

COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC)



POLICY SUMMARY

**to
Guidance Document No 10**

Rivers and Lakes – Typology, Reference Conditions and Classification Systems

Produced by Working Group 2.3 - REFCOND

Explanatory Note

This policy summary gives an overview of the REFCOND guidance document (WFD CIS guidance document No. 10) drafted by the Common Implementation Strategy (CIS) Working Group 2.3. The text has been derived directly from the text of the REFCOND guidance document with very minor rephrasing. The numbering of the sections in this policy summary is the same as in the guidance document. In this summary, you will find references to sections and annexes of the REFCOND guidance document.

Table of contents

- EXPLANATORY NOTE I**
- TABLE OF CONTENTS I**
- INTRODUCTION - A GUIDANCE DOCUMENT: WHAT FOR? 1**
 - TO WHOM IS THE GUIDANCE DOCUMENT ADDRESSED? 1
 - WHAT CAN YOU FIND IN THE GUIDANCE DOCUMENT? 1
 - WHAT YOU WILL NOT FIND IN THE GUIDANCE DOCUMENT 1
- SECTION 1. INTRODUCTION - IMPLEMENTING THE WFD..... 2**
- SECTION 2. COMMON UNDERSTANDING OF CONCEPTS AND TERMS 3**
 - 2.1 REFERENCE CONDITIONS AND HIGH ECOLOGICAL STATUS 3
 - 2.2 GOOD AND MODERATE ECOLOGICAL STATUS..... 3
 - 2.3. SURFACE WATER BODIES..... 4
 - 2.4 WETLANDS 4
 - 2.5. WATER BODY TYPES 4
 - 2.6 CLASSIFICATION OF ECOLOGICAL STATUS 5
- SECTION 3. A STEPWISE APPROACH FOR ESTABLISHING REFERENCE CONDITIONS AND ECOLOGICAL STATUS CLASS BOUNDARIES 7**
 - 3.2 ESTABLISH INFRASTRUCTURE..... 8
 - 3.3 DIFFERENTIATE WATER BODY TYPES..... 8
 - 3.4 USE OF PRESSURE CRITERIA AND ECOLOGICAL CRITERIA..... 8
 - 3.5 ESTABLISH TYPE SPECIFIC REFERENCE CONDITIONS 10
 - 3.6 VALIDATION OF REFERENCE CONDITIONS AND ECOLOGICAL CLASS BOUNDARIES 11
 - 3.7 ASSESS VARIABILITY IN REFERENCE CONDITIONS 11
 - 3.8 OPTIONS FOR SETTING CLASS BOUNDARIES 11

Introduction - A Guidance Document: What For?

The REFCOND guidance document (WFD CIS guidance document No. 10) aims at guiding experts and stakeholders in the implementation of the WFD 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive – WFD). It focuses on the implementation of the Annexes II and V with special emphasis on inland surface waters and definitions, methods and principles for the establishment of reference conditions and ecological status class boundaries between high, good and moderate ecological status.

To whom is the Guidance Document addressed?

The guidance document is addressed to:

- Administrative bodies responsible for the ecological status analysis or stakeholders participating in the analysis;
- Experts undertaking the ecological status analysis;
- Persons leading and managing experts undertaking the ecological status analysis;
- Persons using the results of the ecological status analysis for taking part to the policy making process.

What can you find in the Guidance Document?

- Key elements of the REFCOND guidance document within the implementation timetable of the WFD (Section 1);
- Common understanding of concepts and terms relating to reference conditions and ecological status classes (Section 2);
- General guidance on the stepwise approach for establishing reference conditions and ecological status class boundaries (Section 3);
- Specific tools for establishing reference conditions and ecological status class boundaries (Section 4).

It should be pointed out, that the REFCOND guidance does not provide solutions in detail that may be copied and applied as such. Rather, it offers principles, ways of reasoning and suggestions on alternative pathways of action. It is up to Member States themselves to implement these principles and suggestions under their own circumstances and to be able to verify that the solutions meet the requirements of the WFD. Harmonization between Member States will be achieved through intercalibration (which is described in a separate guidance document) and participation in the work in Pilot River Basins and International River Basin Districts.

What you will not find in the guidance document

The document does not include guidance for specific quality elements or specific water body types but is restricted to general guidance that applies to most quality elements and most inland surface water body types. Groundwater, transitional water and coastal water are not considered in the document. Other issues not considered are classification of poor and bad ecological status, classification of chemical status, method standardisation and intercalibration.

Section 1. Introduction - Implementing the WFD

Guidance on the establishment of reference conditions and class boundaries are needed at several stages in the implementation of the WFD (Figure 1). They will first be needed for the selection of sites for the draft intercalibration register (completed December 2003) and for the selection of sites for the final intercalibration register (completed December 2004). More specifically, methods/tools for selecting minimally disturbed sites (on the high/good boundary) and slightly disturbed sites (on the good/moderate boundary) representative of selected water body types will be needed. The actual intercalibration exercise should be completed 18 months after the final register of sites has been established (described in WFD CIS guidance document No 6 on intercalibration).

The analysis of characteristics of River Basin Districts and the assessment of the risk for individual water bodies of failing the environmental objectives in accordance with Article 5 and Annex II in the WFD will also require guidance on reference conditions and classification. This analysis should be completed at the latest in December 2004.

According to Article 8 of the WFD monitoring programmes shall be operational at the latest in December 2006. The REFCOND guidance document will here be needed for the specification of the monitoring requirements of reference sites (high status sites) and assessing ecological status of all monitoring sites.

Finally, the REFCOND guidance document will be needed when producing the first River Basin Management Plans which should be published at the latest in December 2009. In these plans type-specific reference conditions shall be listed together with map presentations on ecological status classifications for surface waters. No definitions are given in the WFD for poor and bad ecological status. These quality classes will have to be defined for different quality elements by each Member State.

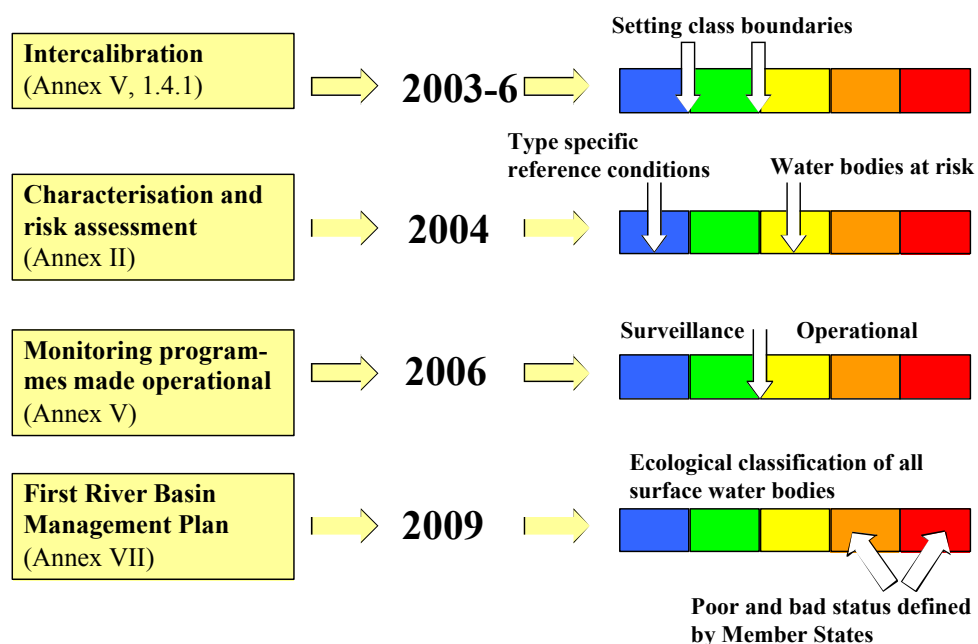


Figure 1. Timetable for implementation of parts of the Water Framework WFD which are depending on guidance from WG 2.3 REFCOND.

Section 2. Common understanding of concepts and terms

2.1 Reference conditions and high ecological status

The following conclusions and recommendations can be given based on relevant parts the WFD pertaining to reference conditions and high ecological status¹:

- Reference conditions (RC) do not equate necessarily to totally undisturbed, pristine conditions. They include very minor disturbance which means that human pressure is allowed as long as there are no or only very minor ecological effects;
- RC equal high ecological status, i.e. no or only very minor evidence of disturbance for each of the general physico-chemical, hydromorphological and biological quality elements;
- RC shall be represented by values of the relevant biological quality elements in classification of ecological status;
- RC can be a state in the present or in the past;
- RC shall be established for each water body type;
- RC require that specific synthetic pollutants have concentrations close to zero or at least below the limits of detection of the most advanced analytical techniques in general use²;
- RC require that specific non-synthetic pollutants have concentrations remaining within the range normally associated with undisturbed conditions (background values)³;

2.2 Good and moderate ecological status

Based on relevant parts the WFD⁴ the following criteria should be met for any surface water body type in **good ecological status**:

- The values of the biological quality elements show slight deviation from reference conditions (low levels of distortion resulting from human activity);
- The levels of the general physico-chemical quality elements do not exceed the range ensuring ecosystem functioning and the achievement of the values associated to biological quality elements at good status;
- Concentrations of specific synthetic and non-synthetic pollutants are not in excess of environmental quality standards (EQS) established in accordance with Annex V 1.2.6. or under relevant Community legislation.

Based on relevant parts the WFD⁵ the following criteria should be met for any surface water body type in **moderate ecological status**:

- The values of the biological quality elements show moderate deviation from reference conditions (moderate signs of distortion resulting from human activity);
- Conditions consistent with the achievement of values for the biological quality elements and significantly more disturbed than under conditions of good status.

¹ Annex II, 1.3 ; Annex V, 1.2.

² Examples on how to select the specific pollutants that are relevant to a particular water body are described in the guidance document from Working Group 2.1 (IMPRESS).

³ See previous footnote.

⁴ Annex V, 1.2.

⁵ Annex V, 1.2.

2.3. Surface water bodies

Based on relevant parts of the WFD⁶ and the horizontal guidance document on water bodies the following conclusions and recommendations can be given:

- “Surface water bodies” must not overlap with each other;
- A surface water body must not cross the boundaries between surface water body types;
- Physical features (geographical or hydromorphological) that are likely to be significant in relation to the objectives of the WFD should be used to identify discrete elements of surface water;
- A lake or reservoir will normally be identified as one water body. However, where different reference conditions apply within a lake due to morphological complexity (e.g. sub-basins), the lake must be sub-divided into separate water bodies. Furthermore, where there are significant differences in status in different parts of a lake, the lake must be sub-divided into separate water bodies to achieve the desired environmental outcome in the most cost effective way;
- A whole river, stream or canal can be a “water body”. However, where different reference conditions apply within a river stream or canal, it must be sub-divided into separate water bodies. Furthermore, where there are significant differences in status in different parts of a river, stream or canal, it must be sub-divided into separate water bodies to achieve the desired environmental outcome in the most cost effective way;
- The lower size limit of surface water bodies may be set lower than the ones prescribed in typology system A (described in Annex II of the WFD) in certain cases, i.e. if Member States decide that certain smaller water bodies are significant and require separate identification. This is of specific ecological relevance for lakes.

2.4 Wetlands

The WFD does not set environmental objectives for wetlands. However, wetlands that are dependent on groundwater bodies, form part of a surface water body, or are Protected Areas, will benefit from WFD obligations to protect and restore the status of water⁷. Relevant definitions are developed in WFD CIS guidance document No. 2 - Water Bodies and further considered in guidance on wetlands (currently in preparation).

2.5. Water body types

The WFD requires that Member States differentiate the relevant surface water bodies with respect to type and that Member States establish reference conditions for these types. The main purpose of typology is consequently to enable type specific reference conditions to be defined which in turn is used as the anchor of the classification system. The following conclusions and recommendations may be given relative to specific issues concerning types:

- Water body types may be differentiated using “System A” or “System B”;
- The two systems are similar in that they contain the same obligatory factors: Geographic position, altitude, geology, size and (for lakes) depth;
- Optional factors of System B can be used as desired by Member States and can be complemented with factors other than those mentioned in the WFD;

⁶ Article 2, point 10.

⁷ Article 1.

- The WFD’s descriptors of geology (in System A) refer to the dominating character (calcareous, silicious, etc.), expected to have the strongest influence on ecological quality of the water body;
- The WFD’s requirement that Member State must achieve the same degree of differentiation with System B as with System A is interpreted to mean that if System B is used, it should result in no greater degree of variability in type specific reference conditions than if System A had been used. Hence, if a lower number of types, using System B, results in equally low or lower variability of reference conditions values as would be given by System A, this would be acceptable;
- Water body specific reference conditions, within a range of values for the type as a whole, may be used in order to cope with natural variability within types.⁸

2.6 Classification of ecological status

The relative roles of biological, hydromorphological and physico-chemical quality elements in status classification are presented in Figure 2.

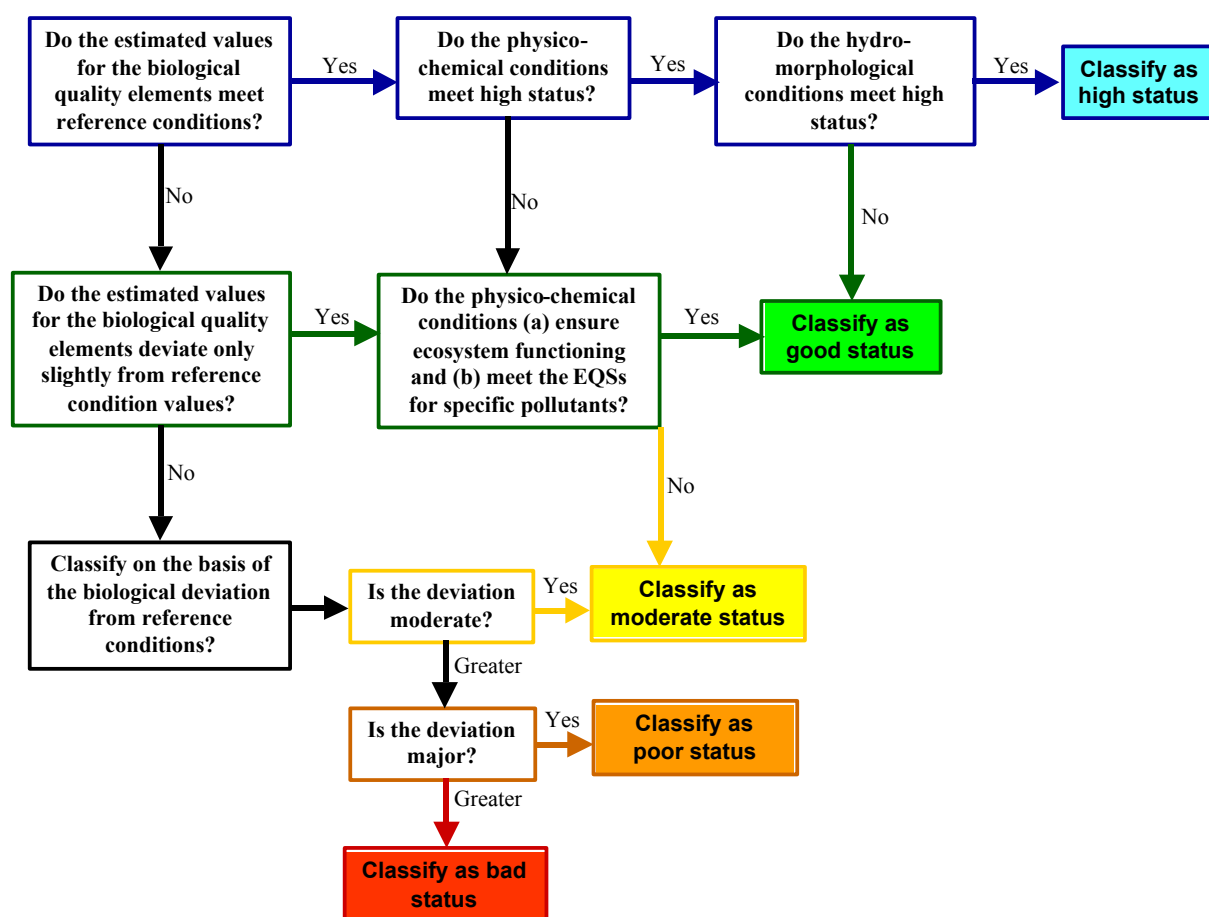


Figure 2. Indication of the relative roles of biological, hydromorphological and physico-chemical quality elements in ecological status classification according the normative definitions in Annex V:1.2.

⁸ It should be stressed that the WFD only requires type specific reference conditions to be established and that water body specific reference conditions only should be regarded as a complementary approach.

Based on relevant parts of the WFD⁹ the following conclusions and recommendations regarding classification of ecological status can be given:

- The normative definitions of the WFD (Annex V, Table 1.2) provide the basis for classifying surface waters according to their ecological status and each Member State must develop classification systems that conform to these status definitions;
- Biological as well as supporting hydromorphological and physico-chemical quality elements are to be used by Member States in the assessment of ecological status (relative roles illustrated in Figure 2);
- Ecological status classifications should be made on the basis of the relevant biological and physico-chemical results, and classification should be made using quality elements and not parameters;
- The ecological status is represented by the lower of the values for the biological and physico-chemical monitoring results for the relevant quality elements. The practical implementation is to be developed within the work programme of the Common Implementation Strategy during 2003;
- Classification of ecological status is to be based on ecological quality ratios, which are derived from biological quality values as illustrated in Figure 3, and on the Member States assessments of ecological quality for physico-chemical quality elements;
- No EQR scheme is envisaged in the WFD for classification of ecological status based on physico-chemical monitoring results. Member States will apply their own methods/tools for assessing ecological quality for these quality elements (see above);
- No definitions are given in the WFD for physico-chemical or hydromorphological quality elements in poor and bad status;
- All Issues relating to how to use physico-chemical quality elements for classification of ecological status will be further developed within the work programme of the Common Implementation Strategy during 2003.

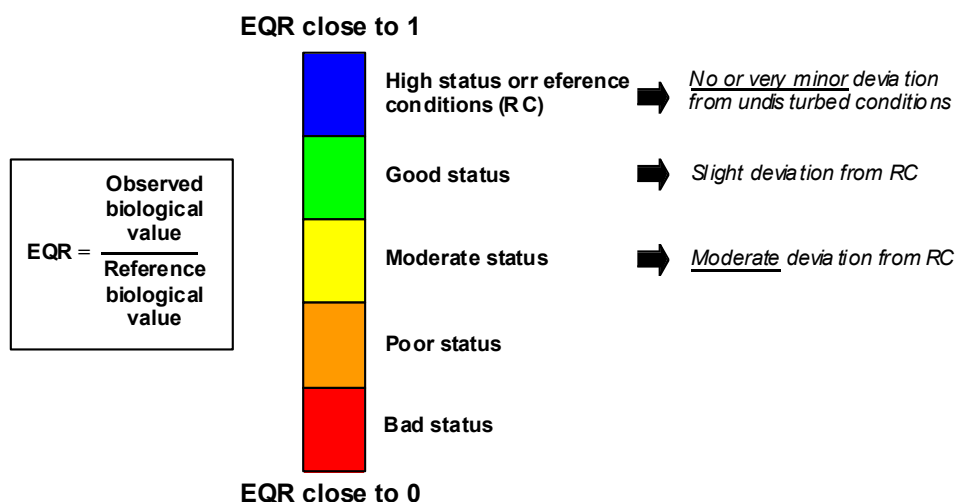


Figure 3. Basic principles for classification of ecological status based on Ecological Quality Ratios.

⁹ Article 2 ; Annex V, 1.2 ; Annex V, 1.4.1 ; Article V, 1.4.2.

Section 3. A stepwise approach for establishing reference conditions and ecological status class boundaries

Figure 4 schematically shows a number of steps that may be taken to establish reference conditions and ecological class boundaries. The different steps in the approach outlined in Figure 4 are described in the following sub-sections of Section 3.

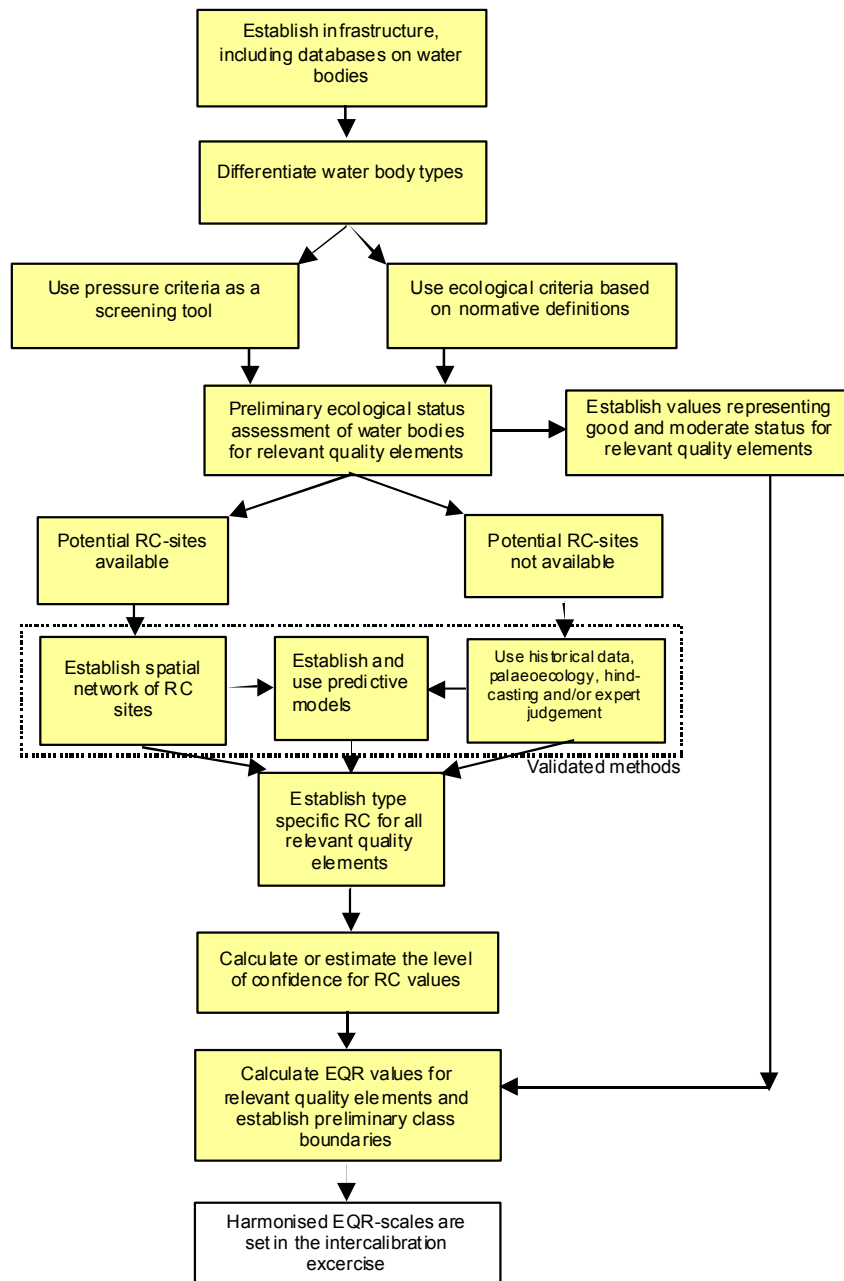


Figure 4. Flow-chart of the suggested step-by-step approach for establishing reference conditions and boundaries between high, good and moderate ecological status classes (RC=reference conditions, EQR=Ecological Quality Ratio).

3.2 Establish infrastructure

Paramount to the implementation of the WFD is an infrastructure at the national as well as the water district level consisting of expertise, databases, assessment methods, models and other tools and organisational structure.

Databases are needed for the identification of relevant water bodies and characterisation of relevant pressures and ecological status, and subsequently for unconstrained implementation of the WFD. State variables would be those required in the WFD for characterisation and classification of water bodies plus optional variables suggested in the WFD or other variables preferred by Member States. Pressure variables would include measures of land-use, point source discharges, hydromorphological alterations, etc.

Assessment methods, models and other tools should include (i) models for determining point-source and diffuse loadings of nutrients, metals and other substances, (ii) methods for determining biological state variables, and (iii) GIS applications.

The *organisational structure*, finally, will vary depending on the circumstances in Member States, and in many cases it will require a great effort of co-ordination among responsible authorities and stakeholders.

3.3 Differentiate water body types

Unlike the WFD CIS Guidance Document No. 5 on transitional and coastal waters no common European typology system is proposed for inland surface waters. Member States sharing the same (eco)region may, however, initiate activities to harmonise typology for inland surface waters on the most appropriate (eco)regional scale as soon as possible or latest in early 2003. This harmonisation should at least cover the types selected to be included in intercalibration and will help in the selection of sites to be included in the draft register for intercalibration network during 2003. The suggested procedure and timetable for the development of (eco)region specific surface water body typologies to be used for selection of types and sites to be included in the intercalibration exercise is further outlined in Annex F of the guidance document.

3.4 Use of pressure criteria and ecological criteria

It follows from the WFD that ecological criteria are the definitive test of high ecological status¹⁰. However, the use of both ecological and pressure criteria may be the most efficient way for screening of potential reference sites or values or needed to aid in at least a preliminary assessment of status of waters. Indeed, to establish reference conditions it could be most cost-effective to start with pressure criteria, because the reference community is defined as the biological community expected to occur where there is no or only very minor anthropogenic disturbance. In other words, to avoid circularity, pressure criteria may be used conveniently to screen for sites or values representing potential reference conditions. Once identified, biological elements should be used to corroborate this ecological high status.

Figure 5 shows how ecological and pressure criteria may be used (i) for determining potential reference sites or values and setting class boundaries between high and good

¹⁰ Annex V, 1.2.

ecological status, (ii) for determining potential sites for the intercalibration network, and (iii) for identifying bodies at risk of failing to achieve the WFD’s objectives.

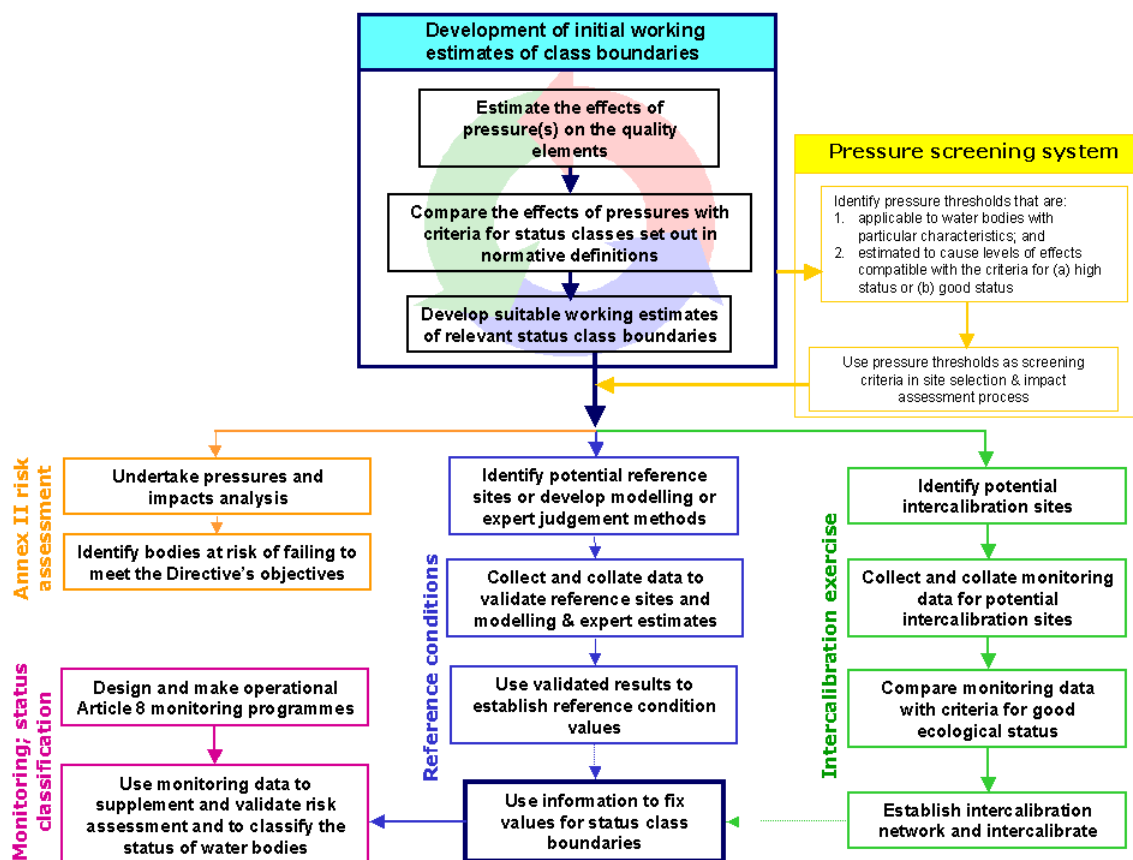


Figure 5. The respective roles of pressure criteria and ecological criteria in identifying status classes.

3.4.1 Setting a benchmark for very minor alterations

The following benchmark for high ecological status or reference conditions is suggested:

- High status or reference conditions is a state in the present or in the past corresponding to very low pressure, without the effects of major industrialisation, urbanisation and intensification of agriculture, and with only very minor modification of physico-chemistry, hydromorphology and biology.

This implies that there should be no fixed temporal and spatial benchmark but raises the problem of not knowing what we are accepting as the degree of change in an anthropogenic pressure that is incorporated into the concept of reference condition.

3.4.2 Use pressure criteria as a screening tool

To facilitate the assessments of status classes, the basic process outlined in Figure 5 can be used to identify generic pressure thresholds (or criteria), which, for any water bodies with a specified set of characteristics, would be expected to result in effects that are compatible with a particular status class. These thresholds can then be used to help screen water bodies in order to identify potential reference sites or values, intercalibration sites or bodies that can be confidently identified as not at risk or at risk of failing to achieve their objectives. Critical loads for acid deposition are an example of such thresholds, although the ecological effects

they reflect need to be validated with the criteria relevant to the boundary between good and moderate ecological status.

Tool no 1 in the Toolbox section in the REFCOND guidance suggests a set of criteria which elaborate on the degree of acceptable change in an anthropogenic pressure, that would provide the limits of reference condition sites or values and, hence, be used as a screening tool. Different water body types will respond differently to one and the same pressure. The proposed pressure screening criteria should therefore be regarded as illustrating concepts and principles to be used for developing water body type specific pressure screening criteria. A prerequisite for the use of pressure screening criteria is that the relationship between pressure-state-impact is established and that the state corresponds to the normative definitions in the WFD¹¹.

3.4.3. Use ecological criteria based on normative definitions

Although the normative definitions¹² must be used as the firm basis for establishment of classification systems by Member States, it is considered useful to provide some further practical guidance on how such definitions can be developed into more quality element specific descriptions of expected ecological conditions at high, good and moderate status. An indicative approach has been provided for the biological quality elements as interim guidance (Tool 2 in the Toolbox section of the REFCOND guidance) but it should be noted that this approach may not be suitable for all types and all pressures. Certain pressures may induce specific needs for ecological status assessment and the choice of parameters may need adjustment according to type and also to prevailing monitoring systems.

3.5 Establish type specific reference conditions

According to the WFD reference conditions need to be established for water body types and quality elements which in turn are represented by parameters indicative of the status of the quality elements. The basis for the identification of reference conditions is given in Annex II, 1.3 in the WFD. Without any specific ranking of the methods the main options for establishing reference conditions are:

- Spatially based reference conditions using data from monitoring sites;
- Reference conditions based on predictive modelling;
- Temporally based reference conditions using either historical data or paleoreconstruction or a combination of both;
- A combination of the above approaches.

And where it is not possible to use these methods, reference conditions can be established with expert judgement.

A short description of a number of methods commonly used to ascertain reference conditions is given in the REFCOND guidance including a description of strengths and weaknesses with different methods. It should be noted that establishing reference conditions for many quality elements may involve using more than one of the methods described.

¹¹ Annex V: 1.2

¹² Annex V: 1.2

3.6 Validation of reference conditions and ecological class boundaries

Since different methods used to establish reference conditions most likely have different inherent errors, some form of validation procedure needs to be performed. The main issue is to determine whether the reference values obtained can be used to achieve robust classifications of ecological status. As part of the decision-making process, it is important to document how the values representing reference conditions and ecological quality class boundaries have been established. Likewise, the steps taken to validate reference and class boundaries need to be documented in detail.

To minimise risk of circularity in establishing reference conditions, ideally mainly physico-chemical, hydromorphological and pressure criteria (i.e. community driving forces) should be used in a first step. Inclusion of biological quality elements in this first step of screening for potential reference sites or values may introduce bias (e.g. different persons/experts may have different perceptions of what reference conditions represents) and circularity (i.e. use of the same variable to delineate and validate reference condition).

3.7 Assess variability in reference conditions

The WFD requires a “sufficient level of confidence about the values for the reference conditions” regardless of which method is used for establishing reference conditions¹³. Adequate confidence and precision in the classification of the quality elements is another statistical requirement mentioned in the WFD¹⁴.

Neither “sufficient level of confidence about the values for the reference conditions” nor “adequate confidence and precision in the classification” is specified in statistical terms in the WFD. It is, consequently, up to the Member States to decide about this definition, taking into account the natural spatial and temporal variability for different quality elements together with errors associated with sampling and analysis.

The reference value for each indicator should be identified, including an estimate of the variance associated with it. The variance should be estimated so that a decision can be taken as to whether the indicator can be used to achieve reliable classification. If the variance is too high, reliable classification will not be possible and the indicator should not be used. One reason for excluding a specific quality element from assessment of ecological status is that the natural variability is too large. This would mean that the natural variability is too high for all relevant quality element indicators.

3.8 Options for setting class boundaries

If the above steps in the suggested approach for establishing reference conditions and class boundaries have been followed one should have derived a set of values representing high, good and moderate ecological status. In order to normalise the values on a common scale Ecological Quality Ratios (EQR) should be calculated as ratios between observed biological values and the reference values. Alternative ways of setting class boundaries may then be used depending on e.g. the availability to data from sites or historical records corresponding to ecological criteria for different quality classes. It should be noted, that whereas Member States may set their own class boundaries, harmonisation into a common scale of EQR values for comparison within Europe will be achieved through the intercalibration exercise. Furthermore, class boundaries will have to be developed for each quality element indicator.

¹³ Annex II, 1.3

¹⁴ Annex V, 1.3

In the first step a suitable summary statistic (e.g. median value or arithmetic mean) of the values pertaining to reference conditions or high status – the reference value – is selected¹⁵. With access to sufficient data from potential reference condition sites or historical records a suitable statistic (e.g. 10th percentile) among the EQR values arrived may be used to represent the boundary between high and good ecological status. This procedure may then be repeated for values pertaining to good status in order to set the boundary between good and moderate ecological status. With scarce access to data from sites or historical records corresponding to ecological quality criteria expert judgement may be used in an iterative process where the boundaries are compared with the ecological quality criteria given by the normative definitions. As a last resort, when no expert judgement of where the quality class boundaries should be set can be made, a statistical distribution approach may be used.

¹⁵ The mean or median value from the distribution of reference site values are considered the most robust values to be used as the reference value in classification of ecological status (relatively few data/sites needed for sufficient confidence in RC).