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Ambient water — Specification

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 564 was prepared by Technical Committee RSB/TC 013, *Water and Sanitation*.

Committee membership

The following organizations were represented on the Technical Committee on *Water and Sanitation* (RSB/TC 013) in the preparation of this standard.

Rwanda Water Resources Board

Water and Sanitation Corporation Ltd

Kigali Water Limited

Rwanda Housing Authority

Shine Engineers Multi-Sectoral Company Limited

SINA Gerard Enterprise URWIBUTSO

University of Rwanda/College of Sciences and Technology

AYATEKE Star Company Ltd

Rwanda Standards Board (RSB) – Secretariat

Introduction

Ambient water bodies are categorized into two types: surface waters (e.g. rivers, lakes, streams, ...) and ground waters (springs, boreholes, ...). These contribute to domestic and industrial water supplies, agricultural practices and fisheries, as well as supporting natural biota. Therefore, their water quality should be managed so as not to cause any adverse effect, including the conservation of aquatic ecosystems. The ambient water quality standards are registered for protecting water bodies, having regard to their type and water usage in many countries. The control of pollutant from point sources such as domestic sewage and industrial waste water treatment plants should be implemented by setting the effluents standard, taking into account the dilution factor and the natural purification capacity of the receiving water bodies. In other words, the ambient water quality standard is a basic tool for every water quality management activity.

With reference to SDG6.3.2, the quality status of individual water bodies is classified based on the compliance of the available water quality monitoring data for the core parameters with target values defined by the country. The indicator is computed as the proportion of the number of water bodies classified as having good quality (i.e. with at least 80 % compliance) to the total number of assessed water bodies, expressed as a percentage.

Ambient water contributes to various activities and uses as well as the conservation of natural ecosystems. Monitoring is conducted to examine compliance with the standards. Both frequency and choice of site are very important in quality monitoring. Water quality must be evaluated comprehensively, using various data taken from several sampling points.

Ambient water — Specification

1 Scope

This Draft Rwanda Standard specifies requirements, sampling and test methods for ambient water.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS ISO 7887, *Water quality — Examination and determination of colour*

RS ISO 7888, *Water quality — Determination of electrical conductivity*

RS ISO 7027-1, *Water quality — Determination of turbidity — Part 1: Quantitative methods*

RS ISO 11923, *Water quality — Determination of suspended solids by filtration through glass-fibre filters*

RS ISO 6059, *Water quality — Determination of the sum of calcium and magnesium — EDTA titrimetric method*

RS ISO 10523, *Water quality — Determination of pH*

ISO 5814, *Water quality — Determination of dissolved oxygen — Electrochemical probe method*

RS ISO 5815-2, *Water quality — Determination of biochemical oxygen demand after n days (BOD_n) — Part 2: Method for undiluted samples*

RS ISO 6060, *Water quality — Determination of the chemical oxygen demand*

RS ISO 10304-1, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate*

RS ISO 11732, *Water quality — Determination of ammonium nitrogen — Method by flow analysis (CFA and FIA) and spectrometric detection*

ISO 15681-1, *Water quality — Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) — Part 1: Method by flow injection analysis (FIA)*

RS ISO 15681-2, *Water quality — Determination of orthophosphate and total phosphorus contents by flow analysis (FIA and CFA) — Part 2: Method by continuous flow analysis (CFA)*

RS ISO 9297, *Water quality — Determination of chloride — Silver nitrate titration with chromate indicator (Mohr's method)*

ISO 6703-3, *Water quality — Determination of cyanide — Part 3: Determination of cyanogen chloride*

ISO 10359-2, *Water quality — Determination of fluoride — Part 2: Determination of inorganically bound total fluoride after digestion and distillation*

RS ISO 22743, *Water quality — Determination of sulfates — Method by continuous flow analysis (CFA)*

RS ISO 5961, *Water quality — Determination of cadmium by atomic absorption spectrometry*

RS ISO 9174, *Water quality — Determination of chromium — Atomic absorption spectrometric methods*

RS ISO 8288, *Water quality — Determination of cobalt, nickel, copper, zinc, cadmium and lead — Flame atomic absorption spectrometric methods*

RS ISO 6332, *Water quality — Determination of iron — Spectrometric method using 1,10-phenanthroline*

RS ISO 6333, *Water quality — Determination of manganese — Formaldoxime spectrometric method*

RS ISO 12846, *Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment*

RS ISO/TS 17379-2, *Water quality — Determination of selenium — Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS)*

ISO 9390, *Water quality — Determination of borate — Spectrometric method using azomethine-H*

RS ISO 17378-2, *Water quality — Determination of arsenic and antimony — Part 2: Method using hydride generation atomic absorption spectrometry (HG-AAS)*

RS ISO 12020, *Water quality — Determination of aluminium — Atomic absorption spectrometric methods*

RS ISO 8165-1, *Water quality — Determination of selected monovalent phenols — Part 1: Gas-chromatographic method after enrichment by extraction*

RS ISO 8165-2, *Water quality — Determination of selected monovalent phenols — Part 2: Method by derivatization and gas chromatography*

RS ISO 9377-2, *Water quality — Determination of hydrocarbon oil index — Part 2: Method using solvent extraction and gas chromatography*

ISO 16265, *Water quality — Determination of the methylene blue active substances (MBAS) index — Method using continuous flow analysis (CFA)*

RS ISO 15089, *Water quality — Guidelines for selective immunoassays for the determination of plant treatment and pesticide agents*

RS ISO 9308-1, *Water quality — Enumeration of Escherichia coli and coliform bacteria — Part 1: Membrane filtration method for waters with low bacterial background flora*

RS ISO 9308-2, *Water quality — Enumeration of Escherichia coli and coliform bacteria — Part 2: Most probable number method*

RS ISO 4831, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of coliforms — Most probable number technique*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes and sampling techniques*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1

ambient water

open waters such as surface waters (e.g. rivers, lakes, streams, ...) and ground waters (springs, boreholes,...) as opposed to closed water supply systems that distribute treated water or wastewater.

3.2

ambient water quality

quality refers to natural, untreated water in rivers, lakes and ground waters and represents a combination of natural influences together with the impacts of all anthropogenic activities.

3.3

aquifer

geological water-bearing formation (bed or stratum) of permeable rock, or unconsolidated material (e.g. sand and gravels) capable of yielding significant quantities of water

3.4

general treatment

treatment of water using coagulation, flocculation, clarification and filtration followed by disinfection

3.5

groundwater

water in the saturated zone and/or unsaturated zone of an underground geological formation or artificial deposit such as made ground, e.g. fill material

3.6

inland surface water

any standing or flowing water on the surface of the land extending up to the boundary of the coastal water

3.7

lake

inland body of standing surface water of significant extent

3.8

river

large stream which serves as the natural drainage for a basin

3.9

simple treatment

simple filtration and boiled at 100 °C

3.10

simple filtration

process of separating suspended solid matter from a liquid, by causing the latter to pass through the pores of a membrane, called a filter.

3.11

stream

flowing body of water in a natural surface channel. Surface water: Water which flows over, or lies on, the ground surface

3.12

parameter

water quality variable or characteristic of water quality, also called a determinant

3.13**non-point-source pollution**

pollution of water bodies from dispersed sources such as fertilizers, chemicals and pesticides used in agricultural activities

3.14**point source pollution:**

pollution with a precisely located origin

4 Requirements**4.1 General requirements**

4.1.1 The quality and safety of ambient water shall be periodically monitored in order to reflect accurately the scientific knowledge on the kind and extent of all identifiable effects on health, welfare and environment that may be expected from the presence of pollutants in any body of water.

4.1.2 No person shall discharge, deposit or emit any pollutant into the inland surface waters to exceed the quality of ambient Water

4.1.3 The competent authority shall be responsible for the maintenance of the quality of inland surface waters.

4.1.4 The ambient water shall be in the following six (6) classes:

- a) **Class A** – Water that requires simple treatment, for drinking;
- b) **Class B** – Bathing and contact recreational water;
- c) **Class C** – Water suitable for aquatic life;
- d) **Class D** – Water source that require to undergo general treatment process, for drinking;
- e) **Class E** – Water suitable for irrigation and agricultural activities; and
- f) **Class F** – Water with minimum quality but does not fall into categories A to E.

4.2 Specific requirements

The ambient water shall comply with the requirements given in Table 1 when tested in accordance with the test methods specified therein.

Table 1 — Specific requirements for ambient water

S/N	Parameter		Requirement					Test method	
			A	B	C	D	E		F
1.	Color, PtCo mg/l, max.		20	-	-	100	-	-	RS ISO 7887
2.	Electrical conductivity, µS/cm, max.		800	800	1000	1000	1000	2000	RS ISO 7888
3.	Turbidity, NTU, max.		5	-	-	-	-	-	ISO 7027-1
4.	Total suspended solids, mg/l, max.		25	-	40	1500	2100	-	RS ISO 11923
5.	Total hardness (as CaCO ₃), mg/l		250 – 600	-	-	-	-	-	RS ISO 6059
6.	pH		5.5 – 8.5	5.5 – 9.0	5.5 – 8.5	5.5 – 9.0	5.5 – 8.5	5.5 – 9.0	RS ISO 10523
7.	Dissolved Oxygen at 25 °C, mg/l, min.		6	5	5	4	3	3	ISO 5814
8.	Biological oxygen demand (BOD ₅) at 25 °C, mg/l, max.		3	4	4	5	12	15	RS ISO 5815-2
9.	Chemical oxygen demand (COD), mg/l, max.		10	10	15	30	-	40	RS ISO 6060
10.	Nitrogen, Nitrates, mg/l, max.		10	10	10	10	-	10	RS ISO 10304-1
11.	Nitrogen, ammonia, mg/l	pH<7.5	-	-	0.94	-	-	9.1	RS ISO 11732
		7.5≤pH<8.5	-	-	0.59	-	-	4.9	
		pH≥8.5	-	-	0.22	-	-	1.6	
12.	Phosphates, mg/l, max.		0.7	0.7	0.4	0.7	-	-	RS ISO 15681-1 or RS ISO 15681-2
13.	Chlorides, mg/l, max.		250	-	-	250	600	-	RS ISO 9297
14.	Cyanides, mg/l, max.		0.05	0.05	0.05	0.05	0.05	0.05	ISO 6703-3
15.	Fluorides, mg/l, max.		1.5	-	-	250	600	-	ISO 10359-2
16.	Sulphates, mg/l, max.		250	-	-	250	600	-	RS ISO 22743
17.	Total cadmium, µg/l, max.		5	-	5	5	-	5	RS ISO 5961
18.	Total chromium, µg/l, max.		50	-	20	50	-	50	RS ISO 9174
19.	Total copper, µg/l, max.		-	-	100	-	-	100	RS ISO 8288
20.	Total iron, µg/l.		300 – 1000	-	-	2000	-	-	RS ISO 6332
21.	Total lead, µg/l, max.	Hardness <120	50	-	2	50	-	-	RS ISO 8288
		120≤hardness<180			3				
		Hardness ≥180			4				

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22.	Total manganese, µg/l, max.	1000	100	1000	1000	1000	1000	RS ISO 6333
23.	Total mercury, µg/l, max.	1	1	1	1	2	2	RS ISO 12846
24.	Total nickel, µg/l, max.	70	100	100	100	200	100	RS ISO 8288
25.	Total selenium, µg/l, max.	10	10	5	10	-	-	RS ISO/TS 17379-2
26.	Total zinc, µg/l, max.	1000	-	1000	1000	2000	24000	RS ISO 8288
27.	Total boron, µg/l, max.	-	-	-	-	1	-	ISO 9390
28.	Total arsenic, µg/l, max.	50	50	50	50	50	50	RS ISO 17378-2
29.	Total aluminium, µg/l, max.	200	-	-	-	5000	5000	RS ISO 12020
30.	Phenolic compounds, µg/l, max.	2	5	2	5	5	5	RS ISO 8165-1 RS ISO 8165-2
31.	Oil/Grease, µg/l, max.	100	-	100	100	-	300	RS ISO 9377-2
32.	Anionic surfactants as MBAS, µg/l, max.	1000	1000	1000	1000	1000	1000	ISO 16265
33.	Pesticides, µg/l, max.							RS ISO 15089
	Aldrin/Dieldrin	0.03	-	-	-	-	-	
	Chlordane (total)	0.3	-	-	-	-	-	
	2,4- Dichlorophenoxyacetic acid	30	-	-	-	-	-	
	DDT (total)	1	-	-	-	-	-	
	Heptachlor and Heptachlor Epoxide	0.03	-	-	-	-	-	
	Hexachlorobenzene	1	-	-	-	-	-	
	Lindane BHC	2	-	-	-	-	-	
	Methoxychlor	20	-	-	-	-	-	
	MCPA, µg/l, max.	2	-	-	20	-	-	
	Pendimethalin, µg/l, max.	2	-	-	20	-	-	
34.	Total coliform, MPN/100ml, max.	10000	10000	-	10000	-	-	RS ISO 9308-1 RS ISO 9308-2
35.	Faecal coliforms, MPN/100ml	500 – 1000	500 – 1000	-	-	-	-	RS ISO 4831

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5 Ambient water quality guidelines and monitoring

5.1 Ambient water quality guidelines

5.1.1 The competent authority shall establish the ambient Water quality guidelines for the protection of aquatic life, wildlife, agriculture, drinking water sources and recreation.

5.1.2 The ambient water quality guidelines shall be used in order to:

- a) protect aquatic life, wildlife and their habitats;
- b) protect water values, including: drinking water, public supply, and food processing; agriculture (livestock watering and irrigation); and recreation;
- c) provide the basis for the evaluation and ambient water quality and environmental impact assessments to inform resource management decisions (e.g., wastewater discharge limits:
- d) provide the basis for water quality objectives; and
- e) report to the public on the state of water quality and promote water stewardship.

5.2 Ambient water quality monitoring

Monitoring programme shall be carefully designed answer specific questions. For example, a programme designed to answer questions about ambient water quality status and trends differ from one designed to answer questions about extent and scale of chemical spill. Ambient water quality activities shall be undertaken for such purposes as:

- a) **Classification of water body.** The water quality is monitored quarterly for a period of one year. Among other factors, e.g., existing use and social acceptability, the result of analyses are taken into account in deciding the appropriate classification of a water body or section of a water body.
- b) **Trend monitoring to check if a water body is meeting its designated use.** The water quality is monitored at regular frequency to check if the water body is meeting the guideline values for its classification. The results are used as basis for decision-making, e.g., whether to institute management interventions to improve water quality, or to reclassify a water body, etc.
- c) **Designation of Non-Attainment Areas.** Designation of Non-Attainment Areas. A water body or portions of a water body may be identified as NAA for parameters whose guideline values are not being met. This is based on:
 - 1) ten monthly sampling in a period of one year within the last two years, or
 - 2) quarterly sampling within the last two years (except for parameters requiring more frequent sampling based on water quality standards).
- d) **Monitoring for ECC compliance.** If required in the ECC, the quality of a water body is monitored to ensure that a project or undertaking within or near a water body is not affecting the water quality.
- e) **Monitoring to identify causes and sources of water-related problems.** In cases of occurrence of water-related problems, e.g., disease epidemic, fish kills, red tide, etc., water quality monitoring is undertaken to identify specific problem pollutants and sources, and used as basis for identification of intervention and management strategies.
- f) **Monitoring for baseline data and scientific studies.** Specific water quality parameters are analyzed for specified period of time to serve as baseline data or for certain studies.
- g) **Monitoring for Other Purposes.** Monitoring for purposes other than those mentioned above.

5.3 Water quality parameters of measurement, timing and frequency for monitoring

5.3.1 The parameters to be monitored shall be specified. Choose the parameters according to the objective of monitoring. For purposes of classification for instance, the classification guidelines recommend minimum test parameters for rivers, lakes and coastal and offshore waters considering the beneficial uses. The list of water quality parameters for monitoring are given in annex A.

5.3.2 The monitoring plan shall describe the intended timing and frequency of monitoring. The frequency of monitoring would depend on the monitoring objective. The timing should consider the effect of temporal variations on water quality.

5.3.3 The sampling plan should describe how often sample will be taken and at what times of the year as water quality changes with the seasons. Except as needed for special studies, it is not advisable to take samples when it is raining, within 24 hours after a heavy downpour or when the water level is at high stage. In these conditions, the water sample is not representative.

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5.3.4 The recommended parameters, frequency and duration of sampling according to the objective of monitoring are shown in Table 2.

Table 2 — Recommended parameters, frequency and duration of sampling

S/N	Objective of monitoring	Parameters	Sampling frequency (minimum)	Minimum duration of monitoring
i.	Classification	Primary parameters	Quarterly ¹	1 year
ii.	Reclassification ²	Primary	10 monthly sampling in a period of one year	3 consecutive years
		Secondary ³	Quarterly	3 consecutive years ⁴
iii.	Trend monitoring	Primary	10 monthly sampling in a period of one year	3 consecutive years ⁵
		Secondary	Quarterly (every 3 months)	3 consecutive years
iv.	Designation of Non-Attainment Areas (NAA)	All relevant parameters	(a) ten monthly sampling in a period of one year within the last two years, or (b) quarterly sampling within the last two years (except for parameters requiring more frequent sampling based on the water quality standards) ⁶	year for monthly monitoring; 2 years for quarterly monitoring
v.	Monitoring for ECC compliance	Selected/specific to project or site condition; parameters prescribed in the EMOp or ECC	As prescribed in the EMOp or in the ECC	As prescribed in the EMOp or in the ECC
vi.	Monitoring to identify causes and sources of water-related problems	Selected /specific to situation	High, will depend on impact area and parameter	very short (days-weeks)
	Monitoring for 1 year	Primary	Once a month for 12 months	1 year

vii.	baseline data and scientific studies	Secondary	Once a month for 12 months	1 year
viii.	Other purposes	Selected based on objective	As necessary depending on objective	< 1 year

¹ Minimum of three (3) sampling sites per water body classification.

² It is not not necessary to undertake separate monitoring if trend monitoring is being conducted. Data from trend monitoring may be used.

³ Important secondary parameters specific to the water body as identified by the EMB-RO or the agency conducting the monitoring

⁴ Data from trend monitoring may be used.

⁵ Monitoring may be continued afterward or may be resumed later as necessary.

⁶ Data from trend monitoring may be used

⁷ Selected parameters specific to the water body as identified by the EMB-RO or monitoring agency

6 Sampling

6.1 Sampling programmes and techniques

The sampling programmes and techniques for ambient water shall be done in accordance with ISO 5667-1.

Annex A
(informative)

Ambient water quality parameters of measurement

Water quality parameter for ambient water monitoring are given in the following table:

NOTE The competent authority may add or reduce the number of parameters when it deems necessary.

Table A1 – Parameters for ambient water monitoring

Category	Parameters
Primary parameters	Biochemical oxygen demand (BOD)
	Chlorides
	Color (true)
	Dissolved oxygen (DO)
	Faecal coliforms
	pH
	Phosphates
	Temperature
	Total suspended solids
	Ammonia-Nitrogen (NH ₃ -N)
Secondary parameters	Barium (Ba)
	Iron (Fe)
	Sulfate (SO ₄ ²⁻)
Secondary parameters – Toxic metals	Arsenic (As)
	Cadmium (Cd)
	Hexavalent chromium (Cr ⁶⁺)
	Copper (Cu)
	Lead (Pb)
	Mercury (Hg)
	Nickel (Ni)
Secondary parameters – Organics	Animal-Vegetable fats and oils
	Benzene
	Toluene
	Ethylbenzene
	Xylene
	Cyanides

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- [2] Philippine, Environmental Management Bureau – Department of Environment and Natural Resources, *Water Quality Monitoring Manual— Volume I: Manual on ambient water quality monitoring*, February 2008.
- [3] United Nations Environment Programme, *Progress on ambient water quality — Global Indicator 6.3.2 Updates and acceleration needs*, 2021

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