

**UK Technical Advisory Group  
on the Water Framework Directive**

**Response to stakeholders' submissions**

**UKTAG Stakeholder Review on  
UK ENVIRONMENTAL STANDARDS AND CONDITIONS  
(PHASE 2)**

**Final**

**March 2008**

**(SR1 – 2007)**

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## SECTION 1 - INTRODUCTION

The UK Technical Advisory Group (UKTAG) sought comments on the scientific principles underpinning its second set of proposals for environmental standards to underpin the implementation of the Water Framework Directive (WFD). The report was released for review and made available on the UKTAG's website.

The present document aims to cover the main points of the responses received; it summarises the issues and gives the response of the UKTAG. The revised and final set of proposals, and the present document, will be placed on the UKTAG website or made available on request.

### Questions posed for the review

The UKTAG asked:

1. Is the report clear in explaining how we have developed the proposed environmental standards and conditions?
2. Do you think that the approach we have taken, as identified in the report and supporting technical documents:
  - a. identifies the environmental standards and conditions required to achieve the environmental objectives of the Water Framework Directive, for example: Good Ecological Status? (Recognising that the standards under other EC Directives will also apply).
  - b. uses the best information currently available? If not, please tell us about any information or scientific methods that could improve the approach.
3. Are there any other issues in relation to the UKTAG's approach to developing UK environmental standards and conditions you wish to comment on?

### Responses submitted

29 responses were received; they are listed in Annex 1. The submissions covered views from non-government environment and fishing organisations, water companies and utilities, energy, industry and farming sectors, conservation agencies, aquatic consultants and research institutes. The submissions are available from the UKTAG web-site ([www.wfduk.org](http://www.wfduk.org)).

## Review of submissions

The UKTAG reviewed the responses, identifying:

- Amendments to its report.
- Issues that needed to be addressed in this response document, but that did not change the UKTAG's proposals. The aim here is to provide more information on, for example, the basis of the proposals, how the standards might be used, or where issues cannot be dealt with at this time.
- Issues that are considered to be outside the scope of the review and the UKTAG. These issues were brought to the attention of UK administrations and agencies.

The UKTAG collated this report with its technical authors and discussed potential changes with the environment and conservation agencies and UK administrations. This report:

- provides summary of responses to questions;
- addresses comments on each section of the draft standards and conditions report.

## Summary of the response

The key amendments to the UKTAG's proposals are:

- improved explanation of lake phosphorus standards;
- proposed nitrogen turbidity standards for coastal waters;
- improved explanation of the approach to managing suspended solids;
- results of trialling and testing of water resource condition limits;
- results of trialling and testing of morphology condition limits.

## SECTION 2 - SUMMARY OF RESPONSE TO THE QUESTIONS

This section is a summary of the general comments from respondents. The UKTAG's response is in Section 3.

### **Q1. Is the report clear in explaining how we have reviewed and developed the proposed UK environmental standards and conditions?**

Generally the feedback identified that the report was clear, understandable, and that it complemented the UKTAG's first report on standards (August 2006). Several respondents suggested improving the report's structure and asked for more information about its tables.

The UKTAG was asked to explain its links to UK policy and the status of statements and proposals set out by the UKTAG.

Some respondents highlighted that the numerical values used as standards cannot be separated from the way in which compliance will be assessed and how action might be taken on failure. The respondents therefore welcomed the information on the classification scheme for surface waters published in December 2007.

It was suggested that the process of developing the proposals for standards could be improved by involving stakeholders at an earlier stage.

### **Q2. Do you think that the approach we have taken, as identified in the report and supporting technical documents:**

#### **a) identifies the environmental standards and conditions required to achieve the Directive's objectives to achieve Good Ecological Status? (recognising that the standards under other EC Directives will also apply)?**

Depending on the proposed standard, there were mixed views on whether the standards were too strict or too lax.

Some said that the standards were representative of ecological status under the Water Framework Directive, whilst others suggested that the proposals were not sufficiently linked to ecology. One respondent asked the UKTAG to explain how the normative definitions of the Water Framework Directive were defined for high, good and moderate status were defined. This respondent said that the technical papers behind the UKTAG's proposals do not explain these concepts, and how they have translated into proposals for standards.

One respondent said that although the report identifies the environmental standards and conditions required to achieve the objectives of the Water Framework Directive, it fails to sufficiently address the complexity of interactions between these parameters covered by standards.

A number of respondents supported for the proposal to revise standards over future cycles of the river basin management plans as new data emerges.

**b) uses the best science currently available? If not, please tell us of any existing information or scientific methods that could improve the proposed approach.**

Whilst some respondents agreed with the approach adopted by UKTAG, others wanted more justification. It was suggested that the UKTAG's process may have been compromised by expediency.

It was suggested that more consideration should have been given to reviewing the literature and that this should supplement approaches based on the particular analyses of data used by the UKTAG. Suggestions and additional references were provided.

Some respondents requested more information on reference conditions and on the data used to carry out the assessment of the implications of the proposed standards. Reassurance was also sought that there would be continuing exercises of data collection in order to contribute to the review of the standards in cycles of river basin planning.

There was support and recognition for the work carried out to develop conditions for hydromorphology. Respondents recognised that the links between hydromorphology and ecology are weak and that the proposals are a good first attempt at setting conditions. The field trials were welcomed as a necessary element to validate this work.

**Q3. Are there any other issues in relation to the UKTAG's approach to developing UK environmental standards and conditions you wish to comment on?**

These were incorporated in the above comments or addressed in section 3 of this document.

## SECTION 3 - DETAILED COMMENTS ON THE UKTAG REPORT

For each section of the draft UKTAG proposal, the following is provided:

- a summary of the comments;
- advice on amendments to the UKTAG report;
- more detailed comments covering the response of the UKTAG.

### UKTAG Report: Section 1 – Introduction

#### Overview

In addition to the issues raised in Section 2, comments included:

- more information on classification, on monitoring and the revisions to the UKTAG's proposals on environmental standards in its first report (phase 1);
- assurance that plans are underway to fill data gaps in data to refine and enhance standards through future cycles of river basin planning;
- support for the elaboration on the use of the indirect approach to applying standards. Further clarification was requested on how the indirect approach would work.

#### Amendments to the UKTAG report

The UKTAG has reviewed the text and updated and extended it to deal with these points, or to indicate where such matters will be dealt with.

Comments	Response
<p>Comments on <b>UKTAG strategic approach</b> to setting standards:</p> <ul style="list-style-type: none"> <li>• Reservation expressed over the approach adopted which has involved the analysis of data from thousands of routine monitoring points. This approach is only valid within a broader suite of approaches and only if the technical limitations are recognised and addressed through consideration of ecological processes and validation using published literature.</li> <li>• Standard development has largely ignored relevant literature and has relied heavily on a data mining approach.</li> </ul>	<p><b>Minor amendments were made to the report.</b></p> <p>There are a different ways to develop environmental standards. The classic way is to expose species to concentrations under laboratory or field conditions and to observe the effects. The problem with this approach is scaling to field conditions and formulating standards that can be used to take regulatory action. (The UKTAG covers this issue in its report). This involves scaling toxicity results into summary statistics of water quality and deciding the “safety factor” to be adopted in doing this scaling. These are difficult issues that are not always well covered by many of the approaches in the literature.</p> <p>For many chemicals the “laboratory” approach is the only one available. (The UKTAG explores this approach in our proposals for Specific Pollutants). For most of these chemicals the approach based on the comparison of monitoring data on chemical quality with monitoring data on biology is not available.</p> <p>For substances like phosphorus and ammonia that are monitored routinely on a large scale it is possible to use an epidemiological approach based on the association between summary statistics of water quality and summary statistics of biology. This has an enormous advantage for agencies and policy because the summary statistics are in the form that can be used for monitoring and regulation and to report national progress. There is little need to wrestle over whether “safety factors” should 10 or 1000.</p> <p>Where such data are available the UKTAG believes that this approach must be used. Where the “laboratory” approach and information from the literature is also available, the final picture must be compatible.</p>
<p>Clarify the <b>role of UKTAG</b> in terms of its links to UK policy and the status of policy statements and decisions set out by UKTAG.</p>	<p><b>Minor amendments were made to the report.</b></p> <p>The role of UKTAG is explained in the introduction of its report. UKTAG provides technical advice and recommendations to the UK’s government administrations. The recommendations are then subject to the normal policy making considerations of the administrations and their agencies. For this reason the approach to adoption and implementation of proposals may vary for each country within the UK.</p>



Comments	Response
<p>Request for following <b>UKTAG reports</b>:</p> <ul style="list-style-type: none"> <li>• Revised (August 2006) Environmental Standards and Conditions (Phase 1) report</li> <li>• Classification report</li> <li>• Monitoring plans and programmes</li> </ul>	<p><b>The report was not amended</b></p> <ul style="list-style-type: none"> <li>• The revised UKTAG report (August 2006) UK Environmental Standards and Conditions (Phase 1) was released to the UKTAG website in November 2007</li> <li>• The UKTAG Classification report was released to the UKTAG website in November 2007</li> <li>• References were added to the UK environment agencies websites where these can provide information on monitoring plans and programmes</li> </ul>
<p>The cost of implementation does not depend on the objective setting process it is dependent on the measures proposed.</p>	<p><b>Minor amendments were made to the report</b></p> <p>UKTAG agrees that the cost of implementation depends on the measures proposed. A water body where an alternative objective has been set will require different measures than a water body with the default objective of Good Status. Objective setting is part of the process which drives measures and hence the cost of implementation.</p>
<p>Comments on the <b>indirect and direct model</b> approach to application of standards:</p> <p><u>General points</u></p> <ul style="list-style-type: none"> <li>• The application of the indirect model poses the question as to why any standards should be direct. Why, for example, is ammonia (total) not considered to be indirect as it is broadly accepted that it is unionised ammonia which is the pollutant.</li> <li>• The term 'standards' is applied both to those parameters which are 'direct' and those which are 'indirect'. This is likely to cause confusion and it would be better to differentiate clearly e.g. describe them as 'd-standards' and 'i-standards' or as 'standards' and 'thresholds'.</li> </ul>	<p><b>The report was amended</b></p> <p>In direct models, permit conditions, for example, are calculated on a local basis as those needed to meet an EQS. The report has been amended to clarify the distinction between an indirect link between failure and response and the use of Weight of Evidence. In the former the response to failure is a uniform approach to contributors and operators such as a uniform emission standard for discharges perhaps regardless of whether this will secure compliance in the receiving water. In the latter, chemical failure is corroborated by other information prior to taking action (whether through a direct or indirect approach). Examples of indirect models are the Directives for UWWTD and Nitrate. For eutrophication these also use a weight of evidence approach to decide the need to act.</p> <p>For ammonia the link between concentration and risk is clear and there is no need for additional weight of evidence on a local basis. Failure of the standard indicates an unacceptable risk to the ecology.</p> <p>For total ammonia there is a clear association between level and set levels of ecological protection. The cause may be the toxicity of unionised ammonia, the toxicity of total ammonia, or general issues correlated with ammonia and associated with the amount of treated sewage in waters and the cocktail of risks associated with this. A standard for unionised ammonia would, at low pH allow 10-15 mgN/l of total ammonia in a river.</p> <p>UKTAG likes the point about 'd-standards' though we might also need to distinguish general measures applied, like uniform standards, and weight of evidence whereby biological evidence is required before certain types of action are taken. The UKTAG has updated its report to</p>

Comments	Response
<p><u>Direct model</u></p> <ul style="list-style-type: none"> <li>The report states that the direct model is only applicable to temperature but this is inconsistent with table 2 (p18) and the text regarding nitrogen.</li> </ul> <p><u>Indirect model</u></p> <ul style="list-style-type: none"> <li>The elaboration of the use of indirect models is broadly welcomed as it should mean that action is only taken where there is a justified environmental need, however, there is a need to understand what the next steps are in the proposals to gather evidence.</li> <li>The report and guidance should make it clear that the precautionary approach should not be taken if the impact on the ecology is uncertain. There should be positive evidence of adverse impact except where human health could be compromised.</li> <li>In the indirect model UKTAG propose the use of a checklist to confirm whether a water body is damaged or at risk. Reference is made in the report that the checklist may lead to action such as “uniform emission standards for a particular discharges”. What is the intention of this paragraph? If this is more than an example then UKTAG are requested to provide full account of proposals to use checklists that may lead to “uniform emission standards for particular discharges”.</li> <li>A number of other respondents offered support for the checklist and requested further elaboration on how this might work.</li> <li>The checklist is clearly provided for in Annex II and Annex V of the WFD and matches well with the Probability Distribution approach referred to by OECD. Request that this checklist approach for environmental standards be proofed against biological standards in the specific water body under examination as the best method of obtaining evidence-based regulatory regimes.</li> </ul>	<p>seek to indicate the mode of use of each standard in a clear manner.</p> <p>The point has been made more general at this point in the text. Details are in specific sections on each standard</p> <p>The UKTAG accepts the need to understand the next steps and has sought to set this out where possible. Where this is incomplete the UKTAG suggests that its proposed standards would indicate the need to collect the additional information and that the process by which action is decided would take account of the justification and consultation required by the procedures of the administrations (and the processes of the river basin plans).</p> <p>The UKTAG’s proposals fit into a process of regulatory impact assessment by administrations and within the processes of river basin planning. These cover issues of cost and effectiveness.</p> <p>This is an example. The report has been changed.</p> <p>We agree that chemical and other standards aimed to protect ecology should be rooted in a knowledge of the effects. There comes a point however that this information is so well established that there can be high confidence of unacceptable risk from mere failure of a chemical standard. For many of the standards discussed by UKTAG this point has not yet been reached.</p>

Comments	Response
<p>Comments on <b>assessing compliance</b> with the standards:</p> <ul style="list-style-type: none"> <li>Levels of confidence are expected to be reported. Will models be required for all situations and who will provide the models?</li> <li>The quantitative value of the standards cannot be separated from the way in which compliance with the standards will be judged. This can only be assessed when the classification rules are made available.</li> <li>The use of tables to highlight compliance with standards, although useful in terms of informing regulatory impact assessments, are not relevant to a consultation which seeks views on the technical (scientific) development of standards.</li> <li>The tables could be misleading as they assume that a standard failure leads to waters being classified as less than good ecological status however throughout the text it is inferred that the environment agencies will be using the indirect models in terms of applying the standards.</li> </ul>	<p><b>The report has not been amended</b></p> <p>Compliance involves an assessment of the water and a comparison with the standards. The UKTAG has stressed that such a comparison must be unbiased and the errors known in order that compliance, action, and judging success are consistent. This requires discipline in how standards are defined.</p> <p>Traditionally compliance involves taking samples and comparing summary statistics with standards. In some circumstances it will be better or inevitable that the summary statistics are estimated by models. The requirement remains to know the errors of estimation and so calculate the confidence of failure. The competent authorities will provide the models.</p> <p>The UKTAG's proposals on classification take further the link between compliance, classification, reporting and taking action. It may be that failure of a standard leads to failed good status but that this leads to investigations and monitoring that can make the case for subsequent action.</p> <p>This distinction between the science and the use of standards is necessary in parts of the overall process but many respondents find it pointless to comment without an indication of compliance. The UKTAG suggests that such information can, in some cases, act as one of the independent checks on whether the science looks right.</p> <p>Agreed. Although it is clear that the indirect approach will often be used to take decisions on improvements, it is not yet decided whether elements of the indirect approach will be used in classification. This point is discussed in the UKTAG's report on classification.</p> <p>It may be that waters are classified on chemical standards but that the type and timing of action is determined, for some issues, on the degree of biological corroboration of risk or damage.</p>
<p>Comments on <b>existing standards</b>:</p> <p>As a general principle the standards should at the very least ensure the same conditions required by the Directives to be repealed under the Water Framework Directive will be met (including Freshwater Fish, the Shellfish and Groundwater Directives).</p>	<p><b>Outside the scope of the stakeholder review.</b></p> <p>UKTAG agrees with this as a general principle. Two points to note:</p> <ul style="list-style-type: none"> <li>the procedures associated with protected areas identified under other European water legislation are outside the scope of this particular report, but under consideration by the UKTAG; and: when carrying out a review of existing standards and setting new standards, the UKTAG sought to strike a balance between environmental protection and setting values which impose unnecessarily tight conditions on water users. This means that where the evidence suggests old standards were too strict the UKTAG would report on this. This can arise where standards are based on assessments of toxicity and further work on can lead to a reduction in the safety factors that were applied because of the earlier lack of such data.</li> </ul>

Comments	Response
<p>Comments on <b>classification</b>:</p> <ul style="list-style-type: none"> <li>Classification may not be a good way of comparing rivers over time. Trending methods need to be defined.</li> <li>As the first classification is “only an initial view” how will this be matched with the timescales for agreeing and implementing the measures?</li> </ul>	<p><b>Report not amended</b></p> <p>Agreed. The UKTAG expects that classification will provide one way of looking at trend - the national or regional trend to say Good Status. But trends in the summary statistics used to define class boundaries, or aggregates of these, will be powerful information, in principle, a better way of estimating trend. The UKTAG notes this as a topic for further work. A footnote was added to the report.</p> <p><b>Report not amended</b></p> <p>This will take place in the cycles of river basin plans. For the draft first plans measures will be identified on the basis of the failure of the established environmental standards, together with biological evidence. The final plans will use the additional biological data. Classification will be based on biology, supplemented by improved information on compliance with environmental standards. Environmental standards will be particularly important for identifying water bodies which are impacted by hydrological and morphological impacts where the biological tools are not well developed.</p> <p>We will use the failure of the standards together with biological evidence to help establish where measures are required. In 2015 classification will assess whether the measures have been successful.</p>
<p>Respondents requested that UKTAG make explain how the <b>WFD normative definitions</b> of high, good and moderate were defined. The technical papers do not explain these concepts and how they have translated into standards.</p>	<p>The normative definitions in Annex V describe the conditions expected of the different quality elements in each of the status classes. The environmental standards for the chemical, physicochemical and hydromorphological quality elements represent the boundaries between conditions consistent with the different status classes.</p> <p>For standards relating to pressures that are being considered within the current round of intercalibration, the standards have been set so that they reflect the proposed intercalibrated biological class boundaries. The method for relating the standards to biological class boundaries are in the chapter on each standard.</p> <p>For other standards, the process involved UKTAG, ecologists and independent experts considering what the degree of biological change would correspond to the boundary between one class and another and then estimating, using the method identified, what value for the chemical, physicochemical or hydromorphological quality element would cause this change. The reference sites were chosen using the criteria agreed through the CIS process (REFCOND).</p>
<p>The standards to support high and good ecological status are distinct from standards used in the assessment of the condition and integrity of <b>designated wildlife sites</b>, such as Special Areas of Conservation (SACs), and Special Protection Areas (SPAs) designated under the Habitats and Birds Directives</p>	<p><b>The report has not been amended</b></p> <p>UKTAG notes this clarification.</p>

Comments	Response
<p>respectively and Site Scientific Interest (SSSIs). The fit between the two standards will be reviewed in detail in due course.</p>	
<p>Several respondents highlighted concern regarding the <b>lack of involvement</b> of environmental NGOs and other stakeholders from business, commerce and academia in the process of developing standards.</p>	<p><b>Report not amended</b></p> <p>UKTAG notes this comment and agrees that future processes to develop standards should include more opportunities for engaging with a wider range of stakeholders at an earlier stage in the process.</p> <p>The UKTAG intends that its future processes would include workshops half way through the development process so that stakeholder views can be considered at an earlier stage. This approach has already been adopted, for example in the workshop on Good Ecological Potential in November 2007.</p> <p>Appendix 3 of this report details stakeholders who were involved in the actual development of the phase 2 environmental standards.</p>
<p>Concern was also expressed in relation to whether the process of developing standards has remained uninfluenced by <b>political</b> and / or <b>socio-economic</b> pressures.</p>	<p><b>Report not amended</b></p> <p>The proposals of the UKTAG are based on the best science and do not take into account the costs and measures that may be required to achieve them. It is the role of the UK Administrations, within the options of the Water Framework Directive, to consider and consult on these wider issues. The UKTAG does ensure that its proposals <u>can</u> be used as a sound basis for estimates of compliance and the costs, and that they can be used as a basis for the assessment of the economic benefits of achieving particular degrees of environmental protection.</p> <p>The UKTAG also considers that best science includes a proper assessment and reporting of what is known, and what remains uncertain.</p> <p>The UKTAG suggests and expects that controls recommended within the Programmes of Measures and detailed within draft River Basin Management Plans will be subject to regulatory impact assessment and strategic environmental assessment.</p>
<p>The <b>consultation</b> was inadequate and badly planned in terms of timing and duration of consultation. Short timescales have affected the ability to review proposed standards.</p>	<p><b>Report not amended</b></p> <p>The UKTAG acknowledges that the consultation could have worked better if more time had been available. The UKTAG operates within its resource constraints and to a demanding timetable driven by the requirements of the Water Framework Directive. In terms of improving engagement in the future see the above point on the involvement of stakeholders an earlier stage.</p>
<p>Comments on <b>reference conditions</b>:</p> <ul style="list-style-type: none"> <li>Request for the list of <b>reference water bodies</b> that have been used to develop the standards to be made publicly available.</li> </ul>	<p><b>Outside the scope of the stakeholder review.</b></p> <p>No single database of reference sites exists and it would involve a lot of work for the environment agencies to collate the information into a single database. Requests for this information should be made directly to the environment agency for consideration.</p>

Comments	Response
<ul style="list-style-type: none"><li>Reference conditions have been decided based upon <b>hindcasting</b> to pre-industrialisation and intensification. Can this approach be justified?</li></ul>	The CIS recommends the hindcasting approach in order to provide information on the biological communities before they are affected by changes from industry and land intensification. The question of whether an environment can or should be returned to such condition is a wider topic considered in the processes of the Water Framework Directive

Comments	Response
<p>Any additional controls proposed for wastewater treatment works must take account of any environmental and economic disbenefits particularly energy use and CO<sup>2</sup> emissions taking <b>whole life costs</b> into consideration.</p>	<p><b>Outside the scope of this review. Note added to text.</b>  Agreed. Controls recommended within the Programme of Measures and detailed within draft River Basin Management Plans should be subject to regulatory impact assessment and strategic environmental assessment. This is likely to include the full costs to perpetuity of energy, the full “costs of carbon” and other economic costs.</p>
<p>It is essential that the <b>disproportionate cost and technical feasibility</b> tests in Article 4 of the WFD are fully and robustly applied to ensure that any further investment in treatment for substances do not increase the carbon footprints of companies for what may be a marginal if any real measurable benefit to the environment.</p>	<p><b>Outside the scope of the stakeholder review.</b>  Agreed. The Water Framework Directive requires that economic tests be applied to Programmes of Measures.  <b>Report not amended</b>  This will be considered by the environment agencies as part of the river basin planning process and in, for example, the sector plans for industry. Additionally regulatory impact assessments and strategic environmental assessments will also be carried out in support of each River Basin Management Plan.</p>
<p>The recommendations should be balanced according to the three pillars of <b>sustainability</b> to ensure regulators are using tools that are fit for purpose.</p>	<p><b>Report not amended</b>  Agreed. A note has been added to report. The three pillars of sustainable development are – economic, environmental and social. The UKTAG’s proposals address the environmental pillar in a way that allows the full assessment of the economic and social pillars. The latter are dealt with, as discussed above, through the processes of the river basin management plans.</p>
<p>International scientific opinion is increasingly focusing on the importance of water quality incidents of <b>short duration and high intensity ‘spikes’</b>. The spikes in water quality are likely to have a significant impact on water ecology but are not picked up during routine annual monitoring as proposed.</p> <p>The standards should reflect the existence and potentially damaging impacts of the spikes by supplementing the annual average standards with a limit on the number and depth of water quality spikes within a current period of time.</p>	<p><b>Report not amended</b>  The logic of the Directive is to use biological monitoring and to move from this to the identification of the problems causing risk or damage. Where the biological data demonstrate a problem, investigations would seek to establish the causes. This might include, for example, pollution spikes not covered by established water quality standards or missed by previous monitoring.</p> <p>The UKTAG disagrees with the comment about spikes as applied in general and disagrees with any implication in this for a general change in the basis of monitoring. Water quality standards, for example, are defined as summary statistics that represent the statistical distributions of water quality. They exploit the established fact that in the main, and for most pollutants, achieving the summary statistic provides adequate protection against extreme events. There are exceptions to this and we must be able to recognise these. There are some locations and types of risk for which continuous monitoring is required.</p> <p>Also we must look for issues where extra water quality standards might be needed to cover rare events – for example in the control of large intermittent discharges like storm sewage overflows. Though even here such standards might be used to establish general and uniform policies for control.</p> <p>The UKTAG covered aspects of monitoring and rare events in Annex 1 of its first report.</p>

Comments	Response
<p>Several respondents commented on the <b>structure</b> and <b>format</b> of the <b>report</b>:</p> <ul style="list-style-type: none"> <li>• Tables 3, 4, 7 require a legend. All tables should be self-explanatory (e.g. Table 3: what is R?, Table 4 what is L?). It is also not clear why Table 7 is structured this way – its columns and rows are mismatched. There is no Table 5 in the report.</li> <li>• Improve the structure of the report as it can, at times, be difficult to follow. The report would benefit from numbering the headings.</li> </ul>	<p><b>Report amended</b></p> <p><b>Report not amended</b></p> <p>Unfortunately the UKTAG was unable to review the structure of the report and its supporting information. The structure reflects the myriad of groups and means adopted (in-house work, external contacts, etc) to develop the standards. UKTAG has however taken on board this advice and future reports such as the classification report now have numbered headings.</p>

## UKTAG Report Section 2 – Temperature – All surface water categories

### Overview

Taken as a whole, the respondents gave a thorough examination of the method and identified a range of key issues:

- A number of respondents welcomed the work highlighting that temperature should be part of the routine assessment of ecological status.
- Whilst some respondents stated that the proposals were in line with existing Freshwater Fish directive standards, a number of other respondents expressed concern at the apparent relaxation of standards.
- One respondent did not agree that a uniform standard is the most appropriate approach to adopt for temperature. If absolute standards are to be used then a sophisticated typology will be required.
- Respondents questioned the approach to setting standards based purely on fish. References to research detailing the impact of temperature on macro invertebrates were supplied (see Annex 2) and a request that the proposals be reconsidered in light of this information.
- Respondents were also unclear as to how the proposed temperature standards would be applied in regulation and classification.
- Clarification on the typology to support the standards was requested.



Comments	Response
<p>There were mixed views in relation to how the proposals link to the <b>Freshwater Fish Directive</b>:</p> <ul style="list-style-type: none"> <li>• Although the proposals are aligned with the Freshwater Fish Directive salmonid and cyprinid limits required for good ecological status, they <b>lean towards salmonid limits</b> across the water body, from the headwaters to the estuary over time. This is not currently the case?</li> <li>• Temperature limits should be brought in line with the requirements of the <b>Freshwater Fish Directive</b> and uplift values should form part of a standard under the WFD.</li> <li>• The proposed standards are not adequate for achieving <b>good ecological status</b> under the WFD.</li> <li>• Concern was expressed at the apparent <b>relaxation of imperative standards</b> for temperature currently in operation under the Freshwater Fish Directive. It was not the intention of the European Parliament and the Council that repealing existing Directive should lead to any reduction in environmental ambition (WFD, Recital 51).</li> </ul>	<p>The UKTAG does not understand this point. The requirements should align with Salmonid and Cyprinid designations through the “cool water” and “warm water” types.</p> <p>The temperature limits in the Freshwater Fish Directive apply to designated stretches receiving “thermal discharges”. These standards have been developed principally to protect rivers from the impacts of heated effluents. The likely impact of climate change on thermal regimes is fully recognised by the UK environment and conservation agencies and they are presently considering how to meet the wide range of challenges posed by climate change including those associated with the objectives of the Water Framework Directive.</p> <p>The UKTAG proposes that there is an insufficient basis for moving to tighter standards than the present proposals, for general classification and regulatory action.</p> <p>The UKTAG suggests that it is reasonable in general and in principle that the science might suggest that standards might be relaxed and for the UKTAG to propose that such standards replace old ones. The science could, for example, suggest that past safety factors had been too strict, It is also reasonable for administrations and others to require that the old standards be retained.</p> <p>The UK environment agencies have undertaken a review of the literature, and have identified standards that the UKTAG proposes will provide the levels of protection required by biological communities under the Water Framework Directive.</p>
<p>Comments on the proposed <b>temperature boundaries</b>:</p> <ul style="list-style-type: none"> <li>• For transitional and coastal waters the <b>high/good boundary</b> of 20°C is more restrictive than that in the WQTAG Natura 2000 guidance for SACs (21.5°C). It is not clear why this should be and may not be attainable for natural waters in the south east of England and in other waters where there may be localised warming in summer due to interactions with exposed intertidal areas.</li> <li>• The proposal for setting the <b>good</b></li> </ul>	<p>This threshold does not apply to Transitional and Coastal Waters. Regulatory standards exist only for point source thermal discharges. No new thermal standards have been set for TraC Waters at this point. The UKTAG has still to review the Turnpenny and Liney technical report. It will recommend standards at a later date after consideration and discussion.</p>

Comments	Response
<p><b>moderate boundary</b> at 23°C is too high. This should be brought in line with the Freshwater Fish Directive of 21.5 degrees.</p>	<p>This is discussed above.</p>
<p>In relation to the approach to setting temperature standards, concern was expressed in relation to the standards having been developed without specific consideration of the impact of temperature on <b>macro invertebrates</b>.</p> <ul style="list-style-type: none"> <li>• There is a significant body of evidence in <b>published literature</b> that demonstrates the effect temperature has on both fish and invertebrates. Invertebrates have the same physiological relationship to temperature (as fish) as it largely acts on cell processes and enzyme function rate.</li> <li>• One respondent estimated that temperature uplifts as large as those proposed i.e. 3°C for good status and 2°C for high status could potentially result in a 40% decrease in species in waters of high ecological status and a 60% decrease in all other cases.</li> <li>• Considering the significant affect that even a 1°C rise in temperature can have on <b>macro invertebrate assemblages</b>. It is recommended that temperature <b>uplift</b> values and temperature <b>range</b> be <b>cross-checked</b> with the temperature requirements for macroinvertebrates. (Reference material provided, see Annex 2).</li> <li>• It is noted that the justification of the cold water standard for estuaries is based on the aim to support cold-water migratory species and, as such, should only be applied to migratory channels rather than inter-tidal areas. One way of approaching this may be to include <b>additional guidance</b> on the <b>interpretation</b> of the <b>applicability</b> of such <b>standards</b>, particularly in intertidal areas, perhaps linked to the concept of mixing zone.</li> </ul>	<p>The UK environment agencies are aware of work on macro-invertebrate communities to assess the impact of climate change on headwater streams. The relevance of this work to the regulation of heated effluents across the UK is being considered, and the issue will be reviewed in the lead up to the second round of characterisation in 2012.</p> <p>The impact of climate change on macro-invertebrate populations is similarly appreciated. The UK environment and conservation agencies are considering how to meet the wide range of challenges posed by climate change, including those associated with the objectives of the Water Framework Directive and how they should be met.</p> <p>The UKTAG agrees that such a uniform standard should apply only in the absence of sufficient information to develop ranges of standards.</p> <p>Temperature recording will be retained as part of the UK environment agencies river monitoring programmes especially in the context of pressures. There will also be a need to pick up changes arising from climate change</p> <p>Temperature uplift assessments would be applied within the context of the regulatory decisions.</p> <p>The UKTAG expects that the environment agencies will take note of the local issues associated with the local interpretation of standards, when it comes to taking regulatory decisions, for example.</p>
<p>Specific comments on the proposed <b>uplift values</b>:</p> <ul style="list-style-type: none"> <li>• Uplift values have little meaning unless they are tied to a <b>reference thermal regime</b> for the site. Guideline values for acceptable uplift relative to the natural thermal regime would help</li> </ul>	<p>There is presently insufficient knowledge about the thermal regimes to take this approach forward in an efficient manner. Its potential in, say, expressing risk in terms of a shift from a natural background is recognised though it requires a measure of precision in establishing</p>

Comments	Response
<p>greatly in ensuring that the combined effects of human activity on temperature is properly evaluated.</p> <ul style="list-style-type: none"> <li>Request for clarification on the background and <b>reasoning</b> to why a 3 to 2oC <b>temperature uplift limit</b> has been proposed? Industry research carried out by the fishing sector show temperature increases greater than this have no significant impact on the fish population.</li> </ul>	<p>the reference thermal regime for each site.</p> <p>But the UKTAG doubts that it will be necessary to develop site specific standards to improve temperature control in rivers. There are big advantages in setting standards if sites can be grouped – the statistical errors are less. These points will be considered further as we prepare for the second round of characterization</p> <p>The proposed uplift values provide a relaxation over the existing Salmonid standards for the Freshwater Fish Directive - our present knowledge of the response of fish populations to heated effluents in rivers suggests that this is acceptable.</p> <p>Recent work has indicates that macro invertebrate populations show adverse responses to increases in water temperature of a scale similar to those associated with the changes that might be expected under climate change. It will be important to consider this work when reviewing the standards in the lead up to second round of characterisation in 2012</p>
<p>Comments on the proposed <b>typology</b> were as follows:</p> <ul style="list-style-type: none"> <li>The temperature regimes of different water bodies vary enormously. If absolute standards are to be used the <b>typology</b> reflecting this natural variation needs to be sophisticated, otherwise the level of protection afforded to a site is too dependent on whether the site falls into one type or the other.</li> <li>It is not clear how water bodies will be categorised according to this <b>over-simplistic</b> two-type <b>typology</b>. If this is done on the basis of existing fish communities, then existing impacts on thermal regimes will be hard-wired into the approach. Basing the typology on reference fish community may be appropriate as fish are likely to be amongst the most sensitive organisms to temperature changes. However, such a typology depends on an ability to <b>define reference fish communities</b>; this is difficult due to the extent to which fish have been transferred between water bodies and beyond their native range by human activity.</li> <li>It appears strange that all <b>transitional</b> and <b>coastal waters</b> of the UK should be placed in the same typology given the natural difference in temperature regime in these waters in the UK. Since the ecosystems in coastal and estuarine waters have adapted to the local natural</li> </ul>	<p>A more sophisticated typology would help underpin temperature regulation; however, the environment agencies presently lack the data required for its development and use in an efficient and consistent manner.</p> <p>The existing typology under the Freshwater Fish Directive will be used to underpin the regulatory process. Where waters have not been allocated to a type, this will be determined with reference to their expected reference fish communities. At present rivers in 30% of the Scottish land area has not been typed but given their geographic position and associated fish communities it is likely that they will be typed as salmonid.</p> <p>The thermal discharge standard is an existing standard and has not yet been adapted to WFD typologies. This comment will be considered when we discuss temperature standards for TRaC Waters in April, 2008. We also need to review the Thermal Technical paper first before making</p>

Comments	Response
<p>temperature regime it seems odd to seek to impose the same absolute temperature standards throughout the entire UK coastal and transitional waters.</p> <ul style="list-style-type: none"> <li>It is not clear from the proposals what the temperature requirements might be for <b>rivers</b> of typology <b>R5-R7</b> through which salmonid and other migrants may seek passage.</li> <li>In terms of the typology, there is no mention of the temperature variations on <b>groundwater fed rivers</b>. Groundwater has an influence on the temperature of the river water leading to less variation throughout the year.</li> </ul>	<p>any decisions on standards for TRaC waters.</p> <p>See above</p> <p>It is recognised that inputs of groundwater can mitigate the impacts of thermal discharges and possible impacts that could arise from climate change. At present we see this feature influencing the decision on how to act on waters under pressure because of temperature.</p>
<p>Comments on linkages to <b>climate change</b>:</p> <ul style="list-style-type: none"> <li>The proposed standards do not begin to address the wider issue of the effects of <b>deviations</b> from <b>natural thermal regimes</b>, which lies at the heart of most concerns about water temperature e.g. climate induced changes generated by the North Atlantic Oscillation.</li> <li>Temperature values should be reviewed in relation to <b>climate change</b> impacts. Should any direct impacts on the aquatic ecology be detected due to climate change, full consideration needs to be given to mitigation measures such as increasing tree cover in the uplands, where this may be an appropriate solution.</li> </ul>	<p>The UKTAG is looking to provide standards that will support work and priorities for the river basin plans, in particular the first cycle of plans. Work will not end at this point. In general, all activities in plans will address the need to mitigate and adapt to climate change, and take on board new understandings and guidance as it develops. It may well be that climate change, or concerns about climate, alters the basis of future standards.</p> <p>The role of water temperature in shaping ecological communities and processes is recognised by the UKTAG and that is why a review of the existing guidelines was undertaken prior to developing these new standards. The regulatory regime presented was developed principally to control the impacts of heated effluents that are released in to rivers. It is the intention of the UK environment agencies to review this matter and make recommendations on how issues associated with climate and land use changes should be taken account of in river regulation. In this the benefits and costs of action such as increasing tree cover would be covered.</p> <p>The Environment Agency's WFD-Climate Change policy identifies that we will not look to adjust typologies, reference conditions and default objectives as a result of climate change in the first cycle. However we will do work in the first cycle to see how climate change impacts these and whether we need to "adapt" them in future cycles.</p>
<p>The report confuses the requirements of the <b>Shellfish Directive</b> (relating only to designated Shellfish waters) and the Guidance relating to Natura 2000 These should be separated.</p>	<p>The standards in this paper are not applicable to TRaC Waters. Generic Standards for TRaC waters other than the thermal discharge standards already in existence have not yet been agreed.</p>
<p>Several respondents asked for clarification on the <b>role and application of temperature standards</b>. The following points were made:</p> <ul style="list-style-type: none"> <li>In places it is clear that UKTAG</li> </ul>	<p>The standards have been developed to support the</p>

Comments	Response
<p>intends that the proposed standards are only <b>applied</b> in relation to <b>thermal effluents</b>, elsewhere in the chapter the text relates to the more general ecological effects of artificial temperature increases (disturbance from expected conditions). The implication is that these temperature standards are generally protective of artificial increases in temperature, which they are not.</p> <ul style="list-style-type: none"> <li>• The report describes the proposed standards for temperature decreases in rivers below impoundments where discharge is from the hypolimnion. We welcome recognition of this problem but it is unclear how the standards will work. The standards seem to suggest that the <b>temperature drop</b> will be a measure of the difference in temperature between upstream and downstream areas at any given point in time however many of the significant problems below reservoirs are <b>seasonal</b>, occurring below water bodies deep enough to become stratified, and easing off as stratification breaks down after the summer. How will this change throughout the year be accommodated by the standards?</li> <li>• We would not wish to see the <b>uplift limit</b> be directly transposed into regulatory consents as a standard condition for all discharges. This should become part of the consenting process which should be flexible and include an individual risk assessment on the fish population to determine the required tailored conditions to protect the local environment.</li> <li>• Where does the <b>lower limit</b> for <b>spawning</b> apply? Many historical spawning areas have been impacted and no longer support spawning. A robust WFD approach would require that such limits are applied to historical spawning areas as well as existing ones</li> <li>• The exclusion of '<b>mixing zones</b>' from assessments of temperature compliance may, in certain situations not be particularly precautionary. Mixing zones may extend through a significant proportion of the water body in question and so it would appear prudent to establish limits for the extent of mixing zones.</li> </ul>	<p>regulation of heated effluents, and further thinking will be required on the approaches required to protect rivers from the impacts of climate change and land use changes. The standards have been based on the requirements of fresh water fish and the relevance of other taxa which show sensitivity to changing thermal regimes will be considered in the lead up to the next round of characterisation in 2012.</p> <p>An issue of this kind would require a mathematical model that predicts the changes and their probabilities and return periods and a set of criteria that defines the short and long term risks from these. The work of the UKTAG is not intended to replace the need for such work. In other regimes the envelope of events and their return periods can be represented by a statistical distribution and a summary statistic. Where this is possible, clear and consistent decisions can be justified, and national policies on controls justified. Where it cannot, a more bespoke process is required which suffers the drawback that there may be insufficient similar sites with which to establish standards that are widely accepted.</p> <p>Such a requirement would be considered in permits where it could be justified and where the local requirements could be established with sufficient justification.</p> <p>The UKTAG suggests this will be part of setting objectives for the Water Framework Directive.</p> <p>Such limits are usually established in terms for the regulation of each discharge using policies designed to ensure a consistent approach overall. It is a good suggestion that policies associated for mixing zones might be reviewed for the Water Framework Directive and this should be considered.</p>

Comments	Response
<ul style="list-style-type: none"> <li>• We welcome the statement that temperature standards should apply at the edge of the <b>mixing zone</b> (p24) and, for the avoidance of doubt suggest that UKTAG should state explicitly that the applicable temperature rise standard also applies at the edge of a mixing zone. It may be helpful to have a link to the statement regarding mixing zones and WFD ecological objectives.</li> <li>• We welcome the primary approach on that the object of control of thermal discharges should be such as to ensure that the <b>mixing zone</b> associated with the thermal discharge is such that the ecology meets the requirements of the WFD. Page 25 indicates this is discussed later but we can find no discussion of it.</li> <li>• We note the ambiguity in the current phrasing and suggest the objective should be that controls on the individual thermal discharge should be such as to ensure that at the edge of the mixing zone the ecology meets the requirements of WFD. This explicitly suggests that some degree of ecological disturbance compared with Water FD norms within the mixing zone is to be regarded as tolerable. For the avoidance of doubt it should be explicitly defined that uplift is defined relative to waters unaffected by the thermal discharges, as in the current Freshwater and Shellfish Directives. It is not clear that the absolute temperature 98%iles (table 9) are necessary to ensure ecological requirements are met.</li> <li>•</li> </ul>	<p>As a general point, generic thermal thresholds for TRAC waters will be considered in April 2008.</p>
<p>There were mixed views on the role of temperature standards in <b>classification</b>:</p> <ul style="list-style-type: none"> <li>• Temperature should be part of the <b>routine assessment</b> of ecological condition of waters.</li> <li>• It is not clear why some standards are not considered suitable to be used for <b>classification</b> purposes. For example, if cool water species require a temperature below 10 degrees for spawning, this should be considered as a physico-chemical condition which would support the fish quality element.</li> </ul>	<p>The UKTAG agrees that temperature will continue to form part of the routine assessment of river quality. As with all monitoring, the level effort should be commensurate with the risks posed by the pressure and the potential benefits of action.</p> <p>Monitoring activities are deployed on a risk basis, and it is felt at the moment that the spawning temperature test should only be used for risk assessment as the risks of breaching the standard are sufficiently low. If the UK environment agencies become aware of any changes to this situation the approach will be reviewed</p>

Comments	Response
<ul style="list-style-type: none"> <li>We support the decision to <b>not include</b> a temperature <b>uplift</b> standard as part of the classification requirements.</li> <li>Temperature is an important parameter in meeting good ecological status in aquatic ecosystems. Although regulation of thermal discharges is important, there are many <b>other factors</b> which can affect temperature to a similar degree as such discharges, such as abstractions, riparian tree management, river flows and reservoir releases, enhanced chemical and biological activity and urban runoff. They should also be monitored and regulated for the achievement of good ecological status.</li> <li>Temperature affects the resilience of ecosystems to other environmental stresses and should therefore form part of the <b>overall classification</b> of all waters. Whilst the assessment of appropriate standards for lakes and estuaries may be complicated, this should not be a reason for excluding temperature as a criterion for classification.</li> <li>We welcome the UKTAG recognition that the relationship between the complex thermal regimes in estuaries and coastal waters and ecology is insufficiently understood to allow use of temperature for classification purposes.</li> </ul>	<p>No comment</p> <p>The UKTAG suggests that the process of accounting for failed objectives and describing the cause, provides the opportunity to look at all ways of achieving objectives. If failure is caused by the temperature regime then all options are available. The scale of action required to achieve particular improvements is a matter for research in the first instance and we must look out for opportunities to justify this.</p> <p>Complexity can lead to uncertainty and so, ultimately, to results of classification that are too imprecise to be useful. This is a good reason for excluding any criterion from classification.</p>
<ul style="list-style-type: none"> <li>The consultation document asserts that ‘adverse <b>effects of temperature on biology</b> are <b>rare</b>’. It may be that adverse effects from specific thermal effluents are rare (although this is unsubstantiated in the document and is open to debate). However, significant artificial changes in the temperature regime of rivers, arising from a range of human activities (including loss of tree cover, the combined effects of all abstractions and discharges, artificial drainage systems, and the over-arching effect of climate change), are commonplace, and many of these changes will have adverse ecological consequences.</li> <li>We welcome UKTAG’s recognition on p23 that adverse effects of</li> </ul>	<p>The UKTAG’s comment was made in the context of the availability of data to set up a regulatory regime in the way that might be done where there were good and damaged sites and apparently only one cause of damage. This leads to a strong and generally agreed association between cause and effect.</p>

Comments	Response
<p>temperature on biology are rare.</p> <p>Comments on the monitoring of temperature:</p> <ul style="list-style-type: none"> <li>The report states that <b>temperature monitoring</b> typically takes place when routine chemical monitoring takes place, usually monthly. The use of temperature standards rely on having good temperature data. Do the regulatory agencies intend investing in a more comprehensive programme of installing continuous temperature recorders in rivers, together with the necessary support. Could this be included within the existing hydrological monitoring networks? Potentially, without a rich supply of data on temperature in water bodies the proposed standards will be difficult to use. With climate change so high on the agenda at present, there should some willingness from Government to invest in further infrastructure to support improved temperature monitoring.</li> <li>How we deal with the <b>combined effects of human activities</b> on water temperature regimes under the WFD remains an unresolved issue, but a key part of the solution is properly reflecting those effects in the monitoring and evaluation regime. The consultation document should emphasise this need. In relation to effluents regarded as 'thermal', however, it seems sensible that the greater the deviation from natural temperature regimes, the more tightly thermal effluents should be controlled – this might be seen as part of an adaptive response to climate change.</li> </ul>	<p>Adding temperature recorders to the hydrological gauging station network provides opportunities and this option will be considered when as the environment agencies review their response to climate change issues.</p> <p>There are many examples of issues where huge decisions have been made with confidence over many years on the basis of monthly monitoring. This is possible where good and simple standards can be justified across a region or Europe. We should continue to explore opportunities to do this for temperature.</p> <p>Sampling programmes will evolve to assess the impact of climate change and it is likely that more continuous monitoring will be needed to help quantify the changing probabilities of rare events.</p> <p>It is accepted that a more refined typology would facilitate the type of protection being advocated however, the UK environment agencies presently lack the data necessary to develop such systems</p>
<p>One respondent highlighted the relationship between increased temperature and <b>other chemicals</b>:</p> <p>Elevated temperature, it is thought, can cause the behaviour of chemicals in water to change. For example cooling water discharges from some industries have demonstrated an impact on water quality by converting some chemicals into a form which is much more toxic to fish.</p>	<p>The UK environment agencies accept that it is not possible to cover every eventuality through regulation, particularly when synergistic effects occur between pollutants. However, where such problems are recognised we retain the flexibility to take appropriate action.</p> <p>For some chemicals the standards have been set in a way that can apply across the whole of Europe and to a range of biota. There are also safety factors. This provides a measure of cover for local variations.</p>
<p>The relationship between temperature and <b>oxygen</b> was also highlighted:</p>	<p>UKTAG has set standards for Dissolved Oxygen which are independent of temperature and it believes that this approach provides a robust framework to protect aquatic</p>



Comments	Response
<p>There is a direct relationship between temperature and dissolved oxygen in water. Dissolved oxygen declines rapidly with even small increases in temperature, which would greatly affect the ecological status of water bodies. Temperature also affects the behaviour of viruses in fish. Fish seem most susceptible at water temperatures of 72-81°F (22-27°C).</p>	<p>riverine communities. Thus no matter what happens to river temperatures there is a need on water users to ensure that their activities do not compromise the likelihood of DO standards being failed, and permit setting is done with this in mind.</p> <p>The proposed good status temperature standards in the warm water type are consistent with the Imperative Cyprinid Water standards under the Freshwater Fish Directive, which maintains the level of protection between the two regimes.</p> <p>There are limits to what the WFD can offer in relation to fish health although the increased risk from disease arising increases in environmental stress are recognised and this situation will be kept under review in the lead up to the next round of characterisation</p>

Comments	Response
<p>Comment on the supporting technical report:</p> <ul style="list-style-type: none"> <li>• We welcome UKTAG's recognition on p25 that there is no good evidence of the reality of thermal barriers except with temperature rises of more than 3°C or near the lethal limit. However, we note that exception cited is not consistent with the supporting Turnpenny &amp; Liney report page 7-2 which indicates evidence only for water temperature near the lethal limit. This is an important difference and reference to the temperature rise element should be cited or reference to the temperature rise element in the qualification removed.</li> <li>• The discussion of thermal regime on p2-7 to 2-10 is insufficiently detailed and does not appear to take into account temperatures observed in UK estuaries (data available from CEFAS).</li> <li>• On p 2-9 a discussion of river Thames temperature is given without reference to specific location and its relevance to the argument could be made more explicit.</li> <li>• We note on p2-4 the statement that power stations have been required to switch to tower cooling when the bulk temperature reaches 21.5°C. In our understanding this results from authorisation negotiations based on the informal NRA and EA policy regarding new thermal discharges to the Thames Tideway. This policy has not been subject to public consultation or regulatory impact assessment and the underlying science for this has not been made public. We presume that the current WFD standards would render this policy superseded.</li> </ul>	<p>These comments have been passed to the authors of the technical reports.</p>
<ul style="list-style-type: none"> <li>• As the main report suggests, the derivation of appropriate simple numerical criteria applicable to estuarine and coastal environments is difficult and assessment needs will tend to be highly site specific.</li> <li>• This technical report is limited in terms of the database used, with case studies including Bradwell on the Blackwater dating from 30 years ago (is there nothing more recent? - there has been much work done on estuarine fish communities and water</li> </ul>	<p>The current UKTAG proposals are not applicable in TRaC waters. Generic thermal standards are yet to be agreed for TRaC waters.</p>

Comments	Response
<p>quality - see Elliott etc.) and the Thames where the historical water quality conditions and the acquired wish to force recovery in fish species numbers are perhaps unique; these are not representative of other estuaries, and no coastal situation is considered.</p> <ul style="list-style-type: none"> <li>• There is a strong bias towards salmonids and fresh-water fish in particular and very little on the thermal ecology of estuarine and coastal fish, let alone other inhabitants of these waters which would appear to see little if any attention. In this context the very limited typology of 'cool water' and 'warm water' may sit well with UK fresh water fish but very much less comfortably with the very much more complex and dynamic environments found in coastal and estuarine waters. How would such a typology survive expected alterations in surface water temperatures over the next decades? Indeed, how would the standards suggested survive this trend?</li> <li>• UKTAG should look at the new Dutch guidelines on cooling water discharges to estuarine and coastal waters, English summary translations of which would seem to post-date this report. The origin of this is work sponsored by the NL's Commissie Integraal Waterbeheer (CIW). This effort considered not only heating within the receiving water but also the effect of initial withdrawal, an appropriate approach to mixing zones, and recommendations on when to encourage vertical mixing or maximise stratification</li> </ul>	
<p>UKTAG would seem to have involved itself with long term environmental assessment practitioners in the power sector - potentially that most affected by the 'chlorine' and thermal interests - very late in the process. As a result there is a significant risk of there being a wide gap between aspiration and practicability in the field, in terms of both detection and assessment methods, and perhaps actual significance. So although British Energy as the operator of the bulk of the coastal and estuarine direct cooled plant on estuarine and coastal waters was consulted on these matters, it has only been at this very late stage with the bulk of the work completed. There is a need</p>	<p>The current UKTAG proposals are not applicable in TRaC waters. Generic thermal standards are yet to be agreed for TRaC waters.</p>

Comments	Response
for UKTAG and its sponsors to deal with this perceived gap in a constructive manner.	

## UKTAG Report Section 2 – Phosphorus – Lakes

### Overview

Taken as a whole, the respondents gave a thorough examination of the method and provided the following comments:

- Respondents were pleased that phosphorus standards have been proposed and raised some questions over some of the boundary values.
- General support for the proposed approach to use site specific standards, however, more information is required with regards to how the individual values will be set.
- Request for nitrogen standards for lakes to be developed.

### Amendments to the UKTAG report

The report has been amended to use minimum cut-off values of 5 and 8ug/l for the HG and GM TP boundaries.

The altitude types for lakes table has now been deleted.

Comments	Response
<p>Comments on the <b>proposed standards</b> were as follows:</p> <ul style="list-style-type: none"> <li>• <b>Pleased</b> that standards for phosphorus in lakes are proposed.</li> <li>• Pleased to see that median values of the range of figures for the good status boundary (Table 14) have decreased since the earlier consultation. However the top end of the ranges given for <b>low alkalinity</b>, very shallow (and to a lesser extent, low alkalinity shallow high boundary values) are <b>high</b>.</li> <li>• The concentrations at the top end of the ranges for <b>low alkalinity lakes</b> do not seem applicable to Scotland. However the proposal is for standards to be set for individual lakes so presumably these higher values will not be imposed on lakes with naturally lower phosphorus concentrations, as the ranges also include lower phosphorus concentrations.</li> <li>• It was surprising that phosphorus limits to achieve Good Ecological Status (GES) are close to current</li> </ul>	<p>The UKTAG notes this comment. The use of lake specific boundaries will always result in lakes near a type threshold having higher values. UKTAG will note this concern and consider changing values in the light of ecological classifications following the first river basin plans.</p> <p><b>Report not amended</b></p> <p>Lake specific boundaries will be set based on our estimate of reference phosphorus using the proposed model. In a minority of cases where we have other evidence the use of site specific standards allows modified values for individual lakes.</p> <p><b>Report not amended</b></p> <p>We do not consider that there should be a direct relationship between the Water Framework Directive and Habitats Directive standards. For many lakes Habitat</p>

Comments	Response
<p><b>Habitats Directive</b> requirements. Habitats standards were expected to be more reflective of High Ecological Status (HES) due to the sensitivity of the water bodies in these areas.</p> <ul style="list-style-type: none"> <li>The phosphorus standards for moderate, poor and bad status derived by a doubling of the adjacent higher standard appears a very arbitrary method of setting standards. No validation is provided. The simple statement that it represents UKTAG's best understanding of relationships with biological quality invites the conclusion that the understanding involved is not of any depth.</li> <li>One respondent stated that the <b>existing standards</b> are <b>adequate</b> to protect freshwater systems where salmon farming takes place. This is particularly true given the continuing uncertainties over the links between ecological change and phosphorus.</li> <li>The report acknowledges the difficulties in developing standards appropriate to <b>marl, peat and brackish lakes</b>. It is important that UKTAG puts in place appropriate measures to ensure that <b>further data</b> for these lake types are obtained and that the necessary analysis takes place to develop a new set of site specific standards.</li> </ul>	<p>Directive standards were set to protect habitat features. This would be broadly consistent with the WFD definitions of Good status.</p> <p><b>Report amended (P.29-30)</b> We have set standards for the High/Good and Good/Moderate boundaries using our current knowledge of ecological response by a range of biological quality elements sensitive to P. Currently we do not have sufficient information to this for the Moderate/Poor and Poor/Bad boundaries, but a doubling is broadly comparable to these boundaries for chlorophyll a and we consider this is the most appropriate method of setting these standards at this time. For those lakes with the lowest reference Total Phosphorus concentrations, very Low Alkalinity and or very Deep lakes we accept that a doubling from reference may in some cases produce a too restrictive boundary for Total Phosphorus. To overcome this we propose to use an override such that the HG and GM boundaries can never be less than the current type boundary (5 and 8 ug/l respectively)</p> <p><b>Report not amended</b> There is overwhelming evidence that phosphorus causes ecological change in lakes. The standards proposed by UKTAG are based on the best available evidence of the relationships between phosphorus and those biological quality elements that are sensitive to P. The UKTAG suggests they represent a significant improvement on previous standards.</p> <p>It is anticipated that data collected during the first river basin plans will be used to refine and develop standards in time for the second cycle of plans.</p>
<p>Several respondents commented on the <b>approach</b> to <b>developing</b> the <b>standards</b>:</p> <ul style="list-style-type: none"> <li>General support for the proposal to employ <b>site specific standards</b> as this is more appropriate than defaulting to type specific standards which may be under (or over) protective for lakes near type boundaries.</li> <li>One respondent thought there <b>wasn't sufficient information</b> on how the standard for individual lakes will be derived. For example, setting individual standards for every lake also means setting individual reference conditions. Setting these for each of thousands of lakes in the UK may prove very time consuming. The final report should contain an <b>explanation of the processes</b> that will be used to determine the phosphorus values for lakes.</li> <li>Consideration should be given to the</li> </ul>	<p><b>Report not amended</b> More detail of the process of setting lake specific standards will be provided on the UKTAG web site. However the approach used is based on a simple regression model and can be applied to the majority of lakes without difficulty.</p> <p><b>Report not amended</b></p>

Comments	Response
<p>possibility of using some <b>general models</b>. A number of models have been developed that predict biomass production, and make predictions of concurrent changes in nutrient concentrations, planktonic and zooplanktonic biomass as well as algal community structure. Total catchment phosphate models are also available, such as Protec etc. (see papers by Colin Reynolds).</p> <ul style="list-style-type: none"> <li>• Will it be up to the <b>competent authority</b> to use the model to determine the specific phosphorus standard for individual lakes? Will there be a variation on this for reservoirs which may be classified as artificial or heavily modified water bodies?</li> <li>• One respondent expressed general agreement over the Morpho Edaphic Model (<b>MEI</b>) <b>approach</b> in England and Wales. The respondent highlighted concerns over the “reference lakes” used in the model development questioning whether they were near pristine however the respondent stated that the resulting <b>values correspond well</b> with “expert judgment” values and those being employed for the EU Habitats and Species Directive sites in England.</li> <li>• Clarification on which <b>region</b> lowland <b>Scotland</b> falls within the (<b>MEI</b>) (footnote 5 page 29).</li> <li>• The last sentence on page 29 states that where the <b>model</b> does not work for lochs in <b>Scotland</b>, previously used models based on land-use and on diatom paleolimnology will continue to be used. This sentence is referenced but the reference is not present in the reference list at the end of the report, or in the foot-note at the bottom of the page.</li> <li>• While the proposed method might be the <b>best method available</b>, its description points to an absence of robust science in this area. For example, if there are some lakes for which the method is acknowledged not to work at all, might there not be other lakes for which the method works but not well?</li> </ul>	<p>The UKTAG is aware of these models. They take into account a wider range of factors which are not available for all lakes. We thus do not consider these to be useful for setting general supporting element standards. They will of course be potentially useful in determining more detailed views when considering possible programmes of measures.</p> <p><b>Report not amended</b></p> <p>The environment agencies will determine phosphorus standards for all lake water bodies using a standard approach which would, in principle, also apply to reservoirs.</p> <p><b>Report not amended</b></p> <p>The model used has been published in a peer reviewed journal and was based on an analysis of reference lakes drawn from a wide area of Europe and follows definitions of reference conditions established during the intercalibration process. UKTAG thus feel it represents a broad consensus of reference conditions and is appropriate for use.</p> <p><b>Report amended</b></p> <p>All of Scotland will fall within the Northern Region of the Morpho Edaphic Model. added “<i>all of Scotland...</i>” to footnote</p> <p><b>Report not amended</b></p> <p>UKTAG acknowledges that further work would improve the confidence of setting lake specific standards. However it considers that the current method will provide appropriate standards for implementing the WFD for all lake types.</p>
<p>Several respondents commented on the use of the <b>indirect model</b>:</p>	

Comments	Response
<ul style="list-style-type: none"> <li>• <b>Mixed views</b> on the application of the indirect approach in terms of using the proposed standard to make decisions. In general terms water users supported this approach and conservation agencies did not.</li> <li>• One respondent stated that there is a large body of evidence for the impact of phosphorus additions upon lake ecology and over reliance on biological evidence may lead to many lakes being <b>under protected</b>. The timing, frequency and method of monitoring will affect the ability to discern biological impacts of phosphorus enrichment.</li> <li>• Understanding the method of application is important in comparing the proposed standard with other values. For example the “<b>Habitats Directive Criteria</b>” presented for comparison in table 14 are used on the basis of face value compliance with an annual mean standard and are applied according to the direct model.</li> <li>• Concern was expressed that the indirect model used to develop loch-specific standards for phosphorus may be <b>incompatible</b> for use with certain water bodies in <b>Scotland</b>. One particular shortfall is that there is insufficient data to treat peat lochs separately as a distinct water body type, instead referencing them to their closest type in terms of their buffering capacity. More data is urgently required in this respect.</li> <li>• Will <b>phosphorus</b> standards also be determined using the indirect model to set standards where there is evidence of ecological harm?</li> </ul>	<p>UKTAG agrees that there is a large body of evidence relating phosphorus addition to lake ecology. However this evidence also makes it clear that individual lakes have different sensitivities to P which cannot be taken into account in a general approach to setting standards. It is thus essential that biological and chemical evidence are taken together when assessing status when deciding on remedial action.</p> <p>The UKTAG is proposing that both face value and confidence of class are reported and that generally the statistical confidence that a water is better or worse than any class is known. There is also a wider issue about confidence in terms of confidence that the link to ecological risk is established, and that action to place a water in a class will lead the expected ecological outcomes.</p> <p>UKTAG recognises this shortfall and will seek to gain additional data during the first RBP to enable this to be resolved.</p> <p>Where there is clear evidence of ecological harm water body status will be reported as worse than Good status. That is the objective of the indirect model which seeks to ensure there is evidence of ecological harm before expensive action is proposed.</p>
<p>With regard to the <b>implications</b> it was noted that the results for Wales are very different from what would be expected; exceeding the levels for Northern Ireland England and Scotland.</p> <p>It was recognized that UKTAG had been very open in acknowledging that a problem with sampling or analysis is suspected. A request was made for more information regarding what has happened and whether there are implications for other phosphorus data.</p>	<p><b>Report not amended</b></p> <p>Further investigations are still being carried out, but recent results suggest that revised sampling protocols and the use of improved analytical techniques is overcoming this issue.</p>



Comments	Response
<p>Clarification was requested in relation to the following points:</p> <ul style="list-style-type: none"> <li>Request for further commentary on tables <b>11</b> and <b>13</b> (page 28).</li> <li>Further explanation with regards to why the text on page 30 states that “<b>peat lakes</b> will be referenced...with respect to alkalinity” however table 11 (page 28), peat lakes are considered by colour only, not alkalinity.</li> </ul>	<p>Table 13 describes the GB Typology, only part is relevant to P standards.</p> <p><b>Report not amended.</b> The UKTAG considers that currently there is insufficient data to determine if peat lakes require different phosphorus standards. For the first river basin plans all lakes will be set standards irrespective of colour using a model based on alkalinity and mean depth.</p>
<p>Some respondents requested UKTAG carry out work to underpin the development of <b>nitrogen standards</b> for lakes. The following points were made:</p> <ul style="list-style-type: none"> <li>There is increasing evidence that nitrogen may also play a role in lake eutrophication and in some lakes nitrogen controls may be required to prevent impacts on ecology. Further consideration of the role of nitrogen is particularly important because there is a suggestion that the impact of nitrogen enrichment may be manifest in a different way to phosphorus enrichment.</li> <li>The role of nitrogen should be considered in specific cases on lake eutrophication where there is a known history of phosphorus enrichment. Nitrogen and phosphorus may be limiting in some low nutrient/acidic lakes and some hypertrophic lakes with some large phosphorus inputs. In such cases, a separate process on identifying the appropriate limited nutrient may be required.</li> <li>It is difficult to see how the Nitrate Directive (91/676/EEC) and the Freshwater Fish Directive (78/659/EEC) can be incorporated under the umbrella of the WFD unless standards for nitrogen and its compounds are set.</li> <li>It was also recognised by the respondents that there is little data available to set specific standards for nitrogen standards but further work is needed. A review of the recent technical literature should be conducted with a view to investigating the need for a national standard on nitrogen.</li> </ul>	<p><b>Report not amended</b> The UKTAG notes the comments and will consider this as part of future standard development work.</p>

## UKTAG Report Section 2 – Nitrogen – Transitional and Coastal waters

### Overview

- Strong support for updating the proposed nitrogen standard (from phase 1) to include standards for transitional waters with different turbidity characteristics. Respondents acknowledged that this is a sensible development as it is well known that there are many transitional waters in the UK that although hypereutrophic are not considered eutrophic due to growth being limited by light.
- Respondents queried the unit of measurement for the standard.
- Further information requested on data used for the preliminary implications assessment along with details of which water bodies fall into high, moderate and good status.
- Respondents supported the use of the indirect model in terms of using standards to make decisions. This model requires evidence from other indicators, some of which biological, before action is taken.
- Recommendation that secondary biological effects be considered before classifying sites as poor / bad on a basis of multipliers.
- Clarification of which winter years the 'winter mean' consists of.

### Amendments to the UKTAG report

Based on the above comments, amendments to the report included:

- Unit of measurement provided in micrograms per litre in addition to micromoles per litre.
- Clarification of 'winter mean' provided.
- UPDATED coastal water turbidity standards and improved explanation in text

Comments	Response
Respondents supported the <b>update</b> to the UKTAG <b>phase 1 proposals</b> in terms of revising the nitrogen standard to include standards for transitional waters with different turbidity characteristics. Respondents also welcomed the link to OSPAR precedents.	<b>UKTAG welcome this view.</b>
One respondent requested reassurance that ecological status, in combination with nutrient levels, will always be assessed and taken fully into account in determining overall status where eutrophication is the	<b>Report not amended</b> Nitrogen standards will be used as the first step in classification. Only if there is evidence from these that a water body may be less than good status will the secondary tests related to turbidity and biology be

Comments	Response
issue.	invoked.
<p>One respondent asked for clarification in relation to which <b>model (direct/indirect)</b> for taking action was applicable to the nitrogen standard.</p>	<p><b>Report not amended</b> As stated on page 10 of the report, the indirect model is applicable to the nitrogen standard. This is reinforced in the text on page 37 of the report which states that “if the threshold for dissolved inorganic nitrogen for good status is failed, the UKTAG proposes that, before action is taken to secure compliance, a second assessment is done to evaluate whether the failure has caused, or is likely to cause biological impacts”.</p>
<p>Some respondents welcomed the proposal use of the indirect model:</p> <p>It is reassuring to see that before measures to tackle nitrogen discharges to transitional waters are imposed there will be a biological assessment to determine where there has been an impact as a result of the breaching of the UKTAG threshold. There is a three stage process for determining whether a transitional water body achieves good status based on the inorganic nitrogen concentration, turbidity and biological assessment.</p>	<p>UKTAG welcome this view.</p>
<p>The <b>predictive model</b> used to inform primary production at various light intensities relates to growth in the water column. The majority of transitional and coastal waters which have been judged to be “eutrophic” in the UK are a result of excessive growth of opportunistic macroalgal growth. It is clear that an understanding of what nutrient reductions are required to reduce macroalgal growth will probably require <b>site specific modelling</b> underpinned by a good understanding of the nutrient (nitrogen and phosphorus) fluxes for that particular system. The standards detailed in this report are only likely to act as a guide in the first instance, when planning restorative action.</p>	<p><b>Report not amended</b> UKTAG agrees with this point. However, the standards will be used to inform initial classifications of water bodies.</p>
<p>The use of <b>micromoles</b> (umoles) per litre seems an unnecessary complication when all other parameters are expressed as milli or microgrammes per litre.</p>	<p><b>Report amended – figures quoted in both units.</b> This is just a convention in the marine world where umoles are used very often as the standard form for expressing concentrations. These can easily be converted into other units.</p> <p>For example DIN standards in umoles/l can be converted to ug/l by multiplying the first number by 14. Thus the high / good and good / moderate thresholds for DIN in coastal waters of 12 and 18 umoles/l convert to 168 and 252 ug/l.</p>
<p>Some respondents requested details of</p>	<p><b>Report not amended</b></p>

Comments	Response
the different datasets used to carry out the <b>implications assessment</b> and information on the water bodies falling within the high, moderate and good status categories.	This issue is beyond the scope of the stakeholder review. The UK environment agencies are responsible for data used in the implications assessment. Respondents should contact the environment agencies directly for data requests.
It is vital that <b>secondary biological effects</b> are considered before classifying sites as poor/bad on a basis of simple multipliers.	<b>Report not amended</b> UKTAG would not recommend this. UKTAG are recommending that the poor and bad thresholds are used as guidelines to prioritise where action may be required. The environment agencies will only formally classify poor and bad status based on assessments of the biological quality elements.
It would be useful to show how <b>estuaries</b> are <b>categorised</b> in terms of turbidity i.e. the spatial and temporal considerations.	<b>Report not amended</b> The environment agencies have not yet assessed individual estuaries against the turbidity thresholds but will do so as part of the initial classifications.
One respondent highlighted that the River Leven catchment is not devoid of farming activity and the bulk of the catchment passes through Lake Windermere. The <b>River Duddon</b> is suggested as a better reference for dissolved inorganic nitrogen estimates	UKTAG welcome this suggestion and will take this into consideration as part of future requirements.
One respondent asked for clarification of the term ' <b>winter mean</b> '.	<b>Report amended (P.33)</b> Winter mean is based on data collected at minimum monthly from November to February. It is recommended that five years data is used e.g. 2001-2205 to calculate the mean.

## UKTAG Report Section 2 – Suspended Solids – All surface water categories

### General comments:

- There were mixed views on the proposed approach to managing suspended solids. Some respondents agreed that it is very difficult to set a relevant standard whilst others requested that a new standard be developed.
- An independent study commissioned by a group of respondents also concluded that a single national standard may not be the most appropriate way of assessing ecological status.
- Some respondents highlighted that existing codes of practice were ineffective as there is no enforcement if practitioners fail to comply.
- A number of respondents provided descriptions of the impacts of suspended solids including references for supporting literature.

### Amendments to the UKTAG report

Comments	Response
There were <b>mixed views</b> on the <b>proposed approach</b> to managing suspended solids. The following comments were made:	
<ul style="list-style-type: none"> <li>• We <b>broadly agree</b> with the approach taken, in particular the approach taken to incident management of sediment release using pollution prevention guidance is also welcomed</li> <li>• We <b>agree</b> with the <b>general rationale</b> proposed for addressing episodic fine sediment loads and subsequent siltation impacts.</li> <li>• Setting environmental standards for suspended solids is <b>difficult</b>, with annual means having been used as an attempt to deal with discontinuous events.</li> <li>• A 25 mg/l suspended solid <b>limit cannot be applied</b> across the board for receiving waters. We agree with the proposed management approach.</li> </ul>	Support noted - as are the alternative views expressed below
<ul style="list-style-type: none"> <li>• The <b>Freshwater Fish Directive's Guideline Standard</b> of an annual mean of 25 mg/l for suspended solids should be reviewed and if possible a new standard needs to be developed.</li> </ul>	Agreed -

Comments	Response
<ul style="list-style-type: none"> <li>The proposed approach is <b>no different</b> to what is <b>already in existence</b>. The screening of suspended solids in discharges has been in place for some time, and codes of good practice have been in existence for decades. Despite this, significant damage to aquatic life in lakes and rivers is still being caused as a result of sedimentation and turbidity. It is clear that a new standard for turbidity and suspended solids is needed to address this issue.</li> </ul>	<p>Although there is much concern and many descriptions of impacts, the UKTAG is not convinced that a classification standard for suspended solids (if one can be devised) will help in these cases any more than the recording of the effects on the biology and following up risks suggested by the results as this, and by following up and learning from incidents. A poor standard is wasteful in terms of monitoring and following up misleading results, and risks action on ineffective measures.</p> <p>The UKTAG agrees that various bespoke approaches will be needed to follow up risks to biology attributed to suspended solids but sees no basis yet for a general standard for use in monitoring in the way ammonia acts as a surrogate for impacts on fish and invertebrates.</p>
<ul style="list-style-type: none"> <li>There are reliable methods for <b>monitoring suspended sediment</b>, and a number of ways by which a relevant standard could be developed.</li> </ul>	<p>Report amended to note the availability of monitoring approaches</p>
<ul style="list-style-type: none"> <li>We have seen many <b>codes of good practice</b> fail to be adopted by the worst practitioners and little or no enforcement action taken to punish them. It is therefore clear that a new way of identifying and dealing with sediment release and turbidity is needed.</li> </ul>	<p>The UKTAG notes that the WFD encourages the creation of knowledge on the effectiveness of measures, and corresponding action on such points</p>

Comments	Response
<ul style="list-style-type: none"> <li>• There is a genuine and pressing need to address the issue of water quality standard for suspended solids, both for the use within the WFD classification and to protect the aquatic environment.</li> <li>• Very little is known of the impact of high loads of suspended solids (peak and frequency of events) on the biota. This should be emphasised in future work on the standard/condition.</li> <li>• Not using an average value of 25 mg/L as the G/M boundary appears to be ecologically meaningful. More emphasis should be put on the effects of the deposition of suspended solids rather than their transport. The former has greater implications for the ecology and has been studied to a greater degree.</li> <li>• Some clarity should be provided as to what is meant by 'scouring of riverbeds' by suspended solids and the process by which this occurs.</li> <li>• Many respondents listed some of the issues relating to suspended solids and turbidity. For example detailed information, which included case studies, was provided on the impact of sedimentation and suspended solids on fish and invertebrates. Detailed references were provided (see Annex 2).</li> <li>• We agree that the current standard under FwFD of 25mg/l is not sufficient for the assessment of risk of damaging events. However, we do not agree with the UK TAG statement that 'there is no useful water quality standard by which to assess this in a reliable way'. In fact, we argue that it is possible to derive new standards which reflect the level of risk to the ecological status based on existing tools and knowledge. We understand, however, that further investigations and research of actual damaging events may help to develop more stringent standards for the use within the WFD.</li> <li>• An independent review of the UK TAG proposals for suspended solids gives the following recommendations: <ul style="list-style-type: none"> <li>- A single national standard may not be the most appropriate way of assessing ecological status.</li> </ul> </li> </ul>	<p>The UKTAG suggests that we are not yet able to meet this need in terms of a general water quality standard that defines good status ...</p> <p>... and that the difficulty in doing this is illustrated by the issues noted opposite and below – the implication that requirements would vary from site to site ...</p>

Comments	Response
<ul style="list-style-type: none"> <li>- A more appropriate assessment should be based upon individual catchment characteristics and the monitoring of damaging events. It is recommended that a single standard be replaced by a number of thresholds taking into consideration exposure length, return period and population recovery time.</li> <li>- For example, fish may be able to withstand a higher suspended solid concentration for a short period of time, than they would be able to withstand over a prolonged period</li> <li>- Further research may be need to develop more stringent standards, which will apply within the WFD, which might take time.</li> <li>- However, setting of interim standards may be required to prevent further deterioration in status.</li> </ul>	
<ul style="list-style-type: none"> <li>- Existing standards developed for FwFD and the EIFAC working party for mining operations in the Yukon (DFO, 2000) can be used as basis for the interim standards, and adapted to take into consideration exposure periods and recovery times.</li> <li>- In addition to suspended solids, standards should be set for deposited solids, and the inclusion of such standards is not currently referred to in the UK TAG report.</li> <li>- The standard for deposited solids needs to be developed, dependant on a number of characteristics including particle size, water velocity and a degree of turbulence.</li> <li>- The UK TAG proposals do not indicate the assessment methods for measuring the concentration of suspended solids, in particular during incidents of high sediment release for example, during heavy rainfall.</li> <li>- There are ways in which turbidity can be monitored continuously through light scattering data loggers.</li> <li>- Deposited solids sampling is also essential assessment of good ecological status, and there is a variety of methods that can be used, including the assessment of scour and fill in riverbeds, the collection of samples for analysis, and the deployment of sediment baskets and traps.</li> </ul>	<p>The proposal for standards based on the EIFAC, etc, but modified for exposure and recovery time is seen by the UKTAG as adding little at present to the approach set out in the report - recording the effect in the biological response in monitoring, or through the follow-up of incidents, and using this evidence to see if particular types of measurement can be developed over time as a surrogate of risk.</p> <p>A general and efficient monitoring standard could not yet be devised that took account of particle size, water velocity and degree of turbulence, though evidence on such matters can be used to drive programmes of measures at the local level</p>



Comments	Response
<p>We oppose the use of General Binding Rules (GBRs), and favour targeted measures which we believe can minimise the costs of delivering the desired benefits by doing only what is necessary where it is necessary. GBRs are a blunt instrument poorly suited to the wide variation of different circumstances which prevail across the catchments of the UK's water bodies.</p>	<p>This view has been raised with Administrations.</p> <p>A general response to a risk requires careful justification part of which should be to establish its effectiveness compared with other approaches. But the UKTAG has noted a general move towards such measures – bearing down on a pressure, and then reviewing the effectiveness.</p>
<p>Some respondents specifically commented on the proposed approach and its application to transitional and coastal waters (TRaC):</p> <ul style="list-style-type: none"> <li>• <b>General Binding Rules</b> are not appropriate for the control of sediment release in TraC waters. Work to develop an approach for determining the navigation sectors contribution has clearly indicated the need for a site specific approach, reflecting the very high variability within and between TraC waters.</li> </ul>	<p>See above. A general response requires careful justification part of which should be to establish its effectiveness compared with other approaches.</p>
<p>Suspended solids as a measure in isolation are likely to be a very <b>poor indicator</b> of surface water quality. Risk of smothering, for example, is much more dependent on the nature of the solids, the rate of flow, and the morphology of the surface water course than any single measure. Many natural and healthy rivers may have permanently high suspended solids. Some rivers in their final “old” stages may actually require a high solids level in order to be healthy or to maintain their bed characteristics or to replenish mudflats that may be bird, amphibian or mollusc habitat.</p>	<p>This point is seen as topic under hydromorphology and managed perhaps in the course of establishing the local causes of a threat to status under the Water framework Directive that has been evidenced in biological data.</p>
<p>Although there is often a link between suspended solids and fine particles not in suspension, the impact on the biota varies considerably. In assessing ecological status more emphasis should be placed on settled particulate matter.</p>	<p>This point is seen as managed in the course of establishing the local causes of a threat to ecological status under the Water framework Directive that has been evidenced in biological data.</p>
<p>In terms of <b>classification</b>, respondents <b>welcomed the proposal</b> not to make suspended solids part of the definition of Good Ecological Status.</p>	<p>UKTAG welcomes this view.</p>
<p>It is not valid to state that compliance with other standards (e.g. for BOD) adequately addresses any breaches that might occur. Suspended solids from <b>certain effluents</b></p>	<p>Discharges of inorganic solids are covered in the report.</p>

Comments	Response
<p>can be <b>inorganic</b> and therefore not breach standards designed to prevent organic pollution.</p> <p>It is not clear why this suspended solids standard is not being proposed as part of a <b>suite of measures</b> to protect against enhanced fine sediment loads.</p> <p>In lakes suspended solids targets should be <b>linked to transparency levels</b>. UKTAG decided not to produce standards for transparency due to issues over monitoring frequency and inherent variability</p>	<p>The annual mean, is suited for picking out and dealing with continuous discharges of relatively steady concentrations of suspended solids like those in the treated discharges from sewage treatment works. In this instance the required action is usually vested in other measurements such as the biochemical oxygen demand.</p> <p>For discharges from wastewater treatment plants, the required control of suspended solids is likely to be met automatically by the action for biochemical oxygen demand and ammonia. In other cases an annual mean of 25 mg/l of suspended solids is used as a check or guideline for use in calculating controls on more or less continuous discharges of suspended solids to waters.</p> <p>The environment agencies use the Guideline standard of 25 mg/l to help set controls on discharges of inorganic material from quarries, open cast coal sites, and mines. This practice will continue.</p> <p>The proposed approach for lakes has not yet been seen by UKTAG as a priority.</p>
<p>One respondent highlighted that the <b>Freshwater Fish Directive</b> standard of 25mg/l-1 annual mean has severe limitations in providing adequate protection against enhanced suspended solids levels. Nevertheless, the standard as an absolute value has an ecological basis (being derived from observations of fish populations subject to china clay discharges), and so non-compliance with it is meaningful even if compliance with it is not (at least for some river types).</p>	<p><b>Report amended. Paragraph inserted</b></p> <p>See above. The UKTAG agrees that the standard is useful in a regulatory context for certain types of discharge and risk but not as helpful as a general national standard for use in the classification of waters and targeting action.</p>
<p>Suspended solids clearly occur in rivers naturally, but are also present too along a spectrum of increasing human exacerbation. This should be better acknowledged in the report along with the difficulty of applying environmental standards to suspended solids.</p> <p>Perhaps one possibility would be to collect site specific information with a limit on the increase in suspended solids up- and down-stream of particular sources of additional solids.</p>	<p>Report amended</p> <p>UKTAG note this suggestion and will consider as part of future development work. It remains an option for environment agencies in dealing with particular cases, though establishing criteria poses the same issues as setting up the more common form of standards</p>
<p>The report describes a number of codes of practice and other mechanisms for helping to control suspended solid loads.</p>	<p>The proposed approach is seen as a way of moving forward. This will be reviewed as more information becomes available.</p>

Comments	Response
<p>The final report should include <b>clear guidance</b> about how they are meant to work any better than at present in the absence of specific standards.</p>	<p>The UKTAG sees the kind of information discussed as also coming out of the discussion of programmes of measures for River Basin Plans in which the outcomes (and so the justification) of particular measures must be set out. This requires a setting out what a code of practice involves.</p>
<p>One respondent highlighted concern that current laboratory methods differ and that different methods can give different results. Until an agreed method is in place it will remain difficult to truly understand the actual sediment loading in UK waters.</p>	<p><b>Report amended (footnote added)</b> UKTAG acknowledges this and notes the responsibility of the environment agencies to ensure analytical methods are standardised or care is taken in interpretation where measurements were from various sources. Footnote added.</p>
<p>There are reliable <b>methods for monitoring</b> suspended sediment. Data loggers or gravel baskets can be used.</p>	<p>The UKTAG sees these methods as part of investigations of sites at risk but not as general methods for national classification systems.</p>
<p>The checklist approach for freshwaters (p44) is not applicable to TraC waters. The cause of elevated suspended sediment concentrations in TraC waters are generally different to those in freshwaters.</p>	<p><b>Report amended. Checklist updated</b> This is not relevant to TraC waters and note that the updated report makes it clear that the checklist approach is not applicable in TraC waters.</p>
<p>The report does not refer to scientific literature. There are a number of scientific publications that assess the effects of elevated suspended sediment concentrations on a range of ecological receptors in TraC waters. These studies could be drawn upon in evaluating potential risks to WFD objectives of elevated suspended sediment concentrations.</p>	<p><b>Report not amended</b> We agree with this comment.</p>
<p>Concern was expressed in relation to the wording of the approach for managing suspended sediment impacts in TraC waters: “where the plant and animal communities as reflected by good ecological status (or other WFD objectives) are at risk from increased sediment or suspended solids, the environment agencies will determine the causes, and act on them in the manner required by the WFD”.</p> <p>This wording could be interpreted as implying that action might be required to be taken in the absence of any evidence of an impact. We suggest that where risks from elevated suspended sediment concentrations are identified, this should initially spawn a requirement for additional monitoring to identify whether any relevant (in WFD terms) ecological impact is occurring, before considering possible measures. In many cases, the subsequent actions are likely to fall to co-deliverers to implement rather than the agencies.</p>	<p><b>Report amended</b> Additional wording inserted. Underlined in below text. “Where the plant and animal communities as reflected by good ecological status (or other objectives under the Water Framework Directive) are at risk from increased sediment or suspended solids, <u>the environment agencies will undertake monitoring with a view to assessing the likelihood and scale of impact and determining the causes.</u> As a consequence of this, the agencies will seek action on causes in the manner required by the Water Framework Directive”.</p> <p>We agree with this comment.</p>

Comments	Response
<p>There is a wealth of scientific evidence on the impacts of suspended, and deposited solids/sediments on aquatic organisms. We are concerned over the proposed standard because there is evidence to suggest that turbidity is one of the factors that contributes to the distribution of fish eating birds. (References and more detail on the impact provided).</p>	<p><b>Report not amended</b></p> <p>The UKTAG notes the range of information about the impact on wildlife activities that affect transparency and suspended matter. But in terms of the two general approaches for the development of standards the UKTAG feels that there is insufficient material to suggest a useful general standard, expressed as a summary statistic required for classification or regulation, that takes us further in terms of classification or regulatory action than the site-specific and evidence-based approaches that are available now.</p> <p>The UKTAG therefore suggests an evidence-led approach, tailored to sites, but which might lead to an indication that particular summary statistics of simple measurements of suspended solids, turbidity or transparency could be used to map out risks and damage in the absence of ecological measurements, or if supported by standardised ecological measurements.</p>

## UKTAG Report Section 2 – Water Resources

### Overview

Taken as a whole the respondents gave a thorough examination of the proposed condition limits and identified a range of key issues:

- Many respondents acknowledged the lack of good information on the causal links between managed flow regimes and ecological impacts.
- General support for the proposed approach to use condition limits as part of a screening mechanism to trigger further investigation into potential impacts.
- Respondents welcomed the validation and trialing and requested UKTAG provide more information on the outcome of this process.
- Request for more information on protected area standards for drinking water areas.

### Amendments to the UKTAG report

Comments	Response
We support the requirement that UKTAG standards for water resources should be used as a <b>screening</b> for further investigations into the perceived impacts rather than specific action.	<b>Report not amended</b> UKTAG welcome this comment.
<b>Validation and Review.</b> We are most interested in the field trials and review planned for summer 2007 and would appreciate more details on how and where this will take place.	<b>Report not amended</b> A report will be published by SNIFFER and place on the UKTAG website early in 2008
We are concerned that not enough attention is being paid to the river <b>typologies</b> and in particular, the fact that a large number of Scottish rivers, on which most of our malt distillery members are situated, are spate rivers which have flows which fluctuate not only seasonally but daily and hourly. It is not uncommon for these rivers or water bodies to run dry at certain times of the year even when distilleries are not in operation. The proposed structure does not seem to take account of this and we would not wish to see the characteristics of Spate Rivers to be seen as a 'departure from the natural flow'.	<b>Report not amended</b> This remark is more appropriate to the phase 1 standards. If rivers run dry naturally, that is part of the natural characteristics that is considered in the methodology.
In some areas there would be considerable and serious difficulties for summer distillation if <b>'hands-off' periods</b> were imposed particularly of the decision to impose a 'hands-off' period was based on inaccurate flow model that doesn't take	<b>Report not amended</b> River flow characteristics are part of the methodology. The impacts on both the ecology and business of the use of Hands off Flows is part of the economic analysis and options appraisal within the River Basin Planning Process.

Comments	Response
<p>account of spate river flow characteristics</p> <p>Some industries cannot simply switch on and off at short notice and using main supply as a top-up or alternative is not an option for quality reasons.</p>	<p>Flow models used by the agencies attempt to represent the range of flow characteristics of the rivers within their region of responsibility. Operators are free to question the validity of these models and may supply data on a case by case basis to support a reassessment of the natural flow regime upon which the condition limits are based.</p>
<p>The report highlights <b>Protected Areas</b> are out with the scope of this document and separate standards may be developed. Many of our members are situated within or abstracting from / discharging into a 'Protected Area' and we would wish to see further details on these standards, especially if the limits are tighter than those set out in this consultation.</p>	<p><b>Report not amended</b> Further work is required to assess whether the requirements of particular conservation features under Habitats Directive are more restrictive than the standards for Good Ecological Status</p>
<p>Page 46 onwards: Water resources – even if flows are significantly altered from the natural situation this does not mean that there are ecological or environmental impacts, or that the relationship between the degree of impact of flow change on ecology is a linear relationship.</p> <p>Page 53 mentions the uncertainty in calculating naturalised flows (i.e. without artificial influence such as reservoirs) - the assessment needs to highlight the uncertainty in the data used and whether this affects the final decision made - there needs to be confidence that changes will actually result in an ecological benefit.</p> <p>Page 54 asks for example data to assess the proposed condition limits - the EA hold flow data for sites immediately downstream of many of our impoundments which is available for such assessments.</p>	<p><b>Report not amended</b> The lack of good information on the causal links between managed flow regimes and ecological impacts was acknowledged in the report, and highlighted as an area where further work is required. Further work is being undertaken on managed flows to identify sites where flow data and ecological data may help to improve some of the causal links.</p> <p>The indirect model underpinning the condition limits detailed in this report allows for the uncertainty in the links between alterations in flow and ecology. The failure of a condition limit is designed to trigger a process whereby supporting evidence is sought to determine status.</p> <p>The trialling report will give more consideration to the data issues. Confidence in ecological benefit from any changes is part of the measures appraisal process</p> <p>EA biology data downstream of impoundments is being used to validate these condition limits</p>
<p>Page 48. <b>Freshwater Flow</b> - the impact of the abstraction of freshwater flow on estuaries. Although the principle behind the method is straightforward (deviation from naturalised flows) the detail of the methodology is complex and therefore difficult to interpret without expert guidance. Our comments are therefore focused on the principles rather than the implications of the standards. We support the use of condition limits</p>	<p><b>Report not amended</b> The lack of good information on the causal links between abstraction impacts on freshwater flow to estuaries and ecological impacts was acknowledged in the report. The proposed flow bands enable the severity of impacts to be reported. A weight of evidence approach will be used with ecological and other data to assess the impact. Further work is required to improve the causal links between abstraction impacts and the ecology.</p>

Comments	Response
<p>rather than numeric limits. The relationship between ecological status and freshwater flow to estuaries is poorly understood. This combined with the social implications of changing industrial, public water supply and agricultural abstractions, means that setting numeric flow targets to achieve ecological status would have very low confidence and is therefore inappropriate.</p>	
<p>Page 49. We also support the approach described that conditions limits are used for screening only. We would anticipate a similar approach to that used in CAMS, where a high level method is used to screen and more targeted site specific investigations applied where appropriate. We would expect to work closely with the Environment Agency as we are currently on the Habitats Directive to establish the effect of Yorkshire Water operations on the Humber Estuary.</p>	<p><b>Report not amended</b> The lack of good information on the causal links between abstraction impacts on freshwater flow to estuaries and ecological impacts was acknowledged in the report. The proposed flow bands enable the severity of impacts to be reported. A weight of evidence approach will be used with ecological and other data to assess impact. Further work is required to improve the causal links between abstraction impacts and the ecology.</p>
<p>Page 49. Table 27 – the tables are clearer than the 2006 document How is the sensitivity (high, medium or low) to be defined? The conditions limits as flows as a % of QnX removes uncertainty, however at very high flows such as &gt;Qn10, the upper allowable reduction of flow (e.g. 40% of Qn60 for high sensitivity) will be quite a small proportion of the actual flow.</p>	<p><b>Report not amended</b> The methodology for assessing sensitivity is in the report. The allowable reduction in flows at high flows is likely to be a small proportion of the flow, but may still represent a large volume. Most abstractors are unable to make use of the volumes that would potentially be available for the very short period of high flows.</p>
<p>Freshwater Flows, Table 27 Regarding impact on estuaries, as a screening test only these may be acceptable; although the condition limits proposed in tables 27 to 29 are confusing (though the tables are clearer than in the 2006 Document). The statement of flows as a % of QnX removes uncertainty over what the percentage refers to. However, at very high flows (for example &gt;Qn10) the upper allowable reduction of flow (e.g. 40% of Qn60 for high sensitivity) will be quite a small proportion of the actual flow. <input type="checkbox"/> How is the sensitivity – high medium or low – to be defined?</p>	<p><b>Report not amended</b> The methodology for assessing sensitivity is in the report. The allowable reduction in flows at high flows is likely to be a small proportion of the flow, but may still represent a large volume. Most abstractors are unable to make use of the volumes that would potentially be available for the very short period of high flows.</p>
<p>Although the principle behind the method is straightforward (deviation from naturalised flows) the detail of the methodology is complex and therefore difficult to interpret without expert guidance. Our comments are therefore limited to the principles rather than the implications of the standards.  We support the use of condition limits</p>	<p><b>Report not amended</b> UKTAG note this comment.</p>

Comments	Response
<p>rather than numeric limits.</p> <p>Scientific understanding of the role of freshwater flows in influencing estuarine ecology is poor. The proposed condition limits are therefore little more than guesses as to what may or may not be important. We note that there has been no testing of the condition limits or attempt to validate them against ecological data.</p>	<p><b>Report not amended</b></p> <p>The poor understanding of causal links between abstraction impact on freshwater flow to estuaries and the ecology is acknowledged. The proposed standards will be used for screening purposes and weight of evidence approach.</p> <p>A SNIFFER project trialling the condition limits where data is available is being undertaken and will be completed by the end of 2007.</p>
<p>We note that the condition limits are proposed to be used as triggers to identify requirements for further investigation. Given the poor understanding of linkages between freshwater flows and estuarine ecology, it may be difficult to identify what further work may be appropriate in a given situation. This may place abstractors in the unenviable position of having to gather evidence to answer questions which themselves are uncertain</p>	<p><b>Report not amended</b></p> <p>The poor understanding of causal links between abstraction impact on freshwater flow to estuaries and the ecology is acknowledged. The proposed standards will be used for screening purposes and weight of evidence approach.</p>
<p>We welcomes that the <b>flow values</b> stated as 'standards' will actually be used as condition limits for screening. We consider that this is the best approach to take for all water bodies to allow more site specific investigations and a better understanding of the hydrology and hydrogeology of the area. We would like to see further work undertaken on condition limits for estuaries and requirements for freshwater flows as we consider there are considerable science gaps.</p>	<p><b>Report not amended</b></p> <p>UKTAG note this comment.</p>
<p>Page 51. Impacts of <b>managed flows</b></p> <p>We support the use of condition limits rather than applying numeric standards, the primary purpose of which is to supply water. In the case of reservoir catchments it must be recognised that we are dealing with heavily modified systems, the primary purpose of which is to supply water. Given that the system is designed to capture and store water, current and historical flow rates are likely to be markedly different from theoretical naturalised flows. Therefore attempts to return to an approximation of a naturalised flow regime may have significant implications for reservoir storage and hence water supply.</p>	<p><b>Report not amended</b></p> <p>Reservoirs and a downstream reach will be Heavily Modified Water Bodies. Operation of the reservoir and flow regime downstream will be considered as part of measures for Good Ecological Potential</p>
<p>Another consideration is that many industries are reliant on compensation releases from reservoirs and changes to regimes may impact on those industries that depend on a specific guaranteed flow rate.</p>	<p><b>Report not amended</b></p> <p>This will be considered as part of the Good Ecological Potential Report which will be published early 2008.</p>
<p>We would like to emphasise that there is a growing understanding of the</p>	<p><b>Report not amended</b></p> <p>The work being undertaken between YWS and the EA will</p>



Comments	Response
<p>relationship between managed flows and ecology which must be fully considered if the aims of the WFD are to be met. Reference is made to some of this work in SNIFFER Project WFD 82.</p> <p>For example in the Humber Region the Environment Agency and YWS have progressed a number of trials in partnership where historical compensation releases have been redesigned to benefit both water supply and downstream ecology. At reservoirs in South and West Yorkshire 5 year trials have been completed which introduced seasonal flows and spate releases to benefit brown trout populations. The trials were a great success and led to the development of models (CRAB1 and CRAM2) which allow the design of environmentally beneficial flow regimes and the prediction of the available habitat arising from these changes. This capability represents a powerful tool in delivering Good Ecological Status or Good Ecological Potential. Furthermore the partnership approach described ensures that a sustainable balance is maintained between water supply and environmental improvement.</p>	<p>be an important part of improving the scientific understanding of the causal links between managed flow regimes and the ecology.</p>
<p>Page 53. In calculating naturalised flows (without artificial influence), the assessment needs to highlight the uncertainty of the data used and whether this affects the final decision made. Confidence is needed that the changes result in ecological benefit.</p> <p>Table 30 – referring to the parameters ‘mean number of times per year the flow exceeds Q25’ and ‘mean number of times per year flow exceeds Q75’, can it be confirmed that this is the number of times the threshold is crossed rather than the number of days?</p> <p>Referring to the parameters ‘mean of annual minimum 7 day flow’ and mean of annual maximum 7 day flow’, Q95 and Q5 are not directly equivalent to these parameters.</p> <p>If all of the IHA parameters in table 30 are used this could lead to complex compensation arrangements. More details are required on this before commenting.</p>	<p><b>Report not amended</b></p> <p>The need to improve the science is acknowledged in the report. Further work will be required to improve decision making on managed flows</p>
<p>Page 54. table 31 – Can it be confirmed that if there is less than 40% flow deviation downstream of an impoundment this would not be classified as heavily modified? SEPA have gauging stations downstream of a number of</p>	<p><b>Report not amended</b></p> <p>There is a transition between flow regimes on largely natural rivers and managed flow regimes. Heavily Modified Water Bodies are designated on use. There may be some cases where the managed flow meets GES.</p>

Comments	Response
impoundments as does Anglian Water downstream of the dam for some impoundments.	
A preliminary assessment of one reservoir group shows that the current regime does not meet the limits for long periods (c.Q20- Q85). If this is representative of many of our reservoirs then the implications for the management of reservoirs and consequently water supply will be significant. Interestingly the reservoir group chosen is one where the flow regime has been designed specifically to meet the flow (depth and velocity) requirements of brown trout at key life stages. This demonstrates the importance of site specific investigations and solutions and we would support the statement on p53 that methods would be 'used to screen the hydrological impacts... and so form the basis for further investigations.'	<p><b>Report not amended</b> Further work is required to assess the requirements of GEP</p>
The concept of 'Condition Limits', as opposed to standards, is new and its creation requires some rationalising. Would the hydrological standards to protect GES in rivers that were proposed in the Phase 1 consultation document now be termed Condition Limits? As we understand it, the Phase 1 river flow standards were designed to protect against flow alterations caused by human activity. It is difficult to find an ecological justification for using different standards (or limits) to protect against impoundment, unless one accepts that the ecological objective is something different than GES, or alternatively one accepts a lower level of certainty of achieving GES. The status of and relationship between the two sets of standards/limits needs clarification, considering the concept of Heavily Modified Water Bodies.	<p><b>Report not amended</b> See above comments. Managed flows are likely to significantly alter the flow statistics compared to a natural river. Managed flows are likely to be associated with Heavily Modified Water Bodies where the use is for water supply.</p>
We agree that the IHA method outlined could be used to determine the degree of hydrological alteration from naturalised for rivers with heavily modified flow regimes. It is not clear how this method generates the deviations from naturalised flows outlined in Table 31 of the consultation document, but these deviations are considerably greater than those defined by the Phase 1 consultation. This implies a reduced level of ecological protection to rivers subject to impoundment and compensation releases. We suggest that the Phase 1 standards represent an attempt to define river flow standards consistent with GES, whilst the Phase 2 standards represent something more akin	<p><b>Report not amended</b> See above comments.</p>

Comments	Response
to river flow standards that might be considered consistent with GEP.	
Since both Phase 1 and Phase 2 standards have been derived using expert judgment only, both need to be subject to ecological validation through strategic R&D and collation of information from existing hydroecological studies.	<p><b>Report not amended</b> The need for further work to improve the science is acknowledged. Abstraction impacts will be used with a weight of evidence approach to justify action.</p>
In terms of application, it may be sensible to consider non-compliance with the Phase 1 standards as the definition of potentially Heavily Modified Water Bodies, with HMWB status being confirmed if the river is subjected to impoundment and compensation releases that cannot comply with the Phase 1 standards without excessive costs. For such rivers, standards derived from the IHA methodology could provide characterisation of a hydrological condition consistent with GEP.	<p><b>Report not amended</b> Agreed. HMWB status is defined by use, which includes water supply. Impoundments and the downstream reach will be Heavily Modified Water Bodies.</p>
<b>Pleased to see that water resources are now being assessed under the Indirect model rather than a direct model as suggested for river flow conditions in Phase 1.</b>	<p><b>Report not amended</b> UKTAG note this comment.</p>
In the case of reservoir catchments it must be recognised that we are dealing with heavily modified systems, the primary purpose of which is to supply water. Given that the system is designed to capture and store water, current and historical flow rates are likely to be markedly different from theoretical naturalised flows. Therefore attempts to return to an approximation of a naturalised flow regime may have significant implications for reservoir storage and hence water supply. The waters above and below such reservoirs must therefore be designated as heavily modified/artificial water bodies as appropriate.	<p><b>Report not amended</b> See above comments.</p>
Another consideration is that many industries are reliant on compensation releases from reservoirs and changes to regimes may impact on those industries that depend on a specific guaranteed flow rate.	<p><b>Report not amended</b></p>
We would like to emphasise that there is a growing understanding of the relationship between managed flows and ecology which must be fully considered if the aims of the WFD are to be met. Reference is made to some of this work in SNIFFER Project WFD 82.	<p><b>Report not amended</b> See above comments.</p>
Interestingly the reservoir group chosen is one where the flow regime has been designed specifically to meet the flow (depth and velocity) requirements of	<p><b>Report not amended</b> <b>UKTAG note this comment.</b></p>

Comments	Response
<p>brown trout at key life stages. This demonstrates the importance of site specific investigations and solutions and we would support the statement on p53 that methods would be 'used to screen the hydrological impacts... and so form the basis for further investigations.' This also confirms that in such artificially controlled waters, full use of the heavily modified water bodies should be made.</p>	
<p>SNH welcomes the development of standards on modified flow regimes downstream from impoundments. We lack the hydrological expertise to comment on whether the 10 indicators in Table 30 are adequate to describe the types of flow modification. We are not familiar with the development of the proposed standards listed in Table 31 (and has not been able to delve into the supporting technical reports) but comments that initially it would appear that needing a 40% change in various indicators to indicate a risk of failing to achieve GES seems a very liberal threshold.</p>	<p><b>Report not amended</b> See the comments above regarding a transition between impacts on 'natural' river flows and a transition to 'managed flows' that are likely to be Heavily Modified Water Bodies where the objective is likely to be Good Ecological Potential</p> <p>The value of 40% deviation from natural conditions for the various flow descriptors has been based upon expert judgement and reflect the current levels of uncertainty in estimating these flow regime indicators. Further research using the biology data available for managed flows is being undertaken to assess the validity of these values. The results of this preliminary analysis will be reflected in the revised report.</p>
<p>It was also surprising to see no mention of climate change in the section on managed flows. The effects of changing climate on flow regimes are already being seen. The text states that mean monthly flows can be calculated on a seasonal basis from individual months in each period. With the recent summer flooding as an example, will it not be likely that these sorts of calculations could become progressively less reliable as seasonal patterns of temperature, rainfall and flow change with time.</p>	<p><b>Report not amended</b> The impacts of climate change are barely discernible on long term flow statistics. Further work is required to consider how climate change may impact on flow statistics, the flow regime and also the changes that may take place to the ecology caused for example by temperature change.</p> <p>The effects of climate change are likely to vary considerably from place to place. The agencies will monitor long term changes to flows under their surveillance monitoring programme as required by the Water Framework Directive. These changes will be reflected in the assessment of natural flows.</p> <p>The condition limits stipulate that deviations from <b>any</b> mean monthly flow should be considered when determining the risk of good status being threatened. This means that the condition limits do not rely on the correlation between particular months and seasonal flows and are therefore not as susceptible to changes in seasonal patterns as suggested.</p>
<p>The UKTAG establish condition limits for alterations to river flow regimes which should be used for screening purposes. This is the first time such condition limits for alterations to river flow regimes have been proposed for UK rivers.</p> <p>At this stage it is probably unwise to attempt to apply flow condition limits at all as an indicator of quality status. Is there</p>	<p><b>Report not amended</b> The use of the 'standards' for screening purposes and a weight of evidence approach has already been noted.</p>

Comments	Response
<p>any data to support the UKTAG suggested percentiles? Each watercourse should be considered on its own merits – some surface waters may be very sensitive in quality terms to flow variations, in others large variations may have negligible effect on quality. A “one size fits all approach” is unlikely to be appropriate not least bearing in mind the vastly different hydrological regimes that exist in the UK from high mountain stream to sluggish delta.</p>	
<p>QPA are concerned about where condition limits will be applied in an individual catchment system. Clarification is needed on where in the water body this limit will be monitored. How will these parameters be applied to point discharges and abstraction points? On what scale will impacts be significant and taken in to account on the river basin scales? Who will be responsible for the background monitoring? Those with responsibility for complying with discharge consents may be asked to do monitoring but may not be able to do so if they do not have access rights to land where monitoring is required. How will data be compiled and shared? This information should be made available to those with and applying for discharge consents and abstraction licences so that potential impacts can be taken in to account.</p>	<p><b>Outside the scope of the stakeholder review.</b> These are matters to be considered in implementing WFD into the Agencies regulatory framework.</p>
<p>We disagree with the statement on p.46 that there is limited quantitative data on impacts of managed flows on the ecology. In fact, we would argue that this area is probably one of the best-studied areas of anthropogenic impacts on ecological functioning. Large numbers of studies have been undertaken that quantify the impacts of managed flows both on fish, macrophytes and invertebrates. The requirements of fish, invertebrates and macrophytes can be made with a carefully designed and implemented environmental release flow programmes. We recommend that an involvement of a multi-disciplinary team of experts, including biologists, hydrologists, hydro engineers, chemists and geomorphologists is needed in order to assess the level of ecological damage and recommend compensation measures.</p>	<p><b>Report not amended</b> There is a considerable body of work that has recently been undertaken, particularly with respect to HD sites. It is important that general principles are drawn from this work to guide future action and the principles of 'managed flow regimes'.</p>
<p>We are concerned that the only measure that is being considered in the UK TAG</p>	<p><b>Report not amended</b> Impacts of managed flows on temperature and sediment</p>

Comments	Response
<p>paper is the impact of managed flows on hydrology, or the % deviation from natural flows. In modified systems, other criteria are also relevant, including temperature, sediments and water chemistry. As explained above, managed flows can have major impacts on sediment transport and deposition. All of these impacts need to be considered when deciding about the degree of damage and action required to address these impacts.</p>	<p>will also need to be considered when considering criteria for GEP. Hydrological criteria only have been considered at this stage when considering managed flows.</p>
<p>Benthic invertebrates play a key role in aquatic ecosystems due to their intermediate position in the food chain. They are also sensitive to change in their ecosystem, which makes them a good indicator of ecological disturbance. In regulated rivers, there are often significant differences in invertebrate diversity when compared with a similar, non-regulated river. Many studies (Loffler, 1990, Scullion et al. 1982, Armitage, 1978, Inverarity et al. 1983) show that regulation causes a decrease in channel species diversity, often with an increase in abundance of common species such as Beatidea and a decrease in more sensitive species, such as Ephemeridae.</p>	<p><b>Report not amended</b> The need to improve the science is acknowledged in the report. Further work will be required to draw out underlying principles to improve decision making on managed flows.</p>
<p>Due to their complex habitat requirements, fish communities, especially larval and juvenile fish, are good indicators of habitat structure and ecological integrity of large river systems. Water regulation can have particularly severe impacts on fish. Modification of natural flow regimes of rivers can affect biota at the population and community levels (Schlosser, 1991; Marchetti &amp; Moyle, 2001) and may cause changes to the natural river habitat. Many of these impacts are linked with changes in sediment transport and natural deposition of sediments. Often, scouring of fine sediments is intensified in the reach immediately below a dam, which can in turn impact macroinvertebrate biomass and physical characteristics of a river bed. The modification of a natural habitat for invertebrate communities is of major concerns as major changes can impact directly or indirectly on co-occurring fish communities. The influx of fine solids at increased levels may result in shifts in habitats and invertebrate distribution and/or reduce species diversity.</p>	<p><b>Report not amended</b> See above comments.</p>
<p>Managing the impacts of modified flows</p>	<p><b>Report not amended</b></p>

Comments	Response
<p>We generally agree with the proposals by the UK TAG that setting a standard for managed flows would be unreliable. Each river considered to be at risk will have specific requirements, which should be considered on a case by case basis. The requirements of fish, invertebrates and macrophytes can be made with a carefully designed and implemented environmental release flow programmes. We recommend that an involvement of a multi-disciplinary team of experts, including biologists, hydrologists, hydro engineers, chemists and geomorphologists is needed in order to assess the level of ecological damage and recommend compensation measures. We are concerned that the only measure that is being considered in the UK TAG paper is the impact of managed flows on hydrology, or the % deviation from natural flows. In modified systems, other criteria are also relevant, including temperature, sediments and water chemistry. As explained above, managed flows can have major impacts on sediment transport and deposition. All of these impacts need to be considered when deciding about the degree of damage and action required to address these impacts.</p>	<p>Case by case analysis is time consuming and expensive. Screening criteria are required to assess the degree of hydrological alteration that has occurred with managed flows so prioritisation of impact and investigation can take place.</p>

## UKTAG Report Section 2 – Morphology – All surface water categories

### Overview

- Mixed views on the tool and its potential application. Some respondents thought that the tool is a sensible and technically sound approach to assessing hydromorphological impacts. Concern was also expressed that this tool in its current form would be inappropriate for use in informing regulatory decisions.
- Most respondents agreed that further work is required to validate the MImAS tools with ecology-hydromorphology relationships. The UKTAG trialing and validation work was welcomed.
- One respondent was sceptical of the use of rigid capacity limits.
- Another respondent expressed concern that the tool does not make a positive contribution to the better regulation agenda.
- Request for clarification of some of the terminology in the chapter and supporting technical report.

- General agreement that further research is required in relation to ecology-hydromorphology relationships.

#### Amendments to the UKTAG report

- The report was updated to include results from the trialling and validation.
- The supporting technical reports will also be updated and placed on the UKTAG website.
- A report describing the field trialling will be placed on the UKTAG website.
- A report describing the peer review process and comments will be placed on the UKTAG website.

Comments	Response
<p>The MImAS tool appears to be a sensible and <b>technically sound</b> approach to assessing hydromorphological impacts under the WFD. This will provide a means of assessing the potential impact of new projects and proposals; ultimately with a better understanding of the links between ecology and hydromorphology the approach could be developed into a classification tool.</p>	<p><b>Report not amended</b> UKTAG welcomes this view.</p>
<p>The general approach of the assessment tool is typical of risk screening tools. The factors which are covered in the tool appear appropriate. However, whilst accepting that such approaches provide a useful framework for structured presentation of information, we are sceptical of the use of <b>rigid capacity limits</b> (Table 42) until considerable practical experience has been built up. We therefore suggest the discussion on p72 is replaced by the approach implied in the supporting report (TraC MimAS version a4 section 1.4 p21) in which the MCLs are just one input to regulatory decision making rather than the sole criterion recommendation of UKTAG.</p>	<p><b>Report not amended</b> The tool is intended to be used in combination with existing regulatory procedures and would not be used as a sole criterion to determine a particular course of action.</p> <p>The thresholds would be used to guide regulatory effort and determine where ecology could be placed at risk and, therefore, where consideration of an exemption (WFD Article 4.7) must be made before making a regulatory decision. Other important steps in the regulatory process include ensuring best practice is followed, ensuring conservation objectives are met and ensuring site specific issues are considered, possible through an EIA or other similar more detailed investigation.</p>
<p>It is unclear how the <b>relative weightings</b> for morphological alterations have been derived, other than by expert judgement. It is not possible, based on the information in the report, to reproduce the weightings given.</p>	<p><b>Report not amended</b> The weightings are based on expert judgment and have been defined through series of modules that break down impacts into consideration of the relevance of a feature or process to a particular environment (type), the morphological / ecological resistance and resilience of features and processes, and the likely extent of impact (localised to pervasive). The expert judgement decisions were built up over a period of a year and through multiple workshops and independent assessments. The focus of future trialling work will be test/validate these assessments using empirical data.</p>
<p>At the UK morphology workshop on 16th August, it was advised that the risk assessment tool would be used in</p>	<p><b>Report not amended</b> The final trialling results have indicated that tool matches expert opinion in over 80% of cases (details of trialling are</p>



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<p>conjunction with existing methods (including expert geomorphological analysis). It is difficult to envisage the tool making a significant positive impact on streamlined consents processes, as it is reported to be only 75% accurate when tested against the relatively simple process of determining current hydromorphological status.</p> <p>We are concerned that this tool makes no positive contribution to the <b>better regulation agenda</b>, but does impose a further layer of bureaucracy that is of questionable value and opens regulators to challenge. We think that a simpler approach is needed.</p>	<p>described below). It is recognised that there will some cases where a tool of this type will not provide a reliable estimate of potential deteriorations in ecological status, for instance where there are important and scarce habitats or where coastal geometry.</p> <p>The UKTAG suggests that the tool <b>does</b> support better regulation, by adopting a transparent, consistent, risk-based approach to making decisions based on sound science.</p>
<p>During discussions at the UK morphology workshop, concerns were raised over the <b>confidence regulators</b> could have in this 'tool'.</p> <p>(1) In the first instance, to assess the current status of the water body there was a 75% agreement with expert opinion. In the second instance to assess the iterative impact of a proposal, the tool is likely to have at best 56% agreement with expert opinion (<math>0.75 \times 0.75 = 0.56</math> i.e. ~56% agreement).</p> <p>(2) What is the confidence level if there are multiple applications on any stretch of coast?</p> <p>(3) Also, what confidence do we have in a mobile and dynamic baseline, as we currently have and will continue to have as climate change accelerates the changes we are already experiencing? Recent research highlights potentially rapid, fragmented and highly complex adjustments that we should expect to see on our coast in the coming years to decades.</p> <p>We are unsure, given the robust discussions in London (and the issues raised here) how this tool contributes towards efficiency savings when the agreement with expert opinion is at best 75%, and especially if the tool is not to be used in isolation (i.e. the assessment will be repeated by an expert).</p>	<p><b>Report not amended</b></p> <p>The results of the trialling exercise indicate that the tool matches professional judgment in over 80% of cases. Where there are mismatches, the tool is within one status class. This corresponds to a spearman rank <math>r^2</math> of 0.84. The suggestion that the confidence in the assessment reduces when additional pressures are added is not statistically valid argument based on the evidence available. Similarly, it is not correct to state that the % agreement reduces as extra pressures are considered. Based on the data available, the confidence in the assessment when compared to our baseline information based on professional judgment would remain at 80%. Addressing issues of climate change in regulatory and classification assessment is something that will require further investigation. It is well recognised that there are gaps in our understanding of link between physical features and process and biotic responses. Climate change trends and their implications creates further complexity that must investigated through on-going monitoring and research.</p>
<p>We have considerable sympathy with the search for a <b>simple assessment</b> tool that reduces demand for use of skilled staff, but there are circumstances where this cannot be avoided; coastal processes is one such example. We think there is much more sense in developing and applying a simple decision-tree that can</p>	<p><b>Report not amended</b></p> <p>The tool is not intended to replace the need for skilled and experiences staff. TraC-MImAS is an additional tool that can be used by these staff to ensure that the requirements of the WFD are being met in a transparent and consistent manner across the UK. Expert overrides to the outputs from the tool will be used by regulators and a clear and auditable decision trail for identifying when these overrides</p>

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<p>be used to define why particular decisions have been made and to provide a clear audit trail so that regulators and applicants alike can understand how a particular outcome has been reached.</p>	<p>should be applied will form part of the regulatory procedures for applying the tool. However, based on the trialling results and the feedback from the regulators, there is clear evidence that the tool will provide valuable information to support decisions in the majority of cases, and that overrides will be limited to subset of cases where site specific circumstances mean that local expert knowledge and information would be required to determine where a water bodies ecological status is being placed at risk.</p>
<p>We are concerned with the approach developed to determine <b>significance</b> of a <b>morphological alteration</b> (or alterations) for ecological status of water bodies, because for most types of alteration, the assessment of significance is highly sensitive to the size of the water body (or length of coastline within the water body) concerned. Thus, so long as less than 5% of a water body is impacted by, say, dredging (or whatever), ecological status of the water body is deemed to be unaffected, irrespective of the absolute magnitude/extent of impact which may be great for larger water bodies. So for large water bodies, extensive alteration may be perceived as having no significant impact, simply because of the size of water body concerned.</p>	<p><b>Report not amended</b> This issue has been identified and scale independent water body assessment rules have been incorporated in the revised report. Testing of these rules was part of the field trialling work. The rules are adapted from an approach adopted for rivers. In short, limits on single discrete activities have been produced by running the tool on fixed size assessment units. These limits apply to all water bodies irrespective of the size of the water body. The limits also apply to pressures that span water body boundaries. These rules will be updated and refined over time as new evidence becomes available.</p>
<p>We do not consider that the MImAS tool in its current form is appropriate for use in informing regulatory decisions. We would wish to see extensive <b>testing/validation</b> to demonstrate whether it can work across a wide range of different environments before agreeing to its formal use. Many of the weightings applied appear to us to be badly wrong. The tool also includes a number of implicit assumptions which are demonstrably false, for example, the tool assumes that the morphological consequences of an alteration are the same irrespective of the location of that alteration within a water body.</p>	<p><b>Report not amended</b> The tool has been tested and peer reviewed. See above comments on the trialling work. A preliminary overview of the trialling results and peer review is available on the UKTAG website.</p>
<p>One of the decisions that is proposed to be taken using the tool relates to whether or not further more <b>detailed assessment</b> of proposed modifications might be necessary. The consultation suggests that these more detailed assessments are likely to take the form of an environmental impact assessment (Environmental Standards consultation p56). EIAs are generally already required for any non-trivial development in the marine environment. The types of thresholds generally applied to the consideration of</p>	<p><b>Report not amended</b> There will be situations where additional information will need to be brought to bear in making decisions on whether a water body is being placed at risk of deterioration in ecological status. For instance, in areas where complex coastal geometry means that relatively minor physical changes could have major knock on impacts. The tool is not designed to deal with these complex situations, and regulatory methods supporting the application of the tool would reflect this. For instance, criteria can be used to identify common situations where additional site specific information should be considered when identifying where the status of a water body could</p>

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<p>the need for EIA are trivial compared to the gross levels of acceptable change being contemplated under WFD. It is therefore highly questionable what benefit such a tool might provide to decision makers. A project will either be trivial, in which case it will not require EIA nor pose any conceivable risk to WFD objectives, or it will be non-trivial, in which case EIA will be required which will evaluate whether or not there are any significant risks to WFD objectives. We therefore question whether the tool is required to support decision-making.</p>	<p>be placed at risk. This could include identifying sensitive parts of the coastline and sensitive habitats that would require additional consideration. IT is envisaged that a more refined coastal typology would helped address some of thee limitations, and this will be investigated for future iterations of the tools. It is important to distinguish between that work that is carried out in EIA and the role of the TraC-MImAS tool. The TraC-MImAS tool is not model that predicts site specific impacts. It is an overarching risk assessment tool that will help regulators determine where water body status is being placed at risk. It can also be used to help guide regulatory effort. EIAs are not used predict where water body status is being placed at risk. The TraC-MImAS tool and EIA work are compatible and have different objectives. Regulatory guidance and procedures will be used to ensure harmony between EIAs and water body risk assessment tools.</p>
<p>The consultation also suggests that the tool might have a role in <b>classification</b> of water bodies. Because of the uncertainties in evaluating morphological change and particularly the lack of scientific understanding of the ecological consequences of morphological change, we do not think that its use in classification would be at all appropriate at the current time. For the tool to be considered for use in classification, it would be necessary to demonstrate both that:</p> <ul style="list-style-type: none"> <li>- The tool reliably represents the nature and extent of morphological change in a water body/water body section; and</li> <li>- The quantification of that morphological change is a reliable indicator of the ecological consequences in the relevant terms of WFD.</li> </ul> <p>In our opinion, neither of these requirements has yet been demonstrated.</p>	<p><b>Report not amended</b></p> <p>To meet high status, the morphological condition of a water body must meet high status criteria. This assessment is independent of the biological assessment. The TraC-MimAS tool is being proposed as a method to help identify where the morphological conditions are representative of high status. For other status boundaries, the Directive requires that morphological conditions are consistent with the achievement of the values required for the biological quality elements. Current biological tools are not going to provide an appropriate assessment of morphological conditions. As such, UKTAG are proposing to use a weight of evidence approach to determining ecological status, where necessary this will include the use of surrogate data. The TraC-MImAS tool is one of the tools that may be used to provide surrogate data to inform classification decisions.</p>
<p>As indicated in the report, <b>links</b> between <b>morphological</b> alteration (in coastal / transitional environments) and <b>ecological</b> status are not well understood. There are no existing environmental standards that can, be applied. We believe the proposals developed are a good first attempt to set appropriate standards and conditions. Crucially, however, we note that field trial and validation of the standards is to be undertaken during 2007. Given the above limitations, we would view this work and revision of the approach or standards as necessary as fundamental.</p>	<p><b>Report not amended</b></p> <p>UKTAG agree that the tool and the assumptions must be tested further as new evidence becomes available. UKTAG are developing research agendas for improving the links between ecology and morphology. The intention is for this work to feed directly into the future development and testing of the morphology tools.</p>
<p>The morphological tool for assessing morphological risk is only relevant to new</p>	<p><b>Report not amended</b></p> <p>Biological information will be used in the classification of</p>

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<p>or proposed morphological alterations. There are a number of unjustified <b>assumptions</b> including:</p> <p>(1) There is a relationship between the extent of morphological alteration and the impact on ecological status.  (2) The response of a water body's morphology to an engineering or other pressure is predictable for that water body.  (3) The response of the ecology to morphological change is predictable and depends on the sensitivity of the ecology of the water body.</p> <p>We consider that these assumptions cannot be supported and therefore biological tools must be used for classification.</p>	<p>TraC water bodies. The current biological tools do not provide a reliable assessment of impacts to ecology from morphological pressures. Work will continue to improve these biological tools to a point where they can provide reliable assessments of how ecology is impacted from a range of morphological (and hydrological pressures). In response to the current deficiencies in the biological tools, UKTAG have proposed that other data should be used, including surrogate data, to inform a weight of evidence approach to classifying water bodies. The TraC-MImAS tool is proposed as one of the tools that could provide surrogate information to inform classification decisions. Other EU member states have similar problems with their biological tools and are likely to adopt similar weight of evidence approaches to classification.</p>
<p>In Table 33, where morphological alterations considered in the lake tool are listed, this includes catchment land use. It is not clear how this is used in the tool, and what can be done if the catchment is found to have a high percentage or a particular land use. The impact of urban areas is indeed very different from agricultural land use and we do not consider that these can be lumped together.</p> <p>It is not clear how figures were obtained for tables 34, 35 or 36. This is a complex tool and for those that have not been involved in its development it is very difficult to understand the reasoning behind the values and indeed the implications. This document needs much further explanation including case studies and predicted outcomes.</p> <p>The same confusion arises with TRAC waters and the inclusion of historical alterations simply adds to the confusion. We would like to see information about how morphological capacity is determined and how the condition limits in Table 42 were determined.</p>	<p>The potential impact of different land use activities on hydromorphology is considered by the tool. It is a fairly simple assessment based on a scoring procedure that ranks different types of land use based on their potential impacts. The inclusion of land use ensures that this important pressure is considered when assessing impacts from proposed new activities/alterations. Urban and agricultural land use are not considered together. The scoring system is described in the technical reports.</p> <p>The values in the tables are created by applying the equations described in the UKTAG Phase 2 Environmental standards report and in the technical reports that describe the tools in more detail. Case studies are also included in the technical reports.</p>
<p>It is stated that the methods will be applied to a 500m area(?) of lake or TRAC water. It is not even proposed, just stated without justification. It seems that this is an arbitrary figure. To take it to extremes, a 1 metre length for assessment would inevitably lead to many failures because morphological changes</p>	<p><b>Report not amended</b>  The 500m assessment is a preliminary regulatory assessment to identify low impact activities. All water body assessment would be made at the scale of the water body. 500m was selected by the tool developer and in consultation with steering group.</p>

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<p>apply to discrete lengths, whereas a greater length will lead to proportionately fewer failures as there is more chance of a modification falling within the specified tolerance. Is this not an issue for debate? It would seem that 500m is rather short, and smaller than most water bodies.</p>	
<p><b>The MImAS tool</b> has not been widely tested. Based on the information presented, we strongly question whether the tool is generating realistic assessments of overall morphological pressure. Indeed, it is questionable whether it is possible to achieve this goal using <b>simplistic approaches</b>. Scientific understanding of the relationship between morphological change and ecological status is far from complete. The only way to be confident about the ecological consequences of morphological change is to observe them directly. For example, a pressure (such as coastal squeeze from flood defences) acting on a single biological quality element (saltmarsh/marine plants) could be sufficient to result in the complete loss of that element, notwithstanding that the pressure was localised.</p>	<p><b>Report not amended</b></p> <p>The planned field trialling has been completed and the tools have been subject to peer review. The trialling work compared professional judgement decisions of the ecological status of water bodies with outputs from the tools. The professional judgement decisions on each water body were collated from workshop discussions and independent assessments. The TraC-MImAS tool was tested on 26 water bodies in Northern Ireland and Scotland. Five status classes were assessed (high to bad). The tool was shown to agree with professional judgement in over 80% of cases. Where there were disagreements the tool was within one class boundary. These are very positive results and indicate that the tool provides a good signal of risk to ecological status from morphological alterations. The next phase in trialling will be to use biological data to empirically test/refine the tool. In the medium to long term, the aspiration is to incorporate information generated from WFD monitoring and from dedicated scientific research programmes. Effort in this area will focus on:</p> <ul style="list-style-type: none"> <li>• Reviewing and test the assumptions underpinning the Lake and TraC-MImAS tools;</li> <li>• Refining the tools to reflect new evidence on the interaction between morphology and ecology, including replacing expert judgment with empirical data where possible; and</li> <li>• Generating further scientific evidence on the links between morphological alterations and ecological status.</li> </ul> <p>Due to the limitations of the current biological tools, some of this work will not commence until the biological tools have been refined.</p>
<p>Further work is required to <b>validate</b> the MImAS tools with ecology-hydromorphology relationships. There is a paucity of data on such relationships and we suggest that further work is commissioned by UKTAG. Given the uncertainties involved there is a risk that the 'condition limits' do not adequately reflect impacts on ecology, therefore during the first RBMP it seems appropriate to apply MImAS as a supporting management tool backed up by expert judgement and site-specific study.</p>	<p><b>Report not amended</b></p> <p>UKTAG and the wider European community recognise this issue. Further research and monitoring is required to generate empirical datasets that will improve understanding in this area. The intention is to update the TraC-MimAS tool as new evidence becomes available.</p> <p>As described above, the intention is to use TraC-MImAS in combination with existing regulatory methods. The TraC-MImAS tool would be applied in two ways (i) to provide an initial local assessment of risk. This assessment would help guide regulatory effort and inform any further more detailed assessments (e.g. EIA); (ii) The tool would be used to determine if a water body could be placed at risk of deterioration from proposed works. In both roles for the tool, the regulatory procedures underpinning its application would ensure that any potential site specific issues/constraints were considered in decisions. Based on feedback from the regulators and</p>

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	<p>the trialling, there will be a significant number of cases where the tool would provide a reliable indication of risk to water body status, however, there will be a smaller subset of cases where local expert opinion will be required, and the regulatory methods will accommodate this need for local knowledge. A standard procedure for capturing and auditing this information would be developed by the regulators.</p>
<p>We have a number of concerns about the risk assessment tool to evaluate the possible implications of developments on morphology in <b>TraC water bodies</b>.</p> <p>Our experience suggests that there is no simple way of evaluating morphological impacts and that this is a subject that can only be resolved through the use of expert geomorphological analysis and an element of practical pragmatism.</p> <p>There are no absolute answers and consistency of decisions and judgments across widely differing coastlines and systems cannot be achieved; evaluations have to be <b>case-specific</b> because the parameters differ significantly according to the sediment regime, base geology, geomorphological evolution and anthropogenic change.</p>	<p><b>Report not amended</b></p> <p>TraC-MimAS is a tool to help regulators identify where there is a risk to good ecological status and/or a risk of deterioration in ecological status. This is a broad scale assessment of overall risk to the water body, and not a detailed site specific investigation on issues.</p> <p>This information would be used determine were an exemption test should be carried out to determine if work should proceed on the basis of benefits to human health, human safety or sustainable development. It is important that these decisions are made in a transparent and consistent manner across the UK.</p> <p>It is recognised, however, that in some situations there will be a requirement to complement the TraC-MimAS assessment of risk to ecological status with local professional judgement. The TraC-MimAS tool is only one aspect of the regulatory process, and depending on the details of an application staff would still review proposals (for instance through the EIA process) to ensure that site specific issues were identified and addressed.</p>
<p>We believe that there are problems with the proposed approach because the <b>metrics</b> used are based upon the development of values derived from a mixture of parametric and non-parametric data. The problems are compounded because a simplistic approach to coastal geomorphology has been adopted. For example, emphasis has been placed upon evaluating morphological impacts based on areas and lengths. Such an approach fails to take account of depth changes and location of particular footprints, and how these affect morphological evolution. Thus, by way of examples:</p>	<p><b>Report not amended</b></p> <p>All data within the tool is parametric in nature. The tool has been updated to create greater flexibility in how users treat dredging activities.</p> <p>Two classes of dredging have been identified- high impact and low impact. This gives the user more flexibility in how to assess a particular dredging operation. The excavation of sediments where there is likely to be considerable damage caused to seabed environment, both within and out with the area dredged. High impact dredging Typically reserved for situations where dredging has not taken place in the past or where dredging has taken place within the last 10 years and impacts are still likely to be present. Typically reserved for situations where sediments are removed to a depth of greater than 1m. The excavation of sediments where the damage is likely to be restricted to the area being dredged. May be used for capital dredging where the impacts are likely to short lived or are being minimised through the use of best practice. Could also be used to capture areas that have been dredged in the past and where there is evidence that some impacts still exists. Some forms of trawling could be captured under this category. High impact dredging would typically be reserved for deep capital dredging work or dredging where impacts out with the vicinity of the dredging are likely. Shallow capital dredging that takes place in a site that minimises knock on impacts could be</p>

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<p>1. A wide shallow dredge at the mouth of a large estuary might be deemed to have greater impact than a narrow deep dredge at a more constrained point, even though the latter is likely to have much greater impact on morphological evolution, tidal range and ultimately on the ecology.</p> <p>2. A construction project with a large footprint in the outer and less sensitive part of an estuary might be deemed to have a greater impact than a small footprint at a pinch-point within that estuary.</p>	<p>input as low impact dredging. Where necessary, Fishing related dredging can now be input under the dredging categories, as well as the catch all bed disturbance category (lowest impact category) As similar approach has been adopted for land claim and bank reinforcement, thus enable the user greater flexibility to consider site specific conditions when running the tool for particular pressures.</p> <p>1- TraC-MimAS is a tool to help regulators identify where there is a risk to good ecological status and/or a risk of deterioration in ecological status. This is a broad scale assessment of overall risk to the water body, and not a detailed site specific investigation on issues.</p> <p>It is recognised that in some situations there will be a requirement to complement the TraC-MimAs assessment of risk to ecological status with more detailed assessments and local professional judgement . The TraC-MimAS tool is only one aspect of the regulatory process, and depending on the details of an application staff would still review proposals (for instance through the EIA process) to ensure that site specific issues were identified and addressed</p> <p>2- This is recognised. The regulatory methods supporting the implementation of TraC-MimAS would include guidance to ensure that additional local knowledge and information was incorporated in assessments of whether the ecological status of a water body is being placed at risk.</p>
<p>Both of above examples point to the failure of the model to take account of the geomorphological processes that actually determine the health (or otherwise) of estuarine environments. They can be extrapolated to the open coast too, in relation to sediment transport, and as such suggest that the model is not robust enough to offer any reassurance that it can be used or even that it will provide any greater degree of consistency. The model used appears to be a direct match to one developed for lakes and again this suggests that simpler fluvial and still water models have been imposed on the coast where water moves according to lunar cycles and air pressure, and is multi-directional over relatively short time-frames (i.e. each tidal cycle).</p>	<p><b>Report Amended</b></p> <p>The TraC-MimAS tool has been developed to provide regulators with a tool to assess risks to Ecological status. The tool has been developed by experienced geomorphologists and ecologists, as well as experienced FEPA regulators. The tool has also been peer reviewed. The trialling results have been very positive and indicate that the tool provides a good a reliable assessment of risk to status when compared with other available information, including professional judgement. The results of the trialling exercise indicate that the tool matches professional judgment in over 80% of cases tested.</p>
<p>With respect to maintenance dredging, capital dredging (inc. aggregate extraction), 'non-dredging alterations to bed level' and disposal of dredging, impact assessment is based entirely on the relative area of the water body</p>	<p><b>Report not amended</b></p> <p>See above comments on dredging.</p>

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<p>affected. The depth of sediment removed (absolute or relative to water column) or height of deposit is not considered. In practice, this aspect can be as important as (or more important than) the area of seabed affected and it would be helpful (though possibly difficult) if depth could be integrated into the calculations. Indeed in certain circumstances (such as dredging of sand for a beach recharge scheme) it may be more environmentally sensitive to remove a thin surficial layer from a mobile sand bed, over a wide area, than to create a deep pit over a much more limited area. This is despite the fact that the former would, through the approach and standards proposed in the report, be deemed to have high impact and the latter, low.</p>	
<p>In estuaries do the proposals take the estuary away from “most probable state”? This would need to caveat that the overall level of floodplain loss may be such that the estuary appears at or close to “most probable state” but has in actual fact lost most of its supra-tidal habitat and is therefore at poor ecological status already.</p> <p>On the open coast, key questions relate to the degree to which proposals impact upon sediment transport and sediment sources. Proposals that interrupt these processes have much wider knock-on effects and therefore they would need to be quantified.</p>	<p><b>Report not amended</b></p> <p>The tool assesses current loss of intertidal habitat, and this is reflected in the assessment of current conditions. The tool does not specifically assess supra-tidal habitat. However, the tool does consider the potential impact from embankments, which will be used as a surrogate for loss of supra-tidal habitat. The tool includes consideration of impacts to sediment transport process, longitudinal and lateral. Impact to these process are weighted to reflect the type and magnitude of the activity and the type of coastal environmental in which the work is occurring, e.g. exposed sedimentary environment.</p>
<p>The meaning of the <b>hydrodynamic zone</b> is not clear and should be <b>defined</b>.</p>	<p><b>Report amended (page 71 para 2)</b></p> <p>The following simple definition of the hydrodynamic zone has been added to the report and supporting technical document.</p> <p>Hydrodynamic features and processes relating to the movement of water, including tides, currents and freshwater mixing.</p>
<p>As indicated in the report, links between morphological alteration (in coastal / transitional environments) and ecological status are not well understood and the relationship between the two is indirect, not direct. Equally, there are <b>no environmental standards</b> that exist that can, already, be applied. We believe the proposals developed are a good first attempt to set appropriate standards and conditions. Crucially, however, we note that field trial and validation of the standards is to be undertaken during</p>	<p>Report amended to include a brief summary of the trialling results (page 61). A separate UKTAG technical report on field trialling will be placed on the UKTAG website).</p> <p>The planned field trialling has been completed and the tool has been subject to peer review. The trialling work compared professional judgement decisions of the ecological status of water bodies with outputs from the tools. The professional judgement decisions on each water body were collated from workshop discussions and independent assessments.</p> <p>The TraC-MImAS tool was tested on 26 water bodies in</p>



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<p>2007. Given the above limitations, we would view this (and revision of the approach or standards as necessary) as fundamental.</p>	<p>Northern Ireland and Scotland. Five status classes were assessed (high to bad). The tool was shown to agree with professional judgement in over 80% of cases. Where there were disagreements the tool was within one class boundary.</p> <p>These are very positive results and indicate that the tool provides a good signal of risk to ecological status from morphological alterations. The next phase in trialling will be to use biological data to empirically test/refine the tool.</p> <p>In the medium to long term, the aspiration is to incorporate information generated from WFD monitoring and from dedicated scientific research programmes. Effort in this area will focus on:</p> <ol style="list-style-type: none"> <li>(1) Reviewing and test the assumptions underpinning the Lake and TraC-MImAS tools;</li> <li>(2) Refining the tools to reflect new evidence on the interaction between morphology and ecology, including replacing expert judgment with empirical data where possible; and</li> <li>(3) Generating further scientific evidence on the links between morphological alterations and ecological status.</li> </ol> <p>Due to the limitations of the current biological tools, some of this work will not commence until the biological tools have been refined.</p>
<p>It is unclear how the morphological condition limits (limits of acceptable morphological change) might relate to the work that is currently being undertaken to develop and apply criteria for the designation of TraC <b>Heavily Modified Water Bodies</b> (which similarly needs to define acceptable limits). Table 15 of the MImAS consultation presents indicative limits for specific modifications (based on an assumption that they are the sole pressure in a water body). The table suggests that capital dredging over an area of 45% of an estuary might be insufficient to threaten good ecological status. This is a very large change and much larger than the risk thresholds that were used for the morphological pressure assessment in RBC1 in England and Wales. A lack of consistency between the two approaches must be avoided. Otherwise a situation could arise in which a water body is classified as Heavily Modified Water Bodies, but the morphological alterations are judged to be below the morphological condition limits for good ecological status (i.e. the water body should not be Heavily Modified Water Bodies).</p>	<p><b>Report not amended</b></p> <p>This was noted during the trialling work. The trialling work has resulted in a number of refinements being made to the tool. This has included changes to how dredging is assessed. The new single limit of dredging is around 20% which is consistent with the values used for the preliminary HMWB work.</p>
<p>A considerable volume of <b>research</b> into the morphology of estuaries has been undertaken as part of the joint Defra/EA Flood and Coastal Erosion Risk</p>	<p><b>Report not amended</b></p> <p>The steering group and panel was made up of experienced scientists (geomorphologists and ecologists). The sensitivity values and impact weightings have also</p>

Comments	Response
<p>Management Research Programme (See Annex 2 for reference).</p> <p>The relative significance placed on different types of morphological alterations within the MImAS tool is described as being based on expert judgement, but no references are provided to support these judgements. The morphological expertise on the Steering Group and Technical Panel is limited.</p>	<p>been subject to external peer review (details available on the UKTAG website).</p>
<p><b>Lake Hydromorphology</b></p> <p>While recognising that the risk <b>assessment tool</b> provides the regulator some flexibility it may still leave uncertainty for business. We are concerned about how this will be <b>applied</b> in practice in a consistent manner. This is another measure that may be impossible to characterise by an index. So much depend on what constitutes good ecological status in a particular locality. Is it the bird life, fish, flora, invertebrates? Also, in the case of artificially created or modified water bodies the greater good to society may be met by reservoir, recreational, or flood capacity use other than just ecology. Each case should be decided on its merits.</p>	<p><b>Report not amended</b></p> <p>The tool is intended to provide a more transparent approach to assessing morphological impacts. Thresholds are used to identify where ecological status could be impaired by new or existing morphological alterations. Where there is a risk the ecological status could be impaired, the agencies would use tests to determine whether an exemption is justified on the basis of human health, human safety or sustainable development. In the case of heavily modified or artificial waters, the agencies recognise that these environments can support important flora and fauna. The ecological target conditions for these environments will be based on the adoption of best practice and appropriate (i.e. technically and economically feasible) mitigation measures. These would be determined on a case by case basis.</p>
<p>The document does not seem to be clear on how creating a new lake would be dealt with under this regime? We believe that the wider <b>sustainability</b> object should apply. For example, with mineral extraction the possibility of sterilising mineral reserves would need to be balanced against a possible desire to restrict the depth of mineral workings to keep lakes shallow to provide better morphological and ecological status. Minerals can only be worked where they occur. The activity is transient and in working with the relevant bodies on restoration the industry can work towards delivering good ecological status sustainably.</p>	<p><b>Report not amended</b></p> <p>The principles discussed here are in agreement with UKTAG guidance. The environment agencies will always endeavour to balance the needs of water users and sustainable development with environment protection. The same principle would apply to the creation of new reservoirs. The Lake-MIMAS tool would have only a minor role in this type of assessment.</p>
<p>UKTAG should not assume that <b>restricted depth</b> is good in ecological terms - water bodies that are too shallow can suffer algal blooms, excessive temperatures, enhanced evaporation and eutrophication and a minimal diversity of fish life. We would argue that the more</p>	<p><b>Report amended</b></p> <p>The tool developers and UKTAG recognise the importance of a range of water depth. The Lake-MImAS is a risk assessment tool, and if there were site specific evidence that increased depth is of benefit to ecology or conservation objectives, this would be incorporated in any regulatory decisions. The updated Lake-MImAS tool</p>

Comments	Response
important feature of excavated lakes is a range of water depth in order to support the maximum biodiversity from reed fringed margins to deep cold water fish.	considers lake raising and lowering.

## ANNEX 1 - LIST OF RESPONDENTS

Submission	Organisation
5	Wessex Water
6	South West Rivers Association
7	APEM
8	Quarry Products Association
9	ABP
10	Thames Water
11	Scottish Natural Heritage
13	United Utilities
14	Severn Trent Water
15	Water UK
16	Environment Link ( <i>joint response from Wildlife and Countryside Link, Scottish Environment Link, Northern Ireland Environment Link and Wales Environment Link</i> )
17	Scottish Water
18	Mecoprop P Task Force
19	Yorkshire Water
20	Natural England
21	Scottish Whisky Association
22	Scottish Salmon Producers
23	Northern Ireland Freshwater Task Force
24	CIWEM
25	Gospall Fishing Club
27	Consumer Council for Water
29	Joint Environmental Programme
30	RSBP
31	WWF
33	Federation of Scottish Aquaculture
34	National Farmers Union
36	British Energy
37	Macaulay Institute
38	CEH

## ANNEX 2 - REFERENCES PROVIDED BY RESPONDENTS

Topic	References	ID
Temperature	Northern Ireland Blackwater TRACE project	23
Temperature	Durance I, Ormerod SJ (2007) Climate change effects on upland streams macroinvertebrates over a 25-year period. <i>Global Change Biology</i> , 13, 942-957.	16
Temperature	Kishi D, Murakami M, Nakano S, Maekawa K (2005) Water temperature determines strength of top-down control in a stream food web. <i>Freshwater Biology</i> , 50, 1315–1322.	16
Temperature	Lepori F, Palm D, Malmqvist B (2005) Effects of stream restoration on ecosystem functioning: detritus retentiveness and decomposition. <i>Journal of Applied Ecology</i> , 42, 228–238.	16
Temperature	Briers RA, Gee JHR, Geoghegan R (2004) Effects of the North Atlantic Oscillation on growth and phenology of stream insects. <i>Ecography</i> , 27, 811–817.	16
Temperature	Elliott JM, Humpesch UH, Macan TT (1988) Larvae of the British Ephemeroptera: a key with ecological notes. Scientific Publications of the Freshwater Biological Association No 49. Freshwater Biological Association, Ambleside	16
Temperature	Vannote RL, Sweeney BW (1980) Geographic analysis of thermal equilibria – a conceptual-model for evaluating the effect of natural and modified thermal regimes on aquatic insect communities. <i>American Naturalist</i> , 115, 667–695.	16
Temperature	Voelz NJ, Poff NL, Ward JV (1994) Differential effects of a brief thermal disturbance on caddisflies (Trichoptera) in a regulated river. <i>American Midland Naturalist</i> , 132, 173–182.	16
Temperature	Chadwick MA, Feminella JW (2001) Influence of salinity and temperature on the growth and production of a freshwater mayfly in the Lower Mobile River, Alabama. <i>Limnology and Oceanography</i> , 46, 532–542.	16
Temperature	Daufresne M, Roger MC, Capra H, Lamouroux N (2004) Long-term changes within the invertebrate and fish communities of the Upper Rhone River: effects of climatic factors. <i>Global Change Biology</i> , 10, 124–140.	16
Temperature	Mouthon J, Daufresne M (2006) Effects of the 2003 heatwave and climatic warming on mollusc communities of the Saone: a large lowland river and of its two main tributaries (France). <i>Global Change Biology</i> , 12, 441–449.	16
Temperature	Langford TE. and Ashton, RJ. (1972) The ecology of some British rivers in relation to warm water discharges from power stations. <i>Proc. Roy. Soc., Lond., B.</i> , 180, 407-419.	16

		Final
Topic	References	ID
Temperature	Markowski S. (1960) Observations on the Response of Some Benthonic Organisms to Power Station Cooling Water. <i>The Journal of Animal Ecology</i> , 29 (2), 349-357	16
Suspended Solids	APEM Scientific report 2007	16
Suspended Solids	Impacts of sedimentation, suspended solids and turbidity on fish <ul style="list-style-type: none"> <li>• (Greig et al., 2005)</li> <li>• (Turnpenny &amp; Williams, 1980) a conductimetric technique for measuring the water velocity in salmonid spawning beds. <i>Water res.</i> 16</li> <li>• Crisp (1996) Environmental requirements of common riverine European salmonid fish species in fresh water with particular reference to physical and chemical aspects. <i>Hydrobiologica</i>, 323</li> </ul>	16
Suspended Solids	See Environment link response for full references... Studies by Eriksson 1985, and Eriksson & Sundberg 1991 (Eriksson, M.O.G, 1985. Prey detectability for fish-eating birds in relation to fish density and water transparency. <i>Ornis Scand.</i> 16: 1-7; Eriksson, M.O.G & Sundberg, P, 1991.	30
Suspended Solids	Tsui, P. and McCart, P. (1981) Effects of stream-crossing by a pipeline on the benthic macro-invertebrate communities of a small mountain stream. <i>Hydrobiologia</i> , <b>79</b>	16
Suspended Solids	Gammon, J.R. (1970) The effect of inorganic sediment on stream biota. <i>Water Pollution Control Research Series</i> . Report No. 18050 DWC 12/70, U. S. Environmental Protection Agency, Government Printing Office, Washington DC.	16
Suspended Solids	Ryan P. (1991) Environmental effects of sediment in New Zealand streams: a review. <i>New Zealand Journal of Marine Freshwater Research</i> , 25: pp. 207 - 221.	16
Suspended Solids	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.	16
Nutrients	"Trophic and Organic Status of the Humber Estuary (2002)	15 & 19
Nutrients	The Impact of Land Use on Salmonids: A Study of the River Torridge Catchment (National Rivers Authority, R & D Report: 30)	16
Phosphorous in lakes	J. Hilton et al "Science of total environment" 365 (2006)	16
Impacts of managed flows	Marchetti & Moyle (2001) effects of flow regime on fish assemblages in a regulated California stream. <i>Ecological Applications</i> 11:	16
Impacts of managed flows	Loffler, 1990, Scullion et al. 1982, Armitage, 1978, Inverarity et al. 1983)	16

		Final
Topic	References	ID
Impacts of managed flows	Schlosser (1991) Stream fish ecology: A landscape perspective, BioScience 41	16
Managed Flows	Dutch guidelines on cooling water discharges to estuarine and coastal waters, English summary translations of which would seem to post-date this report. The origin of this is work sponsored by the NL's Commissie Integraal Waterbeheer (CIW)	36
Morphology	EMPHASYS Consortium. 2000. A Guide to Prediction of Morphological Change within Estuarine Systems. Version 1B. Research by the EMPHASYS Consortium for MAFF Project FD 1401. Report TR114. HR Wallingford, UK, December 2000.	9
Review of individual studies	MCPA Acid – Toxicity to duckweed <i>Lemna gibba</i> , J R Hoberg (1993), Springborn Laboratories, Inc. Report SLI 93-11-5052	18
Review of individual studies	MCPA: Toxicity to <i>Lemna minor</i> , S D Mattock (1998), Covance Laboratories Ltd. UK, Report 785/19-D2145	18
Review of individual studies	MCPA: Toxicity to Duckweed ( <i>Lemna gibba</i> ), Moore, K W and Huchings, M J (2000), AstraZeneca Brixham Environmental Laboratories Ltd. UK, report BL6837/B	18
Review of individual studies	MCPA-DMA salt – Toxicity to Duckweed <i>Lemna gibba</i> , J R Hoberg (1994), Springborn Laboratories, Inc. Report SLI 93-11-5046	18
Review of individual studies	MCPA DMAS: A 14 day toxicity test with duckweed ( <i>Lemna gibba</i> G3), Drottar, K R and Krueger, H O (1999), Wildlife International, Ltd. USA, Report 364A-103	18
Review of individual studies	MCPA-2EH Ester Technical - Toxicity to Duckweed, <i>Lemna gibba</i> , J R Hoberg, (1993), Springborn Laboratories, Inc. Report SLI 93-10-4976	18
Review of individual studies	MCPA (DMA salt): Higher plant ( <i>Lemna gibba</i> ) growth inhibition test. C A Jenkins (2006a) Huntingdon Life Sciences Ltd. Cambs. UK Report TFT 0006/062180	18
Review of individual studies	MCPA (DMA salt): Recovery of <i>Lemna gibba</i> following exposure to the test substance for three days. C A Jenkins (2006b) Huntingdon Life Sciences Ltd. Cambs. UK Report TFT 0008/062236	18

## ANNEX 3 – LIST OF CONTRIBUTORS TO THE SURFACE WATER STANDARDS PHASE 2 REPORT

**Review and development of temperature standards for marine and freshwater environments:**

- Jacobs

**Specialist contacted to feed back on the standards:**

- RWE Npower
- Freshwater Fisheries Laboratory
- University of Southampton

**Questionnaire sent to specialists from around the world to get their feedback on the standards:**

- National Marine Fisheries Service, USA
- Ruhrverband, Germany
- KEMA, Netherlands
- Institute for Water Ecology, Fisheries Lake Research, Austria
- Danish Environment Protection Agency
- Flemish Institute for Technological Research
- Swedish Environmental Protection Agency
- Finnish Environmental Institute
- Council for Scientific and Industrial Research, South Africa
- Aspen Environmental, Canada
- Ministry for the Environment, New Zealand
- Federal Office for the Environment, Switzerland
- VITO (Flemish Institute for Technological Research)
- NIWA, New Zealand
- Federal Office for the Environment, Switzerland

**These organisations formed an independent advisory panel of river specialists who provided direction, guidance, comments and intellectual stimulation through attendance at project workshops and written technical input for the Water Resources chapter:**

- International Fisheries Institute University of Hull (fish)
- Fisheries Research Service, Pitlochry (fish)
- Department of Geography, University of Loughborough (macro-invertebrates)
- Dr Robin Welcomme, Independent Consultant (fish)
- David Solomon, Independent Consultant (fish)
- Environment Agency (macro-invertebrates)
- Alconbury Consultants (macrophytes)
- Chris Binnie, Independent Consultant (dam engineering)
- SINTEF, Norway (hydrology)
- Department of Geography, University of Dundee (hydrology)
- Atlantic Salmon Trust (fish)
- ENTEC (water resources)
- CEH (hydrology macro-invertebrates, geomorphology and macrophytes)
- Wells Consulting
- Heriot-Watt University
- Napier University



Peer review of the proposed methods, principles and assumptions for the Morphology chapter. Specific technical guidance and expert judgment input at key project junctures:

- University of Dundee
- University of Leicester
- Trinity College Dublin
- USA EPA
- RIZA, Netherlands
- Metoc