

Water Framework Directive Intercalibration Exercise

Northern Geographical Intercalibration Group (NGIG)

Reference Conditions Working Definitions and Thresholds for Selection of Reference Sites.

Version 9 – 9 June 2006

Background

This document was developed at the NGIG Edinburgh Feb 2006 and at the Dublin NGIG River meeting 26-28 April 2006 with representatives from SE, NO, FI, UK and IE and subsequently refined by email discussion to its current Version 9 which encapsulates the decisions made in selecting reference sites for inclusion in the NGIG intercalibration.

Use of Reference Conditions Definitions and Thresholds

The tables below provide threshold values by which sites can be selected as representative of ‘reference conditions’ (See Table 1 and Table 2 below) and guidance to assist in agreeing the H/G and G/M boundaries and status classes for WFD purposes (Table 3).

In applying the thresholds it was not deemed necessary for each MS to have data for each catchment pressure or characteristic defined nor for each physico-chemical determinand or biological element. A range of pressures and determinands are provided with a view to allowing Member States to pick those that are relevant within any given country – e.g. some countries measure total P in rivers whereas others measure various ortho-phosphate fractions instead and some countries do not measure BOD or oxygen levels routinely. Where datasets for the threshold criteria listed are available, however, a site must be within the threshold values in order to be accepted as a reference site and when the required datasets are readily available they should be used. In applying this overall approach it is assumed that in cases where only partial datasets are available the overall coherence between the various pressures and state descriptors describing reference conditions will still result in a reliable selection of sites.

Sites selected may then be used to anchor or ‘normalise’ the metrics used to describe the biological communities or indeed other supporting elements using e.g. the ICMi approach in which the calculated metrics are divided by the metric calculated for the reference sites. Typically the median of the available reference sites within a water body type will be used to calculate the EQR value for individual metrics.

If reference sites are not found or insufficient to provide a reasonable statistic, then other means of judging reference conditions should be sought. It is not permissible to use sites which are clearly polluted or significantly departed from reference conditions and their normative definitions if it is clear that the REFCOND and NGIG guidelines are being breached. Typical approaches to finding reference sites might include use of sites from

other river types or using expert judgement to estimate the metric values which are likely to be achieved at true reference conditions bearing in mind results from those water bodies where reference conditions are being achieved. Comparisons of site metrics with corresponding physico-chemical data such as BOD, ammonia, phosphate, nitrate and dissolved oxygen can provide useful guidance for estimating the degree of departure from reference conditions. Nutrients and organic pollutants are less likely to vary from one river or lake type and from one eco-region to another at reference condition. Research on background nutrient concentrations for example suggests that at reference conditions truly background values are very low (e.g. OSPARCOM assessments for ‘background’ reference concentrations used in source apportionment of nutrients in catchments).

Table 1 is based on the CIS REFCOND guidance document and includes the original REFCOND text. It is assumed that all the original REFCOND guidance will be met by any site proposed as a reference site. The guidance is somewhat vague in places, however, and the approach of using maximum thresholds is taken in order to simplify the screening of sites. These thresholds are found in the ‘NGIG Definitions’ column.

Table 2 includes water chemistry threshold values for screening reference conditions sites. It also contains descriptors of expected conditions at reference sites in terms of beneficial uses and, for example, fish populations.

Table 1. Proposed Conditions for Reference Conditions Sites to be included in extended intercalibration of rivers for benchmarking EQRs used in comparing Member State status assessment systems. See Table 2 for physico-chemical thresholds and Table 3 for extended descriptions of the general characteristics associated with the five status classes.

	REFCOND-Guidance	NGIG Definitions
General statement	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.	<ul style="list-style-type: none"> 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, forestry, aquaculture and with only very minor modification of physico-chemistry, hydromorphology and biology. Upstream river should not be in the 'at risk' category in the relevant national Article 5 Characterisation Report.
Diffuse source pollution	NGIG Definitions	Countries using this criterion
Land-use intensification: Agriculture, forestry	<p>Pre-intensive agriculture or impacts compatible with pressures pre-dating any recent land-use intensification. Pressures pre-dating any recent intensification in airborne inputs that could lead to water acidification.</p> <p>Agriculture and Forestry: Agriculture and forestry in catchment upstream of reference sites of low intensity. Maximum percentage area for screening sites with respect to land cover in catchment upstream of a point at which reference conditions are believed to exist is as follows using CORINE terminology: (Figures are tentative and may vary from region to region. In larger reference catchments proximity of pressure to the proposed reference site may be taken into account. Where CORINE datasets are not available similar land use cover data may be used.)</p> <p>Agriculture CORINE Landcover Code – Max % of upstream Catchment CLC21 - Including Arable/Ploughed land – less than 2 – 10 % CLC23 – Pastures (may include rough grazing and extensive low intensity pastures)- less than 30% CLC22+ CLC24 – Permanent Crops and Other Agriculture – less than 15% Forestry (Forestry requires knowledge of management within catchment) CORINE Landcover Code – Max % of upstream Catchment CLC31 – Forestry - clear-felled area within last 5 years - < 5% CLC31 – Forestry - planted area within last 5 years - < 5%</p> <p>Diffuse Urban Pressures: Urban areas should be minimal in the catchments upstream of reference sites CORINE Landcover Code – Max % of upstream Catchment CLC1 – <0.8% of catchment (close to zero)</p>	<p>Agriculture: IE, UK, FI SE, NO</p> <p>Forestry: IE, UK some site by site screening, FI SE</p> <p>URBAN: IE, UK, NO, FI, SE</p>

Table 1. (contd) Proposed Conditions for Reference Conditions Sites to be included in extended intercalibration of rivers for benchmarking EQRs used in comparing Member State status assessment systems. See Table 2 for physico-chemical thresholds and Table 3 for extended descriptions of the general characteristics associated with the five status classes.

Point source pollution		NGIG Definitions	Countries Screening by this Criterion
Specific synthetic pollutants	Pressures resulting in concentrations close to zero or at least below the limits of detection of the most advanced analytical techniques in general use (A Selection process for relevant pollutants in a river basin is presented as an example of best practice in section 6 of the guidance document from Working Group 2.1, IMPRESS).	<ul style="list-style-type: none"> Pressures resulting in concentrations close to zero or below the limits of detection in water of the analytical techniques in general use. Concentrations should be below the NEC level or established national EQS values where available. No significant point sources. Airborne pollutants in water at background concentration. 	<p>SSP: National EQS values have not yet been set. Data availability is a problem generally at likely reference sites.</p> <p>Point Sources: IE, UK, NO, FI, SE</p> <p>Airborne Pollutants: Acidification – NO, SE, UK, IE Airborne metals: NO</p>
Spec. non-synthetic pollutants	Natural background level/load (see reference above)	<ul style="list-style-type: none"> At natural background concentrations or below EQS where available. 	SNSP: National EQS values have not yet been set. Data availability is a problem generally at likely reference sites.
Other effluents/discharges	No or very local discharges with only very minor ecological effects.	<ul style="list-style-type: none"> No or very local discharges with only very minor ecological effects. No effects from IPPC controlled industrial plants No other major discharges controlled by other statutory pollution control licences 	IE, UK, NO, FI, SE
Morphological alterations			
River morphology	Level of direct morphological alteration, e.g. artificial instream and bank structures, river profiles, and lateral connectivity compatible with ecosystem adaptation and recovery to a level of biodiversity and ecological functioning equivalent to unmodified, natural water bodies	Level of direct morphological alteration, e.g. artificial instream and bank structures, river profiles, and lateral connectivity compatible with ecosystem adaptation and recovery to a level of biodiversity and ecological functioning equivalent to unmodified, natural water bodies. No major dams or control structures upstream of reference condition site. The river should not have been subject to any arterial drainage schemes that affect lateral connectivity or cause changes in the natural time of residence. River substratum should be appropriate to the catchment geology and river slope at the point of substratum	IE, UK, NO, FI, SE

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		assessment.	
Water abstraction	REFCOND	NGIG Definition	Countries applying this criterion
water abstraction	Levels of abstraction resulting in only very minor reductions in flow levels or lake level changes having no more than very minor effects on the quality elements.	<ul style="list-style-type: none"> Abstraction of water from the river upstream of a site regarded as being at reference condition should not reduce the 95 percentile discharge flow (m³/s) by more than 10%. (The 95 percentile flow or discharge is that which is exceeded 95% of the time over the hydrological year). 	UK, IE, NO, SE
Flow regulation			
River flow regulation	Levels of regulation resulting in only very minor reductions in flow levels or lake level changes having no more than very minor effects on the quality elements.	<ul style="list-style-type: none"> Levels of regulation resulting in only very minor reductions in flow levels having no more than very minor effects on the quality elements. As a guideline low flow alteration should be less than 20% of monthly minimum flow. There should be no major dams or control structures upstream of the reference condition site. Dams located downstream should not affect the flow regime at the reference site and should not impede the passage of migratory fish. 	NO, IE, UK, FI, SE
Riparian zone vegetation			
	Having adjacent natural vegetation appropriate to the type and geographical location of the river.	<ul style="list-style-type: none"> Having adjacent natural vegetation appropriate to the type and geographical location of the river. 	UK, SE
Biological pressures			
Introductions of alien species	Introductions compatible with very minor impairment of the indigenous biota by introduction of fish, crustacea, mussels or any other kind of plants and animals. No impairment by invasive plant or animal species.	<ul style="list-style-type: none"> Introductions compatible with very minor impairment of the indigenous biota by introduction of fish, crustacea, mussels or any other kind of plants and animals. No impairment by invasive plant or animal species. No recent introductions (<15 years) that are still causing major ecological changes within a river ecosystem. 	NO, IE, UK, FI, SE

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Fisheries and aquaculture	Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends. Stocking of non indigenous fish should not significantly affect the structure and functioning of the ecosystem.. No impact from fish farming.	<ul style="list-style-type: none"> There should be no commercial fishing operations or fish farming which affects the biological quality elements or water quality of the river system. No significant stocking of non-native species or stocking of 'put and take' fish for angling purposes. 	IE, NO, FI, UK, SE
Biomanipulation	No biomanipulation.	<ul style="list-style-type: none"> No biomanipulation or liming of the system in response to acidity pressures. 	NO, IE, UK, FI SE
Other pressures			
Recreation uses	No intensive use of reference sites for recreation purposes (no intensive camping, swimming, boating, etc.)	<ul style="list-style-type: none"> No intensive use of reference sites for recreation purposes (camping, swimming, boating, etc.) causing physical, chemical or biological disturbance 	NO,

Table 2. Further Guidelines Physico-chemical Characteristics and General Characteristics of Reference River Sites. Physico-chemical values to be regarded as maximum threshold values for screening reference sites. Values are tentative and may vary from region to region and according to the national typologies.

Quality of Characteristic	Element	Concentration or Descriptor at Reference	Countries Using this Criterion.
Pollution Status		Pristine, Unpolluted	ALL
Organic Load	Waste	No Observed Effect	ALL
Nutrient Loads		Background	
90%ile B.O.D.		< 2.7 mg/l	IE, UK
Mean BOD		<1.6	IE, UK,
Dissolved Oxygen		Close to 100% (>80% and < 120% saturation at all times)	UK, IE, FI
95%ile Non-ionised Ammonia (mg/l N)		Compliant with the Freshwater Fish Directive National Regulations	IE, UK, FI, SE
Annual Mean total Ammonium (mg/l N)		Compliant with the Freshwater Fish Directive National Regulations for total ammonium	IE, UK, FI, SE
95%ile ammonium (mg N/l)	Total	<0.04 mg/l	IE, UK, FI, SE
Annual ortho-Phosphate	Median	<0.015 mg P/l	IE, UK
Annual ortho-Phosphate	Mean	<0.03 mg P/l	IE, UK
Annual mean total P		R-N1 < 20 ug/l R-N3 < 30ug/l R-N4 < 18 ug/l R-N5 <18 ug/l	NO, SE, FI,
Annual Nitrate (mg N/l)	Mean	< 1.6 mg N/l	SE, IE, UK, FI,NO
Annual Total N (mgN/l)	Mean	<<<<1.8 mg N/l	FI, NO, SE,
Anthropogenic Siltation		None	
'Sewage Fungus'		Never	
Impact of Anthropogenic Acidity		None	
Toxic Substances	Priority	Concentrations close to zero or below the limits of detection in water of the analytical techniques in general use. Concentrations should be below the NEC level or established national EQS values where available.	
Phytobenthos - Filamentous Algae		Limited development. Diverse communities	Generally limited growths
Macrophytes			
Macroinvertebrates (from shallow riffles)		Usually Diverse communities. Normal density. Sensitive forms usually numerous relative to other forms.	
Dominant Fish Communities		Salmonid (R-N3 may have other fish species dominant)	
Water Quality		Highest quality	

Abstraction Potential	Suitable for all
Fishery Potential	Game fisheries
Amenity value	Very high
