[14] SNIFFER WFD48 Development of Environmental Standards (Water Resources) Stage 3 draft Jan '06, p. v.
[15] ibid

percent is judged against flow levels at the Q95, rather than flows on the day in question (p.55, para 4).

The apparently technical distinction between these two is vital. As the draft Standards and Conditions rightly observe, the latter approach might allow for the whole of a river to be abstracted under certain circumstances. We note that the more stringent approach based on the assessment against a percentage of the daily flow proposed in the accompanying technical document already represents a weakening of the expert guidance offered. It would again be entirely unacceptable if even these proposals are further eroded. The definition of acceptable levels in terms of percentage of daily flow as recommended in the supporting technical documents must be clearly adhered to.

6.3 The need for clear specification of environmental flow requirements

The current assessment should be reversed so that a minimum environmental flow requirement is clearly set out rather than an allowable abstraction level.

The fundamental task that the standards for water quantity should address is the establishment of clear environmental flow conditions that will support good ecological status. The approach should be clear: the class of any particular river should be specified, environmental flows should be identified, and the appropriate social and economic means of achieving such flows then assessed.

The current proposal deviates from this approach importantly in defining not the environmental flow requirement but rather the quantity of water that may be abstracted. For example, the proposed standards suggest that 10 percent of the Q95 may be abstracted from 'B2' category rivers from April to October. We believe that this should be restated so that it is instead stated that river levels should be maintained at least at 90 percent of the Q95.

There are important implications to this distinction. Critically, such an approach sets out a clear hands-off flow requirement. Under years of particular water shortage, the standard below which water levels must not be allowed to fall is clearly specified. Under an approach that permits 10% of the Q95 to be abstracted, ever more water is abstracted as river levels fall in drought years. Such an approach is therefore likely to lead to damaging impacts. This consideration is particularly important in the context of climate change and predicted decreases in summer rainfall. As summer water levels decrease, the current proposed approach would permit continuing levels of abstraction, and therefore increasingly water levels. Such a situation is avoided where a clear environmental flow requirement has been set out.

6.4 Need for a more sophisticated environmental flow assessment procedure

A more sophisticated environmental flow procedure should be used where there is significant disagreement or where potentially damaging abstraction is proposed.

A series of more sophisticated models for the assessment of water resource requirements to support ecological status have been developed in recent years. Many of these are in use in other countries around the world. The use of such models to establish WFD standards was recommended by the experts consulted in the construction of the proposed standards, but rejected with almost no justification in arriving at the current proposals.

We recognise that there may be cost issues in the conduct of sophisticated environmental flow assessments in all UK catchments. However, there is a strong case to be made for the use of more sophisticated approaches where there is greater dispute and controversy. We recommend that a read-off table of the type proposed be used as an initial indicator of the water resource standards, but that a more sophisticated assessment be conducted where this is required.

In particular, we believe that if a simple read-off table of the type that is proposed is to be used it should be based on a precautionary assessment of the flows that are available, with the emphasis placed on those who wish to abstract water to demonstrate that further abstraction is possible without leading to ecological damage. It is entirely unacceptable that *both* the more complex models proposed by the experts *and* the precautionary standards proposed be rejected. If a simple approach is to be adopted, it must be precautionary.

It should be emphasised that a more sophisticated assessment of necessary flows may well conclude that more water is available for abstraction than the current proposals, in particular at high river levels.

6.5 Unacceptably weak standards for abstraction at low levels

The proposed levels of permitted abstraction under low-flow and drought conditions must be reviewed and tightened.

From an ecological perspective, the greatest risks come from any abstraction that makes drought conditions either more severe or of a longer duration. It is for this reason that the experts consulted recommended that 'hands-off' flow requirements be imposed under conditions of low flow where levels drop to the Q95. We are disturbed that this expert recommendation was once again thrown out.

We believe that the proposed standards sanctioning abstraction at even the lowest flows are unacceptable. We are particularly alarmed that this approach is to be sanctioned even at High Status sites. The dangers of this approach are likely to be exacerbated under conditions of climate change, where low summer flows in many rivers are likely to become ever more common.

7.0 Morphology

Given the challenges associated with deriving quantitative morphological standards, we recommend that a broader process of engagement and debate be undertaken with the specific intention of developing standards for the first round of river basin planning.

The morphology proposals are in many ways the least developed of those contained in the draft, and are clearly unacceptable as a final standard on which morphological change and improvement can be assessed under the Directive. However, we recognise that the development of quantitative standards for the assessment of morphology remain at an early stage of scientific development, and that the derivation of a UK wide approach at this point in time poses very significant challenges.

Given these challenges, we recommend that a more intensive process of engagement with a broader range of experts be undertaken to attempt to establish a set of standards for the assessment of morphology which will be of greatest use in the first round of river basin plans. Consideration needs to be given as to whether different approaches are necessary to assess no deterioration and the identification of the highest priority morphological interventions for inclusion in Programmes of Measures.

7.1 The need to include wider impacts

The current proposals appear to have been confined to engineering impacts on the river corridor alone. This scope is too narrow.

The proposed standards appear to address engineering alterations alone, without paying sufficient attention to other highly significant morphological impacts – for example the impacts of land drainage for agriculture or stock access to river banks. This is reflected in the table of activities considered in the accompanying technical document. For example, there is no mention of trees and their management, or bankside vegetation planting, one of the dominant influences on channel morphology. Likewise there is no mention of riverside fencing, buffer zones, or land set-aside, all of which have a major influence on river morphology[16].

The restriction of morphological assessment to the riparian zone must also be revised. For example, this results in the exclusion of large areas of floodplain which could play an important part in sustaining ecological quality elements. The very brief mention of catchment impacts suggests that these may have been overlooked until a late stage. The UK Government endorsed the CIS guidance on wetlands, which specifically recognised the role which impacts on the floodplain can play in determining ecological status. There is no reference to this document in the current consultation, and no evidence that these issues have been considered in developing the current morphological standards. This is not acceptable.

7.2 The need for additional risk-based approaches for the assessment of Programmes of Measures

A quantitative method for assessing future modification of water bodies needs to be accompanied by the development of a risk-based approach for assessing key priorities for inclusion in Programmes of Measures.

We recognise that there are clear merits in the development of quantitative standards for the assessment of future morphological change and ensuring that no future deterioration takes place. However, we believe that there is the need for the development of an additional approach to identify the highest priority morphological impacts that must be redressed under the Programme of Measures. For example, there may be situations where threshold effects and limiting values can have profound impacts on ecological status, yet remain within the supposedly allowable alterations under the current standards. Analysis solely on 500m stretches may also be inappropriate for this task. Some morphological pressures can have impacts over far longer stretches – for example the impacts of weirs on migratory fish species.

[16] WFD49 (Rivers): A new impact assessment tool to support river engineering regulatory decisions, Draft report for UKTAG stakeholder review (2006), p. 31.

The technical document on which the draft standards are based appears to have been developed for the purposes of assessing new modifications. Rather than attempting to define the morphological conditions necessary to support good status for biological quality elements, the accompanying technical document is titled: '*A new impact assessment tool to support river engineering regulatory decisions*'. This is an entirely different task and may help explain the considerable weakness of the current proposals in identifying appropriate morphological restoration that is required.

8.0 Future standards and missing work

We welcome a number of areas of proposed future work, and support the view taken by the draft that the standards and conditions will be revised in future. This is clearly vital as our understanding of the factors influencing good ecological status develops. However, it remains unclear the extent to which standards will be transferred from other Directives and how these will be incorporated into WFD standards.

In the context of this uncertainty, we believe that it is vital that two further standards be included in the next stage of development.

8.1 Turbidity

The inclusion of a standard on turbidity is a high priority.

There is considerable evidence that sedimentation and turbidity are significant contributors to declines in populations of aquatic organisms. Tsui and McCart (1981)[17] found that densities and standing stocks of lotic insects were inversely related to levels of sedimentation. Wagener and La Perriere (1985)[18] reported that sedimentation decreased both density and biomass of benthic macro-invertebrate communities and stated that turbidity was the strongest descriptor related to such reductions. Gammon (1970)[19] found that shifts in benthic invertebrate communities were characterised by increases in silt-tolerant genera and these shifts were observed at suspended sediment concentrations as low as approximately 53mgl^{-1}.

Ryan (1991)[20] concluded that a 12 to 17 percent increase in interstitial fine sediment may be associated with a 16 to 40 percent reduction in the total abundance of invertebrates. Flume experiments have shown that several species of mayfly, stonefly and caddisfly all choose un-sedimented substrate when offered a choice. Sedimented regions were avoided due to the loss of interstitial space between stones. In several other cases documented in Rosenberg & Resh (1993)[21], reductions in densities of aquatic insects and in the general diversity of benthic macro-invertebrate communities were associated with areas of stream exposed to heavy siltation.

[17] Tsui, P. and McCart, P. (1981) Effects of stream-crossing by a pipeline on the benthic macro-invertebrate communities of a small mountain stream. *Hydrobiologia*, **79**: pp. 271 - 276.
[18] Wagener, S. and La Perriere J. (1985) Effects of placer gold mining on primary production in subartic streams of Alaska. *Water Research Bulletin*, 22: pp. 91 - 99
[19] Gammon, J.R. (1970) The effect of inorganic sediment on stream biota. *Water Pollution Control Research Series*. Report No. 18050 DWC 12/70, U. S. Environmental Protection Agency, Government Printing Office, Washington DC.
[20] Ryan P. (1991) Environmental effects of sediment in New Zealand streams: a review. *New Zealand Journal of Marine Freshwater Research,* 25: pp. 207 - 221.
[21] Rosenberg, D. and Resh, V. (1993) Introduction to Freshwater Bio-monitoring and Benthic Macro-invertebrates in Freshwater Bio-monitoring and Benthic Macro-invertebrates. Chapman Hall, New York, 10: 488pp.

Decreases in in-stream (autochthonous) primary production has been associated with increases in sedimentation and turbidity through reduced light penetration, smothering and abrasion, and this can produce negative cascading effects through depleted food availability to zooplankton, insects, and fish (Henley *et al*, 2000)[22].

The impact of fine sediment on fish, particularly salmonids, is very well documented[23]. Studies show large egg mortalities in salmonid redds due to oxygen starvation caused by small increases in interstitial fine sediments (Greig *et al*., 2005)[24].

8.2 Nitrogen

There is increasing evidence of the impact of nitrogen on aquatic ecosystems. Given the very extensive contamination of freshwaters by nitrogen, we recommend that a review of the recent technical literature be conducted.

Nitrogen appears to have been removed from the nutrient list as it was deemed that there was not enough evidence to support the concentrations at which nitrogen will affect biota in the river. The inclusion of standards of nitrogen compounds in previous Directives suggests that there is sufficient knowledge to set standards in the WFD. In fact, it is difficult to see how the Nitrate Directive (91/676/EEC) and the Freshwater Fish Directive (78/659/EEC) can be incorporated under within the umbrella of the WFD unless standards for nitrogen and its compounds are set. For example, the table below sets out the standards incorporated in the Freshwater Fish Directive (78/659/EEC) for nitrogen compounds. In addition, compounds such as ammoniacal nitrogen is toxic and is routinely monitored as part of sewage discharge, so if this is a constituent of total nitrogen then why is it not worth monitoring in river systems? Nitrogen causes eutrophication problems in lakes and so these considerations should apply to lakes as well.

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- Wildfowl & Wetlands Trust
- The Wildlife Trusts
- Woodland Trust
- WWF Scotland
- WWF UK

[22] Henley *et al.*, (2000) Effects of Sedimentation and Turbidity on Lotic Food Webs: A Concise Review for Natural Resource Managers, *Reviews in Fisheries Science*, Vol.8, No.2, pp.458-139

[23] The most relevant study linking this impact to the cause is *The Impact of Land Use on Salmonids: A Study of the River Torridge Catchment* (National Rivers Authority, R & D Report: 30).

[24] Greig *et al*., (2005). The most relevant study linking this impact to the cause is: The Impact of Land Use on Salmonids: A Study of the River Torridge Catchment, National Rivers Authority, R & D Report: 30.