

European Union legislation on wastewater treatment and nutrients removal

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ABSTRACT

Building on a tradition of water protection legislation since the 1970s, the European Union has now in place three main pillars addressing nutrients in aquatic ecosystems systems.

- the Directives on urban waste water treatment and on nitrates pollution from agricultural sources¹ from 1991, and
- the 'flagship' of EU water policy and legislation, the Water Framework Directive of 2000.

Whilst the first two are addressing key sources of nutrients pollution at the source, waste water from municipal and industrial sources, the Water Framework Directive has expanded EU water policy to all waters and addresses all sources of impacts.

KEYWORDS

European Union, waste water treatment, nutrients, Water Framework Directive

1. Early steps in European water policy

Early European water legislation focused, in a "first wave" in the 1970s and 1980s, mainly on quality standards for certain types of waters - bathing waters, fish and shellfish waters and waters used for drinking water abstraction. Success stories of this period are, inter alia, the Drinking Water Directive² and the Bathing Water Directive³.

At the same time, over-exploitation, pollution and short-sighted management objectives have led inter alia to eutrophication, ecologic degradation of our rivers, disappearance of wetlands and saline intrusions into coastal groundwaters.

2. Adding the nutrients dimension: addressing pollution from waste water and from agriculture

Increasing pollution and degradation of Europe' waters, freshwaters as well as our regional seas, and an increasing awareness by citizens and policy makers led in the late 1980s/early 1990s to a 'second wave' of EU legislation.

¹ The Nitrates Directive 91/676/EEC, sets out clear rules for nitrates pollution from agriculture, one the main sources of groundwater pollution as well as of eutrophication of surface waters in many regions of Europe. There is a two level approach: Within nitrate vulnerable zones (i.e. regions with elevated nitrates concentrations in groundwater or surface water >50 mg/l, and/or with eutrophic waters, or in danger of become eutrophic) legally binding measures are required, such as minimum manure storage capacities coherent with the nitrogen demand of soil and crop; restrictions for manure application in terms of time, location and nitrogen load per hectare and year etc. Outside vulnerable zones codes of good agricultural practice have to be promoted on a voluntary basis.

² Council Directive 80/778/EEC of 15.7.1980 relating to the quality of water intended for human consumption, OJ L229 of 30.8.1980; replaced by Council Directive 98/83/EC of 3.11.1998, OJ L330 of 5.12.1998

³ Council Directive 76/160/EEC of 8.12.1975 concerning the quality of bathing water, OJ L31 of 5.2.1976

The Urban Waste Water Treatment Directive⁴ of 1991

- provides for an obligation to collect and treat waste water from all settlements and agglomerations but the very small ones
- sets the treatment objective as a rule as secondary treatment (biological carbon removal), plus – in the catchment of all areas being either eutrophic or potentially eutrophic – for nutrients removal
- defines eutrophication and the catchment of waters suffering from (potential) eutrophication giving clear guidance for technical, financial and political decision, and indeed was upheld and interpreted by a range of judgements by the European Court of Justice⁵ promoting water protection
- sets staged deadlines of 1998, 2000 and 2005, depending on the size of the waste water discharge and the characteristics of the affected water:
 - larger agglomerations beyond 10000 p.e. discharging into catchments of 'sensitive areas': 31.12.1998
 - larger agglomerations beyond 15000 p.e. discharging into 'normal areas': 31.12.2000
 - all other agglomeration beyond 2000 p.e.: 31.12.2005
 - For the 10 new Member States in Central and Eastern Europe, which joined the European Union on 1 May 2004, staged transition periods were negotiated as part of the Accession Treaties⁶, obliging the new Member States to comply with the Directive by 2010 to 2015, at the same time providing them considerable financial support by the European Union for planning considerations, design and construction of waste water systems.

With the Urban Waste Water Treatment Directive, the European Union has for the first time in a comprehensive way taken on board the nutrients dimension of water protection. Bearing in mind that many of the regional seas in Europe (Baltic Sea, parts of the North Sea, Black Sea, Northern Adriatic, as well as a range of estuaries and lakes are suffering from eutrophication, the objective set in 1991 is still environmentally sound and its implementation indispensable.

Sensitive areas (i.e. catchment of waters where waste water from treatment plants above 10000 p.e. has to undergo nutrient removal)

- natural freshwater lakes, other freshwater bodies, estuaries and coastal waters which are found to be eutrophic or which in the near future may become eutrophic if protective action is not taken;
- surface waters intended for the abstraction of drinking water which could contain more than 50 mg/l concentration of nitrate ... if action is not taken;
- areas where advanced treatment is necessary to fulfil European Union Directives.

Member States have a (limited) flexibility in applying these provisions: they can either designate (and constantly monitor) individual sensitive areas in accordance with the above criteria, or apply the more stringent provisions of the Directive involving nutrient removal to their whole territory.

⁴ Council Directive 91/271/EEC of 15 May 1991 concerning urban waste water treatment, OJ L 135 of 30.05.1991, amended by Commission Directive 98/15/EC of 27.02.1998, OJ L 67 of 07.03.1998

⁵ Judgements by the European Court of Justice, inter alia cases C-396/00 Commission against Italy of 25.4.2002, C-236/99 Commission against Belgium of 6.7.2000, C-280/02 Commission against France of 23.9.2004; (<http://curia.eu.int>)

⁶ Accession Treaties with Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia, (http://europa.eu.int/eur-lex/lex/en/treaties/treaties_accession.htm).

a) standard provisions

Parameter	Value (concentration)	Value (% reduction)
Biological Oxygen Demand BOD ₅	25 mg/l	70 - 90 %
Chemical Oxygen Demand COD	125 mg/l	75 %

(24 hour average; either concentration or percentage of reduction shall apply)

The Directive provides for mandatory minimum design rules for sewerage systems as well as treatment plants (minimum design requirement = highest maximum weekly average load throughout the year).

b) additional provisions for 'sensitive areas'

Parameter	Value (concentration)	Value (% reduction)
Total nitrogen Plants of 10 000 - 100 000 p.e. Plants >100 000 p.e.	15 mg/l 10 mg/l	70 - 80 %
Total phosphorus Plants of 10 000 - 100 000 p.e. Plants >100 000 p.e.	2 mg/l 1 mg/l	80 %

(annual averages, either concentration or percentage of reduction shall apply)

The Urban Waste Water Treatment Directive has already contributed to an improvement of the quality of our big rivers. However, there are delays, in some cases even scandalous delays, with still prevailing discharges of untreated or insufficiently treated waste water. Consequently, legal enforcement measures including applications to the European Court of Justice had to be applied.

The Urban Waste Water Treatment Directive has set ambitious environmental objectives as well as ambitious deadlines. Two of the three deadlines have already elapsed, with the last – for the smaller agglomerations between 2000 and 10000 p.e. set as per the end of this year. The European Commission has been compiling regular implementation reports⁷, linked to the step by step implementation deadlines of the Directive. The latest report, for the 2000 deadline, concludes as follow:

- Major efforts being taken since 1998, the first deadline under the Directive.
- In European rivers a reduction of BOD levels by 20-30%, of phosphorus concentrations by 30-40%⁸ and of NH4-N levels by around 40% has been achieved;
- Eutrophication of European regional seas continues to be the major problem of water quality in the Baltic Sea, the North Sea and considerable parts of the Mediterranean;
- A compliance rate of about 2/3 of the pollution load covered by the 1998 and 2000 deadlines has been achieved (assessment 2002; further improvements since);
- Several Member States – namely Austria, Denmark and Germany, plus with certain restrictions the Netherlands – have shown that successful and timely implementation is possible, leading to significant improvements in water quality.
- As for the future, adequate performance of constructed treatment plants, and a transparent and accessible reporting system need to be ensured.

**Implementation and
impacts so far**

⁷ Published in print version, and available on the Internet at:
(http://europa.eu.int/comm/environment/water/water-urbanwaste/index_en.html)

⁸ To be seen together with phasing out of phosphates in household detergents in several countries

3. Expanding European water policy and fitting it into a coherent management frame – the EU Water Framework Directive

Water problems throughout Europe have a lot in common, e.g. pollution from waste water and agricultural sources. However, local and regional water problems can present a quite diverse pattern, both as regards quality and quantity, in the North and in the South of the EU, in the present Member States and in countries in Central and Eastern Europe and the Mediterranean soon to join the EU. This is true for the quality of our groundwaters, lakes and rivers, for flood events in some regions, for local and regional scarcity in water in others, and for the protection of our waters as a resource, fresh waters as well as marine waters.

Based on experience gained but also gaps identified, mid-1995 saw pressure for a fundamental rethink of EU water policy coming to a head, and agreement achieved between the Commission, the European Parliament's Environment Committee and the Council of Environment Ministers on the need for a fundamental reform.

The **Water Framework Directive**⁹ presents a breakthrough in European Water Policy, not only as regards the scope of water protection, but also as regards its development and its implementation.

It has been developed by the European Commission, right from the start, in an open and transparent way involving all stakeholders, NGOs and the scientific community. Only based on a broad consultation exercise including a two-day Water Conference with all interested and involved parties did the Commission come forward with its legislative proposals¹⁰, with the following pillars:

- all waters to be protected, groundwaters and surface waters including coastal waters;
- all waters to achieve good quality ('good status'), as a rule by 2015;
- 'good status' comprehensively defined - for surface waters by biological, physico-chemical and hydromorphological elements, for groundwaters by balance between available recharge and abstractions, and chemical elements;
- water management based on river basins;
- "combined approach" of emission limit values and quality standards, plus phasing out particularly hazardous substances;
- economic instruments underpinning environmental objectives, in particular water pricing reflecting cost recovering;
- mandatory participation by citizens, stakeholders and NGOs;
- streamlining legislation, and ensuring one coherent managerial frame.

Expanding the scope of water protection

All of Europe's waters will be protected under the Water Framework Directive, surface waters and ground water (in the past only a limited number of water for specific human use, such as fish waters, shellfish waters, bathing waters are protected under European legislation). Unlike previous water legislation, the Water Framework Directive covers surface water and groundwater together, as well as estuaries and marine waters. Its purpose is threefold: to prevent further deterioration; to promote sustainable water consumption based on the long-term protection of available water resources; and to contribute to the provision of a supply of water in the qualities and quantities needed for its sustainable use.

"Good status" for all waters by a set deadline

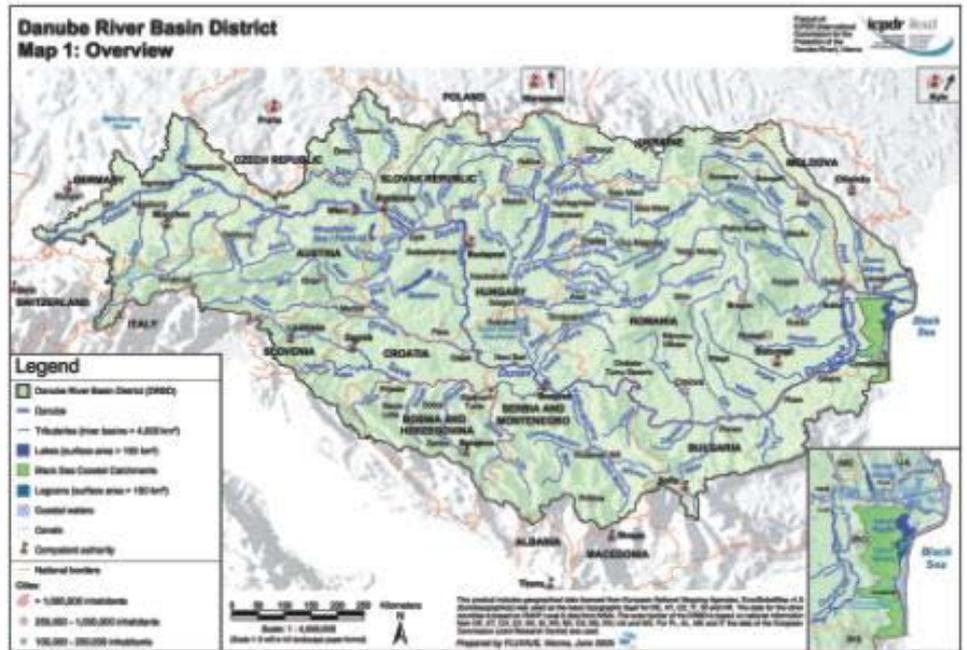
Under the Directive Member States will have to ensure that 'good status' is achieved or kept in all waters by a set deadline, as a rule by 2015. Certain limited derogations will be possible, but linked to a clear set of conditions.

For groundwater, good status is measured in terms of both quantity and chemical purity; for surface waters ecological quality (biology, morphology) and chemical quality are the criteria.

⁹ Directive 2000/60/EC of the European Parliament and the Council establishing a framework for Community action in the field of water policy; OJ L 327 of 22.12.2000

¹⁰ European Commission Proposal for a Water Framework Directive of 26.02.1997, COM(97)49, OJ C 184 of 17.06.1997, of 26.11.1997, COM(97)614, OJ C 16 of 20.01.1998, and of 17.02.1998, COM(98)76, OJ C 108 of 07.04.1998

The same criteria and deadlines will apply to the old 15 Member States and to the 10 new Member States which joined the European Union in 2004.



The Danube: The European Union's largest river basin, and the most international basin world-wide: size 817.000 km², shared between 18 countries.

Map source: International Commission for the Protection of the Danube River (ICPDR), environmental assessment report under article 5 of the EU Water Framework Directive

Nutrients as a major element of 'good status'

One of the major innovations of the Water Framework Directive is its environmental objective of 'good status' being derived from 'high status' (the latter being largely pristine). 'Good status' will allow for only a limited deviation from high status, at the same time

- taking into account regional diversity (e.g. Scandinavian lakes vs. Mediterranean lakes in terms of temperature, turbidity etc)
- allowing for comparability of waters for citizens, policy makers and the scientific community. Comparability of biological monitoring results will be ensured by an intercalibration exercise jointly done by European Commission and 25 Member States, plus on a voluntary basis Bulgaria, Romania and Norway.

To that end, the Directive provides for comprehensive verbal definitions of high, good and moderate status, inter alia in terms of nutrients and their impacts on biological quality elements (annex V.1.2 of the Directive):

Example – definitions related to nutrients for "lakes, good status"

- **Physico-chemical quality elements:** Nutrient concentrations do not exceed the levels established so as to ensure the functioning of the ecosystem and the achievement of the values specified for the biological quality elements.
- **Biological quality elements:** Phytoplankton: There are slight changes in the composition and abundance of planktonic taxa compared to the type-specific communities; Such changes do not indicate any accelerated growth of algae resulting in undesirable disturbance to the balance of organisms present in the water body or to the physico-chemical quality of the water or sediment. A slight increase in the frequency and intensity of the type-specific planktonic blooms may occur.
- **Macrophytes and phytobenthos:** There are slight changes in the composition and abundance of macrophytic and phytobenthic taxa compared to the type-specific communities; Such changes do not indicate any accelerated growth of phytobenthos or higher forms of plant life resulting in undesirable disturbance to the balance of organisms present in the water body or to the physico-chemical quality of the water. The phytobenthic community is not adversely affected by bacterial tufts and coats present due to anthropogenic activity.

In implementing the Water Framework Directive, all parties – Member States, European Commission, Candidate Countries and all other involved parties - face considerable challenges, in terms of substance as well as deadlines.

Transposition into national legislation	December 2003; for new Member States May 2004
Analysis of impacts and pressures	December 2004
Economic analysis of water use	December 2004
Inter-calibration of quality classification	December 2004
Monitoring programmes operational	December 2006
Latest date for starting public participation	December 2006
River basin management plans and programme of measures	December 2009
Implementation of plans and programme; review	December 2015

Further, the majority of our river basins in Europe are shared between countries. A common understanding of the Directive and common approaches are therefore of crucial importance for a successful implementation. This is why, in an unprecedented effort, Member States and European Commission agreed on a Common Implementation Strategy¹¹.

Key activities within the Strategy are

- exchange of information
- development of guidance documents
- management of information and data
- testing in pilot river basins

Looking back at four years of the Common Implementation Strategy, joint work can duly be considered as an example of Good European Governance

- joint ownership by Commission, Member States, stakeholders and NGOs has been ensured; all 10 new EU Member States were fully integrated well before accession;
- close cooperation with the scientific community and European research projects is in place, and remains indispensable for the future;



- guidance documents have been developed in high quality and within time frame; they are available at

[\(<http://forum.europa.eu.int/Public/irc/env/wfd/home>\);](http://forum.europa.eu.int/Public/irc/env/wfd/home)

- implementation results so far (transposition into national legislation; designation of river basin districts and competent authorities; first environmental assessment) show an overall positive picture; implementation record of all countries is available at

[\(<http://europa.eu.int/comm/environment/water/water-framework/scoreboard.html>\)](http://europa.eu.int/comm/environment/water/water-framework/scoreboard.html)

¹¹ European Commission, Member States and Norway: Common Implementation Strategy for the EU Water Framework Directive; Internet:

[\(<http://europa.eu.int/comm/environment/water/waterframework/implementation.html>\)](http://europa.eu.int/comm/environment/water/waterframework/implementation.html)

4. Protecting our water environment - awareness of citizens

- the Water Framework Directive has reached out far beyond the current borders of the European Union: for the Danube basin, EU Member States as well as Romania, Bulgaria, Croatia, Bosnia and Herzegovina, Serbia-Montenegro, Moldova and Ukraine – have committed themselves to the Water Framework Directive, and have jointly and timely delivered the first Danube basin environmental assessment, presented and adopted by a Ministerial Conference in December 2004.

A representative opinion poll performed in all 25 Member States and published in April 2005 delivered highly interesting, and indeed encouraging, results on the attitude of European towards the environment:

Environment just as important as economic and social policies.
Answer: 74%

Country Results	
Greece	95%
Slovenia	94%
Poland	92%
Cyprus	91%
Estonia	91%
Lithuania	91%
Hungary	90%
Czech Republic	89%
Malta	89%
Slovakia	89%
France	87%
Spain	87%
United Kingdom	87%
Sweden	86%
EU	85%
Portugal	85%
Latvia	85%
Denmark	84%
Finland	84%
Luxembourg	83%
Germany	81%
Ireland	81%
Belgium	80%
Italy	79%
The Netherlands	79%
Austria	78%



- “Water” is, amongst all environmental themes, seen by a majority of citizens as the most important one, followed by air quality.
- An overwhelming majority of citizens, 74% to 95% depending on the country, EU average of 85%, expect from policy makers that they take protection of the environment as important and economic and social policies.

Conclusions

The Water Framework Directive commences with the words

“Water is not a commercial product like any other but, rather, a heritage which must be protected ...”

In many fields progress has been achieved, however Europe’s waters are in need of more protection, in need of increased efforts to get them clean or to keep them clean, as emphasised by reports recently published by the European Environment Agency^{12, 13, 14}. After 25 years of European water legislation this is a demand not only by the scientific community and other experts, but also to an ever increasing extent by citizens and environmental organisations.

¹² European Environment Agency: Sustainable use of Europe’s waters? Copenhagen 2000 (part 1); Copenhagen 2001 (part 2), Copenhagen 2002 (part 3); (<http://www.eea.eu.int>).

¹³ European Environment Agency: Eutrophication in Europe’s coastal waters”, Copenhagen 2000; (<http://www.eea.eu.int>).

¹⁴ European Environment Agency: Environmental signals, Copenhagen 2004, and further publications: (http://reports.eea.eu.int/index_table?sort=Thematically#water).

European legislation is setting ambitious objectives for the protection of our water resources across Europe

- binding on environmental objectives,
- flexible on tools to achieve these objective, as well as on organisation and property ownership and financing, and thus open to innovation and technological progress,
- providing a sound basis for long-term planning at a technical, financial and political level,
- involving the civil society, and thus
- providing a living example of Good European Governance.

Nutrients and nutrients removal and reduction technologies will continue to be in the centre of environmental efforts on water protection.

Let us take up the challenge of water protection, one of the great challenges for the European Union in the new millennium. Let us seize the initiative generated by the present political process on the Water Framework Directive, for the benefit of all Europe's citizens and our waters.

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