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CONCEPT PAPER ON THE NEW SYSTEM OF SURFACE WATER QUALITY STANDARDS IN ARMENIA

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LIST OF ACRONYMS

BAT	Best available technologies
BOD	Biochemical demand of oxygen
COD	Chemical demand of oxygen
EEC	European Economic Commission
EQI	Environmental quality index
EQS	Environmental quality standard
EU	European Union
ICPDR	International Commission on Protection of Danube River
MPC	Maximum permissible concentration
$P_{tot.}$	Total composition of phosphorus
SS	Suspended solids
SWQS	Surface water quality standard
“G”	Guidelines (widely used in EU standards)
“I”	Requirements (widely used in EU standards)
RA	Republic of Armenia
TACIS	Technical Assistance to Commonwealth of Independent Countries
UN ECE	United Nations Economic Commission for Europe
USA	United States of America
USAID	US Agency for International Development
USSR	Union of Soviet Socialist Republics
WFD	Water Framework Directive
WOB	Water Oxygen Balance
WPI	Water pollution index

1 INTRODUCTION

1.1 Background Information

The protection of water resources is one of the priority issues in the policy of the Ministry of Nature Protection of RA. The legislation that regulates the protection of water resources in Armenia is quite advanced, if compared with the other countries of the region, and more directed to harmonization with the requirements of the EU. Currently the legislation is in a phase of further development and is aimed at approximation with the EU norms. Integration into EU structures and institutions is the official policy of the RA and is also envisioned by the EU-Armenia Action plan, signed into force by the EU and the Government of the RA in 2005.

Currently the RA still uses the Soviet period water quality standards and norms, which cannot provide for any further protection of water resources anymore. That system is based on anthropocentric approach though can seem comprehensive from the first sight. The system is based on MPCs, includes concentration norms for hundreds of pollutants, for various water use purposes. In fact, it is discrete, as it regulates the protection and use of water resources separately, by different use purposes; and is not related with the integral water ecosystem.

The current RA norms on protection of water resources were developed in the former USSR, in 70s of the past century and were adjusted to the large waterways and flows of the Soviet Union; thus the geographical, morphological, climatic, geochemical, hydro-geochemical, hydrological and other specifics of a country like Armenia, that made only the 0.13% of the territory of the Soviet Union, were not taken into consideration and were not related to the Armenian ecosystems.

The acting system of surface water quality standards, for the aforementioned reasons and the USSR principles of protecting the water resources, does not well fit to the current realities and the current requirements of the water sector. It is very strict in terms of the number of elements to be monitored, e.g. the heavy metals, and too loose for biogenic pollutants. The system includes hundreds of types of compounds and water quality indicators, for part of which the RA does not even have appropriate laboratory equipment and therefore capacity to monitor.

From the overall description we can see that the current system of RA on water quality standards and norms cannot provide for effective protection and management of water resources. There is a need to review the current system and introduce a new system of water quality assessment.

1.2 The Purpose of the Concept Paper

The purposes of developing a Concept paper for transit to a new system of water quality norms and water quality assessment are as follows:

- motivate the transition to a new system of water quality standards and norms in Armenia
- prepare reasonable, justified, economically effective and feasible introduction of that system, taking into account the types of water uses, the interests of the water users and the natural life of aquatic ecosystems
- assist to the harmonization of the RA legislation on protection and management of water resources with the EU legislation and the WFD
- identify the phases of adapting the EU norms and approaches to the RA local conditions

1.3 The Structure of the Concept Paper

The first chapter is introductory, with justification for the development of the document, the purpose, the structure, the basic contents and the concept.

The second chapter describes the system of standards and norms required by the EU WD and applied in EU member states.

The third chapter briefly presents the EU WFD system and the methodology for evaluation of surface waters by quality, applied in the member states.

The forth chapter presents the institutional and regulatory reforms in some countries in transition (the Ukraine, Georgia, Moldova, Romania) aimed at improvement of the norms and standards and classification of surface waters by quality.

The fifth chapter describes the current RA legislation, the acting norms and standards on surface water quality. There is also a brief analysis; and some obvious drawbacks of the working system are demonstrated.

Finally, chapter six presents recommendations on the new system of surface water quality standards and quality evaluation, which should be better harmonized with the requirements of the EU and the EU WFD.

1.4 The General Concept of Surface Water Quality Norms and the New System of Surface Water Quality Assessment

The purpose of the document is to analyze the surface water quality norms and the system of evaluating the quality of surface waters in the RA, to develop and to recommend the new provisions of the improved system, taking into account the acting legislation, the policy on quality of water resources and environmental protection, the international obligations of the RA, the EU WFD and other related directives and the EU legislation pertaining to the water sector.

The main recommendation of the paper is to develop and introduce a new system of surface water quality assessment, which will have three elements:

- Hierarchical five-category classification of surface waters (by quality from clean to most polluted) by purpose of use of the given water resource.
- List of parameters, contributing to the measured level of water pollution; based on the real needs and monitoring capacities.
- Digital values for each of category of waters.

1.5 Discussions of the Paper, Consultations with the Working Group and the Stakeholders

There were two discussions of the Concept Paper on RA surface water quality norms and the new system of water quality assessment: on October 31, 2008 and on February 17, 2009.

A series of consultations with the stakeholders, experts, managers, authorized representatives and decision-makers took place between 13-20th of February 2009.

2 BRIEF DESCRIPTION OF SYSTEMS OF SURFACE WATER QUALITY STANDARDS APPLIED IN EU MEMBER STATES

This chapter describes the European systems of surface water quality standards. That description is given as preliminary information for the recommended new system of standards for the Republic of Armenia.

2.1 Review of EU Water Legislation

Water quality is defined as a characterization of composition and properties of the water, which shows its usefulness for a certain type of use.

The EU member states use ecological normalization of water quality, aimed at implementing three main functions:

1. Prevent predictable environmental damage. The latter is assessed in terms of economic value. The violation of established norms results in sanctions.
2. Regulate anthropogenic pressures and environmental costs, with the purpose of providing for the best conditions for rehabilitation of the damaged ecosystems, while not disturbing economic development.
3. Create incentives for continuous reduction of anthropogenic pressures on the environment.

2.1.1 Development Of EU Water Legislation

According to EU environmental legislation, water is the sector with complex regulation. The EU water policy was formulated in 1970s. In 1973 the first program on environmental protection was developed and later followed by adoption of surface water directive of 1975 and the drinking water directive of 1980.

The first phase of legal reforms in the water sector of the EU incompassed four packages of legal amendments on water quality standards: on fishery-reservoirs (1978), on crustacea ponds (1979), on recreational reservoirs (1976) and ground waters (1980). The maximum permissible discharges were regulated by the Directive on hazardous substances (1978) and documents derived thereto.

The second phase of legal reforms in the water sector of the EU was built upon the results of the first phase and followed the identified and analyzed problems. The legislation of the second phase included the improvements of Directives on treatment of urban wastewaters (1991) and nitrates (1991); the Directives on drinking water (1994), recreation and leisure reservoirs (1995), the Action Plan on Ground Waters (1994) and recommendations for the development of the Directive on Ecological Status of Waters (1994).

After extensive discussions it became clear that the effective protection of water quality was possible only when applying the system of maximum permissible discharges and water quality standards, by using combined approaches. The combined approach was adopted in the Directive on Integrated Pollution Prevention and Control (IPPC (96/61/EEC), which regulated large industrial facilities by issuing integrated permits.

These permits defined the MPCs, which did not allow to exceed the water quality local standards. Realizing the necessity of implementing comprehensive water policy in EU, the EC developed the Water Framework Directive (WFD) (2000/60/EC) that was signed into force in 2000.

Some Directives directly define the surface water quality standards (e.g. Drinking Water Directive (75/440/EEC)). Some others, though aimed at improvement of the surface and groundwater quality, do not define standards of quality (e.g. Urban Wastewater Directive 91/271/EEC and Directive on Nitrates 91/676/EEC).

In the next chapters the most important of the aforementioned directives, which serve as guidelines for the development of the surface water quality system of the RA, are presented.

2.1.2 Drinking Water

Directive 75/440/EEC relates to the drinking water quality: the Directive defines the minimum standards for the drinking water sources. If the water in a reservoir does not correspond to the standards mentioned in the Directive, then a special Action Program is developed and implemented. As far as this directive relates to surface waters, it is of no significant importance for the RA, as only 5% of its surface waters are used for drinking purposes. The drinking water in Armenia is mainly taken from springs. However, it is still important for the water quality standards of the RA, as it defines standards for the drinking water.

The directive separates three categories of water processing, depending on the actual quality of waters. The standard methods of water processing, through which the water is processed into A1, A2 and A3 categories, and described as follows:

- Category A1: simple physical treatment, quick filtration and disinfection;
- Category A2: simple physical treatment, chemical treatment and disinfection, e.g. chlorination, coagulation, flocculation, decantation, filtration and disinfection (final chlorination)
- Category A3: intensive chemical and physical treatment, improved disinfection, like chlorination till purification, coagulation, flocculation, decantation, filtration, absorption and disinfection (by ozone, final chlorination).

Those waters, the physical, chemical and microbiological characterizations of which do not correspond to the maximum permissible values for concentrations under category A3, cannot be used for drinking (with some exceptions, if certain processes, like mixing with cleaner waters, result in improvement of quality and correspondence with the standards).

The second appendix to the directive defines standards for 46 parameters. In fact there are two separate “G” standards for each of the A1, A2 and A3 categories and the indexes “I” (some standards are not defined for certain parameters). Each EU state defines the values of the standards itself, which cannot be more flexible than mentioned in column “I” of the appendix; and the values in column “G” must be used as guidelines. The sixth article of the Directive allows the member states to define stricter standards than required by the Directive. This Directive is included in the Water Framework Directive since 2007.

2.1.3 Recreation and Leisure

The Directive 76/160/EEC is aimed at ensuring the swimming water quality. This Directive defines 19 physical, chemical and microbiological parameters (See Appendix 1). The Directive requires the member states to implement quality monitoring of shore waters, with a certain frequency of sampling and parameters, also to provide for the necessary measures, aimed at ensuring the implementation of standards foreseen by the Directive. That table, as in a number of EU directives, has “G” and “I” values. For some parameters

the Directive does not have any digital values, so left up to the member States to define. In 2006 the 2006/7/EC Directive on swimming waters was adopted and then replaced by Directive 76/160/EEC.

2.1.4 Fishery Waters

These waters are regulated by Directive 78/659/EEC on protection and improvement of fresh waters, and conservation of biological conditions for the fish. The Directive is aimed at protecting those fresh water systems that are considered fisheries in the EU states. For these water bodies indexes “G” and “I” are defined (for Salmons and Cyprinids). If the quality of water in those water bodies does not comply with the standards, then a pollution reduction program shall be implemented. The Directive also defines the monitoring and sampling requirements. The standards are shown in Appendix 2. Following the WFD, this directive shall be in force till the 31st of December 2013.

2.1.5 Directive on Hazardous Substances

The Directive 76/464/EEC 1976 - “On pollution from discharge of hazardous substances into the environment”; The Directive must be considered only in combination with amendments thereto.

- Directive 82/176/EEC, 1982, on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry;
- Directive 83/513/EEC, 1983, on limit values and quality objectives for cadmium discharges;
- Directive 84/156/EEC, 1984, on limit values and quality objectives for mercury discharges by sectors other than the chlor-alkali electrolysis industry;
- Directive 84/491/EEC, 1984, on limit values and quality objectives for discharges of hexachlorocyclohexane;
- Directive 86/280/EEC of 1986, 76/464/EEC; the first list in the Directive defines the MPCs for hazardous substances and the target concentrations in waters.

The Directive 76/464/EEC requires the member states to control all the discharges of hazardous substances through applying sanctions and permit mechanisms. This Directive and its amendments are aimed at separate hazardous substances and the compounds thereof (See Appendix 1 for general information). This Directive first demonstrated the concepts of first and second substance lists. The purpose of the directive is to eliminate the pollution foreseen by the first list and reduce the pollution foreseen by the second.

- The First List (List I) includes groups and categories of substances, from which separate elements must be selected, based on sustainability, level of toxicity and bioaccumulation. The list includes 132 elements. For 18 separate elements, up to now, five sub-directives have defined MPCs and water quality standards. These sub-directives were the first separate minimal requirements for the implementation of the approach on best technical measures (later named the best available technical methods approach). The 1996 Directive IPPC (96/61/EC) accepts the MPC standards for 18 separate elements of the List I as a minimal requirement for large industrial facilities.
- List II includes a number of groups and compounds of pollutants that have disastrous effect on the water environment. List II also includes 114 elements from List I that are not yet being regulated in EU. The EU member states are obliged to implement pollution reduction measures and target quality enforcement for the elements included in List II. A large number of pollutants mentioned in Directive 76/464/EC were also included in the WFD primary list. In general, the Directives 82/176/EEC, 83/513/EEC,

84/156/EEC, 84/491/EEC and 86/280/EEC, on implementation of the WFD, will come into force till the 22nd of December 2012.

2.2 The Systems and Methods of Water Quality Standards Applied in EU States

The practice of adopting natural water quality standards is different in EU states. However, the following main principles are used: the aquatic ecosystems or separate parts thereof are delineated by the purpose of use; by defining a special list of most important elements for each type of use and expert indicators for each of the elements, i.e. quantitative characterizers – target values, grades and indices. Some examples are shown in this chapter.

Belgium uses about 40 quality elements that are grouped. The two most important groups are: water oxygen balance (WOB) and heavy metals. In order to assess the WOB, three elements are observed – density of the dissolved oxygen, the BOD_5 and the ammonium-nitrogen. The quantitative characterization of each element (concentration, percentage) is ranked on a 5-scale system (See Table 1). The sum of the points defines the WOB value. For metals there are 4 water quality standards. Those are the 20, 40, 60 and 80 percents of multi-annual average cadmium concentrations in all observation samples of all gauging stations of the national monitoring network.

Table 1. Scale System of Assessment of WOB

Scale	Dissolved Oxygen, Oxygen Contents, %	BOD_5, mg/dm^3	$NH4^+$-N, mg/dm^3
1	91-110	≤3	<0,4
2	71-90 111-120	3,1-6,6	0,5-1,0
3	51-70 121-130	6,1-9,0	1,1-2,0
4	31-50	3,1-15,0	2,1-5,0
5	≤30 and >130	>15	>5

In 1983, Denmark delineated separate groups of water bodies and sections by water-economic characteristics or water use. The waterways are divided into 8 groups. For each type of water use expert water quality indicators are defined, that are maintained for keeping the necessary quality foreseen for the given type of water use. For example, in waters inhabited with Salmons the following quality requirements must be enforced: temperature - 20°C in summer and 10°C in winter, maximum temperature change in case of pollution - 1°C, dissolved oxygen - 6-8 mg/dcm^3 and 9-12 mg/dcm^3 (50% time shift), hydrogen index - 6-9, maximum deviation from various inflows - 0.5, ammonium - < 0.025 mg/dcm^3, ammonium ion - < 1 mg/dcm^3, chlorine - < 0.004 mg/dcm^3, zinc - < 0.3 mg/dcm^3, suspended solids - < 25 mg/dcm^3, BOD_5 - < 3 mg/dcm^3.

The assessment of water quality in the Netherlands, especially for lakes and reservoirs, is done based on general contents of phosphorus, which is related to its dominating role in the processes of eutrophication. A simple scale is used for assessment, the concentration values in which are compared to permissible quantities. 3-step classification is applied: below the norm (< 0.2 mg/dcm^3), normal (0.2 -0.3 mg/dcm^3), above the norm (>0.3 mg/dcm^3).

The Netherlands have an assessment system with standards for 6 metal compounds and 3 categories of water are established based on concentrations: below the norm (up to 20% MPC), normal (20% MPC to 100% MPC) and above the MPC norm.

The following groups are defined for organic substances: polycyclic aromatic carbohydrates, chlorine-organic compounds, phenols, anionic surface active substances, petroleum products, for which norms are also defined. The principle of assessment is the same as for the metals. In France a special water quality measuring scale was developed in 1975 (See Table 2), enacted by hydro-chemical indicators and based on the results of inventory of polluted waterways in the country, performed in 1971.

Table 2. Values of Parameters Corresponding to Quality Classes of Multi-Objective Scale

Parameter	Class			
	1A	**1B**	**2**	**3**
Electric conductivity (20^oC)	<400	400-750	750-1500	1500-3000
Temperature, ^oC	<20	20-22	22-25	25-30
pH				
Suspended solids, mg/dm^3	<30	<30	<30	30-70
Dissolved oxygen, mg/dm^3	>7	5-7	3-5	Aerobian environment, should always be maintained
Oxygen saturation, %	>90	70-90	50-70	
BOD_5, mg/dm^3	<3	3-5	5-10	10-25
Oxidation, mg/dm^3	<3	3-5	5-8	-
COD, mg O $/dm^3$	<20	20-25	25-10	40-80
NH_4^+, gm/dm^3	<0,1	0,1-0,5	0,5-2	2-8
NO_3^-, md/dm^3	-	-	<44	44-100
Total nitrogen	<1	1-2	2-3	>3
Fe, mg/dm^3	<0,5	0,5-1	1-1,5	-
Mn , mg/dm^3	<0,1	0,1-0,25	-	0,25-0,50
F^-, mg/dm^3	<0,7	0,7-1,7	0,7-1,7	>1,7
Cu, mg/dm^3	<0,02	0,02-0,05	0,05-1	>1
Zn, mg/dm^3	<0,5	0,5-1	1-5	>5
As, mg/dm^3	<0,01	<0,01	0,01-0,05	>0,05
Cd, mg/dm^3	<0,001	<0,001	<0,001	>0,001
Cr, mg/dm^3	<0,05	<0,05	<0,05	<0,05
CN^-, mg/dm^3	<0,05	<0,05	<0,05	<0,05
Pb, mg/dm^3	<0,05	<0,05	<0,05	<0,05
Se , mg/dm^3	<0,01	<0,01	<0,01	>0,01
Hg, mg/dm^3	<0,0005	<0,0005	<0,0005	>0,0005
Phenol, mg/dm^3	-	<0,001	0,001-0,05	0,05-0,5
CMAN, mg/dm^3	<0,2	<0,2	0,2-0,5	>0,5
CCE, mg/dm^3	<0,2	0,2-0,5	0,5-1	>1
Coliforms, in 100 ml	<50	50-5000	5000-50000	-
E. Coli, in 100 ml	<20	20-1000	2000-20000	-
Faecal streptococcus, in 100 ml	<20	20-1000	1000-10000	-
Difference between normal and biotic indices	1	2-3	4-5	6-7

Germany uses several options for classification of water quality, by considering various groups of hydro-chemical indicators. For example: only three elements are observed (COD_5, ammonium-nitrogen and the volume of the dissolved oxygen), as well as standards and criteria (See Table 3).

The Great Britain uses the schemes developed by the British National Council for assessment of quality in rivers and waterways. According to that scheme, the water quality is classified into 4 categories, which correspond to a certain type of water use (See Table 4).

Table 3. Quality Classification of Surface Waters in Germany

Class	Organic Pressure	Saprobity System	Saprobity Index	BOD_5, mg/dm^3	NH_4^+, mg N/dm^3	Dissolved oxygen, mg/dm^3
1	None or very low	Oligosaprobic	1,0-<1,5	1	signs	>8
1-2	Low	Transitional, from oligosaprobic to β–mezosaprobic	1,5-<1,8	1-2	<0,1	>8
2	Sufficient	β–Mezosaprobic	1,8-<2,3	2-6	<0,3	>6
2-3	Critical	α–β Marginal mezosaprobic	2,3-<2,7	5-10	<1,0	>4
3	Strong	α– Mezosaprobic	2,7-<3,2	7-13	0,5-1,0	>2
3-4	Very Strong	Transitional, from α– mezosaprobic to polysaprobic	3,2-<3,5	10-20	point	<2
4	Extremely	Polysaprobic	3,5-<4,0	>15	point	<2

Table 4. River Classification according to British National Water Council

Quality class	Water quality	Quality norms	Observations	Application
1A	Good	Dissolved oxygen contents is more than 80% BOD_3≤ 3 mg/dm^3 $[NH_4^+]$≤ 0,4 mg/dm^3 If the water is used for drinking purposes, then it should satisfy to EEC requirements 2A; According to EIFIAC criteria, is not toxic for fish	Average value ՃԿՊ$_3$≤ 1.5 mg/dm^3 External signs of pollution are absent	Useful for water supply Industrial production of valuable fishes Recreation
1B		The contents of dissolved oxygen is more than 60% BOD_5≤ 5 mg/dm^3 $[NH_4^+]$≤ 0,9 mg/dm^3 If the water is used for drinking purposes, then it	Average value BOD_5≤ 2 mg/dm^3 Average value $[NH_4^+]$≤ 0,5 mg/dm^3 High quality	Entirely the same

Quality class	Water quality	Quality norms	Observations	Application
		should satisfy to ECE requirements 2A Is not toxic for fish	waters which cannot be classified as 1A class due to sewerage impact, low intention to euthrophication Water quality classes 1A and 1B for the 1st class	
2	Satisfactory	Contents of dissolved oxygen is more than 40% BOD_5≤ 9 mg/dm^3 If the water is used for drinking purposes, then it should satisfy to ECE requirements 3A According to EIFIAC criteria, is not toxic for fish	Average value BOD_5≤ 5 mg/dm^3 Water which do not have physical signs of pollution except humus coloring	Useful for water supply after detailed treatment Industrial production of valuable fishes
3	Low	Contents of dissolved oxygen is more than 10% Airless conditions are unlikely BOD_5 ≤ 17 mg/dm^3	-	Recreation
4	Bad	All criteria are worse than in the 3rd class	-	Useful for satisfying technical demand

3 THE SYSTEMS AND METHODOLOGY OF WATER STATUS ASSESSMENT IN EU STATES: EU WATER FRAMEWORK DIRECTIVE

3.1 UN ECE

The UN ECE System of Statistical Classification of Surface Water Quality, aimed at ensuring of the water systems, was introduced in 1992 [EEC, 1992]. This classification, in fact, is the statistical characterization of fresh surface waters' quality, from the point of usefulness for the aquatic life.

The primary purpose of this classification is to provide methodical and conceptual warranties for the collection of data on the quality of transboundary waters. This classification delineates 5 categories of waters, starting from Category I that characterizes the natural condition of the water without anthropogenic impact, up to Category V –

significantly polluted waters. This document does not define water sampling frequency or quality indicators.

This classification has not been escalated by any EU state into a system of standards. In comparison with other systems, including the acting systems in EU, both the water quality standards and the UN EEC system are very strict. This system of standards is used when the main goal is the preservation of aquatic life.

3.2 Experience of EU States

The classification schemes, developed in EU, are mostly based on physical, chemical and biological methods, though they quite differ from the point of complexity, practice and applicability. At the same time, the largest part of classification schemes used in the EU states has common sides, i.e. the usage of color codes for the mapping of water quality.

The examples of classification schemes used in the EU are the schemes used in Germany (Table 3) and in Great Britain (Table 4).

The main system of classification in France is the multi-purpose scale. It is formed on the basis of Table 2 and is largely used by organizations responsible for control, including the Basin Management Bodies and the Ministry of Environmental Protection (Table 5). The Multi-purpose scale shows what necessary requirements are satisfied for the given type of water use.

Table 5. Multi-Purpose Scale

Class	Quality criteria for specific water use type	Quality	Color Code
1A	Unpolluted water, useful	Extremely good	Blue
1B	Slightly bad quality water, which are however used for any type of water use	Good	Green
2	Waters of satisfactory quality, which are used for irrigation and industrial purposes. After proper treatment can also be used for drinking purposes	Satisfactory	Yellow
3	Waters of average quality. Are used for irrigation and navigation. Fish cannot live in such waters.	Average	Orange

The assessment of surface water quality in the Netherlands is also performed through the color scheme. See the color scheme classification example, by oxygen balance, in Table 6.

Table 6. Mutual Connection of P_{total} and Classification Color Codes

Color Code	P_{total}, mg/dm^3 (from April to September)
Sky blue	0,10
Green	0,11-0,20
Yellow	0,21-0,30
Orange	0,31-0,74
Red	0,75 and more

3.3 Indexes for Assessment and Classification of Surface Waters

Currently, various indexes are used for the assessment and classification of the surface water quality, i.e. indexes of eco-toxicity and gene-toxicity of the chemical and physical-biological quality or pollution of waters [See: CCME Water Quality Index Technical Report. Excerpt from Publication No. 1299; ISBN 1-896997-34-1.Winnipeg; 2001 - Guidelines on Monitoring and Assessment of Transboundary Rivers; UN ECE Task Force on Monitoring & Assessment; 2000]. Classification of rivers, river basins and regions, as well as leveling of waters by usefulness criteria are done also by the water quality indexes. The index methods of surface water classification and assessment give an opportunity to present the data on water quality in indexes, which would combine all the necessary data on quality and would provide for a better and clearer understanding of the resource for the water users. There is no one general index for all, currently. Even one state can use different indexes. In many countries, like the USA, various indexes and classification systems that are based on those indexes are used by different universities [See: Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness. Journal of the American Water Resources Association, vol. 37, No. 1, 2001]. Those are in the process of scientific research yet, however they develop quite expediently. In some countries the water quality is classified only by indexes (Belgium, Canada, Malaysia and Russia); which are used as the official system of classification. As an example this document illustrates only the biotic index of Belgium (BBI). The BBI is calculated for the assessment of the water quality by hydro-biological parameters. This method is based on the analysis of two methods that identify pollution: reduction in the number of congener groups and biodiversity. According to the BBI, the waters are classified in a 6-grade scale, which shows the connection between the index and water quality (Table 7). The assessment is made through the color schemes.

Table 7. Mutual Relation of Water Quality and Biotic Index

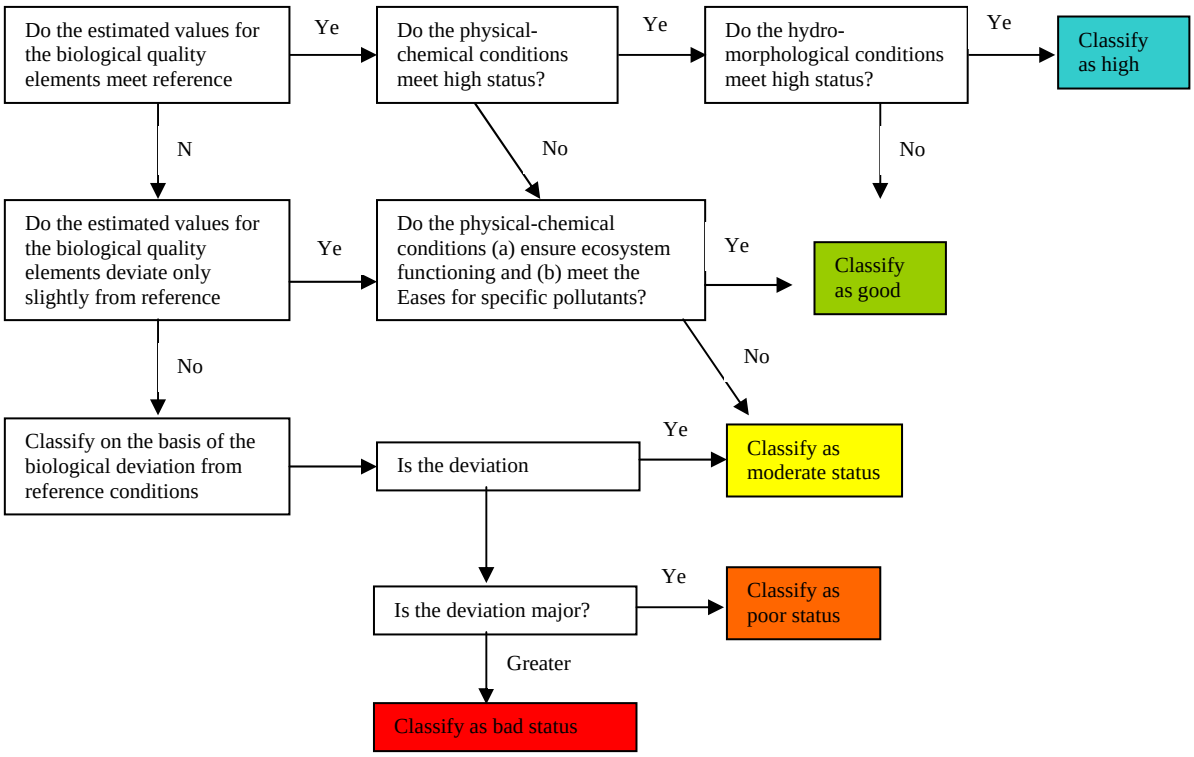
Quality Class	Biotic Index	Color Code	Water Quality
1	10-9	**Sky blue**	Slightly polluted or unpolluted
2	8-7	**Green**	Slightly polluted
3	6-5	**Yellow**	Sufficiently polluted, critical condition
4	4-3	**Orange**	Highly polluted
5	2-0	**Red**	Extremely polluted
6	0	**Black**	Research impossible due to complete absence of bio-indicator

3.4 Water Framework Directive

The Water Framework Directive (2000/60/EC) brings completely new and complex approaches to the management of waters. The WFD has perspective goals and consequences for the institutional and technical frameworks of any system. The main goal of the WFD is the provision of “good” quality of all waters in 2015. For those water bodies, the quality of which has been degraded, measures shall be developed and implemented, aimed at improvement of the quality therein.

One of the properties of the WFD is the complex approach. That is also related to the assessment of the condition of the surface waters. The first figure shows a scheme for evaluating the status of a water body, which also demonstrates some specifics of the WFD.

Figure 1: The relative meaning and the role of biological, hydro-morphological and physical-chemical quality elements for the evaluation of the ecological condition of the water system. (Demonstrated in EU Guidance 10 [EU, 2003]).



As you can see from Figure 1 the biological, physical-chemical and hydro-morphological parameters are used for the assessment of the condition of the water object. That assumes that the quality network must be able to monitor the whole scope of various quality elements and use the collected data for evaluating the condition of the water object in accordance with the requirements of the WFD. The quality elements are shown in the Table 8.

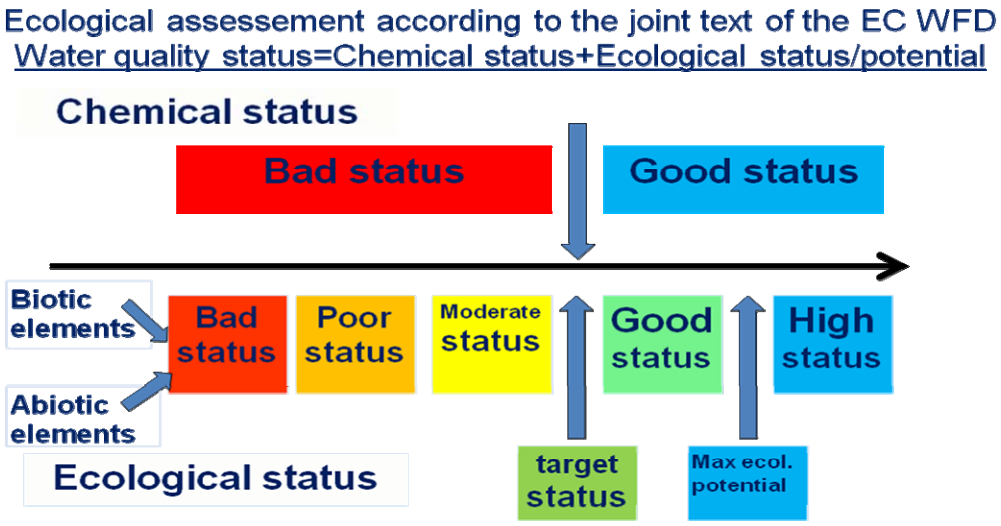
The assessment of the ecological condition, in fact includes, two types of assessment: for chemical and ecological conditions, respectively (See: Figure 2). While evaluating the ecological condition both the biological quality and the chemical-physical quality parameters are observed, mentioned as general conditions, temperature conditions, oxygen regime, salinity, acidity level and organics. It is expected that the EU member states will use environmental quality indexes for the biological quality, following the WFD requirements.

Table 8. Quality elements in evaluation of the ecological condition of the rivers and lakes [WFD, Annex V, EU, 2003]

RIVERS	LAKES
Biological elements	
• Composition, abundance of aquatic flora • Composition, abundance of benthic invertebrate fauna • Composition, abundance and age structure of fish fauna	• Composition, abundance of aquatic flora • Composition, abundance of benthic invertebrate fauna • Composition, abundance and age structure of fish fauna • Composition, abundance and biomass of phytoplankton

Hydro-morphological elements supporting the biological elements	
• Quantity and dynamics of water flow • Connection to ground water bodies • River continuity • River depth and width variation • Structure and substrate of the river bed • Structure of the riparian zone	• Residence time • Connection to the groundwater body • Lake depth variation • Structure and substrate of the lake bed • Structure of the lake shore
Chemical and physical-chemical elements supporting the biological elements	
• Thermal conditions • Oxygenation conditions • Salinity • Acidification status • Nutrient conditions • Specific pollutants ❖ pollution by Priority Substances discharged into the water body. ❖ pollution by other substances discharged in significant quantities into the water body.	• Transparency • Thermal conditions • Oxygenation conditions • Salinity • Acidification status • Nutrient conditions • Specific pollutants ❖ pollution by priority substances discharged into the water body. ❖ pollution by other substances in significant quantities into the water body.

Figure 2: Assessment of the Ecological Condition of the Water System by the WFD [EU, 2000].

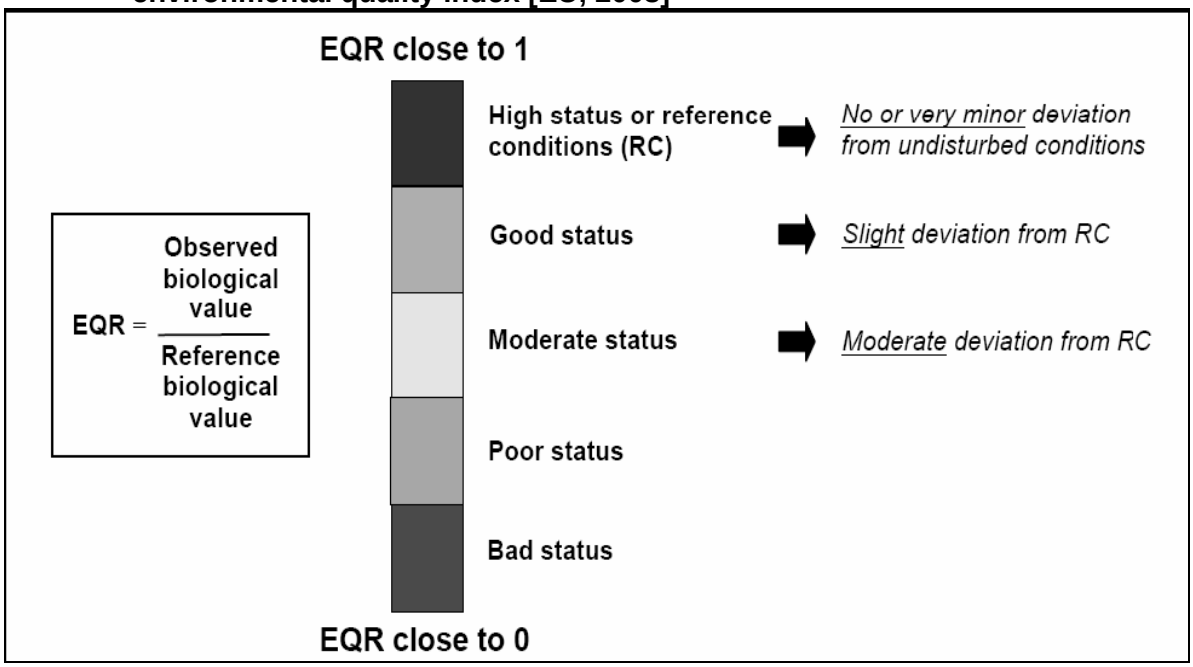


For the evaluation of the chemical condition it is enough to figure out principally, whether the chemical condition of the water body is “good”. That evaluation, however, goes in parallel with a number of difficulties. The WFD includes 33 initial pollutants. The decisions of the EU Parliament № 2455/2001/EC and the European Council of 20.10.2001 the list of primary pollutants in the water sector was defined (the Directive amended to 2000/60/EC, later). The contents of the mentioned elements in the waters have to be reduced gradually, and in case of hazardous substances they must be gradually reduced to complete elimination. A number of substances, which are included in the 76/464/EC Directive, were considered primary by the WFD. In EU there are environmental quality standards for the mentioned primary elements. These standards are used for the evaluation of the chemical condition of the water system. Appendix 1 has information and data on the primary elements and the environmental quality standards. Besides, the EU has also defined environmental standards for a number of other substances (pesticides,

carbon tetrachloride, tetrachloride-ethylene, and trichlorine-ethylene), see Appendix 1. For synthetic and natural pollutants the WFD envisages a special procedure to be used by the member states in defining chemical quality standards, which requires implementation of ecotoxicological studies.

It is expected that the EU member states will use environmental quality indexes for the biological quality, following the WFD requirements. The main principles of evaluating the ecological condition, based on the environmental quality indexes, are shown in Figure 3. That classification is considered the most complicated of those recommended by the WFD monitoring.

Figure 3: The main principles of assessing the ecological condition based on environmental quality index [EU, 2003]



3.5 Main principles of the Water Framework Directive

Generally the assessment by means of biological and physical-chemical methods has its weaknesses and strengths. It allows the implementation of the so called local pollution assessment or the evaluation of the nature of pollution and some secondary effects.

The main privilege of the physical-chemical method is that it allows more accuracy of collected quality data; the data is quantitative, which allows the assessment of the water quality to the defined standards.

The second method gives an opportunity for evaluating only the general impact of the pollutants on the ecosystems, deciding on the level of alteration and get integral evaluations of the water quality. While defining the ecologically permissible quantities of chemicals in water, the hydrological, physical-chemical, biochemical, mathematical and statistical data must be taken into consideration.

In contrast with the chemical and biological quality, the WFD does not define the quality of one element in a certain area and time, but assesses the general condition of the ecosystem as a whole, the evaluation and control, management and improvement thereof.

The evaluation of the environmental status must also reflect the condition of separate elements and constituents of the water ecosystem. All the biological groups that are defined by the WFD must be taken into consideration with the physical and chemical parameters. The classification must emanate from the environmental status.

Being a tool for protection and improvement of aquatic ecosystems, the WFD must provide for the conservation of water systems continuously.

The application of quality elements in classification may result in some opposite opinions, as the reaction of various elements to the same pressure is different. In this regard, the complex approaches of the WFD have a crucial privilege in the process of evaluation. The complex or the integrated approach makes the evaluation of the ecosystem more credible.

One of the main principles in ecological evaluation is the consideration of various aquatic organisms in the process. The aquatic organisms are divided into separate types (EU Guidance document no 2, 2003), which represent the respective groups of aquatic life. The natural condition of the aquatic ecosystems is also assessed by considering those types.

Each aquatic ecosystem must have its initial, natural and original conditions defined.

4 DEVELOPMENTS IN THE SYSTEMS OF WATER QUALITY STANDARDS IN SOME EASTERN EUROPEAN AND CAUCASIAN COUNTRIES (Moldova, the Ukraine, Romania, Georgia) IN THE LAST DECADES

4.1 Background

The chapter discusses some examples of development and introduction of systems of water quality standards. The following options are observed as preliminary:

- Moldova. The interest towards Moldova is conditioned by a number of factors. First, it is a European country, in terms of development of water legislation there are similarities with Armenia; in the last several years the water legislation has been seriously amended, the reforms continue. A special working group, acting within the framework of the Environmental Action Plan for Eastern Europe, Caucasus and Central Asia has developed a report on transiting to a new system of surface water quality standards. That report and the recommended mechanism can serve as guidelines for Armenia, in the process of transition to a new system of water quality standards that corresponds to the EU requirements and the WFD.
- Romania. The Romanian system and the phased development of water legislation are the best guidelines for Armenia to follow. The system of classification developed by Danube International Commission is a good example of cooperation among different states, the legislations and the national systems of which differ from each other.
- Georgia. A neighboring country to Armenia, significant part of the country is within the Kura-Araks basin. During the last decades Georgia has adopted new surface water quality standards.
- UN ECE. The statistical classification system of surface water quality standards, aimed at protection of the aquatic life, was adopted in 1992. This classification is the statistical characterization of the fresh surface water quality from the point of

usefulness for aquatic life. This system can be used as a sample system of standards, when the main goal is the protection of aquatic organisms.

4.2 General Information on the System of Surface Water Quality Standards Used in Moldova

This subchapter has general information on laws and legislation of Moldova, related to water quality standards. Detailed analysis of the laws enacted in the sector of water resources management in Moldova is beyond the scope of this document.

4.2.1 General Information on the Legislation of Moldova on Water Resources Management

The concept of national policy on water resources, the main principle of which is the complex approach to the management of water resources, was developed in 2003. That concept is based on international conventions and the requirements of the EU directives. The two most important legal acts, related to surface water quality standards, are:

- The Law on Environmental Protection, (1993, amended in 1998)
- The Water Code (1993, amended in 2003).

Both are framework documents, which define the general principles and mechanisms of managing surface waters. The Law on Environmental Protection has requirements pertaining to the pollution sources and defines limitations on discharges to surface water bodies. The Water Code, in its turn, states the following: “The wastewaters can be discharged into the surface water bodies, if the concentrations therein do not exceed the defined MPCs”. The Water Code also defines the main types of surface water uses.

4.2.1.1 General Information on Surface Water Quality Standards Applied in Moldova

The surface water quality standards are defined in:

- Surface water protection rules 1991 (USSR developed legal act),
- Hygienic norms No. 06.6.3.23, 1997 – “Protection of Reservoirs from Pollution”, Moldova Ministry of Health

4.2.1.2 Drinking, Domestic and Irrigation Waters

For drinking, domestic and irrigation uses Moldova has developed norms on “Protection of reservoirs from pollution”, which define MPCs for 238 chemical elements and the classification of water objects by quality.

The document on “Protection of reservoirs from pollution” has a part on drinking water, which separates three categories of waters. Based on the category the processing and production of the given resource is organized. If the standards for the third category of water are not satisfied, the drinking of that water is prohibited.

4.2.1.3 Fishery Waters

The norms and standards for waters used in fisheries are defined by Surface water protection rules of 1991. Water bodies that encounter the living, the recreation and the migration of fish species and other aquatic organisms are considered of fishery significance. There are three categories of water bodies used for fisheries:

1. Highest category - Areas of recreation and seasonal stay of valuable fish species, protected areas;

2. First category - Areas of recreation and seasonal stay of primary value fish species;
3. First category – Areas for fishing and fish production.

The list of MPCs for the fisheries includes 1083 elements; there are safety levels for another 48 elements, as well.

In 2003 the TACIS Program on "Support to Implementation of Environmental Policy in the Countries of Eastern Europe, Caucasus and Central Asia" [Tacis, 2003] developed a report on detailed studies of the system of surface quality standards in Moldova. In 2007 the Working Group on Support to Implementation of Environmental Policy in the Countries of Eastern Europe, Caucasus and Central Asia developed and published a new report on "Recommended System of Surface Water Quality Standards in Moldova", [See the table on the recommended system in Appendix 2]. That system was fundamental and realistic, it will probably be accepted by Moldova. It is a transitional system, but represents a serious step towards harmonization of the local systems with the ones applied by the EU states and required by the WFD. The recommended system, after certain improvements, is generally acceptable for Armenia, as it contains the main ideas and concepts of EU legislation and the WFD.

4.3 General Information on The System Of Surface Water Quality Standards in Romania

This chapter has general information on the legal acts and regulations that are related to the surface water quality standards and norms in Romania. There is information on the phases of development of the Romanian legislation and water quality standards in the process of reforms in the sector of water resources management.

4.3.1 General Information on Romanian Legislation in the Sector of Water Resources Management

The legislation of Romania on the management of water resources has been modified and amended a number of times for the last decades. There are new, more fundamental changes foreseen, the main driving force of which is the future membership in EU. The development of the system of water quality standards has passed three phases:

I. Old system of water quality assessment 1988-2002.
II. Interim system of water quality assessment 2002-2005.
III. Acting system of water quality assessment, in force from 2006.

4.3.2 The Systems of Surface Water Quality Standards in Romania in Different Phases of Development

Old system of water quality assessment 1988-2002 - according to this system the waters are divided into 4 quality categories:

1. Drinking and salmon breeding waters
2. Fishery and industrial waters, and waters for drinking after processing
3. Irrigation waters
4. Degraded waters

Interim system of water quality assessment 2002-2005: the interim system of standards in Romania is based on the standards developed by the international monitoring network of Danube International Commission. That system also includes some additional elements.

Acting system of water quality assessment starting at 2006: As a result of reforms in water legislation, the interim system became obsolete and the inconsistencies with the EU legislation became clear. Especially in the case with dissolved metals and organic substances, the acting system had stricter standards than foreseen by the EU 75/440/EEC Directive. It created serious problems, in contrast with the realistic assessment of water quality, and required higher costs of treatment.

4.3.3 The Main Goals of Introducing a New System

- Inclusion of those biological elements, which are used for evaluating the ecological conditions in the system of standards and monitoring;
- Removal of the criteria of natural conditions from the list of norms and monitoring indicators;
- Development of new (EU required) standards for organic elements in fishery waters;
- Development of new standards, in accordance with the requirements of other EU directives

The new system included several lists of some new organic micro-pollutants and heavy metals, though they are included in the primary or secondary lists of hazardous substances. According to the WFD, those substances are viewed only in chemical assessment and are not taken into account while evaluating the ecological condition. The standards were defined in #161 Decision of the Romanian Government (16.02.2006 "On Approval of Surface Water Quality Classification Norms for the Definition of the Water Quality in the Reservoirs"): It must be mentioned also that the new requirements inscribed in the WFD defined those standards and indicators as transitory. See the new and old Romanian systems of surface water quality standards and classification of waters by quality in Appendix 3.

4.3.4 Transfer of EU Directives into the Romanian Legislation

The WFD has been considered in the Romanian legislation in the amendments 310/2004 and 112/2006 to the Law "On Water" of 107/1996.

4.4 The system developed by the Danube International Commission

In 2001 the International Commission on Protection of Danube River (Danube Commission) developed an international classification system for the protection of the current condition and enforcement of further improvement of waters in River Danube and its Tributaries [ICPDR, 2006]. That system includes 37 parameters. Five categories are used for assessment; the target values are considered the second category values. For synthetic elements the targets are the first category values are considered. Category III means not meeting the requirements. The maximum values for those systems exceed the target values 2-5 times. The system of classification is shown in Appendix 3.

4.5 The New System of Water Quality Standards in Georgia

In 1996 Georgia adopted new standards on surface water quality for fisheries (see Appendix 4). One of the most important elements of these standards is that they have been defined for two separate fish species: first category – for salmons and second

category – for all other species. This new system of fishery standards is in harmony with the EU water legislation and the WFD requirements; their adoption is a kind of a progress.

In 2001 Georgia adopted new surface water quality standards for leisure and drinking (see Appendix 4). For some elements the standards of the World Health Organization were adopted. The complete list contains 1346 elements. This system of standards has all those weaknesses as the one in Moldova. Moreover, the analytical skills for controlling all those elements are currently not in presence in Georgia.

4.6 UN ECE System of Statistical Classification of Surface Water Quality

The statistical classification system of surface water quality standards, aimed at protection of the aquatic life, was adopted in 1992. This classification is the statistical characterization of the fresh surface water quality from the point of usefulness for aquatic life. This system can be used as a sample system of standards, when the main goal is the protection of aquatic organisms.

The classification delineates 5 categories of water quality. It does not, however, define sampling frequencies and quality criteria. The classification has not been adopted by any EU state as a system of standards. In comparison with other systems, including those acting in EU, the UN ECE standards are quite strict. Nevertheless that system is discussed in this document, as the main goal of it is the protection of aquatic life.

5 RA WATER LEGISLATION: SURFACE WATER QUALITY, APPLIED NORMS (STANDARDS), CLASSIFICATION SYSTEM

Armenia uses the system of standards for the water quality in accordance with the sanitary-hygienic requirements. According to that principle, the water quality norms are defined with the purpose of limitation of maximal permissible impact on the contents and properties of water, with the goal of ensuring the ecological safety of the population, protection of the gene pool, effective use of water resources in the process of sustainabl economic development. Currently there three types of indicators applied: sanitary, toxicological and gustatory.

The RA legislation, pertaining to the water quality, is based on the above mentioned principles. Recently, the legislation has significantly developed and included some new principles from the EU legislation and the WFD. The following question is important here: does the RA legislation, at least generally, provide for reforming the water sector and have a system of management that is closer to the EU and emanating from the requirements of the WFD.

5.1 RA Water Legislation: Surface Water Quality

The detailed and comprehensive analysis of the legislation is beyond the scope of this document. However, even the superficial observation of the legislation already shows that the answer to the question raised above is positive, as there are exact provisions, which serve as a basis for development and introduction of a new system of surface water quality standards, which is in better harmony with the EU legislation and the requirements of the WFD. Appendix 5 contains parts of the RA legislation that are directly or indirectly related to the standards on water quality and classification of water quality. The RA legislation has a number of important provisions that are in harmony with EU legislation and the WFD. Those are:

1. Definition of water quality standards for the purpose of protection of aquatic

ecosystems. This provision is inscribed in a law. (**RA Water Code, 2002, Chapter 8: Water Quality Standards**):

Article 68. Maximum Permissible Quantities, which states:
The maximum permissible quantities shall be defined based on:
Maximum permissible level of anthropogenic impact, the long-term existence of which does not result in alteration of the natural condition of waters or changes in chemical composition, beyond the levels of seasonal and multi-annual fluctuations.

2. Water quality standards can be defined by the type of water use and the specificities of a given area. These principles are defined in a law (**RA Water Code, 2002)**, **CHAPTER 8: Water Quality Standards**), Article 66: Water Quality Standards, which reads:

The water quality standards can change, depending on the type of the area. By law they can be defined for each basin management area. There can be standards defined by type of water use, including agricultural, industrial and domestic. The water standards must reflect the degradation, depletion of water resources, as well as the terms on prevention of pollution and definition of environmental flows.

3. The definition of water quality standards can be temporary, aimed at implementation of pollution reduction policy. This principle is also defined by a law (**RA Water Code, 2002**), CHAPTER 8: Water Quality Standards.

Article 66: Water quality standards
The water quality standards shall serve as guidelines for the definition of maximal limits of all pollutants, and define means for the reduction of that pollution in a period of time.

RA Law on National Water Program, 2006
Article 24: Limitations of impact on water resources and water quality protection norms, which are defined based on health requirements, as well as obligations to prevent the degradation, depletion, pollution and define environmental flows, with the perspective of satisfying the international requirements thereto.

4. The water resources are classified by type of water use and quality. These provisions are defined by law. (**RA Law on National Water Program, 2006, CHAPTER 8: Water Quality Standards. Article 10 – Classification of water resources:**

1. The surface waters of the Republic of Armenia, i.e. rivers and lakes, shall be classified by:

7) Purpose of use: drinking-domestic, irrigation, industrial, power generation, fisheries and recreation
8) Excellent, Good, Satisfactory and Poor quality **(RA Law on National Water Policy and Principles 2005)**
Article 9. Assessment of water resources:
"The assessment of water resources shall be implemented by a complete and integrated inventory of the quantity, quality, form and distribution of the water resources, implemented in accordance with the requirements of the Water Code and the legal acts and regulations emanating from it".

5. The acting legislation of the RA requires the harmonization of water quality norms and the methodology for their development with the requirements of international agreements. **(RA Law on National Water Program 2006)**

Article 20: Introduction of methods for development of norms on water quality protection and reduction of impacts on water resources; harmonization of the methods with the requirements of the international agreements of RA.

5.2 Water Quality Standards Used in Armenia

Control over the quality of surface water in Armenia is performed based on the principle of establishing sanitary-hygienic standards for hydro-chemical indices. The main legislative criteria for evaluating water quality are the MPCs, the values of which depend upon the type of water use.

The MPCs are the sanitary-hygienic standards for drinking-domestic and agricultural waters, which define the concentrations of chemical compounds in the water. Those are the concentrations that do not impact the human health over certain period of time, cannot affect the future generations and do not degrade the water quality and the hygienic conditions of water use.

The MPCs for fisheries are the standards that define the concentrations of separate elements and chemical compounds in water. Those are the concentrations that do not impact the fish population over the time.

The list of MPCs includes more than 1000 sanitary-hygienic concentrations of chemical compounds and separate elements in water and more than 1200 for fisheries. Despite the continuously increasing number of indicators, the MPC system is not comprehensive, as it lags behind the newly appearing elements, the number of which increases every year in the environment, sometimes by more than several thousands. Thus, control over and assessment of water quality by considering all existing elements is impossible, both from technical and economic points of view.

Armenia still uses the 1975 Soviet time MPCs for drinking-domestic and agricultural waters. Those MPCs are based on anthropocentric approach, which assumes that if the humans are protected – the environment is protected. The MPCs acting in Armenia are shown in Table 9.

Table 9. Water Quality Indicators and Corresponding MPCs in Armenia, according to Water Use Purpose

Pollution indicators	MPC, Fisheries[4-5]	MPC, Household	Drinking[1]	MPC, Drinking - WHO
pH	6.5-8.5	6.5-8.5	6-9	6.5-8.5
Dissolved oxygen, mg/dm^3	>6	>4	-	-
BOD_5, mg/dm^3	3	6	-	-
COD_{Cr}, mg/dm^3	30	30	15	15
NO_2^-, mgN/dm^3	0,024	0,024	0.91	0,91
NO_3^{--}, mgN/dm^3	9	9	10	11,3
NH_4^{+-}, mgN/dm^3	0,39	2,6	1.5	1,5
SO_4^{2-}, mg/dm^3	100	500	500	250
Cl^-, mg/dm^3	300	350	350	250
Na, mg/dm^3	120	-	200	200
Mg, mg/dm^3	40	-	-	-
Al, mg/dm^3	0,04	0.5	0.5	0,2
Fe, mg/dm^3	0,5	0,5	0.3(1)[2]	0,3
Cu, mg/dm^3	0,001	0,01	1	1
Zn, mg/dm^3	0,01	1	5	3
Ni, mg/dm^3	0,01	0,1	0.1	0,02
Mn, mg/dm^3	0,01	-	0.1(0.5)[2]	0,1
V, mg/dm^3	0,001	-	-	-

Pollution indicators	MPC, Fisheries[4-5]	MPC, Household	Drinking[1]	MPC, Drinking - WHO
pH	6.5-8.5	6.5-8.5	6-9	6.5-8.5
Cr, mg/dm^3	0,001	0,5	0.05	0,05
Pb, mg/dm^3	0,01	0,03	0.03	0,01
K, mg/dm^3	50	-	-	-
Ca, mg/dm^3	180	-	-	-
Co, mg/dm^3	0,01	1	-	-
As, mg/dm^3	0,05	0,05	0.05	0,01
Br, mg/dm^3	0,2	0,2	-	-
Se, mg/dm^3	0,001	-	0.01	0,01
Ba, mg/dm^3	2	-	-	0,7
Sb, mg/dm^3	0,05	-	0.005	0,005
Cd, mg/dm^3	0,005	0,01	0.001	0,003
P, mg/dm^3	0,6[3]	-	-	-
PO_4, mg/dm^3	3.5	3.5	-	-
Si, mg/dm^3	10	-	-	-
Mo, mg/dm^3	0,5	0,5	0.25	0,07
B, mg/dm^3	0,018	0,5	0.5	0,3
Salinity, mg/dm^3	1000	1000	1000 (1500)[2]	1000
TDS, mg/dm^3	30	30	-	-

[1]- N2-III-Ա2-1 RA Ministry of Health Order No 876 (25.12. 2002)

[2].Value in brackets can be defined by the local Sanitary-Hygienic doctor

[3]Fishery norms of European Union have been applied for Total Phosphate (Directive 2006/44/EC).

[4] Обобщённый перечень предельно допустимых концентраций и орентировочно безопасных уровней воздействия вредных веществ воды рыбохозяйственных водоёмов, Главрыбвод, Москва 1990 .

[5] Каменцева В. М. Рыбоохрана, Сборник нормативных актов, Министерство рыбного хозяйства СССР, М. Юрид. Лит, 1988г.

5.3 Armenian System of Classification of Waters by Quality

Many countries in the world use chemical, physical-chemical and biological indexes for complex analysis, assessment and classification of surface water quality [See Chapters 2-3]. The index based methods of assessment and classification of surface waters provide an opportunity for presenting the data collected on various indicators of water quality in index values, which mathematically combine all the data from all measurements of water quality and provides for easy and understandable description thereof.

By means of combining the hydro-chemical and other indexes a number of systems for quantitative assessment of surface water quality have been developed.

The RA currently applies a 4-scale system of water quality classification. According to the RA Law on National Water Program of 2006 Article 10, item 8 the water resources of the RA shall be classified by quality as excellent, good, satisfactory and poor. Up to day no implementation mechanism has been developed.

In fact, the water pollution index is being applied. It has been developed and introduced in Soviet times. The water pollution index (WPI) was developed for the water resources of the whole state, without taking into account specifics of each aquatic ecosystem. It was based on fishery MPCs and was calculated as follows:

$$WPI = \frac{1}{n}\sum_{i=1}^{n} C_i / MPC_i$$

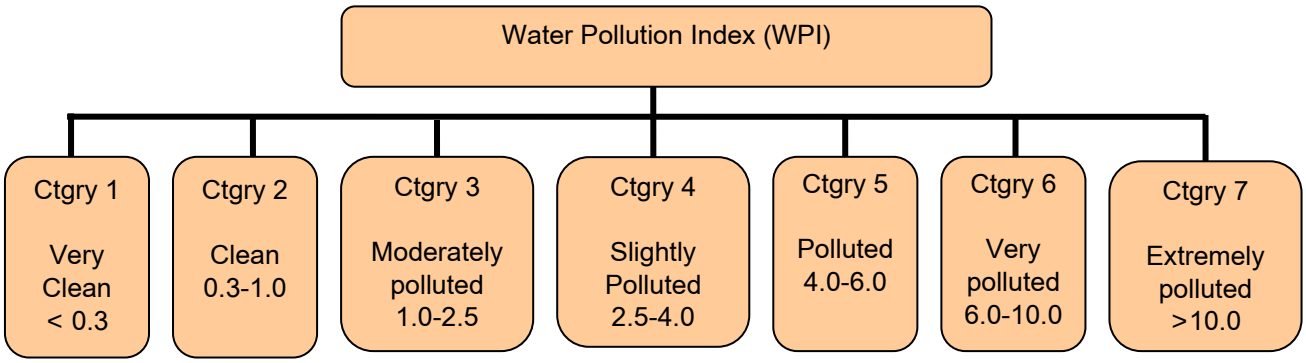
Where

C_i – is the average concentration of element i,
MPC_i – is the maximum permissible concentration of element i

The WPI is based on the calculation of average annual concentrations of water quality indicators, the following of which are permanently measured: dissolved oxygen and the BOD_5. The other constituents are selected by primary MPC exceedings. Usually the following four elements are also observed: ammonia nitrogen, nitrate nitrogen, zinc, petroleum products.

The selection of the list of elements in the WPI was also regulated by using methodological guidelines developed in Soviet period. That list was compiled in complete ignorance of specific properties of the aquatic ecosystems of the RA. In general, all the weaknesses that are characteristic for the concept of MPC were also characteristic to this index.

Before a new system is developed and adopted, the classification of surface water quality in Armenia is performed using WPI. Depending on the WPI index, the level of water pollution is classified into 7 categories.



For the calculation of the WPI, the values of fishery MPCs are used, as primary indicators.

Index Name	**MPC mg/dcm^3**	**Name of the component**	**MPC mg/dcm^3**
Dissolved oxygen	not less than 7.0	Nitrate-nitrogen	0.02
BOD_5	3.0	Zinc	0.01
Ammonium-nitrogen	0.39	Oil products	0.05

Such classification, despite a number of scientific and practical weaknesses, is inconsistent neither with the RA nor with EU requirements (see the next chapter for examples). Thus, the application of that index cannot be considered expedient anymore.

5.4 Analysis of the Armenian System of Surface Water Quality Standards

This chapter contains general information on the Armenian system of surface water quality standards. It also contains some comparisons with the EU systems.

5.4.1 Regulatory Framework

Armenia currently uses the system of standards left from the previous century (70s). The number of regulated elements significantly exceeds the one of EU, especially for fisheries. For example the Directive 78/659/EEC defines 14 indicators for fishery waters, when in Armenia the number of indicators reaches 1000. This large number of regulated indicators results in unrealistic demands towards the systems of monitoring and control. At the same time, some carcinogens are left out of the list.

5.4.2 Maximum Permissible Concentrations

There are clear differences already in the conceptual part of the MPCs, between Armenia and the EU. All the EU directives have “G” and “I” values. Armenian standards have only one group of MPCs. Besides, the RA fishery standards are defined only by MPCs, without any differentiation of the fish species. Whereas the EU 78/659/EEC Directive defines two groups of standards, which are stricter for Salmons and the Cyprinids. There are no separate MPCs for the dissolved and total metals in Armenia. Based on the Soviet time methodological guidelines on analysis and sample conservation, we can assume that the MPCs are more related to the dissolved forms of metals, while the total concentrations are not regulated.

Table 10: Target Values and MPCs for Zinc and copper in Armenia and the EU

	MPC, RA	78/659/EEC, Salmons		78/659/EEC, Cyprinids	
		“G”	“I”	“G”	“I”
Cu_{Total}, µg /dm^3	1	100[a]	-	-	-
$Cu_{Sol,}$ µg /dm^3	1	40		40	
$Zn_{Total,}$ µg /dm^3	10		300 b		1000 b

[a] Calculated value, Cu_{Total}, µg/dm^3≈ $Cu_{Sol,}$ µg/dm^3 x 2.5
[b] For 100 µg/dcm^3 $CaCO_3$ of water density.

According to Table 10 the MPCs for zinc and copper are 30 and 100 times, respectively, stricter than in EU. The comparison shows that the Armenian MPCs are not scientifically justified, especially if considering the fact that the background concentration of copper in different waters exceeds the defined MPC by 2-8 times (even in distilled water, the concentration of copper must be 20 µg/dcm^3, according to the USSR State Standard).

In case with the drinking water standards the values of MPCs coincide with the A3 category of drinking water standards, in some cases they are more flexible in comparison with the standards of the World Health Organization.

Table 11. Target Values and Drinking Water MPCs for Copper and Zinc in the RA and the EU Member States

	MPC	75/440/EEC					
		A1		A2		A3	
		“G”	“I”	“G”	“I”	“G”	“I”
Cu µg/dm^3	1000	20	50	50	-	1000	-
Zn, µg/dm^3	5000	500	3000	1000	5000	1000	5000

The comparison of drinking and fishery standards for zinc and copper is given in Tables 9-11, where it shows that the fishery MPCs are quite stricter. In rare cases, e.g. for cadmium and lead, the drinking water standards are equal or stricter than the ones for fisheries.

However, the impression that the MPCs are very strict is not evident. The contrast of the RA MPC to the WFD requirements for primary elements does not give the picture so clear.

The hydro-biological indicators in the RA acting system are not definite, which is a weakness from the point of view of the WFD, because the biological quality of waters and the ecological condition thereof play the most important role in the WFD.

5.5 Conceptual weaknesses of assessment system of the water objects

In recent years an increased body of knowledge is observed on water ecosystems given the increase of anthropogenic impact on water flows and water basins. Parallel to this, an opinion is formed that the current system of standards does not provide for control of environmental quality and its efficient management. The system of assessment of water pollution based on MPCs has several evident drawbacks, which are briefly presented below:

1. The approach of MPCs is based on impact assessment of pollutants at the organism level, after which the assessment moves into general level. However, methodically this approach is not correct. It should be added that test-organisms are not always typical representatives of hydro-biological interaction in water ecosystems. While assessing the MPCs often the concentration of polluting substances not causing significant impact under test conditions on separate individuals, might cause significant changes in entire water populations.
2. The system of indicators based on MPCs does not take into account the synergism and antagonism of various pollutants. Out of observation remain several processes, such as accumulation of polluting substances in water organisms. This drawback largely relates to ignoring the role of biota and deep sediments, which in reality have active role in migration of pollutants in water ecosystems, as well as transformational processes. The above-mentioned facts have been proved experimentally.
3. The applied system does not allow assessing how the level of exceeding MPCs and duration of pollution impact the ecological status of water objects. Whereas the above-mentioned factors have tremendous importance.
4. Another drawback relates to the fact that the same value of pollutant MPC is applied to water objects in different physical-geographic zones. This is particularly important for Armenia, since the currently operating MPCs have been developed in the former USSR for significantly different ecosystems, and their mechanical replication in Armenia is strongly questionable.
5. For assessment of surface water quality several very important properties of pollutants such as eco-toxicity, depend upon the specific water ecosystem and specific water chemical condition. In the system of MPCs this fact is not taken into consideration at all.
6. The system of MPCs does not take into account the complex and multi-stage transformations of polluting substances after penetrating into the water. Often, in water objects the intermediate results of transformation of chemical elements are more toxic than the final polluting substances. They can differ from the output elements both by intensity and mechanisms of impact. For example, derivatives of phenols are more toxic in case of transformation into hydroquinones, or mutagen nitrose- or nitrogen-aromatic substances. The above-mentioned examples are sufficient to conclude that MPCs, as standards intended to protect human health, often to not protect the ecosystem.

The way out of this deadlock is establishment of principally different legal concept of standards, which should be based on the knowledge of internal processes in water objects, transformations of pollutants, and consequences of their impacts. Thus, it is

necessary to study not the reaction of separate test-organisms, but rather of an entire ecosystem to the external impacts, which is the main idea of WFD.

From this perspective it is necessary to revise the existing norms of water quality in Armenia, including the legal basis, and implement transition towards ecological norms.

5.6 Conclusions

A number of conclusions can be drawn from the presented material on the system of RA surface water quality standards.

- In comparison with the similar systems appied in EU, the RA deploys a stricter system of standards. For some elements, especially the primary chemicals, the standards are comparable with the EU WFD requirements.
- The RA acting system of surface water quality standards does not envisage dynamic timelines and targets for improvement of the water quality, unlike the WFD, which has the goal of ensuring “good” status of all surface waters by 2015.
- The current RA system of standards includes a longer list of pollutants than the one in the WFD; however, only one third of the WFD list of primary elements is considered therein.
- The number of really controlled elements is quite small in proportion to the listed number of elements. A large number of toxics is not simply considered or is considered only in the recently developed monitoring systems.
- Due to weak capacity of monitoring agencies to detect pollutants, the lower level of detectability for some substances exceeds the MPCs multiple times.

General conclusion

Armenia needs a more compact, economically viable, controllable and realistic (in terms of monitoring) system of surface water quality standards, which will be based on EU water legislation and the ideology of the WFD, as well as on quality management principles and provisions.

6 RECOMMENDATIONS ON THE NEW ARMENIAN SYSTEM OF SURFACE WATER QUALITY STANDARDS AND NORMS

The studies of the current RA system of standards assume that the legal framework of the country pertaining to the environmental protection can be improved, by approximating it to the criteria of the EU. This chapter describes the most important elements, characteristics and approaches of that system.

The presented document suggests introducing a new system adjusted to the type of water use, viewed as a priority issue for the reforms in RA. The recommended system is based on the EU current system and on the principles of the WFD.

6.1 Basic Approaches

The main approaches in the recommended system of surface water quality standards are the following:

1. The new system must provide for an opportunity to manage the water resources by type of use of the given resource, by considering:

a. Types of water use
b. The capacity of monitoring and assessment of surface water quality

c. Capacity and resources (including financial) for implementing measures to abate the pollution of surface waters

2. The new system must include or at least be in harmony with the current EU legislation. The EU standards must be included, however, the new system must be flexible enough to encompass further amendments and changes for better harmonization with the EU legislation
3. The new system must be in harmony also with the acting and future international agreements and obligations of the Republic of Armenia
4. The elements of the current system that are already in harmony with the EU requirements and are specific to Armenia must be kept intact.

6.2 Management System Based on the Specific Purpose of the Water Resources

As mentioned in Chapter 5 (following the RA Law on the National Water Program of 2006, Chapter 8), Armenian legislation defines several main types of water use: drinking-domestic, irrigation, industrial, power generation, fishery and recreation.

Article 12 of the RA Law on National Water Policy and Principles of 2005 defines the following types of water uses (quantity, quality):

1) Domestic-drinking and other life supporting purposes, 2) agricultural, 3) industrial, 4) fishery, 5) recreational, 6) power generation and equipment cooling, nuclear power production, 7) under international obligations on transboundary waters, 8) accumulation of water resources.

The priorities of water use and protection are defined in Article 13:

For the purposes of protection and sustainable management of water resources, and based on the results of supply-demand assessment, the prioritized distribution of waters among the water users is implemented by the following priorities:

- National Water Reserve: protection and use of renewable water resources of necessary quality and quantity for satisfying the needs of the population, reduction and prevention of diseases occurring in the lack of water and protection of aquatic ecosystems;
- Traditional in-stream use of waters, not for industrial purposes;
- Use of water resources in accordance with the RA legislation and the international conventions;
- Domestic use: use of water for satisfying the everyday domestic needs of the population;
- Agricultural use: use of water for irrigation, watering the pastures, cattle farming and other, non-industrial needs;
- Power generation: use of water for production of electricity;
- Industrial: use of water in production processes;
- Recreation: use of water for sports, fishing, swimming, navigation and aesthetic enjoyment,
- Measures against drought: use of water for reducing the consequences of droughts.

Table 12. Water Use Purposes Ranked by Water Quality Requirements

	UN ECE Guidelines	NATIONAL WATER POLICY AND PRINCIPLES
Category 1: Uses without need to assess the quality	• Transport system (water, waterways, navigation) • Extraction of minerals • Power generation (hydropower dams)	• Recreation and tourism
Category 2: Uses with defined quality standards	• Process/cooling water in industry • Irrigation in agriculture • Fishery • Recreation and tourism • Domestic water supply	• Process/cooling water in industry • Power generation (hydropower dams) • Irrigation in agriculture Domestic water supply
Category 3: Use with 'undisturbed' quality	• Ecosystem functioning	• Fishery • Protection of waterways • Ecosystem functioning • National water reserve

Table 12 contrasts the UN ECE (UN ECE, 1996) principles with the priority uses defined in the RA Law on National Water Policy and Principles. The table gives the significance and function is correspondence to stricter quality standards (i.e. stricter regulated parameters and sometimes stricter MPCs). As we can see from the table on purpose of use/function, based on the UN ECE managing principles, the data partially do not correspond to the defined functions and purposes of the RA Law on National Water Policy and Principles.

However, as far as the main priorities are the national water reserve, the waterways and the aquatic ecosystems, it can be assumed that the water quality standards can be stricter for all the water resources of the RA. **In this regard no additional differentiation of the link between purpose and function in Armenia is currently suggested**. **The recommended new system suggests maintaining the same conditions for the next five years, till 2014, defining it as transitional, and then only reviewing the priorities of water use and the exact purpose/function of the resources, as the delineation of water uses is a serious basis for better management of water resources.**

Table 13. Recommended System for Functional Classification of the Surface Waters in RA

Water resources function	Lake Sevan	Other inland waters	Other inland rivers	Araks	Transboundary rivers
National Water Reserve	√				
Ecosystem functioning	√				
Protection of waterways	√				
Fishery	√				
Drinking water supply					
Recreation and tourism	√				
Irrigation	√				
Process/cooling water in industry					
Power generation (hydropower dams)					

√- use/function applies, Lake Sevan is an example
- use/function does not apply

Despite the schematics of the above mentioned classification, table 13 shows the list of issues pertaining to the management and planning of water resources. For example, it is useless to apply the fishery or fishing standards in cases when the given water body is not used for those purposes.

The introduction of the new system of surface water quality standards requires classification of water resources by quality and purpose of use into 5 categories. Each class defines the type of use for the given resource, based on the quality of water therein.

The system of quality categories and use purposes is displayed in Table 14.

Table 14. Recommended System of Categories by Purpose and Quality

Purpose/Function	Class, use differentiation	Use class I, high	Use class II, good	Use class III, Satisfactory	Use class IV, Average	Use class V, Poor
National Water Reserve		√	√			
Protection of waterways		√	√	-	-	-
Ecosystem functioning Fish breeding/ protection	Salmonid	√	√	-	-	-
	Cyprinid	√	√	√	-	-
Drinking water treatment	simple treatment	√	√	-	-	-
	normal treatment			√	-	-
	intensive treatment				√	-
Recreation and tourism		√	√	√	-	-
Irrigation in agriculture		√	√	√	√	-
Process/cooling water in industry		√	√	√	√	√
Power generation (hydropower dams)		√	√	√	√	√

√ Applied
- Not applied

The application of this classification system is an important step towards the establishment of the 5-category system of the WFD. The two types of water use are divided into sub-categories:

- 75/440/EU Directive on drinking water supply separates three types of treatment, depending on the quality of surface water taken for drinking purposes.
- The 78/659/EU Directive on fish industries and fish protection differentiates the waters by those for Salmons and other river fish, thus separating the water quality standards, depending on the dominating species.

Various categories of use purposes can be characterized the following way:

- The 1st category can be considered “excellent” water, according to the WFD. This category waters are useful for all mentioned purposes.
- The 2nd category cannot be always considered of “good status”, according to the WFD, though it can be considered an important step in the sector. The 2nd category water is also useful for all purposes. The simplest method of water processing is enough for making it useful for drinking.
- In case of Category 3, some water uses may be restricted. The simple method of water processing for drinking purposes will not be enough anymore. The conditions of water defined for Salmons are not kept in such waters. Degradation of aquatic ecosystems can be expected. The 3rd category can be considered “satisfactory” water.
- Category IV waters can be used for the purposes, for which lower quality conditions are established or for which these conditions are lacking. This category cannot satisfy even for the survival of Cyprinids. The Category IV water is of “poor” quality.
- Category V waters are useful only for purposes, for which no quality requirements are defined; e.g. power generation/cooling. If the WFD definition is applied here, then such waters are considered “bad quality”.

For the aforementioned five categories of water quality color definitions are recommended, as used in EU states. The color scheme can be taken from the WFD (See: Figures 2 and 3). In the Table 14 each water category column is shaded into the respective color. The recommended system is not going to serve as a tool for evaluation (e.g. in annual reports for evaluation of the quality in reservoirs, though even for that purpose the system would do well).

Principally, it is expected that the system will be used as an active tool for management of water resources and decision-making. The recommended quality standards, listed below, can become a key to evaluating the usefulness of reservoirs for water use of one or another type. Any additional information on the introduction and application of the system will be produced later, within the framework of programs on establishment of the new system of surface water quality standards in Armenia.

6.3 Harmonization with the EU Legislation

It is important to compare the new system with the WFD, as the latter will soon become the main regulatory tool of the EU on water quality.

The assessment of surface water quality in accordance with the WFD is a complicated system. Construction of the basis on the hydro-biological condition of the surface waters is unprecedented experience in EU; and the laboratory testing of the most elements requires new analytical equipment and methods, as well as qualified staff. The monitoring norms and assessments (for the definition of the quality of reservoirs) incur serious requirements for all EU states. As the experience in EU states shows, Armenia will need several years (and significant resources) for building the needed monitoring capacity. For that reason, the establishment of the new system of surface water quality standards, that would perfectly match with all EU requirements, is not realistic in the short-term. However, the WFD requirements are partially considered in the new system and in the future they will be completely inscribed, while amending the document.

The following characteristics of the recommended new system will become the most significant steps on the way of WFD implementation:

- Application of the five categories of water use, with water quality limit defined for each, can be considered the interim step.
- The “general conditions” (temperature, oxygen, mineralization, acidity and organic elements) are considered the important group of physical-chemical elements in the WFD, to be evaluated with the biological elements of quality in parallel.
- The WFD list of primary elements and the lists of pollutants, as well as the norms shall be introduced into the new system gradually.

The hydro-biological elements of quality from the WFD cannot be included in the recommended system yet, however they will be partially used and later considered completely.

The introduction of the new system also requires:

- Inventory of the existing monitoring capacities
- Develop a new monitoring and assessment program
- Harmonize the monitoring system and the technical capacities thereof with the requirements of the WFD on monitoring
- Develop a new mid-term program on capacity building in the monitoring sub-sector
- Develop a mid-term program on gradual introduction of a system of hydro-biological monitoring of surface waters

6.4 Selection of regulated parameters

The bases for selection of parameters are the EC Directives 75/440/EEC, 76/160/EEC and 78/659/EEC and the WFD. These three directives simply define three purpose functions that are included in the recommended system of surface water quality standards on fisheries, drinking-domestic, leisure and recreation. The parameters must be selected based on these Directives.

It is recommended:

1. To reduce the list of surface water quality indicators and harmonize it with the EU Directives EC 75/440/EEC, 76/160/EEC, 78/659/EEC and the WFD; While re-designing the list, consider the specifics of the RA water resources, as well as the current and expected monitoring capacities;
2. To eliminate the MPCs and introduce target quantities for indicators, based on background values defined;
3. Based on the target values for the indicators, introduce the multi-purpose scale of water quality;
4. Apply the following principle for the classification of surface water quality: “The quality is defined without any exception by the target value of quality indicator”. The list of the parameters and the digital values of the standards will be defined later, within the framework of programs aimed at development of the new surface water quality standards system.

6.5 Conclusion

It is recommended to introduce a new, more compact, economically viable, realistic and manageable system of surface water quality standards and classification, which would reflects the monitoring capacity in the country in harmony with the EU legislation and the WFD ideology on quality management.

The main elements of the recommended system would be:

- The water resources and the ecosystems are classified by use purpose;
- The water resources and ecosystems are classified by purpose into five categories, for each of which the characteristic codes are defined in colors;
- The MPCs must be eliminated;
- The list of monitored water quality elements is gradually harmonized with the one of EU and the WFD;
- The list of elements is defined in consideration of the specifics of the RA waters, as well as the current and expected capacities of the monitoring;
- Target values for the water quality are introduced, based on EC Directives, WFD indicators and background pollution values defined in the RA;
- The classification of water resources and ecosystems is performed based on target values of the indicators, by establishing and using a multi-purpose scale of water quality;
- The principle “Water quality is defined, without any exception, by the target value of each element” is applied for the classification of water quality.

ANNEX 1

DATA SHEETS FOR SURFACE WATER QUALITY STANDARDS

SECTION 1: PHYSICO-CHEMICAL PARAMETERS

WATER TEMPERATURE (T_{WATER})

PART A: EXISTING QUALITY STANDARDS

Abstraction of surface water for drinking water supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[°C]	22	25 (O)	22	25 (O)	22	25 (O)

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[°C]	-	-	-	-

Protection of Fish Life/Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[°C] (1), (2)	-	21.5 (3) 10 (3)	-	28 (3) 10 (3)

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[°C]	cold waters: 20 °C summer, 5 °C winter warm waters: 28 °C summer, 8 °C winter		-

Bathing Water /Recreation

EU: 76/160/EEC	G	I
[°C]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[°C]	-	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[^{o}C]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
[^{o}C]	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
[^{o}C]	-	-	-	-	-

Footnotes

(1) The directive 78/659/EEC contains two sets of standards. The first set (not mentioned in the table above) reads (Annex I): "*1. Temperature measured downstream of a point of thermal discharge (at the edge of the mixing zone) must not exceed the unaffected temperature by more than: 1.5 oC, I value salmonid waters; 3 oC, I value for cyprinid waters. Derogations limited in geographical scope may be decided by Member States in particular conditions if the competent authority can prove that there are no harmful consequences for the balanced development of the fish population.*"

(2) Annex I of 78/659/EEC mentions: "*Thermal discharges must not cause the temperature downstream of the point of thermal discharge (at the edge of the mixing zone) to exceed the following values [see table above] … The 10 ^{o}C temperature limit applies only to breeding periods of species which need cold water for reproduction and only to waters which may contain such species.*"

(3) Derogations are possible in accordance with Article 11: "*The Member States may derogate from this Directive: (a) in the case of certain parameters marked (0) in Annex I, because of exceptional weather or special geographical conditions; (b) when designated waters undergo natural enrichment in certain substances, so that the values set out in Annex I are not respected. Natural enrichment means the process whereby, without human intervention, a given body of water receives from the soil certain substances contained therein.*"

(0) Exceptional climatic or geographical conditions

PART B: PROPOSED QUALITY STANDARDS

Water temperature as such will fluctuate with the climatological (seasonal) conditions and in this respect cannot be expected to be 'regulated'. From an environmental point of view it merely makes sense to apply quality standards for water temperature in case of thermal discharges (e.g. cooling water of power plants or industry). Too high temperatures will negatively affect the aquatic ecosystems, notably organisms like fish. Latter importance for instance can be inferred from the fact that both the Moldovan and the EU fish-related regulations contain standards for water temperature.

As quality standards it is proposed to maintain the existing Moldovan standards, while noticing that in the EU 78/659/EEC directive the standards for salmonid waters are more stringent than for the cyprinid waters. Since the temperature regime is only relevant for Ecosystem functioning and Fish breeding/protection, there is no need to apply standards for the Use Classes IV and V (by default these would imply temperatures higher those defined for the Use Classes II/III.

Proposed quality standards for water temperature (T)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
T_{water} [^{o}C]	- (*natural temperature variations*)	cold waters: ≤20 ^{o}C summer, ≤5 ^{o}C winter warm waters: ≤28 ^{o}C summer, ≤8 ^{o}C winter	cold waters: ≤20 ^{o}C summer, ≤5 ^{o}C winter warm waters: ≤28 ^{o}C summer, ≤8 ^{o}C winter	cold waters: >20 ^{o}C summer, >5 ^{o}C winter warm waters: >28 ^{o}C summer, >8 ^{o}C winter	cold waters: >20 ^{o}C summer, >5 ^{o}C winter warm waters: >28 ^{o}C summer, >8 ^{o}C winter

Compliance testing

sampling frequency* [-]	statistics for class boundary compliance testing
52 (weekly)	Temperature limits may be exceeded for 2% of the cases in summer / winter period
less than 52	Maximum value of summer / winter period

* both upstream and downstream of the point thermal discharge

DISSOLVED OXYGEN (O_2)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg O_2/l]	-	-	-	-	-	-
[%]*	>70	-	>50	-	>30	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[mg O_2/l]	≥4	≥4	≥4	-
[%]	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg O_2/l]	50% ≥9 100% ≥7	50% ≥9 6 (1)	50% ≥8 100% ≥7	50% ≥7 4 (2)
[%]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg O_2/l]	≥6	≥6 summer ≥4 winter	-
[%]	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg O_2/l]	-	-
[%]	80 to 120	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg O_2/l]	≥4	-
[%]	-	

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg O_2/l]	9	7	5	4	<4
epilimnion (stratified waters) [%]	90 – 110	70 - 90	50 – 70	30 – 50	<30
hypolimnion (stratified waters) [%]	90 – 70	70 – 50	50 – 30	30 – 10	<10
unstratified waters [%]	90 – 70	70 – 50	50 – 30	30 – 10	<10

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg O_2/l]	7	6	5	5	<4
[%]	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
[mg O_2/l]	>7	7 – 6	6 – 4	4 – 3	<3
epilimnion (stratified waters) [%]	90 – 110	70 – 90, 110 – 120 (3)	50 – 70, 120 – 130 (3)	30 – 50 130 – 150 (3)	<30 >150 (3)
hypolimnion (stratified waters) [%]	90 – 70	70 – 50	50 – 30	30 – 10	<10
unstratified waters [%]	90 – 70	70 – 50, 110 – 120 (3)	50 – 30, 120 – 130 (3)	30 – 10, 130 – 150 (3)	<10, >150 (3)

Footnotes

(1) When the oxygen concentration falls below 6 mg/l, Member States shall implement the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population. [Article 7 (3) mentions "*If sampling shows that a value set by a Member State in accordance with Article 3 or a comment contained in either of columns G or I of Annex I is not respected, the Member State shall establish whether this is the result of chance, a natural phenomenon or pollution and shall adopt appropriate measures.*"]

(2) When the oxygen concentration falls below 4 mg/l, Member States shall implement the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population.

(3) Upper ranges refer to oversaturation.

(*) Reference to 75/440/EEC Article 8 (d): "*in the case of surface water in shallow lakes or virtually stagnant surface water, for parameters marked with an asterisk in the table in Annex II, this derogation being applicable only to lakes with a depth not exceeding 20 m, with an exchange of water slower than one year, and without a discharge of waste water into the water body.*"

PART B: PROPOSED QUALITY STANDARDS

Dissolved oxygen (O_2) is needed by fish and other aquatic organisms for their respiration and therewith an important ecological parameter. Low oxygen contents as such not directly hamper uses like production of drinking water or recreation, but can indicate pollution stresses and/or eutrophication phenomena that as such may negatively affect these functions.

Proposed quality standards for dissolved oxygen, O_2

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg O_2/l]	≥7 (*or natural background levels*)	≥7	≥5	≥4	<4

The proposed standards mainly follow the standards of the EU 78/659/EEC Directive and have been incorporated as following.

- The class I and II values comply with the most stringent G value for both salmonid and cyprinid waters (100% ≥7).

- The class III boundary has been changed from ≥6 to ≥5 mg/l as requested during the stakeholder meetings on 1 November 2006

- The class IV boundary to the most stringent I value for cyprinid waters (4 mg/l).

Compared to the Rules for surface water protection 1991, the standard of Use Class II is more stringent.

The boundaries of the classes I – IV are in agreement with the SRN (1997) standard for drinking water supply and communal waters.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	5–percentile
less than 12	minimum concentration

The compliance testing procedure deviates from Directive 78/659/EEC, which includes criteria like "50% ≥ *value*" together with "100%≥ *value*". The proposed procedure is more demanding, since now the more stringent values of the I categories have to met (5 percentile). The proposed compliance checking is more simple and in line with most other parameters.

BIOCHEMICAL OXYGEN DEMAND (BOD_5)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg O_2/l]	<3	-	<5	-	<7	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997) [(1)]	Category I	Category II	Category III	MAC
[mg O_2/l]	≤3	≤5	≤7	-

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg O_2/l]	≤3	-	≤6	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg O_2/l] [(1)]	3	3	-

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg O_2/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg O_2/l] [(1)]	≤6	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg O_2/l]	3	5	7	20	>20

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg O_2/l]	3	5	10	25	>25

ECE	Quality class				
	I	II	III	IV	V
[mg O_2/l]	-	-	-	-	-

Footnotes

[(1)] The Moldovan standards are for BOD_{total}.

PART B: PROPOSED QUALITY STANDARDS

Biochemical Oxygen Demand (BOD, often called Biological Oxygen Demand) as such is not an actual pollutant. The underlying principle is that for the aerobic degradation of organic waste, the oxygen available in the water is used and hence may no longer be available for aquatic organisms like fish. With a higher BOD the actual oxygen concentration not necessarily has to be lower. But: the higher the BOD, the larger the *risk* for oxygen depletion. Because of the links with the oxygen regime, similar considerations can be applied as for dissolved oxygen: the major focus will be on fish and other aquatic organisms (see data sheet Dissolved oxygen, O_2). The Moldovan standards are defined for BOD_{total} (BOD_{20}): the biochemical oxygen demand over 20 days. In most of Europe, BOD_5 (5 days) is commonly used.

Proposed quality standards for biochemical oxygen demand, BOD_5

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg O_2/l]	3 (*or natural background levels*)	5	6	7	>7

The concentrations for the classes I, II and IV have been set by inserting the G values of the Directive 75/440/EEC. For Use Class III, the G values for cyprinid waters of the Directive 78/659/EEC have been applied.

Since the Moldovan standards are for BOD_{total} (BOD_{20}), one cannot directly compare the proposed new BOD_5 standards. Generally, a standard of BOD_{total} of for instance 5 mg O_2/l is basically more stringent then a standard of BOD_5 of 5 mg O_2/l.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

CHEMICAL OXYGEN DEMAND (COD_{MN})

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
COD_{Mn} [mg O_2/l]*	-	-	-	-	30? (1)	-
COD_{Cr} [mg O_2/l]*	-	-	-	-	30? (1)	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
COD_{Mn} [mg O_2/l]	7	15	20	-
COD_{Cr} [mg O_2/l]	-	-	-	-

Protection Of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
COD_{Mn} [mg O_2/l]	-	-	-	-
COD_{Cr} [mg O_2/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
COD_{Mn} [mg O_2/l]	7	15	20
COD_{Cr} [mg O_2/l]	-	-	-

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
COD_{Mn} [mg O_2/l]	-	-
COD_{Cr} [mg O_2/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
COD_{Mn} [mg O_2/l]	30	-
COD_{Cr} [mg O_2/l]	*nu se reglamenteaa*	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
COD_{Mn} [mg O_2/l]	5	10	20	50	>50
COD_{Cr} [mg O_2/l]	10	25	50	125	>125

ICPDR	Class				
	I	II (TV)	III	IV	V
COD_{Mn} [mg O_2/l]	5	10	20	50	>50
COD_{Cr} [mg O_2/l]	10	25	50	125	>125

ECE	Quality class				
	I	II	III	IV	V
COD_{Mn} [mg O_2/l]	<3	3 – 10	10 – 20	20 – 30	>30
COD_{Cr} [mg O_2/l]	-	-	-	-	-

Footnotes

(1) The directive 75/640/EEC does not specify whether it is COD_{Mn} or COD_{Cr}

(*) Reference to 75/440/EEC Article 8 (d): "*in the case of surface water in shallow lakes or virtually stagnant surface water, for parameters marked with an asterisk in the table in Annex II, this derogation being applicable only to lakes with a depth not exceeding 20 m, with an exchange of water slower than one year, and without a discharge of waste water into the water body.*"

PART B: PROPOSED QUALITY STANDARDS

Chemical Oxygen Demand (COD) is a measure for the amount of oxygen consumed by the chemical breakdown of organic and inorganic matter. For determining Chemical Oxygen Demand, two different oxidising agents can used: potassium permanganate ($KMnO_4$), indicated with COD_{Mn} or potassium dichromate ($K_2Cr_2O_7$), indicated with COD_{Cr}. The latter is more effective, oxidising all organic compounds nearly completely. The big difference with BOD (see data sheet Biochemical Oxygen Demand, BOD_5) is that COD also may include the oxygen consumption for the breakdown of inorganic matter and that it is solely based on *chemical* agents, contrary to *biochemical* oxygen demand.

Proposed quality standards for Chemical Oxygen Demand (permanganate), COD_{Mn}

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
COD_{Mn} [mg O_2/l]	<7 (*or natural background levels*)	7	15	20	>20

There is only one entry for COD in the EU Directives (a not-specified COD= 30 as G values in Directive 75/440/EEC). Standards for COD are nevertheless proposed because of their inclusion in the HR, 1997. The proposed class boundaries for the Use Classes II-IV are those of the categories 1 – 3 of the HR, 1997.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

NITRATE (NO_3)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg N/l] (1)	5.6	11.3 (O)	-	11.3 (O)	-	11.3 (O)

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[mg N/l]	-	-	-	-

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg N/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg N/l]	-	-	9.1

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg N/l] (2)	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg N/l] (1)	11.3	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg N/l]	1	3	5.6	11.2	>11.2

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg N/l]	1	3	6	15	>15

ECE	Quality class				
	I	II	III	IV	V
[mg N/l]	-	-	-	-	-

Footnotes

(1) Recalculated from NO_3 to NO_3_N with the conversion factor 0.226.
(2) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
(O) Exceptional climatic or geographical conditions
(*) Reference to 75/440/EEC Article 8 (d): "*in the case of surface water in shallow lakes or virtually stagnant surface water, for parameters marked with an asterisk in the table in Annex II, this derogation being applicable only to lakes with a depth not exceeding 20 m, with an exchange of water slower than one year, and without a discharge of waste water into the water body.*"

PART B: PROPOSED QUALITY STANDARDS

Nitrate is one of the nitrogen compounds that, together with phosphorus, are considered as major nutrients for plants and algae. So, to a certain extent, nutrients in most aquatic systems actually are required for growth of plants and phytoplankton. Pollution with nitrate (NO_3) can be related to various uses:

- *Drinking water supply*. Too high levels of NO_3 in drinking water may cause "Methemoglobinemia" also knows as the 'blue-baby syndrome', since only infants (up to about 6 months) are prone to this phenomenon. Although the nitrate as such has no such effects, it is the conversion of nitrates to nitrites that may cause the problem.

- *Ecology, fishfarming, recreation, drinking water supply.* The key factor here is "eutrophication". An excessive amount of nutrients may lead to algae blooms or overgrowth of plant vegetation. Algae blooms can lead to oxygen depletion and therewith can disturb the aquatic ecology. Swimming in a 'green algae soup' is not considered a pleasure. Algae blooms may go accompanied with too high amount of bluegreen algae (Cyanobacteria), which can have toxic effect when such water is swallowed e.g. during swimming. Algae blooms (through the degradation of dead organic matter) also may cause problems with smell or taste, negatively affecting the drinking water supply (organoleptic quality). In freshwater, eutrophication risks are commonly associated with phosphorus pollution, although meanwhile also there are indications that nitrogen compounds can lead to eutrophication in freshwaters.

Proposed quality standards for NO_3

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg N/l]*	1 (*or natural background levels*)	3	5.6	11.3 **	>11.3

* The conversion factor from NO_3 to NO_3_N is 0.226
** GD 161 mentions 11.2 mg N/l, but it is assumed that latter has been the result of a slightly less accurate conversion factor for a total concentration of 50 mg/l NO_3.

Considering the abovementioned considerations, the Romanian GD 161 standards for nitrate seem most appropriate; they furthermore compare overall rather well with the standards of the ICPDR. The values for the classes III-V mainly follow the requirements for drinking water supply, while the proposed standards for the Use Classes I and II are expected to avoid risks for eutrophication.

One problem with setting standards for nutrients is that the effects of pollution with nutrients can differ between areas and between water types. For instance: standing waters (lakes, reservoirs) are more prone to eutrophication than running waters (rivers). Conditions in upper reaches of rivers can be different from the lowland reaches. Different aquatic ecosystems can respond differently to the same nutrient concentrations. The EU Water Framework Directive has introduced the term "type-specific" to underline this problem. Setting of type-specific nutrient standards turns out to be quite complicated and require many data, expert knowledge and understanding of the various water bodies. Within the current settings

(both of the project and Moldova) it is not feasible to formulate type-specific standards for nutrients. Nevertheless, quality standards are proposed, also in order to provide a basis and rationale for the short-term water management. Derogations from the proposed concentrations may be considered once there is sufficient evidence that no eutrophication phenomena occur and the ecosystem functioning of the water bodies concerned is not impaired by higher nitrate levels.

The proposed standards are fully in line with the existing Moldovan standard for communal water use. Compared to the fisheries MAC, the concentrations of the Use Classes I-III are more stringent. Considering "eutrophication", this merely reflects the wider ecological connotation.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

NITRITE (NO_2)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
[mg N/l]	-	-	-	-	-	-

MD: Hygienic regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[mg N/l]	-	-	-	-

Protection of Fish Life / Fisheries

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
[mg N/l] [(1)]	0.003	-	0.009	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
[mg N/l]	-	-	0.02

Bathing Waters / Recreation

EU: 76/160/EC	G	I
[mg N/l]	-	-

MD: Hygienic regulation Nr. 06.6.3.23	(Annex 1)	MAC (Annex 2)
[mg N/l] [(1)]	-	1.0

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg N/l]	0.01	0.03	0.06	0.3	>0.3

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg N/l]	0.01	0.06	0.12	0.3	>0.3

ECE	Quality class				
	I	II	III	IV	V
[mg N/l]	-	-	-	-	-

Footnotes

[(1)] Recalculated from NO_2 to NO_2_N with the conversion factor 0.304.

PART B: PROPOSED QUALITY STANDARDS

In the so-called 'nitrogen-cycle', organic nitrogen is broken down to ammonium (NH_4/NH_3). During "nitrification", ammonium is broken down to nitrates (NO_3) and nitrites (NO_2). Nitrite is relatively short-lived in water, because it is quickly converted to nitrate by bacteria. Because of its short lifetime, pollution with NO_2 mainly is relevant for aquatic organisms (during the abstraction and preparation of drinking water from surface water nitrites already will have been degraded). The EU directive 78/659/EC only provide Guide values for salmonid respectively cyprinid waters, while the Moldovan fisheries standards only contain one MAC.

During the stakeholder consultation sessions in Chişinău on 1 and 10 November 2006 it has been requested to propose standards for nitrite ($N0_2$) in the new system of SWQS.

It is proposed to use the ICPDR standards for the boundaries of the Use Classes I-V.

Compared to the Moldovan fish standards these values are less stringent, except for Use Class I.

Proposed quality standards for nitrite (NO_2)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg N/l]	≤0.01 (*or natural background levels*)	0.06	0.12	0.3	>0.3

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

AMMONIUM (NH_4)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg N/l] (1)	0.04	-	0.8	1.2	1.6	3.1 (O)

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[mg N/l]	-	-	-	2

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg N/l] (1), (2)	0.03	0.8 (3)	0.2	0.8 (3)

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg N/l] (1)	-	-	0.4

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg N/l] (4)	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg N/l]	-	2

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg N/l]	0.4	0.8	1.2	3.2	>3.2

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg N/l]	0.2	0.3	0.6	1.5	>1.5

ECE	Quality class				
	I	II	III	IV	V
[mg N/l]	-	-	-	-	-

Footnotes

(1) Recalculated from NH_4 to NH_4_N with the conversion factor 0.776.

(2) Annex I of 78/659/EEC mentions: "In order to diminish the risk of toxicity due to non-ionized ammonia, of oxygen consumption due to nitrification and of eutrophication, the total ammonium should not exceed the following *[authors: follow the concentrations mentioned in the table above]*".
(3) In particular geographical or climatic conditions and particularly in cases of law water temperature and of reduced nitrification or where the competent authority can prove that there are no harmful consequences for the balanced development of the fish population, Member States may fix values higher than 1 mg/l *[authors: ⇔ 0.78 mg N/l]*.
(4) These parameters must be checked by the competent authorities when there is a tendency towards eutrophication of the water.

PART B: PROPOSED QUALITY STANDARDS

The term ammonia refers to two chemical species of ammonia which are in equilibrium in water (NH_3, un-ionized and NH_4+, ionized, also known as ammonium). Tests for ammonia usually measure total ammonia (NH_3 plus NH_4^+). The toxicity to ammonia is primarily attributable to the un-ionized form (NH_3), as opposed to the ionized form (NH_4^+). The percentage of NH_3 increases with temperature and pH.

Ammonium is a relevant parameter because:

- of its (indirect, see above) toxicity, hence possibly affecting aquatic organisms, including fish;
- being a nitrogen compound, possibly adding as a nutrient to risks of eutrophication (see data sheet for NO_3 for further details).

According to the WHO *"Ammonia is not of direct importance for health in the concentrations to be expected in drinking-water. A health-based guideline has therefore not been derived"*

Proposed quality standards for ammonium, NH_4

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg N/l]	0.2 (*or natural background levels*)	0.4	0.8	3.1	>3.1

With primarily the ecological uses (general ecology and fisheries) being at stake, the boundary for Use Class III has been set to 0.8 mg N/l, being the mandatory I value for cyprinid (and salmonid) waters according to the Directive 78/659/EEC. With salmonid waters generally requiring better water quality, the boundary for Use Class II has been set to 0.4 mg N/l, in accordance with the current MAC used in Moldova. The standard for Use Class I has been set to 0.2 mg N/l. This seems a reasonable estimate for an 'average' background concentration level. The concentration for Use Class IV is based on the I value of the Directive 75/440/EEC.

Natural ammonium concentrations may vary between water types and areas and vice versa different aquatic ecosystems may respond differently to same concentration levels of ammonium. So, also ammonium finally needs to be regarded in the type-specific context as explained in the data sheet for NO_3.

Compared to the existing Moldovan standards, the following differences can be notice with the proposed values:

- In the case of cyprinid water the MAC for fisheries will be increased from 0.4 to 0.8 mg N/l; for salmonid waters the proposed quality standard is the same.
- Compared to the current Moldovan MAC for communal use (2 mg N/l), the boundary concentration for the related Use Class III (up to Use Class III waters are considered suitable for the recreation function) is considerably lower. As mentioned above: the relation between NH_4 and communal use is mainly via eutrophication. The footnote for the bathing water directive

76/160/EEC (see above) is considered an important additional criterion. Derogation of the standard for Use Class III in case of communal use may be considered if there is sufficient evidence that higher NH_4 concentrations will not have negative impacts for recreational use of the waters.

- Considering the abstraction of drinking water function, the proposed standard for Use Class IV is higher than the current Moldovan MAC. Taking into account the viewpoint of the WHO, this standard therefore should not be decisive for the drinking water abstraction.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

TOTAL NITROGEN (N_{TOT})

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg N/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
[mg N/l]	-	-	-	-

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg N/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg N/l]	-	-	-

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg N/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg N/l]	-	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg N/l]	1.5	7	12	16	>16

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg N/l]	1.5	4	8	20	>20

ECE	Quality class				
	I	II	III	IV	V
[mg N/l]	<0.3	0.3 – 0.75	0.75 – 1.5	1.5 – 2.5	>2.5

PART B: PROPOSED QUALITY STANDARDS

Total nitrogen comprises both inorganic nitrogen (NO_2, NO_3, NH_4) and organic nitrogen. While NO_3 and NH_4 as nutrients can contribute to eutrophication, it prevails to apply standards for total nitrogen as well. Finally it is the total nitrogen loading being important for risks of eutrophication.

Proposed quality standards for total-N

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg N/l]	1.5 (*or natural background levels*)	4	8	20	>20

The Romanian standards contain relatively high concentrations (compare also the ECE standards) and are expected to not sufficiently adequate for prevention of eutrophication. It is therefore proposed to apply as standards the concentrations of the ICPDR, although they have primarily been introduced for *classification* purposes.

Total-N concentrations may vary between water types and areas. Vice versa different aquatic ecosystems may respond differently to same concentration levels of nitrogen. Thus, total-N needs to be regarded in the type-specific context (as explained in the data sheet for NO_3). Therefore, derogations from the proposed concentrations may be considered once there is sufficient evidence that no eutrophication phenomena occur and the ecosystem functioning of the water bodies concerned is not impaired.

Total-N is not included in the current Moldovan quality standards, so as such represents a new parameter.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

TOTAL-PHOSPHORUS (P_{TOT}); ORTHO-PHOSPHATES (PO_4)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
Total-P [mg P/l] * (1)	0.4	-	0.7	-	0.7	-
PO_4 [mg P/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
Total-P [mg P/l]	-	-	-	-
PO_4 [mg P/l]	-	-	-	-

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
Total-P [mg P/l] (2)	-	-	-	-
PO_4 [mg P/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
Total-P [mg P/l]	-	-	-
PO_4 [mg P/l] **	-	-	0,2 mg/l (P) for eutrophic waters, 0,1 mg/l (P) for mezo-trophic waters and 0,04 mg/l (P) for oligo-trophic waters

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
Total-P [mg P/l]	-	-
PO_4 [mg P/l] (3)	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
Total-P [mg P/l]	-	-
PO_4 [mg P/l]	-	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
Total-P [mg P/l]	0.15	0.4	0.75	1.2	>1.2
PO_4 [mg P/l]	0.1	0.2	0.4	0.9	0.9

ICPDR	Class				
	I	II (TV)	III	IV	V
Total-P [mg P/l]	0.1	0.2	0.4	1	>1
PO_4 [mg P/l]	0.05	0.1	0.2	0.5	>0.5

ECE	Quality class				
	I	II	III	IV	V
Total-P [mg P/l] (4)	<0.01 (<0.015)	0.01-0.02 (0.015-0.04)	0.025-0.05 (0.04-0.075)	0.05-0.125 (0.075-0.19)	>0.125 (>0.19)
PO_4 [mg P/l]	-	-	-	-	-

Footnotes

(1) The parameter has been included to satisfy the ecological requirements of certain types of environment.
(2) Total phosphorus is included in Annex I of 78/659/EEC, but no numeric values are mentioned.
(3) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
(4) Bracketed data refer to flowing water.
(*) Reference to 75/440/EEC Article 8 (d): "*in the case of surface water in shallow lakes or virtually stagnant surface water, for parameters marked with an asterisk in the table in Annex II, this derogation being applicable only to lakes with a depth not exceeding 20 m, with an exchange of water slower than one year, and without a discharge of waste water into the water body.*"
(**) These standards are so-called OMACs (oriented MACs)

PART B: PROPOSED QUALITY STANDARDS

Most common analyses of phosphorus in water samples are: total-Phosphorus (P_{tot}) and ortho-phosphates (PO_4). Total-Phosphorus comprises both dissolved and particulate forms of P. PO_4 is only dissolved and the form used by plants.

As a nutrient, phosphorus is an essential element for plant growth. But, too much loading with nutrients though can lead to eutrophication. Therefore, mainly the 'ecosystem functioning' use is an important consideration for setting quality standards for phosphorus. As explained in the data sheet for NO_3, eutrophication furthermore can negatively impact the drinking water supply, fishfarming and recreation. Phosphoros/phosphates are not toxic to people (thus not an issue for drinking water abstraction) or animals.

Proposed quality standards for total-P and PO_4

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
P_{tot} [mg P/l]	0.1 (*or natural background levels*)	0.2	0.4	1	>1
PO_4 [mg P/l]	0.05 (*or natural background levels*)	0.1	0.2	0.5	>0.5

The Romanian standards contain relatively high concentrations (compare also the ECE standards) and are expected not to be sufficiently adequate for prevention of eutrophication. It is therefore proposed to apply the concentrations of the ICPDR, although they have primarily been introduced for *classification* purposes.

As is the case with nitrogen compounds, also phosphorus concentrations may vary between water types and areas. Vice versa different aquatic ecosystems may respond differently to same concentration levels of phosphorus. The ECE standards are a good example: the concentration of the quality standards for running waters are higher than for standing waters (incl. lakes and reservoirs), since standing waters are more prone to eutrophication. Thus, also total-P and PO_4 finally need to be regarded in the type-specific context as explained in the data sheet for NO_3. Therefore, derogations may be considered once there is sufficient evidence that no eutrophication phenomena occur and the ecosystem functioning of the water bodies concerned is not impaired.

Total-P is not included in the current Moldovan quality standards, so as such represents a new parameter.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

VARIOUS GENERAL PARAMETERS

pH

The pH as a typical parameter that can be considered as 'intrinsic' water bodies. The acidity/basicity is determined by a (complex) combination of factors, like the geological settings of the water body. For these and other reasons, it simply is not possible to set 'uniform standards' for pH. But, at least there are some ranges within which the pH of surface waters normally can be found. A pH value is outside of this range may be caused some extraordinary circumstances (effluent discharge, eutrophication, et cetera) and as such can serve as an 'alarm-indicator'.

Proposed quality standards for pH

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[-]	6.5 – 9.0	6.5 – 9.0	6.5 – 9.0	6.5 – 9.0	<6.5 or >9.0

The EU Directive 78/659/EEC mentions a pH range of 6-9. The Directive 75/440/EEC mentions G values for two ranges: 6.5-8.5 (A1) and 5.5-9 (A2, A3). The upper limit has been changed from 8.5 to 9.0 as requested during the November 2006 consultations.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	5-percentile (for lower limits: <6.0) 95–percentile (for upper limits: >9.0)
less than 12	minimum pH (for lower limits: <6.0) maximum pH (for upper limits: >9.0)

TOTAL MINERALIZATION

Total mineralization comprises a wide range of 'major ions' and can be assessed in different ways (individual ions, total dissolved salts, electric conductivity, et cetera). Major ions are present in all aquatic ecosystems just because of geogenic and other natural sources. For a country like Moldova this is an important feature. Just because of the geological conditions, there is a gradient with increasing salinity from north to south. Of course, anthropogenic activities can lead to increasing the salinity.

Salinity (total mineralization) may be an issue for the following water uses:

- *Drinking water supply*. People simply will not appreciate getting 'salty tasting' water from the tap (but health risks are not really involved). For instance food processing industries will need potable water with low salinity in order for their products not to be affected. Generally, salts can induce corrosion of the pipes.

- *Irrigation*. Albeit depending on the type of crops, irrigation waters containing too much salt finally can impact agricultural production. Furthermore, salinisation of soils is a mere irreversible process.

- *Process/cooling water*. Being basically a 'low quality demanding' type of use, even the use of surface water for such generic purposes like cooling can benefit from low salinity. Besides (increased) corrosion of the piping system, also hardness can become an issue (risks for 'clogging' of the pipes with limestone).

Proposed quality standards for total mineralization, Min_{tot}

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	<1000	1000	1300	1500	.>1500

The above standards for the classes III-V were proposed during the consultation sessions (1 and 10 November 2006). The standards for the classes I and II are in line with the ones defined in HR, 1997.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

FLOATING MATERIALS

Floating materials encompasses a wide range of not naturally introduced objects (debris) like plastic bags, polyethylene or glass bottles and other such kind of domestic/municipal solid waste products.

Proposed quality standards for Floating Materials

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
visual inspection	absent	absent	absent	absent	might be present

Monitoring of floating materials will be by means of monthly visual inspections by the competent authorities. A statistical compliance checking method is not suitable for this parameter.

TOTAL IRON (Fe)

Iron as such does not impose human health or other ecotoxicological risks (unless being introduced in extreme quantities). Because of its effect on the taste of drinking water, iron nevertheless can be a parameter of interest. Iron can be present in the surface waters from natural sources; the geogenic loading with iron can differ between regions.

Inclusion of Fe in the proposed system of standards is merely done for compatibility reasons with SRN (1997).

Proposed quality standards for total iron (Fe)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	<1 (*or BG*)	1	3	5	>5

The Directives 75/440/EEC contains standards for dissolved iron (compare Annex II). Nevertheless, the existing standards of SRN (1997) for total iron are proposed.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

MANGANESE (Mn)

Manganese as such does not impose human health or ecotoxicological risks. Because of its effect on the taste of drinking water, manganese nevertheless can be a parameter of interest. Manganese can be present in the surface waters from natural sources. The geogenic loading with manganese can differ between regions.

Inclusion of Mn in the proposed system of standards is merely done for compatibility reasons with SRN (1997).

Proposed quality standards for manganese (Mn)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	<0.1 (*or BG*)	0.1	1	2	>2

The Directives 75/440/EEC contains only G values for manganese (compare Annex II). The existing standards of SRN (1997) for manganese are proposed.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

ODOUR

Odour is a typical organoleptic parameter. A ‘bad smell’ simply makes a water body not attractive for recreation or drinking water supply, although basically no human health risks will be involved. Of course, odour can be an indicator of surface water being in a poor condition because of different reasons (discharges of waste water, rotting processes induced by eutrophication, oil spills, et cetera).

Proposed quality standards for odour

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
points (20 ^{o}C and 60 ^{o}C)	<2 (*natural smell*)	2	2	4	>4

The Directive 75/440/EEC contains G values for odour. The Directive 76/160//EEC mentions odour in the context of Phenols (phenol indices, C_5H_5OH). The proposed standards are based upon SRN (1997), with one noticeable difference. Because of its link with Bathing/recreation, the standard for Use Class III is set to 2 points, while the standard for the matching category 2 water body for abstraction of drinking water is 3 points. In cases where bathing/recreation is not relevance, a derogation of the standard of Use Class III to 3 points can be considered when abstraction of drinking water is the major use.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

COLOUR

Although there is no such thing as 'the colour of (surface) water', it still is useful to include colour as a –regulatory- parameter. Colour as such does not have human health or ecotoxicological effects, but can serve as a more generic water quality status indicator. Observations that can be considered as 'abnormal' should trigger actions in the water management sector.

Proposed quality standards for odour

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[grade]	<35 (*natural colour*)	35	120	200	>200

Colour is included in the various EU Directives as such, but it is proposed to use the standards currently in place in Moldova since they are already well known. The standards are those of the SRN (1997). (The RPSW (1991) merely mention that the Presence of an artificial colour is prohibited)

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

CHLORIDE (CL^-)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg/l]	200	-	200	-	200	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997) [(1)]	Category I	Category II	Category III	MAC
[mg/l]	350 [(1)]	350 [(1)]	350 [(1)]	500

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg/l]	-	-	-

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg/l]	350 [(1)]	500

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg/l]	25	50	250	300	>300

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg/l]	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
[mg/l]	-	-	-	-	-

Footnotes

[(1)] The concentrations for chloride are mentioned as part of the standards for Total mineralization in the HR, 1997.

PART B: PROPOSED QUALITY STANDARDS

The chloride ion (Cl^-) as such is not a harmfull toxic substance. For two types of water uses, the chloride concentrations nevertheless can be important:

- **Drinking water supply**: chloride concentrations first off all could negatively impact the taste of the drinking water ("salty"). High chloride concentrations in the potable water may cause problems to people who have problems with the functioning of their kidneys or suffer from high blood pressure. The chloride ion cannot simply be removed with common drinking water treatment procedures. Interesting to notice is that many 'mineral waters' recommended for consumption actually can contain high chloride concentrations (1000 mg/l and more).

- **Irrigation**: major ions (salts) tend to accumulate in the soils of irrigated areas, which can result in salinization of the soils, finally maybe even rendering these soils no longer being suitable for crop production.

Chloride concentrations can vary due to natural geological and geochemical background conditions. For instance: in Moldova there appears to be a gradient with increasing major ion concentrations from north to south. This can be explained by the presence of former marine sediments closer and closer to the earth's surface in a southward direction.

Chloride is already included in the existing Moldovan HR, 1997 standards for Total mineralization. Nevertheless, during the stakeholder consultation sessions in Chişinău on 1 and 10 November 2006 it has been requested to propose separate standards for chloride in the new system of SWQS.

Proposed quality standards for chloride (Cl^-)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	<200 (*or natural background levels*)	200	350	500	>500

The proposed quality standards are derived as follows:

- the standards for Class I and II are based on the Guidance values of the EU 75/440 Directive; please notice that natural background concentrations of chloride can vary between regions because of their specific geological/geochemical natural background conditions.

- the standard for Class III is the one already mentioned in the standard for Total mineralization in the Moldovan HR, 1997

- the standards for Class IV and V were proposed during the consultation sessions on 1 and 10 November 2006.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

SULPHATES (SO_4)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
[mg/l]	150	250	150	350[(O)]	150	350[(O)]

MD: Hygienic Regulation Nr. 06.6.3.23 (1997) [(1)]	Category I	Category II	Category III	MAC
[mg/l]	500 [(1)]	500 [(1)]	500 [(1)]	-

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
[mg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
[mg/l]	-	-	-

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
[mg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
[mg/l]	500 [(1)]	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
[mg/l]	60	120	250	300	>300

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg/l]	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
[mg/l]	-	-	-	-	-

Footnotes

[(O)] Exceptional climatic or geographical conditions

[(1)] The concentrations for sulphates are mentioned as part of the standards for Total mineralization in the HR, 1997.

PART B: PROPOSED QUALITY STANDARDS

Sulphates basically already are included in the existing Moldovan HR, 1997 standards for Total mineralization. Nevertheless, during the stakeholder consultation sessions in Chişinău on 1 and 10 November 2006 it has been requested to propose separate standards for SO_4 in the new system of SWQS.

Proposed quality standards for sulphates (SO_4)

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	<250 (*or natural background levels*)	250	350	500	>500

The proposed quality standards are derived as follows:

- the standards for Class I and II are based on the Mandatory values of the EU 75/440 Directive
- the standard for Class III is the one already mentioned in the standard for Total mineralization in the Moldovan HR, 1997
- the standards for Class IV and V were proposed during the consultation sessions on 1 and 10 November 2006.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

PHENOLS

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
Phenols (phenol index) paranitraniline 4 aminoantipyrine mg/1 C_6H_5OH	-	0.001	0.001	0.005	0.01	0.1

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
[mg/l]	-	-	-	0.001

Protection of Fish Life / Fisheries

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
[mg/l C_6H_5OH]	-	([2])	-	([2])

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
=	-	-	0.3

Bathing Waters / Recreation

EU: 76/160/EC	G	I
Phenols (phenol indices)	X	No specific odour
[mg/l C_5H_5OH]	≤0.005	-

MD: Hygienic regulation Nr. 06.6.3.23 (1997)	(Annex 1)	MAC (Annex 2)
[mg/l]	-	0.001

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
Total phenols (phenols index) [mg/l]	0.001	0.005	0.020	0.050	>0.050

ICPDR	Class				
	I	II (TV)	III	IV	V
[mg/l]	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
[mg/l]	-	-	-	-	-

Footnotes

([2]) Phenolic compounds must not be present in such concentrations that they adversely affect fish flavour.

PART B: PROPOSED QUALITY STANDARDS

The perception of the significance of pollution with phenols in ambient waters differs, but an overall denominator seems to be: taste. During the stakeholder consultation sessions in Chişinău on 1 and 10 November 2006 it has been requested to propose standards for phenols in the new system of SWQS. The proposed standards follow the I values of the categories A1 – A3 of the Directive 75/440.

Proposed quality standards for phenols

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	0.001 (*or natural background levels*)	0.001	0.005	0.1	>0.1

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

OIL PRODUCTS

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
Dissolved or emulsified hydrocarbons (after extraction by petroleum ether) [mg/1]	-	0.05	-	0.1	0.5	1

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
[mg/l]	-	-	-	0.5

Protection of Fish Life / Fisheries

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
petroleum hydrocarbons [mg/l]	-	([3])	-	([3])

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
=	-	-	0.05

Bathing Waters / Recreation

EU: 76/160/EC	G	I
Mineral oils	-	No film visible on the surface of the water and no colour

MD: Hygienic regulation Nr. 06.6.3.23 (1997)	(Annex 1)	MAC (Annex 2)
[mg/l]	-	0.5

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

Footnotes

([3]) Petroleum products must not be present in water in such quantities that they:
- form a visible film on the surface of the water or form coatings on the beds of water-courses and lakes,
- impart a detectable 'hydrocarbon' taste to fish,
- produce harmful effects in fish.

PART B: PROPOSED QUALITY STANDARDS

During the stakeholder consultation sessions in Chişinău on 1 and 10 November 2006 it has been requested to propose standards for oil products in the new system of SWQS. The proposed standards have been derived in the following way: the I values of the categories A1 – A3 of the EU Directive 75/440 have been used as the standards for the Use Classe I, II and IV. The standard for Use Class III is set in accordance with the MAC of the HR, 1997.

Proposed quality standards for phenols

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
[mg/l]	0.05	0.1	0.5	1	>1

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

SECTION 2: TRACE METALS

The Environmental Quality Standards for the WFD Priority Substances include standards for cadmium, lead, mercury, and nickel (see Annex 2 for more details on the WFD EQS). There are two problems in making these standards operational in the proposed system of SWQS for Moldova:

- For proper use of the standards, the natural background concentration should be incorporated; these are not yet known for Moldovan surface waters

- The standards are defined for *dissolved* concentrations, and partially because of this the concentrations can be quite low. The Annual Average-EQS (hardness Class 3) for cadmium is for instance 0.09 µg/l. Even with modern analytical techniques it will be a problem to analyse at such a low level. And the current laboratory capacity of the major monitoring organisations in Moldova will not be able to analyse at these levels at all.

In order to meet the abovementioned complications, it is proposed to use previously defined EU quality standards for these four trace metals. Details are presented in the data sheets.

Besides the four WFD trace metals, furthermore standards are proposed for copper and zinc, because of inclusion in the Directive 78/659/EEC.

Primer on total and dissolved trace metal concentrations

The various systems of surface water quality standards in Annex 2 and 3 contain standards for trace metals for both dissolved as well as total concentrations. The Directive 78/659/EEC even contains both types: the standards for copper are for the *dissolved* concentration, while the standards for zinc are for the *total* concentration.

There is no general consensus for what would prevail as water quality standards: dissolved or total. Part of this discussion concerns the issue of *bioavailability* of the trace metals. For water consumption by human beings, the dissolved fraction is more relevant (since adsorbed metals mainly remain stuck to particles and thus not will be released into the rest of the human body outside the digestion system). On the other hand, several bottom dwelling organisms (invertebrate macro fauna) actually 'digest' sediment/suspended solids (via which metals become available in the food chain), or can be impacted by exposure to polluted sediment/suspended solids otherwise.

In surface water, trace metals can occur both dissolved in water as well as adsorbed to suspended solids. The *total* concentration of a surface water sample encompasses both matrices, *dissolved* in water plus *adsorbed* in suspended solids. Normally, an equilibrium between the dissolved and the adsorbed fractions exists. This equilibrium depends on several factors:

a) chemical characteristics of the heavy metals ('partition coefficient');
b) physico-chemical conditions of the surface water, like pH and hardness.

In addition, for the total metal concentration furthermore the

c) amount of suspended solids (SS)

in the sample is relevant.

Partition coefficient K

The chemical characteristics are expressed by the partition coefficient K. There are no uniform values for the partition coefficient (partially because of the influence of different physico-chemical conditions). For this Technical Report the partition coefficients applied in the Dutch system of surface water quality standards have been selected. The partition coefficients of a selected number of trace metals are shown in the table below, as well as the calculated fraction dissolved of the total concentration.

Partition coefficients –K- used in The Netherlands; calculated percentage dissolved concentration (with suspended solids SS= 30 mg/l)

	K	*dissolved*
Ni	8	*81%*
As	10	*77%*
Cu	50	*40%*
Zn	110	*23%*
Cd	130	*20%*
Hg	170	*16%*
Cr	290	*10%*
Pb	640	*5%*

The last column illustrates that there can be huge differences for the extent into which metals tend to remain dissolved in the water phase either adsorb to suspended solids.

Suspended solids: standardisation of total concentration

From the tendency to adsorb to suspended solids, it automatically follows that the *amount of suspended solids* also will determine the *total metal concentration* of an unfiltered surface water sample; the more suspended solids in the sample, the higher the total concentration. Therefore, a sample can have high total metal concentrations not because of being more polluted by heavy metals, but simply because of containing more suspended solids.

The Dutch system of water quality standards takes such characteristics of metals into account. The Dutch quality standards for total concentrations of metals in surface waters are defined for surface water containing 30 mg/l suspended solids. Therefore, before checking the compliance with standard, the result first have to be corrected for the amount of suspended solids (= being standardised). For this standardisation, formula (1) applies. In this formula one easily can recognise the partition coefficient K and the factor 30 mg/l for the standard amount of suspended solids.

(1)

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

with:

$C_{total,\ standardised}$	standardised total concentration in [µg/l]
$C_{total,\ measured}$	total concentration as analysed by the laboratory in [µg/l]
K	partition coefficient [l/g]
SS	measured (analysed) concentration of Suspended Solids of the sample [mg/l] The lower limit for suspended solids is 10 mg/l. If the measured concentration SS is less than 10 mg/l, for standardisation has set the concentration SS to 10 mg/l.

Not taking into account the amount of suspended solids when interpreting a 'total metal concentration' can lead to serious mistakes in the interpretation of results.

For example. In 1999, during the Tacis "Prut Basin Water Management Project, Moldova", a survey was organised along the Prut River. The total zinc concentration of the surface water sample taken at Girla mare was 50 µg/l. In the Netherlands, the Maximum Allowable Concentration (MAC) for total zinc is 40 µg/l. The result of the laboratory analysis for total zinc in the sample at Girla mare therewith implies that the concentration exceeds the Dutch MAC. But: the concentration of suspended solids of the sample at Girla mare was 880 mg/l. After correcting for this (very high) concentration of suspended solids, the *standardised* concentration is only 2 µg/l!

Method for calculation of total concentrations to dissolved concentrations and vice versa

With the principles mentioned above, one can calculate dissolved concentrations from total concentrations and vice versa. Such calculations are mere approximations. But, at least they allow for coping with situations where standards are defined for total either dissolved concentrations only

Total metal concentration in a surface water sample actually is the result of the sum of:

a) 'solid phase matrix'
   - the concentration of the metal in the suspended solids, in combination with
   - the amount of suspended solids,

plus

b) 'dissolved phase matrix'
   - dissolved metal concentration.

(2) $$C_{total} = C_{'adsorbed''} + C_{dissolved}$$

with:

C_{total} total metal concentration, in [µg/l])
$C_{dissolved}$ metal concentration dissolved in water ('water phase matrix'), in [µg/l]
$C_{'adsorbed'}$ metal concentration of the adsorbed fraction ('solid phase matrix), in **[µg/l]**

The key to the calculations is in the partition coefficient K:

(3) $$K = \frac{C_{SS\_adsorbed}}{C_{dissolved}}$$

with:

$C_{SS\_adsorbed}$ metal concentration in suspended solids ('solid phase matrix'), in [mg/kg]
$C_{dissolved}$ metal concentration dissolved in water ('water phase matrix'), in [mg/m^3]
K partition coefficient, in [m^3/kg]

Equation (3) can be rewritten as:

(4) $$C_{dissolved} = \frac{C_{SS\_adsorbed}}{K}$$

(5) $$C_{'adsorbed''} = C_{SS\_adsorbed} * SS$$

with:

$C_{'adsorbed'}$ metal concentration of the adsorbed fraction(as part of the total concentration), in [µg/l]
$C_{SS\_adsorbed}$ metal concentration in suspended solids ('solid phase matrix'), in [mg/kg]
SS suspended solids concentration of the –unfiltered- surface water sample, in [kg/m^3]
K partition coefficient, in [m^3/kg]

In case a standard has been defined for a total metal concentration only, the standard for the dissolved concentration can be calculated with equation (6)

(6)
$$C_{dissolved} = \frac{C_{total}}{(1 + K * SS)}$$

with:
$C_{dissolved}$ dissolved metal concentration in [µg/l]
C_{total} total metal concentration in [µg/l]
SS suspended solids concentration of the (unfiltered) surface water sample, in [kg/m^3]
K partition coefficient, in [m^3/kg]

If the standard has been defined for the dissolved concentration, then the standard for the total concentration can be calculated with equation (7).

(7)
$$C_{total} = C_{dissolved} * (1 + K * SS)$$

with:
C_{total} total metal concentration in [µg/l]
$C_{dissolved}$ dissolved metal concentration in [µg/l]
SS suspended solids concentration of the (unfiltered) surface water sample, in [kg/m^3]
K partition coefficient, in [m^3/kg]

For the calculations of standards, SS has been set to **30 mg/l (0.03 kg/m^3)**, in accordance with the Dutch system of surface water quality standards.

CADMIUM (CD)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] [(1)]	1	5	1	5	1	5
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l] [(1)]	-	-	-	1 [(2)]
dissolved [µg/l] [(1)]	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] [(1)]	-	-	-	-
dissolved [µg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] [(1)]	-	-	5 [(2)]
dissolved [µg/l] [(1)]	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
total [µg/l] [(4),(5)]	-	-
dissolved [µg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] [(1)]	-	1 [(2)]
dissolved [µg/l]		

Ambient Standards

EU: 83/513/EEC	MAC
total [µg/l]	5
dissolved [µg/l]	-

EU: WFD ***(inland waters)***	AA-EQS	MAC-EQS
total [µg/l]	-	-
dissolved [µg/l]	≤0.08 (3) 0.08 0.09 0.15 0.25	≤0.45 (3) 0.45 0.6 0.9 1.5

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	0.5	1	2	5	>5
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
total [µg/l]	background	1	2	5	>5
dissolved [µg/l]	-	0.1	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] (6)	<0.07	0.07-0.53	0.53-1.1	1.1-3.9	>3.9
dissolved [µg/l]	-	-	-	-	-

Footnotes

(1) document uses [mg/l] as unit

(2) From available documents it is not clear whether the standard applies to dissolved or total copper.

(3) For Cadmium and its compounds, the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40 mg $CaCO_3$/l, Class 2: 40 to <50 mg $CaCO_3$/l, Class 3: 50 to <100 mg $CaCO_3$/l, Class 4: 100 to <200 mg $CaCO_3$/l and Class 5: ≥200 mg $CaCO_3$/l).

(4) The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg

(5) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.

(6) Applicable for hardness from about 0.5 meq/l to 8 meq/l

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Cadmium, Cd

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	<1 (*or natural background levels*)	1	5	5	>5
dissolved [µg/l]	<0.2 (*or natural background levels*)	0.2(calc)	1(calc)	1(calc)	>1

(calc) calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

The ambient standard for inland surface waters defined in the Daughter Directive 83/513/EEC is a total concentration of 5 µg/l. This is similar to the I value in the Directive 75/440/EEC. A standard of 5 µg/l is therefore proposed for the Use Classes III and IV. For Use Class II the G value of Directive 75/440/EEC of 1 µg/l is proposed.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the beginning of this Section).

LEAD (PB)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] (1)	-	50	-	50	-	50
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l] (1)	-	-	-	30 (2)
dissolved [µg/l] (1)	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] (1)	-	-	-	-
dissolved [µg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] (1)	-	-	100 (2)
dissolved [µg/l] (1)	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
total [µg/l] (3),(4)	-	-
dissolved [µg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] (1)	-	30 (2)
dissolved [µg/l]		

Ambient Standards

EU: 76/464/EEC	MAC
total [µg/l]	-
dissolved [µg/l]	-

EU: WFD ***(inland waters)***	AA-EQS	MAC-EQS
total [µg/l]	-	-
dissolved [µg/l]	7.2	not applicable

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	5	10	25	50	>50
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
total [µg/l]	background	5	10	25	>25
dissolved [µg/l]	-	1	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] [(5)]	<0.1	0.1-1.6	1.6-3.2	3.2-82	>82
dissolved [µg/l]	-	-	-	-	-

Footnotes

[(1)] document uses [mg/l] as unit
[(2)] From available documents it is not clear whether the standard applies to dissolved or total copper.
[(3)] The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg
[(4)] Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
[(5)] Applicable for hardness from about 0.5 meq/l to 8 meq/l

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Lead, Pb

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	<50 (*or natural background levels*)	50	50	50	>50
dissolved [µg/l]	<2.5 (*or natural background levels*)	2.5[(calc)]	2.5[(calc)]	2.5[(calc)]	>2.5

[(calc)] calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

- There are no standards defined for lead in the Directive 76/464/EEC or its Daughter Directives. Only the Directive 75/440/EEC contains standards for lead with I values for all three categories of 50 µg/l.

- When calculating the dissolved concentration from 50 µg/l, the resulting concentration is 2.5 µg/l. This is lower than the WFD AA-EQS! The substance data sheet for lead indicates that there are some complications with deriving the EQS. It mentions that the Maximum Permissible Admission concentration for the Rhine as example is 2.3 µg/l http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/i-priority_substances/supporting_background&vm=detailed&sb=Title

- It nevertheless is proposed to follow the I values of the Directive 75/440/EEC, but the notice above should be taken into account.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the beginning of this Section).

MERCURY (HG)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] (1)	0.5	1	0.5	1	0.5	1
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l](1)	-	-	-	0.5 (2)
dissolved [µg/l] (1)	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] (1)	-	-	-	-
dissolved [µg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] (1)	-	-	0.01 (2)
dissolved [µg/l] (1)	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
total [µg/l] (3),(4)	-	-
dissolved [µg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] (1)	-	0.5 (2)
dissolved [µg/l]		

Ambient Standards

EU: 82/176/EEC	MAC
total [µg/l]	1
dissolved [µg/l]	-

EU: WFD ***(inland waters)***	AA-EQS	MAC-EQS
total [µg/l]	-	-
dissolved [µg/l]	0.05	0.07

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	0.1	0.3	0.5	1	>1
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class

	I	II (TV)	III	IV	V
total [µg/l]	background	0.1	0.2	0.5	>0.5
dissolved [µg/l]	-	0.1	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] [5]	<0.003	0.003-0.007	0.007-0.012	0.012-2.4	>2.4
dissolved [µg/l]	-	-	-	-	-

Footnotes

[1] document uses [mg/l] as unit
[2] From available documents it is not clear whether the standard applies to dissolved or total copper.
[3] The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg
[4] Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
[5] Applicable for hardness from about 0.5 meq/l to 8 meq/l

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Mercury, Hg

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	<1 (*or natural background levels*)	1	1	1	>1
dissolved [µg/l]	<0.2 (*or natural background levels*)	$0.2^{(calc)}$	$0.2^{(calc)}$	$0.2^{(calc)}$	>0.2

(calc) calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

The I values of the Directive 75/440/EEC are the same concentration as the quality objective of the Daughter Directive 82/176/EEC. It is proposed to apply this standards to the Use Classes II – IV.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the end of this Section).

NICKEL (Ni)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] (1)	-	-	-	-	-	-
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l](1)	-	-	-	100 (2)
dissolved [µg/l] (1)	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] (1)	-	-	-	-
dissolved [µg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] (1)	-	-	10 (2)
dissolved [µg/l] (1)	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
total [µg/l] (3),(4)	-	-
dissolved [µg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] (1)	-	100 (2)
dissolved [µg/l]		

Ambient Standards

EU: 76/464/EEC	MAC
total [µg/l]	-
dissolved [µg/l]	-

EU: WFD ***(inland waters)***	AA-EQS	MAC-EQS
total [µg/l]	-	-
dissolved [µg/l]	20	*not applicable*

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	10	25	50	100	>100
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V

total [µg/l]	background	50	100	250	>250
dissolved [µg/l]	-	1	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] (5)	<15	15-87	87-160	160-1400	>1400
dissolved [µg/l]	-	-	-	-	-

Footnotes

(1) document uses [mg/l] as unit
(2) From available documents it is not clear whether the standard applies to dissolved or total copper.
(3) The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg
(4) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
(5) Applicable for hardness from about 0.5 meq/l to 8 meq/l

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Nickel, Ni

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	10 (*or natural background levels*)	25	50	100	>100
dissolved [µg/l]	$8^{(calc)}$ (*or natural background levels*)	$20^{(calc)}$	$40^{(calc)}$	$80^{(calc)}$	>80

(calc) calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

- Interestingly, no actual concentrations are defined for nickel in the Directives 75/440/EEC or 76/464/EEC and its Daughter Directives.

- The WFD EQS are only defined for the (Annual Average) AA-EQS which represents the annual mean concentration. A dissolved concentration of nickel of 20 µg/l would tentatively compare with a total concentration of 25 µg/l.

- Because of the lack of sufficient alternative EU standards, it is proposed to include the Romanian GD 161 standards.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the beginning of this Section).

COPPER (CU)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] (1)	20	50 (O)	50	-	1000	-
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l] (1)	-	-	-	1000 (2)
dissolved [µg/l] (1)	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] (1)	-	-	-	-
dissolved [µg/l]	≤400 (at 100 mg/l $CaCO_3$) (3)	-	≤40 (at 100 mg/l $CaCO_3$) (3)	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] (1)	-	-	1 (2)
dissolved [µg/l] (1)	-	-	

Bathing Waters / Recreation

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] (1)	-	1000 (2)
dissolved [µg/l]		

Ambient Standards

WFD (inland waters)	AA-EQS	MAC-EQS
total [µg/l] (1)	-	-
dissolved [µg/l]	-	-

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	20	30	50	100	>100
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
total [µg/l]	background	20	40	100	>100
dissolved [µg/l]	-	2	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] (6)	<2	2-7	7-12	12-18	>18
dissolved [µg/l]	-	-	-	-	-

Footnotes

(1) document uses [mg/l] as unit

(2) From available documents it is not clear whether the standard applies to dissolved or total copper.

(3) Annex II: Particulars regarding total zinc and dissolved copper "*Dissolved copper concentrations for different water hardness values between 10 and 3500 mg/l $CaCO_3$:*

	Water hardness (mg/l $CaCO_3$)			
	10	*50*	*100*	*300*
[µg/l] Cu	5*	22	40	112

* the presence of fish in waters containing higher concentrations of copper may indicate a predominance of dissolved organo-cupric complexes.

(4) The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg

(5) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.

(6) Applicable for hardness from about 0.5 meq/l to 8 meq/l

(O) Exceptional climatic or geographical conditions

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Copper, Cu

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	<50 (*or natural background levels*)	50	100(calc)	1000	>1000
dissolved [µg/l]	<20 (*or natural background levels*)	20(calc)	40	400(calc)	>400

(calc) calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

- the boundary concentration for Use Class II is set to the I value of the Directive 75/440/EEC
- the boundary concentration for Use Class III is set to the G value of the Directive 78/659/EEC
- the boundary concentration for Use Class IV is set to the G value of category A3 of the Directive 75/440/EEC

Contrary to the Directive 78/659/EEC, no further differentiation for hardness classes has been made. In case the hardness of Moldovan surface waters would substantially differ from 100 mg/l $CaCO_3$, then the ranges included in Annex II of the Directive 78/659/EEC can be used for adjusting the standards.

Compared to the current Moldovan standards, the proposed standards are less stringent for waters to be used for fish-farming. In the case of abstraction of drinking water, the standards of Use Classes II and III are more stringent than the current MAC.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the beginning of this Section).

ZINC (ZN)

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EEC	A1		A2		A3	
	G	I	G	I	G	I
total [µg/l] (1)	500	3000	1000	5000	1000	5000
dissolved [µg/l]	-	-	-	-	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	Category I	Category II	Category III	MAC
total [µg/l] (1)	-	-	-	1000 (2)
dissolved [µg/l] (1)	-	-	-	

Protection of Fish Life / Fisheries

EU: 78/659/EEC	Salmonid		Cyprinid	
	G	I	G	I
total [µg/l] (1)	-	≤300 (at 100 mg/l $CaCO_3$) (3)	-	≤1000 (at 100 mg/l $CaCO_3$) (3)
dissolved [µg/l]	-	-	-	-

MD: Rules for Protection of Surface Water (1991)	Super and first class	Second class	MAC
total [µg/l] (1)	-	-	10(2)
dissolved [µg/l] (1)	-	-	

Bathing Waters / Recreation

EU: 76/160/EEC	G	I
total [µg/l] (4),(5)	-	-
dissolved [µg/l]	-	-

MD: Hygienic Regulation Nr. 06.6.3.23 (1997)	(Annex I)	MAC (Annex II)
total [µg/l] (1)	-	1000 (2)
dissolved [µg/l]	-	

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
total [µg/l]	100	200	500	1000	>1000
dissolved [µg/l]	-	-	-	-	-

ICPDR	Class				
	I	II (TV)	III	IV	V
total [µg/l]	background	100	200	500	>500
dissolved [µg/l]	-	5	-	-	-

ECE	Quality class				
	I	II	III	IV	V
total [µg/l] [6]	<45	45 – 77	77 – 110	110 – 120	>120
dissolved [µg/l]	-	-	-	-	-

Footnotes

[1] original document uses [mg/l] as unit

[2] From available documents it is not clear whether the standard applies to dissolved or total zinc

[3] Annex II: Particulars regarding total zinc and dissolved copper: "*Zinc concentrations for different water hardness values between 10 and 500 mg/l $CaCO_3$:*

	Water hardness (mg/l $CaCO_3$)			
	10	*50*	*100*	*500*
Salmonid waters ([µg/l Zn)	30	200	300	500
Cyprinid waters ([µg/l Zn)	300	700	1000	2000

[4] The annex to 76/160/EEC mentions: heavy metals such as As, Cd, Cr, Pb, Hg

[5] Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.

[6] Applicable for hardness from about 0.5 meq/l to 8 meq/l

PART B: PROPOSED QUALITY STANDARDS

Proposed quality standards for Zinc, Zn

unit	Use Class I	Use Class II	Use Class III	Use Class IV	Use Class V
total [µg/l] (*with SS= 30 mg/l*)	<300 (*or natural background levels*)	300	1000	5000	>5000
dissolved [µg/l]	$<70^{(calc)}$ (*or natural background levels*)	$70^{(calc)}$	$233^{(calc)}$	$1163^{(calc)}$	>1163

(calc) calculated; see Primer on total and dissolved trace metal concentrations included at the beginning of this Section.

The proposed standards are derived as follows:

- the boundary concentrations for Use Classes II and III are set in accordance with the I values of the Directive 78/659/EEC for respectively salmonid and cyprinid waters
- the boundary concentration for Use Class IV is set to the I value of category A3 of the Directive 75/440/EEC

Contrary to the Directive 78/659/EEC, no further differentiation for hardness classes has been made. In case the hardness of Moldovan surface waters would substantially differ from 100 mg/l $CaCO_3$, then the ranges included in Annex II of the Directive 78/659/EEC can be used for adjusting the standards.

Compared to the current Moldovan standards, the proposed standards are less stringent for waters to be used for fish farming. The boundary concentration of Use Class IV is higher than the current MAC for the abstraction of drinking water.

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

For compliance testing of the total concentration, the measured concentration first has to be standardised to 30 mg/l Suspended Solids (see Primer on total and dissolved trace metal concentrations included at the beginning of this Section).

SECTION 3: BACTERIOLOGICAL PARAMETERS

TOTAL COLIFORMS 37^0 C

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
No./100 ml	50	-	5 000	-	50 000	-

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
No./100 ml	100	1 000	5 000	

Fisheries / Protection of Fish Life

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
No./100 ml	-	-	-	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
No./100 ml			-

Bathing Waters / Recreation/Irrigation

EU: 76/160/EC	G	I
No./100 ml	50	10 000
	500	-

MD: Hygienic regulation Nr. 06.6.3.23		
No./100 ml	5 000	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
No./100 ml	-	-	-	-	-

ICPDR	Class				
	I	II	III	IV	V
No./100 ml	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
No./100 ml	-	-	-	-	-

PART B: PROPOSED QUALITY STANDARDS

The EU regulation states that only for bathing and drinking purpose, this parameter is necessary. In EU WFD also it is stated that the aquatic ecosystems can have their own level of microbiology without affecting ecosystem life.

Total coliforms 37 ^{0}C is not needed by fish and other aquatic organisms for their good health but it is important for human health, both when is about drinking water, raw water intended for drinking purpose and for bathing, meaning both direct and indirect use for human needs and therewith is an important ecological parameter. Lower the content is, better for human health. The parameter indicates total species of coliforms being able to survive and develop into human body at normal human body temperature and means the parameter bearing “water born disease”. Very low contents as such are not directly jeopardise uses like production of drinking water but increasing levels indicates different levels of treatment, meaning chlorine input in water treatment process. Higher the outside temperature is, bigger quantity of chlorine is necessary, but this disturbs the smell and general quality of water treated. Also, higher content of residual chlorine increase the risk of carcinogenic characteristics of drinking water because of free chlorine radicals. Low content of total coliforms does not bother so much recreation water, but can indicate pollution stresses during bathing season. Total coliforms are measured my means of adequate growing medium. The water sample is seeded on the medium and the presence and/or absence as well as the number of coli. The method is European accepted, ISO method.

Although the EU Directives 75/440/EC and 76/160/EEC only contain quality standards for total coliforms, the region of ICPDR and ECE does not contain provisions for such parameter. Normally, it is considered that this parameter can be naturally present in surface water in a certain level, being harmless for other alive organism than human beings al low number of colonies, coming from natural background.

The proposed standards mainly follow the standards of the EU 75/440/EEC and 76/160/EEC Directives and have been incorporated as following. The class I and II values comply with the G values for class A1 and A2 for raw water intended for drinking purpose, but also for class III from hygienic regulation from Moldova. The class III comply with Indicative value for bathing waters; the class IV comply with G value for class A3 from 75/440/EEC Directive.

Compared to the current Moldovan standards (Hygienic regulation) water bodies with total coliforms from class I and II are more severe that the proposed standards. Actually, the proposed class II standard comply with class III from Moldovan Regulation, meaning that what was before considered class III can be included now in class II, similar with “good quality water”.

Waters corresponding to the class V are “any value bigger than class IV”, referring mainly at the “waste waters category” but not only.

Proposed quality standards for Coliforms total

Proposal	Class				
	I	II	III	IV	V
No./100 ml	500	5 000	10 000	50 000	-

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

FAECAL COLIFORMS

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
No./100 ml	50	-	2 000	-	20 000	-

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
No./100 ml	100	1 000	5 000	

Fisheries / Protection of Fish Life

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
No./100 ml	-	-	-	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
No./100 ml			

Bathing Waters / Recreation/Irrigation

EU: 76/160/EC	G	I
No./100 ml	100	2 000
	500	-

MD: Hygienic regulation Nr. 06.6.3.23		
No./100 ml		-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

ICPDR	Class				
	I	II	III	IV	V
	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

PART B: PROPOSED QUALITY STANDARDS

The EU regulations state that only for bathing and drinking purpose, this parameter is necessary. In EU WFD, it is also stated that the aquatic ecosystems can have their own level of microbiology without affecting ecosystem life.

Faecal coliforms is not needed by fish and other aquatic organisms for their good health but it is important for human health, both when is about drinking water, raw water intended for drinking purpose and for bathing purpose, meaning both direct and indirect use for human needs and therewith is an important ecological parameter. Lower the content is, better for human health. The parameter indicates total species of faecal coli coming both from human and animal intestinal activity being able to affect internal function of human body (digestive system, kidneys, immunological system) in case of ingestion of polluted water and means the parameter bearing "imuno-suppresor disease" from a certain level of concentration. Very low contents as such are not directly jeopardise uses like production of drinking water but increasing levels indicates different levels of treatment, meaning chlorine input in water treatment process. Higher the outside temperature is bigger quantity of chlorine is necessary, but this exceeding chlorine disturbs the smell and general quality of water treated. Also, higher content of residual chlorine increase the risk of carcinogenic characteristics of drinking water because of free chlorine radicals. Very low content of faecal coliforms does not bother so much recreation water, but can indicate pollution stresses during bathing season. Faecal coliforms are measured my means of adequate growing medium. The water sample is seeded on the medium and the presence and/or absence as well as the number of coli. The method was used to be European accepted, ISO method but being changed lately by a more specific method for intestinal enterococci with only human origin.

Although the EU Directives 75/440/EC and 76/160/EEC only contain quality standards for faecal coliforms, the region of ICPDR and ECE does not contain provisions for such parameter. Neither Romania adopted any more such parameter for monitoring of surface water (GD 161/2006). Normally, it is considered that this parameter can be present in surface water in a certain level coming from animal and human digestive system, being harmless for other organism than human beings at low number of colonies.

The proposed standards mainly follow the standards of the EU 75/440/EEC and 76/160/EEC Directives and have been incorporated as following. The class I value is bigger than the G values for class A1 (covering completely the directive value) and is identical with Class I from Moldovan Hygienic Regulation. Class II is identical with G value for Class A2 and indicative value for bathing water, meaning good quality water with medium level of treatment for raw water intended for drinking purpose and more generous level (twice bigger) than Class II from Moldovan Hygienic Regulation. The class III is twice less severe than G value fro class III for raw water, meaning less severe quantity of chlorine treatment. Class IV from the new proposal complies with class IV comply with G value for class A3 from 75/440/EEC Directive. The proposed values meet the most stringent value from the hygienic regulation but also requirement for raw water and bathing waters from European Directives.

Compared to the current Moldovan standards (Hygienic regulation) water bodies with total coliforms from class II are more relaxed that the proposed standards. Actually, the proposed class II and class III standard will include waters which were before included in class III and class IV, minimising the water category included in "degraded water".

Waters corresponding to the class V are "any value bigger than class IV", referring mainly at any other waters than class I-IV including also some of the "waste waters category".

Proposed quality standards for Faecal Coliforms

Proposal	Class				
	I	II	III	IV	V
No./100ml	100	2 000	10 000	20 000	-

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

FAECAL STREPTOCCOCI

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
No./100 ml	20	-	1 000	-	10 000	-

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
No./100 ml	-	-	-	-

Fisheries / Protection of Fish Life

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
No./100 ml	-	-	-	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
No./100 ml			

Bathing Waters / Recreation/Irrigation

EU: 76/160/EC	G	I
No./100 ml	100	-

MD: Hygienic regulation Nr. 06.6.3.23		
No./100 ml	-	-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

ICPDR	Class				
	I	II	III	IV	V
	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

PART B: PROPOSED QUALITY STANDARDS

The EU regulations state that only for bathing and drinking purpose, this parameter is necessary. In EU WFD, it is also stated that the aquatic ecosystems can have their own level of microbiology without affecting ecosystem life.

Faecal streptococci is not needed by fish and other aquatic organisms for their good health but it is important for human health, both when is about drinking water, raw water intended for drinking purpose and for bathing purpose as an obligatory parameter, meaning both direct and indirect use for human needs and therewith is an important ecological parameter. Lower the content is, better for human health. The parameter indicates total species of faecal cocci coming from human intestinal activity being able to affect internal function of human body (digestive system, kidneys, immunological system) in case of ingestion of polluted water and means the parameter bearing "imuno-suppresor disease" from a certain level of concentration. Very low contents as such are not directly jeopardise uses like production of drinking water but increasing levels indicates different levels of treatment, meaning chlorine input in water treatment process. Higher the quantity is bigger quantity of chlorine is necessary, but this exceeding chlorine disturbs the smell and general quality of water treated. Also, higher content of residual chlorine increase the risk of carcinogenic characteristics of drinking water because of free chlorine radicals. Very low content of faecal cocci does not bother so much recreation water, but can indicate pollution stresses during bathing season. Faecal cocci are measured my means of adequate growing medium. The water sample is seeded on the medium and the presence and/or absence as well as the number of cocci. The method was used to be European accepted, ISO method but being changed lately by a more specific method for intestinal enterococci with only human origin.

Although the EU Directives 75/440/EC and 76/160/EEC only contain quality standards for faecal cocci, the region of ICPDR and ECE does not contain provisions for such parameter. Neither Romania adopted any more such parameter for monitoring of surface water (GD 161/2006). Normally, it is considered that this parameter can be present in surface water in a certain level coming from animal and human digestive system, being harmless for other organism than human beings at low number of colonies.

The proposed standards mainly follow the standards of the EU 75/440/EEC and 76/160/EEC Directives and have been incorporated as following. The class I value comply with the G values for class A1. Class II is identical with G value for Class A2 and covers obligatory value for bathing water, meaning good quality water with medium level of treatment for raw water intended for drinking purpose. The class III is twice less severe than G value fro class III for raw water, meaning less severe quantity of chlorine treatment. Class IV from the new proposal complies with G value for class A3 from 75/440/EEC Directive. The proposed values does not meet any value from the hygienic regulation but covers the obligatory requirements for raw water and bathing waters from European Directives.

Compared to the current Moldovan standards, it is easily seen that, up to now, this parameter was not measured in Moldova.

Waters corresponding to the class V are "any value bigger than class IV", referring mainly at any other waters than class I-IV including also some of the "waste waters category".

Proposed quality standards for Faecal Streptococci

Proposal	Class				
	I	II	III	IV	V
No./100ml	20	1 000	5 000	10 000	-

Compliance testing

sampling frequency [-]	statistics for class boundary compliance testing
12 (monthly) or more	95–percentile
less than 12	maximum concentration

SALMONNELA

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
No./100 ml	-	-	-	-	-	-

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
No./100 ml				

Fisheries / Protection of Fish Life

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
No./100 ml	-	-	-	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
No./100 ml			

Bathing Waters / Recreation

EU: 76/160/EC	G	I
No./100 ml	-	0

MD: Hygienic regulation Nr. 06.6.3.23		
No./100 ml		

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

ICPDR	Class				
	I	II	III	IV	V
	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

PART B: PROPOSED QUALITY STANDARDS

It is regulated only for bathing/recreational purpose at EU level for indicative level, not for mandatory (G) and for drinking water (after treatment) not for surface waters.

It is not regulated and monitored in Romania and at ICPDR level.

It is regulated in Romania for drinking water and monitored only by human health authorities with ‘’0‘’ value for all 5 classes.

Not regulated yet in Moldovan standards.

It is proposed not to be introduced in new Moldova WQS for monitoring of surface waters.

ENTEROVIRUSES

PART A: EXISTING QUALITY STANDARDS

Abstraction of Surface Water for Drinking Water Supply

EU: 75/440/EC	A1		A2		A3	
	G	I	G	I	G	I
No./100 ml	-	-	-	-	-	-

MD: Hygienic regulation Nr. 06.6.3.23	Category I	Category II	Category III	MAC
No./100 ml				

Fisheries / Protection of Fish Life

EU: 78/659/EC	Salmonid		Cyprinid	
	G	I	G	I
No./100 ml	-	-	-	-

MD: Rules for protection of Surface Water 1991	Super and first class	Second class	MAC
No./100 ml			

Bathing Waters / Recreation

EU: 76/160/EC	G	I
No./100 ml	50	10 000
	-	0

MD: Hygienic regulation Nr. 06.6.3.23		
No./100 ml		-

Ambient Standards

RO: GD 161	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

ICPDR	Class				
	I	II	III	IV	V
	-	-	-	-	-

ECE	Quality class				
	I	II	III	IV	V
	-	-	-	-	-

PART B: PROPOSED QUALITY STANDARDS

Enteroviruses is regulated only for bathing/recreational purpose at EU level for indicative level with ‘’0‘’ value, not for mandatory (G) and for drinking water (after treatment), but not for surface waters.

It is not regulated and monitored in Romania and at ICPDR level in surface waters.

It is regulated in Romania for drinking water and monitored only by human health authorities with ‘’0‘’ value for all 5 classes.

Not regulated yet in Moldovan standards.

It is proposed not to be introduced in new Moldova WQS for monitoring of surface waters.

“**Lacto positive coli”** and **“Colifagi”,** as well as **“Ovum of helmintes’’** can not be found in European legislation, ICPDR or UN ECE regulations, being saprophyte microbiological parameters in certain circumstances. They pose a risk for human health from direct (drinking water) or indirect activities (bathing/recreation). As a matter of fact, **“Lacto positive coli”** and **“Colifagi”** are normally included in “total coliforms”, according to European analysis methods.

An increased attention should be paid to parameter ***“Intestinal enterococci”,*** taking into account that it appears as a new parameter in the Bathing water Directive. From scientific point of view, this new parameter reflects better the impact of human activity as well as the potential danger upon human life. Animals or other alive organisms (plans, fish, etc.) must be taken into consideration when assessing ecological status, based on biological parameters and not microbiological ones. Also, the new ISO analysis method includes considerations upon this aspect and the old ISO method is replaced by new one, focused mainly on this parameter.

It is also recommended to adopt as soon as possible these European analysis methods that offer an integrated picture of microbiological risk, rather than the present Moldovan parameters. Also, this should a task only for Sanepid laboratories and not for Hydromet or Ecological Inspectorate, who should eliminate the analysis from their normal monitoring, re-allocating the rooms and staff for future increasingly necessities.

For class V –- bigger than class 4 of a line (as a matter of fact bad class can be worse than class 4).

Salmonella, enterovirusis, ovums of helmintes - absent for all 5 classes.

ANNEX 2

EU DIRECTIVES: QUALITY STANDARDS AND ACCOMPANYING INFORMATION

DIRECTIVE 75/440/EEC CONCERNING THE QUALITY REQUIRED OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER

ANNEX II: Characteristics of surface water intended for the abstraction of drinking water

	Parameters		Al G	Al I	A2 G	A2 I	A3 G	A3 I
1	pH		6.5 to 8.5		5.5 to 9		5.5 to 9	
2	Coloration (after simple filtration) scale	mg/1 Pt	10	20(O)	50	100 (O)	50	200 (O)
3	Total suspended solids	mg/1 SS	25					
4	Temperature	°C	22	25 (O)	22	25 (0)	22	25 (0)
5	Conductivity	µS/cm at 20 °C	1000		1000		1000	
6	Odour (dilution factor at 25 °C)		3		10		20	
7*	Nitrates	mg/1 NO3	25	50 (O)		50 (O)		50 (O)
8 (1)	Fluorides	mg/1 F	0.7 to 1	1.5	0.7 to 1.7		0.7 to 1.7	
9	Total extractable organic chlorine	mg/1 Cl						
10*	Dissolved iron	mg/1 Fe	0.1	0.3	1	2	1	
11*	Manganese	mg/1 Mn	0.05		0.1		1	
12	Copper	mg/I Cu	0.02	0.05 (O)	0.05		1	
13	Zinc	mg/1 Zn	0.5	3	1	5	1	5
14	Boron	mg/1 B	1		1		1	
15	Beryllium	mg/1 Be						
16	Cobalt	mg/1 Co						
17	Nickel	mg/1 Ni						
18	Vanadium	mg/1 V						
19	Arsenic	mg/1 As	0.01	0.05		0.05	0.05	0.1
20	Cadmium	mg/1 Cd	0.001	0.005	0.001	0.005	0.001	0.005
21	Total chromium	mg/1 Cr		0.05		0.05		0.05
22	Lead	mg/1 Pb		0.05		0.05		0.05
23	Selenium	mg/1 Se		0.01		0.01		0.01
24	Mercury	mg/1 Hg	0.0005	0.001	0.0005	0.001	0.0005	0.001
25	Barium	mg/1 Ba		0.1		1		1
26	Cyanide	mg/1 Cn		0.05		0.05		0.05
27	Sulphates	mg/1 SO4	150	250	150	250 (O)	150	250 (O)
28	Chlorides	mg/1 Cl	200		200		200	
29	Surfactants (reacting with methyl blue) (laurylsulphate)	mg/1	0.2		0.2		0.5	
30 * (2)	Phosphates	mg/1 P_2O_5	0.4		0.7		0.7	

	Parameters	Al G	Al I	A2 G	A2 I	A3 G	A3 I
31	Phenols (phenol index) paranitraniline 4-aminoantipyrine mg/1 C-$_6H_5OH$		0.001	0.001	0.005	0.01	0.1
32	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether) mg/1		0.05		0.2	0.5	1
33	Polycyclic aromatic hydrocarbons mg/1		0.0002		0.0002		0.001
34	Total pesticides (parathion, BHC, dieldrin) mg/1		0.001		0.0025		0.005
35*	Chemical oxygen demand (COD) mg/1 O_2					30	
36*	Dissolved oxygen saturation rate % O_2	>70		>50		>30	
37*	Biochemical oxygen demand (BOD_5) (at 20 'C without nitrification) mg/1 O_2	< 3		< 5		< 7	
38	Nitrogen by Kjeldahl method (except N03) mg/1 N	1		2		3	
39	Ammonia mg/1 NH_4	005		1	15	2	4(0)
40	Substances extractable with chloroform mg/1 SEC	0.1		0.2		0.5	
41	Total organic carbon mg/1 C						
42	Residual organic carbon after flocculation and membrane filtration (5mu) TOC mg/l C						
43	Total coliforms 37 'C /100 ml	50		5000		50000	
44	Faecal coliforms /100 ml	20		2000		20000	
45	Faecal streptococci /100 ml	20		1000		10000	
46	Salmonella	Not pre-sent in 5000ml		Not pre-sent in 1000 ml			

I = mandatory.

G = guide.

O = exceptional climatic or geographical conditions.

* = see Article 8 (d).

(1) The values given are upper limits set in relation to the mean annual temperature (high and low).

(2) This parameter has been included to satisfy the ecological requirements of certain types of environment.

DIRECTIVE 76/160/EEC ON THE QUALITY OF BATHING WATERS

ANNEX: Quality Requirements for Bathing Water

	Parameters	G	I	Minimum sampling frequency	Methods of analysis and inspection
	Microbiological:				
1	Total coliforms [/100 ml]	50	10000	Fortnightly (1)	Fermentation in multiple tubes. Subculturing of the positive tubes on a confirmation medium. Count according to MPN (most probable number) or membrane filtration and culture on an appropriate medium such as Tergitol lactose agar, endo agar, 0,4 % Teepol broth, subculturing and identification of the suspect colonies. In the case of 1 and 2, the incubation temperature is variable according to whether total or faecal coliforms are being investigated.
2	Faecal coliforms [/100 ml]	100	2000	Fortnightly (1)	
3	Faceal streptococci [/100ml]	100	-	(2)	Litsky method. Count according to MPN (most probable number) or filtration on membrane. Culture on an appropriate medium. Fermentation in multiple tubes. Subculturing of the positive tubes on a confirmation medium. Count according to MPN (most probable number) or membrane filtration and culture on an appropriate medium such as Tergitol lactose agar, endo agar, 0,4 % Teepol broth, subculturing and identification of the suspect colonies.
4	Salmonella [/1 l]	-	0	(2)	Concentration by membrane filtration. Inoculation on a standard medium. Enrichment — subculturing on isolating agar — identification.
5	Enteroviruses [PFU /10 l]	-	0	(2)	Concentrating by filtration, flocculation or centrifuging and confirmation.
	Physico-chemical:				
6	pH	-	6 to 9 (O)	(2)	Electrometry with calibration at pH 7 and 9
7	Colour	-	No abornal change in colour (O)	Fortnightly (1)	Visual inspection or photometry with standards on the Pt.Co scale.
			-	(2)	
8	Mineral oils	-	No film visible on the surface of the water and no colour	Fortnightly (1)	Visual and olfactory inspection or extraction using an adequate volume and weighing the dry residue.
	[mg/litre]	≤ 0.3	-	(2)	
9	Surface-active substances reacting with methylene blue	-	No lasting foam	Fortnightly (1)	Visual inspection or absorption spectrophotometry with methylene blue.
	[mg/l (lauryl-sulfate)]	≤ 0.3	-	(2)	
10	Phenols (phenol indices)	-	No specific odour	Fortnightly (1)	Verification of the absence of specific odour due to phenol or absorption

	Parameters	G	I	Minimum sampling frequency	Methods of analysis and inspection
					spectrophotometry 4-aminoantipyrine (4 AAP) method.
	[mg/l C_5H_5OH]	≤ 0.005	-	(2)	
11	Transparency [m]	2	1 (O)	Fortnightly (1)	Secchi's disk
12	Dissolved oxygen [% saturation]	80 – 120	-	(2)	Winkler'smethod or electrometric method (oxygen meter).
13	Tarry residues and floating materials such as wood, plastic articles, bottles, containers of glass, plastic, rubber or any other substance. Waste or splinters.	Absence		Fortnightly (1)	Visual inspection
14	Ammonia [mg/litre NH_4)			(3)	Absorption spectrophotometry, Nessler's method, or indophenol blue method.
15	Nitrogen Kjeldahl [mg/litre N]			(3)	Kjeldahl method
	Other substances regarded as indications of pollution				
16	Pesticides (parathlon, HCH, diedrin) [mg/l]			(2)	Extraction with appropriate solvents and chromatographic determination
17	Heavy metals such as: — arsenic [mg/l As] — cadmium [mg/l Cd] — chrome VI [mg/l Cr VI] — lead [mg/l Pb] — mercury [mg/l Hg]			(2)	Atomic absorption possibly preceded by extraction
18	Cyanides [mg/litre Cn]			(2)	Absorption spectrophotometry using a specific reagent
19	Nitrates [mg/litre] NO_3] and Phosphates [mg/litre PO_4]			(2)	Absorption spectrophotometry using a specific reagent

G = guide
I = mandatory
(0) Provision exists for exceeding the limits in the event of exceptional geographical or meteorological conditions.
(1) When a sampling taken in previous years produced results which are appreciably better than those in this Annex and when no new factor likely to lower the quality of the water has appeared, the competent authorities may reduce the sampling frequency by factor of 2.
(2) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
(3) These parameters must be checked by the competent authorities when there is a tendency towards the eutrophication of the water.

DIRECTIVE 2006/7/EEC CONCERNING THE MANAGEMENT OF BATHING WATER QUALITY AND REPEALING DIRECTIVE 76/160/EEC

ANNEX I

For inland waters

	A	B	C	D	E
	Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
1	Intestinal enterococci (cfu/100 ml)	200 (*)	400 (*)	330 (**)	ISO 7899-1 or ISO 7899-2
2	Escherichia coli (cfu/100 ml)	500 (*)	1000 (*)	900 (**)	ISO 9308-3 or ISO 9308-1

(*) Based upon a 95-percentile evaluation. See Annex II.

(**) Based upon a 90-percentile evaluation. See Annex II.

For coastal and transitional waters

	A	B	C	D	E
	Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
1	Intestinal enterococci (cfu/100 ml)	100 (*)	200 (*)	185 (**)	ISO 7899-1 or ISO 7899-2
2	Escherichia coli (cfu/100 ml)	250 (*)	500 (*)	500 (**)	ISO 9308-3 or ISO 9308-1

(*) Based upon a 95-percentile evaluation. See Annex II.

(**) Based upon a 90-percentile evaluation. See Annex II.

ANNEX II Bathing water assessment and classification

1. Poor quality

Bathing waters are to be classified as 'poor' if, in the set of bathing water quality data for the last assessment period ([a]), the percentile values ([b]) for microbiological enumerations are worse ([c]) than the 'sufficient' values set out in Annex I, column D.

2. Sufficient quality

Bathing waters are to be classified as 'sufficient':

1. if, in the set of bathing water quality data for the last assessment period, the percentile values for microbiological enumerations are equal to or better (d) than the 'sufficient' values set out in Annex I, column D; and

2. if the bathing water is subject to short-term pollution, on condition that:

i. adequate management measures are being taken, including surveillance, early warning systems and monitoring, with a view to preventing bathers' exposure by means of a warning or, where necessary, a bathing prohibition;

ii. adequate management measures are being taken to prevent, reduce or eliminate the causes of pollution; and

iii. the number of samples disregarded in accordance with Article 3(6) because of short□term pollution during the last assessment period represented no more than 15 % of the total number of samples provided for in the monitoring calendars established for that period, or no more than one sample per bathing season, whichever is the greater.

3. Good quality

Bathing waters are to be classified as ‘good’:

1. if, in the set of bathing water quality data for the last assessment period, the percentile values for microbiological enumerations are equal to or better (d) than the ‘good quality’ values set out in Annex I, column C; and

2. if the bathing water is subject to short-term pollution, on condition that:

i. (adequate management measures are being taken, including surveillance, early warning systems and monitoring, with a view to preventing bathers' exposure, by means of a warning or, where necessary, a bathing prohibition;

ii. adequate management measures are being taken to prevent, reduce or eliminate the causes of pollution; and

iii. the number of samples disregarded in accordance with Article 3(6) because of short□term pollution during the last assessment period represented no more than 15 % of the total number of samples provided for in the monitoring calendars established for that period, or no more than one sample per bathing season, whichever is the greater.

4. Excellent quality

Bathing waters are to be classified as ‘excellent’:

1. if, in the set of bathing water quality data for the last assessment period, the percentile values for microbiological enumerations are equal to or better than the ‘excellent quality’ values set out in Annex I, column B; and

2. if the bathing water is subject to short-term pollution, on condition that:

i. adequate management measures are being taken, including surveillance, early warning systems and monitoring, with a view to preventing bathers' exposure, by means of a warning or, where necessary, a bathing prohibition;

ii. adequate management measures are being taken to prevent, reduce or eliminate the causes of pollution; and

iii. the number of samples disregarded in accordance with Article 3(6) because of short‐term pollution during the last assessment period represented no more than 15 % of the total number of samples provided for in the monitoring calendars established for that period, or no more than one sample per bathing season, whichever is the greater.

Notes

(a) 'Last assessment period' means the last four bathing seasons or, when applicable, the period specified in Article 4(2) or (4).

(b) Based upon percentile evaluation of the log10 normal probability density function of microbiological data acquired from the particular bathing water, the percentile value is derived as follows:

(i) Take the log10 value of all bacterial enumerations in the data sequence to be evaluated. (If a zero value is obtained, take the log10 value of the minimum detection limit of the analytical method used instead.)

(ii) Calculate the arithmetic mean of the log10 values (μ).

(iii) Calculate the standard deviation of the log10 values (σ).

The upper 90‐percentile point of the data probability density function is derived from the following equation:

upper 90‐percentile = antilog (μ + 1,282 σ).

The upper 95‐percentile point of the data probability density function is derived from the following equation:

upper 95‐percentile = antilog (μ + 1,65 σ).

(c) 'Worse' means with higher concentration values expressed in cfu/100 ml.

(d) 'Better' means with lower concentration values expressed in cfu/100 ml.

DIRECTIVE 76/464/EEC ON POLLUTION CAUSED BY CERTAIN DANGEROUS SUBSTANCES DISCHARGED INTO THE AQUATIC ENVIRONMENT OF THE COMMUNITY

List I of families and groups of substances

List I contains certain individual substances which belong to the following families and groups of substances, selected mainly on the basis of their toxicity, persistence and bioaccumulation, with the exception of those which are biologically harmless or which are rapidly converted into substances which are biologically harmless:

1. organohalogen compounds and substances which may form such compounds in the aquatic environment,
2. organophosphorus compounds,
3. organotin compounds,
4. substances for which it has been proved that they possess carcinogenic properties in or via the aquatic environment (where certain substances in List II are carcinogenic, they are included in category 4 of this list),
5. mercury and its compounds,
6. cadmium and its compounds,
7. persistent mineral oils and hydrocarbons of petroleum origin,
8. persistent synthetic substances which may float, remain in suspension or sink and which may interfere with any use of the waters.

List II of families and groups of substances

List II contains:

1. substances belonging to the families and groups of substances in List I for which the limit values referred to in Article 6 of the Directive have not been determined,
2. certain individual substances and categories of substances belonging to the families and groups of substances listed below,

and which have a deleterious effect on the aquatic environment, which can, however, be confined to a given area and which depend on the characteristics and location of the water into which they are discharged.

Families and groups of substances referred to in the second indent

a The following metalloids and metals and their compounds:

1. zinc
2. copper
3. nickel
4. chromium
5. lead
6. selenium
7. arsenic
8. antimony
9. molybdenum
10. titanium
11. tin
12. barium
13. beryllium
14. boron
15. uranium
16. vanadium
17. cobalt
18. thalium
19. tellurium
20. silver

b Biocides and their derivatives not appearing in List I.

c Substances which have a deleterious effect on the taste and/or smell of the products for human consumption derived from the aquatic environment, and compounds liable to give rise to such substances in water.

d Toxic or persistent organic compounds of silicon, and substances which may give rise to such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances.

e Inorganic compounds of phosphorus and elemental phosphorus.

f Non persistent mineral oils and hydrocarbons of petroleum origin.

g Cyanides, fluorides.

h Substances which have an adverse effect on the oxygen balance, particularly: ammonia, nitrites.

Statement on Article 8

With regard to the discharge of waste water into the open sea by means of pipelines, Member States undertake to lay down requirements which shall be not less stringent than those imposed by this Directive.

DIRECTIVE 78/659/EEC ON THE QUALITY OF FRESH WATERS NEEDING PROTECTION OR IMPROVEMENT IN ORDER TO PROTECT FISH LIFE

ANNEX I List of Parameters

Parameter	Salmonid waters		Cyprinids waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
1. Temperature (°C)	1. Temperature measured downstream of a point of thermal discharge (at the edge of the mixing zone) must not exceed the unaffected temperature by more than:				Thermometry	Weekly, both upstream and downstream of the point of thermal discharge	Over-sudden variations in temperature shall be avoided
		1.5°C		3°C			
	Derogations limited in geographical scope may be decided by Member States in particular conditions if the competent authority can prove that there are no harmful consequences for the balanced development of the fish population 2. Thermal discharges must not cause the temperature downstream of the point of thermal discharge (at the edge of the mixing zone) to exceed the following:						
		21.5 (0)		10(0)			
		28 (0)		10(0)			
	The 10°C temperature limit applies only to breeding periods of species which need cold water for reproduction and only to waters which may contain such species Temperature limits may, however, be exceeded for 2 % of the time.						
2. Dissolved oxygen (mg/1 O_2	50 % ≥ 9 100 % ≥ 7	50 % ≥ 9 When the oxygen concentration falls below 6 mg/1, Member States shall implement	50 % ≥ 8 100 % ≥ 7	50 % ≥ 7 When the oxygen concentration falls below 4 mg/1, Member States shall implement	Winkler's method or specific electrodes (electro-chemical method)	Monthly, minimum one sample representative of low oxygen con-ditions of the day of sampling. However, where major daily variations are suspected, a minimum of two day samples in	

Parameter	Salmonid waters		Cyprinids waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
		the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population		the provisions of Article 7 (3). The competent authority must prove that this situation will have no harmful consequences for the balanced development of the fish population		one day shall be taken	
3. pH		6-9 (^{0}) (^{1})		6-9 (^{0}) (^{1})	Electrometry calibration by means of two solutions with known pH values, preferably on either side of, and close to the pH being measured	Monthly	
4. Suspended solids (mg/1)	≤ 25 (0)		≤ 25 (0)		Filtration through a 0.45 micron filtering membrane, or centrifugation (five minutes minimum, average acceleration of 2 800 to 3200 g) drying at 105°C and weighing		The values shown are average concentrations and do not apply to suspended solids with harmful chemical properties. Floods are liable to cause particularly high concentrations
5. BOD, (mg/1) 0_2	≤ 3		≤ 6		Determination of O2 by the Winkler method before and after five days incubation in complete darkness at 20 ± 1°C. (nitrification should not be inhibited)		
6. Total phosphorus (mg/1 P)					Molecular absorption spectro-photometry		In the case of lakes of average depth between 18 and 300 m, the following formula could be applied:

Parameter	Salmonid waters		Cyprinids waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
							$L \leq 10 \frac{Z}{(1+\sqrt{T_w})}$ T_w where:
							L = loading expressed as mg P per square metre lake surface in one year *i* = mean depth of lake in meters T_w = theoretical renewal time of lake water in years. In other cases limit values of 0.2 mg/l for salmonid and of 0.4 mg/l for cyprinid waters, expressed as PO_4, may be regarded as indicative in order to reduce eutrophication
7. Nitrites (mg/1 $N0_2$)	≤ 0.01		≤ 0.03		Molecular absorption spectro-photometry		
8. Phenolic compounds (mg/ 1 C_6H_5OH)		([2])		([2])	By taste		An examination by taste shall be made only where the presence of phenolic compounds is presumed
9. Petroleum hydrocarbons		([3])		([3])	Visual By taste	Monthly	A visual examination shall be made regularly once a month, with an examination by taste only where the presence of hydrocarbon

Parameter	Salmonid waters		Cyprinids waters		Methods of analysis or inspection	Minimum sampling and measuring frequency	Observations
	G	I	G	I			
							is presumed
10. Non-ionized ammonia (mg/1 NH,	≤ 0.005	≤ 0.025	≤ 0.005	≤ 0.025	Molecular absorption spectro-photometry using indophenol blue or Nessler's method asso-ciated with pH and temperature determination	Monthly	Values for non-ionized ammonia may be exceeded in the form of minor peaks in the daytime
	In order to diminish the risk of toxicity due to non-ionized ammonia, of oxygen consumption due to nitrification and of eutrophication, the concentrations of total ammonium should not exceed the following:						
11. Total Ammonium (mg/1 NH_4)	≤ 0.04	≤ l ([4])	≤ 0.2	≤ l ([4])			
12. Total residual chlorine (mg/1 HOC1)		≤ 0.005		≤ 0.005	DPD-method (dietyl-p-phenyle-nediamene)	Monthly	The I-values correspond to pH = 6 Higher concentrations of total chlorine can be accepted if the pH is higher
13. Total zinc (mg/ 1 Zn)		≤ 0.3		≤ 1.0	Atomic absorption spectrometry	Monthly	The I-values correspond to a water hardness of 100 mg/1 $CaCO_3$. For hardness levels between 10 and 500 mg/1 corresponding limit values can be found in Annex II
14. Dissolved copper (mg/1 CU)	< 0.4		< 0.04		Atomic absorption spectrometry		The G-values correspond to a water hardness of 100 mg/1 $CaCO_3$. For hardness levels between 10 and 300 mg/1 corresponding limit values can be found in Annex II

G = guide.
I = mandatory.
(0) = derogations are possible in accordance with Article II.

([1]) Artificial pH variations with respect to the unaffected values shall not exceed ± 0.5 pH unit within the limits falling between 6.0 and 9.0 provided that these variations do not increase the harmfulness of other substances present in the water.

([2]) Phenolic compounds must not be present in such concentrations that they adversely affect fish flavour.

([3]) Petroleum products must not be present in water in such quantities that they:

- form a visible film on the surface of the water or form coatings on the beds of water-courses and lakes,
- impart a detectable 'hydrocarbon' taste to fish,
- produce harmful effects in fish.

([4]) In particular geographical or climatic conditions and particularly in cases of law water temperature and of reduced nitrification or where the competent authority can prove that there are no harmful consequences for the balanced development of the fish population; Member states may fix values higher than 1 mg/l.

ANNEX II Particulars Regarding Total Zinc and Dissolved Copper

Total zinc

(see Annex I, No 13, 'Observations' column)

Zinc concentrations for different water hardness values between 10 and 500 mg/l $CaCO_3$:

	Water hardness (mg/l $CaCO_3$)			
	10	*50*	*100*	*500*
Salmonid waters ([µg/l Zn)	30	200	300	500
Cyprinid waters ([µg/l Zn)	300	700	1000	2000

Dissolved copper

(see Annex I, No 14, 'Observations' column)

Dissolved copper concentrations for different water hardness values between 10 and 3500 mg/l CaCO3:

	Water hardness (mg/l $CaCO_3$)			
	10	*50*	*100*	*300*
[µg/l Cu	5*	22	40	112

* the presence of fish in waters containing higher concentrations of copper may indicate a predominance of dissolved organo-cupric complexes.

PROPOSAL FOR
A DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON ENVIRONMENTAL QUALITY STANDARDS IN THE FIELD OF WATER POLICY AND AMENDING DIRECTIVE 2000/60/EC

ANNEX I: Environmental Quality Standards for Priority Substances and Certain Other Pollutants

PART A: Environmental Quality Standards (EQS) for Priority Substances in surface water

AA: annual average;
MAC: maximum allowable concentration.
Unit: [µg/l].

	Name of substance	CAS number	AA-EQS[1] Inland surface waters	AA-EQS Other surface waters	MAC-EQS[2] Inland surface waters	MAC-EQS Other surface waters
(1)	Alachlor	15972-60-8	0.3	0.3	0.7	0.7
(2)	Anthracene	120-12-7	0.1	0.1	0.4	0.4
(3)	Atrazine	1912-24-9	0.6	0.6	2.0	2.0
(4)	Benzene	71-43-2	10	8	50	50
(5)	Pentabromodiphenylether[3]	32534-81-9	0.0005	0.0002	*not applicable*	*not applicable*
(6)	Cadmium and its compounds (*depending on water hardness classes*[4])	7440-43-9	≤0.08 (Class 1) 0.08 (Class 2) 0.09 (Class 3) 0.15 (Class 4) 0.25 (Class 5)	0.2	≤ 0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	
(7)	C10-13-chloroalkanes	85535-84-8	0.4	0.4	1.4	1.4
(8)	Chlorfenvinphos	470-90-6	0.1	0.1	0.3	0.3
(9)	Chlorpyrifos	2921-88-2	0.03	0.03	0.1	0.1
(10)	1,2-Dichloroethane	107-06-2	10	10	*not applicable*	*not applicable*
(11)	Dichloromethane	75-09-2	20	20	*not applicable*	*not applicable*
(12)	Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1.3	1.3	*not applicable*	*not applicable*
(13)	Diuron	330-54-1	0.2	0.2	1.8	1.8
(14)	Endosulfan	115-29-7	0.005	0.0005	0.01	0.004

[1] This parameter is the Environmental Quality Standard expressed as an annual average value (EQS-AA).

[2] This parameter is the Environmental Quality Standard expressed as a maximum allowable concentration (EQS-MAC). Where the MAC-EQS are marked as "not applicable", the AA-EQS values are also protective against short-term pollution peaks since they are significantly lower than the values derived on the basis of acute toxicity.

[3] For the group of priority substances covered by brominated diphenylethers (No. 5) listed in Decision 2455/2001/EC, an EQS is established only for pentabromodiphenylether.

[4] For Cadmium and its compounds (No. 6) the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40 mg CaCO3/l, Class 2: 40 to <50 mg CaCO3/l, Class 3: 50 to <100 mg CaCO3/l, Class 4: 100 to <200 mg CaCO3/l and Class 5: ≥200 mg CaCO3/l).

(15)	Fluoranthene	206-44-0	0.1	0.1	1	1
(16)	Hexachlorobenzene	118-74-1	0.01	0.01	0.05	0.05
(17)	Hexachlorobutadiene	87-68-3	0.1	0.1	0.6	0.6
(18)	Hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02
(19)	Isoproturon	34123-59-6	0.3	0.3	1.0	1.0
(20)	Lead and its compounds	7439-92-1	7.2	7.2	*not applicable*	*not applicable*
(21)	Mercury and its compounds	7439-97-6	0.05	0.05	0.07	0.07
(22)	Naphthalene	91-20-3	2.4	1.2	*not applicable*	*not applicable*
(23)	Nickel and its compounds	7440-02-0	20	20	*not applicable*	*not applicable*
(24)	Nonylphenol	25154-52-3	0.3	0.3	2.0	2.0
(25)	Octylphenol	1806-26-4	0.1	0.01	*not applicable*	*not applicable*
(26)	Pentachlorobenzene	608-93-5	0.007	0.0007	*not applicable*	*not applicable*
(27)	Pentachlorophenol	87-86-5	0.4	0.4	1	1
(28)	Polyaromatic hydrocarbons[5]	*not applicable*	*not applicable*	*not applicable*	*not applicable*	*not applicable*
	(Benzo(a)pyrene),	50-32-8	0.05	0.05	0.1	0.1
	(Benzo(b)fluoranthene),	205-99-2	∑= 0.03	∑= 0.03	*not applicable*	*not applicable*
	(Benzo(g,h,i)perylene),	191-24-2				
	(Benzo(k)fluoranthene),	207-08-9	∑= 0.002	∑= 0.002	*not applicable*	*not applicable*
	(Indeno(1,2,3-cd)pyrene)	193-39-5				
(29)	Simazine	122-34-9	1	1	4	4
(30)	Tributyltin compounds	688-73-3	0.0002	0.0002	0.0015	0.0015
(31)	Trichlorobenzenes (all isomers)	12002-48-1	0.4	0.4	*not applicable*	*not applicable*
(32)	Trichloromethane (Chloroform)	67-66-3	2.5	2.5	*not applicable*	*not applicable*
(33)	Trifluralin	1582-09-8	0.03	0.03	*not applicable*	*not applicable*

[5] For the group of priority substances of polyaromatic hydrocarbons (PAH) (No. 28), each individual EQS shall be complied with, i.e., the EQS for Benzo(a)pyrene and the EQS for the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene and the EQS for the sum of Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene must be met.

PART B: Environmental Quality Standards (EQS) for other Pollutants

AA: annual average;
MAC: maximum allowable concentration.
Unit: [μg/l].

	Name of substance	CAS number	AA-EQS[21] Inland surface waters	AA-EQS[21] Other surface waters	MAC-EQS[22] Inland surface waters	MAC-EQS[22] Other surface waters
(1)	DDT total[6]	*not applicable*	0.025	0.025	*not applicable*	*not applicable*
	para-para-DDT	50-29-3	0.01	0.01		
(2)	Aldrin	309-00-2	∑= 0.010	∑= 0.005	*not applicable*	*not applicable*
(3)	Dieldrin	60-57-1				
(4)	Endrin	72-20-8				
(5)	Isodrin	465-73-6				
(6)	Carbontetrachloride	56-23-5	12	12	*not applicable*	*not applicable*
(7)	Tetrachloroethylene	127-18-4	10	10	*not applicable*	*not applicable*
(8)	Trichloroethylene	79-01-6	10	10	*not applicable*	*not applicable*

PART C: Compliance with Environmental Quality Standards

1. Column 4 and 5: For any given surface water body, compliance with EQS-AA requires that for each representative monitoring point within the water body, the arithmetic mean of the concentrations measured at different times during the year is below the standard.

2. Column 6 and 7: For any given surface water body compliance with EQS-MAC means that the measured concentration at any representative monitoring point within the water body must not exceed the standard.

3. With the exception of cadmium, lead, mercury and nickel (hereinafter "metals") the Environmental Quality Standards (EQS) set up in this Annex are expressed as total concentrations in the whole water sample. In the case of metals the EQS refers to the dissolved concentration, i.e. the dissolved phase of a water sample obtained by filtration through a 0.45 μm filter or any equivalent pre-treatment.

If natural background concentrations for metals are higher than the EQS value or if hardness, pH or other water quality parameters affect the bioavailability of metals, Member States may take this into account when assessing the monitoring results against the EQS. If they choose to do so, the use of calculation methods set up pursuant to Article 2(5) is compulsory.

[6] DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl) ethane (CAS number 789-02-6); 1,1-dichloro-2,2 bis (p-chlorophenyl) ethylene (CAS number 72-55-9); and 1,1-dichloro-2,2 bis (pchlorophenyl) ethane (CAS number 72-54-8).

Standards Suggested for Surface Waters: Moldova Case

Indicator (*group*)	Acronyms	Measurement Unit	Category I	Category II	Category III	Category IV	Category V
GENERAL REQUIREMENTS							
Temperature							
Water temperature	T_{water}	^0C	Natural fluctuations in temperature	**Cold waters:** 20^0C in summer, 5^0C in winter, **Warm waters** 28^0C in summer, 8^0C	**Cold waters:** 20^0C in summer, 5^0C in winter, **Warm waters** 28^0C in summer, 8^0C	**Cold waters:** 20^0C in summer, 5^0C in winter, **Warm waters** 28^0C in summer, 8^0C in winter	**Cold waters:** 20^0C in summer, 5^0C in winter, **Warm waters** 28^0C in summer, 8^0C in winter
Oxygen regime							
Dissolved oxygen	O_2	mg O2/l	>=7 (or BL)*	>=7	>=5	>=4	>=4
Five day BOD	BOD_5	mg O2/l	3 (or BL)	5	6	7	>7
Five day COD, permanganate method	COD_{Mn}	mg O2/l	<7 (or BL)	7	15	20	>20
Biogenic substances							
Total nitrogen	N_{total}	mg N/l	1.5 (or BL)	4	8	20	>20
Nitrate	NO_3	mg N/l	1 (or BL)	3	5.6	11.3	>11.3
Nitrite	NO_2	mg N/l	0.01 (or BL)	0.06	0.12	0.3	>0.3
Ammonium	NH_4	mg N/l	0.2 (or BL)	0.4	0.8	3.1	>3.1
Total phosphorus	P_{total}	mg P/l	0.1 (or BL)	0.2	0.4	1	>1
Orthophosphates	PO_4	mg P/l	0.05 (or BL)	0.1	0.2	0.5	>0.5
Salinity							
Chloride	Cl^-	mg/l	200 (or BL)	200	350	500	>500
Sulphates	SO_4	mg/l	<250 (or BL)	250	350	500	>500
Total mineralization		mg/l	<1000 (or BL)	1000	1300	1500	>1500
Acidity							
pH	pH	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	<6.5 or >8.5
Other indicators							
Floating particles		Visual observation	NA	NA	NA	NA	Possible existence
Total iron	Fe_{total}	mg/l	<1 (or BL)	1	3	5	>5
Manganese	Mn	mg/l	<0.1 (or BL)	0.1	1	2	>2
Odour (20^oC and 60^oC)		points	<2 (or natural scent)	2	2	4	>4
Color		degree	<35 (natural color)	35	120	200	>200
Phenols		mg/l	0.001 (or BL)	0.001	0.005	0.01	>0.01
Petroleum products		mg/l	0.05	0.1	0.5	1	>1
METALS							
Cadmium, total (total suspended solid =30mg/l)	Cd_{total}	µg/l	<1 (or BL)	1	5	5	>5
Dissolved	$Cd_{dis.}$	µg/l	<0.2 (or BL)	0.2	1	1	>1
Lead, total (total suspended solid =30mg/l)	Pb_{total}	µg/l	<50 (or BL)	50	50	50	>50
Dissolved	Pb_d	µg/l	<2.5 (or BL)	2.5	2.5	2.5	>2.5
Mercury, total (total suspended solid =30mg/l)	Hg_{total}	µg/l	<1 (or BL)	1	1	1	>1
Dissolved	$Hg_{dis.}$	µg/l	<0.2 (or BL)	0.2	0.2	0.2	>0.2
Nickel, total (total suspended solid =30mg/l)	Ni_{total}	µg/l	10 (or BL)	25	50	100	>100
Dissolved	$Ni_{dis.}$	µg/l	8 (or BL)	20	40		
Copper, total (total suspended solid =30mg/l)	Cu_{total}	µg/l	<50 (or BL)	50	100	1000	>1000
Dissolved	$Cu_{dis.}$	µg/l	<20 (or BL)	20	40	400	>400
Zinc, total (total suspended solid =30mg/l)	Zn_{total}	µg/l	<300 (or BL)	300	1000	5000	>5000
Dissolved	$Zn_{dis.}$	µg/l	<70 (or BL)	70	233	1163	>1163

Indicator (*group*)	Acronyms	Measurement Unit	Category I	Category II	Category III	Category IV	Category V
MICROBIOLOGICAL INDICATORS							
Lacto-positive bacteria		amount/l	1000	10000	50000	>50000	>50000
Coli-phages		amount/l	NA	100	100	100	>100
Helminthes ova		-	Should not be identified	Should not be identified	Should not be identified	Should not be identified	Should not be identified
Total of coli bacteria		amount/100ml	500	5000	10000	50000	>50000
Fecal coli-bacteria		amount/100ml	100	2000	10000	20000	>20000
Fecal streptococcus		amount/100ml	20	1000	5000	10000	>10000
Intestine entheroccocus		KE/ 100ml	<200	200	400	>400	>400
Escherichia coli		KE/ 100ml	<500	500	1000	>1000	>1000
PRIORITY SUBSTANCES (organic micro-pollutants)							
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
Benzole		µg/l	10	30	42	50	>50
Pentabromodiphenylether		µg/l	0.0005	0.001	0.0013	0.0015	>0.0015
C 10-13-chloroalkanes		µg/l	0.4	0.9	1.2	1.4	>1.4
Chlofenvinphos		µg/l	0.1	0.2	0.26	0.3	>0.3
Chlorinepyrophosis		µg/l	0.03	0.065	0.086	0.1	>0.1
1,2-dichlorethane		µg/l	10	20	26	30	>30
Dichlormethane		µg/l	20	40	52	60	>60
Di (2-ethylhexyl) Phthalate		µg/l	1.3	2.6	3.4	3.9	>3.9
Diuron		µg/l	0.2	1	1.2	1.8	>1.8
Endosulphan		µg/l	0.005	0.0075	0.009	0.01	>0.01
Fluoranthene		µg/l	0.1	0.55	0.82	1	>1
Hexachlorobenzole		µg/l	0.01	0.03	0.04	0.05	>0.05
Hexachlorbutadiene		µg/l	0.1	0.35	0.5	0.6	>0.6
Hexachlorcyclahexane		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
Nonylphenole		µg/l	0.3	1.1	1.7	2	>2
Octylphenol		µg/l	0.1	0.2	0.26	0.3	0.3
Pentachlorobenzene		µg/l	0.007	0.014	0.018	0.021	0.021
Pentachlorphenol		µg/l	0.4	0.7	0.9	1	1
(Benzo(a)pyren)		µg/l	0.005	0.075	0.09	0.1	>0.1
(Benzo(b)fluoranthene)		µg/l	∑ = 0.03	∑ = 0.06	∑ = 0.08	∑ = 0.09	∑ > 0.09
(Benzo(h,k,i)perylene)		µg/l	∑ = 0.002	∑ = 0.004	∑ = 0.005	∑ = 0.006	∑ > 0.006
(Benzo(k)fluoranthene)		µg/l					
(Indeno(1,2,3-cd)pyrene)		µg/l					
Simazine		µg/l	1	2.2	3.4	4	>4
Tributyltin compounds		µg/l	0.0002	0.00085	0.00124	0.0015	>0.0015
Tricholorobenzenes all isomers		µg/l	0.4	0.8	1.04	1.2	>1.2
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
OTHER SEPARATE POLLUTANTS							
Total DDT		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
Aldrin		µg/l	∑ = 0.010	∑ = 0.020	∑ = 0.026	∑ = 0.030	∑ > 0.030
Dieldrin		µg/l					
Endrin		µg/l					
Isodrin		µg/l					

Indicator (*group*)	Acronyms	Measurement Unit	Category I	Category II	Category III	Category IV	Category V
Carbontetrachloride		µg/l	12	24	31	36	>36
Tetrachlorethylene		µg/l	10	20	26	30	>30
Trichlorethylene		µg/l	10	20	26	30	>30

*BL - natural background level

ANNEX 3

QUALITY STANDARDS AND CLASSIFICATION SCHEMES OF ROMANIA, ICPDR AND ECE

Old Romanian water quality classification scheme (STAS 4706/1988)

	Class		
General parameters	**1**	**2**	**3**
pH	6.5-8.5	6.5-8.5	6.5-8.5
Ammonium ion (NH_4^+) (mg/l)	1	3	10
Free ammonia (NH_3) (mg/l)	0.1	0.3	0.6
Nitrate (NO_3^-) (mg/l)	10	30	No standard
Nitrite (NO_2^-) (mg/l)	1	3	No standard
Calcium (mg/l)	150	200	300
Residual free chlorine (mg/l)	0.005	0.005	0.005
Chloride (mg/l)	250	300	300
Free carbon dioxide (mg/l)	50	50	50
Phenols (mg/l)	0.001	0.02	0.05
Iron total (mg/l)	0.3	1	1
Phosphorus (mg/l)	0.1	0.1	0.1
Hydrogen sulphide (mg/l)	absent	absent	0.1
Magnesium (mg/l)	50	100	200
Manganese (mg/l)	0.1	0.3	0.8
Dissolved oxygen (mg/l)	6	5	4
Hydrocarbons (mg/l)	0.1	0.1	0.1
Filterable residue (mg/l)	750	1000	1200
Sodium (mg/l)	100	200	200
BOD_5 (mg/l)	5	7	12
COD (MnO_4^-) (mg/l)	10	15	25
COD ($Cr_2O_7^{2-}$) (mg/l)	20	20	30
Sulphate (mg/l)	200	400	400
Coliform bacteria (cfu/l)	100000	-	-

Dangerous substances (mg/l)	**All classes**	**Dangerous substances (mg/l)**	**All classes**
Silver	0.01	Molybdenum	0.05
Arsenic	0.01	Nickel	0.1
Barium	1	Pesticides	
Cadmium	0.003	- triazine	0.001
Cyanide	0.01	- triazinone	0.001
Cobalt	1	- toluidine	0.001
Chromium (Cr^{III})	0.5	- 0rganochlorines	0.001
Chromium (Cr^{VI})	0.05	- 0rganophosphorus	absent
Copper	0.05	- Organometallic	absent
Anionic detergents	0.5	- Nitro derivatives	absent
Fluoride	0.5	Lead	0.05
PAH	0.0002	Selenium	0.01
Mercury	0.001	Zinc	0.03

Quality elements and physico-chemical quality standards for assessment of ecological status of surface water in Romania, 2006 (GD 161)

Nr.	Quality indicator / parameter	unit	Quality class				
			I	II	III	IV	V
C.1. **Thermal and acidification regime**							
1	Temperature	ºC	not regulated				
2	pH		6.5 – 8.5				
C.2. **Oxygen regime**							
1	Dissolved oxygen (DO)	mg O_2/l	9	7	5	4	<4
2	Dissolved oxygen saturation	%					
	-epilimnion (stratified waters)		90-110	70-90	50-70	30-50	<30
	-hypoilimnion (stratified waters)		90-70	70-50	50-30	30-10	<10
	-unstratisfied waters		90-70	70-50	50-30	30-10	<10
3	BOD_5	mg O_2/l	3	5	7	20	>20
4	COD – Mn	mg O_2/l	5	10	20	50	>50
5	COD-Cr	mg O_2/l	10	25	50	125	>125
C.3. **Nutrients**							
1	Ammonia ($N\text{-}NH_4^+$)	mg N/l	0.4	0.8	1,2	3.2	>3.2
2	Nitrites ($N\text{-}NO_2^-$)	mg N/l	0.01	0.03	0.06	0.3	>0.3
3	Nitrates ($N\text{-}NO_3^-$)	mg N/l	1	3	5,6	11,2	>11,2
4	Total Nitrogen (TN)	mg N/l	1.5	7	12	16	>16
5	Orthophosphates ($P\text{-}PO_4^{3-}$)	mg P/l	0.1	0.2	0.4	0.19	>0.19
6	Total phosphorous (P)	mg P/l	0.15	0.4	0.75	1.2	>1.2
9	Chlorophyll "a"	µg/l	25	50	100	250	>250
C.4. **Salinity**							
1	Conductivity	µS/cm					
2	Total residue at 105 ºC	mg/l	500	750	1000	1300	>1300
3	Chorides (Cl^-)	mg/l	25	50	250	300	>300
4	Suphates (SO_4^{2+})	mg/l	60	120	250	300	>300
5	Calcium (Ca^{2+})	mg/l	50	100	200	300	>300
6	Magnezium (Mg^{2+})	mg/l	12	50	100	200	>200
7	Natrium (Na^+)	mg/l	25	50	100	200	>200
C.5**. Specific toxic polutants of natural origin – total value**							
1	Chromium total (Cr^{3+} + Cr^{6+})	µg/l	25	50	100	250	>250
2	Copper (Cu^{2+})[5]	µg/l	20	30	50	100	>100
3	Zinc (Zn^{2+})	µg/l	100	200	500	1000	>1000
4	Arsenium (As^{3+})	µg/l	10	20	50	100	>100
10	Barium (Ba^{2+})	mg/l	0.05	0.1	0.5	1	>1
5	Selenium (Se^{4+})	µg/l	1	2	5	10	>10
6	Cobalt (Co^{3+})	µg/l	10	20	50	100	>100
7	Lead (Pb)[6]	µg/l	5	10	25	50	>50
8	Cadmium (Cd)	µg/l	0.5	1	2	5	>5
8	Total iron (Fe^{2+} + Fe^{3+})	mg/l	0.3	0.5	1.0	2	>2
9	Mercury (Hg)[6]	µg/l	0.1	0.3	0.5	1	>1
9	Manganese total (Mn^{2+} + Mn^{7+})	mg/l	0.05	0.1	0.3	1	>1
10	Nickel (Ni)[5]	µg/l	10	25	50	100	>100
C.6**. Other relevant chemical elements**							
1	Total phenols (phenols index)	µg/l	1	5	20	50	>50
2	Non-ionic detergents	µg/l	100	200	300	500	>500
3	AOX	µg/l	10	50	100	250	>250

ICPDR Water quality classification scheme used for TNMN purposes

Determinand	Unit	Class				
		I	II TV	III	IV	V
Oxygen regime						
Dissolved oxygen*	mg/l O_2	7	6	5	4	>4
BOD_5	mg/l O_2	3	5	10	25	>25
COD-Mn	mg/l O_2	5	10	20	50	>50
COD-Cr	mg/l O_2	10	25	50	125	>125
Nutrient regime						
Ammonium-N	mg N/l	0.2	0.3	0.6	1.5	>1.5
Nitrite-N	mg N/l	0.01	0.06	0.12	0.3	>0.3
Nitrate-N	mg N/l	1	3	6	15	>15
Total-N	mg N/l	1.5	4	8	20	>20
Ortho-phosphate-P	mg P/l	0.05	0.1	0.2	0.5	>0.5
Total-P	mg P/l	0.1	0.2	0.4	1	>1
Chlorophyll "a"	µg/l	25	50	100	250	>250
Metals (dissolved)**						
Zinc	µg/l	-	5	-	-	-
Copper	µg/l	-	2	-	-	-
Total Chromium (Cr-III + VI)	µg/l	-	2	-	-	-
Lead	µg/l	-	1	-	-	-
Cadmium	µg/l	-	0.1	-	-	-
Mercury	µg/l	-	0.1	-	-	-
Nickel	µg/l	-	1.0	-	-	-
Arsenic	µg/l	-	1.0	-	-	-
Metals (total)						
Zinc	µg/l	bg	100	200	500	>500
Copper	µg/l	bg	20	40	100	>100
Total Chromium (Cr-III + VI)	µg/l	bg	50	100	250	>250
Lead	µg/l	bg	5	10	25	>25
Cadmium	µg/l	bg	1	2	5	>5
Mercury	µg/l	bg	0.1	0.2	0.5	>0.5
Nickel	µg/l	bg	50	100	250	>250
Arsenic	µg/l	bg	5	10	25	>25
Toxic substances						
AOX	µg/l	10	50	100	250	>250
Lindane	µg/l	0.05	0.1	0.2	0.5	>0.5
pp' DDT	µg/l	0.001	0.01	0.02	0.05	>0.05
Atrazine	µg/l	0.02	0.1	0.2	0.5	>0.5
Trichlormethane	µg/l	0.02	0.6	1.2	1.8	>1.8
Tetrachlormethane	µg/l	0.02	1	2	5	>5
Trichlorethane	µg/l	0.02	1	2	5	>5
Tetrachlorethane	µg/l	0.02	1	2	5	>5
Biology						
Saprobic index of macrozoobenthos		≤1.8	1.8 – 2.3	2.31 – 2.7	2.71 – 3.2	>3.2

* values concern 10-percentile value
** for dissolved metals only guideline values are indicated
bg background values
TV target value

ECE (Economic Commission for Europe) Standard Statistical Classification of Surface Freshwater Quality for the Maintenance of Aquatic Life

Variables affecting aquatic life and their concentration ranges by quality class

		Class I	Class II	Class III	Class IV	Class V
Oxygen regime						
DO (%)	epilimnion (stratified waters)	90-110	70-90, 110-120	50-70, 120-130	30-50, 130-150	<30, >150
	hypolimnion (stratified waters)	90-70	70-50	50-30	30-10	<10
	unstratified waters	90-70	70-50, 110-120	50-30, 120-130	30-10, 130-150	<10, >150
DO (mg/l)		>7	7-6	6-4	4-3	<3
COD-Mn (mg O_2/l)		<3	3-10	10-20	20-30	>30
COD-Cr (mg $O_{2/l}$)		-	-	-	-	-
Eutrophication[a]						
Total P (µg/l)		<10 (<15)	10-25 (15-40)	25-50 (40-75)	50-125 (75-190)	>125 (>190)
Total N (µg/l)		<300	300-750	750-1,500	1,500-2,500	>2,500
Chlorophyll a (µg/l)		<2.5 (<4)	2.5-10 (4-15)	10-30 (15-45)	30-110 (45-165)	>110 (>165)
Acidification						
pH (values <9.0 only)[b]		9.0-6.5	6.5-6.3	6.3-6.0	6.0-5.3	<5.3
Alkalinity (mg $CaCO_3$/l)		>200	200-100	100-20	20-10	<10
Metals						
Aluminium (µg/l; pH 6.5)		<1.6	1.6-3.2	3.2-5	5-75	>75
Arsenic (µg/l)[c]		<10	10-100	100-190	190-360	>360
Cadmium (µg/l)[d]		<0.07	0.07-0.53	0.53-1.1	1.1-3.9	>3.9
Chromium (µg/l)[c]		<1	1-6	6-11	11-16	>16
Copper (µg/l)[d]		<2	2-7	7-12	12-18	>18
Leader (µg/l)[d]		<0.1	0.1-1.6	1.6-3.2	3.2-82	>82
Mercury (µg/l)[d]		<0.003	0.003-0.007	0.007-0.012	0.012-2.4	>2.4
Nickel (µg/l)[d]		<15	15-87	87-160	160-1400	>1400
Zinc (µg/l)[d]		<45	45-77	77-110	110-120	>120
Chlorinated micropollutants and other hazardous substances						
Dieldrin (µg/l)		n.a.	n.a.	<0.0019	0.0019-2.5	>2.5
DDT and metabolites (µg/l)		n.a.	n.a.	<0.001	0.001-1.1	>1.1
Endrin (µg/l)		n.a.	n.a.	<0.0023	0.0023-0.18	>0.18
Heptachlor (µg/l)		n.a.	n.a.	<0.0038	0.0038-0.52	>0.52
Lindane (µg/l)		n.a.	n.a.	<0.08	0.08-2.0	>2.0
Pentachlorophenol (µg/l)		n.a.	n.a.	<13	13-20	>20
PCBs (µg/l)		n.a.	n.a.	<0.014	0.014-2.0	>2.0
Free ammonia (NH_3)		n.a.	n.a.	-	-	-
Radioactivity						
Gross-alpha activity (mBq/l)		<50	50-100	100-500	500-2500	>2500
Gross-beta activity (mBq/l)		<200	200-500	500-1000	1000-2500	>2500

Note: measures falling on the borderline between classes are to be classified in the lower numbered class

a bracketed data refer to flowing water

b Values >9.0 are disregarded in classification

c Applicable for hardness from abut 0,5 meq/l to 8 meq/l. Arsenic V (chromium III) to be converted to arsenic III (chromium VI).

d Applicable to hardness from about 0.5 meq/l to 8 meq/l

n.a. not applicable

ANNEX 4

OVERVIEW OF PARAMETERS ROUTINELY MONITORED IN SURFACE WATERS IN MOLDOVA

Group	**Parameter**	**Sanepid**	**Hydromet**	**Ecological Inspectorate**	**shared by**
general physical	CO3		X		
	free dissolved CO2		X		
	pH	X	X		
	Suspended solids		X	X	
	transparency		X		
	Water color	X			
	Water odour	X			
	Water temperature		X	X	
	Water turbulence	X			
oxygen regime	BOD5	X	X	X	all
	COD, Cr	X	X	X	all
	COD, Mn		X		
	oxygen dissolved	X	X	X	all
	oxygen saturation		X		
major ions	Alkalinity		X		
	Ca		X	X	
	Cl	X	X	X	all
	conductivity		X		
	Hardness	X		X	
	HCO3		X		
	K		X	X	
	Mg	X	X	X	all
	Mineralisation (total salts)	X		X	
	Na		X	X	
	SO4	X	X	X	all
	total dissolved salts		X		
nutrients	Kleldahl nitrogen		X		
	NH4	X	X	X	all
	NO2	X	X	X	all
	NO3	X	X	X	all
	orthophosphate		X	X	
	Silicates		X		
	total phosphour		X		
metals	Cd	X	X		
	Co			X	
	Cr	X	X		
	Cr 3+			X	
	Cr 6+			X	
	Cu	X	X	X	all
	Fe	X	X		
	Fe2+			X	
	Fe3+			X	

Group	**Parameter**	**Sanepid**	**Hydromet**	**Ecological Inspectorate**	**shared by**
	Mn	X	X		
	Ni	X	X	X	all
	Pb	X	X	X	all
	Zn	X	X	X	all
various	anionic active surfactants		X		
	Detergents	X		X	
	F	X			
	Floating materials			X	
	Grease			X	
	Oil products	X	X	X	all
	PCBs(7)		X		
	Phenols	X	X		
	Technical oil			X	
pesticides	a-HCH		X		
	Atrazin	X			
	Bazudin			X	
	b-HCH		X		
	Carbamid			X	
	Carbafos			X	
	DDD		X		
	DDE		X		
	DDT	X	X		
	Dieldrin	X			
	Endrin	X			
	Hexaclorocyclohexan	X	X		
	Metafos			X	
	organochlorinated pesticides		X		
	Simazin	X			
	sum a-HCH + c-HCH			X	
	sum DDE+DDT+DDD			X	
microbiology	Coli fagi	X			
	E.coli	X			
	Helminthes	X			
	Latoza positive bacteria	X			
	Pathogens	X			
	Total number of microbes	X			
	Viruses	X			
total	**81**	**41**	**47**	**38**	**15**

Annex 5

Table 1. EXISTING SURFACE WATER QUALITY STANDARDS IN GEORGIA ("Regulation on the protection of Georgian surface waters from pollution", MoE order N147, 17.09.96)

Parameter	Water for Fish	
	I category (sensitive species as such salmon)	II category (other species)
1	4	5
Suspended Solids, mg/l	B* + 0,25	B* + 0,75
Colour	no visible change	no visible change
Odour, taste	no detectable change	no detectable change
Temperature, ^{o}C	< 20^{o}C in summer, <5^{o}C in winter	<28^{o}C in summer, <8^{o}C in winter
pH	6,5 - 8,5	6,5 - 8,5
Total Dissolved Solids, mg/l	_	_
Dissolved Oxygen, mg O_2/l	>6	>6
BOD, mg O_2/l	3	6
COD, mg O_2/l	_	_
Total coliform bacteria	_	_
Ammonium (as N_{NH4}), mg/l	0,39	0,39
Aluminium (Al), mg/l	0,5	0,5
Barium (Ba), mg/l	2,0	2,0
Beryllium (Be), mg/l	0,0002	0,0002
Boron (B), mg/l	10,0	10,0
Arsenic (As), mg/l	0,05	0,05
Vanadium (V), mg/l	0,001	0,001
Mercury (Hg), mg/l	0	0
Wolfram (W), mg/l	0,0008	0,0008
Zinc (Zn), mg/l	0,01	0,01
Cadmium (Cd), mg/l	0,005	0,005
Cobalt (Co), mg/l	0,01	0,01
Caprolactam, mg/l	1,0	1,0
Manganese (Mn), mg/l	0,01	0,01
Molibden (Mo), mg/l	0,012	0,012
Nitrites (NO_2), mg/l	0,08	0,08
Nitrates (NO_3), mg/l	40,0	40,0
Nickel (Ni), mg/l	0,01	0,01
Iron (Fe), mg/l	0,005	0,005
Selenium (Se), mg/l	0,0016	0,0016
Copper (Cu), mg/l	0,001	0,001
Sulphates (SO_4), mg/l	100	100
Antimony (Sb), mg/l	0,05	0,05
Thallium (Tl), mg/l	0,0001	0,0001
Titanium (Ti), mg/l	0,1	0,1
Lead (Pb), mg/l	0,1	0,1
Tellurium (Te), mg/l	0,0028	0,0028
Phosphorus element. (P), mg/l	0	0
Fluorides (F), mg/l	0,05	0,05
Chlorides (Cl), mg/l	300,0	300,0
Chromium (Cr-Y!), mg/l	0,001	0,001
Cyanides (CN), mg/l	0,05	0,05
Ethylene (CH_2=CH_2), mg/l	0,5	0,5
Synthetic Surface Active Substances (Detergents), mg/l	0,1	0,1
Methanol (CH_3OH), mg/l	0,1	0,1
Oil products, mg/l	0,05	0,05
Formaldehyde (HCHO), mg/l	0,01	0,01
Acetone $(CH_3)_2CO$, mg/l	0,05	0,05
Butyl alcohol $(CH_3)_3COH$, mg/l	0,03	0,03
Phenols (C_6H_5OH), mg/l	0,001	0,001

*)B - background concentration

Table 2. HYGIENIC REQUIREMENTS TO SURFACE WATER USED FOR DRINIKING AND RECREATIONAL PURPOSES AND MAXIMUM ALLOWABLE CONCENTRATIONS OF POLLUTANTS IN THESE WATERS*)

("Sanitary Rules and Norms on Protection of Surface Waters against Pollution",

MoH order N297/n, 16.08.01)

Parameter	Water for the centralised and non-centralised Drinking Water Supply Systems	Water for Recreation (bathing, sports and surface waters in the limits of settlements)
1	2	3
Suspended Solids, mg/l	B** + 0,25	B** + 0,75
Colour	no visible change in 20 cm column	no visible change in 10 cm column
Odour	no odour	no odour
Temperature, ^{o}C	<30^{0}C after wastewater discharge	<30^{0}C after wastewater discharge
pH	6,5 - 8,5	6,5 - 8,5
Total Dissolved Solids, mg/l	1000, incl. Sulphates - 500 mg/l, Chlorides - 350 mg/l	
Dissolved Oxygen, mg O_2/l	>4 at 12 o'clock a.m.	>4 at 12 o'clock a.m.
BOD, mg O_2/l	3 (at 20^{0}C)	6 (at 20^{0}C)
COD, mg O_2/l	15	30
Anilin	0,1	0,1
Ammonia (as N), mg/l	2,0	2,0
Aluminium (Al), mg/l	0,5	0,5
Barium (Ba), mg/l	0,1	0,1
Benz(a)pirene, mg/l	0,000005	0,000005
Boron (B), mg/l	0,5	0,5
Bismut (Bi), mg/l	0,1	0,1
Vanadium (V), mg/l	0,1	0,1
Mercury (Hg), mg/l	0,0005	0,0005
Wolfram (W), mg/l	0,05	0,05
Zinc (Zn), mg/l	1,0	1,0
Hydrazine, mg/l	0,01	0,01
Iron (Fe), mg/l	0,3	0,3
Cadmium (Cd), mg/l	0,001	0,001
Caprolactam, mg/l	1,0	1,0
Cobalt (Co), mg/l	0,1	0,1
Nitrites (NO_2), mg/l	3,3	3,3
Nitrates (NO_3), mg/l	45,0	45,0
Nickel (Ni), mg/l	0,1	0,1
Litium (Li), mg/l	0,03	0,03
Selenium (Se), mg/l	0,01	0,01
Copper (Cu), mg/l	1,0	1,0
Magnium (Mg), mg/l	0,1	0,1
Antimony (Sb), mg/l	0,05	0,05
Thallium (Tl), mg/l	0,0001	0,0001
Titanium (Ti), mg/l	0,1	0,1
Lead (Pb), mg/l	0,03	0,03
Tellurium (Te), mg/l	0,01	0,01
Phosphorus element.(P), mg/l	0,0001	0,0001
Fluorides (F), mg/l	1,2	1,2
Chromium (Cr^{+3}), mg/l	0,5	0,5
Chromium (Cr^{+6}), mg/l	0,05	0,05
Cyanides (CN), mg/l	0,1	0,1
Ethylene (CH_2=CH_2), mg/l	0,5	0,5
Chlorophorm, mg/l	0,06	0,06
Methan (CH_4), mg/l	2,0	2,0
Oil products, mg/l	0,3	0,3

Formaldehyde (HCHO), mg/l	0,05	0,05
Ethylbenzole, mg/l	0,01	0,01
Ferocyanides, mg/l	1,25	1,25
Phenols (C_6H_5OH), mg/l	0,001	0,001
Molybden (Mo), mg/l	0,25	0,25
Triethilamine, mg/l	2,0	2,0
Arsenic (As), mg/l	0,05	0,05
Natrium (Na), mg/l	200,0	200,0
Nitrobenzole, mg/l	0,2	0,2
Polyphosphates (PO_4), mg/l	3,5	3,5
Propylene, mg/l	0,5	0,5
Argentum (Ag), mg/l	0,05	0,05
Stirol, mg/l	0,1	0,1
Ethylenglykol, mg/l	1,0	1,0
Lindane, mg/l	0,004	0,004
DDT, mg/l	0,1	0,1
Coliphages counts in 100 l	1	1
Helminthes, tenia, oncospheros, pathogens, cysts	n.d. in< 1 litre	n.d. in <1 litre
Lactophages	n.d. in<10000 l	n.d. in <5000 l

Comments:
*)- the total list includes 1346 organic and non-organic pollutants

ANNEX 6

Excerpts from Armenian Legal Acts That Directly or Indirectly Relate to Water Quality Standards and Water Classification by Quality

WATER CODE OF THE RA, 2002

CHAPTER 8. WATER QUALITY STANDARDS

Article 66. Water Quality Standards

The water resources management and protection body jointly with the corresponding interested state management bodies shall develop water quality standards drafts.

The water resource quality standards shall be included in the National Water Program and they have to conform with the established classification system.

Water quality standards may vary according to the specifics of various locales. According to the rules established by legislation water quality standards can be established in each water basin management area. Standards based on water use also can be established, including: agricultural, industrial and household standards. The water standards must depict the terms of degradation, depletion, and contamination prevention of water resources, as well as the terms of establishment of minimum environmental flows.

The Water Resources Management and Protection Body shall ensure the conformity of water qualitative criteria to the established standards through oversight conducted at least twice a year.

Water standards shall provide guidance for tolerable levels of all likely pollutants and include limits with an objective toward annually reduction of these limits.

In consultation with the National Water Council, the Water Resources Management and Protection Body shall conduct a thorough bi-annual inspection (review) of standards, including social and environmental impacts, and propose amendments to them and present this information to the Government as part of the “National Water Program”. The procedure of adopting water standards shall be established by law.

Article 67. Compliance with Standards

In case of violation of the established water standards the water use is considered illegal and a liability, established by legislation, shall apply.

If the water use permit establishes norms that allow for a deviation from standards and may lead to cumulative impact, than these permits are considered null and void according to procedure established by the legislation.

In cases where water use permit establishes higher standards that are impossible to meet with the existing means, than the person holding water use permit shall submit to the Water Resources Management and Protection Body a progressive improvement plan of its activities for the next 5 years that shall be considered as inseparable part of the water use permit.

Article 68. Allowed Marginal Criteria

Maximum allowable criteria shall be established based on:

1) Maximum allowed level of human-made loads, the long-term impact of which will not result in change of natural properties and composition of water ecosystems out of limits of natural seasonal and multi-year variations,
2) Volume of polluters, which reaches the water intake basin in the form of organized and unorganized outflows.

Criteria for maximum allowable discharges criteria for polluters in wastewaters shall be determined for each water resource based on conditions of inadmissible excision

accumulations of allowed maximum concentration of polluters within water intake basin and inadmissible accumulation of their residual quantities in bed sediments and water organic substances.

Article 69. Standards of Limiting Impact on Water Resources
Standards of limiting impact on water resources shall be developed by Water Resources Management and Protection Bodies, taking into account present ecological, social and economic condition, as well as terms and stages established by state target (goal-oriented) programs on rehabilitation, use and protection of water resources.

Article 70. Drinking Water Standards
Water supplied for drinking, healthcare purposes, needs of municipal and household services must meet the requirements of drinking water quality standards.

Persons carrying out the supply of drinking water must provide the conformity of drinking water quality to the of drinking water standards. The state authorized body of health protection, according to the order defined by legislation, carries out supervision on conformity of drinking water standards being supplied to public.

The systems of drinking water supply are ranked as the most important vital-needs water systems.

The water resource meeting the requirements of drinking water standards can be used as water source for drinking, health, municipal and household public needs, should it be possible to provide sanitary zones and special maintenance territories there, in accordance with the order established by the Government.

Drinking water treatment and processing before water supply shall be implemented only in accordance with the developed and adopted methods established according to the Governmental procedure.

Article 79. Establishment of Tariffs for Non-Competitive Water Use
The tariffs may vary:
3. Based on the qualitative parameters depending on classification of water resources.

Article 99. Primary Requirements towards the Protection of Water Resources
The water resources in the Republic of Armenia shall be protected.
The primary requirements towards the protection of water resources are as follows:
1) The use of water resources is permitted only on conditions of their protection and restoration;
2) The water resources are a constituent part of the ecosystem and the natural landscape, and their protection shall be stipulated by the maintenance of balance within the given ecosystem;
3) The water resources shall be subject to protection when used, as well as when not used;
4) If not used, the protection of water resources must maintain the balance and welfare in the given ecosystem completely when it comes to the water issue;
5) If used, the protection of water resources must maintain the balance in the given ecosystem;
6) Water resources shall be subject to protection from pollution, littering, infection and depletion;

Article 120. Specifics of Operation of Drinking Water Supply and Wastewater Systems
Prior to the adoption of the Law of the Republic of Armenia on Drinking Water, the following shall be carried out in the sector of drinking water supply and wastewater:

- The use of the water resources, meeting the quality standards of drinking water, for drinking, household and residential, and health needs shall be considered top priority;

- The drinking, household and residential water supply systems shall be classified as highly important life-supporting objects;
- The supervision of the quality parameters of drinking water shall be carried out in procedures established by the legislation of the Republic of Armenia.

THE RA LAW ON NATIONAL WATER PROGRAM OF THE REPUBLIC OF ARMENIA, 2006

Article 10. Classification of water resources

1. Surface waters of the Republic of Armenia – rivers and lakes, are classified by:
   7) **significance of use** – drinking/domestic, irrigation, industry, power generation, fisheries, recreation;
   8) **quality** – high, good, average, low .
3. Due to natural mineralization, the water resources of the Republic of Armenia are classified as follows: fresh, low mineralization, moderate mineralization, high mineralization, salty and very salty.
4. Due to natural composition, the water resources of the Republic of Armenia are classified by anionic hydro-carbon, carbon, chlorine and cationic calcium, magnesium, sodium.

Article 24. Norms for limiting the impact on water resources and quality assuranace norms

1. Water standards are defined based upon health requirements, as well as the needs for preventing the degradation, aggravation and pollution of water resources and ensuring of minimal ecological flow. For the purpose of meeting the international norms, water standards include the permissible quantities of all possible pollutants and their reduction indicators by years.
2. Norms for limiting the impact on water resources are defined, based on water standards, and considering the actual pollution of the water resource and the self-treatment capacity.
3. Depending on the specialties of the given area, water standards for each basin management area are defined by the State authorized standardizing body of the Republic of Armenia, which are further included in the basin management plans.

ANNEX TO THE LAW OF THE REPUBLIC OF ARMENIA "ON THE NATIONAL WATER PROGRAM OF THE REPUBLIC OF ARMENIA"

PHASED PROGRAM OF MEASURES FOR IMPLEMENTATION OF THE NATIONAL WATER PROGRAM

Water Resources Management Needs

Development of new programs for monitoring of surface and ground water resources.

6. Development and testing of a pilot monitoring system in one basin management area.

7. Development of a monitoring strategy and a national program, technical capacity building of the regional sub-divisions of monitoring services, needs assessment, structural improvements and technical modernization, establishment of an electronic data exchange system.

8. Re-establishment of the ground water resources monitoring system in Armenia.

Implementation of the monitoring strategy and the national program.

Development and implementation of monitoring systems and programs for the other four basin management areas in compliance with the IWRM requirements.

Elaboration and enforcement of water quality standards

20. Adjustment and introduction of internationally accepted methodology for determination of norms for limitation of impact on water resources and standards for ensuring water quality, taking into consideration the best international practices.

Development and adoption of norms for limitation of impact on water resources and standards for ensuring water quality.
Study of possibilities for localization of water quality standards on the level of basin management areas.
Enforcement of norms for limitation of impact on water resources and standards for ensuring water quality.
Adoption of water quality standards on the level of basin management areas.
Accepted methodology for determination of norms for limitation of impact on water resources and standards for ensuring water quality.
Implementation of water quality management.
24. Development of a strategy for water quality management.
Implementation of the strategy for water quality management strategy.
Monitoring and further improvement of the water quality management strategy.
Accepted water quality management strategy.

RA LAW ON FUNDAMENTALS OF THE NATIONAL WATER POLICY
Adopted May 3, 2005

Article 9. Water Resources Assessment

The Water Resources Assessment shall be conducted by complete inventory of all surface and ground water resource, quality, quantity, form and distribution in accordance with the requirements of the Water Code of the Republic of Armenia and implementing regulations.
The Water Resources Assessment shall be conducted on a periodical basis, at least once per 5 year.

Article 12. Components of the Water Resources Demand Assessment

1. The water resources demand assessment shall include but not limited to the following water uses (quantity and quality):

1. Residential (domestic);
2. Agricultural;
3. Industrial;
4. Fish farming;
5. Recreation;
6. Power generation, including power generation and cooling; nuclear power plants.
7. Trans-boundary water resources;
8. Storage of water resources.

2. The demand reported in this assessment shall include:

    1 Goal of water use, justification for water demand, perspectives of water use
    2 Water quantity, regime, location of intake by volume;
    3 Water quality,
    4 Pollution caused by water use

Article 13. Water Resources Use and Protection Priorities

1. With the purpose of sustainable water resources management and protection, water allocation among water users based on the results generated from total supply assessment shall be carried out by priority directions, in the following order:

1) National Water Reserve; use and protection of renewable water resources of the adequate quantity and quality required to meet basic human needs, reduce and prevent water borne diseases, and sustain aquatic ecosystems,

2) Traditional; historic, non extractive use of water within a natural stream bed;

3) Water resources use according to the Legislation and International Contracts of the Republic of Armenia,

4) Domestic; water to satisfy all other domestic water needs above and beyond the basic human needs;

5) Agricultural; water for irrigation, watering of pastures, animal husbandry and other non-industrialized activities;

6) For energy to satisfy the needs for its production;

7) Industrial; water for production facilities;

8) Recreational use; water for amateur fisheries, swimming, boating, and aesthetic enjoyment;

9) Drought control; means to minimize flood and drought damages.

2. No water allocation could take place if such allocation causes any damage to the National Water Reserve