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Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities and for the assessment of drinking water services

Activités relatives aux services de l'eau potable et de l'assainissement — Lignes directrices pour le management des services publics de l'eau potable et pour l'évaluation des services fournis

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 24512 was prepared by Technical Committee ISO/TC 224, *Service activities relating to drinking water supply systems and wastewater systems - Quality criteria of the service and performance indicators*.

ISO 24512 is one of a series of standards addressing water services. The full series consists of the following International Standards:

— ISO 24510, *Activities relating to drinking water and wastewater services — Guidelines for the assessment and for the improvement of the service to users*

— ISO 24511, *Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services*

— ISO 24512, *Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities and for the assessment of drinking water services*

Introduction

NOTE Words in bold are key terms which are defined in Clause 2.

0.1 Water issues: global context and policies framework

Water constitutes a worldwide challenge for the 21st century, both in terms of the **management** of available water resources and the provision of access to **drinking water** and sanitation for the world's population. In 2000, the United Nations (UN) recognized that access to water is an essential human right, and in conjunction with national governments, it set ambitious goals (the "Millennium Development Goals") to increase access to **drinking water** and **wastewater services,** including safe disposal or reuse of **residues** (hereinafter jointly referred to as "water **services**"), particularly in developing countries. International conferences on **sustainable development** and water (e.g. the World Summit on Sustainable Development in Johannesburg in September 2002, the third World Water Forum in Kyoto in March 2003 and the fourth World Water Forum in Mexico City in March 2006) have highlighted this issue, and UN agencies (including WHO and UNESCO) have developed recommendations and programmes to establish a framework in which to advance.

The United Nations' Commission on Sustainable Development (CSD13) has emphasised that governments (referred to as "**relevant authorities**" in this International Standard) have a primary role in promoting improved access to safe **drinking water** and basic sanitation through improved governance at all levels and appropriate enabling **environments** and regulatory frameworks, with the active involvement of all **stakeholders**. This **process** should incorporate institutional solutions to make the water sector more productive and the **management** of water resources more sustainable. In this respect, the Ministerial declarations from the Third and Fourth World Water Forum recommended that governments endeavour to reinforce the role of parliaments and local public authorities, particularly with regard to the provision of adequate water **services**, and recognized that an effective collaboration with and between these actors is a key factor for meeting water-related challenges and goals.

Examples of key issues for efficient **drinking water** and sanitation services policy frameworks are:

— clear definition of the roles of the different **stakeholders**;

— definition of sanitary rules and organization for **assessment** of compliance;

— processes to assure consistency between the policies regarding urban development and **water utility infrastructure**;

— regulation for water withdrawal and **wastewater** discharge;

— information to the **users** and to the **communities**.

0.2 Water utilities: general objectives

In addition to public health protection, sound **management** of the **drinking water** and **wastewater utilities** (hereinafter jointly referred to as "**water utilities**") is an essential element of integrated water resources **management**. When applied to these utilities, sound **management** practices will contribute, both quantitatively and qualitatively, to **sustainable development**. Sound utility **management** also contributes to social cohesion and economic development of the **communities** served, because the **quality** and **efficiency** of water **services** have implications for virtually all activities of society.

As water is considered a "social good" and activities related to water **services** support the three aspects (economic, social and environmental) of **sustainable development**: it is logical that the **management** of **water utilities** be transparent to and inclusive of all **stakeholders** identified in accordance with the local context.

There is a broad array of types of **stakeholders** that can play a role in activities related to water **services**.

Examples of such **stakeholders** include:

— governments or public agencies (international, national, regional or local) acting with legal or legislative authority;

— associations of the utilities themselves (e.g. international, regional/multinational and national **drinking water** or **wastewater** associations;

— autonomous bodies seeking to play an overview role (e.g. organizations concerned, such as non-governmental organizations);

— **users** and associations of water **users**.

The relationships between **stakeholders** and **water utilities** vary around the world. In many countries, there are bodies that have responsibility (in whole or in part) for overseeing the activities related to water **services**, whether the utilities are publicly or privately owned or operated and whether they are regulated by **relevant authorities** or acting in a system of technical self-regulation. Standardization and technical self-regulation are possible ways of ensuring involvement of all **stakeholders** and meeting the subsidiarity principle.

The aim of **water utilities** is logically to offer **services** to everybody in the area of responsibility of the utility, and to provide **users** with a continuous supply of **drinking water** and the collection and treatment of **wastewater**, under economic and social conditions that are acceptable to the **users** and to the utility. **Water utilities** are expected to meet the requirements of **relevant authorities** and the expectations specified by the **responsible bodies** in conjunction with the other **stakeholders**, while ensuring the long-term sustainability of the service. In a context of scarcity of resources, including financial resources, it is advisable that the investments made in installations be appropriate and that necessary attention be paid to proper maintenance and effective use of the installations. It is advisable that water **tariffs** generally aim at meeting cost-recovery principles and at promoting **efficiency** in the use of the resources, while striving to maintain affordable basic access to water **services**.

It is advisable that the **stakeholders** be involved in both setting **service** objectives and assessing the adequacy and **efficiency** of **service.**

0.3 Objectives, content and implementation of this International Standard

The objective of this International Standard is to provide the relevant **stakeholders** with guidelines for assessing and improving the **service** to **users**, and with guidance for managing **water utilities**, consistent with the overarching goals set by the **relevant authorities** and by the international intergovernmental organizations noted above. This International Standard is intended to facilitate dialogue between the **stakeholders**, enabling them to develop a mutual understanding of the functions and tasks that fall within the scope of **water utilities**.

The series of standards addressing water services consists of ISO 24510 (**service**-oriented), ISO 24511 and this International Standard (both **management**-oriented).

ISO 24510 addresses the following topics:

— a brief description of the components of the **service** relating to the **users**;

— core objectives for the **service**, with respect to **users**' needs and expectations;

— guidelines for satisfying **users**' needs and expectations;

— **assessment** criteria for **service to users** in accordance with the provided guidelines;

— examples of **performance indicators** linked to the **assessment** criteria that can be used for assessing the **performance** of the **service.**

ISO 24511 and this International Standard address the following topics:

— a brief description of the physical/infrastructural and managerial/institutional components of **water utilities**;

— core objectives for **water utilities**, considered to be globally relevant at the broadest level;

— guidelines for the **management** of the **water utilities**;

— guidelines for the **assessment** of the water **services** with **service assessment** criteria related to the objectives, and **performance indicators** linked to these criteria.

The **performance indicators** presented in this International Standard, ISO 24510 and ISO 24511 are simply for purposes of illustration, because assessing the **service** to **users** cannot be reduced to a single or universal set of **performance indicators**.

The scope formally excludes the installations inside a user's premises. However, attention is drawn to the fact that the **quality** of the supplied water (or discharged **wastewater**) can be adversely impacted between the **point-of-delivery** (or, in the case of wastewater, the **point-of-collection)**, and the **point-of-use** (or, in case of wastewater, the **point-of-discharge**) by the installations inside the premises. Some **stakeholders**, e.g. **relevant authorities**, owners, contractors and **users,** can have a role to play regarding this issue.

Because the organization of **water utilities** falls within a legal and institutional framework specific to each country, this International Standard does not prescribe the respective roles of various **stakeholders**, nor does it define required internal organizations for local, regional or national bodies that can be involved in the provision of water **services**. In particular, this International Standard does not interfere with the free choice of the **responsible bodies** regarding the general organization and the **management** of their **utilities**. This International Standard is applicable to publicly and privately owned and operated **utilities** alike, and does not favour any particular ownership or operational model.

The guidelines given in this International Standard, ISO 24510 and ISO 24511 focus on **users'** needs and expectations and on the water **services** themselves, without imposing a means of meeting those needs and expectations, the aim being to permit the broadest possible use of this International Standard, ISO 24510 and ISO 24511 while respecting the cultural, socio-economic, climatic, health and legislative characteristics of the different countries and regions of the world. It should therefore be understood that, in the short term, it might not always be possible to meet the expectations of local **users**. This can be due to factors such as climate conditions, resource availability and difficulties relating to the economic sustainability of the water **services**, particularly regarding financing and the **users'** ability to pay for improvements. These conditions can limit the achievement of some objectives or restrict the implementation of some recommendations in developing countries. However, this International Standard is drafted with such constraints in mind and, for example, allows for differing levels of fixed networks and the need for on-site alternatives. Notwithstanding the need for flexibility in terms of engineering and hardware, many recommendations in this International Standard, such as consultation mechanisms, are intended to apply universally.

In order to assess and improve the **service to users** and to ensure proper monitoring of the improvements, an appropriate number of **performance indicators (PIs)** or other methods for checking compliance with **requirements** can be established. The use of **PIs** is only one of the possible support tools for continuous improvement. Stakeholders can select **PIs** from the examples given or develop other relevant **PIs**, taking into account the principles described in this International Standard, ISO 24510 and ISO 24511. The **PIs** logically relate to the objectives for which they are defined through the **assessment** criteria, and are used to measure **performance**. They can also be used to set required or targeted values. This International Standard does not impose any specific **indicator** or any minimum value or **performance** range. It respects the principle of adaptability to local contexts, facilitating local implementation.

While it is in no way intended that this International Standard, ISO 24510 and ISO 24511, and more specifically the **performance indicators** given as examples, be considered as a prerequisite or condition for the implementation of a water policy or for the financing of projects or programmes, they can serve to assess progress towards policy goals and the objectives of financing programmes.

The objective of this International Standard, ISO 24510 and ISO 24511 is not to lay down systems of specifications supporting direct certification of conformity, but to provide guidelines for the continuous improvement and for the **assessment** of the **service**. Use of this International Standard, ISO 24510 and ISO 24511 is voluntary, in accordance with ISO rules.

This International Standard, ISO 24510 and ISO 24511 are consistent with the principle of the "plan-do-check-act" (PDCA) approach: they propose a step-by-step process, from identifying the components and defining the objectives of the utility to establishing **performance indicators**, with a loop back to the objectives and to the **management**, after having assessed the **performances**. Figure 1 summarizes the content and application of this International Standard. Implementation of this International Standard, ISO 24510 and ISO 24511 does not depend upon adoption of the ISO 9000 series and/or the ISO 14000 series of standards. Nevertheless, this International Standard, ISO 24510 and ISO 24511 are consistent with those **management systems** standards. Implementation of an overall ISO 9001 and/or ISO 14001 **management system** can facilitate the implementation of the guidelines contained within this International Standard, ISO 24510 and ISO 24511; conversely, these guidelines can help to achieve the technical provisions of ISO 9001 and ISO 14001 for organizations choosing to implement them.

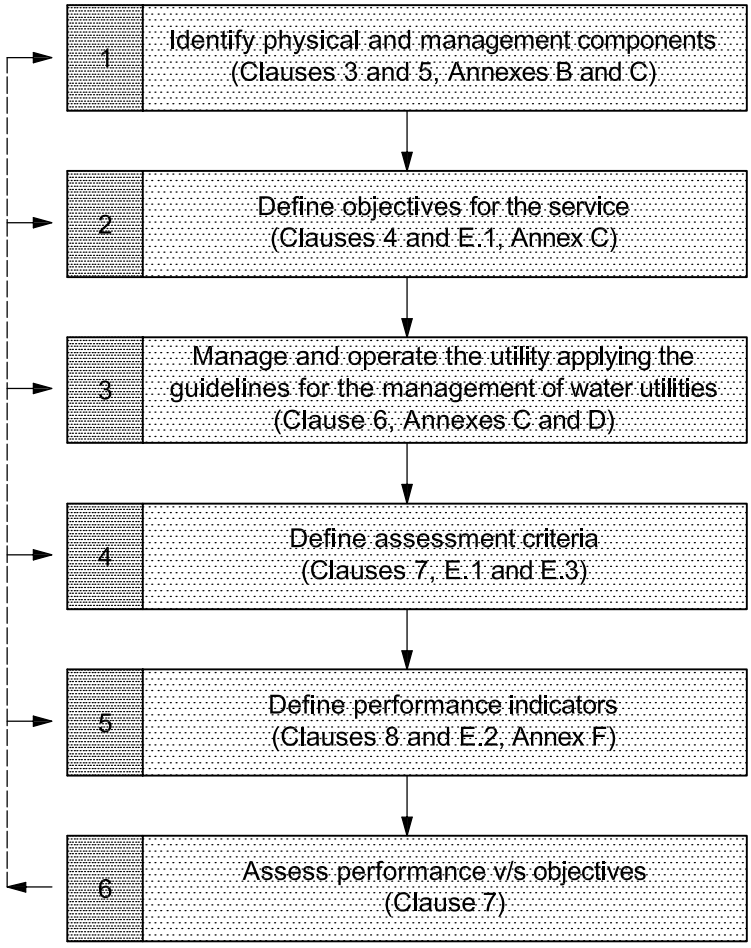

Figure 1 — Content and application of this International Standard

0.4 Drinking water supply services

When reading this International Standard, it is important to bear in mind that utilities have constructed **infrastructure** and facilities that are operated primarily to supply **drinking water** to **users** of the **service**. Many utilities can supply the **users** either by direct pipe **connection** or by other means (e.g. trucks, bottles). In broad terms, the social objectives of the **service** are to promote public health and social and economic development, while protecting the **environment**.

This International Standard only applies to **services** to and at the **point-of-delivery** to the **user** (which can be different from the point-of-consumption or use).

The function of utilities is to provide **drinking water** for civil life, urban activities and industrial or other uses. The supply of **drinking water** is considered to be a core activity on which society depends, and it therefore has a social as well as a public welfare role. Supplying **drinking water** involves the abstraction of water from the **environment** and the construction of **infrastructure** having a lifetime typically stretching over several human generations. This suggests that intergenerational equity and regard also need to be a feature of the **assessment** of the **service**. Consequently, a **water utility**, regardless of ownership, is public in nature and will be subject to public scrutiny and policy.

NOTE **Intergenerational equity** is a concept which recognizes that current societies or populations should not take actions or ignore current responsibilities that result in unfairly shifting economic or social burdens to future generations.

Operationally, under normal conditions, the broad objectives of a utility are to supply **drinking water** on a continuous basis. Some utilities cannot provide **drinking water** on a continuous, 24-hours-a-day, 7-days-a-week basis, nor is there an expectation that this will be achieved. Often these utilities are those that cannot deliver safe **drinking water**. In such cases, an intermittent but scheduled supply would be satisfactory if quantities supplied are sufficient to meet **users**' reasonable demands.

The **drinking water** needs to be suitable for direct human consumption in accordance with local potability **requirements**, regardless of the other uses made of the water delivered. Efforts need to be made to achieve that **quality** at all times. Where that is the general expectation, when potability standards are not maintained or achieved, a specific warning to **users** needs to be provided.

Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities and for the assessment of drinking water services

1 Scope

This International Standard provides guidelines for the management of drinking water utilities and for the assessment of drinking water services.

This International Standard is applicable to publicly and privately owned and operated water utilities. It does not favour any particular ownership or operating model.

This International Standard addresses drinking water systems in their entirety and is applicable to systems at any level of development (e.g. on-site systems, distribution networks, treatment facilities).

The following are within the scope of this International Standard:

— the definition of a language common to different stakeholders;

— the definition of the components of drinking water supply systems;

— guidelines for the management of drinking water utilities;

— guidelines for objectives, service assessment criteria and related performance indicators, appropriate for the assessment of drinking water services.

The following are outside the scope of this International Standard:

— target values and thresholds for proposed objectives, service assessments criteria and related performance indicators;

— matters relating to the design and construction of drinking water systems;

— matters relating to the management structure of drinking water utilities;

— matters relating to the regulation of drinking water services, including management and operational activities;

— matters relating to regulating the content of contracts or subcontracts;

— installations between point-of-delivery and point-of-use.

NOTE 1 This International Standard, ISO 24510 and ISO 24511 comprise a series of standards addressing water services. It is therefore advisable to use these three International Standards in conjunction with each other.

NOTE 2 The list of terms and definitions in Clause 2 is common to this International Standard, ISO 24510 and ISO 24511.

NOTE 3 Annex A contains three tables of correspondence between equivalent terms in English, French and Spanish.

2 Terms and definitions

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

2.1
accuracy
closeness of agreement between a measure and the accepted reference value

NOTE 1 The term “accuracy”, when applied to a set of measures, involves a combination of random components and a common systematic error or bias component.

NOTE 2 Adapted from ISO 5725-1:1994.

2.2
affordability
ability to be economically bearable for the **users** (2.50)

NOTE The affordability can be estimated through the degree to which charges for **services** (2.44) can be paid by targeted social groups of users without significant adverse economic or social impact, taking into account allowances for subsidies and payment assistance programmes for low-income users.

2.3
assessment
process (2.31), or result of this process, comparing a specified subject matter to relevant references

2.4
asset
capital-forming goods used for the provision of the **service** (2.44)

NOTE 1 Assets can be tangible or intangible. Examples of tangible assets are: land, buildings, pipes, wells, tanks, treatment plants, equipment, hardware. Examples of intangible assets are: software, databases.

NOTE 2 Contrary to consumables, assets can be depreciated in accounting systems.

2.5
asset management
processes (2.31) that enable a **water utility** (2.53) to direct, control and optimize the provision, **maintenance** (2.19) and disposal of **infrastructure** (2.17) **assets** (2.4), including the necessary costs for specified **performances** (2.24), over their life-cycle

2.6
availability
extent to which the **infrastructure** (2.17), **assets** (2.4), resources and employees of a **water utility** (2.53) enable effective provision of **services** (2.44) to **users** (2.50) according to specified **performances** (2.24)

2.7
community
one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organizations or groups, having interests in the area where the **service** (2.44) is provided

2.8
confidence grade
assessment (2.3) of the **quality** (2.32) in terms of **accuracy** (2.1) and **reliability** (2.37)

2.9
connection
set of physical components ensuring the link between a **point-of-delivery** (2.26) and the local water main or the **point-of-collection** (2.25) and the sewer

NOTE 1 For **drinking water systems** (2.12), the term “service pipe” is currently used, but the connection can include components other than the service pipe, such as valves, meters, etc.

NOTE 2 In English speaking countries, for **wastewater systems** (2.52), the term “drain” can also be used; the connection can also be equipped with ancillaries.

2.10
coverage
extent to which the **assets** (2.4) of a **water utility** (2.53) allow **services** (2.44) to **users** (2.50), within its defined area of responsibility

2.11
drinking water
water intended for human consumption

NOTE **Requirements** (2.40) for drinking water **quality** (2.32) specifications are generally laid down by the national **relevant authorities** (2.36). Guidelines are established by the World Health Organization (WHO).

2.12
drinking water system
tangible **assets** (2.4) necessary for abstracting, treating, distributing or supplying **drinking water** (2.11)

2.13
effectiveness
extent to which planned activities are realized and planned results achieved

[ISO 9000:2005]

2.14
efficiency
relationship between the result achieved and the resources used

[ISO 9000:2005]

2.15
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

NOTE 1 Surroundings in this context extend from within an organization to the global system.

[ISO 14001:2004]

NOTE 2 For the application of this International Standard, environment is considered as a specific **stakeholder** (2.47). The interests of this specific **stakeholder** (2.47) can be represented by **relevant authorities** (2.36), by the **communities** (2.7) or by other groups, such as non-governmental organizations (NGOs).

2.16
indicator
parameter, or a value derived from parameters, which provides information about a subject matter with a significance extending beyond that directly associated with a parameter value

NOTE 1 Adapted from OECD works on “Core sets of indicators for environmental performance reviews”[9].

NOTE 2 Indicators can refer to context, conditions, means, activities or **performances** (2.24).

2.17
infrastructure
system of tangible fixed **assets** (2.4) needed for the operation of a **water utility** (2.53)

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 It may also be necessary for the **water utility** (2.53) to use technical equipment for transport which is not fixed (e.g. trucks, vans, bottles) on a permanent or occasional basis, or in emergency situations. It is advisable to reserve the term “infrastructure” for fixed equipment and installations.

2.18
interruption
situation where the **service** (2.44) is not available

NOTE Interruptions can be planned or unplanned.

2.19
maintenance
combination of all technical, administrative and managerial actions during the life cycle of an **asset** (2.4) intended to retain it in, or restore it to, a state in which it can perform the required function

2.20
management
coordinated activities to direct and control an organization

NOTE 1 In English, the term “management” sometimes refers to people, i.e. a person or group of people with authority and responsibility for the conduct and control of an organization. When “management” is used in this sense, it should always be used with some form of qualifier to avoid confusion with the concept “management” defined above. For example, “management shall…” is deprecated whereas “top management shall…” is acceptable.

[ISO 9000:2005]

NOTE 2 The term “management” can be qualified by a specific domain it addresses. Examples are: public health management, environmental management, risk management, etc.

2.21
management system
system to establish policy and objectives and to achieve those objectives

[ISO 9000:2005]

NOTE A management system of a **water utility** (2.53) can include different management systems, such as a **quality** (2.32) management system, a financial management system or an environmental management system.

2.22
on-site system
set of physical **assets** (2.4) necessary for supplying **drinking water** (2.11) or collecting and treating **wastewater** (2.51) without physical **connection** (2.9) to centralized installations from a **water utility** (2.53)

2.23
operator
person or organization performing day-to-day **processes** (2.31) and activities necessary for the provision of the **service** (2.44)

NOTE 1 There can be one or several operators for a given **water utility** (2.53), e.g. distinct operators for installations operation, billing and recovering **service** (2.44). Their missions are determined by the **responsible body** (2.42). An operator may subcontract some of its operations to other contractors, if allowed by the responsible body.

NOTE 2 The operator(s) can be legally distinct, or not, from the **responsible body** (2.42). They can be public or private. Examples where responsible body and operator are not legally distinct: a technical department in a municipality, a specific division of a regional authority. Examples of legally distinct entities: a public organization, a private corporate company, a small contractor, an NGO, a cooperative.

NOTE 3 In the context of this International Standard, an “operator” is not a person employed within an organization to operate a piece of equipment or **process** (2.31).

2.24
performance
achievements of an activity, a **process** (2.31) or an organization

2.25
point-of-collection
⟨wastewater⟩ physical fixed interface, upstream of which the **water utility** (2.53) does not have the overall legal responsibility for the **service** (2.44) or **infrastructure** (2.17)

EXAMPLE The limit boundary between private and public property.

NOTE 1 The point-of-collection is generally defined in the **service agreement** (2.45).

NOTE 2 In general, the water utility employees have no legal empowerment for obtaining direct physical access to the installations upstream of the point-of-collection.

2.26
point-of-delivery
⟨drinking water⟩ physical fixed interface, downstream of which the **water utility** (2.53) does not have the overall legal responsibility for the **service** (2.44) or **infrastructure** (2.17)

EXAMPLES A **connection** (2.9) box, a meter, the limit boundary between public and private property.

NOTE 1 The point-of-delivery is generally defined in the **service agreement** (2.45).

NOTE 2 In general, water utility employees have no legal empowerment for obtaining direct physical access to the installations downstream of the point-of-delivery.

2.27
point-of-discharge
physical fixed interface where the **user** (2.50) normally discharges **wastewater** (2.51) for its collection and disposal

EXAMPLES A sink, a toilet.

2.28
point-of-use
physical fixed interface where the **user** (2.50) normally takes the water for the intended use

EXAMPLES A tap, a public drinking fountain.

NOTE 1 The point-of-use can be in private or public property.

NOTE 2 The point-of-use can be the same as the **point-of-delivery** (2.26), e.g. in the case of a public drinking fountain.

2.29
price
counterpart in money or alike paid for the supply or provision of a product or **service** (2.44)

NOTE When relevant, price is expressed relating to a unit of product or service.

EXAMPLE Price of a cubic metre of **drinking water** (2.11**)**, price of a **connection** (2.9) of xx metres in length.

2.30
procedure
specified way of carrying out an activity or a **process** (2.31)

NOTE Procedures can be documented or undocumented.

2.31
process
set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2005]

2.32
quality
degree to which a set of inherent characteristics fulfils **requirements** (2.40)

[ISO 9000:2005]

NOTE There is a clear distinction between quality of the product [**drinking water** (2.11) or treated **wastewater** (2.51)] and quality of the **service** (2.44). This International Standard does not give specifications for product quality.

2.33
rate of return
percent measure of project profitability, equal to project income divided by project investment

NOTE The time period of measurement can be annual or over the lifetime of the investment.

2.34
registered user
customer
user (2.50) for whom relevant information is recorded by the **responsible body** (2.42) or **operator** (2.23)

NOTE The term “customer” can be considered as a synonym, given that a customer has a commercial relationship, e.g. a **service agreement** (2.45), with the **water utility** (2.53). The term “customer” is currently used in such expressions as “customer relations”.

2.35
rehabilitation
operation on an **infrastructure** (2.17) that restores it to a defined level, or improves it to a higher level of **performance** (2.24)

2.36
relevant authority
public body entitled to set general policies, plans or **requirements** (2.40), or to check compliance with these rules, concerning all the **water utilities** (2.53) included in its area of jurisdiction

EXAMPLES National, regional or local governments, public agencies, regulators.

NOTE For a given water utility, there can be several relevant authorities, which have jurisdiction in different domains.

2.37
reliability
〈information〉 degree of confidence in the information for representing or for qualifying the relevant subject matter

NOTE Information can be data, **indicators** (2.16) or estimations.

2.38
reliability
〈asset, process〉 probability that a device, system, or **process** (2.31) will perform its prescribed function without failure for a given time when operated correctly in a specified environment

2.39
repair
action on a non-conforming product, equipment or facility to make it acceptable for the intended use, but not changing the original parameters of the product, equipment or facility

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 Repair includes remedial action taken on a previously conforming product to restore it for use, e.g. as part of **maintenance** (2.19).

NOTE 3 Repair can affect or change parts of the non-conforming product.

NOTE 4 Repair can be planned [e.g. preventive **maintenance** (2.19)] or unplanned (e.g. in the case of damage).

2.40
requirement
need or expectation that is stated, generally implied or obligatory

[ISO 9000:2005]

NOTE "Generally implied" means that it is custom or common practice for the drinking water or wastewater utilities, the **users** (2.50) of the **service** (2.44) and other interested parties, that the need or expectation under consideration is implied.

2.41
residues
subproducts resulting from the different **processes** (2.31) applied to **drinking water** (2.11) or **wastewater** (2.51)

NOTE Residues can be liquid, solid, gaseous or mixtures.

EXAMPLES Sludge, septage, sand or grit, grease, debris.

2.42
responsible body
body that has the overall legal responsibility for providing **drinking water** (2.11) or **wastewater** (2.51) **services** (2.44) for a given geographic area

EXAMPLE A local or municipal government (i.e. for a village, town or city), a regional government, or a national or federal government through a specified agency, or a private company.

NOTE 1 The responsible body can be public or private.

NOTE 2 The responsible body acts within a framework of law and governance established by the **relevant authorities** (2.36); it generally establishes the strategy, the specific policies adapted to the characteristics of its area of responsibility and the general organization of the relevant **water utility** (2.53).

NOTE 3 The responsible body can operate the water utility directly with its own means through an internal **operator** [direct or internal **management** (2.20) or "in house"] or entrust one or several **operators** (2.23) for the operations ("outsourced" or contracted management).

2.43
restriction
situation where the **service** (2.44) does not meet the availability conditions specified in the **service agreement** (2.45)

NOTE Restrictions can be planned or unplanned.

2.44
service
result of a **process** (2.31)

NOTE 1 Adapted from the definition of "product" in ISO 9000:2005.

NOTE 2 Services are one of the four generic categories of products with software, hardware and process materials. Many products comprise elements belonging to different generic product categories. Whether the product is then called "service" depends on the dominant element.

NOTE 3 Service is the result of at least one activity necessarily performed at the interface between the provider of the service and, in the first place, its **user** (2.50) and, in the second place, a **stakeholder** (2.47). Service is generally intangible. Provision of a service can involve for example the following:

— activity performed on a tangible product supplied by the user, e.g. **wastewater** (2.51),

— activity performed on an intangible product coming from the user, e.g. processing new **connection** (2.9) requests,

— delivery of an intangible product, e.g. delivery of information,

— creation of ambience for the user, e.g. reception offices.

NOTE 4 The word "service" in common English can also refer to the entity providing the actions related to the subject in question, as is implicit in such phrases as "bus service", "police service", "fire service" and "water or wastewater service". In this context and usage, "service" implies the entity that is delivering the service, e.g. "the public transport of passengers", "the provision of public security", "fire protection and response", and "delivering drinking water or collecting wastewater". If "service" can be understood in this way, "water service" becomes synonymous with "**water utility**" (2.53); hence in this International Standard, in order to avoid confusion, only the definition in 2.44 applies.

2.45
service agreement
establishment of an accord between the **registered user** (2.50) and the **water utility** (2.53) on the conditions of **service** (2.44) provisions

EXAMPLE A contract.

NOTE It may be implicit or explicit.

2.46
service area
local geographic area where an organization has the legal or contractual responsibility to provide a **service** (2.44)

NOTE The service area can be established by political boundaries (e.g. citywide utility), by legislative action (e.g. formation of a utility district), or by interjurisdictional agreements [e.g. intercity agreements to provide **wastewater** (2.51) services].

2.47
stakeholder
person or group or organization having an interest in the **performance** (2.24) or success of an organization

EXAMPLES **Users** (2.50) and building owners, **relevant authorities** (2.36), **responsible bodies** (2.42), **operators** (2.23), employees of the operator, external product suppliers and providers of other **services** (2.44), contractors, **communities** (2.7), customers and environmental associations, financial institutions, scientific and technical organizations, laboratories.

NOTE 1 Adapted from the definition of "interested party" in ISO 9000:2005.

NOTE 2 For the application of this International Standard, **environment** (2.15) is considered as a specific stakeholder (see 2.15, Note 2).

2.48
sustainable development
development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs

2.49
tariff
structured publicly available elements permitting calculation of the **price** (2.29) paid for a product or **service** (2.44)

EXAMPLE Flat (uniform) tariff for a cubic metre of **drinking water** (2.11), blocks with progressive or decreasing **prices** (2.29), prices of **connections** (2.9) depending on the pipe diameter.

2.50
user
person, group or organization that benefits from **drinking water** (2.11) delivery and related **services** (2.44), or from **wastewater** (2.51) service activities

NOTE 1 Users are a category of **stakeholder** (2.47).

NOTE 2 Users can belong to various economic sectors: domestic users, commerce, industry, tertiary activities, agriculture.

NOTE 3 The term “consumer” can also be used, but in most countries the term “user” is more frequent when referring to public services. It is not appropriate for wastewater services.

2.51
wastewater
water arising from any combination of domestic, industrial or commercial activities, surface runoff and any accidental sewer inflow/infiltration water and which can include collected storm water, discharged to the **environment** (2.15) or sewer

NOTE 1 The definition of wastewater in this International Standard also includes sanitary waste in undiluted form.

NOTE 2 Wastewater can flow in separate or combined sewer systems.

2.52
wastewater system
tangible **assets** (2.4) necessary for collecting, treating and disposing or reusing **wastewater** (2.51), as well as wastewater **residues** (2.41)

2.53
water utility
whole set of organization, **processes** (2.31), activities, means and resources necessary for abstracting, treating, distributing or supplying **drinking water** (2.11) or for collecting, treating and disposing of **wastewater** (2.51) and for providing the associated **services** (2.44)

NOTE 1 Some key features for a water utility are:

— its mission, to provide drinking water services or wastewater services, or both:

— its physical area of responsibility and the population within this area,

— its **responsible body** (2.42),

— the general organization with the function of **operator** (2.23) being carried out by the responsible body, or by legally distinct operator(s),

— the type of physical systems used to provide the services, with various degrees of centralization.

NOTE 2 Drinking water utility addresses a utility dealing only with drinking water; wastewater utility addresses a utility dealing only with wastewater.

NOTE 3 When it is not necessary or it is difficult to make a distinction between responsible body and operator, the term “water utility” covers both.

NOTE 4 In common English, “water service” can be used as a synonym for “water utility” (see 2.44, Note 4), but this International Standard does not recommend using the term in this way.

3 Components of drinking water supply systems

3.1 General

A drinking water supply system generally comprises four components:

— water source (see 3.3),

— intake and transport (see 3.4),

— treatment, if necessary, and if appropriate, disposal of residues (see 3.5 and 3.7), and

— storage, transport and distribution (see 3.6).

The drinking water supply system extends only to the point-of-delivery to the user. Installations from the point-of-delivery to the point-of-use are excluded.

3.2 Types of drinking water supply systems

The systems can be centralized or on-site.

Schematic presentations showing the elements or components of drinking water systems and the relations between the various components are shown in Annex B.

The supply can be continuous or intermittent; the water may be delivered continuously by pipe to the users or intermittently by some other means (e.g. truck, bottle, etc.). In addition, the utility may be linked to other utilities allowing the exchange (import or export) of raw or treated water.

In some simple systems, the treatment facility component may not be present depending on the quality of the raw water, or the facility may include only a disinfection component. In more complex drinking water systems, there may be multiple sources, multiple pumping stations and reservoirs in the transport system, multiple stages to the treatment facility and processes and pumping and re-treatment stations in the distribution system, including re-treatment activities at treated water reservoirs.

3.3 Water source

Any water, either groundwater or surface water, can be a water source. Surface water sources could include streams, rivers, lakes or reservoirs. Seawater and reclaimed wastewater are increasingly important as water sources. Groundwater is water contained within the geological formations accessed by springs, wells or boreholes.

Drinking water utilities generally have to use the water that is available to them. Groundwater sources are normally less exposed than surface water to microbial and other hazards. Large utilities may have a number of independent water sources.

3.4 Intake and transport

The water intake system normally requires pumping stations to abstract water from the groundwater, or from a surface source, and to transport the water to the treatment facility, if any. Some utilities may have the advantage of a water source that allows the use of gravity fed transport systems. The transmission mains may have in-system storage reservoirs. To protect the water from microbiological hazards, disinfection systems may be used.

3.5 Treatment

Drinking water treatment facilities can vary from basic systems, providing disinfection, to multiple processes, providing clarification (e.g. coagulation, flocculation and filtration steps) with pH adjustment as necessary for optimal treatment and processing. Mechanical filtration using micro-filtration or reverse osmosis technology is also increasingly being used (e.g. for desalination of brackish or saline water sources). A final stage of treatment is often used to provide disinfection, inactivation of pathogens and to ensure disinfection residuals exist in the distribution system. More advanced technologies can be employed as necessary and appropriate.

Residues may be produced at a number of stages in the water treatment process (see 3.7).

Some utilities with extremely high quality water sources may not have any treatment facilities.

3.6 Storage, transport and distribution

Drinking water entering the distribution system passes through a series of pipes whose diameter diminishes as the volume of the water supplied decreases and the distance from the treatment facility increases, i.e. from water mains or trunk mains to the smaller water pipes connected to users. In some cases, the final distribution of drinking water may be by truck or some other means. The distribution system may have storage reservoirs located at key points to take advantage of natural physical topography, or for reasons of balancing supply over peak and non-peak periods of demand or for emergency situations.

It may be necessary to install disinfection facilities to ensure the safety of the drinking water to be delivered.

It may be necessary to install pumping stations to maintain adequate pressure throughout the distribution system.

Valving and metering equipment may be installed throughout the distribution system for control purposes.

Metering equipment is frequently installed at the point-of-delivery for the purposes of measuring consumption.

3.7 Disposal of residues

Residues may be produced at a number of stages in the water treatment process. Disposal of large volumes of untreated sludge can pose a threat to the environment.

Since the cost of disposal of residues is volume related and residues normally contain a large amount of water, they are generally dewatered to reduce the volume.

The options for disposal, depending on quality and local requirements, are:

— transfer to a treatment facility,

— return to source water body,

— deposit at landfill sites, and

— reuse, if possible.

4 Objectives for the drinking water utility

4.1 General

4.1.1 The responsible body, in conjunction with its operator(s), if relevant, should establish for the drinking water utility:

— the objectives,

— all related requirements (mandatory or self-established), and

— a service assessment policy, taking into account the variety of assessment tools available, such as audits, compliance assessment, relevant service assessment criteria and related performance indicators with targeted, maximum or threshold values.

4.1.2 All these elements should take into account:

— legal requirements,

— land and urban planning and human settlement policies established by the relevant authorities,

— expectations of the users and other stakeholders,

— the physical and management components of the drinking water utility, and

— affordability for customers (see ISO 24510 for guidance).

4.1.3 Figure 2 gives an example of possible relationships among stakeholders for establishing objectives, and also shows the relationships between objectives, service assessment criteria and performance indicators.

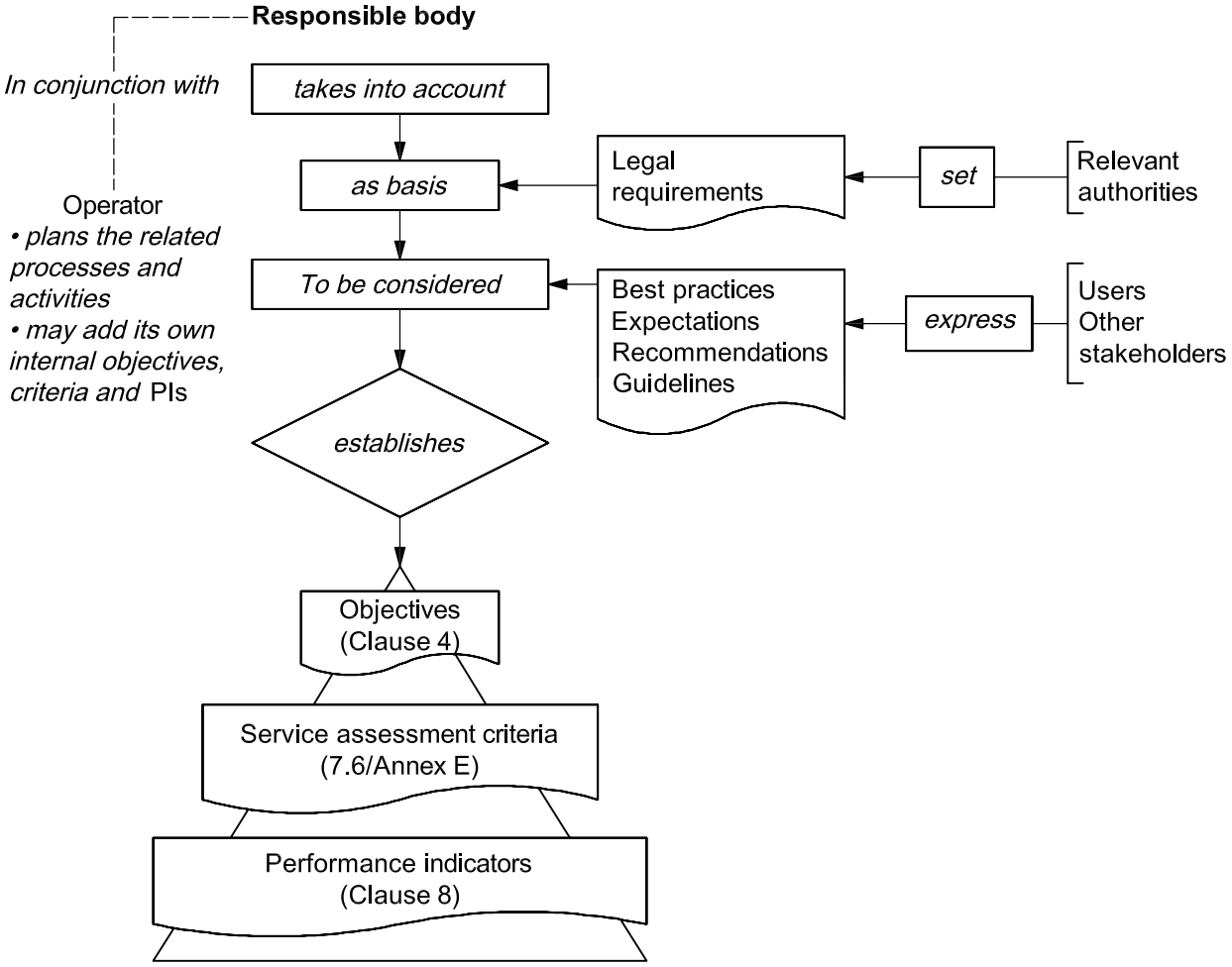

Figure 2 — Example of relevant relationships among stakeholders for establishing objectives, service assessment criteria and performance indicators

4.1.4 The management of a drinking water utility should include:

— formulation of objectives and service assessment criteria, and

— evaluation of the performance.

4.1.5 The objectives specified in 4.2 to 4.7 are considered to be the principal objectives for drinking water utilities. Examples of service assessment criteria related to these objectives can be found in 7.4. Possible actions that a drinking water utility can undertake to achieve these objectives are shown in Table C.1.

4.2 Protection of public health

An objective of a drinking water utility should be to ensure a sufficient supply of safe and agreeable drinking water.

“Sufficient supply” means a quantity of drinking water in accordance with the applicable national public health standards, regulations or guidelines, taking into account the World Health Organization (WHO) Sanitation Guidelines[11].

“Safe” drinking water means water that has a quality in accordance with the applicable national public health standards, regulations or guidelines taking into account the World Health Organization (WHO) Drinking Water

Guidelines[10]. Drinking water quality is normally expressed in terms of microbiological, chemical or radiological parameters.

“Agreeable” drinking water means drinking water that is aesthetically acceptable (e.g. in terms of taste, odour, or colour).

In addition to being safe, it is important that the drinking water is of sufficient supply and agreeable to those who consume or use the water (i.e. aesthetically acceptable), as the user might otherwise be inclined to go to unsafe water sources.

4.3 Meeting users’ needs and expectations

An objective of a drinking water utility should be to ensure activities meet users’ reasonable needs and expectations.

For guidelines on users’ needs and expectations, see ISO 24510.

4.4 Provision of services under normal and emergency situations

An objective of a drinking water utility should be to ensure that, under normal conditions, drinking water is available on a continuous basis.

Drinking water is essential for public health and societal development and sustainability. Continuity of supply is equally essential. From time to time, the water supply may be interrupted by planned or emergency events. Risk management activities should be undertaken to minimize this possibility. However, where an emergency condition applies, emergency plans and response actions should be initiated.

The objective should also be to provide drinking water to critical customers or critical service areas during emergency situations and to restore service as quickly as possible when interruptions have occurred.

Critical customers (e.g. hospitals, schools) include those who may not be able to be evacuated to areas where safe water supply is still available; critical service areas may include areas of governance or transportation corridors. The continuity of service, quantity and the safety of drinking water should be restored as quickly as possible after interruptions have occurred. Provision of drinking water in emergency conditions may involve alternative distribution mechanisms or obtaining water from adjacent unaffected supply services.

4.5 Sustainability of the water utility

An objective for a drinking water utility should be to ensure that the assets are maintained and provide capacity to meet current and future needs.

Drinking water utilities represent major social investments. It is expected they will provide service over many decades. Natural, social and environmental changes will occur in this period affecting water source availability and drinking water demand. Ensuring the sustainability of the drinking water utility over time is an important objective.

The water utility should maintain and when necessary replace assets in order to keep the drinking water service reliable through time.

The water utility should react to changes in the natural and social environments, such as water source availability and drinking water demand, taking into consideration the most current research and appropriate technology.

4.6 Promotion of sustainable development of the community

An objective for a drinking water utility should be to promote the sustainable development of the community.

“Sustainable development” means the ability of the community to grow and prosper within the environmental resources available to it, without limiting the use of those resources by future generations.

The water utility should:

— contribute to and implement sustainable water resources management policies and practices, such as efficient use of water, recycling, reuse and pollution prevention through elimination or separation of pollutants at their sources,

— contribute to development planning and resource allocation through consultation, provision of information and analysis in conjunction with appropriate institutions,

— contribute to public health and safety,

— contribute to fire protection (where a utility is responsible for providing an adequate water supply for this purpose), and

— implement information and education of the community on these topics, notably on the efficient use of water and pollution prevention.

4.7 Protection of the environment

An objective for a drinking water utility should be to minimize adverse environmental impacts and remediate tangible adverse effects to the environment caused by the utility.

Adverse environmental impacts are generally caused by the following:

— consuming energy,

— generating environmental pollutants, emitting gases, noise and odours and improperly managing residues and other wastes,

— contaminating water sources and watershed and abstraction areas, impairing freshwater quality and quantity in rivers, lakes and groundwaters, aquatic ecosystems,

— changing flow regimes and constructing barriers to fish migration, and

— depleting water sources, which affect quality or quantity of groundwaters or surface waters and their ecosystems.

The utility should have proactive monitoring programmes to assess the impacts on the environment and should activate mitigation plans, as required.

5 Management components of a drinking water utility

5.1 General

Management of a drinking water utility may have the following components:

— activities and processes,

— resources,

— assets,

— customer relations,

— information,

— environment, and

— risks.

5.2 Activities and process management

There are many individual activities and processes within a drinking water utility. These may be undertaken at all levels within the hierarchy of the organization. Examples of activities and processes to be managed include:

— policy-making,

— strategy formulation,

— procedures development,

— regulatory compliance,

— internal and external coordination, and

— operations and controls.

5.3 Resources management

Drinking water utilities have many resources. Examples of the resources to be managed include:

— personnel (human resources),

— material and equipment (non-fixed assets, e.g. spare parts, vehicles, and chemicals),

— financial resources (revenues, expenses, reserves and investments), and

— natural resources (e.g. land and water rights).

5.4 Asset management

Water utilities have tangible and intangible assets. Examples of asset management include:

— maintaining a system inventory,

— monitoring and documenting data on the condition of the system,

— taking a long-term view,

— planning, maintaining or rehabilitating the system,

— optimizing depreciation and reinvestment,

— identifying and managing risk.

All of these actions should aim at ensuring the serviceability of the assets.

5.5 Customer relations management

A drinking water utility exists to provide service to its users. Customer relations management is critical to the success of the utility. Examples include:

— identifying user needs and expectations,

— striving to meet user needs and expectations,

— registering and handling of complaints,

— accounting and billing, and

— communicating, educating and disseminating information.

For further guidance, see ISO 24510.

5.6 Information management

In all drinking water utilities, information management is important and is often a feature of a regulatory control programme, with information needing to be communicated transparently within the utility as well as to relevant authorities, users and other stakeholders. Examples of the steps in information management include:

— acquisition,

— evaluation,

— registration,

— protection,

— updating,

— communicating, and

— archiving.

5.7 Environmental management

Environmental management is an essential part of operating a drinking water utility and is fundamental for planning its further development.

Examples of environmental management include:

— improving step-by-step the water supply system,

— taking a long-term view,

— taking into account population and urbanization development,

— examining the possibilities for water demand management and water reuse,

— minimizing impacts of construction and repair activities (e.g. noise and community disruption),

— safeguarding public health, and

— protecting the water source.

The environmental impacts addressed cover more than exclusively water-related issues, and may be permanent or temporary.

5.8 Risk management

Risk management comprises proactive approaches taken to assure the continuity of the service and the protection of public health, and is of great importance. Risk management covers

a) emergency situations, caused for example by technological failures, natural disasters (earthquake, extreme weather events, etc.), criminal acts of vandalism or terrorism, or other accidents, and

b) qualitative and quantitative aspects linked to chronic or permanent situations, such as insufficient supply systems, regular pollution, conflicts between users (agriculture, industry, etc.).

Examples of risk management steps include:

— conducting hazard analyses,

— establishing and monitoring critical points of control,

— developing standard operating procedures,

— providing and implementing scheduled preventive maintenance programmes,

— maintaining on-hand inventories of materials and critical equipment, and

— developing and exercising contingency and emergency plans.

6 Guidelines for the management of drinking water utilities

6.1 General

The task of the drinking water utility is to abstract, treat and distribute water and to treat, reuse or dispose of its residues in an acceptable manner, addressing all the components of the management of the drinking water utility as described in Clause 5 in order to fulfil the objectives as stated in Clause 4.

The organization's management structure should be designed to ensure the correct, effective and efficient planning, implementation, monitoring and checking of all tasks, processes and activities. It should encompass the full range of services or functions provided. For effective management of a drinking water utility, it is recommended that utilities establish an integrated management system that encompasses all the management components and fields of the water utility.

Process management of and within drinking water utilities should be carried out using the four-point “plan-do-check-act” scheme, as outlined below:

— **plan**: establish the objectives and processes necessary to deliver results in accordance with legal, responsible authority and customer requirements and utility policies;

— **do:** implement the processes;

— **check:** monitor and measure processes and product against policies, objectives and requirements for the product and report the results;

— **act**: take actions to continually improve process performance.

Centralized, decentralized and on-site water systems should be monitored and improved to aid the protection of water sources and of the receiving environment from pollution, and to ensure maximum recovery and reuse of process water and residues.

Consideration should be given to the multi-barrier approach or drinking water safety plans:

a) drinking water sources should be protected and the abstraction should be sustainable;

b) water treatment should result in an appropriate quality of drinking water;

c) the drinking water distribution system should be planned, constructed, operated and maintained in order to minimize changes in the drinking water quality and to deliver drinking water in accordance with the normal demand of users (quantity and pressure); in particular, the entry of pollutants and micro-organisms from outside should be prevented as far as possible;

d) drinking water storage should ensure the protection of the drinking water quality and assure appropriate supplies during fluctuations in demand or supply, including adequate supply of water for fire protection (where applicable);

e) the residues should have minimum impact on the environment.

Since a drinking water utility exists to serve its users, special consideration should be given to achieving user satisfaction. For further guidance, see ISO 24510.

6.2 Organization

6.2.1 General

The drinking water utility should establish and document a management system comprising its hierarchy and organizational structure, responsibilities and workflow.

Periodic reviews of the management system should be carried out to ensure proper application and continual improvement.

Managers and supervisors should check for compliance the hierarchy and organizational structure, responsibilities and workflow, and all legal or other requirements. If they detect non-conformity, immediate remedial action should be taken.

Management capability appropriate to the organization is required.

Adequate financial capability and funding should be provided to meet the day-to-day operational, sustainable long-term capital and socio-political requirements.

Consideration should be given to developing and making the best use of staff expertise.

6.2.2 Organizational structure and responsibilities

The drinking water utility should define all tasks, competencies and the ensuing responsibilities relating to its activities. The management structure and organization should be clearly defined to establish and delegate responsibilities and to ensure that all activities are covered and completed correctly.

Further information is given in Annex D.

6.2.3 Organization of work flow

The drinking water utility should define the sequence of all essential operations required for the proper performance of its tasks, processes and activities on the basis of its hierarchical organization, ensuring that both internal cooperation and the interfaces resulting from the integration of third-party organizations are

organized in a harmonious manner. More detailed working instructions (such as standard operating procedures and operation and maintenance manuals) should be given whenever required, in order to ensure the proper and expert handling of individual activities, adhering to applicable national generally accepted requirements or practices.

There should be a clear definition of the type, scope and level of detail of the organization of workflow, including the qualification level and in-service proficiency of the employees in charge of handling all tasks and activities.

6.2.4 Operational documents and records

Tasks and activities should be documented and the documents should be retained to furnish proof that the tasks and activities have been carried out properly and expertly.

Managers and supervisors should check these records at regular intervals.

All supervision and checking activities should be documented.

If not stated otherwise in national legal provisions, license permits and official directions or the nationally generally accepted requirements or practices, every document should be kept on record for a defined period.

Examples of documents and records include:

— system plans and documentation;

— operating instructions, log books, and work rules;

— financial records;

— employee records including training and occupational health and safety records;

— test records, proof of maintenance;

— records of water, effluents and residue quality and quantity;

— contractual and legal affairs.

6.3 Planning and construction

Planning the development and the construction of the water system should be based on a long-term comprehensive strategy for protecting human health and the natural environment and ensuring long-term sustainability of operations. Planning involves improving the water system step by step, taking into account

— local climatic conditions,

— population changes and urbanization development,

— the evolution of users' expectations,

— changes in legal and other requirements,

— the mitigation of service interruptions, and

— the safeguarding of public health and the protection of the environment, including the water source.

The construction of drinking water system components should be carried out in an economic and environmentally compatible manner. Further information is given in Annex D.

6.4 Operations and maintenance

6.4.1 General

Operations and maintenance concerning the assets (including their assessment) of the drinking water supply system include:

a) abstraction,

b) treatment of raw water,

c) distribution of drinking water to point-of-delivery,

d) reduction in process water and the treatment and reuse of such process water, and

e) the safe transportation and disposal/reuse of residues.

The operator should develop a plan for an operations and maintenance strategy, covering both proactive and corrective/reactive maintenance activities. Proactive maintenance should be performed based on the condition of the assets or at scheduled intervals to prevent, minimize, or delay failures or shutdowns that result in unplanned maintenance activities, or to ensure continued, efficient asset operation and to prolong asset life. Corrective or reactive maintenance includes maintenance performed following a failure or shutdown, and involves activities necessary to repair or restore assets or systems of assets to a satisfactory condition or level of performance.

The activities and responsibilities of the water operator should include the aspects listed below:

— planning,

— operations,

— operational efficiency controls,

— maintenance (inspection, servicing, repair, including particularly leak management and rehabilitation),

— monitoring of source water, drinking water and residue quality and quantity,

— commissioning (stopping, testing, re-commissioning and decommissioning),

— troubleshooting (during and outside normal hours of work),

— documentation and record keeping, and

— emergency response.

6.4.2 Technical activities

6.4.2.1 Water souces

In liaison with the relevant authority, catchment zones should be defined for the protection of water sources and adequate constraints should be imposed in order to protect the quality of the raw water. Any water rights, licenses and easements should be listed in the land registers.

Where permitted, the water utility should manage the immediate protection zone around the withdrawal facilities (intakes or boreholes), maintaining fences that prevent access by unauthorized persons, and ensuring that the premises are kept clean and that the surrounding land is kept in good condition, without the use of fertilizer or herbicides.

The quality of the water sources should be monitored.

6.4.2.2 Water treatment facilities

The management of treatment and other processes within the drinking water utilities should be undertaken in a manner that optimizes the use of equipment and resources involved.

Each unit of the water treatment facilities should be operated in accordance with its specifications. The proper operation of the treatment facilities may require in particular:

— monitoring and adjusting the treatment process and the type and quantity of chemicals used to the characteristics of the water or residues,

— ensuring the regular supply of treatment products, their correct storage and maintenance of equipment and dosing devices,

— disposal of waste and by-products,

— optimizing the process efficiency, and

— establishing and monitoring critical points of control.

6.4.2.3 Water transportation and distribution system

Water can be transported and distributed by different means (e.g. pipelines, road tankers, etc.), designed to ensure appropriate capacity, and instrumented and operated to maintain appropriate quality. The transportation and distribution system may include temporary storage and subsequent pumping. The distribution system should be capable of preventing backflow at the point-of-delivery, in order to reduce the risk of contamination.

Leak detection and repair programmes should be implemented in order to protect the drinking water against any possible hygienic risks and to prevent any deterioration in the hydraulic efficiency of the network, taking into account the utility's economic and environmental constraints.

Depending on conditions such as the sedimentation in pipes or internal corrosion, maintenance or rehabilitation campaigns (e.g. cleaning) should be implemented in order to prevent deterioration in water quality and to restore the original capacity of the pipes.

Metering at strategic points in the drinking water supply system, i.e. at the different stages of drinking water production (e.g. withdrawal, treatment plants) and distribution (e.g. main lines, storage outflows, points-of-supply), should be performed in order to manage the drinking water utility.

In order to prevent any loss or deterioration of the quality of the treated drinking water, drinking water storage should be kept in good condition. The storage should therefore be controlled, and cleaned and rehabilitated as necessary.

Further information is given in Annex D.

6.4.2.4 Emergency provisions

The quality and continuity of the drinking water service to users is a priority for protecting public health and the environment. The drinking water utility should therefore be prepared to take the necessary steps to deal with emergency situations. Emergency situations can include technological failures (e.g. pipe failures) and natural disasters (e.g. earthquakes and severe weather events), as well as criminal acts of vandalism and terrorism. Emergency plans covering all these situations should be developed. When drinking water does not meet potability standards, a specific warning to users should be provided. When service is interrupted, the service should be restored as soon as possible. Special attention should be given to the needs of critical customers or critical service areas and the needs for fire protection (where applicable).

For emergency situations, in order to minimize the negative impacts on the water service, the drinking water utility should have an emergency response plan.

It is recommended that the emergency plan be tested and that simulation exercises be conducted in order to train the operating personnel in managing emergency situations. Experience of previous crises and simulation exercises should be documented.

On the basis of the risks previously analysed and classified, preventive actions should be assessed, economically evaluated and an appropriate response initiated.

6.4.3 Support activities

6.4.3.1 Purchasing equipment, materials and products

Procedures should be established for both the procurement and stockpiling of all materials, equipment and products.

Clear and precise specifications should be produced and conformity assessed.

Appropriate equipment should be available to employees to carry out the tasks and activities.

The maintenance of drinking water quality requires the use of chemically, microbiologically and sanitarily satisfactory additives and construction materials, paints and coatings for all surfaces coming into contact with drinking water.

The physical demands placed on the pipeline during installation and operation should be taken into account in the choice of materials.

These requirements should be fulfilled in both the procurement and stock-keeping processes for all such materials and components.

Further information is given in Annex D.

6.4.3.2 Contractual and legal affairs

All rights, permits and contracts (e.g. supply contracts, customer contracts, service agreements) should be managed properly. Specific attention should be paid to material requirements, abstraction and discharge consents or permits, rights to lay water mains, easements for treatment, storage and disposal facilities.

6.4.3.3 Accounting/billing

The accounting system should take into account all costs, which may include environmental and resource costs. If charged for the provision of water, fees may reflect the full or partial costs of the water services in accordance with applicable social policies. The calculation of the fee should be transparent.

6.4.3.4 Human resources

The drinking water utility should make sure that all employees are qualified for the tasks to be carried out, and should provide routine performance planning and evaluation.

Employees should be capable of accomplishing the tasks assigned to them. Furthermore, specially instructed, experienced or expert staff may be required to carry out special activities, in accordance with legal provisions, generally accepted technical rules and regulations for the prevention of accidents. Before assigning a task, it should be shown that the relevant qualification requirements are met.

The utility management should be responsible for providing sufficient and suitable in-service training and instructions to maintain the qualification.

6.4.3.5 Protection of labour

The drinking water utility should provide a safe environment, appropriate equipment (e.g. personal safety equipment) and work procedures. The personnel concerned should receive instruction on worker safety, with routine follow-up training as appropriate. Attention should be paid to the occupational health for all personnel with respect to specific risk in operating water systems (including outsourced personnel).

6.4.3.6 Outsourcing

When outsourcing work, the overall responsibility remains with the drinking water utility. Consequently, the utility should specify that the third-party involved

— meets all the necessary personnel and material requirements,

— is capable of ensuring the proper monitoring and checking of its own activities,

— has at its disposal staff of suitable skills, reliability and efficiency, as well as having the technical and expert knowledge required to perform the tasks in question, and

— reports reliably and regularly on its activities and the conditions of its contract.

6.4.3.7 Protection of the environment

Environmental management is an essential part of operating and maintaining a drinking water utility and should include a long-term strategy for environmental protection. The environmental impacts of operations and maintenance activities cover more than just water-related issues, and may be permanent or temporary.

Environmental management includes minimizing the impacts of operations, maintenance, construction and repair activities (e.g. noise and community disruption), protecting public health and safety as well as the water source.

6.4.3.8 Public awareness and communications

The drinking water utility should develop and implement:

— activities to raise public awareness regarding the importance, costs and operations of water supply services;

— programmes to communicate with the public regarding levels of service, user needs, water conservation and economic/social/environmental/sustainability of drinking water services.

7 Assessment of water services

7.1 General

Assessment as a process should be managed to achieve a clear and precise purpose and refer to the objectives outlined in Clause 4. The following should be established as part of a comprehensive policy (see 7.2):

— the goal and scope of the assessment (see 7.3);

— the parties involved in the assessment (see 7.4);

— the methodology of assessment (see 7.5);

— the necessary service assessment criteria (see 7.6);

— the resources necessary to conduct the assessment (see 7.7);

— the production of output and recommendations for the use of the output (7.8).

How and by whom the assessment information is to be used, should also be identified.

If not precisely specified, the assessment can cause confusion or conflicts among the parties involved.

There is a great variety of types of assessments, depending on the characteristics listed above.

EXAMPLE Environmental performance assessment, conformity assessment relating to best practice, risk assessment, audits.

The output of this process (i.e. assessment as a result) should facilitate the further decision-making process for the stakeholder requesting the assessment.

7.2 Assessment policy

The responsible body should establish a comprehensive policy for the assessment of service.

A sound assessment policy is a key component of the continuous improvement of the service. It should give a general framework for the assessment. It facilitates the determination of the actual situation and how strategic planning and decision making influences performance.

The assessment policy should address the overall efficiency and effectiveness of the strategic planning and decision-making activities. It should be designed to encompass all of the various management systems and procedures, and include self-assessment in the management component.

It should assist in the measurement of achievements of the various functions and activities performed for providing the services, closing the cycle and linking

— the set of objectives stipulated in Clause 4,

— the guidelines for satisfying users' needs and expectations in Clause 5, and

— the selected assessment criteria in Clause 6.

Assessment should be designed and implemented as a tool for promoting the development of collective learning and feedback to decision making.

7.3 Goal and scope of the assessment

The general goal of assessment is to check if the water service objectives concerning the users have been met. Objectives for the service to users are defined in Clause 4.

The goal and scope for a specific assessment should be clearly defined.

This International Standard does not deal with the assessment of the management of the utility.

Service assessments should be focused on service performance, on the satisfaction of users and on meeting the objectives for the service, but not on the means used or the detailed organization implemented for meeting the objectives.

Part of the assessment of water services deals with the assessment of service to users. For service to users, assessment should focus on the interface between the utility and the user (e.g. measuring user satisfaction). Assessment of service to users should involve effectively the users in the process. More guidance is given in ISO 24510 for identifying users' expectations and their criteria for assessing the quality of the service.

With regard to assessment of water services (in addition to the assessment of service to users), the general recommendation is to focus on the service performance. Nevertheless, some activities do not fit well with direct measurement of their performance. In such cases, indirect assessment of the performance can be accomplished through the evaluation of some management systems (e.g. risk management, security management, asset management).

7.4 Parties involved in the assessment

The responsible parties and all other parties (e.g. the assessment team) involved in the assessment should be clearly defined. Their responsibilities, their role in the process and the framework of operation for each party should be specified.

When the responsible body and the operator(s) are not the same legal body, assessment procedures, if not fixed by legal requirements from the relevant authorities, should be agreed to in advance to provide coherent assessment results from all involved parties, in accordance with respective rights and responsibilities. Concerning service to users, the responsible body and its operator(s) should take a consistent position relevant to the assessment procedures concerning service to users.

7.5 Methodology of assessment

Due to the diversity of legal, institutional and managerial systems governing water services, this International Standard does not present detailed service assessment procedures. However, this International Standard should be used to configure assessment procedures appropriate to local conditions.

The selection of the assessment tools should fit the assessment goals and scope. Performance indicator systems are one of these tools (see Clause 8).

NOTE In some cases, specifications for assessments can be required by relevant authorities or by financial investors.

Assessment methodology and procedures should be:

— developed with a capacity for repeated measurement to determine trends;

— periodically reviewed to check their efficiency and effectiveness, paying attention notably to avoidance of duplication;

— flexible to adjust to changes in goals, framework, assessment criteria and indicators as new insights are gained.

Some types of assessment procedures may be already standardized. In such cases, it is recommended that the relevant standards be used.

EXAMPLE Review [ISO 9000:2005, 3.8.7]; environmental performance evaluation [ISO 14031:1999, 2.9].

If, at a geographically relevant level (country, region and city), specifications are established for the water services, then these specifications should also include provisions concerning assessment processes (e.g. user satisfaction).

7.6 Service assessment criteria

The necessary service assessment criteria should be selected in accordance with the objectives and requirements of interest as determined by stakeholders taking into account local conditions.

Service assessment criteria are the link between objectives and performance indicators. The example below shows, for one of the objectives proposed in Clause 4, possible service assessment criteria. More examples are given in Annex E.

It should be noticed that a service assessment criteria can be related to more than one objective.

EXAMPLE

Objective: Protection of public health

An objective of a drinking water supply service should be to ensure a sufficient supply of safe and agreeable drinking water.

Possible service assessment criteria:

— meet public health and drinking water quality standards

— meet threshold or minimum microbiological, chemical and radiological quantities

— maintain system integrity

— maintain acceptable aesthetic (taste odour and colour) criteria

7.7 Resources to conduct the assessment

The responsible party for the assessment should ensure that the necessary resources, including human, financial, organizational and required information technology, are available. The team with the responsibility for carrying out the assessment should be clearly defined. This team should be empowered to specify and steer the assessment process within the given framework (e.g. goals, scope, resources, parties involved, methodology, outputs).

7.8 The production of output and recommendations for the use of the output

The output of assessment should be a report about the assessment process and its results. It should include additional guidelines for the use of these outputs. The output should make transparent the distinction between the defined targets and the actual service.

8 Performance indicators

8.1 General

Performance indicators are used to measure the efficiency and effectiveness of a utility in achieving its objectives (particularly those identified in Clause 4).

Performance indicator systems should be considered as a key assessment tool among the various existing assessment tools (see Clause 7).

Performance indicators should be used within the context of a comprehensive service assessment system. This system should include, amongst other tools, a coherent set of indicators and the related components that allow for a clear definition of these performance indicators and assist in their interpretation.

8.2 Performance indicators systems

8.2.1 Key components of a performance indicator system

A performance indicator system comprises a set of the following key components:

— performance indicators,

— context information, and

— variables.

In addition, specific targets for each indicator should be established and routinely monitored, tracked and adjusted as needed.

8.2.2 Performance indicators

Individual performance indicators should be unique and collectively appropriate for representing the relevant aspects of the service in a true and unbiased way.

Each performance indicator should:

— be clearly defined, with a concise and unequivocal interpretation;

— be assessed from variables that are easily and reliably measured at a reasonable cost;

— contribute to the expression of the level of actual performance achieved in a certain area;

— be related to a specified geographical area (and, in the case of comparison analysis, it should be for the same geographical area);

— be related to a specific time period (e.g. annual, quarterly);

— allow for a clear comparison with targeted objectives and simplify an otherwise complex analysis;

— be verifiable;

— be simple and easy to understand;

— be objective and avoid any personal or subjective appraisal.

Performance indicators are typically expressed as ratios between variables. These ratios may be commensurate (e.g. %) or non-commensurate (e.g. $/m^3). In the case of non-commensurate ratios, the denominator should represent one dimension of the system (e.g. number of service connections; total water main length; annual costs). This allows for comparisons through time, or between systems.

Variables that may vary substantially in time (e.g. annual extraction/discharge volumes), particularly if not under the control of the utility, should be avoided as denominators in the indicator ratios. An exception can be made when the numerator varies in the same proportion as the denominator.

A clear processing rule should be defined for calculating each indicator. The rule should specify all the variables required and their algebraic combination. The variables may be data generated and managed within the utility (utility data) or externally (external data). In either case, the quality of the data should be assessed (see 8.3) and verified. The interpretation of the performance indicators should not be carried out without taking into account the context, particularly if it is based on comparisons with other cases. Therefore, complementary to the performance indicators, the context information should consider also the characteristics of the system and the region in which the services are provided.

Additional information on performance indicators and grading systems for performance indicators are provided in Annexes E and F.

8.2.3 Variables

Each variable should:

a) fit the definition of the performance indicator or context information it is used for;

b) refer to the same geographical area and the same period of time or reference date as the performance indicator or context information it will be used for;

c) be as reliable and accurate as the decisions made based on it require.

Some of the variables are external data and mainly informative, and their availability, accuracy, reference dates and limits of the corresponding geographical area is generally out of the control of the utility. In this case, variables should also:

— whenever possible be collected from official sources, which include information on the accuracy and reliability of the variable(s);

— be essential for the performance indicator assessment or interpretation.

8.2.4 Context information

Context information defines inherent characteristics of a system that are relevant for the interpretation of the performance indicators. There are two possible types of context information:

— information describing pure context and external factors that are not under the control of the utility (e.g. demographics, topography, climate), and

— characteristics that can only be influenced by management decisions in the long term (e.g. age of the infrastructures).

8.3 Quality of the information

The quality of the data should reflect the importance of the assessment being conducted.

A scheme providing information on data quality is needed so that users of the performance indicators and context information are aware of the reliability of the information available. The value of the performance indicators can be questionable without this scheme.

The confidence grade of a performance indicator can be assessed in terms of its accuracy and reliability. The accuracy accounts for measurement errors in the acquisition of input data. The reliability accounts for uncertainties in evaluating the reliability of the source of the data.

An example of a confidence-grading scheme is presented in Annex F.

8.4 Example of a performance indicator

Performance indicators are relevant to service assessment criteria to which they link. The example below shows, for one of the objectives proposed in Clause 4, possible performance indicators relevant to one of the service assessment criteria shown in 7.6. More examples are given in Annex E.

EXAMPLE

Objective: protection of public health

An objective of a drinking water utility should be to ensure a sufficient supply of safe and agreeable drinking water.

Possible service assessment criteria: safe drinking water

Performance indicator: meeting or exceeding drinking water quality requirements

An example of a possible PI related to this assessment criteria is:

Performance indicator: quality of supplied water (%)

Definition: percentage of the total number of treated water tests performed that comply with the applicable standards or legislation

Processing rule: [Compliant aesthetic tests (number) + Compliant microbiological tests (number) + Compliant physical-chemical tests (number) + Compliant radioactivity tests (number)] × 100/[Treated water quality tests carried out (number)]

Comment: Each jurisdiction should establish legislated requirements or guidelines for safe drinking water and use acceptable methods of measurement. This performance indicator can also apply to individual parameters including microbiological, chemical, radioactivity, and aesthetic requirements or guidelines. This indicator should be assessed on an annual basis. It may also be assessed for periods shorter than one year, but special care is required in result interpretation when used for internal or external comparisons.

IWA[1)] **code:** QS18

NOTE Other PIs can be established and could include (but are not limited to) the following: “Aesthetic test compliance” (%, IWA code: QS19); “Microbiological test compliance” (%, IWA code: QS20).

1) IWA: International Water Association.

Annex A
(informative)

Tables of corresponding terms in English, French and Spanish

This annex contains three tables of correspondence between equivalent terms in English, French and Spanish. Table A.1 lists the English terms defined in Clause 2 in alphabetical order together with the corresponding French and Spanish terms. Table A.2 lists the French terms in alphabetical order together with the corresponding English and Spanish terms. Table A.3 lists the Spanish terms in alphabetical order together with the corresponding English and French terms.

Table A.1 — Table of corresponding terms, English alphabetical order

Numerical term	English	French	Spanish
2.1	accuracy	exactitude	exactitud
2.2	affordability	accessibilité économique	asequibilidad
2.3	assessment	évaluation	evaluación
2.4	asset	bien	activo
2.5	asset management	gestion du patrimoine	gestión de infraestructura
2.6	availability	disponibilité	disponibilidad
2.7	community	communauté	comunidad
2.8	confidence grade	niveau de confiance	nivel de confianza
2.9	connection	branchement	conexión
2.10	coverage	couverture	cobertura
2.11	drinking water	eau potable	agua potable
2.12	drinking water system	système d'alimentation en eau potable	sistema de agua potable
2.13	effectiveness	efficacité	eficacia
2.14	efficiency	efficience	eficiencia
2.15	environment	environnement	medio ambiente
2.16	indicator	indicateur	indicador
2.17	infrastructure	infrastructures	infraestructura
2.18	interruption	interruption	interrupción
2.19	maintenance	maintenance	mantenimiento
2.20	management	management	gestión
2.21	management system	système de management	sistema de gestión
2.22	on-site system	système autonome	sistema local
2.23	operator	opérateur	operador
2.24	performance	performance	desempeño
2.25	point-of-collection	point de collecte	punto de recolección
2.26	point-of-delivery	point de livraison	punto de suministro

Table A.1 (*continued*)

Numerical term	English	French	Spanish
2.27	point-of-discharge	point de rejet	punto de descarga
2.28	point-of-use	point de consommation	punto de uso
2.29	price	prix	precio
2.30	procedure	procédure	procedimiento
2.31	process	processus	proceso
2.32	quality	qualité	calidad
2.33	rate of return	taux de retour	tasa de retorno
2.34	registered user	abonné	cliente registrado
2.35	rehabilitation	réhabilitation	rehabilitación
2.36	relevant authority	pouvoirs publics	autoridad competente
2.38	reliability ⟨asset or process⟩	fiabilité ⟨bien ou processus⟩	confiabilidad ⟨activo o proceso⟩
2.37	reliability ⟨information⟩	fiabilité ⟨informations⟩	credibilidad ⟨información⟩
2.39	repair	réparation	reparación
2.40	requirement	exigence	requisito
2.41	residues	résidus	residuos
2.42	responsible body	organisme responsable	organismo responsable
2.43	restriction	restriction	restricción
2.44	service	service	servicio
2.45	service agreement	contrat d'abonnement	acuerdo de servicio
2.46	service area	zone de compétence	área de servicio
2.47	stakeholder	partie intéressée	parte interesada
2.48	sustainable development	développement durable	desarrollo sostenible
2.49	tariff	tarif	tarifa
2.50	user	usager	usuario
2.51	wastewater	eaux usées	agua residual
2.52	wastewater system	système d'assainissement	sistema de agua residual
2.53	water utility	service public de l'eau	entidad prestadora de serviciosde agua

Table A.2 — Table of corresponding terms, French alphabetical order

Numerical term	French	English	Spanish
2.34	abonné	registered user	cliente registrado
2.2	accessibilité économique	affordability	asequibilidad
2.4	bien	asset	activo
2.9	branchement	connection	conexión
2.7	communauté	community	comunidad
2.45	contrat d'abonnement	service agreement	acuerdo de servicio
2.10	couverture	coverage	cobertura
2.48	développement durable	sustainable development	desarrollo sostenible
2.6	disponibilité	availability	disponibilidad
2.11	eau potable	drinking water	agua potable
2.51	eaux usées	wastewater	agua residual
2.13	efficacité	effectiveness	eficacia
2.14	efficience	efficiency	eficiencia
2.15	environnement	environment	medio ambiente
2.3	évaluation	assessment	evaluación
2.1	exactitude	accuracy	exactitud
2.40	exigence	requirement	requisito
2.38	fiabilité ⟨bien ou processus⟩	reliability ⟨asset or process⟩	confiabilidad ⟨activo o proceso⟩
2.37	fiabilité ⟨informations⟩	reliability ⟨information⟩	credibilidad ⟨información⟩
2.5	gestion du patrimoine	asset management	gestión de infraestructura
2.16	indicateur	indicator	indicador
2.17	infrastructures	infrastructure	infraestructura
2.18	interruption	interruption	interrupción
2.19	maintenance	maintenance	mantenimiento
2.20	management	management	gestión
2.8	niveau de confiance	confidence grade	nivel de confianza
2.23	opérateur	operator	operador
2.42	organisme responsable	responsible body	organismo responsable
2.47	partie intéressée	stakeholder	parte interesada
2.24	performance	performance	desempeño
2.25	point de collecte	point-of-collection	punto de recolección
2.28	point de consommation	point-of-use	punto de uso
2.26	point de livraison	point-of-delivery	punto de suministro
2.27	point de rejet	point-of-discharge	punto de descarga
2.36	pouvoirs publics	relevant authority	autoridad competente

Table A.2 (*continued*)

Numerical term	French	English	Spanish
2.29	prix	price	precio
2.30	procédure	procedure	procedimiento
2.31	processus	process	proceso
2.32	qualité	quality	calidad
2.35	réhabilitation	rehabilitation	rehabilitación
2.39	réparation	repair	reparación
2.41	résidus	residues	residuos
2.43	restriction	restriction	restricción
2.44	service	service	servicio
2.53	service public de l'eau	water utility	entidad prestadora de serviciosde agua
2.22	système autonome	on-site system	sistema local
2.12	système d'alimentation en eau potable	drinking water system	sistema de agua potable
2.52	système d'assainissement	wastewater system	sistema de agua residual
2.21	système de management	management system	sistema de gestión
2.49	tarif	tariff	tarifa
2.33	taux de retour	rate of return	tasa de retorno
2.50	usager	user	usuario
2.46	zone de compétence	service area	área de servicio

Table A.3 — Table of corresponding terms, Spanish alphabetical order

Numerical term	Spanish	English	French
2.4	activo	asset	bien
2.45	acuerdo de servicio	service agreement	contrat d'abonnement
2.11	agua potable	drinking water	eau potable
2.51	agua residual	wastewater	eaux usées
2.46	área de servicio	service area	zone de compétence
2.2	asequibilidad	affordability	accessibilité économique
2.36	autoridad competente	relevant authority	pouvoirs publics
2.32	calidad	quality	qualité
2.34	cliente registrado	registered user	abonné
2.10	cobertura	coverage	couverture
2.7	comunidad	community	communauté
2.9	conexión	connection	branchement
2.38	confiabilidad ⟨activo o proceso⟩	reliability ⟨asset or process⟩	fiabilité ⟨bien ou processus⟩
2.37	credibilidad ⟨información⟩	reliability ⟨information⟩	fiabilité ⟨informations⟩
2.48	desarrollo sostenible	sustainable development	développement durable
2.24	desempeño	performance	performance
2.6	disponibilidad	availability	disponibilité
2.13	eficacia	effectiveness	efficacité
2.14	eficiencia	efficiency	efficience
2.53	entidad prestadora de serviciosde agua	water utility	service public de l'eau
2.3	evaluación	assessment	évaluation
2.1	exactitud	accuracy	exactitude
2.20	gestión	management	management
2.5	gestión de infraestructura	asset management	gestion du patrimoine
2.16	indicador	indicator	indicateur
2.17	infraestructura	infrastructure	infrastructures
2.18	interrupción	interruption	interruption
2.19	mantenimiento	maintenance	maintenance
2.15	medio ambiente	environment	environnement
2.8	nivel de confianza	confidence grade	niveau de confiance
2.23	operador	operator	opérateur
2.42	organismo responsable	responsible body	organisme responsable
2.47	parte interesada	stakeholder	partie intéressée
2.29	precio	price	prix
2.30	procedimiento	procedure	procédure

Table A.3 (*continued*)

Numerical term	Spanish	English	French
2.31	proceso	process	processus
2.27	punto de descarga	point-of-discharge	point de rejet
2.25	punto de recolección	point-of-collection	point de collecte
2.26	punto de suministro	point-of-delivery	point de livraison
2.28	punto de uso	point-of-use	point de consommation
2.35	rehabilitación	rehabilitation	réhabilitation
2.39	reparación	repair	réparation
2.40	requisito	requirement	exigence
2.41	residuos	residues	résidus
2.43	restricción	restriction	restriction
2.44	servicio	service	service
2.12	sistema de agua potable	drinking water system	système d'alimentation en eau potable
2.52	sistema de agua residual	wastewater system	système d'assainissement
2.21	sistema de gestión	management system	système de management
2.22	sistema local	on-site system	système autonome
2.49	tarifa	tariff	tarif
2.33	tasa de retorno	rate of return	taux de retour
2.50	usuario	user	usager

Annex B
(informative)

Schematics of drinking water supply systems

There are four essential elements or components of a drinking water supply system, as shown in Figure B.1.

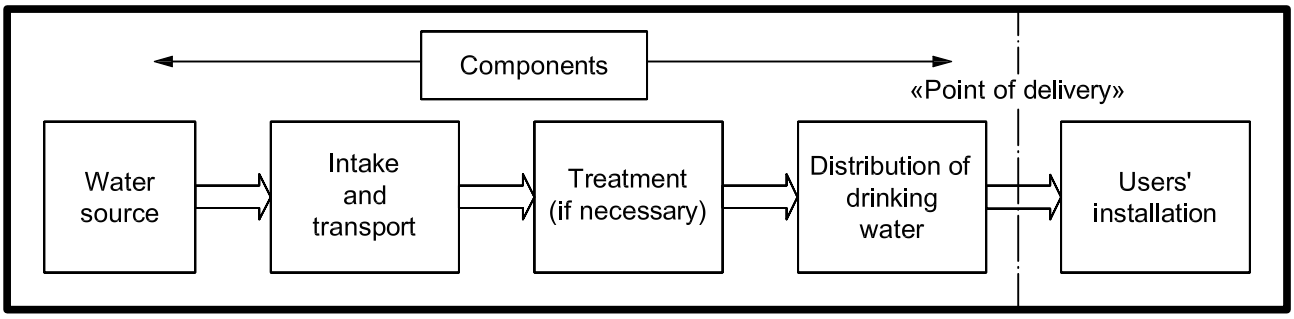

Figure B.1 — Basic schematic of a drinking water supply system

These components can be recognized in a typical on-site system, such as may be found in private water supply systems of rural residences and buildings, with the following:

— a well,

— a pump,

— piping to connect the well to the building,

— (possibly) some sort of point-of-entry or point-of-use treatment system, such as a water softener or filter, and

— a plumbing system connected to a series of taps located in the building, or in some cases to a stand pipe for common use within a village.

They can equally be recognized as elements of a central water supply system, as may be found in communities ranging from villages to cities, and even regional water supply systems supplying several communities in a given geographic area. In this case, the distribution system includes a broader distribution system of treated water mains connected to serviced buildings within the community.

Figure B.2 illustrates such a system, and indicates that there may be connections between such a system and other systems, which may be undertaken for a series of operational or security reasons.

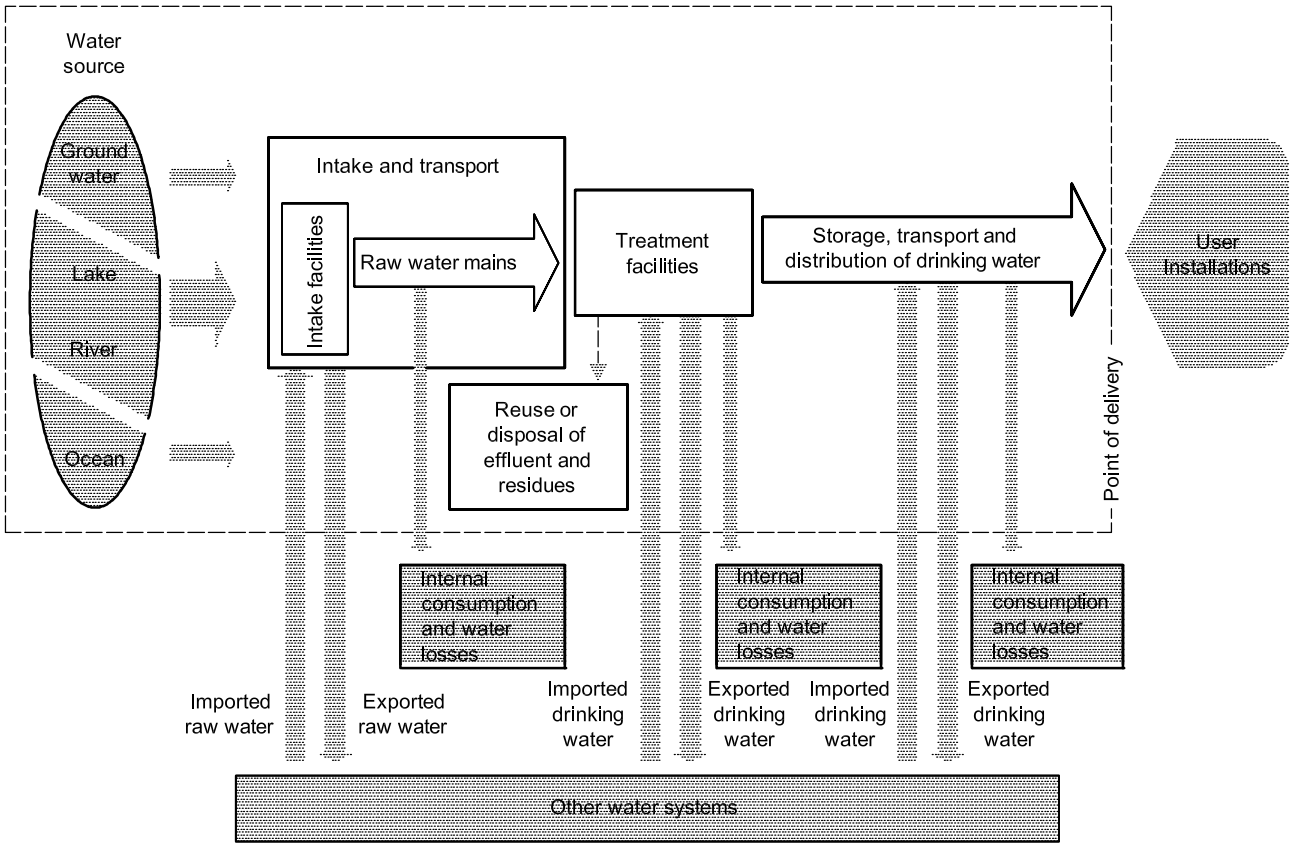

Figure B.2 — Example of a centralized drinking water supply system

Annex C
(informative)

Possible actions to achieve the objectives of the drinking water utility

In order to achieve the objectives described in Clause 4, care should be taken not to give the “means to achieve an objective” the status of being an “objective”. For example, “having a well-trained labour force” could be an objective, but it could alternatively be a means to achieving an objective such as “producing safe drinking water” or “having a sustainable water utility”.

For most objectives, a series of related action steps can be developed, as illustrated in Table C.1.

Table C.1 — Drinking water utility objectives and examples of possible actions

Drinking water utility objective	Examples of possible actions
Protection of public health (see 4.2)	— provide drinking water that is potable at the point-of-delivery to the user — provide drinking water that is aesthetically acceptable at the point-of-delivery to the user — provide sufficient drinking water to meet the public health and sanitation needs of the user
Meeting users’ needs and expectations (see 4.3)	— see ISO 24510
Provision of services under normal and emergency situations (see 4.4)	— provide a continuous supply of drinking water — provide an adequate pressure of drinking water — manage factors affecting the reliability of service
Sustainability of the water utility (see 4.5)	— ensure access to water resources — provide an adequate system capacity — maintain the substance and capacity of water resources with regard to sustainability — operate and maintain or replace the assets to maintain a good condition — have an appropriate, safe and qualified labour force — establish a pricing mechanism that is fair to customers and provide appropriate revenue flows — establish tariff structures that provide for, and recovery of all drinking water supply costs

Table C.1 (*continued*)

Drinking water utility objective	Examples of possible actions
Promotion of sustainable development of the community (see 4.6)	— contribute to sustainable integrated water resources management policies and practices including protection of water sources — reduce environmental pollution through the reduction of gas, noise and odour emissions and the discharge of effluents from drinking water supply facilities — select where possible materials of construction for assets or additives for treatment systems and infrastructure construction methods that are environmentally benign
Protection of the environment (see 4.7)	— optimize various energy consumptions — minimize the generation of environmental pollutants, the emissions of gases, noise and odours from drinking water facilities — manage residues and other wastes — contribute to and implement sustainable integrated water resources management policies and practices — protect water abstraction areas from contamination — contribute to development planning and resource allocation through consultation, provision of information and analysis in conjunction with appropriate institutions — protect water resources, freshwater quality and quantity in rivers, lakes and groundwaters

Annex D
(informative)

Further guidelines for the management of drinking water utilities

D.1 Organizational structure and responsibilities

See 6.2.2.

In addition to the person or persons in charge of checking and supervision, the water utility should have at its disposal a sufficient number of qualified staff. The number of staff required for the individual tasks and activities should correspond to the type and size of the water utility, the condition and size of the distribution system and any outsourced activities. The potential unavailability of staff due to holiday leave, sick leave and in-service training, as well as staff required for the proper control of fault and emergency situations, should be taken into account.

D.2 Planning and construction

See 6.3.

In all cases in which the abstracted water does not have the necessary quality level at all time, it should be treated to meet the qualities of drinking water. Unwanted changes of the drinking water quality level caused by drinking water treatment are to be minimized in accordance with technical standards.

Within the framework of this supply concept, all necessary approval and notice procedures should be carried out, interest in land and rights of way should be secured, technical design should be determined, and the financing of all measures should be safeguarded.

In the case of contracting, the water utility should determine and verify the contractor's professional suitability and willingness to perform the work.

In construction projects, the water utility should ensure that construction management and supervision as well as the acceptance of contracted work are carried out properly. Within the framework of acceptance of contracted work, it should be verified by suitable testing that the construction was done properly.

D.3 Operations and maintenance

D.3.1 Water transportation and distribution system

See 6.4.2.3.

Each component of the drinking water storage, distribution and transportation facilities should be operated in accordance with its standard operating procedure.

The proper operation of the storage, distribution and transportation facilities for drinking water may include the following:

— monitoring the quality of the water, by scheduled sampling and analysis at specified strategic locations in the distribution and storage facilities for public health assurance;

— carrying out surveillance programmes against drinking water theft to ensure recovery of cost through charges;

— carrying out rehabilitation programmes on components assuring the required level of hygiene as well as technical and economic viability;

— carrying out inspection and maintenance.

There should be a regular assessment of all assets (components) on their condition and functioning, in order to optimize maintenance, repair and rehabilitation programmes.

A tool, such as a mathematical model of the network, should be used in order to assess the transfer capacities of the network under real or simulated hydraulic situations.

D.3.2 Purchasing equipment, materials and products

See 6.4.3.1.

Unless the water utility has out-sourced stand-by service (for failures or faults) to third-party companies, vehicles equipped with the most important tools and aids should be kept ready for immediate dispatch in case of disruptions.

The water utility should ensure that all tools and aids are in perfect working condition throughout their service life in accordance with the laws and ordinances. To this end, status and functionality tests should be carried out at regular intervals.

Annex E
(informative)

Examples of service assessment criteria related to the drinking water utility objectives, performance indicators related to assessment criteria, and service assessment criteria related to components of a drinking water system

E.1 Examples of service assessment criteria related to the drinking water utility objectives

Drinking water objectives from Clause 4 are stated, followed by example service assessment criteria. Many service assessment criteria may be applicable to more than one objective. The examples given in this annex are considered to represent a direct relationship between objectives and assessment criteria.

a) Protection of public health

An objective of a drinking water utility should be to ensure sufficient supply of safe and agreeable drinking water (see 4.2).

Possible assessment criteria:

— meet public health and drinking water quality standards;

— meet threshold or minimum microbiological, chemical or radiological quantities;

— maintain system integrity;

— maintain acceptable aesthetic (taste odour and colour) qualities.

b) Meeting users' needs and expectations

An objective of a drinking water utility should be to ensure activities meet users' reasonable needs and expectations (see 4.3).

Possible assessment criteria: see ISO 24510 for guidance.

c) Provision of service under normal and emergency situations

An objective of a drinking water utility should be to ensure that under normal conditions drinking water supply is available on a continuous basis (see 4.4).

The objective should also be to provide drinking water to critical customers or critical service areas during emergency situations and to restore service as quickly as possible when interruptions have occurred (see 4.4).

Possible assessment criteria:

— access to the service;

— maintenance of a positive pressure in the distribution system;

— maintenance of a positive pressure that is greater than minimum requirements;

— maintenance of an adequate quantity of drinking water in the distribution system that is greater than minimum requirements;

— meet targeted risk levels;

— have a critical customer supply plan;

— keep assets in reserve (connected pipe/networks).

d) Sustainability of the water utility

An objective for a drinking water utility should be to ensure that the assets are maintained and provide capacity to meet current and future needs (see 4.5).

Possible assessment criteria:

— legal access to water sources;

— design abstraction capacity, treatment capacity;

— design distribution system capacity;

— keep the assets in good condition and optimize continuously.

e) Promotion of sustainable development of the community

An objective for a drinking water utility should be to promote the sustainable development of the community (see 4.6).

Possible assessment criteria:

— manage drinking water demand;

— participate in development planning;

— provide education and awareness programmes.

f) Protection of the environment

An objective for a drinking water utility should be to minimize adverse environmental impacts and remediate tangible adverse effects to the environment caused by the utility (see 4.7).

Possible assessment criteria:

— minimize natural water resources abstraction;

— minimize energy consumed;

— minimize pollutants generated;

— remediate contaminated river or lake beds.

Table E.1 illustrates how individual service assessment criteria could be used in respect of more than one objective.

Table E.1 — Examples of objectives and directly related service assessment criteria for a drinking water system

Assessment criteria	Objective		
	Protection of public health	Meet users' needs and expectations	Provision of service (under normal and emergency situations)
Meet public health and drinking water quality standards	✓	✓	✓
Maintain system adequate quantity of drinking water	✓	✓	✓
Maintain a positive pressure in the distribution system	✓	✓	✓
Legal access to water source		✓	✓
Manage drinking water demand		✓	✓
Minimize pollutants generated	✓	✓	
Minimize energy used		✓	
etc.			

E.2 Examples of performance indicators related to assessment criteria

E.2.1 General

The drinking water service can be assessed and the management of the systems can be improved in accordance with the objectives defined in Clause 4.

The fulfilment of these objectives can be measured in accordance with appropriate service assessment criteria by means of related performance indicators. However, performance indicators are often not the only method of measurement.

Examples of performance indicators (PI) presented in this annex have been taken from *IWA Performance Indicators for Water Supply Services*[12]. The corresponding IWA PI codes are indicated and guidelines are also provided, indicating the objectives and assessment criteria they relate to. It is noted that performance indicators and guidelines are sensitive to local conditions, and therefore those presented in this annex serve only as examples.

E.2.2 Objective: protection of public health

Possible service assessment criteria: safe drinking water, meeting or exceeding drinking water quality requirements.

An example of a possible PI related to this assessment criteria is:

Performance indicator: quality of supplied water (%)

Definition: percentage of the total number of treated water tests performed that comply with the applicable standards or legislation

Processing rule: [compliant aesthetic tests (number) + compliant microbiological tests (number) + compliant physical-chemical tests (number) + compliant radioactivity tests (number)] × 100/[treated water quality tests carried out (number)]

Comment: Each jurisdiction should establish legislated requirements or guidelines for safe drinking water and use acceptable methods of measurement. This performance indicator can also apply to individual parameters including microbiological, chemical, radioactivity, and aesthetic requirements or guidelines. This indicator should be assessed on an annual basis. It may also be assessed for periods shorter than one year, but special care is required in result interpretation when used for internal or external comparisons.

IWA code: QS18

NOTE Other PIs can be established and could include (but are not limited to) the following: “Aesthetic test compliance” (%, IWA code: QS19); “Microbiological test compliance” (%, IWA code: QS20).

E.2.3 Objective: meet users’ needs and expectations

An example of a possible assessment service criteria and PI related to this objective are:

Performance indicator: see ISO 24510 for guidance

E.2.4 Objective: provision of service under normal and emergency situations

Possible service assessment criteria: access to the service

An example of a possible PI related to this assessment criteria is:

Performance indicator: population coverage (%)

Definition: percentage of the resident population that is served by the utility

Processing rule: [resident population served by the water utility (number of persons)]/[total resident population (number of persons)] × 100

Comment: This performance indicator provides an indication of the degree to which the residential population has access to water. It is important to recognize that the drinking water supply system ensures water is continuously available under normal conditions and available to critical customers or critical service areas under emergency conditions. This indicator should refer to a pre-set reference date.

IWA code: QS3

NOTE Other PIs can be established and could include (but are not limited to) the following:

— population coverage can also be assessed differently, e.g. “Households and businesses supply coverage” (%, QS1), “Population coverage with public taps or standpipes” (%, QS5);

— in the case of developing regions, for instance, other examples of PI related to the provision of services might be “Average distance from water points to households” (m, QS7), “Operational water points” (%, QS6), “Per capita water consumed in public taps and standpipes” (l/person/day, QS8), “Population per public tap or standpipe” (persons/tap, QS9).

E.2.5 Objective: sustainability of the water utility

Possible service assessment criteria: design distribution system capacity

An example of a possible PI related to this assessment criteria is:

Performance indicator: treated water storage capacity (days)

Definition: total capacity of treated water service reservoirs tanks per unit volume of system water input

Processing rule: [total capacity of transmission and distribution service reservoirs tanks (private storage tanks excluded) (m^3)/system input volume during the assessment period (m^3)] × assessment period (day)

Comment: This performance indicator provides an indication of the reliability of the supply system. Similar performance indicators can be used for failures of service connections, hydrants, and power supplies. This indicator should not be assessed for periods shorter than one year, since this may lead to misleading conclusions. If a shorter assessment period cannot be avoided, special care is required in interpreting results. External comparisons on such time bases should be avoided. In case of bulk supply systems, if the delivery point is a storage tank, its capacity can be accounted for, even though it is neither owned nor operator by the water utility. The interpretation of the values of this indicator shall take into account the seasonal, monthly, daily and hourly peak factors.

IWA code: Ph3

NOTE Other PIs can be established and could include (but are not limited to) the following: “Raw water storage capacity” (days, Ph2); “Mains failures” (No./100 km/year, Op31); “Unit total costs” ($/m3, Fi4).

E.2.6 Objective: promotion of sustainable development of the community

Possible service assessment criteria: manage drinking water demand

An example of a possible PI related to this assessment criteria is:

Performance indicator: inefficiency of use of water resources (%)

Definition: percentage of water that enters the system and is lost by leakage and overflows up to the point of customer metering

Processing rule: [real losses during the assessment period (m^3)/ system input volume during the assessment period (m^3)] $\times$ 100

Comment: This indicator should not be assessed for periods shorter than one year, since this may lead to misleading conclusions. If a shorter assessment period cannot be avoided, special care is required in interpreting results. External comparisons on such time bases should be avoided. This indicator is not recommended to be used as a measure of efficiency of management of the transmission and/or the distribution system.

Guidance: Sustainable development is the ability of the community to grow and prosper without limiting the use of the water resources, including:

a) contribution to and implementation of sustainable water resources; and

b) contribution to development planning and resource allocation of the water resources.

IWA code: WR1

NOTE Other PIs can be established and could include (but are not limited to) the following: “Water resources availability” (%, WR2); “Reused supplied water” (%, WR4); “Population coverage” (%, QS3).

E.2.7 Objective: protection of the environment

Possible service assessment criteria: minimize natural water resources abstraction

An example of a possible PI related to this assessment criteria is:

Performance indicator: reused supplied water (%)

Definition: percentage of water entering the system that is reused

Processing rule: [reused supplied water during the assessment period (m^3)/system input volume during the assessment period (m^3)] $\times$ 100

Comment: This indicator should not be assessed for periods shorter than one year, since this may lead to misleading conclusions. If a shorter assessment period cannot be avoided, special care is required in interpreting results. External comparisons on such time bases should be avoided. This indicator is applicable to systems when there is the need to use treated wastewater to complement the conventional available water resources.

IWA code: WR4

NOTE Other PIs can be established and could include (but are not limited to) the following: “Water losses per service connection” (m3/connection/year, Op23); “Recycled treatment sludge” (%); “Inefficiency of use of water resources” (%, WR1); “Water resources availability” (%, WR2); “Standardised energy consumption” (kWh/m3/100m, Ph5).

E.3 Examples of service assessment criteria related to components of a drinking water system

E.3.1 General

A drinking water system can have the following components (see Clause 3):

— water resources (see E.3.2),

— intake and transport (see E.3.3),

— treatment if necessary and, if appropriate, disposal of residues (see E.3.4 and E.3.6), and

— storage, transport and distribution (see E.3.5).

Assessment criteria can also be related to these components. E.3.2 to E.3.6 provide some examples of assessment criteria related to the above listed system components.

E.3.2 Examples of assessment criteria related to water sources

The following are examples of assessment criteria related to water sources:

— surface or groundwater access,

— adequacy of source,

— protection of source,

— water quality,

— withdrawal facilities,

— monitoring and recording, and

— environmental sustainability.

E.3.3 Examples of assessment criteria related to intake and transport

The following are examples of assessment criteria related to intake and transport:

— permission for water withdrawal,

— capacity to meet existing and future needs,

— sustainability of intake and transport,

— condition assessment,

— operation and maintenance,

— monitoring,

— safety and training, and

— environmental sustainability.

E.3.4 Examples of assessment criteria related to treatment

The following are examples of assessment criteria related to treatment:

— capacity to meet existing and future needs,

— meet user expectations,

— ability to meet and sustain public health requirements,

— redundancy and reliability,

— ability to sustain quality of treated drinking water,

— plant integrity,

— safety and training,

— efficiency, and

— ability to meet environmental requirements.

E.3.5 Examples of assessment criteria related to storage, transportation and distribution

The following are examples of assessment criteria related to storage, transportation and distribution:

— capacity to meet existing and future needs,

— coverage,

— integrity of equipment,

— tightness and leakage,

— operation and maintenance,

— monitoring,

— safety and training, and

— meet user expectations.

E.3.6 Examples of assessment criteria related to the disposal of residues

The following are examples of assessment criteria related to the disposal of residues:

— quality and quantity of effluent,

— environmental requirements, and

— reuse.

Annex F
(informative)

Example of confidence-grading scheme for performance indicators systems

The quality of input data should be assessed in terms of the reliability of the source and of the accuracy of data. The reliability of the source accounts for uncertainties in how reliable the source of the data may be, i.e. the extent to which data source yields consistent, stable and uniform results over repeated observations or measurements under the same conditions each time. The accuracy accounts for measurement errors in the acquisition of input data.

NOTE 1 No measurement device is completely accurate, and some of the data for use in assessing the performance indicators may have been obtained by less accurate methods.

NOTE 2 Old records can be reliable in terms of depicting the current situation of assets.

Practice shows that, in general, data providers do not have detailed information on reliability and accuracy, but are able to provide informed estimates, if broad bands are adopted. An example of possible data accuracy bands is given in Table F.1.

Table F.1 — Example of data accuracy bands

Accuracy band %	Associated uncertainty
0 to 5	Better than or equal to ± 5 %
5 to 20	Worse than ± 5 %, but better than or equal to ± 20 %
20 to 50	Worse than ± 20 %, but better than or equal to ± 50 %
> 50	Worse than ± 50 %

An example of possible bands for the reliability of the source is given in Table F.2.

Table F.2 — Example of data source reliability bands

Reliability band	Definition
★★★	Highly reliable data source: data based on sound records, procedures, investigations or analyses that are properly documented and recognized as the best available assessment methods.
★★	Fairly reliable data source: worse than ★★★, but better than ★.
★	Unreliable data source: data based on extrapolation from limited reliable samples or on informed guesses.

For instance, a variable measured with an estimated uncertainty of ± 12 % and from a highly reliable source will have a confidence grade of [5 % to 20 %/***].

Data source reliability and data accuracy should be assessed for every input variable.

Clearly, a [0 % to 5 %/***] confidence grade can be achieved for some input variables, although it may not be generally attainable for every variable. Utilities should aim for a grade of at least [5 % to 20 %/**].

Confidence grades can only be estimated directly for the variables. Based on these, uncertainty assessment of the resulting PI should be assessed as well, either quantitatively or, at least, qualitatively. Quantitative assessment should be based on the uncertainty propagation theory, in accordance with the *Guide to the expression of uncertainty in measurement (GUM)*[8].

Confidence grades should be assessed for every water service and for every indicator. To make it possible for comparisons to be carried out between services, confidence grades should be chosen appropriately and applied consistently.

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