

Content - Questions to be answered

Water Supply

- **Legal framework**
- How much do we need (per capita demand)
- Where to get it from (resources, extraction, protection)
- Quality (substances in the water)
- Treatment (surface water, metals, germs, hardness, nitrogen / in situ)
- Transport, storage and distribution (layout, design, pumps)
- Metering and billing
- Sustainable operation (monitoring, controlling, management)
- Construction (mains, service connection, reservoirs)

Legal framework

Objectives

- keep waters and groundwater clean,
- obtain and **preserve** natural waters,
- no degradation of the present situation (**prohibition of degradation**),
- meet economical criteria at the same time

Regulations to fulfill these objectives

- guidelines of **EU** (subsidiary → national rights)
- **Water rights act** (national) + supplementing regulations,
- **regional** planning laws (federal states of Austria)
- the **ground-water protection** programs
- various schemes of redevelopment (incentives)

EU and in Austria have a water protection law based on a **combination of two principles**:

Emission & Pollution (Immission)

- The emission principle defines a minimum standard for waste water treatment (**effluent concentration**)
- The pollution principle defines quality standards for waters; important for protection (**concentration after mixture**)

EU-Laws

principle of **subsidiarity**: European Union guidelines and laws are converted into appropriate national laws

- 2000/60/EC **water framework directive** (coordination of actions concerning water politics)
- 98/83/EC **quality of water intended for human consumption - Drinking Water Directive**
- 96/61/EC avoidance and reduction of the environmental pollution
- 91/271/EEC **treatment of municipal waste water**
- 88/347/EEC change of limit values and quality goals for dangerous materials
- 86/280/EEC limit values and quality goals for dangerous materials
- 86/278/ EEC protection of the environment when using **sewage sludge in agriculture**
- 80/778/ EEC **quality of water** for the human consumption
- 80/68/ EEC **protection of the groundwater** against contamination due to certain dangerous materials
- 79/869/ EEC measuring methods and frequency for surface water used for drinking water purpose
- 79/117/ EEC prohibition of **plant protection agents**, which contain certain active substances
- 78/659/ EEC **quality of fresh water**, in order to protect fish
- 76/464/ EEC contamination due to derivatives of certain dangerous materials
- 76/160/ EEC quality of swimming waters
- 75/440/ EEC quality requirements for **surface water used for drinking water purpose**

EU-Laws: Drinking Water Directive

Council Directive 98/83/EC of 3 November 1998 on the **quality of water intended for human consumption** as amended by Regulation 1882/2003/EC

Short name: **Drinking Water Directive**

key aims:

- Directive concerns the quality of water for human consumption.
- ... shall be to protect human **health** from ...effects of contamination of ... water...
- make sure drinking water ... is indeed healthy, **clean and tasty**
- ... sets **standards** for the most **common substances** (so-called parameters)
- 48 **microbiological** and **chemical** parameters must be monitored and tested...
- ...In principle **WHO guidelines** are used as a basis for the standards ...
- ... the Member States of the European Union can include **additional requirements**
- → additional substances ... relevant within their territory or set higher standards
- → But are not allowed to set lower standards

[http://ec.europa.eu/environment/water/water-drink/index_en.html]

WFD ... the new European water policy

key aims (ii)

- expanding the scope of water protection to all waters, surface waters and groundwater
- achieving "good status" for all waters by a set deadline
- water management based on river basins
- "combined approach" of emission limit values and quality standards
- getting the prices right
- getting the citizen involved more closely
- streamlining legislation (old directives to be repealed)

WFD... A single system of water management: River basin management

river basin

→ the natural geographical and hydrological unit

instead of administrative or political boundaries

a "river basin management plan" will need to be established and updated every six years

WATER FRAMEWORK DIRECTIVE RIVER BASIN DISTRICTS IN THE UK AND IRELAND



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Co-ordination of objectives – **good status** for all waters by a set deadline

Key objectives:

- **general protection of the aquatic ecology**
- **specific protection of unique and valuable habitats**
- **protection of drinking water resources**
- **protection of bathing water**

All these objectives must be integrated for each river basin.

Surface water

1) *Ecological protection*

2 elements:

"good ecological status" and "good chemical status".

- in terms of the quality of the biological community,
- the hydrological characteristics and
- the chemical characteristics.

no absolute standards for biological quality can be set which apply across the Community, because of ecological variability,

Controls allowing **only a slight departure** from the **biological community** which **would be expected in conditions of minimal anthropogenic impact.**

Surface water

2) *Chemical protection*

Good chemical status is defined in terms of **compliance** with all the **quality standards** established for chemical substances at European level.

Directive provides a mechanism for **renewing these standards**
...by means of a prioritisation mechanism for **hazardous chemicals**.

This will ensure a minimum chemical quality,
particularly in relation to **very toxic substances**

Surface water

3) *Other uses*

...for which water is protected:

- apply in specific areas, not everywhere.
 - specific protection zones
 - more stringent requirements

key examples

- flood protection
- essential drinking water supply

Less clear-cut cases (activity is open to alternative approaches):

- Navigation
- power generation



Groundwater

1) Chemical status

groundwater should not be polluted at all

...setting chemical quality standards may not be the best approach

→ Member States can fill up allowed level of pollution

Better way:

→ a **prohibition on direct discharges** to groundwater

→ and to cover indirect discharges: a requirement to **monitor groundwater** bodies so as to detect changes in chemical composition,

Principle: minimum anthropogenic impact.



Groundwater

2) Quantitative status

... Quantity is a major issue for groundwater

→ only a certain amount of recharge into a groundwater each year

→ For good management, only that portion of the overall recharge not needed by the ecology can be abstracted

WFD = Co-ordination of measures

(i) analysis of human impact

→ determine for each body of water how far it is from the **objective**.

(ii) see if full implementation of existing legislation solves the problem

→ **Yes** → **OK**

→ **NO** → Member State must **identify exactly why**,
and design additional measures



"combined approach"

(i) emission limit values and (ii) quality standards

(i) On the **source side**,

all existing technology-driven source-based controls must be implemented as a first step

(ii) On the **effects side**,

overall objective of **good status** for all waters,



The river basin management plan

plan = detailed account of how the **objectives** set for the river basin are to be reached within the timescale required

- **ecological status,**
- **quantitative status,**
- **chemical status**
- **protected area objectives**

additional components

- an **economic analysis** of water use within the river basin
(to enable a rational discussion on the cost-effectiveness of possible measures)
- interested parties must be fully involved in this discussion
(the public participation requirement)



Public participation

two main reasons for public participation:

(i) to achieve the objectives → **balancing the interests** of various groups

... The economic analysis requirement provides a rational basis for this

(ii) enforceability

... The greater the transparency
→ the greater the willingness to implement and follow the legislation

→ **the river basin management plan must be issued in draft,**

→ **biannual conference** → **regular exchange of views and experiences**



Getting the prices right

one of the Directives's most important innovations:

→ the introduction of pricing.

... Adequate **water pricing** acts as an **incentive for the sustainable use** of water resources and thus helps to achieve the environmental objectives under the Directive.

E.g.: Pricing reflects the true costs for:

- abstraction and distribution of **fresh water**
- the collection and treatment of **waste water**

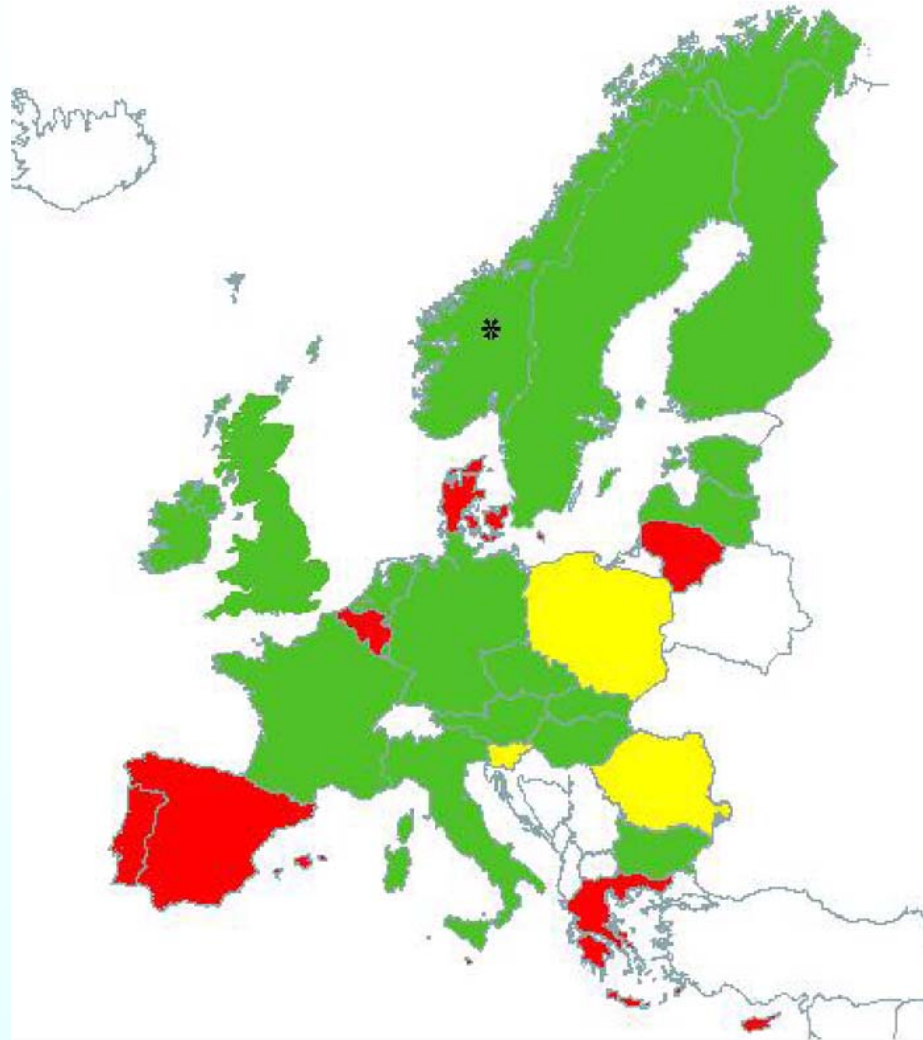
WFD - Timetable for implementation

http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

2000	Directive entered into force	Art. 25
2003	Transposition in national legislation Identification of River Basin Districts and Authorities	Art. 23 Art. 3
2004	Characterisation of river basin: pressures, impacts and economic analysis	Art. 5
2006	Establishment of monitoring network Start public consultation (at the latest)	Art. 8 Art. 14
2008	Present draft river basin management plan	Art. 13
2009	Finalise river basin management plan including programme of measures	Art. 13 & 11
2010	Introduce pricing policies	Art. 9
2012	Make operational programmes of measures	Art. 11
2015	Meet environmental objectives First management cycle ends Second river basin management plan & first flood risk management plan.	Art. 4
2021	Second management cycle ends	Art. 4 & 13
2027	Third management cycle ends, final deadline for meeting objectives	Art. 4 & 13



State of implementation by end of 2010



RBMP adopted (16)

**Consultation finalised,
awaiting adoption (3)**

**Consultation on-going
or not started (8)**

**By the end of 2010
RBMPs will cover**

75% of EU territory

80% of EU population

water.europa.eu



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water.europa.eu/policy



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UK Example: Surface Water Classification Schemes

1) *Ecological Status*

expression of the **quality of the ecosystem** indicated quality elements:

(i) biological quality elements

(ii) chemical quality elements (pollutants being discharged)

(iii) hydromorphological quality elements

(‘one out - all out’ principle)

five classes for ecological status;

'high'

'good'

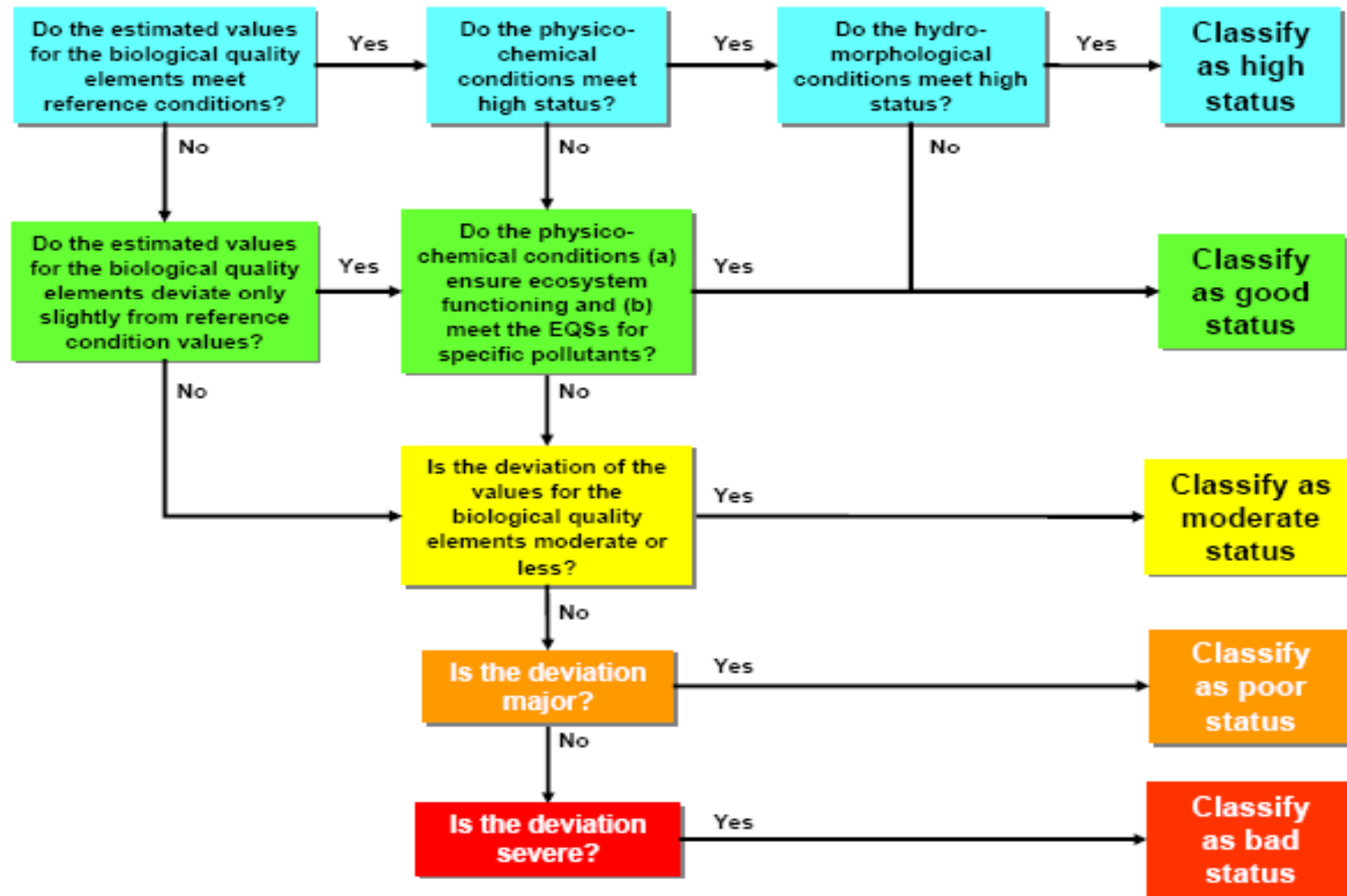
'moderate'

'poor'

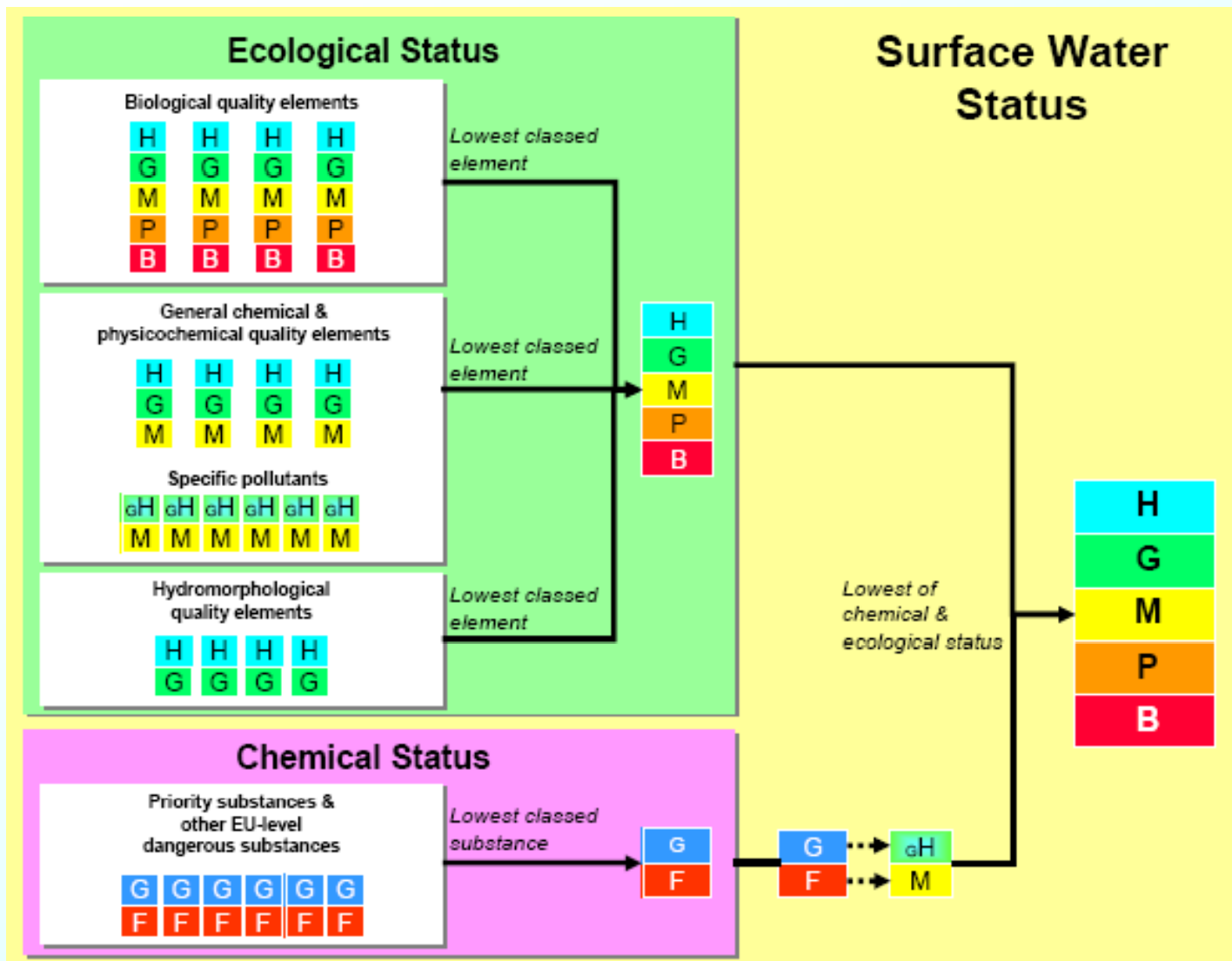
'bad'



Decision-tree: criteria determining different ecological status classes



Combining the results for different quality elements...



Biological quality elements

Table 1: Biological quality elements relevant to the different categories of surface water

Rivers	Lakes	Transitional waters	Coastal waters
(i) Benthic invertebrates	(i) Benthic invertebrates	(i) Benthic invertebrates	(i) Benthic invertebrates
(ii) Fish	(ii) Fish	(ii) Fish	(ii) Phytoplankton
(iii) Phytoplankton	(iii) Phytoplankton	(iii) Phytoplankton	(iii) Macroalgae and angiosperms
(iv) Macrophytes and phytobenthos	(iv) Macrophytes and phytobenthos	(iv) Macroalgae; and (v) Angiosperms	



Chemical and physicochemical quality elements

Table 2: General chemical and physicochemical quality elements relevant to the different categories of surface water

Water category	Quality elements	Indicators for which standards have been proposed by UKTAG
Rivers	<ol style="list-style-type: none"> 1. Thermal conditions 2. Oxygenation conditions 3. Salinity 4. Acidification status 5. Nutrient conditions 	<ol style="list-style-type: none"> 1. Temperature 2. Dissolved oxygen concentration 3. - 4. pH 5. Soluble reactive phosphorus concentration
Lakes	<ol style="list-style-type: none"> 1. Transparency 2. Thermal conditions 3. Oxygenation conditions 4. Salinity 5. Acidification status 6. Nutrient conditions 	<ol style="list-style-type: none"> 1. - 2. - 3. Dissolved oxygen concentration 4. Conductivity 5. Acid neutralising capacity 6. Total phosphorus concentration
Transitional waters (e.g. estuaries)	<ol style="list-style-type: none"> 1. Transparency 2. Thermal conditions 3. Oxygenation conditions 4. Nutrient conditions 	<ol style="list-style-type: none"> 1. - 2. - 3. Dissolved oxygen concentration 4. Dissolved inorganic nitrogen
Coastal waters	<ol style="list-style-type: none"> 1. Transparency 2. Thermal conditions 3. Oxygenation conditions 4. Nutrient conditions 	<ol style="list-style-type: none"> 1. - 2. - 3. Dissolved oxygen concentration 4. Dissolved inorganic nitrogen

Hydromorphological quality elements

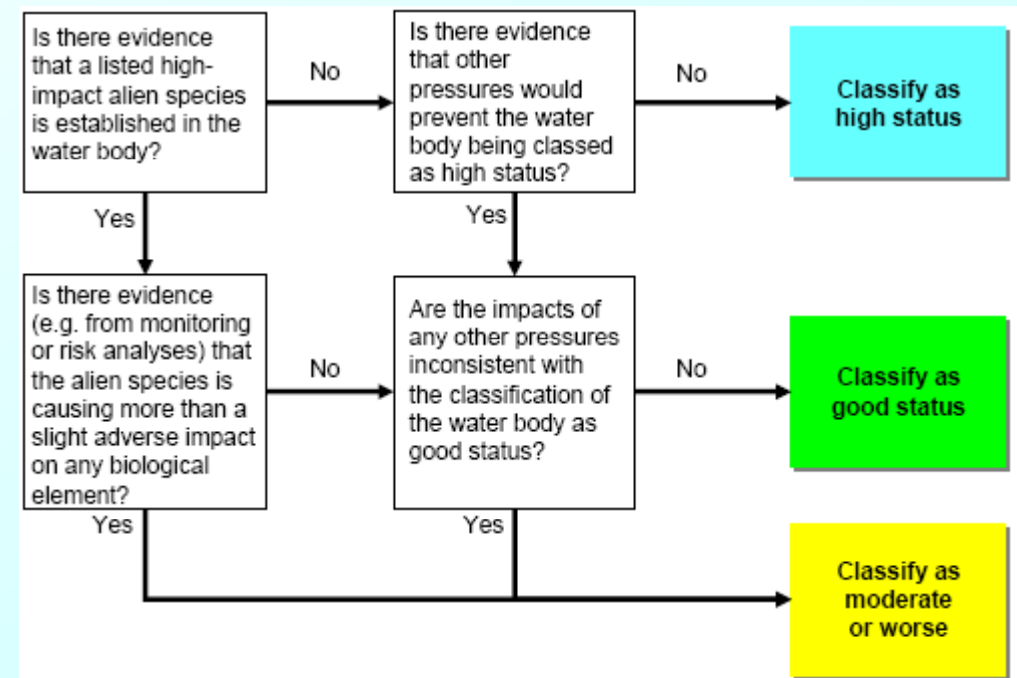
Table 5: Hydromorphological quality elements

Rivers	Lakes	Transitional Waters	Coastal Waters
(i) quantity and dynamics of water flow	(i) quantity and dynamics of water flow	(i) depth variation,	(i) depth variation
(ii) connection to ground water bodies	(ii) residence time	(ii) quantity, structure and substrate of the bed	(ii) structure and substrate of the coastal bed
(iii) river continuity	(iii) connection to the ground water body	(iii) structure of the inter-tidal zone	(iii) structure of the inter-tidal zone
(iv) river depth and width variation	(iv) lake depth variation	(iv) freshwater flow	(iv) direction of dominant currents
(v) structure and substrate of the river bed	(v) quantity, structure and substrate of the lake bed	(v) wave exposure	(v) wave exposure
(vi) structure of the riparian zone	(vi) structure of the lake shore		

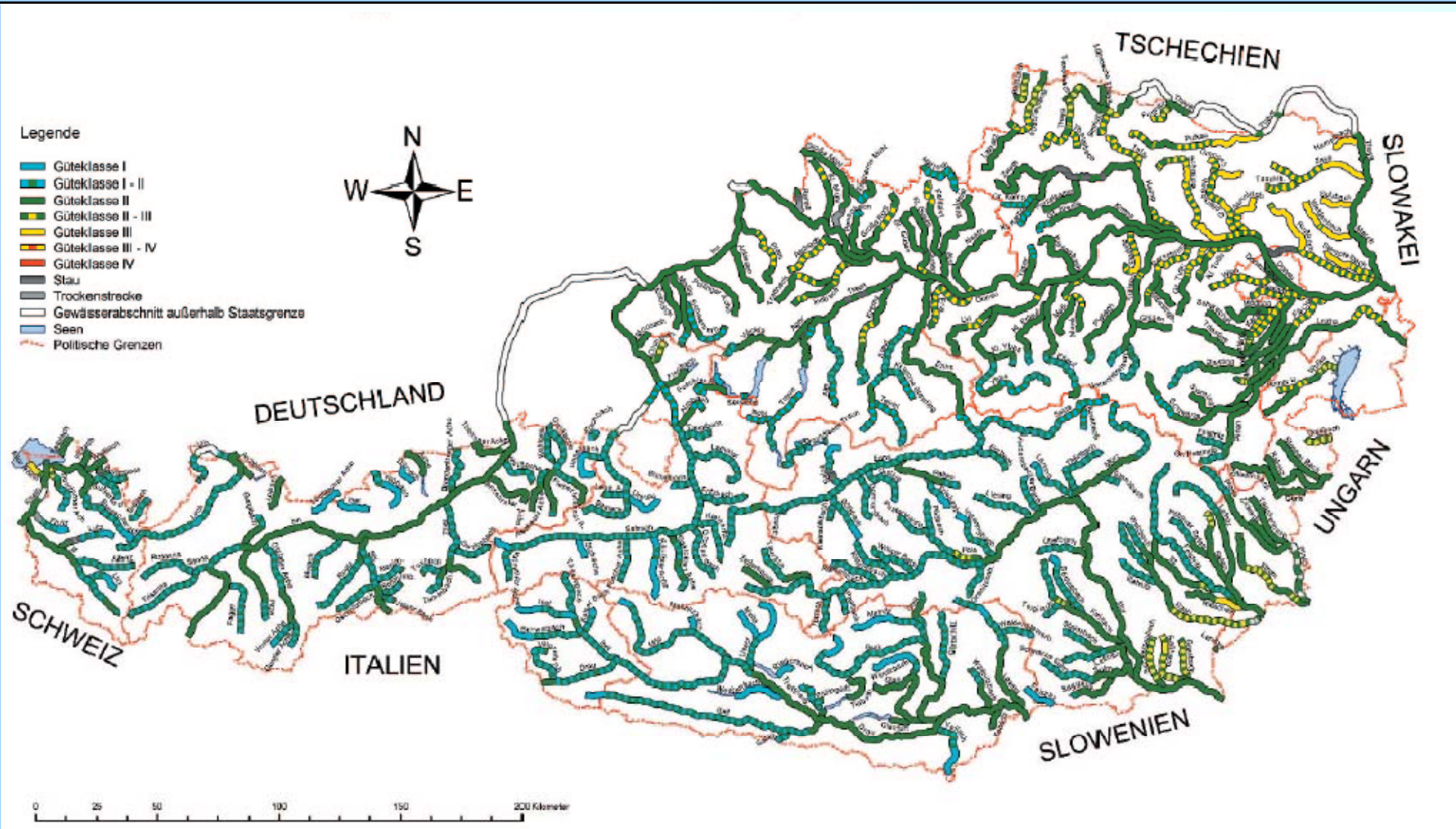
biological classification tools and alien species

Prediction of the community of organism that would be found at a site by reference to a database of river sites

Determination of deviation to “the natural state”



Result: e.g. Biological Status of Austrian Rivers 2005



Austrian Laws: Sources of law

concerning water supply and drinking water treatment

- 1. Water law (WRG 1959) = **federal Water Rights Act**
- 2. Food law (LMG 1975)
 - **Quality of water for the human use** (drinking water directive – TWV)
 - Sub regulations (included in the drinking water regulation)
 - -Drinking water - nitrate regulation
 - -Drinking water - pesticide regulation
 - -Drinking water - exception regulation
 - -Drinking water information regulation
 - surface water - drinking water regulation
 - Mineral water regulation
 - ...Austrian **food Codex** chapter **B1 „drinking water“**
- 3. Hydrographic law (1990)
- 4. Hydraulic engineering law (1985)
- 5. Environmental and water management fund law (1987)
- 6. Environment protection (1993)

Austrian Laws: WRA

Austrian Water Rights Act (Wasserrechtsgesetz 1959, zuletzt geändert mit BGBl. I Nr. 87/2005)

key aims: (aim of an ecologically oriented water management)

- Preservation of **quality** and **quantity** of water resources
- Restriction of pollution
- **Prohibition of degradation**
- Prohibition of dumping dangerous materials
- Preservation of the **habitat** ("waters" for humans, animals and plants)
- Ensure **ecological functions**

Regulations set in the act:

- **protection of humans** and property from waterborne endangerments
- safeguarding of **public benefits and warrants**
- **protection of waters** from illegal damage on qualitative condition
- **precaution** for preservation of water resources and redevelopment of polluted waters
- regulation of **requirements**

Austrian Laws

aspects concerning **water supply** and **drinking water treatment**:

1. if possible use water resources with constant, **high quality**, drinking water condition **by nature**
2. ensure the quality by **protection** and redevelopment
3. appropriate treatment when there is insufficient quality

Austrian Laws: food Codex chapter B1

water can be used as drinking water if:

- The concentration of **microorganism** and **other substances** is low enough to **prevent hazards on human health**.
- The water complies with **Parameter** (limit) and **Indicator Parameter** (potentially problem) given in the **drinking water directive**.

and if the water meets the following, additional specifications:

- Drinking water **must not contain bacteria, viruses and parasites** in a concentration, which could cause a disease or could affect human health.
- Therefore drinking water is **regularly checked** on indicator bacteria that could be a sign of pollution.
- **Specifications** of chemical and microbiological analysis are given in the appendix 1 of the **drinking water regulation**.
- **Prevention of any kind of pollution** especially with waters used for drinking water purposes.
- **Protection** of drinking water is done by defining **protection zones** and **preservation areas**. These areas are defined by the authority if someone applies for a certain water right (e.g. extraction).

Austrian Laws: Austrian Drinking Water Directive

(Trinkwasserverordnung (BGBl. II Nr. 304/2001) novelliert mit BGBl. II Nr. 254/2006, ausgegeben am 6. Juli 2006)

Parameter: (limits) [[LINK to Quality \(substances in the water\) + Treatment](#)]

microbiological parameter for non disinfected water

Parameter	(quantity / 100 ml)
<i>Escherichia coli</i> (E. coli)	0
Coloform bacteria	0
Enterococci	0
<i>Pseudomonas aeruginosa</i>	0
<i>Clostridium perfringens</i>	0

For disinfected water: Non within 250 ml

Austrian Laws: Austrian Drinking Water Directive

(Trinkwasserverordnung (BGBl. II Nr. 304/2001) novelliert mit BGBl. II Nr. 254/2006, ausgegeben am 6. Juli 2006)

Parameter chemical	limits	unit (ppm = µg/l)
:		
Lead	10	µg/l
:		
Cadmium	5,0	µg/l
:		
Nitrate	50	mg/l (= 50,000 µg/l)
nitrite	0,1	mg/l (= 100 µg/l)
pesticides	0,10	µg/l
total pesticides	0,50	µg/l
PAH	0,10	µg/l (polycyclic aromatic hydrocarbon)
mercury (quicksilver)	1,0	µg/l
:		
CHC	10	µg/l (chlorinated hydrocarbon e.g. trichloroethane)

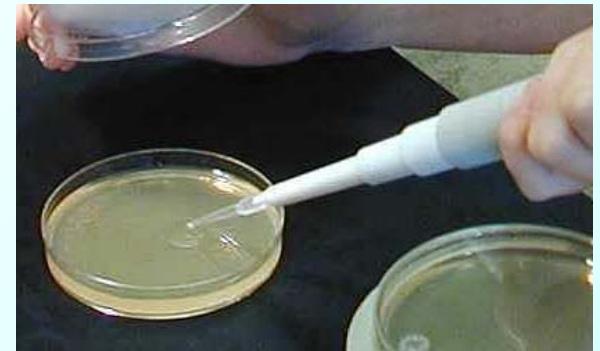


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Indicator Parameter (potentially problem)

microbiological Indicators:



E.g. microbiological indicator parameter for non disinfected water (plate count)

CFU 22 (colony forming unit at 22°C)	100 / ml
CFU 37 (colony forming unit at 37°C)	20 / ml

E.g. micro biological indicator parameter for disinfected water (plate count)

CFU 22 (colony forming unit at 22°C)	10 / ml
CFU 37 (colony forming unit at 37°C)	10 / ml



Austrian Laws: Austrian Drinking Water Directive

(Trinkwasserverordnung (BGBl. II Nr. 304/2001) novelliert mit BGBl. II Nr. 254/2006, ausgegeben am 6. Juli 2006)

Indicator Parameter

chemical	limits	unit (ppm = $\mu\text{g/l}$)
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:

Aluminium	0,2	mg/l
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Ammonium	0,50	mg/l
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Chlorid	200	mg/l
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Iron	0,2	mg/l
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Conductivity	2 500	$\mu\text{S cm}^{-1}$ @ 20°C
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Manganese	0,05	mg/l
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Sodium	200	mg/l
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oxidizeable Subst.	5,0	mg/ O ₂
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Sulphate	250	mg/l
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