



# Establishing a Dynamic System of Surface Water Quality Regulation:

Guidance for Countries of Eastern Europe, Caucasus and Central Asia



EAP Task Force

**ESTABLISHING A DYNAMIC SYSTEM OF SURFACE  
WATER QUALITY REGULATION:  
Guidance for Countries of Eastern Europe,  
Caucasus and Central Asia**

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### **СОЗДАНИЕ ДИНАМИЧНОЙ СИСТЕМЫ РЕГУЛИРОВАНИЯ КАЧЕСТВА ПОВЕРХНОСТНЫХ ВОД: Рекомендации для стран Восточной Европы, Кавказа и Центральной Азии**

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## FOREWORD

This guidance document promotes the adoption of ambitious but feasible water quality requirements by building capacity for the preparation and implementation of a water quality planning and regulatory components of integrated water resources management in countries of Eastern Europe, Caucasus and Central Asia (EECCA). It is addressed to senior and mid-level staff of water resources management and environmental protection authorities, and is designed to help EECCA countries to progress with a “second generation” of water-related legislation – a legal framework that is anchored in the economic and social environment of the country.

This document was prepared by the OECD/EAP Task Force Secretariat as an input to the Astana Environment for Europe Ministerial Conference (21-23 September 2011) where sustainable management of water and related ecosystems, including improved water governance, is one of the key discussion issues. It builds on the results of the project conducted by the Secretariat in 2006-2008 on surface water quality regulation in the Republic of Moldova.

The document was prepared by Mr. Paul Buijs, a consultant from the Netherlands, and Mr. Eugene Mazur of the EAP Task Force Secretariat. It was discussed and enriched at an EECCA regional expert meeting in Paris on 5-6 May 2011 and presented at the EAP Task Force meeting in Berlin on 12-13 May 2011. The work was financially supported by the Government of Finland.

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## ACRONYMS

BAT	Best available technique
BOD	Biochemical oxygen demand
COD	Chemical oxygen demand
EEA	European Environmental Agency
EECCA	Eastern Europe, Caucasus, Central Asia
ENP	European Neighbourhood Policy
ELV	Effluent limit value
EQS	Environmental quality standard
EU	European Union
EUWI	European Union Water Initiative
IPPC	Integrated pollution prevention and control
IWRM	integrated water resources management
MAC	Maximum allowable concentration
MWWTP	Municipal wastewater treatment plant
NGO	Non-governmental organisation
NPD	National policy dialogue
OECD	Organisation for Economic Co-operation and Development
SWQR	Surface water quality regulation
SWQS	Surface water quality standard
UNECE	United Nations Economic Commission for Europe
WFD	Water Framework Directive
WPI	Water Pollution Index

## EXECUTIVE SUMMARY

Learning from international good practices, countries of Eastern Europe, Caucasus and Central Asia (EECCA) are increasingly engaged in managing their water resources in accordance with the principles of integrated water resources management. This process requires that EECCA countries move beyond the “first generation” of their water-related laws and adopt a flexible system of water quality regulation that takes account of the constantly changing economic, social and environmental conditions.

The objective of this guidance document is to propose an approach to surface water quality regulation and management that would make it:

- Commensurate with the available resources;
- Flexible enough to respond to different and changing water uses and water quality conditions;
- Conducive to continual improvement of the surface water quality; and
- Consistent with the principles of integrated water resources management.

The diversity of water uses is at the core of the multi-functional nature of water quality management. Water uses and functions (aquatic ecosystem functioning, fishery, drinking water abstraction, bathing and irrigation) can be classified in a hierarchical order of increasing (or decreasing) water quality requirements. *Linking the hierarchy of water quality with the hierarchy of water uses through use-based classes with differentiated sets of surface water quality standards is the first key element of the proposed flexible approach to water quality regulation.*

*The second essential element is the adjustable scope of regulation: the list of parameters to be regulated should be determined by a combination of factors, including water management objectives, water uses, discharges and impacts of pollutants, and monitoring and laboratory analysis capacity. Dynamic water quality regulations should also contain mechanisms for periodically revising the scope of regulation by removing or adding parameters and/or adjusting the respective limit values.*

*Another fundamental principle is multi-stage planning and management, where an overall water quality objective has to be achieved over the long-term through a number of successive steps. Each step would consist of a feasible and affordable water management programme with its own specific medium-term (five to ten-year) targets.*

A regulatory framework supporting such multi-stage planning and management has to include an *iterative water quality planning process and a system of surface water quality standards with values corresponding to the respective medium-term targets.* An iterative water quality planning process involving multiple governmental and non-governmental stakeholders is designed to find a balance between the desired water uses and quality targets on the one hand and the available financial, technical and human resources on the other.



Each iteration of this planning process should comprise the following steps:

1. Define water bodies based on the analysis of characteristics of the river basin, pressures on water quality and existing water uses;
2. Explicitly identify and agree desirable water uses for the defined water bodies;
3. Assess whether existing water quality conditions of the respective water bodies support the desired water uses;
4. Should the current water quality conditions fall short of the respective requirements, conduct an affordability analysis of measures needed to achieve them and, if necessary, reconsider the desired water uses; and
5. Set a target and respective regulatory requirements for the water body and develop a water quality management programme to achieve and/or maintain it.

*Wastewater discharges should be regulated in accordance with the “combined approach”*: effluent limit values should be based on best available techniques or statutory effluent standards (technique-based approach), unless the applicable surface water quality standard/objective requires stricter effluent conditions (environmental quality-based approach).

*Regulating surface water quality in transboundary basins requires*, at a minimum, that the riparian states agree on *joint criteria for the assessment of surface water quality*. Joint criteria are needed in order to assure that countries make compatible assessments and draw conclusions about the water quality. The next steps would be for the riparian states to establish *joint surface water quality targets to be achieved on both sides of the border* as well as coordinate their water management measures.

The present document offers guidance for the introduction and implementation of an approach to water quality regulation in line with the above-mentioned principles. It can be used by competent authorities in EECCA countries to further improve surface water quality regulation while taking into account their national policies, international commitments, institutional capacity, as well as available financial, technical and human resources.

## 1. INTRODUCTION

### 1.1 Challenges of Water Quality Regulation in EECCA

For the last two decades, management of water resources has been one of the many environmental challenges facing countries<sup>1</sup> of Eastern Europe, Caucasus and Central Asia (EECCA). After the collapse of the Soviet Union, each country had to organise its own water management structures.

Learning from international good practices, EECCA countries are increasingly engaged in managing their water resources in accordance with the principles of integrated water resources management (IWRM). Many EECCA countries have started the convergence with key approaches the EU environmental legislation, especially the Water Framework Directive (WFD, 2000/60/EC), aiming to improve surface water quality.

This process requires that EECCA countries move beyond the “first generation” of their water-related laws that were based on the regulatory and management approaches, largely inherited from the Soviet Union and characterised by a rigid water classification system with little regard to actual water uses, lack of separation of scientific analysis and policy making, lack of risk management, and lack of transparency and stakeholder cooperation (OECD, 2000). In many EECCA countries, these laws imposed the same stringent standards on all surface waters without due consideration of social and economic impacts. The institutional fragmentation, the lack of technical capacity as well as the shortage of human and financial resources have further hampered the management of water resources in the region.

Water quality in EECCA countries is affected by the changing economic and climate conditions. The recovery of industrial and agricultural activities from the drastic decline in the 1990s is likely to increase the pollution pressure on the region’s water bodies, this time coming from a changed spectrum of sources. The anticipated (and already evident) effects of climate change, including higher water temperatures and increased frequency of floods and droughts, would exacerbate water pollution from sediments, nutrients, dissolved organic carbon, pathogens, pesticides and salt, as well as cause thermal pollution. These problems are likely to be further complicated by trans-boundary water issues. The need to promote structural reforms to green the economy and make it more diversified, as well as climate adaptation needs, would require a flexible system of water quality regulation.

### 1.2 Objectives of the Guidance Document

The principal objective of this guidance document is to promote the adoption of ambitious but feasible water quality requirements by building capacity for the preparation and implementation of a water quality planning and regulatory components of IWRM. This guidance, addressed to senior and mid-level staff of water resources management and environmental protection authorities, is designed to help EECCA countries to progress with a “second generation” of water-related legislation – a legal framework that is anchored in the economic and social environment of the country.

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<sup>1</sup> Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

### 1.3 Process of Development

A first attempt to test some elements of a flexible approach to water quality regulation was made within a pilot EAP Task Force project that aimed to assist the Government of Moldova in revising its system of surface water quality standards in line with Moldova's commitment to converge with the EU environmental legislation<sup>2</sup>. This approach was further promoted in recent projects in Western EECCA countries with support of the European Commission and in Central Asia with assistance from the UNECE.

The annotated outline of this document was discussed and endorsed at the annual meeting of the EECCA regional Regulatory Environmental Programme Implementation Network (REPIN) in November 2010. A draft was prepared by Paul Buijs (independent consultant, the Netherlands) in close cooperation with Eugene Mazur of the EAP Task Force Secretariat/OECD, who was also the document overall editor. A regional meeting was convened on 5-6 May 2011 in Paris to discuss the draft guidance document and refine regional policy recommendations.

### 1.4 Definition of Key Terms

*Water management* is the activity of planning, developing, distributing, managing, and optimising the use of water resources under defined water policies and regulations.

*Integrated water resources management* is a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems<sup>3</sup>.

*Water governance* is a set of political, organisational and administrative processes that support decision-making with respect to water resources management.

*Surface water quality regulation* includes the legal and institutional arrangements for regulating the quality of surface water resources.

*Surface water quality standard* is a concentration of a water quality parameter representing a threshold value related to certain water uses and environmental conditions.

*Water quality management programme* is a programme of measures and actions for managing and controlling anthropogenic activities (emissions of pollutants and other pressures) in order to achieve defined water quality conditions.

### 1.5 Document Structure

Chapter 2 describes the main elements of a flexible approach to surface water quality regulation (SWQR). Chapter 3 deals with legal, institutional and management issues related to the introduction of this approach in EECCA countries. Chapter 4 elaborates on the mechanism of practical implementation of a reformed SWQR system. Finally, Chapter 5 discusses international aspects of surface water quality regulation.

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<sup>2</sup> See policy recommendations at [www.oecd.org/dataoecd/34/23/41833059.pdf](http://www.oecd.org/dataoecd/34/23/41833059.pdf).

<sup>3</sup> Technical Committee of the Global Water Partnership, [www.gwptoolbox.org](http://www.gwptoolbox.org).

## 2. MAIN FEATURES OF A DYNAMIC WATER QUALITY REGULATION SYSTEM

Water management is strongly linked with other societal and economic sectors, such as healthcare, energy, industry, transport, agriculture, fishery, forestry, etc. The constantly changing economic, social and environmental conditions demand flexibility of all components of water management, including water quality regulation. This chapter discusses the key elements of such dynamic system of water quality regulation.

### 2.1 Diversity of Water Uses

Water management decisions have to balance different and sometimes conflicting needs and interests, in terms of both quantity and quality of water. Several uses require water to be of certain quality, while on the other hand anthropogenic activities inevitably lead to discharge of pollutants, deteriorating the water quality. The general public, with the majority in the EECCA region having very modest incomes, expects potable water of good quality, as well as facilities for the treatment of wastewater, at affordable costs. Investments in the protection of water resources against pollution from industrial and agricultural sources are a factor of economic development. Finally, the protection of aquatic ecosystems is also a matter of public interest.

The diversity of water uses is at the core of the multi-functional nature of water quality management (UNECE, 2000). Uses may compete or even conflict, in particular if water is scarce or its quality deteriorating. Multi-functional water management tries to strike a balance between all desired uses, including ecosystem functioning. It allows the introduction of a hierarchy in uses and provides flexibility for the different levels of development of water resources management policies and for prioritisation in time.

The concept of uses of surface waters has been long recognised in the EECCA region. Table 1 compares the types of uses of surface waters identified by the UNECE Task Force on Monitoring and Assessment<sup>4</sup> with the one included in the 1998 Water Code of Belarus, which is representative of water legislation of other EECCA countries.

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<sup>4</sup> The UNECE Task Force on Monitoring and Assessment was established to support implementation of the 1992 Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

**Table 1. Categories of Uses of Surface Waters**

	<b>UNECE</b>	<b>Water Code of the Republic of Belarus</b>
Uses with “undisturbed” water quality (Category 3)	<ul style="list-style-type: none"> <li>• Ecosystem functioning</li> </ul>	<ul style="list-style-type: none"> <li>• Water bodies located in specially protected natural territories</li> <li>• Water bodies having special state importance or special scientific, cultural or other value</li> </ul>
Uses with defined water quality standards (Cat. 2)	<ul style="list-style-type: none"> <li>• Fishery</li> <li>• Domestic water supply</li> <li>• Recreation and tourism</li> <li>• Irrigation in agriculture</li> <li>• Process/cooling water in industry</li> </ul>	<ul style="list-style-type: none"> <li>• Fishery and hunting management, amateur fishing</li> <li>• Drinking water, communal and other needs of the population</li> <li>• Curative, resort, health rehabilitation, sports, recreational and fire-fighting purposes</li> <li>• Agricultural needs</li> <li>• Industrial and energy sector needs</li> </ul>
Uses without water quality requirements (Cat. 1)	<ul style="list-style-type: none"> <li>• Power generation</li> <li>• Transport system (water, wastewater, shipping)</li> <li>• Extraction of minerals</li> </ul>	<ul style="list-style-type: none"> <li>• Use in the hydraulic energy sector</li> <li>• Discharge of wastewater, drain and quarry (mine, well shaft) water</li> <li>• Water transport and timber rafting</li> </ul>

As can be seen in Table 1, there is a good rapport between the two typologies of water uses, with a possible exception of ecosystem functioning. While the functioning of the aquatic ecosystem is an inherent characteristic rather than a “use” of water resources, it is commonly considered in international policy frameworks to be a use of water resources in accordance with the multi-functional approach to water resources management (UNECE, 1996). At the same time, the Belarusian Water Code refers to special and protected natural territories rather than to the functioning of aquatic ecosystems as an intrinsic feature.

The UNECE scheme provides a useful link with water quality regulation, as it presents a certain hierarchy in terms of water quality requirements. Ecosystem functioning has generally the most demanding water quality requirements; under Category 2, water quality requirements become less demanding; and there are no water quality requirements for the uses listed under Category 1.

This kind of hierarchy has traditionally not been reflected in water quality requirements in EECCA countries. Maximum allowable concentrations (MACs)<sup>5</sup> inherited from the Soviet Union cover sanitary/hygienic uses (including drinking water abstraction and bathing) and fishery. No explicit MACs have been defined for irrigation<sup>6</sup> and ecosystem functioning.

It is sometimes suggested that the fishery MACs could also be regarded as more generic ecological water quality standards. This is not necessarily the case: the fishery MACs have been set with respect to impact on (salmonid) fish and not on other aquatic species which may be as important to an aquatic ecosystem.

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<sup>5</sup> MAC was defined in the USSR State Standard (GOST) 27065-86 as a concentration of a substance in water above which the water is unsuitable for one or several types of water use (OECD, 2000).

<sup>6</sup> GOST 17.1.2.03-90 “Criteria and quality characteristics of water for irrigation” only lists parameters without indicating allowable concentrations.

## 2.2 Water Quality Classes

An iterative approach to surface water quality management implies the availability of differentiated sets of surface water quality standards (SWQSs). MACs used in EECCA countries allow only two interpretations of water quality: compliant or non-compliant with the MAC. Water quality classification schemes represent surface water quality conditions aggregated in classes of water quality, labelled with easily understandable qualifiers. Classification schemes allow for differentiation that is also useful from a planning and management points of view. They make it clear, for example, that it would take more time and effort to transform an “extremely dirty” water body to a “clean” than a “moderately polluted” one. This section discusses several types of classification schemes and their advantages and disadvantages.

One example of a classification scheme is one based on the Water Pollution Index (WPI), widely applied in the EECCA region. The WPI is the average annual exceedance of MACs for a number of (usually six or seven) parameters. Depending on the value of the index (i.e. the average degree of exceedance), seven quality classes are distinguished: “clean”, “relatively clean”, “moderately polluted”, “polluted”, “dirty”, “very dirty” and “extremely dirty”. In Russia, waters with the WPI value no more than 0.2 (20% average exceedance of selected MACs) are considered “clean”, and waters with the WPI between six and ten are labelled “very dirty”<sup>7</sup>.

Other classification schemes have also been developed in EECCA by government agencies and academic institutions. Some of them consider natural background concentrations of pollutants to correspond to the highest quality class (e.g. Stankevich, 2008), but lower quality classes are always tied to the level of exceedance of fishery MACs for selected parameters. Ukraine has developed an ecological classification scheme of five classes based on physico-chemical parameters and hydro-biological indicators in accordance with the 1998 “Methodology of Ecological Assessment of Surface Water Quality”.

While the classification schemes that currently exist in EECCA are suitable for general *evaluation* and reporting of water quality, they have a number of disadvantages with respect to water quality management:

- They only reflect the (aggregated) conditions for a limited number of parameters, which may not be representative of the overall ambient conditions;
- They do not expose the parameters “responsible” for assigning a lower quality class to a water body, while such information is needed to plan an improvement.
- These classification schemes are not appropriate for simultaneously addressing a variety of water uses (from qualifiers like “moderately polluted” it is not obvious which water uses would actually be impaired).

In order to be useful tools of water quality management, water quality classes should offer a possibility to plan step-by-step improvement of the condition of water bodies, with each class representing one step.

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<sup>7</sup> EU project on Harmonisation of Environmental Standards in Russia (HES II), [http://www.ipcc-russia.org/public/cluster10/CI\\_10-8\\_Setting\\_water\\_quality\\_standards\\_in\\_RF\\_EN.pdf](http://www.ipcc-russia.org/public/cluster10/CI_10-8_Setting_water_quality_standards_in_RF_EN.pdf).

The EU WFD defines five classes for the status of surface water bodies: “high”, “good”, “moderate”, “poor” and “bad” (Box 1). The status of surface water bodies has become a key regulatory principle for EU Member States. The Member States have to develop their own metrics for ‘high’ through ‘bad’ ecological status, since reference (natural background) conditions are different for surface waters throughout the European Union. The Priority Substances and their respective environmental quality standards, necessary for determining the chemical status, require quite sophisticated laboratory capacities, well-trained staff and sufficient financial resources for the analysis.

**Box 1. Good Status of Surface Water Bodies under the WFD**

The overall objective of the WFD is good status of all waters (surface water and groundwater) by the year 2015. For water bodies which are (expected to be) of less than good status, plans of measures have to be prepared and implemented in order to improve the status to become at least “good”. The status of surface water bodies consists of two components: ecological status and chemical status. The ecological status, which can range from “high” to “bad”, is determined by a combination of biological quality elements (aquatic flora, benthic invertebrate fauna and fish fauna) and physico-chemical quality elements (such as oxygenation conditions, nutrient conditions, salinity, as well as specific pollutants).

Good chemical status means compliance with the environmental quality standards defined in Directive 2008/105/EC<sup>8</sup>. This Directive comprises a list of 33 Priority Substances and certain other pollutants (including pesticides, heavy metals, polyaromatic hydrocarbons, and others).

In order for a surface water body to be classified as being of good status, the criteria for both good ecological and good chemical status have to be met. The overall good status objective represents surface water conditions that are appropriate for all types of water uses and functions, besides healthy aquatic ecosystems.

As discussed in Section 2.1, water uses/functions can be classified in a hierarchical order of increasing (or decreasing) water quality requirements. Therefore, it makes sense to link the hierarchy of water quality with the hierarchy of water uses. Different schemes can be devised for different typologies of water uses and corresponding number of classes. An example of a classification scheme based on water uses is provided in Table 2.

**Table 2. Example of a Use Class Scheme for Surface Waters**

Use / function	Use differentiation	Use Class	Use Class	Use Class	Use Class	Use Class	
		I	II	III	IV	V	
Ecosystem functioning		√	√	-	-	-	
Fishery/protection of fish life	salmonid	√	√	-	-	-	
	cyprinid	√	√	√	-	-	
Drinking water supply (incl. industries requiring potable water quality)	simple treatment	√	√	-	-	-	
	normal treatment				√	-	-
	intensive treatment					√	-
Bathing/recreation		√	√	√	-	-	
Irrigation		√	√	√	√	-	
Industrial water use (technological processes, cooling)		√	√	√	√	-	
Power generation		√	√	√	√	√	
Extraction of minerals		√	√	√	√	√	
Transport (water, wastewater, shipping)		√	√	√	√	√	

√ use/function supported  
- use/function not supported/allowed

<sup>8</sup> Directive 2008/105/EC “on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC”.

In the above scheme, the use classes are directly linked with water uses and can be characterised as follows:

- Use Class I corresponds to physico-chemical and microbiological conditions of a virtually undisturbed, natural aquatic system. Concentrations of synthetic (man-made) pollutants would not cause harm for humans and aquatic ecosystems. All intended uses are supported by water quality in compliance with the limit values of Use Class I.
- Water conforming to the standards for Use Class II has been disturbed to some degree by human activity but still supports all uses adequately, including properly functioning aquatic ecosystems. Simple treatment methods suffice for the preparation of drinking water (Box 2).
- For surface waters with the quality falling under Use Class III, simple treatment methods no longer suffice for drinking water preparation. The conditions required for salmonid fish (with species as such as salmon, trout, grayling and whitefish) may no longer be supported. One can expect deterioration of the aquatic ecosystem.
- Use Class IV surface waters require intensive treatment of the raw surface water abstracted for drinking water production. The conditions for cyprinid fish (with fish belonging to the cyprinids or other species such as pike, perch and eel) may no longer be supported.
- Use Class V waters only suffice for uses indifferent to water quality like hydropower generation, receiving wastewater discharges, shipping, etc.

#### **Box 2. Methods of Treatment of Raw Water for the Preparation of Drinking Water**

EU Directive 75/440/EEC “concerning the quality required of surface water intended for the abstraction of drinking water” distinguishes three treatment methods, depending on the actual surface water quality. The definition of the methods of treatment for transforming surface water of categories A1, A2 and A3 into drinking water are:

- Category A1: simple physical treatment and disinfection, e.g. rapid filtration and disinfection;
- Category A2: normal physical treatment, chemical treatment and disinfection, e.g. pre-chlorination, coagulation, flocculation, decantation, filtration and disinfection (final chlorination);
- Category A3: intensive physical and chemical treatment, extended treatment and disinfection, e.g. chlorination to break-point, coagulation, flocculation, decantation, filtration, adsorption (activated carbon) and disinfection (ozone, final chlorination).

Since the proposed approach is based on the link between water use and water pollution, it is likely to be an efficient tool in meeting water management objectives. For example, it can enable a comparison between the costs of treating water downstream before using it for drinking and the costs of reducing pollution upstream. When water management authorities know cost of treatment for water supply operators, this gives them a good idea of the costs of upstream pollution, which they can use to estimate the rates at which pollutant releases should be charged.

The use class scheme requires the definition of limit values for each class, expressed as concentrations representing water quality thresholds for certain water uses or functions. These limit values are essentially SWQs that apply to a water body for which a certain use class has been set as a target. An example of such an integrated set of SWQs, developed as a proposal for the government of Moldova, is presented in Annex 1. Such SWQs would play the same regulatory role as the sanitary/hygienic and fishery MACs currently used in EECCA countries.



In January 2011, the Government of Armenia introduced a system of use-based classes and SWQs similar to that proposed in Moldova but adapted to local conditions. Resolution No. 75-N “On the definition of water quality norms for each water basin management area, taking into consideration local specifics” distinguishes five classes, each related to a set of SWQs for 104 parameters. The new system identifies the following water uses/functions: “waters of national significance”, surface water protection, ecosystem functioning and fish protection, recreation and tourism, irrigation in agriculture, process/cooling water in industry, and hydropower generation. Natural background concentrations of selected parameters have been estimated for the main (sub-)basins in order to better define the locally appropriate SWQs.

A use class-based set of SWQs represents a hierarchical order of requirements, which would contribute to transparent water quality planning and management. However, having several “options” of requirements may initially be confusing for water managers and water users, who are used to a single list of MACs.

### 2.3 Adjustable Scope of Regulation

Surface water quality management consists of controlling anthropogenic activities (discharges of pollutants and other pressures) in order to achieve certain defined water quality conditions, characterised by the following groups of parameters:

- *Physico-chemical*: thermal conditions, oxygenation conditions, salinity, acidification status, nutrient conditions, specific synthetic pollutants, specific non-synthetic pollutants, and radionucleoids.
- *Microbiological*: bacteria, viruses, protozoa, helminths, cyanobacteria.
- *Hydro-biological*: fish, aquatic flora (phytoplankton, macrophytes), benthic invertebrate fauna, and zooplankton.<sup>9</sup>
- *Hydro-morphological*: quantity and dynamics of water flow, river continuity, structure and substrate of the river/lake bed, structure of the riparian zone, etc.<sup>10</sup>

The precise scope of parameters to be regulated is determined by a combination of the following factors:

- Water management objectives and targets;
- Water uses;
- Discharges of substances/pollutants;

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<sup>9</sup> Hydro-biological parameters can be effective indicators of pollution and other anthropogenic stresses. They are also relevant to ecosystem functioning, as physico-chemical parameters are insufficient to describe and predict the state of aquatic ecosystems. Currently, there is lack of robust hydro-biological metrics that would reflect different geological, physical and climate conditions. In addition, these parameters do not easily lend themselves to regulation, which is why they are not considered further in this document. Nevertheless, further development and strengthening of monitoring and assessment of hydro-biological parameters in EECCA countries is recommended.

<sup>10</sup> Hydro-morphological parameters are not water quality parameters per se. However, hydro-morphological conditions can affect, and should be considered in conjunction with, certain hydro-biological conditions.

- Impacts of substances/pollutants;
- Monitoring capacity; and
- Laboratory analysis capacity.

The above factors are not static. For example, industrial activities can change, with new factories opening and existing ones shutting down, resulting in different cocktails of pollutants; enhanced capacity for laboratory analysis widens the scope of substances that can be measured in surface waters and, therefore, regulated; progress in scientific and environmental knowledge can shift the focus to new pollutants. Furthermore, there can be a differentiation within countries, e.g. in terms of industrial activities or water uses, implying a different focus on parameters in and between water (sub-)basins.

For this reason, besides establishing tailored and manageable lists of regulated parameters, dynamic water quality regulations should also contain mechanisms for periodically revising the scope of regulation by removing or adding parameters and/or adjusting the respective limit values.

In the Soviet Union, sanitary/hygienic MACs were established for over 1300 parameters and fishery MACs for nearly 1100 parameters. Such long lists are useful reference sources and represent an important “scientific capital”, but their practical application has proven to be ineffective: the entire lists were regarded as water quality regulations, since no further instructions or guidance were provided to downsize the number of parameters.

The main problem with this enormous scope of regulation is that its implementation requires a vast laboratory capacity and budget to analyse so many parameters at often low concentrations. The laboratory capacity is a critical and often limiting factor because it is impossible to regulate water quality parameters that cannot be measured or quantified otherwise, notably when it comes to compliance assurance. Several EECCA countries (including Armenia, Belarus, Georgia, Moldova, Russia and Ukraine) have in the last two decades significantly upgraded their laboratories for the analysis of physico-chemical and microbiological parameters, but in many others the laboratory capacity remains rather basic.

In order to make their water quality requirements more realistic, several EECCA countries have reduced the number of regulated parameters. For example, Georgia’s 1996 “Guidelines for the Protection of Surface Waters against Pollution” defined MACs for 51 parameters (their values remained equal to the Soviet sanitary/hygienic and fishery MACs). In Belarus, the number of fishery MACs has been reduced to 788. As mentioned in Section 2.2, Armenia has recently adopted new SWQSs differentiated by use class and covering 104 parameters. In many other EECCA countries, the lists of MACs have not been significantly updated (in terms of parameters and/or concentrations) since the 1990s.

## 2.4 Iterative Approach to Surface Water Quality Management

Surface water quality management has to be tailored in accordance with the overall objectives, specific targets, agreed and desired water uses and functions, present water quality, and the available means and resources. This means that the planning has to go through a number of iterations (Figure 1), including the following steps:

1. *Designation of uses and functions of water bodies.* Not all surface water bodies have to serve the same purposes (unless an overall objective like “healthy aquatic ecosystem functioning of all surface waters” has been formulated), so it must be decided which specific uses and functions to assign to the various water bodies.

At present, EECCA countries tend to classify virtually all surface waters as fishery water bodies, following the practice introduced by the USSR Council of Ministers’ Resolution No. 1045 of 1958 which declared that “all water bodies and their tributaries which are being used or *could be used* for commercial fishing ... are considered water bodies for fishery purposes”. Even if a water body is not used for commercial fishing, it still is subject to the MACs for fishery waters.

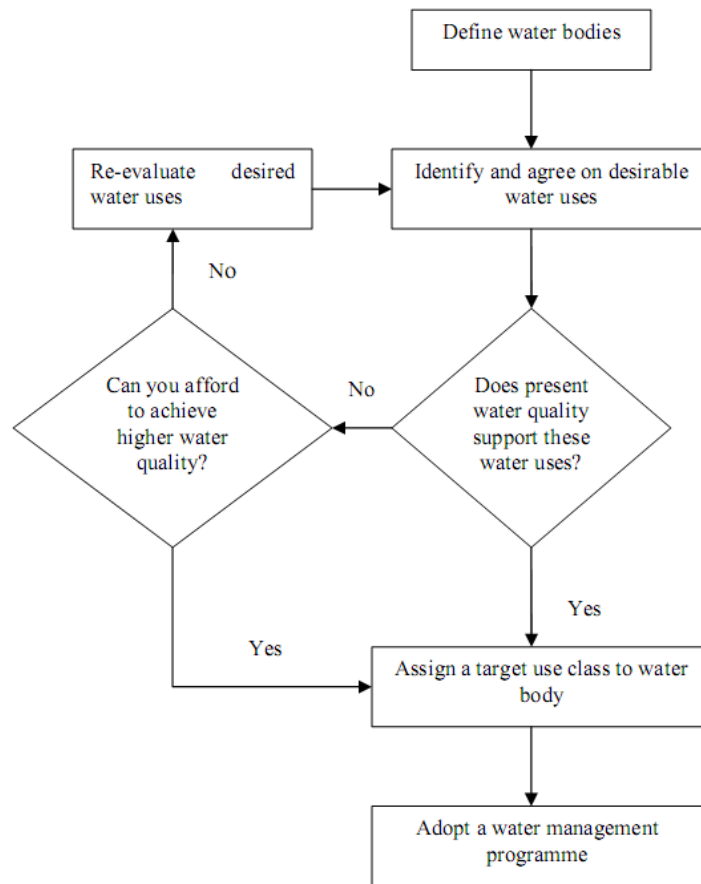
2. *Evaluation of the water quality.* The present water quality should be assessed in order to see whether the existing conditions support the designated uses, and if not, which measures would be required to improve the water quality.

The existing surface water quality is currently taken into consideration, for example, in defining new abstraction points for drinking water or in temporarily prohibiting bathing when microbiological parameters exceed their MACs during the recreational season. However, designating fishery water bodies is often done *a priori*, whether or not the actual water quality complies with the fishery MACs.

3. *Feasibility and affordability of measures.* After improvement measures have been identified, it is necessary to assess whether they can be implemented under the existing financial, technical, institutional and/or other constraints. In case the envisaged measures turn out to be unfeasible and/or unaffordable, certain desired water uses cannot be realised and some existing uses may have to be abandoned or adjusted. Such feasibility analysis is almost never conducted in EECCA as part of water quality planning.
4. *Adoption of a water quality management programme.* A water quality management programme for a period of five to ten years should set time-specific targets (or reflect policy targets defined in other strategic documents) of use classes for individual water bodies and define measures for achieving them. If feasibility studies indicate that certain targets cannot be reached according to the schedule, they have to be revised to lower their ambition.

At present, such time-specific water quality planning is also absent in most EECCA countries. Several Soviet-era fishery and sanitary/hygienic MACs correspond to nearly pristine conditions with very low levels of disturbance resulting from human activity. Although achieving surface water quality close to natural conditions is an extremely ambitious target, MACs basically require immediate compliance, since implementation timeframes are not defined. However, in recent years fishery MACs in Russia have begun to be regarded as long-term water quality targets, with interim goals per water basin to be set in five-year programmes.

Figure 1. Example of an Iterative Water Quality Planning Process



Water quality management programmes have to be reviewed and revised periodically, since a range of conditions can change with time:

- Demands on surface water bodies, including the types of their uses, may change;
- Existing industrial and agricultural activities may be phased out and new activities launched;
- The economic and financial situation may improve or deteriorate, affecting the affordability of certain water quality improvement measures;
- Technological progress may make additional measures available;
- Progress in the scientific knowledge and in the laboratory analysis capacity may shift the focus to different pollutants; etc.

The implementation of this iterative process in EECCA countries would signify a drastic departure from the existing water quality management practices, but will require a substantial investment of time and human resources.

## 2.5 Stakeholder Participation

The water quality planning process outlined in the previous section should involve a wide spectrum of institutional stakeholders. Their number reflects the broad impact of water quality management on other sectors of society. Governmental stakeholders are likely to include national and/or regional offices of ministries or state committees with responsibilities for the environment; health; agriculture and fisheries; water supply and sanitation; land use planning; infrastructure; transport; industry, etc. as well as key cross-sectoral ministries of economy and finance. Sub-national and local administrations are also important players in this process, along with water supply and wastewater management companies, NGOs, academic experts and the general public.

The need for stakeholder participation in water management is acknowledged in the legislation of several EECCA countries. For example, the 2006 Water Code of the Russian Federation states in Article 3 that “citizens and social groups have the right to participate in making decisions [that] may have an impact on the use and protection of water bodies”. However, in practice, both the inter-agency collaboration and public participation in EECCA leave much to be desired.

Stakeholder collaboration is always a challenge. Firstly, it can take quite effort and resources to establish formal or informal mechanisms of cooperation. Secondly, conflicting interests can sometimes be reconciled only using special tools of dispute resolution.

## 2.6 Effluent Regulation

The prevailing method in the EECCA region for defining effluent limit values (ELVs)<sup>11</sup> is site-specific. ELVs are calculated based upon the MACs set for the receiving surface water body (which in practice are always the fishery MACs, possibly complemented by certain sanitary/hygienic MACs, for example for microbiological parameters). The technical and financial feasibility of achieving the calculated effluent limits are not taken into consideration.

This way of setting ELVs has important implications for the operations of facilities discharging wastewater into water bodies, notably municipal wastewater treatment plants (MWWTPs). MWWTPs of a similar size and capacity are bound by more stringent ELVs when discharging into a relatively small surface water body and more lenient ELVs when discharging into a relatively large one. In the former case, the effluent requirements may surpass the performance of MWWTPs with a standard design (raising the issue of affordability of more stringent pollution controls), whereas in the latter case the plants would be “over-performing”. In addition, some existing fishery MACs in EECCA are so stringent that, if enforced, compliance with the respective ELVs would require large, often unaffordable, investments in wastewater treatment.

To address this issue, several EECCA countries have moved to regulating wastewater discharges via ELVs fixed in a regulation (so-called “statutory” ELVs). For example, Ukraine in 1999 established the same technology-based standards for BOD, COD and suspended solids on all water utilities regardless of the status of the receiving waters. Moldova’s 2008 regulation “On conditions for urban wastewater discharges into natural waters” was largely based on EU’s Urban Wastewater Treatment Directive (91/271/EEC)<sup>12</sup>. The Directive prescribes effluent concentrations (or a minimum percentage of reduction of pollution load) for BOD<sub>5</sub>, COD and suspended solids, as well as for total phosphorus and total nitrogen for discharges in “sensitive areas” (serving for drinking water abstraction or at risk of eutrophication).

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<sup>11</sup> In EECCA, the term “maximum allowable discharges” (MAD) is commonly used instead of “effluent limit values”.

<sup>12</sup> Available in Russian at [www.ecbsea.org/files//content/Dir\\_91\\_271\\_UWWT\\_as\\_amended\\_by\\_Dir\\_98\\_15\\_ru.pdf](http://www.ecbsea.org/files//content/Dir_91_271_UWWT_as_amended_by_Dir_98_15_ru.pdf).

Apart from statutory ELVs, effluent conditions can be set in reference to Best Available Techniques (BAT) – the primary basis for determining case-by-case permit conditions for large industrial installations in the EU according to the Integrated Pollution Prevention and Control (IPPC) Directive 2008/1/EC<sup>13</sup>. Technique-based regulation is also an important means to address numerous toxic water pollutants for which SWQs are not established due to capacity constraints of laboratory analysis (see Section 2.3).

However, even when complying with technique-based standards, effluents from any point source of pollution should not lead to exceedance of established SWQs for the receiving water body (corresponding to a certain use class under the proposed SWQS system). This is the essence of the *combined approach* envisaged in the WFD. Any direct discharger should demonstrate in a permit application, with the help of a conventional mass balance model, the non-exceedance of the SWQs for the relevant key parameters. If the analysis shows that the SWQs are likely to be exceeded, other factors affecting surface water quality in the area should be considered before more sophisticated effluent treatment requirements are imposed. This feature of the combined approach is an important tool in addressing the need for predictability of investments in wastewater treatment plants and adapting to possible changes of water quality as a result of climate change.

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<sup>13</sup> Such installations receive an integrated permit that, along with ELVs for direct discharges, also covers effluent minimisation and treatment techniques, discharges into the sewerage system, etc.

### 3. ESTABLISHING THE SYSTEM

The implementation of the approach to surface water quality regulation introduced in Chapter 2 – based on iterative water quality planning and SWQs tied to use classes of water bodies – would entail a number of legal and institutional changes as well as efforts to build capacity of different stakeholder organisations. This chapter discusses different aspects of establishing such a flexible SWQR system.

#### 3.1 Factors of a Policy Decision

Before making a decision about whether or not to adopt the proposed SWQR approach, policy-makers would need information on the following questions:

- *Are the principles of water quality planning and management accepted by the competent authorities and other stakeholders?* A stakeholder consultation should confirm relevant authorities' commitment to adopting a system based on iterative planning with time-specific water quality targets and regulatory requirements related to water uses. They should also be convinced that this approach would be adequate for safeguarding the desired surface water uses and functions.
- *What are the benefits and the financial implications of changing the SWQR system?* Decision makers would be interested in the anticipated improvements vis-à-vis the current system; projected staff and other resource requirements to implement it (for example, to enhance the laboratory capacity); the ramifications for investments in water supply and sanitation; expected changes in levels of revenue from pollution charges imposed on effluents; etc. Some of these issues would be addressed as part of the regulatory impact analysis (Section 3.3).
- *How does the proposed SWQR approach compare with international requirements and the respective systems of the neighbouring states?* This question is particularly relevant for countries sharing transboundary basins and those interested in convergence with the EU legislation.

#### 3.2 Legal and Management Documentation Supporting the System

The Water Code (or Law) is the main piece of primary legislation that has to enable and support the SWQR system. It should lay out the system's general principles and attribute key institutional responsibilities. The existing Water Code/Law may already contain provisions that allow the needed changes (see Box 3), otherwise amendments may be necessary.

The implementation mechanisms of the SWQR system should be elaborated in one or several regulations (secondary legislation). For example, a water use classification scheme and respective SWQs would be authorised in a regulation. As of early 2011, the absence of a relevant regulation in force in Armenia and Moldova meant that SWQs did not legally exist in these countries<sup>14</sup>, although de facto both continued to apply Soviet-based MACs.

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<sup>14</sup> In Armenia, such a regulation has been missing since the adoption of the 2002 Water Code. In Moldova, the regulation defining SWQs was repealed under the 2004 law "On reviewing and optimising the normative framework for regulating business activities".

### **Box 3. Using the Existing Legal Provisions: Water Codes of Belarus and the Kyrgyz Republic**

It is always preferable to use the existing legal provisions to accommodate changes to the SWQR because a revision of a Water Law/Code could be very time-consuming.

For example, the relevant articles of the Water Codes of Belarus and Kyrgyz Republic are phrased in a way that is consistent with introducing a use-based set of SWQs. For example, the Water Code of Belarus (as amended in 2009) contains the following provision on water quality norms (Article 14): “water quality norms shall be established, including general physical, biological and chemical quality indicators and maximum allowable concentrations of substances, ... for various purposes of water use”.

Similarly, Article 49 “Classification of Waters” of the 2005 Kyrgyz Water Code stipulates that “the National Water Council establishes a classification of waters of the Kyrgyz Republic in accordance with the quality and the types of use for each water body”.

Regulations can be complemented by supporting documentation such as manuals and guidance documents providing further operational details, e.g. the interpretation, presentation and reporting of water quality monitoring results. Such documentation not only supports staff in the routine work, but also ensures the consistency of the implementation of the new approach.

### **3.3 Regulatory Impact Analysis**

The regulatory impact analysis (RIA) is a process of systematically identifying and assessing the expected effects of regulatory proposals, using a consistent analytical method, such as benefit/cost analysis (OECD, 2008). RIA is a comparative process: it is based on determining the underlying regulatory objectives and identifying all the policy interventions that are capable of achieving them. These alternative regulatory instruments must be systematically assessed to inform decision-makers about the strengths and weaknesses of different regulatory options and enable the most effective and efficient options to be chosen. RIA’s most important contribution to the quality of decisions is not the precision of the assessment, but the analysis itself – questioning, understanding real-world impacts and exploring assumptions. The use of RIA will also contribute to the broader efforts of public administration reform and “better regulation” in EECCA countries. Table 3 illustrates how RIA can be applied to the proposed SWQR approach.



**Table 3. Application of RIA to Surface Water Quality Regulation**

<b>RIA Elements</b>	<b>Description</b>	<b>SWQR Examples</b>
1. Objective	Clearly state the policy objective(s) and goal of the regulatory proposal	To facilitate water management following the principles of IWRM
2. Problem	Describe your assessment of the nature and extent of the problem to be addressed by the regulatory proposal	Present SWQR system does not provide the necessary flexibility
3. The regulatory proposal	<p>Explain the regulatory proposal:</p> <ul style="list-style-type: none"> <li>• Describe the regulations</li> <li>• Outline the legal authority to make the regulation</li> <li>• List the groups likely to be affected by the regulation</li> <li>• Outline the enforcement regime and proposed strategy for ensuring compliance</li> </ul>	<p>The environment ministry could be mandated to draft the regulation.</p> <p>Affected groups include ministries (environment, health, agriculture, etc.), owners and operators of municipal and industrial WWTPs, local authorities, NGOs and citizens.</p> <p>Mechanisms for water quality monitoring and implications for effluent regulation should be elaborated.</p>
4. Analysis of Benefit and Costs	<p>Clearly outline the benefits and costs expected from the regulatory proposal for each group:</p> <ul style="list-style-type: none"> <li>• Administrative</li> <li>• Economic</li> <li>• Social</li> <li>• Environmental</li> <li>• Enforcement and Compliance</li> </ul>	<p>Costs of the new SWQR system affect the state budget, local authority budgets and private funds (industry and farmers) and include investments in wastewater treatment, consumer tariffs for drinking water and wastewater, costs of monitoring surface water and effluent quality, planning and management staff, etc.</p> <p>Benefits comprise more rational planning and management, including investment planning, improvement of surface water quality, better consideration of stakeholder interests, etc.</p>
5. Compare the costs and benefits	Include a table comparing the cost and benefits for each of the above categories, listing the monetary values of each or providing a description.	
6. Identify alternatives	List the practical alternatives, including any non-regulatory approaches that have been considered as options instead of the proposed regulatory approach.	Alternatives include: not changing the existing SWQR system (“business as usual”), adopting approaches used in other countries, e.g. in the Russian Federation, or the EU WFD.
7. Compare the costs and benefits of alternatives	Describe the benefits and costs for each practical alternative that was considered.	
8. Compare the alternatives with the regulatory proposal	Outline how and in what ways the identified regulatory proposal is superior to the alternatives that were considered.	The WFD could be considered as “better” (more robust), but may not be attainable for EECCA countries in the short/medium term.
9. Consultation	Describe the process of consultation that have been undertaken to collect stakeholder views. List all the groups that were invited to comment on the regulatory proposal and summarise their comments.	

Source: Adapted from OECD, 2008

### 3.4 Governance Structure

The water quality planning process requires a number of organisational arrangements. Where possible, these arrangements should be settled within the existing structures, by attributing mandates and establishing dedicated mechanisms for stakeholder cooperation, including working groups. The main advantage of implementing the new approach to water quality planning and regulation within the existing institutional framework is to avoid the additional costs and competency losses associated with organisational restructuring.

At least the following institutional responsibilities have to be allocated:

- *Process supervision.* Supervision of the water quality planning process is primarily an administrative task. One ministry (responsible for the environment and/or water) should have these coordinating functions.
- *Identification of water bodies.* The identification and delineation of water bodies is a task that can be implemented by a technical working group, preferably comprising representatives of different ministries. Involvement of regional and local departments is crucial, mainly due to their knowledge and understanding about the local situation.
- *Identification and agreement on desirable water uses.* This would be a typical task for stakeholder platforms. It is important to define the rules of decision making in advance (consensus building, voting by majority, etc.) as well as the status of outputs (recommendations, binding advice, etc.).
- *Selection of regulated parameters and definition of SWQs.* The selection of parameters to be regulated and the setting of limit values will require a team of specialists from various sources and disciplines. Specialists from ministries (environment, health, agriculture) may have to seek external support, for example from universities and other knowledge centres.
- *Surface water quality monitoring.* Monitoring is best conducted by two organisations at most, in order to obtain more uniform and consistent sets of data. Monitoring of microbiological conditions would be a typical task of the ministry of health, whereas routine monitoring of the physico-chemical surface water quality would be conducted by an organisation like the hydro-meteorological service.<sup>15</sup>
- *Assessment of the present water quality.* A proper assessment of the surface water quality should go beyond a mere comparison of the monitoring data against the limit values of the use classes. A multidisciplinary team/working group should conduct a comprehensive analysis and evaluation of the available monitoring data.
- *Preparation of a plan of measures and evaluation of their feasibility and affordability.* Specific expertise has to be mobilised depending on the types of identified potential measures. For example, measures involving wastewater treatment can be best identified by an environmental inspectorate and MWWTP specialists, whereas measures involving irrigation practices or the application of pesticides and fertilisers require agricultural expertise. Templates and expertise for financial analysis also have to be available.

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<sup>15</sup> Hydro-meteorological service is mentioned merely as an example. The organisation conducting routine monitoring of physico-chemical and hydro-biological parameters can vary from country to country. In some countries, more than one government agency is involved in routine monitoring of physico-chemical parameters.

- *Evaluation of actual/desired water uses against the estimated programme implementation efforts.* The evaluation and adjustment of water uses based on the results of the feasibility and affordability analyses should be performed by a representative group of competent stakeholders. A multidisciplinary team will be needed, since technical, financial, social as well as political considerations will have to be taken into consideration. This is a crucial stage, since the outcome of this evaluation will be an important basis for decision-making and ensuing activities.
- *Development of a water management plan.* The development of water management plans requires multidisciplinary teams and inter-departmental cooperation.

While the implementation of a dynamic SWQR system does not require, and should not be dependent on, an institutional restructuring, the planning and management could benefit from establishing dedicated bodies, such as river basin agencies or river basin councils. Practice has shown that such bodies best function when organised at the level of river basins (or river basin districts<sup>16</sup>). Small river basins may be combined with larger river basins or joined with neighbouring small basins to form a unit. The river basin (district) agency becomes responsible for the planning process in each basin, under the auspices of the central government. These agencies would include representatives of central and local public administration bodies, water user associations, representatives of the academia and civil society.

Since the establishment of river basin (district) agencies can be time-consuming, the introduction of the revised SWQR system and the creation of river basin agencies could be conducted in parallel. Once the latter have been established, they can assume the operational tasks and duties related to the SWQR system.

Several EECCA countries already have established a legal framework for the creation of river basin agencies. This is the case in Armenia (Water Basin Management Authorities), the Kyrgyz Republic (Basin Councils), the Russian Federation (Basin Councils), and Ukraine (Basin Administrations of Water Resources). Moldova's draft new Water Law contains provisions for establishment of River Basin District Committees.

### **3.5 Development of Technical Capacity**

The capacity for *laboratory analysis* is one of the critical factors for the selection of regulated parameters. As explained in Section 2.3, the existing laboratory capacity is the key factor in defining the list of parameters to be regulated. At the same time, countries should think about strategies for enhancing their laboratory analysis capacity where deemed necessary (laboratory capacity is also a matter of having sufficient and well-trained staff). The list in Annex 1 could be used as a reference to identify needs for further development of the capacity to analyse physico-chemical and microbiological parameters.

Functional surface water quality and effluent *monitoring programmes* are a prerequisite for any SWQR system. However, the approaches and suggestions introduced in Chapter 2 do not impose any additional specific monitoring requirements.

Capacity development is also needed in the area of technique-based effluent regulation (see Section 2.6). Although environmental permitting based on best available techniques have already been the subject of many national and international initiatives and projects in the EECCA region, significant capacity building efforts are still required to make the BAT concept operational in these countries. Applying statutory ELVs for MWWTPs can be adopted relatively easily, but it will take more time to implement the technique-based approach for setting ELVs for industrial wastewater discharges.

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<sup>16</sup> According to the WFD, a river basin district is an area of land and sea, made up of one or more neighbouring river basins together with their associated groundwater and coastal waters.

### 3.6 Driving Forces and Barriers

The adoption of the proposed SWQR system may be driven by a combination of factors, including, among others:

- *Dissatisfaction with the current SWQR system.* EECCA countries may not be satisfied with the demands, requirements and/or performance of their current SWQR system. This is an essential driving force for change, although by itself not necessarily leading to the adoption of the approach to SWQR that is described in this guidance document.
- *Transition toward IWRM.* EECCA countries are committed to reforming their water management in accordance with the principles of IWRM. The flexible approach to SWQR introduced in Chapter 2 is compatible with IWRM requirements and sufficiently pragmatic to be used under the capacity constraints in the EECCA region.
- *Conversion with EU environmental policies.* Several EECCA countries, notably in the western part of the region, are interested in the harmonisation or even approximation with EU policies.<sup>17</sup> The WFD is the fundamental policy instrument for water management in the EU Member States. This Directive is comprehensive and demanding in terms of preparation and implementation, requiring significant legal, institutional and methodological changes. EECCA countries would not be ready to implement all WFD requirements in the short or medium term, even if they were interested in doing so.

The proposed approach to SWQR is compatible with the WFD and other EU legislation. The water quality planning process (Section 2.4) is in line with the planning principles of the WFD, without having to comply with specific objectives like “good status”. An integrated set of SWQS in Annex 1 includes most physico-chemical and microbiological parameters relevant under the WFD, including the Priority Substances and other pollutants covered by Directive 2008/105/EC on water quality standards. In the future, the SWQS system can be extended to hydro-biological criteria. Finally, the combined approach to effluent regulation (Section 2.6) is one of the essential features of the WFD.

At the same time, there are a number of barriers to the implementation of the dynamic system of surface water quality regulation. Section 3.5 already touched upon the issue of technical capacity limitations. In addition to those, the *lack of human and financial resources* is a major constraint in the preparatory work, which would include finalising the design of the SWQR system, organising stakeholder consultations, conducting a RIA, drafting relevant regulations, preparing manuals and guidance documents, training of staff, etc. To bridge this resource gap, countries may seek assistance from donors and international organisations.

As discussed in Section 2.5, successful implementation of a new SWQR system requires inter-agency cooperation and multi-level stakeholder consultation. *The institutional fragmentation* in EECCA countries in the area of water management (with gaps or overlaps in competencies and poor communication between relevant authorities) is an important impediment in this respect. Participatory mechanisms become more and more widespread in the region but have not yet been firmly institutionalised.

Finally, the *inertia of professional water managers* is also likely to slow down the reform process. Many people involved in water management in EECCA countries have applied Soviet-era regulatory schemes for most of their professional careers. It could be difficult for them to accept an entirely different approach. In order to overcome this barrier, it is important to involve people in the reform process from the start. The strengths and weaknesses of the old and the new approach should be addressed in an objective and practical way in informational seminars, trainings, and other professional exchanges.

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<sup>17</sup> See “Convergence with EU Environmental Legislation in Eastern Europe, Caucasus and Central Asia: A Guide” (ERM, 2003) for the differences between harmonisation and approximation.

## 4. IMPLEMENTING THE SYSTEM

This chapter describes in detail the mechanism for the implementation of the flexible approach to SWQR, both in defining regulatory requirements in accordance to the principles discussed in Section 2.3 and applying them through the iterative water quality planning process described in Section 2.4.

### 4.1 Selection of Regulated Parameters and Limit Values

A combination of criteria should be applied to define a relevant set of parameters to be regulated, including the presence of pollutants in wastewater discharges to the water body; existing and desirable water uses, and the laboratory analysis capacity. The parameters included in Annex 1 could be used as a long list for orientation purposes.

#### *Substances in existing pollution flows*

Inventories of pollution flows into surface waters (and groundwater) can be used to identify a preliminary range of relevant parameters. A basic pollution inventory is simply a list of specific anthropogenic activities that can result in releases of pollutants to surface waters:

- Discharges of treated and untreated municipal wastewater: They usually feature a mix of parameters, including biochemical oxygen demand (BOD), nutrients, trace metals, organic micro-pollutants and microbiological parameters.
- Direct discharges of treated and untreated industrial wastewater: The type of industry can indicate the presence of certain pollutants in the effluent. For example, food industry is associated with BOD and nutrients, metallurgy with trace metals, chemical industry with organic micro-pollutants, etc.
- Agriculture: Inflow of organic pollution (BOD), nutrients and microbiological parameters can be expected from dairy, pig and poultry farms. Application of fertilizers and manure on agricultural land leads to the runoff of nutrients. Agriculture also can be an important non-point source of plant protection agents (pesticides, insecticides, fungicides, etc.).

Data collected through the monitoring of effluents provides a good basis for the identification of regulated parameters. More information can be retrieved via the Internet, e.g. by searching for parameters found in comparable wastewater flows in other countries. Indicative information can also be drawn from statistics on annual application of fertilizers and plant protection agents, specific industrial products, etc.

It is preferable to complement pollution flow inventories by field measurements and surveys: taking and analysing samples of surface water, groundwater and wastewater discharges. The laboratory analysis capacity is a critical factor in the identification of pollutants, so one-time contracting of laboratories abroad may be an option if laboratories within the country are poorly equipped to do this.

In transboundary basins, upstream pollution inflow from neighbouring countries should also be taken into account. In case the transboundary exchange of data and information is limited, identification of pollutants through sampling and analysis near the border may constitute an alternative.

## Water Uses

Water uses also provide clues to which parameters should be regulated. Table 4 presents an indicative matrix of how different types of water quality parameters affect water uses.

**Table 4. Relevance of Water Quality Parameters to Specific Water Uses**

Group of parameters	Examples of specific parameters	Ecosystem functioning	Fishery/ protection of fish life	Drinking water supply	Bathing/ recreation	Irrigation	Industrial water use
<b>General conditions</b>							
Thermal conditions	<i>water temperature</i>	o	x				
Oxygenation conditions	$O_2$	x	x				
	$BOD_5$	o	o	x			
	$COD$			x			
Nutrient conditions	$P_{total}$ , $PO_4$ , $NO_3$ , organic N	x	o	o	o		o
	$NH_4$	o	x				
	$NO_2$	o	o	o			
Salinity	<i>mineralisation, Cl, <math>SO_4</math></i>			o		x	o
Acidification status	<i>pH</i>	o	o	o			
Other parameters	<i>odour, colour, floating material</i>	o	o	x	x		
	<i>Mn, Fe, phenols, oil products</i>	o	o	x			
<b>Trace metals</b>	<i>Cd, Cu, Hg, Ni, Pb, Zn, etc.</i>	x	x	x		o	
<b>Organic micro-pollutants</b>	<i>pesticides, polycyclic aromatic hydrocarbons, etc.</i>	x	x	x		o	
<b>Microbiological parameters</b>	<i>E.coli, enterococci, streptococci, parasites, viruses</i>			x	x	o	

x Parameters can have significant impacts on use/function

o Parameters can negatively affect use/function

Nutrients (phosphorus and nitrogen) are a good example of parameters that can have a significant negative impact on water uses. Nutrients are key factors of eutrophication that can lead to serious disturbances of aquatic ecosystems, but they also affect the conditions of bathing waters (e.g. by inducing the growth of green algae). In addition, eutrophication can result in blooms of cyanobacteria, also known as blue-green algae, which produce cyanotoxins that can be dangerous to animals and humans.

## Laboratory analysis capacity

In practice, the capacity for laboratory analysis is a decisive limiting factor in defining the scope of regulation. Since it is difficult to regulate parameters that cannot be measured, sets of regulated parameters should generally be restricted to those that can be analysed under the existing constraints.

At the same time, a strategy can be elaborated to enhance the laboratory capacity. Accurate analysis of micro-pollutants (trace metals, pesticides, etc.) could not only require a substantial investment in procuring new analytical equipment, but also involve expensive analysis to be carried out by experienced staff under proper laboratory conditions. The list of parameters in Annex 1 provides a good basis for identifying specific needs for enhancing the laboratory capacity.

After the regulated parameters have been defined, *limit values should be set for each use class* (see Section 2.2). In the example presented in Annex 1, such limit values were derived from existing SWQSSs, primarily those defined in EU Directives. While limit values can also be derived from other sources or defined analytically, it is important that they be established with consideration of all associated uses.

## 4.2 Definition of Water Bodies

Although a river basin should be regarded as a continuum, dividing it into smaller units facilitates its management. Distinguishing smaller units with specific water uses and pressures enables the preparation and implementation of targeted management plans.

There is no generic methodology for the identification and delineation of water bodies. A guidance document “Identification of Water Bodies” (EC, 2003) was issued to support EU Member States in the identification of water bodies for implementation of the WFD. Being tied to the concept of ecological status, central to the WFD but not recommended for immediate implementation in EECCA, the EU guidance is not entirely applicable in EECCA countries. Nevertheless, some of its principles are useful and are explained in this section.

Water bodies are best defined within a river basin or sub-basin (depending on the size) based on their physical and hydro-morphological features, existing water uses as well as predominant pressures via the following five steps:

1. *Distinguish the surface water category.* The four main surface water categories are rivers, lakes, transitional waters and coastal waters. These categories allow for a first large-scale division of the basin.
2. *Differentiate the main course of the river and its tributaries.* Most countries have registers of rivers and tributaries, which definitely will facilitate this step.
3. *Distinguish heavily modified and artificial water bodies.* A heavily modified surface water body is a water body substantially physically altered by human activity (e.g. a reservoir). An artificial water body is one that has been created by human activity (e.g. a canal connecting two rivers). The concepts of heavily modified and artificial water bodies are important under the WFD, since such water bodies are not required to attain good ecological status (see Box 1 in Section 2.2).<sup>18</sup> Nevertheless, distinguishing heavily modified and artificial water bodies is also relevant for SWQR because their existence implies certain specific water uses.
4. *Differentiate water bodies according to their existing water uses.* The preliminary definition of water bodies on the basis of physical and hydro-morphological features can be further differentiated for the various actual water uses in the (sub-)basin. In most countries, the areas for abstraction of surface water for the drinking water supply, for recreation (bathing) and for abstraction of water for irrigation are identified and mapped. This is also the case with recognised nature protection areas, like wetlands.
5. *Differentiate water bodies according to pressures.* With respect to surface water quality, pressures come from both point sources (wastewater discharges from MWWTPs and industries, thermal discharges of cooling water from power plants) and non-point (diffuse) sources (runoff of pesticides, manure or fertilisers from agricultural land, stormwater and sewage overflows in urban areas, atmospheric deposition, etc.). Additional delineation of water bodies based on predominant pressures is helpful in the subsequent identification of water quality improvement measures.

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<sup>18</sup> The main WFD objective for heavily modified and artificial water bodies is to reach good ecological *potential*, as well as good chemical status.

As the main purpose of defining water bodies is to facilitate river basin management, it is important to end up with a manageable number of water bodies. Endless sub-division of water bodies should be avoided in order to reduce the administrative burden of managing them individually. For example, there are more than 20,000 rivers, more than 10,000 lakes and about 1,200 reservoirs and ponds in Belarus.<sup>19</sup> The Netherlands, a small country with a surface area of roughly 42,000 km<sup>2</sup>, has identified 724 surface water bodies under the WFD. It is obvious that over 30,000 water bodies cannot be managed individually. Even a few hundred water bodies require considerable efforts that may exceed the management capacity of most EECCA countries.

It is recommended to prepare a detailed inventory of water bodies following above-mentioned steps 1 through 3 and employ water uses and pollution pressures as criteria for further selection and prioritisation. Defining water bodies is an iterative process: the initial delimitation of water bodies may have to be refined or revised during future rounds of water quality planning.

### **4.3 Agreement on Desirable Water Uses**

Reaching agreement about the desired water uses requires a series of discussions and consultations with governmental and non-governmental stakeholders. A water use like drinking water abstraction is quite evident, often already prioritised in the legislation. Discussions about fishery uses may become more complicated, even if most surface waters are assigned as fishery water bodies by a governmental decision, as is presently the case in EECCA. Ecosystem functioning would likely raise most difficult discussions, partly because it is complicated to express its benefits in financial and economic terms.

Including ecosystem functioning among potential uses does not automatically imply immediate commitments. Even if the feasibility and affordability analyses (Section 4.5) shows that safeguarding ecosystem functioning is not yet a realistic option in the short or medium term, this use can be kept in mind for a longer-term planning horizon. During each new planning iteration (Section 2.4), it can be assessed to which extent further progress can be made in attaining it.

Many countries have plenty of small rivers, streams and lakes that at a first glimpse seem to be rather “use-less”, except for the ubiquitous designation of fishery waters or when applying ecosystem functioning as an overall intrinsic feature. Small water bodies will require special attention: being small makes them more prone to negative impacts of pollutants from wastewater discharges or runoff from agricultural lands. However, it is difficult to monitor and manage all such water bodies individually because of their small size and large number.

### **4.4 Assessment of Existing Water Quality Conditions**

The assessment of existing water quality is a key element of water management. A proper assessment goes beyond merely comparing the monitoring data with the MACs or the limit values of a classification scheme and involves wider interpretation of the data and observed phenomena.

Competent authorities in EECCA countries presently use maximum values (concentrations) of parameters (minimum values for dissolved oxygen) as part of monitoring data to check compliance against the MACs. This method does not address the issue of accidental peak concentrations that are not representative of the “normal” conditions over an extended period of time. Such accidental peak concentrations can be caused by a range of factors, from exceptional natural conditions to flaws in the laboratory analysis. To avoid a disproportionate effect of peak concentrations on water quality analysis, it is highly advisable to use

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<sup>19</sup> State of Water Resources of the Republic of Belarus, 2003, <http://enrin.grida.no/htmls/belarus/water2003en>.



*percentiles* – a relatively simple statistical method of ‘peak-shaving’ envisaged, for example, by many water-related EU Directives<sup>20</sup>.

To determine the use class of a water body in accordance with the approach presented in Section 2.2 and illustrated in Table 2, it is necessary to go through the following steps:

1. Calculate the actual values of regulated parameters: If ten or more samples have been taken over the year, calculate the 90<sup>th</sup> percentile value; if there are less than ten samples, take the maximum value. This applies to most parameters<sup>21</sup> but not to organic micro-pollutants, which, if regulated, should be assessed using an annual average concentration.
2. Compare the calculated actual values with the limit values of the use classes (defined as shown in Annex 1 or otherwise). If the limit value for a parameter is the same for several use classes, consider the actual concentration for this parameter to conform to the higher quality class.
3. Determine which use class corresponds to the value of each parameter, as shown in the example in Table 5.
4. Determine the “worst quality” use class corresponding to *any* of the parameters. This use class corresponds to the overall water quality in the water body.

**Table 5. Example of Assigning a Use Class to a Water Body**

<b>Parameters</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
BOD <sub>5</sub>	II	III	II
Cl	I	I	I
Cu	I	I	I
Dissolved O <sub>2</sub>	I (I-II)	III	I (I-II)
Fe	I	I	I
NH <sub>4</sub>	IV	III	III
NO <sub>3</sub>	II	II	III
Oil products	III	III	II
PO <sub>4</sub>	II	II	II
P <sub>total</sub>	II	II	I
pH	I (I-IV)	I (I-IV)	V
phenols	I (I-II)	I (I-II)	I (I-II)
SO <sub>4</sub>	I	I	I
Zn	II	II	II
<b>Resulting use class of the water body</b>	<b>IV</b>	<b>III</b>	<b>V</b>

<sup>20</sup> A percentile is the value of a variable below which a certain percentage of observations fall. For example, the 90<sup>th</sup> percentile is the value below which fall 90% of the observations. A formula for calculating percentiles can be easily found using an Internet search.

<sup>21</sup> For dissolved oxygen, the 10<sup>th</sup> percentile value should be calculated if there are more than ten samples, and the minimum value if there are less than ten samples.

The final outcome of the conformance check against the limit values of the use classes should be critically reviewed. It is also recommended to take into account several (three-four) years of monitoring observations. Factors to be taken into consideration include, among others:

- Relevance to the existing water uses<sup>22</sup>;
- Accidental peak concentrations (as already discussed above);
- Laboratory performance;
- Representativeness of the sampling locations;
- Type-specific conditions (for example, lakes and reservoirs can respond differently to pollution than rivers); and
- Natural background conditions.

An important reason for applying expert judgement to the preliminary outcome of the use class conformance check is to avoid wrongly qualifying a water body. Since problematic water bodies imply serious follow-up activities (including investments), the assessment of a water body's overall water quality should not be based on a sheer mathematical exercise of comparing concentrations against limit values.

Assessment of water quality conditions to verify conformance to a use class has to be done in principle only when starting a new water quality planning period. However, it is also advisable to include an assessment for how the monitoring results compare with use classes as part of regular water quality reporting.

#### **4.5 Feasibility and Affordability Analyses**

At this stage, the actual and desired uses associated with the identified water bodies have been defined (Sections 4.2 and 4.3), and the actual physico-chemical and/or microbiological quality of the water bodies have been assessed in relation to the established use classes (Section 4.4).

The results of the assessment would show that the water body's actual water quality either complies with the (use class) limits for the actual and desired uses or falls short of the respective requirements. In the latter case, interventions are needed to improve the water quality.

The problematic parameters in principle have been identified as part of the water quality assessment, so the next step is to find out the causes of their non-conformance to the limit values. The suspected causes include pollution from point and non-point sources, but phenomena like eutrophication can also affect the water body's physico-chemical and microbiological conditions. If the recorded monitoring data cannot be explained by known sources or causes, field investigations and surveys may have to be organised.

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<sup>22</sup> In the example in Table 5, the water body in 2005 would be qualified as conforming to Use Class V because of the pH reading. Expert judgement should be used to determine whether or not this pH level would indeed imply a serious risk for the existing water uses.

Following the analysis of pressures, an action plan would be needed to be developed in order to improve the water quality conditions. For each identified measure at least the following must be addressed:

- Expected results (in terms of water quality improvement);
- Technical, financial, regulatory and institutional aspects;
- Major actors involved in the implementation;
- Estimated implementation timeframe; and
- Overall feasibility (opportunities and constraints).

Finally, it has to be determined which of the projected measures are feasible and affordable. In order to assess the technical feasibility of measures, expert judgements should be called upon and international references for BAT and best environmental practices should be consulted. Costs of various measures can also be assessed quite accurately and objectively. There are, however, no objective criteria of financial affordability: besides the national and local economic and financial situation and priorities, social and political factors would need to be considered.

A problem with technical feasibility of the proposed measures should trigger their reconsideration and another round of analysis should be undertaken. Affordability constraints may mean that the desired uses have to be re-evaluated and possibly postponed. Actual uses (e.g. bathing) may even have to be prohibited or current practices adjusted (e.g. by applying more intensive treatment methods for the preparation of drinking water from the abstracted surface water).

There could be situations where not much could be done to improve the water quality conditions in the short term. For example, this could be the case with properly functioning MWWTPs discharging wastewater complying with the statutory ELVs (see Section 2.6) but with volumes that are relatively large compared to the volume of the receiving surface water. In such cases it may simply be too difficult (and/or expensive) to better treat the effluent and improve the surface water quality. Therefore, a reasonable alternative would be to adjust the (desired) uses of the water body for the given planning period and to prepare better solutions for the future.

#### **4.6 Assignment of a Target Class and Adoption of a Water Quality Management Programme**

If, as a result of the feasibility and affordability analyses, the improvement measures are deemed realistic, they justify the desired water uses and the assignment of the respective target class to the given water body.

Since water uses assigned to water bodies vary, and water bodies may be polluted to a different degree, different target classes would usually be assigned to different water bodies. One could argue that all parts upstream a river's section with a certain water use also should comply with the same conditions. However, this position does not acknowledge processes like self-purification, retention of pollutants (e.g. through sedimentation) and/or dilution due to inflow of cleaner tributaries. Experts opinions, preferably supported by modelling, should be used when setting a target class for different sections of a river.

The requirements (SWQs) associated with the assigned target classes become mandatory for the planning period. This would affect effluent requirements (ELVs) as well as activities of the governmental bodies involved in implementation of the water quality management programme.

A typical planning period of the water quality management programme is between five and ten years. It is recommended that a water quality management programme include the following components<sup>23</sup>:

- A general description of the characteristics of the river basin (district), including maps with the locations and boundaries of defined water bodies;
- A summary of significant pressures and impacts of human activities on the status of the water bodies, including an assessment of the present surface water quality, an analysis of point and non-point source pollution and other impacts of human activity on water quality;
- A list of agreed water uses/functions and the water quality targets assigned to the defined water bodies;
- A summary plan of measures for each defined water body;
- A summary of the public information and stakeholder consultation activities conducted as part of the preparation of the surface water quality management programme; and
- A list of competent authorities, including their expected roles, tasks and responsibilities.

When the current water quality of the water body complies with the limits for the actual and desired uses, no immediate actions or measures would be needed other than preventing deterioration of the surface water quality. However, the latter also requires active management and planning. This implies, for example, that the pollution loading may not increase beyond the existing levels or even may have to be reduced to allow a margin for new economic activities to be introduced in the area.

#### **4.7 Surface Water Quality Monitoring**

A properly functioning surface water quality monitoring programme producing robust and reliable data is a prerequisite for an effective SWQR system. Whether or not the surface water quality meets the targets and SWQSS can only be determined by routinely measuring it. The monitoring data are also a major input into the next cycle of water quality planning and management.

It is beyond the scope of this guidance document to elaborate on the design of monitoring of surface waters. There are many publications and guidance documents dealing with surface water monitoring. For example, the UNECE has issued several relevant publications, including the recent “Draft Guidelines for Developing National Strategies to Use Water Quality Monitoring as an Environmental Policy Tool”, (UNECE, 2010)<sup>24</sup>.

A number of specific considerations with respect to surface water quality monitoring have to be kept in mind in light of the approaches introduced in this guidance document:

- *Monitoring focusing on the quality of selected water bodies.* With a management approach oriented toward water bodies, the surface water quality monitoring network will have to be revised accordingly. Monitoring locations should be set so that they can furnish representative data about the conditions of the selected water bodies.

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<sup>23</sup> This tentative outline is partly based on Annex VII “River Basin Management Plans” of the WFD.

<sup>24</sup> This and other UNECE documents related to water quality monitoring (most of them available in Russian) can be found at <http://www.unece.org/env/water/publications/pub74.htm>.

- *Targeted selection of monitoring parameters per water body.* From a cost-effectiveness point of view, it is possible to limit the monitoring parameters to those relevant for the use(s) assigned to the water body. For instance, microbiological conditions are most critical for bathing waters, whereas organic micro-pollutants or trace metals are basically not relevant for bathing and other water contact sports. Skipping the expensive analysis of such parameters could be appropriate in such cases. Table 4 in Section 4.1 shows the correlation between water quality parameters and water uses.
- *Sampling frequencies.* Monthly sampling should be aimed at, at least for the “general conditions” parameters like oxygen, BOD<sub>5</sub> and nutrients (see Annex 1 for more details about the groups of parameters). The concentrations of many parameters vary throughout the year, which is important information for the interpretation and assessment of the monitoring data. A monthly sampling frequency also provides a sounder statistical basis for compliance checking. If monthly sampling and analysis of trace metals and organic micro-pollutants turns out to be too expensive; at least quarterly sampling should be conducted.

## 5. INTERNATIONAL ASPECTS

There are many transboundary basins in the EECCA region. For example, the Aral Sea basin covers the five Central Asian countries (Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan), while the Kura/Araks basin covers the three Caucasus countries (Armenia, Azerbaijan and Georgia). Several basins in the western part of the EECCA region (e.g. Lake Chudskoye, the Western Bug, the Danube, etc.) are shared with EU Member States.

Since water quality in transboundary river basins can be affected by upstream and/or adjacent neighbouring countries<sup>25</sup>, additional aspects are introduced to water quality management:

- Joint assessment criteria, joint water quality targets and joint management objectives;
- Exchange of information;
- International agreements; and
- Mechanisms and platforms for inter-state meetings, policy setting and decision making.

### 5.1 Relevant International Requirements

#### *Joint assessment criteria*

Assessment criteria are used for the interpretation of water quality based on monitoring data. For example, assessment criteria are used to come to judgements of “good” or “poor” water quality. It is important that countries situated in one river basin apply similar assessment criteria in order to have a common interpretation and understanding of water quality conditions throughout the basin.

The assessment criteria do not necessarily have to be the same as the SWQs and classification schemes stipulated in national water quality regulations. For example, the Danube countries have agreed to apply the same water quality classification scheme for reporting the data collected under the Transnational Monitoring Network (TNMN). The TNMN 2001 yearbook mentions that “the classification scheme ... is intended to serve international purposes for the presentation of current status and improvements of water quality in the Danube River and its main tributaries, and is not to be a tool for implementation of national water policy” (ICPDR, 2006).

In EECCA countries, MACs inherited from Soviet-era regulations are currently used for regulatory as well as assessment purposes (“the MAC for parameter y was exceeded by x times”). However, as MACs are gradually phased out due to their incompatibility with IWRM, they will also lose their value as transboundary assessment criteria.

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<sup>25</sup> In fact, dependencies exist in both upstream-downstream and downstream-upstream directions: water quality downstream is affected by upstream discharges, whereas accumulated pollution downstream can become a barrier for migratory fish spawning in upstream reaches.

A use class scheme with an integrated set of SWQs that is proposed in this guidance document is also suitable for assessment purposes. It could be considered an advantage that the outcome of the assessment can be directly linked to actual and desired water uses.

The situation is a bit more complicated for those EECCA countries that share a basin with one or several EU Member States. EU countries have to assess the status of surface water bodies in accordance with the WFD, using specific physico-chemical, hydro-biological and hydro-morphological parameters. Still, a system with five quality classes defined for physico-chemical and microbiological parameters could be a reasonable precursor of the WFD system for the classification of the status of surface waters.

For the selection of parameters, criteria similar to those mentioned in Sections 4.1 and 4.7 can be applied. While agreeing on joint assessment criteria, existing laboratory and monitoring capacities of the neighbouring countries should be taken into account.

### ***Joint water quality targets***

The next level of transboundary cooperation is reaching a consensus about joint water quality targets. Unlike joint assessment criteria, joint water quality targets imply certain commitments (from performing to the best of one's abilities to formal obligations, depending on the context under which the targets have been agreed).

Joint water quality targets do not necessarily have to be (although usually are) equal to the SWQs adopted under the national water quality regulations, but they should not contradict them. For example, as part of the Rhine Action Programme, target values were agreed and became compulsory for all Rhine riparian states in parallel with the national water quality requirements. Joint water quality targets are usually set for relatively short lists of parameters, which allows countries to focus their efforts and makes it easier to demonstrate progress.

One could argue that the Soviet-era MACs can be adopted as joint water quality targets for a transboundary basin, since they are still in force in most EECCA countries. However, it is often questioned whether these MACs represent targets that *feasible* and *achievable* in the short and medium term. Setting other targets for priority parameters, preferably associated with water uses in each basin, would be a better option.

In addition, the situation of EECCA countries sharing basins with EU Member States is different. EU countries do not have the flexibility to set water quality targets, since the requirements (associated with the "good status" goal) are prescribed by various Directives, notably the WFD. At the same time, EECCA countries are in a position to set intermediate targets corresponding with the prioritised water uses and their available means. This does not mean that EECCA/EU countries sharing a basin cannot agree on mutual targets, but this will require special arrangements.

### ***Joint management objectives***

The ultimate step in cross-border collaboration on water quality would be for neighbouring countries to reach joint management objectives and to agree on a harmonised and coordinated action plan. For example, the overall objective of the first Rhine Action Programme of 1987 was the return of salmon to the Rhine by the year 2000. This objective was broken down into time-specific targets for the reduction of discharges of selected substances, tightening safety norms in industrial plants and undertaking specific ecosystem rehabilitation measures. All Rhine riparian states had to comply with these requirements.

Similar approaches could be imagined in the EECCA region, even if not in the near future.

## 5.2 Information Sharing

Surface water quality regulation in transboundary basins requires the availability of information on the surface water quality conditions in different sections of the basin, their upstream-downstream variation and evolution over time; as well as on major discharge points and pollution loadings across the basin. This information allows countries within the basin to assess what can be done on their own territory to improve the surface water quality and to what extent the improvement depends on measures to be taken in the other countries.

There are several ways to exchange information and data, once countries have agreed to do so:

- *Hard copies of annual reports.* Countries could agree to exchange reports that they produce routinely or prepare dedicated reports to publish relevant transboundary raw and/or aggregated data in a uniform reporting format.
- *Exchange of data and information via the Internet.* Competent authorities can agree to exchange data and information electronically, i.e. via e-mail or a joint website. On a website, electronic versions of reports can be posted, data can become available to a wider audience, news items can be published, events can be announced, etc. Here it is also important use uniform templates.
- *Central database.* A common database may be created by mutual agreement and made accessible to all participating countries. This option allows countries to have continuous access to extensive sets of data but has several prerequisites: agreement on the scope of the database; its maintenance by a certain mandated organisation; creation of infrastructure (hardware, software) for accessing the database; and protocols and templates for submitting the data.

It is important that besides exchanging data, countries also develop mechanisms that allow assessing the *comparability* of these data. A series of factors affect water quality monitoring data, including sampling location, frequency, and method; sample pre-treatment, transport and storage; and equipment and methods used for laboratory analysis. There are several ways to get better understanding of the comparability of monitoring data, including:

- Exchanging (raw) monitoring data collected near the border;
- Taking samples by joint sampling teams of two or more countries and having samples analysed by different laboratories in the respective countries; and
- Conducting inter-laboratory calibration tests by having different laboratories analyse especially prepared water samples.

## 5.3 International Agreements

Joint assessment criteria, joint water quality targets and/or joint management objectives, as well as information exchange must be set in international agreements.

The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992) is the most important multilateral instrument for this in the region. It is specifically aimed at strengthening national measures for the protection and ecologically sound management of transboundary surface waters and groundwater. EECCA countries that are party to the Water Convention are Azerbaijan, Belarus, Kazakhstan, Moldova, the Russian Federation, Ukraine and Uzbekistan. Its Article 3 calls on the parties to “define, where appropriate, water-quality objectives and adopt water-quality criteria for the purpose of preventing, controlling and reducing transboundary impact”.



Moreover, at least 23 intergovernmental (mostly bilateral) transboundary water agreements have been concluded since the early 1990s with the participation of EECCA countries. These agreements may represent the easiest way to set joint criteria, objectives and targets as well as organise information exchange. Joint assessment criteria have already been agreed in the framework of the 1994 Convention on Cooperation for the Protection and Sustainable Use of the Danube River, which involves Moldova and Ukraine. Water quality management arrangements between EECCA countries and EU Member States may also be established in the framework of the European Neighbourhood Policy (ENP) – a cooperation instrument created in 2004 between the enlarged EU and its neighbours, including Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

There are only few multilateral water management agreements between EECCA countries. The need for such agreements is evident, since all riparian countries in multinational transboundary water basins should preferably “speak the same language”. When new agreements are concluded, it is advisable to start with putting in place joint assessment criteria and an information exchange mechanism, and aim at expanding the collaboration later.

The implementation of an international agreement on transboundary waters may be coordinated by a designated institution (e.g. a joint commission) or plenipotentiary representatives of national governments.

International water agreements in EECCA commonly envisage the mechanism of plenipotentiaries. National representatives can form working groups, call upon experts and organise expert meetings, etc., but they typically lack support staff and resources to manage domestic activities to implement the agreement.

Joint commissions, typically with a permanent secretariat, are much more widespread in the international practice, especially with respect to the protection and use of transboundary river basins. Joint commissions coordinate and assist riparian states in their activities to implement the agreement, conduct oversight and reporting, and resolve disputes.

#### **5.4 Technical Assistance Programmes for Water Quality Regulation Reforms**

Over the last decade, EECCA countries have benefited from a number of technical assistance programmes supporting reforms of water quality regulation. Given the present lack of human, technical and financial resources in EECCA, technical assistance is very important in the preparatory phase of the reform, which includes finalising the design of the SWQR system, organising stakeholder consultations, conducting a RIA, drafting relevant regulations, preparing manuals and guidance documents, training of staff, etc. (see Section 3.6). Technical assistance programmes can make resources available for these and other tasks as well as transfer of knowledge and experiences from other countries. They can also serve as a trigger and a motor of the reform process.

This can be illustrated by the development of the reform process in Moldova. The initial concept of a use class-based system of SWQs was introduced in 2003 under the EU/Tacis project “Support for the Implementation of Environmental Policies and NEAPs in the NIS”. There was no follow-up until in 2006 the OECD/EAP Task Force launched the project “Support for Convergence with EU Water Quality Standards in Moldova”. During that project the concept was made operational with the proposal of an iterative water quality planning process. The EuropAid project “Environmental Collaboration for the Black Sea” (concluded in 2009) provided support for the preparing a draft Regulation “On the Protection of Surface Waters against Pollution” in which the use class-based system of SWQs was incorporated. The EuropAid project “Water Governance in the Western EECCA” (2008-2010) helped Moldovan water managers and users to become better acquainted with the use class-based system of SWQs and the iterative water quality planning process.

The project “Water Governance in the Western EECCA” also promoted the reform of water quality regulation in Armenia, Azerbaijan, Belarus, Georgia and Ukraine<sup>26</sup>, as the similar EU project “Water Governance in Central Asia” ran in parallel. In most western EECCA countries this work resulted in the further development and adaptation to local specifics of the use class-based system of SWQS developed in Moldova. For example, Armenia adopted new water quality standards in January 2011 (see Section 2.2).

The experience of these technical assistance programmes also demonstrates that the SWQR reform is a long process, particularly given the capacity constraints in EECCA countries. Therefore, donor assistance should also be designed in several stages to provide long-term support in the design and implementation of the reform process.

While the continuity of donor efforts in Moldova to support the reform of water quality regulation is definitely an example to follow, it would not have sufficed for the reform’s implementation. It was mainly a long and extensive consultation process involving a wide range of stakeholders that helped reach a common understanding and acceptance of the new management and regulatory system. Drawing from the experience of the recent technical assistance projects in this field, other important factors of ensuring the sustainability of the work include the existence of political will for reform and the engagement of, and reliance on, a strong local technical team.

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<sup>26</sup> Refer to [www.wgw.org.ua](http://www.wgw.org.ua) for further details.

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## ANNEX 1. SAMPLE USE CLASS SCHEME: PARAMETERS AND LIMIT VALUES

The following use class scheme was developed as part of the project “Support for Convergence with EU Water Quality Standards in Moldova” (OECD, 2007). This annex contains proposed SWQs for each use class, references regulatory sources used to justify them and explains the mechanism of checking compliance with these standards.

### Parameters and Limit Values

Parameter (group)	Acronym	Unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
<b>GENERAL CONDITIONS</b>							
<i>Thermal conditions</i>							
Water temperature	T <sub>water</sub>	[°C]	<i>natural temperature variations</i>	cold waters: 20 °C summer, 5 °C winter  warm waters: 28 °C summer, 8 °C winter	cold waters: 20 °C summer, 5 °C winter  warm waters: 28 °C summer, 8 °C winter	cold waters: >20 °C summer, >5 °C winter  warm waters: >28 °C summer, >8 °C winter	cold waters: >20 °C summer, >5 °C winter  warm waters: >28 °C summer, >8 °C winter
<i>Oxygenation conditions</i>							
Dissolved oxygen	O <sub>2</sub>	[mg O <sub>2</sub> /l]	>7 (or BG)	≥7	≥6	≥4	<4
Biochemical oxygen demand (5 days)	BOD <sub>5</sub>	[mg O <sub>2</sub> /l]	3 (or BG)	5	6	7	>7
Chemical oxygen demand, permanganate method	COD <sub>Mn</sub>	[mg O <sub>2</sub> /l]	<7 (or BG)	7	15	20	>20
<i>Nutrient conditions</i>							
Total nitrogen	N <sub>tot</sub>	[mg N/l]	1.5 (or BG)	4	8	20	>20
Nitrate	NO <sub>3</sub>	[mg N/l]	1 (or BG)	3	5.6	11.3	>11.3
Nitrite	NO <sub>2</sub>	[mg N/l]	0.01 (or BG)	0.06	0.12	0.3	>0.3
Ammonium	NH <sub>4</sub>	[mg N/l]	0.2 (or BG)	0.4	0.8	3.1	>3.1
Total phosphorus	P <sub>tot</sub>	[mg P/l]	0.1 (or BG)	0.2	0.4	1	>1
Ortho-phosphates	PO <sub>4</sub>	[mg P/l]	0.05 (or BG)	0.1	0.2	0.5	>0.5
<i>Salinity</i>							
Total mineralization	Min <sub>tot</sub>	[mg/l]	<1000 (or BG)	1000	1000	1000	>1000
Chloride	Cl	[mg/l]	<200 (or BG)	200	350	500	>500
Sulphates	SO <sub>4</sub>	[mg/l]	<250 (or BG)	250	350	350	>350

Parameter (group)	Acronym	Unit	Use Class	Use Class	Use Class	Use Class	Use Class
			I	II	III	IV	V
<b>Acidification status</b>							
pH	pH	[-]	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	<6.5 or >9.0
<b>Other parameters</b>							
Floating materials	Debris	[visual inspection]	absent	absent	absent	absent	might be present
Total iron	Fe <sub>tot</sub>	[mg/l]	<1 (or BG)	1	3	5	>5
Manganese	Mn	[mg/l]	<0.1 (or BG)	0.1	1	2	>2
Odour (20 °C and 60 °C)		[point]	<2 (or natural smell)	2	2	4	>4
Colour		[grade]	<35 (or natural colour)	35	120	200	>200
Phenols		[mg/l]	<0.001 (or BG)	0.001	0.005	0.1	>0.1
Oil products		[mg/l]	0.05	0.1	0.5	1	>1
<b>TRACE METALS</b>							
Cadmium total (SS= 30 mg/l)	Cd <sub>tot</sub>	[µg/l]	<1 (or BG)	1	5	5	>5
dissolved	Cd <sub>diss</sub>	[µg/l]	<0.2 (or BG)	0.2	1	1	>1
Lead total (SS= 30 mg/l)	Pb <sub>tot</sub>	[µg/l]	<50 (or BG)	50	50	50	>50
dissolved	Pb <sub>diss</sub>	[µg/l]	<2.5 (or BG)	2.5	2.5	2.5	>2.5
Mercury total (SS= 30 mg/l)	Hg <sub>tot</sub>	[µg/l]	<1 (or BG)	1	1	1	>1
dissolved	Hg <sub>diss</sub>	[µg/l]	<0.2 (or BG)	0.2	0.2	0.2	>0.2
Nickel total (SS= 30 mg/l)	Ni <sub>tot</sub>	[µg/l]	10 (or BG)	25	50	100	>100
dissolved	Ni <sub>diss</sub>	[µg/l]	8 (or BG)	20	40	80	>80
Copper total (SS= 30 mg/l)	Cu <sub>tot</sub>	[µg/l]	<50 (or BG)	50	100	1000	>1000
dissolved	Cu <sub>diss</sub>	[µg/l]	<20 (or BG)	20	40	400	>400
Zinc total (SS= 30 mg/l)	Zn <sub>tot</sub>	[µg/l]	<300 (or BG)	300	1000	5000	>5000
dissolved	Zn <sub>diss</sub>	[µg/l]	<70 (or BG)	70	233	1163	>1163
<b>MICROBIOLOGICAL PARAMETERS</b>							
Colifages		[№/l]	absent	100	100	>100	>100
Coliforms faecal		[№/100 ml]	100	2,000	10,000	20,000	>20,000
Coliforms total		[№/100 ml]	500	5,000	10,000	50,000	>50,000
Escherichia coli		[cfu/100 ml]	<500	500	1,000	>1,000	>1,000
Intestinal enterococci		[cfu/100 ml]	<200	200	400	>400	>400
Lacto positive bacteria		[№/l]	1,000	5,000	5,000	>5,000	>5,000
Streptococci faecali		[№/100 ml]	20	1,000	5,000	10,000	>10,000
Ovum of Helminthes		[№/25 l]	absent	absent	absent	might be	might be

Parameter (group)	Acronym	Unit	Use Class	Use Class	Use Class	Use Class	Use Class
			I	II	III	IV	V
						detected	detected
Enteroviruses		[№/10 l]	absent	absent	absent	might be detected	might be detected
<b>ORGANIC MICROPOLLUTANTS</b>							
1,2-Dichloroethane		[µg/l]	10	20	26	30	>30
Alachlor		[µg/l]	0.3	0.5	0.6	0.7	>0.7
Anthracene		[µg/l]	0.1	0.25	0.34	0.4	>0.4
Atrazine		[µg/l]	0.6	1.3	1.7	2	>2
Benzene		[µg/l]	10	30	42	50	>50
Benzo(a)pyrene		[µg/l]	0.05	0.075	0.09	0.1	>0.1
Benzo(b)fluoranthene		[µg/l]	Σ= 0.03	Σ= 0.06	Σ= 0.08	Σ= 0.09	Σ >0.09
Benzo(g,h,i)perylene		[µg/l]					
Benzo(k)fluoranthene		[µg/l]	Σ= 0.002	Σ= 0.004	Σ= 0.005	Σ= 0.006	Σ >0.006
Indeno(1,2,3-cd)pyrene		[µg/l]					
C10-13-chloroalkanes		[µg/l]	0,4	0,9	1,2	1,4	>1,4
Carbontetrachloride		[µg/l]	12	24	31	36	>36
Chlorfenvinphos		[µg/l]	0,1	0,2	0,26	0,3	>0,3
Chlorpyrifos		[µg/l]	0.03	0.065	0.086	0.1	>0.1
Cyclodiene pesticides: Aldrin Dieldrin Endrin Isodrin		[µg/l]	Σ= 0.010	Σ= 0.020	Σ= 0.026	Σ= 0.030	Σ >0.030
DDT total <sup>(1)</sup>		[µg/l]	0.025	0.05	0.065	0.075	>0.075
para-para-DDT		[µg/l]	0.01	0.02	0.026	0.03	>0.03
Di(2-ethylhexyl)phthalate	DEHP	[µg/l]	1.3	2.6	3.4	3.9	>3.9
Dichloromethane		[µg/l]	20	40	52	60	>60
Diuron		[µg/l]	0.2	1	1.5	1.8	>1.8
Endosulfan		[µg/l]	0.005	0.0075	0.009	0.01	>0.01
Fluoranthene		[µg/l]	0.1	0.55	0.82	1	>1
Hexachlorobenzene		[µg/l]	0.01	0.03	0.04	0.05	>0.05
Hexachlorobutadiene		[µg/l]	0.1	0.35	0.5	0.6	>0.6
Hexachlorocyclohexane		[µg/l]	0.02	0.03	0.036	0.04	>0.04
Isoproturon		[µg/l]	0.3	0.65	0.86	1	>1
Naphthalene		[µg/l]	2.4	4.8	6.2	7.2	>7.2
Nonylphenol		[µg/l]	0.3	1.1	1.7	2	>2
Octylphenol		[µg/l]	0.1	0.2	0.26	0.3	0.3
Pentabromodiphenylether		[µg/l]	0,0005	0,001	0,0013	0,0015	>0,0015
Pentachlorobenzene		[µg/l]	0.007	0.014	0.018	0.021	0.021
Pentachlorophenol		[µg/l]	0.4	0.7	0.9	1	1
Simazine		[µg/l]	1	2,5	3,4	4	>4
Tetrachloroethylene		[µg/l]	10	20	26	30	>30
Tributyltin compounds		[µg/l]	0.0002	0.00085	0.00124	0.0015	>0.0015
Trichlorobenzenes (all isomers)		[µg/l]	0.4	0.8	1.04	1.2	>1.2
Trichloroethylene		[µg/l]	10	20	26	30	>30
Trichloromethane (Chloroform)		[µg/l]	2.5	5	6.5	7.5	>7.5
Trifluralin		[µg/l]	0.03	0.06	0.078	0.09	>0.09

BG natural background level

SS suspended solids

<sup>(1)</sup> DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3; EU number 200-024-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl) ethane (CAS number 789-02-6; EU number 212-332-5); 1,1-dichloro-2,2 bis (p-chlorophenyl) ethylene (CAS number 72-55-9; EU number 200-784-6); and 1,1-dichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 72-54-8; EU number 200-783-0).

## **Regulatory references**

The limit values of the use classes have been derived from already existing surface water (environmental) quality standards included in:

EU Directives:

- 75/440/EEC “concerning the quality required of surface water intended for the abstraction of drinking water”;
- 2006/7/EC “concerning the management of bathing water quality and repealing Directive 76/160/EEC”;
- 78/659/EEC (2006/44/EC) “on the quality of freshwaters needing the protection or improvement in order to support fish life”;
- 82/176/EEC “on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry”;
- 83/513/EEC “on limit values and quality objectives for cadmium discharges”;
- 2008/105/EC on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC.

Other regulatory sources:

- The Rules for Protection of Surface Waters of 1991 (adopted by the State Committee for Environmental Protection of USSR);
- The Hygienic Regulation No. 06.6.3.23. of 3 July 1997 “Protection of Water Bodies against Pollution”, issued by the Ministry of Health of the Republic of Moldova;
- The Romanian Governmental Decision No. 161 of 16.02.2006 “On approval of norms concerning water surface quality classification in order to establish qualitative status of water bodies”;
- Assessment criteria used by the International Commission for Protection of the Danube River.

## **Compliance checking**

The values in the table above represent concentrations “less than or equal to” (mathematically:  $\leq$ ), unless mentioned otherwise.

For the compliance checking of the water quality of a particular surface water body against limit values of the use classes included in Table 1, the following procedure is assumed:

- The 90-percentile value of the dataset has to be used for the parameters listed under the groups “general conditions”, “trace metals” and “microbiological parameters”, except for dissolved oxygen for which the 10-percentile value is to be used, in case 10 or more samples have been taken over the year.



- The maximum value of the dataset has to be used for the parameters listed under “general conditions”, “trace metals” and “microbiological parameters”, except for dissolved oxygen, for which the minimum value must be used, in case less than 10 samples have been taken in a year.
- The annual average concentration is to be used for the parameters listed under the group “organic micro-pollutants”.

For *trace metals*, either the total or the dissolved concentration may be used for compliance testing, depending on the prevailing sampling and/or pre-treatment methods.

Dissolved concentrations apply to the concentration in a sample after filtration over a 0.45 µm mesh filter prior to the laboratory analysis.

Total concentrations apply to the concentration of a sample that are not filtered prior to the laboratory analysis. The results of the laboratory analysis are to be recalculated to a standardised suspended solids concentration of 30 mg/l prior to compliance testing, applying the following formula:

$$C_{total (SS=30mg/l)} = C_{total,measured} * \left( \frac{1 + K * \frac{30}{1000}}{1 + K * \frac{SS}{1000}} \right)$$

with:

- $C_{total (SS= 30 mg/l)}$  standardised total concentration, [µg/l]  
 $C_{total, measured}$  total concentration as analysed by the laboratory, [µg/l]  
 K partition coefficient, [l/g]  
 SS measured (analysed) concentration of suspended solids in the same sample, [mg/l]

The lower limit for suspended solids is 10 mg/l. If the measured concentration is less than 10 mg/l, for standardisation the concentration of suspended solids is to be set to 10 mg/l.

The partition coefficients of the metals are listed below.

	K
Cadmium (Cd)	130
Copper (Cu)	50
Lead (Pb)	640
Mercury (Hg)	170
Nickel (Ni)	8
Zinc (Zn)	110

## **ESTABLISHING A DYNAMIC SYSTEM OF SURFACE WATER QUALITY REGULATION: Guidance for Countries of Eastern Europe, Caucasus and Central Asia**

This guidance document promotes the adoption of ambitious but feasible water quality requirements by building capacity for the preparation and implementation of the water quality planning and regulatory components of integrated water resources management in EECCA countries. It is addressed to senior and mid-level staff of water resources management and environmental protection authorities, and is designed to help EECCA countries to progress with a “second generation” of water-related legislation – a legal framework that is anchored in the economic and social environment of the country.

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