UK Technical Advisory Group on the Water Framework Directive

Guidance on Typology for Lakes for the UK
(Draft)

This Guidance Paper is a working draft defined by the UKTAG. It documents the principles to be adopted by agencies responsible for implementing the Water Framework Directive (WFD) in the UK. This method will evolve as it is tested, with this working draft amended accordingly.

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WFD Requirement:	Article 5; Annex 2 Characterisation: Typology	**UKTAG Review:**	25 March 2003 (Principles of methodology) 5 June 2003 (Results for GB) Reviewed LTT June 2004

1. Purpose of this Paper

The paper sets out UKTAG's guidance on **lake reporting typology** as required under Article 5 of the Directive. It identifies the methodology to be adopted in the UK as well as the preliminary results for the Great Britain (GB) ecoregion.

2. The Directive's Requirements

2.1 As part of the characterisation process for typing surface waters in each River Basin District, Article 5 and Annex II of the Water Framework Directive require Member States to undertake an analysis of its characteristics according to the technical specification outlined in Annex 2.

2.2 Member States must complete the process of characterisation by 22nd December 2004, and report the results to the Commission by 22 March 2005. The initial definition and testing of the typology method for rivers, lakes, and transitional and coastal waters is therefore urgent priority tasks in the implementation of the Directive.

2.3 This paper also supports the definition of type-specific reference conditions across the UK and the process of intercalibration as identified in Guidance 10.a.

3. Background & relationship to other UK TAG Guidance Documents

3.1 This guidance is related to and should be read in association with, other guidance documents produced to support the typology of surface waters across the UK, specifically the following:

- Task 2.a (ii) *Guidance on Typology for Rivers for the UK*
- Task 2.a (iii) *Guidance on Typology for Transitional and Coastal Waters for the UK and Republic of Ireland*

3.2 This methodology was developed and tested in consultation with Lakes Task Team.

4. Content of this Guidance Paper

- Approach to typology method for lakes in the UK (Section 5)
- Application of typology method to the Great Britain (GB) Ecoregion, supported by tables and maps as relevant (Section 6)
- Future requirements for method development and testing (Section 7)

5. Approach to Typology for Lakes in the UK

5.1 Section 1.2 of Annex 2 of the WFD outlines two systems (A and B) for typology for Ecoregion and surface water body types.

5.2 The proposed typology to be adopted in the UK uses System B with some minor modifications, recognising it is very similar to that proposed as the common Intercalibration Typology. The approach uses:

- alkalinity boundaries as a surrogate of geology to sub-divide the geological categories required by System B;
- has 2 rather than 3 depth types; and
- has only one category for altitude, latitude and longitude divisions when applied to the Great Britain ecoregion, thereby being redundant in the first iteration of the typology process. (Note: an operational size division is proposed for future iterations and when further data become available a geographic (Lat/Long) division may need to be included)

As a result, there are fewer types for lakes than would have been produced using System A as outlined in the WFD.

5.3 UKTAG has adopted this approach as expert judgement suggests that the proposed typology is more likely to explain biological variation than System A. There is currently insufficient biological data available to demonstrate this but this will be developed and tested during 2005.

5.4 A tiered typology is proposed (outlined in Figure 1 below) in which each tier relates to its ability to explain biological variation in lakes (based on expert judgement). These are grouped into specific types and are able to be flexibly applied.

Figure1. Criteria and Types applied under typology for Great Britain Ecoregion

Core Typology	Full Typology		Criteria	Types
		Tier 1	**Catchment Geology Types**	Organic Siliceous Calcareous Brackish
		Tier 2	**Depth of lakes**	Very Shallow Deep
		Tier 3	**Altitude of lakes**	Lowland Mid-Altitude High Altitude
		Tier 4	**Size of lakes**	Very Small Small Large

5.5 The method and criteria under each tier that is used to identify **lake typology** and account for biological variation is described below.

Tier		**Step**					
Tier 1 Geological Types		Classify each water body into Geological Types using criteria described below and assign a level of confidence in this allocation. (High confidence if based on measured alkalinity, moderate confidence if based on conductivity (except for Brackish when high), low confidence if derived from geology maps)					
Criteria							
Types		Abrev	Catchment	Alkalinity		Conductivity[1]	Colour
				ueq/l	$MgCaCO_3$/l	uS/cm	MgPt/l
Geology[2]	Organic	P	> 75% Peat				>30
	Siliceous	LA	> 90% siliceous solid geology	< 200	< 10	< 70	<=30
		MA	> 50% siliceous solid geology	200 – 1000	10 – 50	71 – 250	
	Calcareous	HA	> 50% calcareous geology	> 1000	> 50	251 – 1000	
		Marl	> 65% limestone				
	Brackish	B				> 1000	

Tier 2 Depth Types		Classify each water body into Depth Types using criteria described below and assign a level of confidence in this allocation. High confidence if based on measured data, Low confidence if based on modelled data (Bennion etal 2004)	
Criteria			
Types		Abrev	Mean depth
			m
Depth	Very Shallow	Sh	<= 3.0
	Deep	D	>3.0 m

Tier 3 Altitude Types		Classify each water body into Altitude Types using criteria described below and assign a level of confidence in this allocation.	
Criteria			
Types		Abrev.	Basin altitude
			M
Altitude	Lowland	Low	< 200
	Mid-Altitude	Mid	200 – 800
	High-Altitude	High	>800

Note: The following tier is not yet adopted as part of full typology.

Tier 4 Size		Classify each water body into Size using criteria described below and assign a level of confidence in this allocation.		
Criteria				
Operational Divisions		Abrev	Water area (ha)	Operational Definitions
Size	Very small[3]	VS	1 – 9	Very small lakes - only monitored in exceptional circumstances
	Small	S	10 - 49	Small lakes which may require monitoring
	Large	L	50 – 10,000	Large lakes which require monitoring

[1] Conductivity is used only as a guide to type.

[2] Solid geology overridden by base status of drift and soil type using Acid Sensitivity Class

[3] Unlikely to be included as an "important" water body within WFD unless they are within a Protected Area and/or are at High Status and exposed to a risk of not maintaining that status.

6. Results of Application of Typology Methodology to Great Britain Ecoregion

6.1 The typology methodology was tested to confirm the a) applicability of the proposed process in terms of available data, accuracy and ease of use; and b) assess the results for including in the reporting on typology for the Ecoregion 18 (Great Britain).

6.2 The Core Typology approach (including Tier 1 and 2) was applied to all water bodies in Great Britain included in the Great Britain Lake Inventory, with a water area of greater than 1 hectare. This divided lakes into 12 types using the base status of:

- their drainage water (i.e. catchment **geology)** with 6 types (tier 1); and
- their mean **depth** with 2 types (Tier 2).

Other factors needed for subsequent tiers were also applied.

6.3 Each water body was allocated to type together with a level of confidence in this allocation. (This will potentially support application of type-specific classification boundary allocation).

6.3.1 Data was applied to each district. Results for the Cumbrian Lake District below provide an example of the application of Provisional Great Britain Lake Typology.

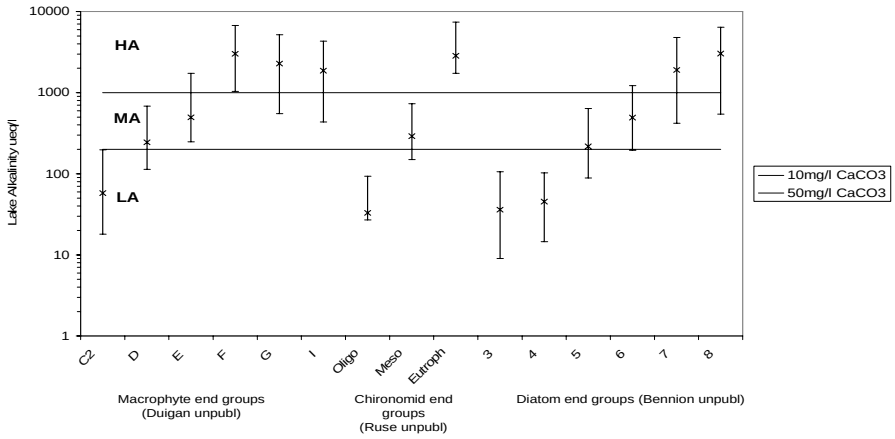
WBID	NAME	WB AREA	Size type	GB Core	Geol conf	Depth conf	GB_full
28965	Derwent Water	528.70	L	LA,D	H	H	LA,D,Low
28986	Loweswater	60.32	L	LA,D	H	H	LA,D,Low
29021	Thirlmere	313.34	L	LA,D	H	H	LA,D,Low
29184	Grasmere	60.70	L	LA,D	H	H	LA,D,Low
29183	Wast Water	277.97	L	LA,D	H	H	LA,D,Low
29052	Buttermere	90.87	L	LA,D	H	H	LA,D,Low
29062	Ennerdale Water	301.31	L	LA,D	H	H	LA,D,Low
29073	Haweswater Reservoir	379.01	L	LA,D	H	H	LA,D,Mid
29328	Esthwaite Water	96.19	L	MA,D	H	H	MA,D,Low
28955	Ullswater	868.21	L	MA,D	H	H	MA,D,Low
28847	Bassenthwaite Lake	523.89	L	MA,D	H	H	MA,D,Low
29129	Grisedale Tarn	11.03	S	LA,D	L	H	LA,D,Mid
29338	Devoke Water	34.14	S	LA,D	H	L	LA,D,Mid
29146	Blea Water	16.66	S	LA,D	M	L	LA,D,Mid
29116	Brothers Water	18.96	S	MA,D	H	H	MA,D,Low
29270	Blelham Tarn	10.57	S	MA,D	H	H	MA,D,Low
29094	Dock Tarn	1.95	VS	LA,D	M	L	LA,D,Mid
29083	Red Tarn or 'Red Tarn, Helvellyn'	7.82	VS	LA,D	H	L	LA,D,Mid
29157	Styhead Tarn	1.91	VS	LA,D	M	L	LA,D,Mid
29163	Sprinkling Tarn	2.34	VS	LA,D	L	L	LA,D,Mid

WBID	NAME	WB AREA	Size type	GB Core	Geol conf	Depth conf	GB_full
29231	Little Langdale Tarn	6.31	VS	LA,D	M	L	LA,D,Low
29231	Little Langdale Tarn	6.31	VS	LA,D	M	L	LA,D,Low
28905	Scales Tarn	1.22	VS	LA,D	L	L	LA,D,Mid
28854	Bowscale Tarn	2.22	VS	LA,D	M	L	LA,D,Mid
29097	Blea Tarn	7.39	VS	LA,D	H	L	LA,D,Mid
29381	Out Dubs Tarn	1.71	VS	MA,D	L	L	MA,D,Low
29323	Priest Pot	1.16	VS	MA,D	H	L	MA,D,Low

6.4 Issues affecting future use of the Typology for Lakes in the UK.

6.4.1 Testing of the typology with available data suggests that at least the first division (geology) is appropriate (refer Figure 2). In common with the proposed intercalibration typology (refer Guidance 10.a), the geology boundaries were based on the alkalinity of drainage water rather than catchment geology which is known to be the major influence on many biota. Where these data are not available a method has been identified which enables lakes to be allocated to type from the proportion of siliceous or calcareous rock types in their catchments.

Figure 2. Comparison of geological boundaries with respective Geological Types.



6.4.2 The process generated the number of water bodies greater than or equal to 10 hectares in Scotland and England/Wales in each core lake type as listed below.

GB_Core	Size type	Total WBID	England	Scotland	Wales
B,D	L	2		2	
B,Sh	L	1	1		
HA,D	L	61	32	23	6
HA,Sh	L	40	19	19	2
LA,D	L	172	21	136	15
LA,Sh	L	14	3	11	
MA,D	L	138	22	114	2
MA,Sh	L	27	7	18	2
Marl,D	L	5	5		
Marl,Sh	L	1	1		
P,D	L	12		12	
P,Sh	L	4		4	
B,D	S	7		7	
B,Sh	S	5	3	2	
HA,D	S	271	105	154	12
HA,Sh	S	314	280	19	15
LA,D	S	559	56	469	34
LA,Sh	S	60	23	34	3
MA,D	S	322	47	269	6
MA,Sh	S	70	41	23	6
Marl,D	S	27	14	13	
Marl,Sh	S	4		2	2
P,D	S	216	15	200	1
P,Sh	S	16	2	13	1

Notes:

1. Data generated July 2004
2. The numbers of water bodies in this table will depend on the interpretation of the Small Water Bodies Guidance (Guidance WP3a)
3. Not all WBs between 10 and 50ha are likely to be included, but in some cases smaller WBs may be sufficiently important to include in the first Article 5 report
4. No allowance has been made for Artificial WBs in this summary

Legend

GB_Core: Waterbody type as defined in Section 5.5 (Geology type and Depth type)

Size Type: Size type as defined in section 5.5

Total WBID: Total number of identified water bodies

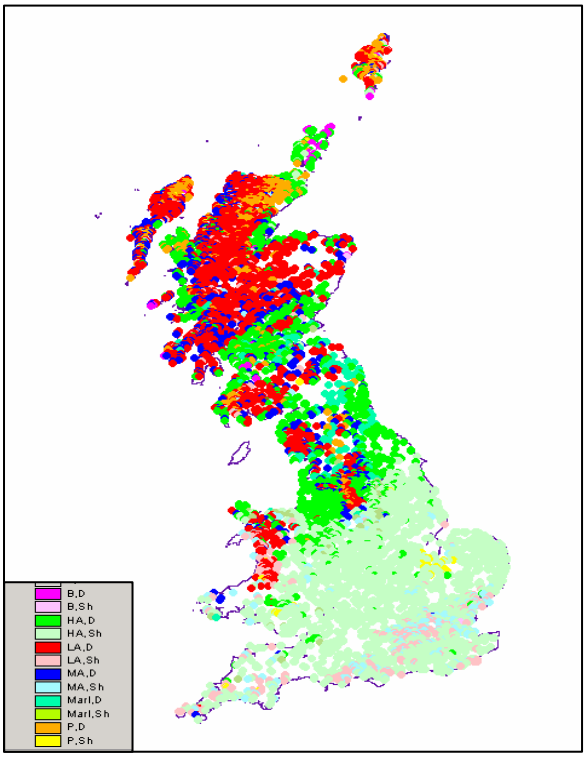
England: Number of water bodies in England

Wales: Number of water bodies in Wales

Scotland: Number of water bodies in Scotland

6.4.3 The following map (Map 1) shows the distribution of water bodies characterised by the Core Typology for Lakes in Great Britain (for all lakes greater than 1.0 ha)

Map 1. Distribution of WFD Core Typology in Great Britain (all lakes >1.0 ha)



7. Future requirements for method development and testing

7.1 The results of the application of this typology require further quality testing as part of the classification process, noting:

- Few measured depth data for lakes have been identified and the depth of many lakes is based on an estimate.
- Some Heavily Modified or Artificial Water Bodies with catchments that are not determined by the natural topography may have been assigned to incorrect geological types.