Aqua Rating

Focused Analysis

Water **Losses Management** in Water and Sanitation Utilities

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Focused Analysis

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Contents

Introduction

This document is part of a collection named "**Focused Analyses,**" which addresses relevant themes within the provision of water and sanitation services in a particular way.

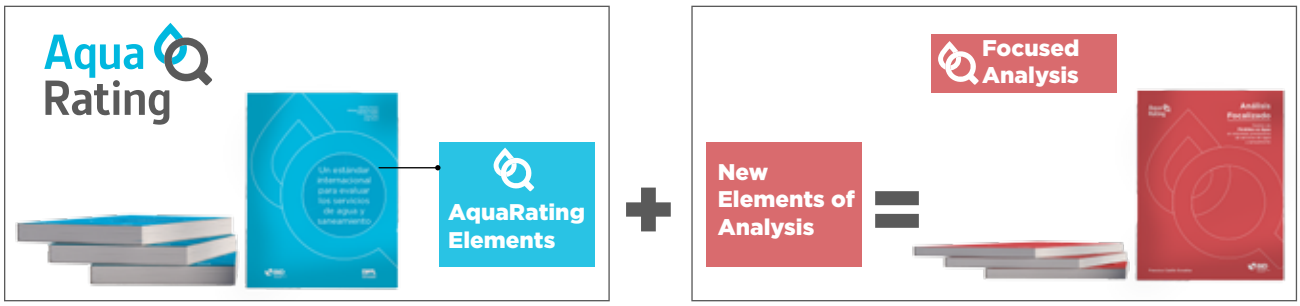
The **Focused Analyses** aim to establish a method and criteria for the characterization and assessment of a particular aspect of the management of provision of the aforementioned services in areas such as: Innovation, Climate Change, and Water Losses, the latter being the subject of the current document. These and other Focused Analyses can be found at www.aquaRating.org.

The idea for developing this collection was born of the need to approach a partial and focused way of analysis from a different perspective, a concrete means, within a broad, comprehensive framework, of applying the AquaRating[1] system in the context of a company. The characterization is developed through a series of indicators and parameters that facilitate the analysis of the particular subject in this Focused Analysis.

A Focused Analysis studies the possible links with information that has already been taken into account within the **AquaRating** evaluation structure, and which complements the identification of information and additional parameters needed for a particular characterization of this new focus and perspective.

1 www.aquaRating.org

Finally, we make an assessment of the feasibility of expanding the AquaRating evaluation elements based on the experiences and new parameters identified in this document, all with the end of developing a **Focused Characterization.**



The purposes of a Focused Analysis include:

- Having at a better understanding of a certain aspect of the management of water and sanitation services
- Developing a more focused characterization of a certain aspect of management
- Identifying potential improvements and additions to the AquaRating evaluation structure
- Helping to better understand the processes and the ecosystem of a specific aspect of management

The current document tackles the subject of the management of losses in water supply and distribution networks, understanding the term “losses” in the broadest sense, with respect to the volume of water whose use or final destination is not known with certainty, is not accounted for, or is simply not billed or does not generate revenue for the company.

This document is organized in the following manner:

First, we offer a brief review of the types of losses that occur in the management of supply and distribution of water services, identifying the most frequently used terminology and the main components and means of evaluating said services.

Next, we examine the different lenses through which losses management is evaluated, with respect to losses volumes, infrastructure, and losses management practices. Additionally, we identify the distinct elements that make up the focused characterization of evaluation and practices related to management and evaluation of losses, those that are already taken into account within the AquaRating framework, as well as some individual variables that complement our understanding of losses management.

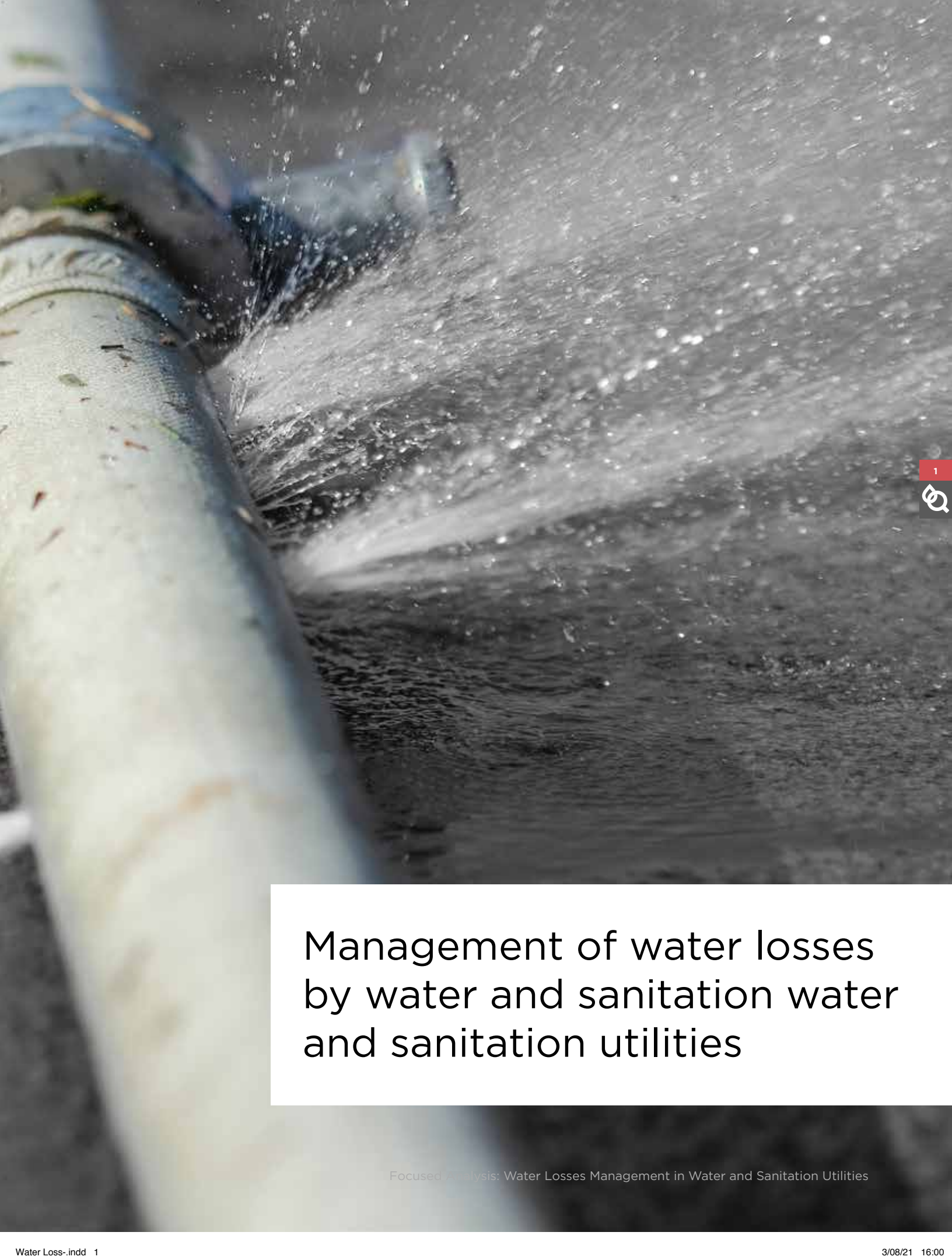
Following that, we detail the content of each focus area, which contains a series of elements like practices and indicators that are included in the AquaRating standard, as well as elements that are not explicitly included in the AquaRating framework but which are considered necessary for a more detailed and complete analysis of management and performance related to losses. Each section details the proposed considerations that must be taken into account for the development of the Focused Characterization that combines the elements described in the distinct sections of this document.

Finally, we include reliability tables for each of the different evaluation elements, a Glossary with the terms used in this document, and a summary of the evaluation elements used that did not form part of the structure of the AquaRating elements.

AquaRating Results and Products

The AquaRating Certification, the AquaRating Characterization, the Focused AquaRating Characterization and other AquaRating Products are based solely on the information provided by the Water and Sanitation Service Provider, and as such, the responsibility for the accuracy and authenticity of said information remains exclusively with the Service Provider. Similarly, the results of the auditing process carried out by the auditing firm are based on information provided by the Service Provider; as such, the Inter-American Development Bank is not responsible for, nor does it certify, the audit results.

The results of the AquaRating Characterization and/or the AquaRating Certification and/or the Focused Characterization, and all of the information and documents related to the implementation of AquaRating, do not necessarily reflect the opinion of the Inter-American Development Bank (IDB), nor of its Executive Director, nor the countries it represents.



Management of water losses by water and sanitation water and sanitation utilities

Water losses in distribution networks, both real and apparent, are principal challenges for the water supply sector, and are considered a fundamental indicator of efficacy with respect to infrastructure and its management. The aging infrastructure of distribution networks and their inadequate functioning are the most frequent causes of real losses, while apparent losses are typically the consequence of inefficient practices in different management processes, ranging from the accurate and complete measurement of flow and consumption, billing, charges or fraud control. Together, both real and apparent losses combine to create total system losses. The search for efficiency should include practices for identifying and combating losses, based on the particular context of each setting.

Real Losses

Real water losses, also known as physical losses, are always impossible to quantify with absolute precision. In many cases, the water is lost at the infrastructural level, whether through flows or storage, through small fissures or at joints and openings, or in hidden locations that are beyond view. Although these kinds of losses may, individually, represent a small losses, their duration across time, when continuous, can represent a significant losses volume.

Management of water losses by water and sanitation utilities

Infrastructure breaks that result in outflows of surface water, whether in the form of flowing water or in the form of humidity, are also counted as physical losses. The volume lost in either case cannot be known with precision, given that it is impossible to know the exact moment when the rupture occurred, and similarly impossible to know the losses flow rate. In these cases, although the flow is high and visible, the contribution to the total volume of physical losses might not be significant, since these are likely to be of a shorter duration. In contrast, hidden leaks with even a small flow (sometimes undetectable) represent significant volumes of losses because they continue leaking over long periods of time.

Physical water losses are of principal concern, as they represent inefficient resource management of water that has been captured, treated, and, in many cases, sent into the distribution system, but which does not reach its intended destination and which, furthermore, tests the capacity of the infrastructure and systems that have to manage it.

The importance of physical water losses is not limited to infrastructure size and operation costs. Physical water losses also have environmental impacts because they represent an increase in the volume of water that is taken from the natural environment and then returned to aquifers or the drainage system or via other unknown means. Physical losses increase flows through infrastructure and affect service pressure levels for each end user. They are also a possible point of entry for agents that can contaminate the distribution networks.

When they are finally detected or when they reach a flow level that make them visible, such leaks generate service interruptions when the repair processes commence, precipitating supply interruptions in the service area.

Total Losses

When one uses the term “losses” without any kind of qualifier, it is often understood that the term refers to physical losses. Nonetheless, in specialist literature, it is understood that it is impossible to quantify precisely the total cost of physical water losses, and that when the global term “losses” is used, or when total losses include both “real” (that is, physical) and “apparent losses” whose volumes have been taken into account within the system of supply and distribution, that these have not been recorded by measurement instruments for flow and consumption. As a result of this lack of information about unrecorded volumes, when a calculation is made to

determine what is incorporated into the system and what is measured and used, both real and apparent losses caused by lack of measurement should be included. In this way, the balance between what is incorporated into the system and what is consumed or exported should be identified as “Total Losses.”

Fraudulent use or errors caused by insufficient precision in measurement of individual consumer use via micro-meters are an example of some types of apparent losses. For this reason, when referring to total losses as the sum of real and apparent losses, other terms are frequently used that reflect greater precision, such as “water not accounted for,” when referring to differences in readings with respect to system inputs and outputs. “Non-billed water” is also used to refer to volumes that are introduced into the system but which do not get invoiced for later collection. This term – beyond including both real and apparent losses – also applies to billing policies and authorized uses without billing each company, or invoices that do not measure use.

Non-revenue water (NRW) is the term used to refer to specific economic factors, which include water volumes that, billed or non-billed, do not translate into revenue for the company. The term includes real and apparent losses, billing policies, and collection practices. Both non-invoiced water and apparent losses are sometimes included when referencing comercial losses. This is a very quick overview of the component parts, focuses, and terms used in water losses management, which served as the basis for preparing this document and for identifying parameters for efficient management.

Water losses is relevant because it is a highly representative indicator of the efficiency in the management of supply and distribution systems.

The document addresses water losses management in its broadest sense, from the identification of parameters and indicators that can best describe different understandings of losses, such as those that are useful for an analysis of management policies and their performance with respect to the results they obtain.

Definition of criteria for characterization and assessment

Parameters to evaluate the scope and amount of each of the main components of a storage and supply system should be used to begin understanding the variables that affect total losses in a supply and distribution system. In addition, it is important to identify and consider all the variables that help us to know and evaluate the direct and indirect factors that influence the final amounts of components and their respective losses within the system. Examples of these variables include: techniques used for active management; the process for searching for and repairing leaks; or those variables that describe the degree of infrastructure deterioration and its exposure to bursts and leaks.

This group of parameters that influence and determine losses volumes are referred to in this document as management practices and management structure, and include both the availability of infrastructure, resources, equipment, and technology, as well as the procedures and techniques used by and the capabilities of the people who manage the system.

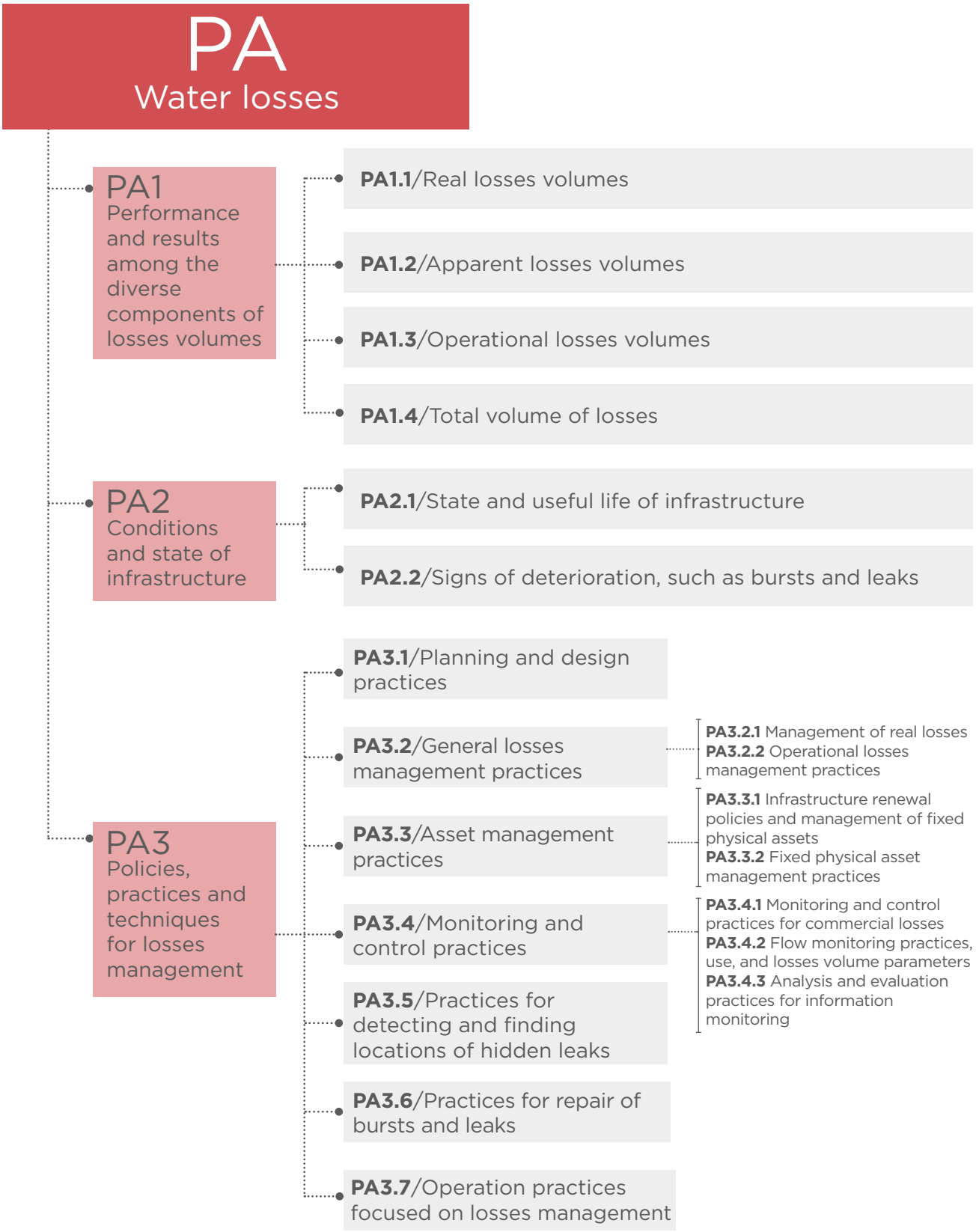
The proposed characterization rests upon the following approaches:

- A holistic characterization of capacities, techniques, structures, and results.
- Quantification of the different components of total losses within a distribution network.
- Characterization of the structural conditions of the distribution network.
- Evaluation of the variables that contribute to and explain the volumes and components of total losses.

For each of the approaches, we have used elements that are already taken into account within the AquaRating evaluation structure (such as indicators or management practices) and additional practices and indicators that are not included in the AquaRating evaluation structure.

- The PA Focused Characterizationtries to quantify the integrity of practices and results, and has a global perspective.
- Approach PA1 specifically addresses performance in terms of total losses volumes and their respective components.
- Approach PA2 addresses performance, confining itself to variables such as the state of infrastructure, as it is the main determinant of bursts, leaks, and malfunctions within the supply and distribution networks and, consequently, of real losses.
- Approach PA3 addresses all of the factors that impact the outcomes, taking into account the two previous approaches, the state of infrastructure and the volumes of distinct types of losses. In other words, Approach 3 takes into account all of the practices and techniques of operation and management.

Each approach has, in turn, a series of groups that describe what is intended to be measured in each case, as described in the following graphic:



The following method has been used for the weighting and normalization of the different descriptive elements noted:

Initial evaluation based on a single value that references the strategy, results, and global management as they relate to a company's water losses. This will reflect the overall PA approach, and is determined based on a weighting of each of the PA1, PA2, and PA3 approaches.

Secondly, a parameter is sought to describe each approach, for which it is necessary to identify the elements (practices, technologies, etc.) associated with each approach and how to weight and group them.

At the same time, more detailed approaches have been identified for certain groups, with the elements and weights with which they should be grouped, also having been identified.

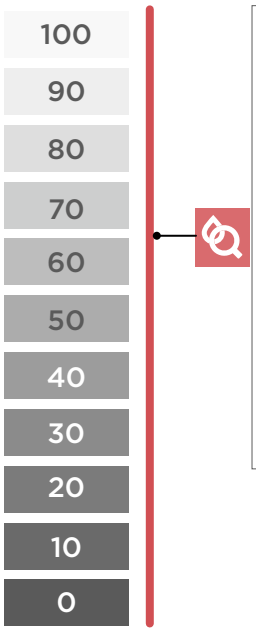
Finally, in Chapter 4 we present the global descriptive indicator and the different approaches and groups, with each case accompanied by a table that includes the codes for descriptive elements and their relative weights, taking each case into account individually and as part of a larger group.

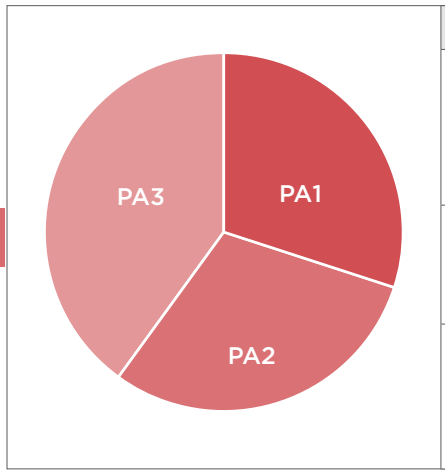
PA1	Performance and results among the diverse components of losses volumes
PA2	Conditions and state of the infrastructure
PA3	Policies, practices and techniques for losses management

The global value of the Focused Characterization of the company's water losses management will be the result of the grouped and weighted characterization of the set of elements mentioned in this document. It aims to represent, in a single value, the totality of management indicators and practices related to a company's losses management. It is understood that losses are total, and include each of its main components.

The global value will be determined with the values resulting from the different approaches (PA1, PA2 and PA3), weighted in accordance with what is laid out in the following table, which, in turn, breaks down information into specific groups, individual practices, and indicators.

The global value will fall in a range between 0 and 100, and will be accompanied by a reliability factor that has been applied in determining said global value. Reliability will refer to the mean of the reliabilities that have been calculated for each of the approaches, using the same weights.





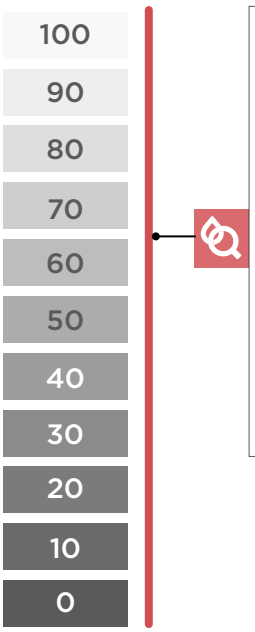
Approach	Weight	Description
PA1	3	Performance and results among the diverse components of losses volumes
PA2	3	Conditions and state of the infrastructure
PA3	4	Policies, practices and techniques for losses management

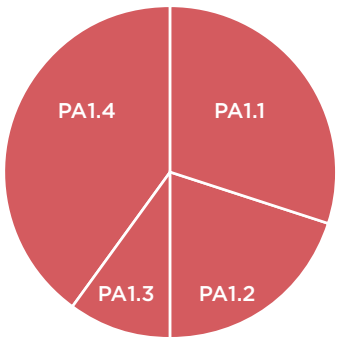
Approaches for the focused characterization of water losses management in water and sanitation companies

PA1 Performance and results among the diverse components of losses volumes

The characterization of performance and results as they relate to the diverse components of losses volumes aims to synthesize the full range of indicators that reflect the amounts of main losses components, as well as total losses values, in a single value. The intent is to place a value on performance that is based exclusively on losses volumes. This value will be the result of grouped characterization and will be weighted with all the volumes of real, apparent, operational and total losses.

The value will include a consolidation of the groups PA1.1 to PA1.4, corresponding with the PA1 approach and their relative weights from the table below. The evaluation will be the result of these groups, represented on a scale from 0 to 100, which will be accompanied by the corresponding reliability value.





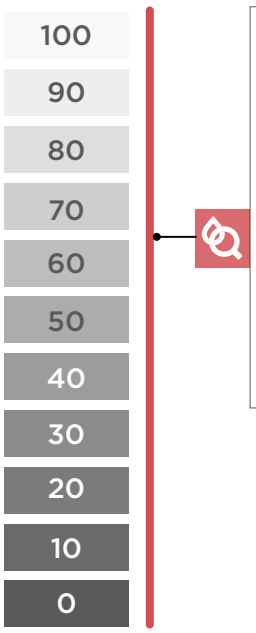
Group	Weight	Description
PA1.1	3	Real losses volumes
PA1.2	2	Apparent losses volumes
PA1.3	1	Operational losses volumes
PA1.4	4	Total volume of losses

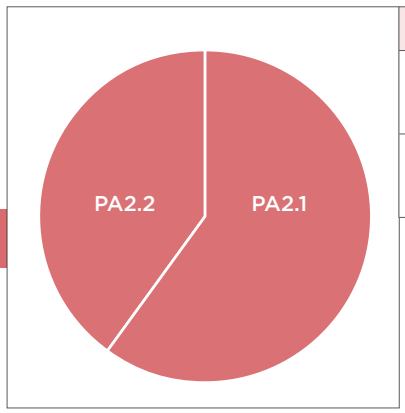
- Evaluation of real losses PA1.1: Evaluates real losses by estimating annual volumes deducted from water balances along with the number of bursts and leaks detected, and costs of preventive and corrective maintenance along the distribution network
- Evaluation of apparent and comercial losses PA1.2: Evaluates the control of use and end-user consumption, along with billing and collection practices, and the efficacy of said practices
- Evaluation of operational losses PA1.3: Evaluates both the losses of water volumes caused by the operating activities of the supply and distribution systems, as well as supply disruptions caused by repair work for bursts and leaks
- Quantification of total losses PA1.4: Evaluates the water that has been incorporated into the supply and distribution systems, but has not been billed.

PA2 Conditions and state of the infrastructure

The characterization of the structural conditions of the distribution network aims to synthesize into a single value, the state of deterioration and the useful life of the infrastructure that comprise the distribution networks within the evaluation area. The characterization will be the result of the grouped and weighted characterization of the evaluation of the state and useful life of the infrastructure, as well as the deterioration in the form of detected bursts and leaks.

It will include the grouping of PA2.1 and PA2.3, using the PA 2 approach, with the relative weights noted in the table below. The score will be the result of these groupings, referenced on a scale from 0-100, which will be accompanied by the corresponding reliability value.



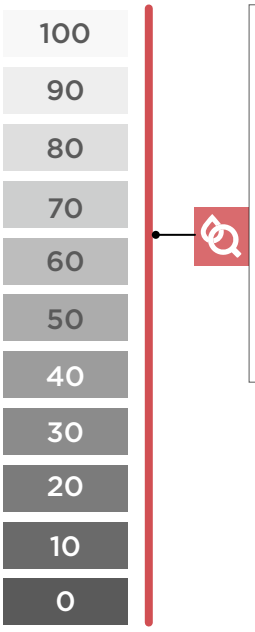


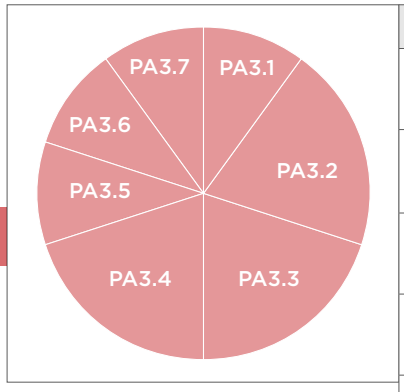
Group	Weight	Description
PA2.1	6	State and useful life of the infrastructure
PA2.2	4	Evidence of deterioration, such as bursts and leaks

PA3 Policies, practices and techniques for losses management

The definition of losses management policies, practices, and techniques aims to synthesize, in a single value, the totality of a company's losses management practices and techniques. This will be the result of the grouped and weighted characterization of the variables included in the table below.

It will include a grouping of PA3.1 through PA3.7, that correspond to the PA3 approach, with their relative weights as identified in the table below. The score will be the result of these groupings, referenced on a scale of 0 to 100, which will be accompanied by the corresponding reliability value.





Group	Weight	Description
PA3.1	1	Planning and design practices
PA3.2	2	Generic losses management practices
PA3.3	2	Asset management practices
PA3.4	2	Monitoring and control practices
PA3.5	1	Detection and location practices
PA3.6	1	Rupture and leak repair practices
PA3.7	1	Operational practices focused on losses management

At the same time, groups PA3.2, PA3.3 and PA3.4, which constitute approach PA3, from evaluation to planning, operation, and management in general, have been segregated into subgroups that permit a more detailed analysis that allows us to better describe and, later, identify, opportunities for improvement. Below, we name the subgroups, which will be further detailed later in the document:

PA3.2 Generic losses management practices:

Subgroup	Weight	Description
PA3.2.1	7	Management of real losses
PA3.2.2	3	Operational losses management practices

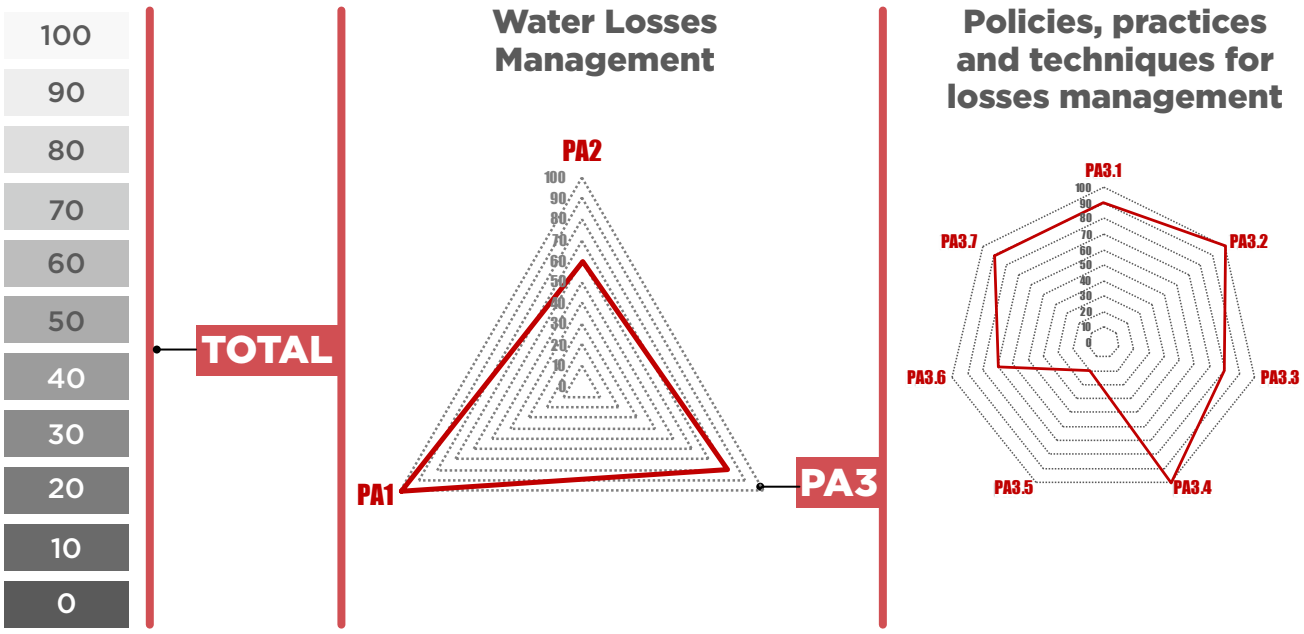
PA3.3 Asset management practices:

Subgroup	Weight	Description
PA3.3.1	7	Infrastructure renewal policies and management of fixed physical assets
PA3.3.2	3	Fixed physical asset management practices

PA3.4 Monitoring and control practices:

Subgroup	Weight	Description
PA3.4.1	3	Monitoring and control practices for commercial losses
PA3.4.2	2	Flow monitoring practices, use, and losses volume parameters
PA3.4.3	5	Analysis and evaluation practices for information monitoring

For example, the Focused Characterization of water losses management in a water and sanitation utility can have a final score of 44/100, as observed in the following graphic, which is calculated by the weighted grouping of its three approaches, where each approach has equal weight; approach PA3, which measures "Policies, practices and techniques for losses management," has a score, in this example, of 86/10, as a result of the weighting of the component groups, as well as the calculations, weights, and reliability of the other factors.



Variables that comprise the focused characterization

The integrated characterization of a company's losses management approach must be based on a set of parameters that reflect the company's management practices and techniques, along with the evaluation of these techniques' efficacy.
Next, we present a set of parameters and indicators that allow a global, detailed characterization of losses management, as well as a decision-making analysis. In each case, only the parameters that are most significant and useful for the purpose should be chosen and applied.

Losses management is a prominent part of the overall provision of water supply and distribution services, which is why it has been explored and discussed frequently, with a wide variety of indicators suggested by institutions such as the International Water Association (IWA), or other international experts in the field, who draw from a wide range of research references.

The development of the proposed indicators and parameters included in the current document has taken into account all of the indicators that are endorsed by international losses management experts, as they have been used and determined viable as good management practices and techniques, as well as for performance measurement.

In addition to the most widely-used indicators, another set of parameters must be developed to help us better understand results and their implications, depending upon the reason and purpose for which losses diagnosis is conducted within a system. This integrated definition incorporates methods, practices, capacities and techniques, making possible an integrated analysis of the range of variables that can explain or describe performance, including: volumes of water with an unknown destination; infrastructure condition as it impacts losses volumes; and service problems.

As indicated in the previous sections, the information collected for and from a company in the AquaRating applications, provides essential data that allow us to determine the most commonly-used parameters for a holistic evaluation of practices and outcomes. Below, we enumerate and describe the parameters and indicators to be used in this holistic characterization of losses management in a water distribution system, as well as the way to determine them using the information collected through AquaRating and those that are identified and proposed in this document.

The proposed parameters are directly and individually linked to an indicator, or reflect a set of indicators or practices, which in turn reflect as a whole, a significant aspect of the management of global losses or losses of one of the main components.
The definition of these parameters is always accompanied by a number that reflects the reliability or precision with which they have been determined, using a methodology similar to that used for AquaRating.

Complementary individual values to analyze water losses management in water and sanitation companies

A. Characterization of water incorporated into the system that does not produce revenue (Non-revenue Water NRW)

Employs 3 parameters:

- Amount of water that is not billed. Expressed by the percentage relationship between the volume of water that has not been billed (regardless of collection) and the volume of water that has entered the entire distribution system. It corresponds to the raw score (before normalizing) of AquaRating indicator SF3.4 AquaRating, which is found in group PA1.2 of the current document
- Average reliability of the two variables used to calculate SF3.4
- Normalized characterization, referenced on a scale of 0 to 100 (and affected by reliability) in AquaRating. Normalized value of SF3.4

B. Indicator of real losses

Employs 5 parameters:

- Amount of real losses. Expressed, based on the density of user connections, in m/3 length of the distribution network in Km and day, if the density is less than 20 connections per km. Expressed in m^3/number of connections and day, if the density of connections is more than 20 connections per km. from the point of distribution. It will be the raw score (before normalizing) of AquaRating indicator EO1.4, found in group PA1.1 of the current document
- Reliability of the estimate of real losses as an average score of the reliabilities of the variables used in the calculation of EO1.4
- Characterization normalized to a scale of 0 to 100 (affected by reliability) in AquaRating. Normalized value of EO1.4
- Amount of real losses expressed as a percentage of entry into the system. This will correspond to the parameter defined in Section 5, as in PA1.5.1
- Reliability of real losses, expressed as a percentage of the volumes contributed to the system. Average score of the reliability of EO1-V3 and EO1-V2

C. Global characterization of the practices and techniques used in the management of real losses

Employs 2 parameters:

- This will be the value resulting from the grouped characterization of practices included in the EO1.3 AquaRating element, with the same internal distribution of weights, which is found in group PA3.2.1 in the current document. The indicator will be the result of these groupings, and will reference a scale from 0 to 100.
- The indicator will be accompanied by the reliability score that corresponds to the reliability groupings that were applied to calculate the characterization values, using the same weights.

D. Indicator for uncontrolled water

Employs 3 parameters:

- Amount of water provided to the system, but not measured in the individual use measurements taken at each point of use or at consumption. Expressed by the percentage relationship between the volume of water introduced into the system that has not been measured by individual meters, and the volume of water incorporated into the entire distribution system. It corresponds to the raw value (not normalized) of AquaRating variable EO1.2 that is in group PA1.2 of the current document.
- Reliability determined as the mean of the two variables that are used in the calculation of EO1.2.
- Normalized characterization (affected by reliability) in AquaRating.

E. Relationship between commercial and real losses

This allows an assessment of the relative distribution of the water balance volumes that are linked to the estimates of physical losses and estimates for unbilled water.

Employs 2 parameters:

- Quantification of the relationship between the volume of commercial losses (non-revenue water) and the volume of real (or physical) losses. (([EO1-v2]-[SF3-V11]) / [EO1-V3])
- Reliability determined as the mean of calculated variables. EO1-V2, SF3-V11 and EO1-V3

F. Obsolescence indicator in the distribution network

This parameter offers orientation about the state of infrastructure that comprises the distribution system, which is linked to the probability of the existence of leaks and the occurrence of bursts.

Employs 3 parameters:

- Percentage of the components of the distribution network (pipes, connections, and other elements) with a residual useful life of less than five years. Corresponds with indicator PA2.1.1
- Reliability of the previous obsolescence indicator
- Normalized characterization of PA2.1.1, affected by the reliability factor

G. Minimum overall nocturnal flow in direct areas of the distribution network

This is an indicative value of real losses within distribution networks. As it is a global value representing the entire scope of direct supply (without taking into account storage and regulation factors) and has an average annual value, the minimum overall nocturnal flow value will not help in the detection and location of leaks to improve efficient management of losses; however, it will provide information about possible losses that have not yet been detected or about fraudulent consumption at night. As it is a global value that is usually obtained as the sum of supply amounts to areas, districts, or distribution sectors, it opens up possibilities for each area of the sector, thereby pointing to and prioritizing areas for active losses management practices.

Employs 3 parameters:

- The raw score resulting from PA1.1.1, expressed in liters per property, per hour
- The normalized value of PA1.1.1. on a scale of 0 to 100
- The reliability of PA1.1.1

H. Characterization of the management of commercial and apparent losses

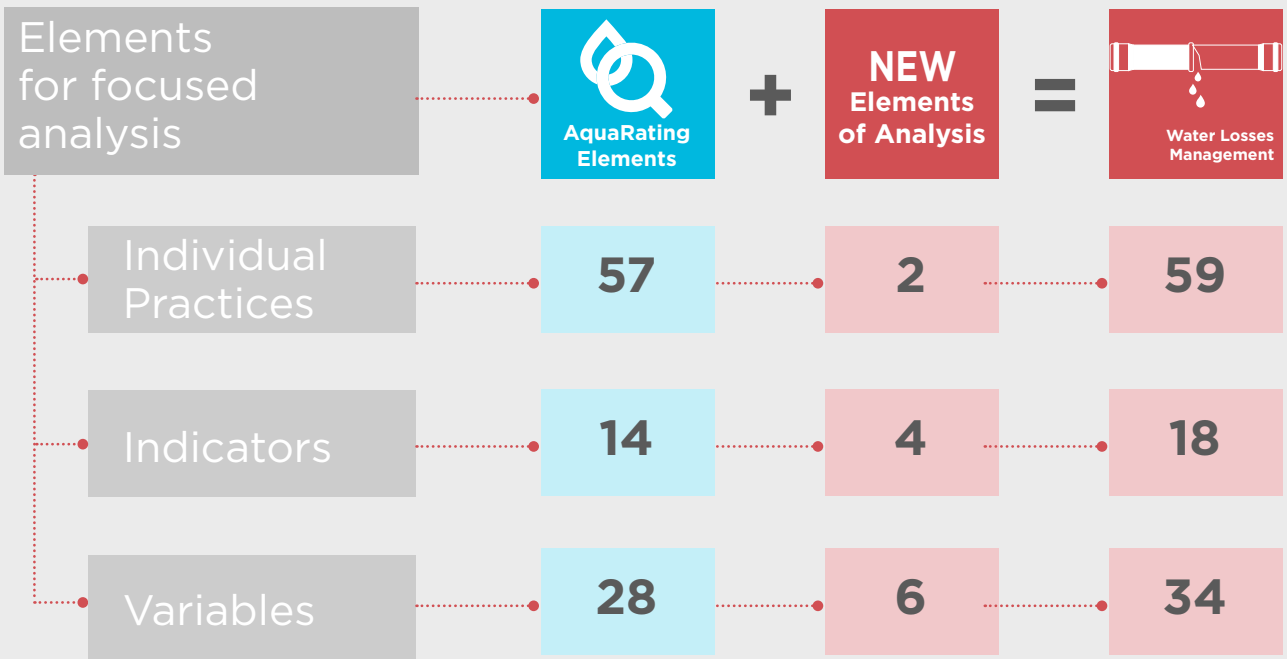
This is the score resulting from the grouped and weighted characterization of the set of methods, practices and techniques used to manage commercial and apparent losses.

Employs 2 parameters:

- This will be the score resulting from the grouped characterization of the practices included in the EO1.1 AquaRating element, with the same internal distribution of weight. The indicator will be a result of these groupings, and will be represented on a scale of 0 to 100.
- The indicator will be accompanied by the reliability value that corresponds to the group of reliabilities that were applied to calculate the descriptive values, using the same weightings.

Focused Characterization of water losses management in water and sanitation utilities

The Focused Characterization of water losses management in water and sanitation utilities is comprised of a total of 59 individual practices, 18 indicators and 34 variables resulting from the combination of elements included in the AquaRating standard, as well as new, specific items for analysis.



Focused Analysis: Water Losses Management in Water and Sanitation Utilities

Elements of analysis included in the AquaRating structure

The first step has consisted in the search for and identification of the elements for evaluation, the indicators, variables and individual practices already included in the AquaRating structure, which are related to some of the approaches or descriptive groups of losses management that were mentioned in earlier sections.

Fifty-seven elements for evaluation have been identified, 14 of them being of a quantitative nature, to which 28 variables are applied. The rest of the elements belong to a group of management practices and techniques.

Each element taken from AquaRating maintains its original coding, and is identified in the first column of the descriptive tables with a "  ".

New elements of analysis that are not included in the AquaRating structure

In addition to the evaluative elements and practices considered in the AquaRating structure, it is important to take into account additional practices, indicators and variables for a more complete, detailed characterization of the company with respect to its water losses management policies and practices, in accordance with the identified components.

The additional elements considered include 2 individual practices, 4 evaluative elements of a quantitative nature, and 6 variables.

Each new element is identified with a (✚) in the first column of the descriptive tables.

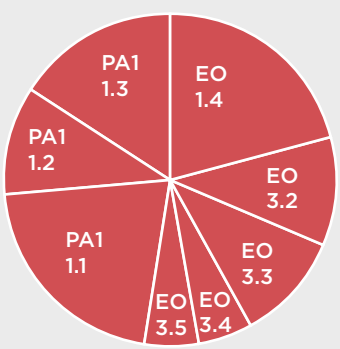
Performance and results in the diverse components of losses volumes

PA1.1 Real losses volumes

Real losses are determined by deducting the estimate of annual volumes from the water balances, along with the number of bursts and leaks that have been detected, and the costs of preventive and corrective maintenance within the distribution network.

This parameter intends to encompass within a single value, the set of factors that offer guidance regarding the real losses that might exist in a distribution network. It is a value that encompasses factors that are very distinct in nature, although each one can provide a perspective on the possible amount and scope of real losses within a network.

Real losses volume will be the result of the grouped and weighted characterization of the estimated volumes of real losses, of the bursts in network infrastructure, of minimum nocturnal flows, of operating pressure, and of the relative reference value of real losses in context of the characteristics and operation of the network being assessed.



Type ——————— Indicators and Practices
Normalization — Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	OE 1.4	OE 1.4	Real losses in the water supply, transportation and distribution infrastructure	T.42 and T.44	4
	OE 3.2	OE 3.2	Number of bursts in transportation and distribution pipes	T.43 and T.50	2
	OE 3.3	OE 3.3	Number of bursts in service connections (connections up to private supply systems)	T.44 and T.51	2
	OE 3.4	OE 3.4	Expenditure on "corrective maintenance" of fixed physical assets linked to the water intake, treatment and distribution "system"	T.35 and T.36	1
	OE 3.5	OE 3.5	Expenditure on "preventive maintenance" of fixed physical assets linked to the water intake, treatment and distribution "system"	T.35 and T.36	1
	PA1.1	PA1.1.1	Minimum overall nocturnal flow in direct areas of the distribution network	T.13 and T.401	4
	PA1.1	PA1.1.2	Risk analysis of bursts or leaks is carried out along sections of the network, as a result of the operation of the distribution network (valve closures, drains)	T.402	2
	PA1.1	PA1.1.3	Index of Leaks in Infrastructure (ILI).	T.42 and T.403	3

PA1.1.2

This is a parameter that assesses the use of advanced methods for identifying distribution network sections that have a greater risk of deterioration because they have been subjected to sudden pressure variations and, as a result, have a greater probability of bursts or leaks.

OE1.4 Real losses in the water supply, transportation and distribution infrastructure

Real losses refer to the volume of water exiting the supply and distribution infrastructure unintentionally and at unplanned network points without an established use or purpose.

Definition — Daily volume of physical water losses in the "geographical area to be rated" due to poor supply, transportation and distribution infrastructure condition or operation as a proportion of pipe length or number of service connections in the year of rating. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.

Type — Indicator

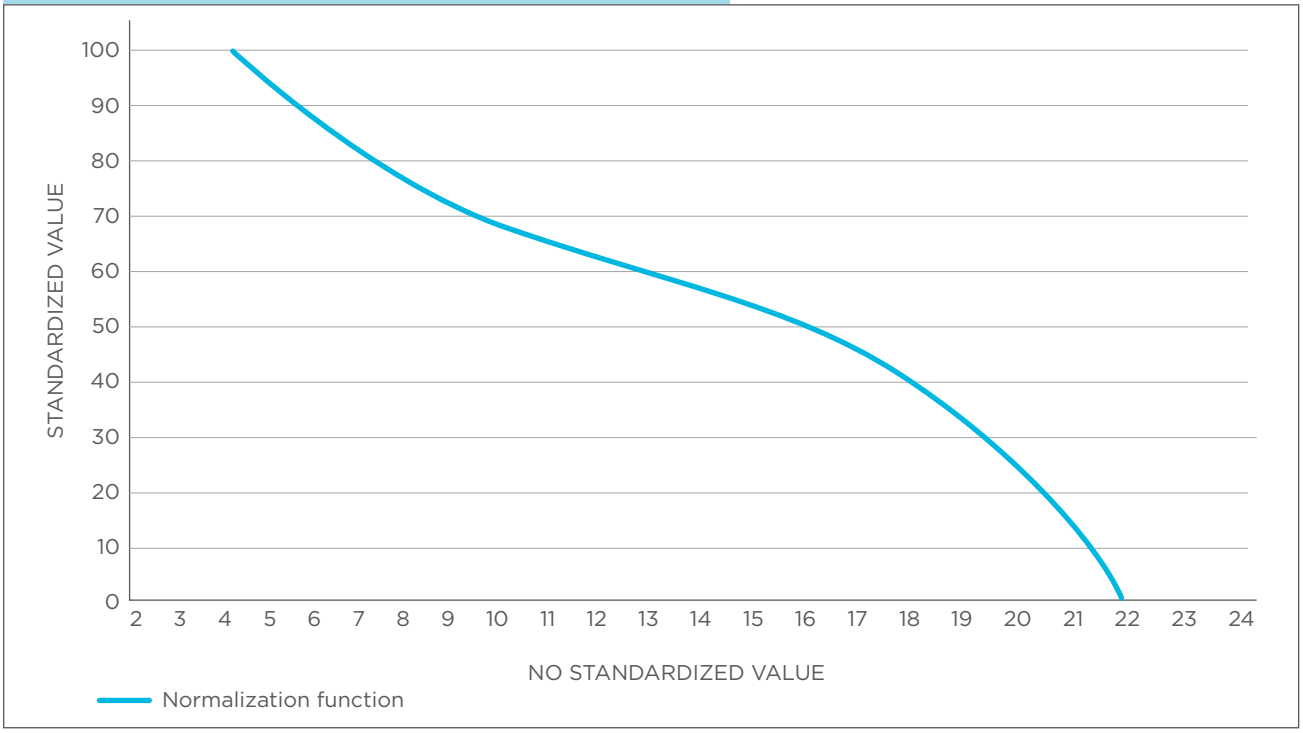
Service — Drinking Water

Glossary — Geographical area to be rated

Formula — **If connections density < 20**
([EO1-V3]/[EO1-V4]) Unit: m^3/km/day
If connections density >= 20
([EO1-V3]/[EO1-V5]) Unit: m^3/connection/day

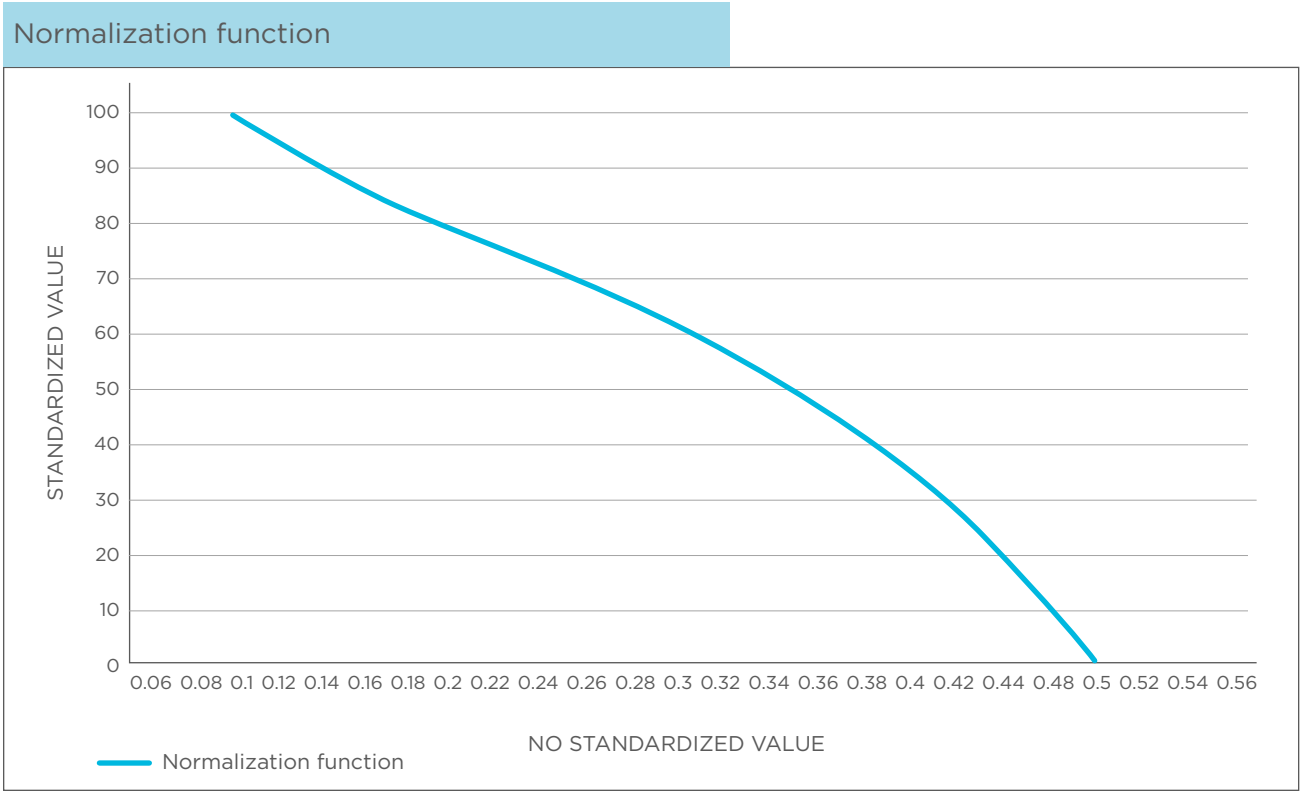
If connections density < 20

Normalization function



If connections density >= 20

Normalization function



Variables

[EO1-V3] Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation

Definition — Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation in the year of rating. It includes losses of both raw and treated water. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.
Units — m^3/day
Reliability — Table 42

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.
Units — km
Reliability — Table 43

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition — Total number of drinking water service connections at the end of the rating year.
Units — connections
Reliability — Table 44

OE3.2 Number of bursts in transportation and distribution pipes

Definition — Annual number of reported bursts in transportation or distribution pipes per kilometer of such pipes in the "system". The average of the year of rating and the 2 preceding years.

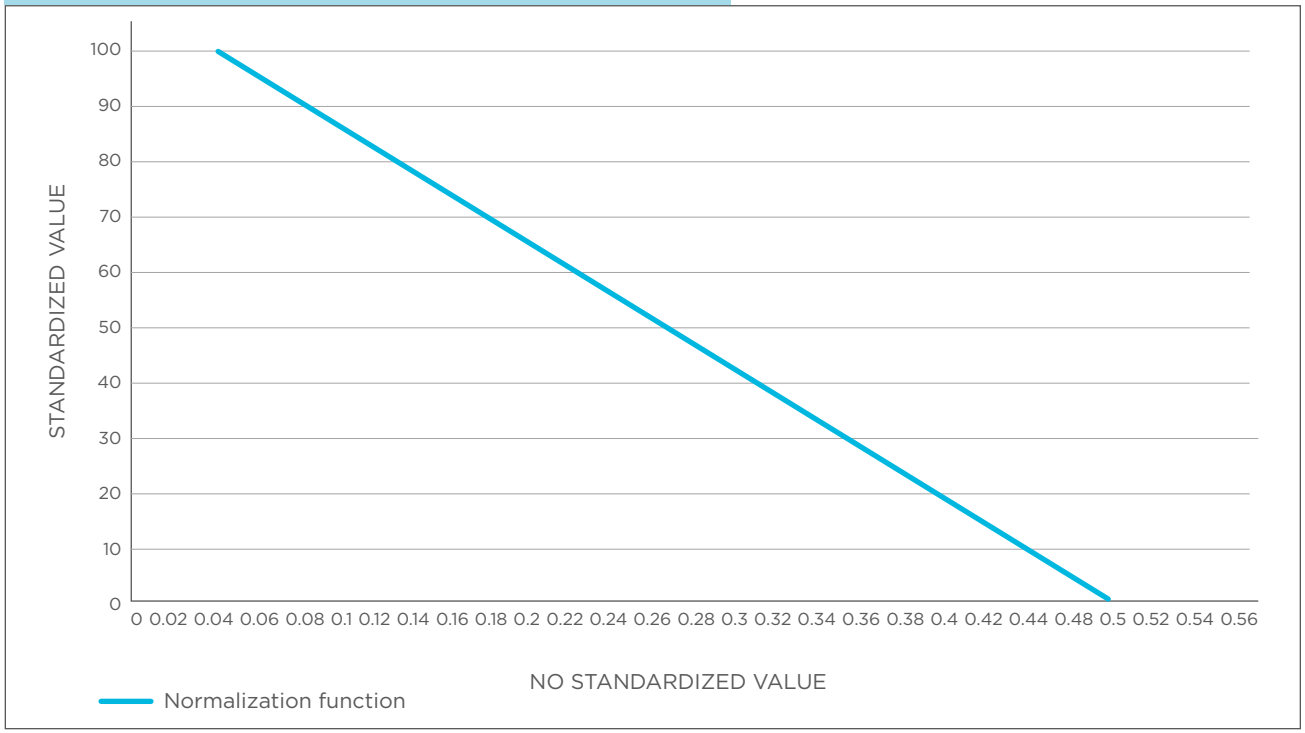
Type — Indicator

Service — Drinking Water

Glossary — System, Geographical area to be rated

Formula — [EO3V1]/[EO1-V4] Unit: Nº/km

Normalization function



Variables

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.
Units — km
Reliability — Table 43

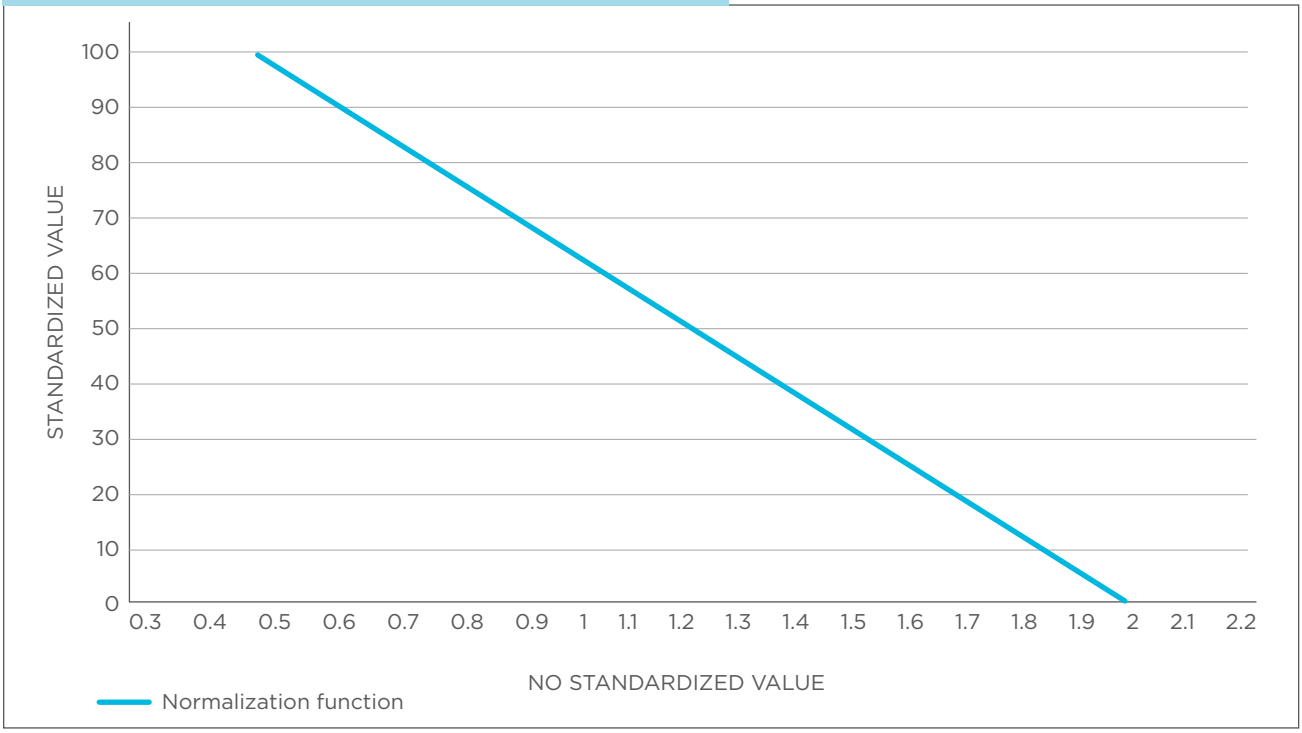
[EO3-V1] Annual number of known bursts in transportation or distribution pipes

Definition — Annual number of known bursts in transportation or distribution pipes (average of the year of rating and the 2 preceding years).
Units — no.
Reliability — Table 50

OE3.3 Number of bursts in service connections (connections up to private supply systems)

Definition — Number of reported bursts per 100 connections (average of the year of rating and the 2 preceding years).
Type — Indicator
Service — Drinking Water
Formula — ([EO3-V2]/[EO1-V5])*100 Unit: Nº/100 connections

Normalization function



Variables

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition — Total number of drinking water service connections at the end of the rating year.
Units — connections
Reliability — Table 44

[E03-V2] Annual number of known bursts in connections

Definition — Annual number of known bursts in connections (average of the year of rating and the 2 preceding years)
Units — no.
Reliability — Table 51

OE3.4 Expenditure on "corrective maintenance" of fixed physical assets linked to the water intake, treatment and distribution "system"

Considers expenditure on all "corrective maintenance" performed on the water intake, treatment and distribution "system", including "incident" resolution, as a proportion of the value of the corresponding assets. It includes repair of bursts, as well as all other incidents that affect service. Infrastructure replacements not programmed in the renewal plans will be counted as corrective maintenance. Compensation costs for damages due to anomalies will also be included. If a specific policy exists, the annual cost of the policy will be added. Expenses for the year of ratingand asset values at the beginning of the financial period will be considered.

Definition — Percentage representing annual expenditure on "corrective maintenance" of the fixed physical assets linked to the water intake, treatment and distribution "system" as a proportion of their gross value (except land) at the beginning of the year of rating. The average for the year of rating and the two preceding years is considered.

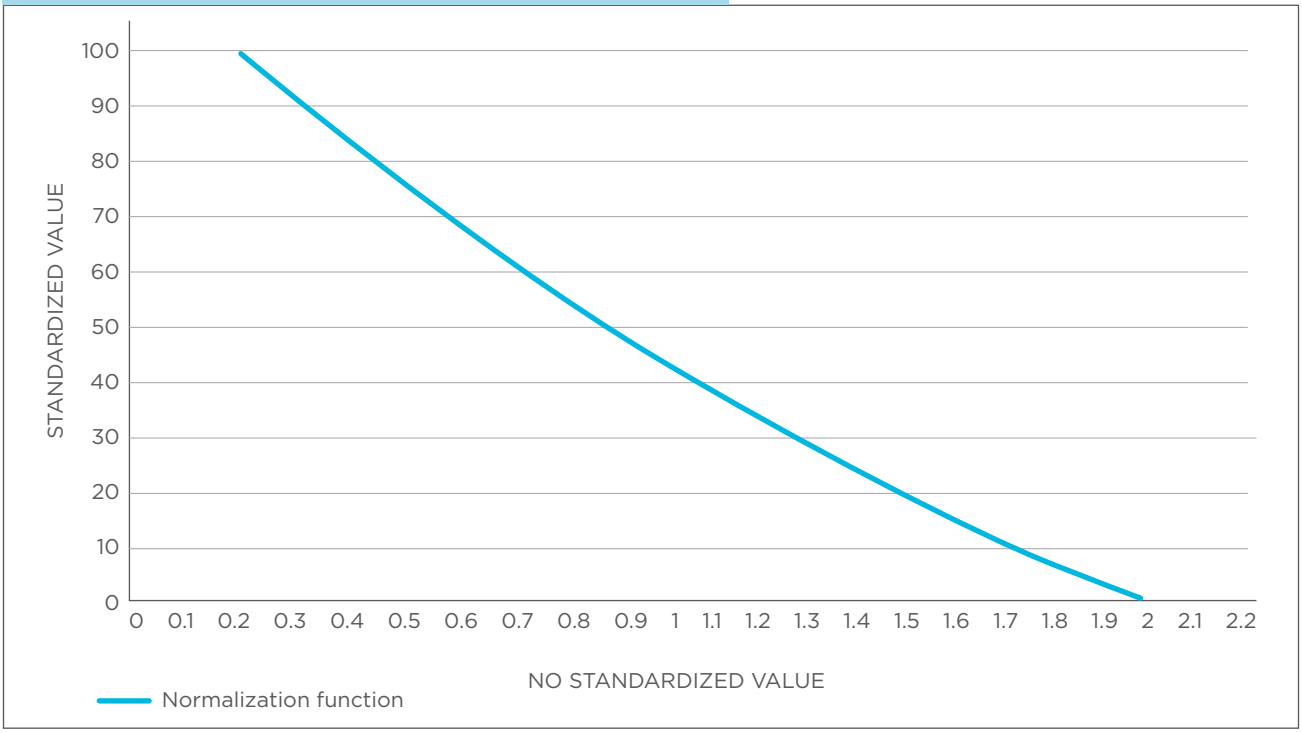
Type — Indicator

Service — Drinking Water

Glossary — System, Incident, Corrective maintenance, Geographical area to be rated

Formula — ([EO3-V3]/[EP3-V2.1])*100 Unit: %

Normalization function



Variables

[EO3-V3] Total annual expenditure on all "corrective maintenance" performed on water intake, treatment and distribution "systems"

Definition — Total annual expenditure on all "corrective maintenance" performed on water intake, treatment and distribution "systems", including incidents resolved, replacement not programmed in renewal plans, compensation for damages to third parties, and specific insurance policies.

Units — financial statement currency

Reliability — Table 35

[EP3-V2.1] Gross value of the fixed physical assets linked to the water intake, treatment and distribution "system"

Definition — Gross value of the facilities, equipment and infrastructure linked to the water intake, treatment and distribution "systems" in the "geographical area to be rated" (except land), including infrastructure not owned by the utility in the case that the utility is responsible for its replacement and maintenance costs. The gross value must match the gross value entered in the accounts at the beginning of the year, including value adjustments if applicable.

Units — financial statement currency

Reliability — Table 36

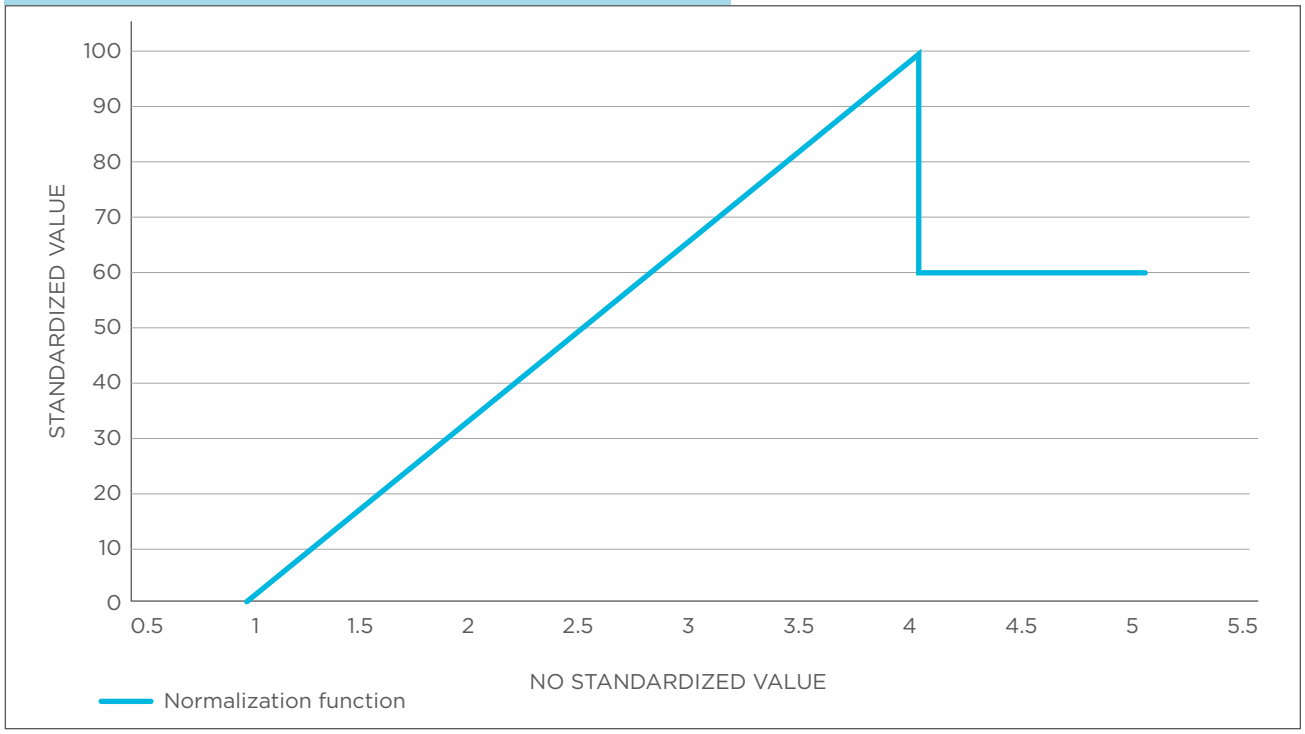
OE3.5 Expenditure on "preventive maintenance" of fixed physical assets linked to the water intake, treatment and distribution "system"

Total expenditure on "preventive maintenance" performed on the water intake, treatment and distribution "system", including inspection, handling and resolution of anomalies detected during inspection, and replacement as a proportion of the gross value of the corresponding fixed physical assets (except land). In neither of these two cases are the costs of programmed renewal of infrastructure and facilities considered.

Definition — Percentage representing annual expenditure on "preventive maintenance" of the fixed physical assets linked to the water intake, treatment and distribution "system" as a proportion of their gross value (except land) at the beginning of the year of rating. The average for the year of rating and the 2 preceding years is considered.

Type Indicator
Service Drinking Water
Glossary System, Preventive maintenance, Geographical area to be rated
Formula ([EO3-V4]/[EP3-V2.1])*100 Unit: %

Normalization function



Variables

[EO3-V4] Annual expenditure on “preventive maintenance” of fixed physical assets linked to the water intake, treatment and distribution “system”

Definition — Annual expenditure on “preventive maintenance” of fixed physical assets linked to the water intake, treatment and distribution “system” (year of rating and the 2 preceding years).
Units — financial statement currency
Reliability — Table 35

[EP3-V2.1] Gross value of the fixed physical assets linked to the water intake, treatment and distribution “system”

Definition — Gross value of the facilities, equipment and infrastructure linked to the water intake, treatment and distribution “systems” in the “geographical area to be rated” (except land), including infrastructure not owned by the utility in the case that the utility is responsible for its replacement and maintenance costs. The gross value must match the gross value entered in the accounts at the beginning of the year of rating, including value adjustments if applicable.
Units — financial statement currency
Reliability — Table 36

PA1.1.1 Minimal global nocturnal flow in the areas within the distribution network.

This is a parameter that is indicative of the real losses that are likely within a distribution network. This parameter is most useful when it references a small area or maintains a small scope, such as a measured section within a sector or district. As a result, there is more detail and precision in the registered flow values and in the water consumption activity during hours of minimum consumption.

It is a parameter that, even taking into account median annual values and the entire distribution network (excluding the part of the distribution network that can regulate tank flows at night), can help to describe an entire system, especially if sufficient complementary information is available to estimate the minimum net nocturnal flows (the difference between the recordeddocumented and the used) at different times of the year.

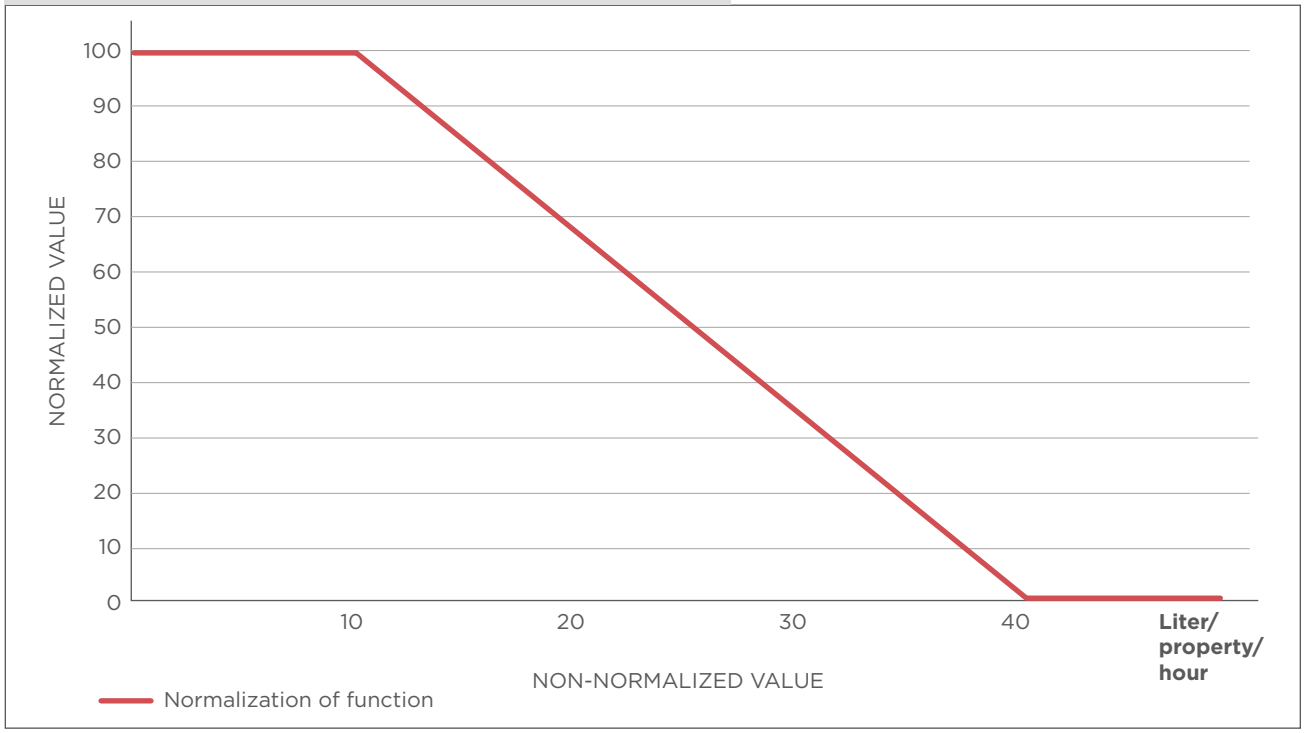
Definition — Minimum average nocturnal flow throughout the year, in all of the supply area, divided by the number of properties supplied

Type — Indicator

Service — Potable Water

Formula — [PA1-V1]/ [CS2-V2]

Normalization of function



Variables

[PA1-V1] Minimal nocturnal flow in areas within the distribution network

Definition — This is the flow that enters the direct distribution system without first passing through tanks or other structures that regulate and can store flows during the nighttime. It can only be determined if all of the elements of measurement and recording (conducted at least hourly) are available at all points at which water is supplied directly to the distribution network. If a network is completely sectorized, this will be the sum of the nocturnal values of all sectors. If the network is not sectorized, it will be the sum of the nocturnal flow values registered in all the inputs to the distribution and outputs of the deposits.
Valor medio de la suma de los caudales registrados en todas las entradas
Calculation — Median value of the sum of the flows recorded at all of the inputs into the distribution network, during the hours of 2-4 a.m.
Units — liters/hour
Reliability — Table 401

[CS2-V2] Number of "properties" supplied

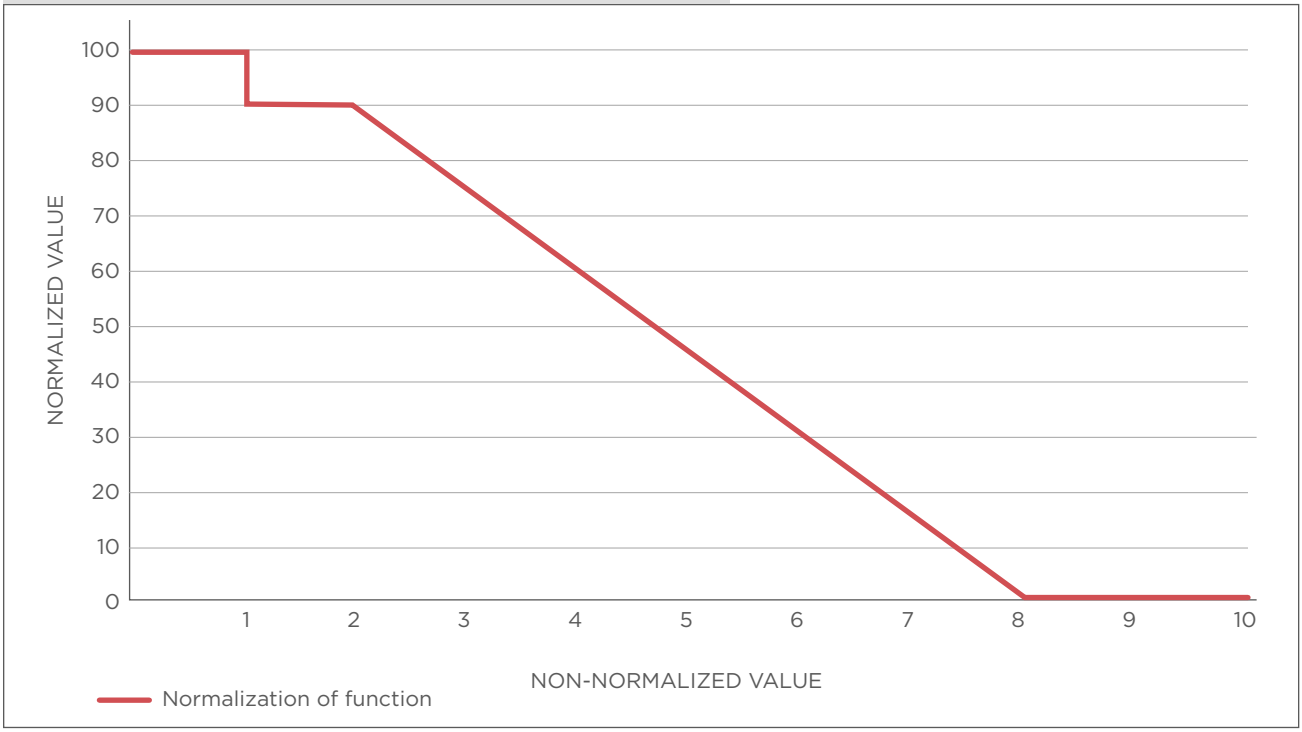
Definition — Number of "properties" supplied at the end of the year of rating.
Units — properties
Reliability — Table 13

PA1.1.3 Infraestructure leakage Index (ILI).

This is a parameter that evaluates the relationship between current anual real losses and unavoidable or unavoidable or undetectable evaluated real losses

Definition — It is obtained by dividing the volume of real losses by the achievable level of real losses
Type — Indicator
Service — Potable Water
Formula — [EO1-V3] / [PA1-V2]

Normalization of function



Variables

[EO1-V3] Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation

Definition — Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation in the year of rating. It includes losses of both raw and treated water. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.

Units — m^3/day

Reliability — Table 42

[PA1-V2] Achievable level of real losses in relationship to mean pressure and connections density

Definition — This is a parameter that evaluates the level of losses that can be considered unavoidable or undetectable in accordance with the IWA's recommended formulas, which are based on empirical studies, supported by the average operating pressure values and connection density of the distribution network.

Formula — (18 x [EO1-V4] + 0.8 x [EO1-V5] + 25 x [PA1-V4]) x [PA1-V3]

[EO1-V4] Length of water supply, transport and distribution pipes

Definition — Length of water supply, transport and distribution pipes in the "territorial area to be evaluated" whose operation and maintenance is the responsibility of the operator (at the end of the evaluation year). Includes raw and purified water pipes. The length of the connection or connection pipes will not be considered.

Units — km

Reliability — Table 43

[EO1-V5] Total number of potable water connections at the end of the evaluation year.

Definition — Total number of potable water connections at the end of the evaluation year.

Units — connections

Reliability — Table 44

[PA1-V4] Total length of service connections from property line to customer's meter

Definition — Total length of service connections from property boundary to customer's meter (km). It will be zero (0) in cases where the micrometer is at the property boundary.

Units — km

Reliability — Table 43

[PA1-V3] Average pressure in the distribution network

Definition — This is the average operating pressure that is analyzed within the distribution network. The average of pressures at each one of the connections can be used. In this way, the service condition and the operating pressure of the connections will be assessed, but will not necessarily reflect the operating pressures of the pipes that comprise the distribution network. Nevertheless, it is assumed that this pressure value is the most reliable calculation. The value will be obtained as the average of all the pressures in all the connections to points of use, and consumption under conditions of average annual consumption.

Units — meters of water column

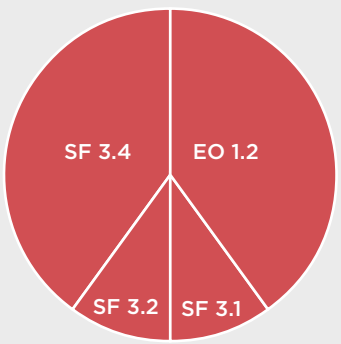
Reliability — Table 403. Will depend upon the format and database used to determine the pressures of each connection in average use conditions.

Apparent losses volumes

PA1.2 Apparent losses volumes

Evaluates the control of use and consumption among end users, alongside billing and collection practices, and the efficacy of these practices.

This parameter aims to synthesize within a single value the set of values representing unbilled water, uncontrolled water, and billing and collection practices. It groups the values of accounting and measurement of water with respect to its final uses and destinations (which provides information about apparent losses), of unbilled water as an indicator of commercial losses and the billing and collection practices with respect to their influence on non-revenue water.



Type ——— Indicators and practices
Normalization — Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	OE 1.2	OE 1.2	Control of water at points of use and consumption	T.40 and T.41	4
	FS 3.1	FS 3.1	Billing and collection	T. 93	1
	FS 3.2	FS 3.2	Billing effectiveness	T.98	1
	FS 3.4	FS 3.4	Unbilled water	T.41 and T.98	4

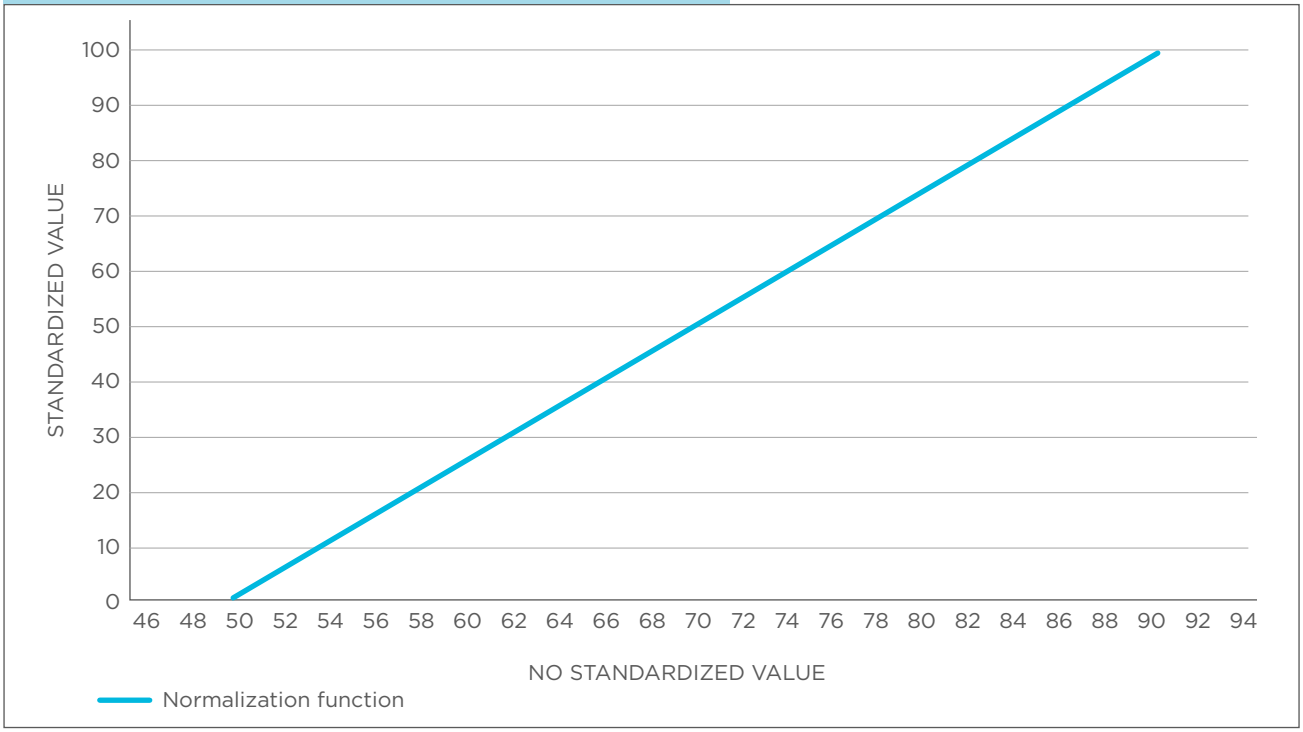
OE1.2 Control of water at points of use and consumption

This indicator assesses the degree of control over the final destination of the water introduced into the supply "system" by measuring individual flow rates and volumes at each point of use and consumption. It reveals water balance reliability and geographical distribution. It reflects good practice and, in many cases, it is also the least disputable parameter among those usually employed to measure water resource usage efficiency. Similarly, it is the best starting point when diagnosing and implementing improvement measures. Individual consumption volumes that cannot be considered controlled water can only be assessed by means of estimates, which inevitably will be much less reliable than measured individual consumption volumes.

Uncontrolled water includes both real and apparent losses, fraud, operational uses and water used and consumed at a known point but not measured due to lack of an individual metering device, also known as authorized uses.

Definition — Percentage of "water introduced into the system" consumed and micro-metered as a proportion of total water introduced into the "system". Total water metered for individual consumption (whether users have a contract or not) in the year of rating will be considered.
Type — Indicator
Service — Drinking Water
Glossary — System, Water volume incorporated into the system
Formula — ([EO1-V1]/[EO1-V2])*100 Unit: %

Normalization function



Variables

[EO1-V1] "Water volume introduced into the system" consumed at the points of use and consumption and micro-metered

Definition — "Water volume introduced into the system" consumed at the points of use and consumption and micro-metered
Units —
Reliability — Table 40

[EO1-V2] Total "water volume introduced into the system"

Definition — Total "water volume introduced into the system"
Units — m^3
Reliability — Table 41

FS3.1 Billing and collection

AR	Component	Element	Description	Reliability	Weight
	FS 3.1	FS 3.1.1	Billing is based on measurement (meter reading) for at least 99% of billed users.	T. 93	3
	FS 3.1	FS 3.1.2	The user register and classification is updated within 10 days of establishment of a service agreement or of deactivation of a connection.	T. 94	1
	FS 3.1	FS 3.1.3	A user register exists that includes information concerning user type, service status (active/inactive), meter data, "property" data and other information necessary for billing the service.	T. 33	1
	FS 3.1	FS 3.1.4	Data scanners with a magnetic interface to the billing system or remote meter-reading technologies are in use.	T. 95	2
	FS 3.1	FS 3.1.5	The quality of meter reading and bill issue in each zone or sector is systematically monitored.	T. 95	2
	FS 3.1	FS 3.1.6	Services are billed monthly or bimonthly or payments are received with this regularity if bills are issued less frequently.	T. 93	1
	FS 3.1	FS 3.1.7	The bill format contains all data required to verify computation of the amount billed, comprising at the very least the following: amount payable and due date (highlighted), reading date and quantities (current and previous), volume consumed, volume billed and tariff for each service billed, and other charges or adjustments applied.	T. 96	1
	FS 3.1	FS3.1.8	Formally defined collection procedures exist that include systematic use of coercive recovery instruments for users in arrears, to the extent allowed by legislation.	T. 93	2

AR	Component	Element	Description	Reliability	Weight
	FS 3.1	FS3.1.9	A policy exists for detecting and regularizing fraud in its various forms (meter calibration, detection of illegal connections, detection of false information regarding type of use or any other variable that influences tariffs) and, in the case that estimated losses attributable to users exceed 10% of unbilled water volume, systematic operations are carried out to detect illegal connections. If an estimate of losses attributable to users is not available, it is assumed that these amount to more than 10% of unbilled water volume.	T. 97	2

FS3.2 Billing effectiveness

Definition Number of service users billed as a proportion of total "active users". The average rate for the year of rating is considered.

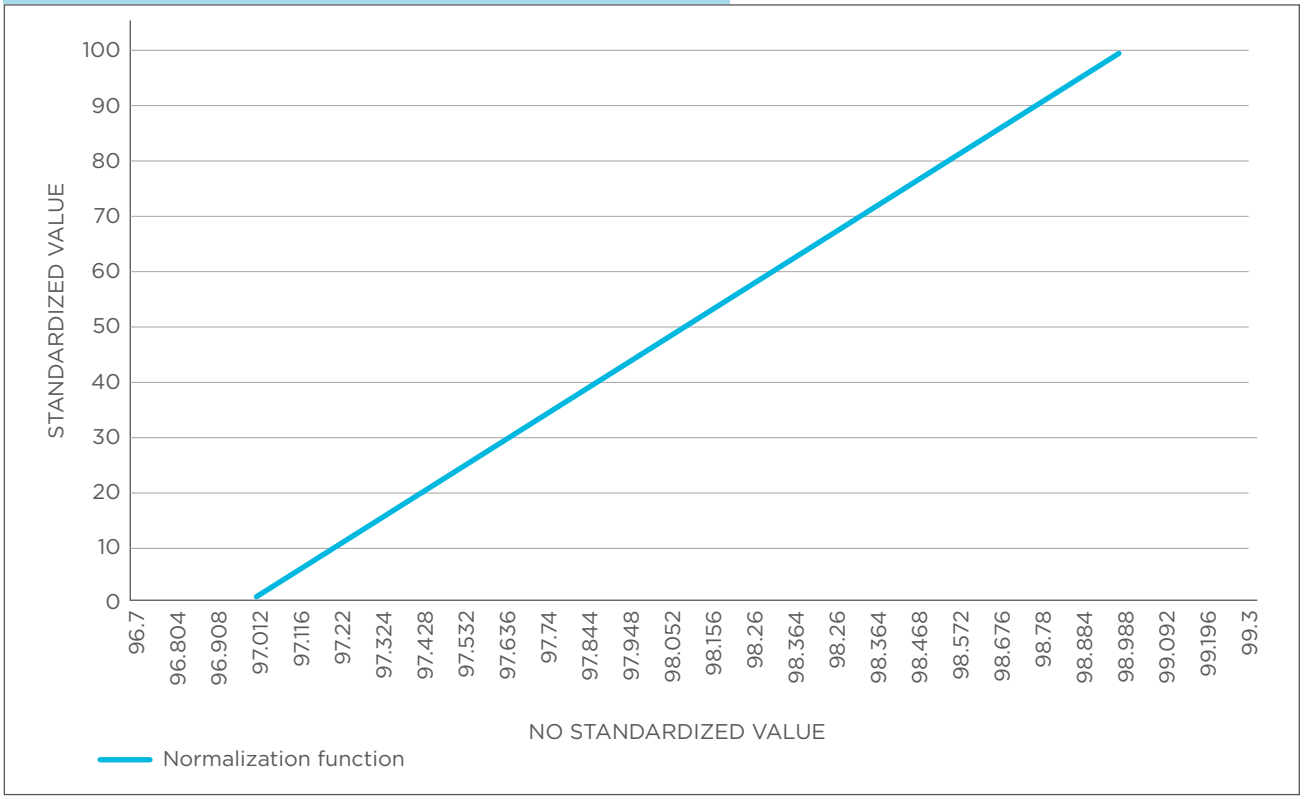
Type Indicator

Service Drinking Water and/or Sanitation

Glossary Registered user, Active users, Zero-value bill

Formula ([SF3-V1]/[SF3-V2])*100 Unit: %

Normalization function



Variables

[SF3-V1] Number of users billed, excluding "zero-value bills"

Definition — Number of users billed, excluding "zero-value bills" Average for the year of rating (sum of number of users billed in each billing period [excluding zero-value bills] / number of billing periods).
Units — no.
Reliability — Table 98

[SF3-V2] Total "active users"

Definition — "Users registered" with the utility to use or consume drinking water and/or wastewater services and receiving those services. Average for the year of rating (sum of total active users in each billing period / number of billing periods).
Units — no.
Reliability — Table 98

FS3.4 Unbilled water

Definition — Proportion of water introduced into the "system" that is not billed in the rating year.

Type — Indicator

Service — Drinking Water and/or Sanitation

Glossary — System, Water volume incorporated into the system

Formula — **If connections density < 20**

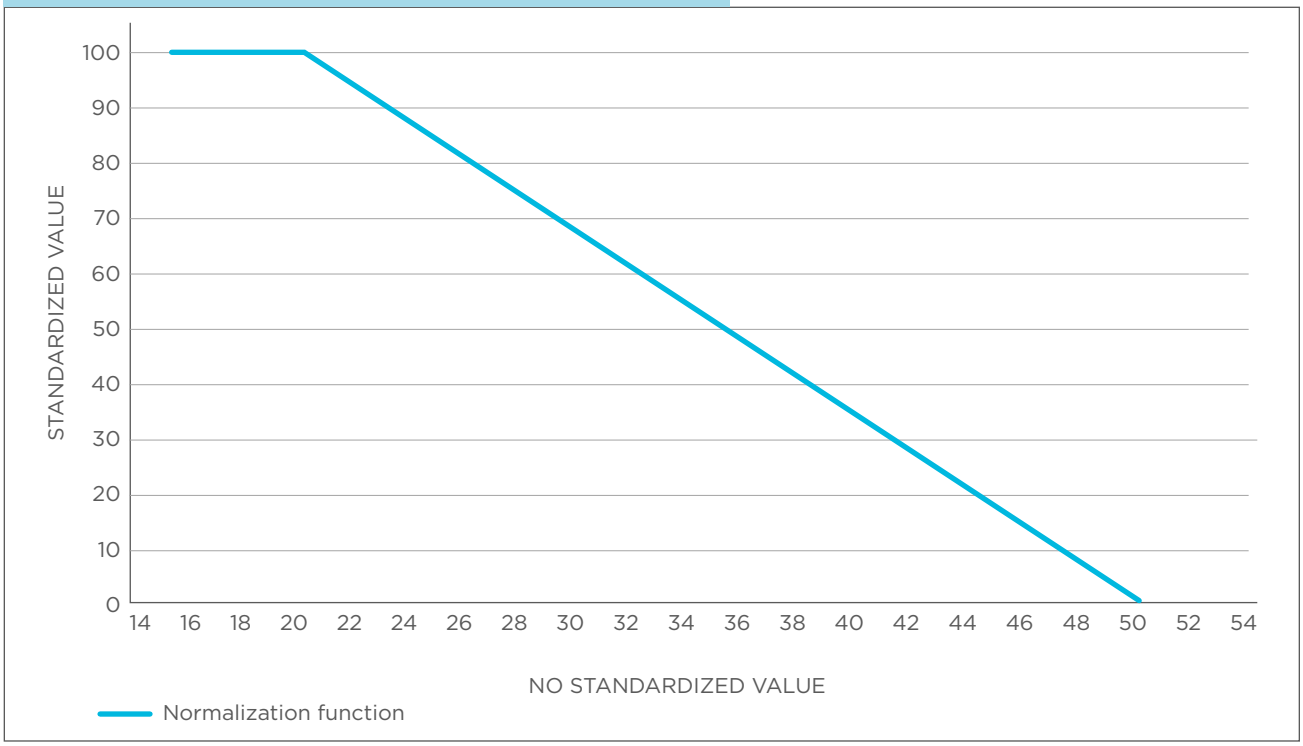
(([EO1-V2]-[SF3-V11])/[EO1-V2])*100 Unit: %

If connections density >= 20

(([EO1-V2]-[SF3-V11])/[EO1-V2])*100 Unit: %

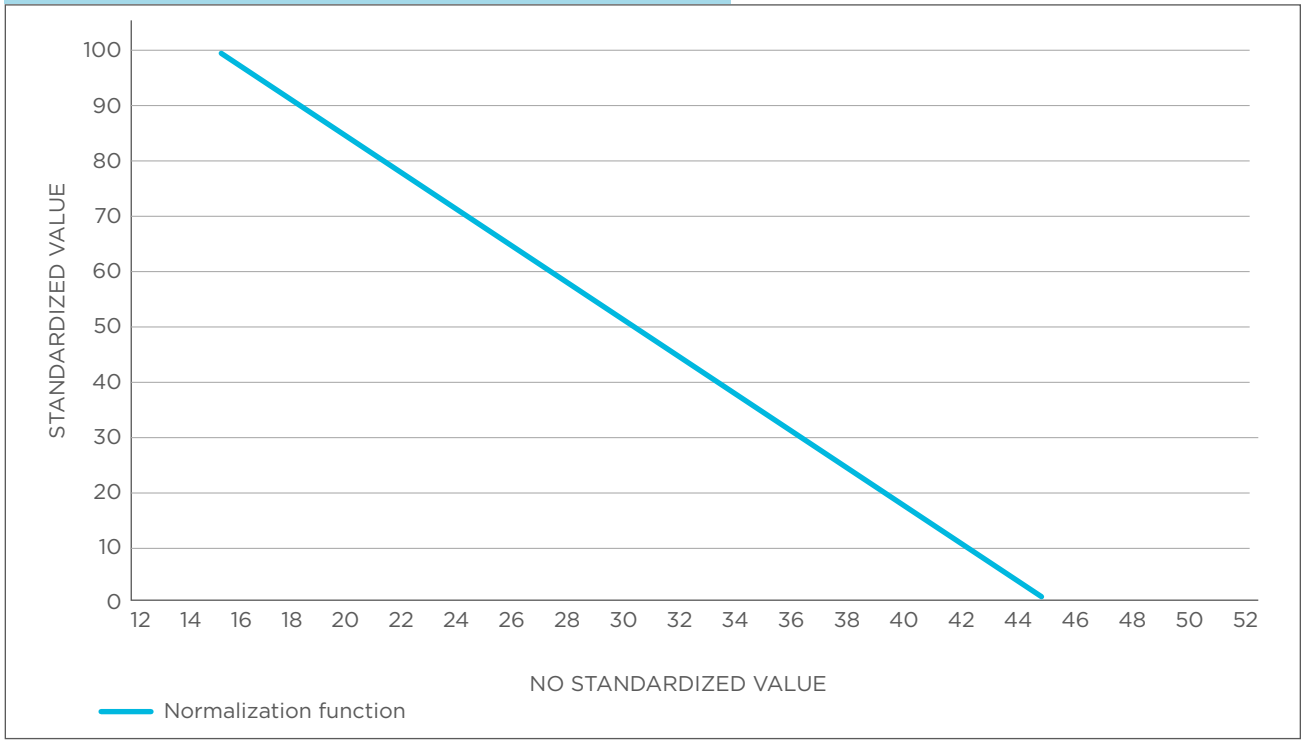
If connections density < 20

Normalization function



If connections density >= 20

Normalization function



Variables

[EO1-V2] Total "water volume introduced into the system"

Definition —— Total "water volume introduced into the system"
Units —— m^3
Reliability —— Table 41

[SF3-V11] Billed water volume

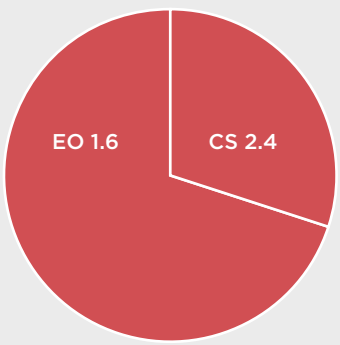
Definition —— Total billed water volume in the rating year, according to billing system records.
Units —— m^3
Reliability —— Table 98

Operational losses volumes

PA1.3 Operational losses volumes

This evaluates the losses of water volumes caused by the operating activities of the supply and distribution systems, as well as the supply disruptions that are caused by the repair of bursts and leaks.

This value is an indicator of the amount of water used in the operation of the distribution network, which is generally not measured by the meters for individual use and consumption; as such, it contributes to uncontrolled, unbilled water, or non-revenue water. In some cases, such as the cleaning of new pipes, this can translate into billed volumes based on estimates or specific measures. In cases where this consumption is measured and recorded, it will be counted in the same ways as individual use and consumption is recorded and billed. When based on estimates, operational losses volumes will be accounted for in this parameter as operating losses, along with the rest of operational volumes that are used in operation, but whose values are not measured.



Type ——— Indicators and Practices
Normalization ——— Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	SQ 2.4	SQ 2.4	Supply continuity	T.12 and T.13	3
	OE 1.6	OE 1.6	Water used in operation	T.41 and T.45	7

SQ2.4 Supply continuity

This assessment element evaluates service continuity based on the number of hours during which the "hydraulic conditions" at the point of connection to the distribution "system" at each "property" supplied are sufficient for use and consumption.

Definition — Number of hours during which "hydraulic conditions for use and consumption" have not been met for each "property" in the year of rating.

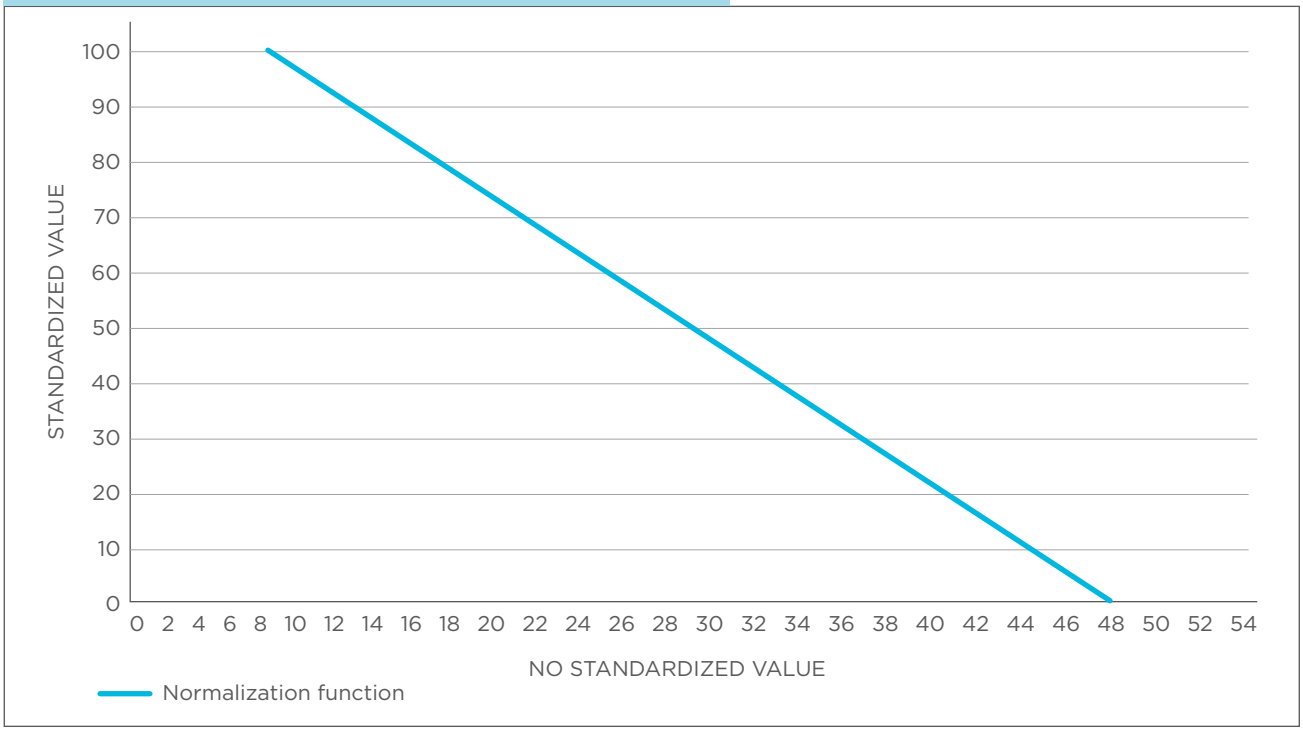
Type — Indicator

Service — Drinking Water

Glossary — System, Sufficient hydraulic conditions for use and consumption, Property

Formula — [CS2-V1]/[CS2-V2] Unit: hours

Normalization function



Variables

[CS2-V1] Total number of hours of interrupted supply

Definition — Total number of hours of interrupted supply or without the necessary "hydraulic conditions for supply and consumption" in each property throughout the year of rating. In "systems" in which continuous supply is generally not available, interruption hours will be applied to all properties located in the area that lacks such service.
Units — hours
Reliability — Table 12

[CS2-V2] Number of "properties" supplied

Definition — Number of "properties" supplied at the end of the year of rating.
Units — properties
Reliability — Table 13

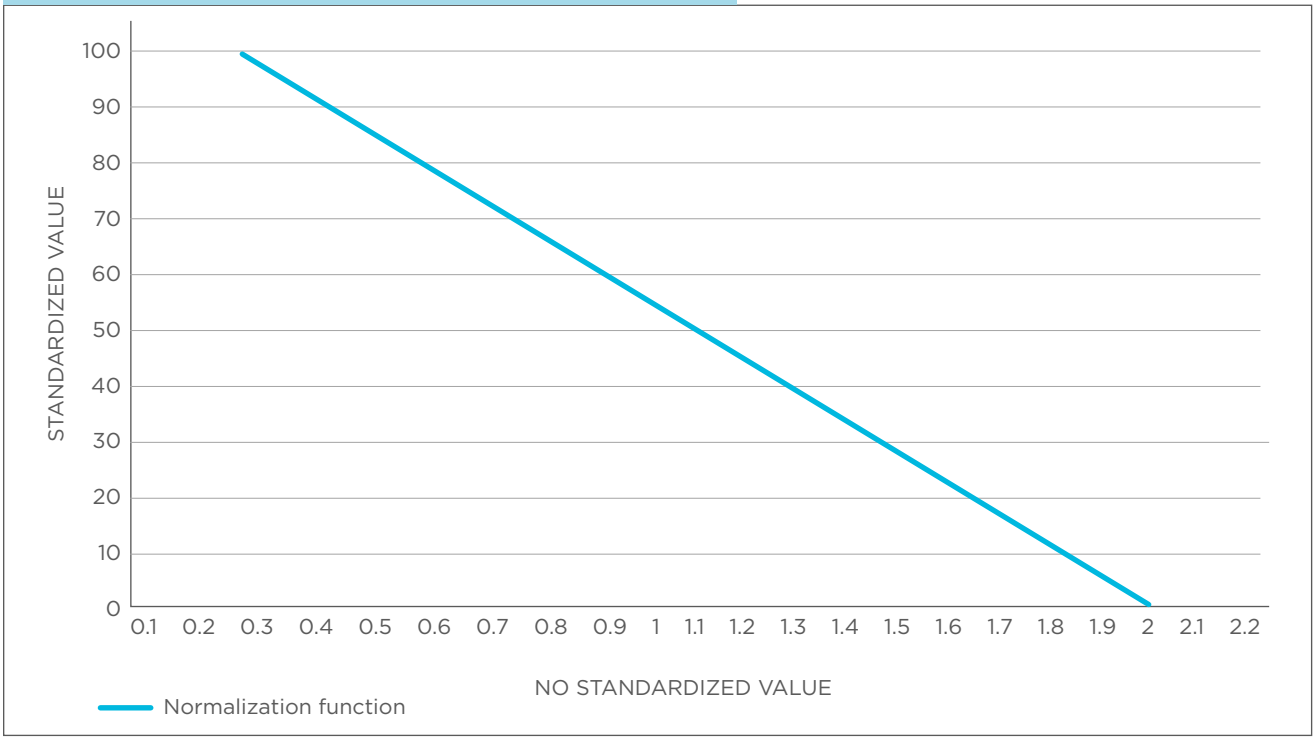
OE1.6 Water used in operation

Assesses volumes used in supply and distribution "system" operations, such as water not reclaimed when cleaning treatment plant filters, facility pipe cleaning and repair work, occasional or systematic purges to assure appropriate water quality, and tank emptying for cleaning and maintenance.

It is assessed by comparing volumes used in operation and total "volume introduced into the system".

Definition — Percentage of water used voluntarily and intentionally in operation of the supply, treatment and distribution infrastructure as a proportion of total "water introduced into the system" in the year of rating.
Type — Indicator
Service — Drinking Water
Glossary — System, Water volume incorporated into the system
Formula — ([EO1-V6]/[EO1-V2])*100 Unit: %

Normalization function



Variables

[EO1-V2] Total “water volume introduced into the system”

Definition —— Total “water volume introduced into the system”
Units —— m^3
Reliability —— Table 41

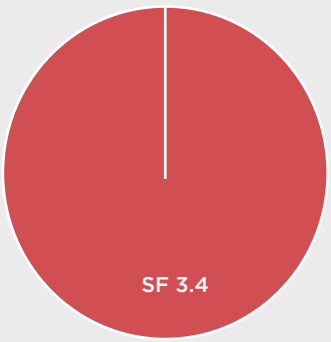
[EO1-V6] Water volume used in infrastructure operation

Definition —— Water volume used in infrastructure operation (includes purges and cleaning of pipes, tanks, equipment and facilities in general carried out voluntarily by the utility).
Units —— m^3
Reliability —— Table 45

Total volume of losses

PA1.4 Total volume of losses

This evaluates the water that has been incorporated into the system of supply and distribution, but which has not been billed.



Type ——— Indicators and Practices
Normalization — Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	FS3.4	FS3.4	Unbilled water	T.41 and T.98	10

FS3.4 Unbilled water

Definition Proportion of water introduced into the "system" that is not billed in the rating year.

Type Indicator

Service Drinking Water and/or Sanitation

Glossary System, Water volume incorporated into the system

Formula

If connections density < 20

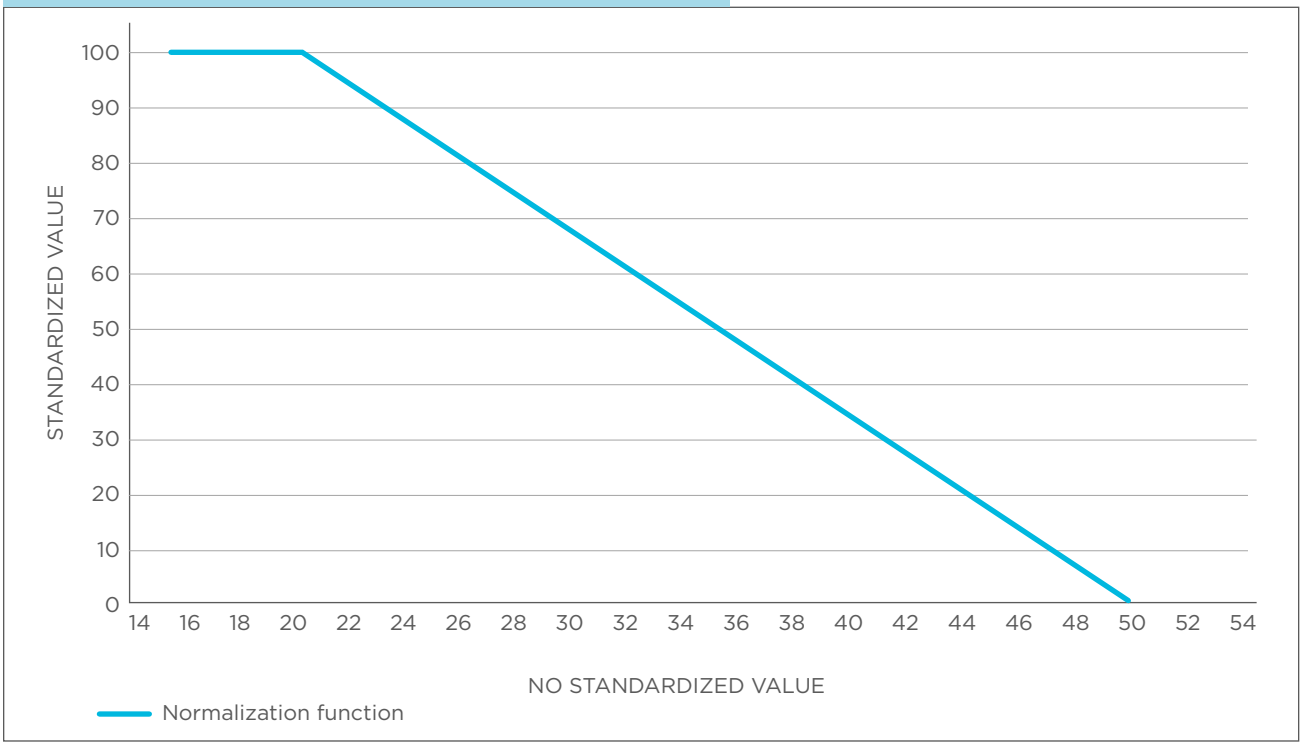
([EO1-V2]-[SF3-V11])/[EO1-V2])*100 Unit: %

If connections density >= 20

([EO1-V2]-[SF3-V11])/[EO1-V2])*100 Unit: %

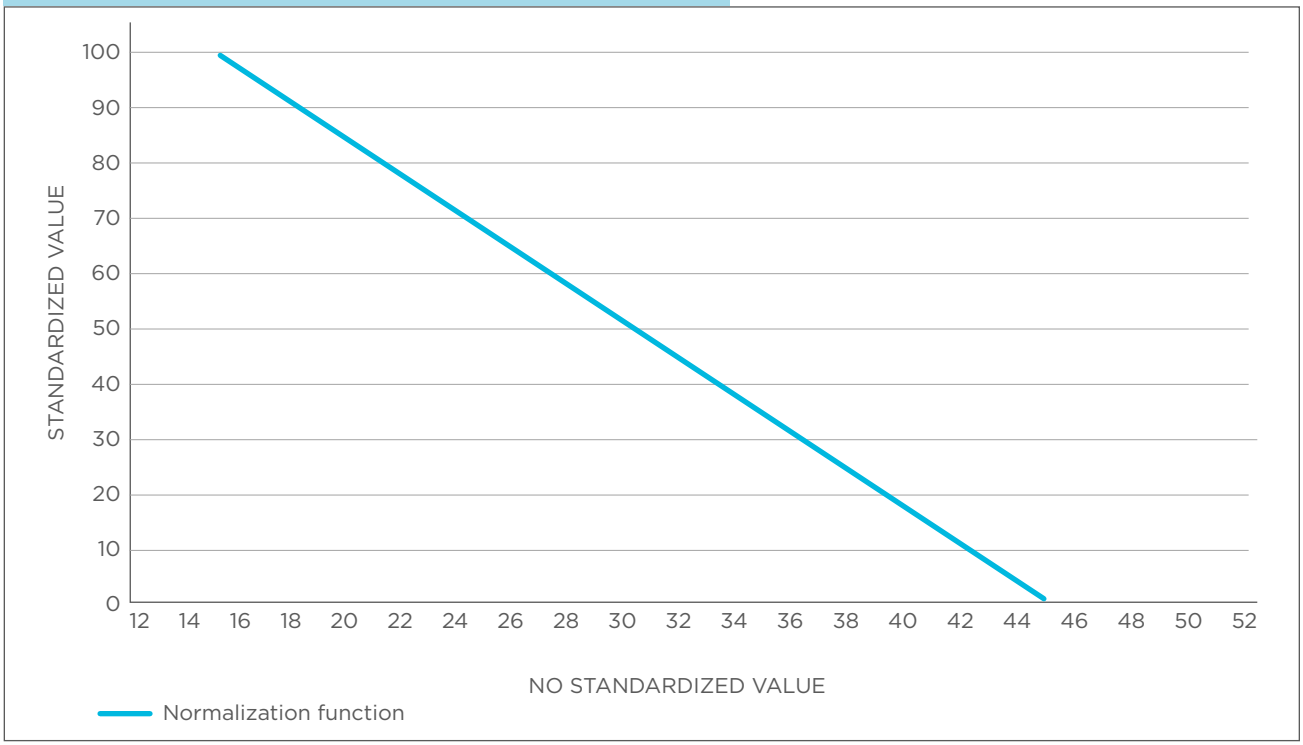
If connections density < 20

Normalization function



If connections density >= 20

Normalization function



Variables

[EO1-V2] Total volume of water introduced into the system

Definition — Total "water volume introduced into the system" Definition: Total "water volume introduced into the system"
Units — m^3
Reliability — Table 41

[SF3-V11] Billed water volume

Definition — Total billed water volume in the rating year, according to billing system records.
Units — m^3
Reliability — Table 98

Additional elements for analysis of the performance and results of diverse components of losses volumes

PA1.4.1 Amount of real losses, measured as a percentage of total water incorporated into the supply and distribution system

Description This parameter is called into question because of its tendency to introduce erroneous values and wrong actions. The value cannot be used to make comparisons between different companies or even sectors of the same company, as it refers to a value dependent upon factors that are independent of losses. Similarly, it is also not useful for measuring evolution over time, since its value can change as use and consumption change, even if real losses volumes themselves do not change.
Nevertheless, we propose its inclusion because it is a parameter that is widely used. Its value will be determined even though it is not used in any group characterization or approach.

Type Indicator

Calculation (Estimated volume of losses in the time period/ Total volume incorporated into the system during the time period) *100.

Formula ([EO1-V3]/[EO1-V2]) *100

Normalization Inversely linear from 0-100, equivalent to the parameter's value

Variables

[EO1-V3] Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation

Definition — Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation in the year of rating. It includes losses of both raw and treated water. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.
Units — m^3/day
Reliability — Table 42

[EO1-V2] Total "water volume introduced into the system"

Definition — Total "water volume introduced into the system"
Units — m^3
Reliability — Table 41

PA1.4.2 Density of service connections in the distribution network

Description — This parameter is used to describe and differentiate distribution networks and their indicators, based on the density of connections per pipe length. This parameter makes it possible to assess other indicators, since it is often the case that real losses and leaks are manifested more frequently in connections and joints with the main pipe, as well as measuring devices. It does not contribute to the calculation of any approach or group.
Type — Indicator
Calculation — Total number of connections in the area/Length of pipes in km in the area. Both variables are taken into account in AquaRating EO1.4.
Normalization — Normalization does not occur, as it is not used for any indicator. It is only considered informative and helps identify the most representative indicators, depending on the relationship.

Variables

[EO1-V3] Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation

Definition — Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation in the year of rating. It includes losses of both raw and treated water. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks
Units — m^3/day
Reliability — Table 42

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.
Units — km
Reliability — Table 43

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition — Total number of drinking water service connections at the end of the rating year.
Units — connections
Reliability — Table 44

Conditions and state of infrastructure

State and useful life of infrastructure

PA2.1 State and useful life of infrastructure

Type ——— Indicators and Practicess
Normalization ——— Weighted by each element

AR	Group	Element	Description	Reliability	Weight
+	PA2.1	PA2.1.1	Percentage of elements that comprise the distribution system (pipes, connections, and other components) that have a residual useful life of less than 5 years.	T.401 to T.409	10

PA2.1.1 Percentage of elements that comprise the distribution system (pipes, connections, and other components) that have a residual use life of less than 5 years.

Definition Value that globally evaluates the residual useful life of the elements that comprise the distribution network.

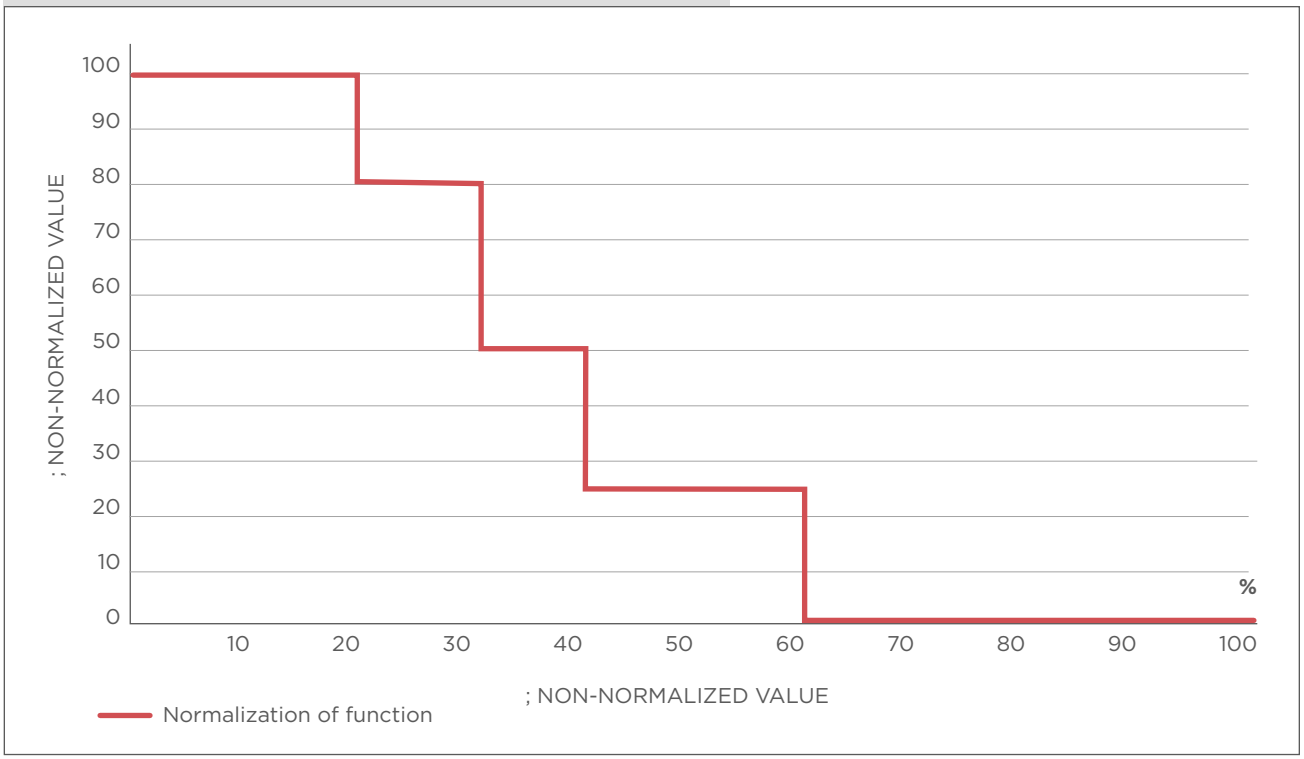
Calculation This value is calculated by simultaneously evaluating the residual useful life values for each of the main parts of the distribution network (pipes, connections, and other components). These values are quantified by the percentage of each type, with residual useful life values greater than five years. The simultaneous evaluation calculates a weighted average, assigning a weight of 3 to the indicator for the length of pipes; 2 to the indicator for the number of connections; and 1 to the indicator referencing the rest of the elements. The unit to be applied will be represented in a percentage value. In cases where the needed information about the residual useful life of the pipes in the distribution network is not available, it will be considered unavailable, and the indicator will not be calculated.

Type Indicator

Service Potable Water

Formula ([PA2-V1]*3 + [PA2-V4]*2 + [PA2-V7])/6

Normalization of function



Variables

[PA2-V1] Residual useful life of the pipes that comprise the distribution network.

Description — Residual useful life is understood as the number of years left before the number of bursts and leaks exceeds a threshold that justifies their repair.

Calculation — Determined as the percentage of the length of distribution pipes (without accounting for connections to users) whose residual useful life is less than five years with respect to the reference threshold established in PA2-V3.

Reliability — Quantified from 0 to 1, depending upon the studies that have been done regarding the useful life of pipes specifically with respect to the company's infrastructure network, and on the variables that establish the threshold and the reliability of information linked to said threshold in PA2-V3.

Formula — [PA2-V2]/ [EO1-V4] *100

[PA2-V2] Length of pipes in the distribution network with a residual useful life at risk of failure due to proximity to the end of its useful life.

Description — It is the length of all the pipes in the distribution network that have a residual useful life of less than five years, with respect to the useful life reference threshold PA2-V3. It is assumed that all pipes that are close to the end-of-life reference value in less than five years are at risk of breakage or failure. This is calculated by adding the length of all the pipe sections whose residual useful life falls within this range of values.

Units meters of pipe

Reliability Table 404. Will depend on the form and the data used to determine the length of pipes at-risk, as well as the reliability in determining their age since construction, repair, or replacement, and on the reliability with which the useful life reference threshold has been determined for each type of pipe in the network.

[PA2-V3] Threshold, in years, of residual useful life of pipes in the distribution network that are being evaluated

Definition Understood as residual useful life, the number of years remaining before the number of bursts, leaks, or other malfunctions of pressure or water quality will exceed a threshold justifying continued repair.

Calculation The useful life in which it is no longer convenient (or profitable) to repair a pipe, can be determined as a mean reference value for all types of pipes, or it may have been established for each type of pipe according to previously identified variables (such as material, diameter, function, etc.). The useful life is determined using a technical approach, independent from the practice used for accounting and financial management purposes. The residual useful life is the difference between the actual age of the pipes and their useful life.

Units years

Reliability Table 405

[EO1-V4] Length of supply, transportation and distribution pipes

Definition Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.

Units km

Reliability Table 43

[PA2-V4] Residual useful life of the connections that comprise the distribution network

Description Understood as the residual useful life of the connections, the number of years before the number of bursts and leaks in the connections to users exceed a threshold that justify their repair.

Calculation Determined as the percentage of connections to users whose residual useful life is less than five years, with respect to the reference threshold established in PA2-V6.

Reliability Quantified from 0 to 1, depending on the useful life studies of the connections that have been carried out in the specific company in question, in the variables that establish the threshold, and in the reliability of information related to said threshold in PA2-V6.

Formula [PA2-V5] / [EO1-V5]*100

[PA2-V5] Number of distribution network connections that are at risk of failure due to their proximity to the end of their useful life

Definition The number of connections to users in the distribution network that have a residual useful life less than five years, with respect to the threshold reference of useful life in PA2-V6. It is assumed that all of the connections that are close to the end of useful life reference value, within five years or less, are at risk of failure or rupture. This is calculated by accounting for all connections whose residual useful life is within this range of values.

Units Number of connections to users.

Reliability Table 406. Depends on the form and available information with which the number of connections is determined, on the reliability of determining their age since construction, repair, or replacement, and on the reliability with which the residual useful life reference threshold has been determined for each type of connection within the network.

[PA2-V6] Threshold, in years, of residual useful life of connections in the distribution network that is being evaluated

Definition Residual useful life is understood as the number of years remaining before the number of bursts, leaks, or malfunctions in pressure or water quality exceed a threshold that justifies continued repairs.

Calculation The useful life in which it is not convenient (or profitable) to repair a connection may be determined as a median reference value for all types of connections, or it may be determined for each type of connection, according to previously identified variables (such as material, diameter, installation conditions, etc.). The useful life will be determined using a technical approach, independent from that used for accounting and financial management purposes. The residual useful life will be the difference between the actual age of the connections and their useful life.

Units years

Reliability Table 407

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition Total number of drinking water service connections at the end of the rating year.

Units connections

Reliability Table 44

[PA2-V7] Residual useful life of the elements (except pipes, connections, and propulsion components) that comprise the distribution network

Description Residual useful life is understood as the number of years that are left before the number of bursts and leaks in the network elements (except pipes, connections, and propulsion components) exceed a threshold that justify their repair.

Calculation Determined as a percentage of network elements that do not include pipes, connections, or propulsion components, whose residual useful life is less than five years with respect to the threshold reference established in PA2-V9.

Reliability Is quantified from 0 to 1, depending upon the useful life studies conducted for network elements that are specific to the company and the variables that are established by the threshold and the reliability of information related to said threshold in PA2-V9.

Formula [PA2-V8] / Total number of elements*100

[PA2-V8] Number of elements (except pipes, connections, and propulsion components) that comprise the distribution network and are at risk of failure because of their proximity to the end of their useful life.

Definition The number of elements in the distribution network that have a residual useful life of less than five years with respect to the threshold reference of useful life indicated in PA2-V9. It is assumed that all elements that are close to the end of life reference value in less than five years or less, are at risk of failure or rupture. The value is calculated by accounting for the elements whose residual useful life falls within that range of values.

Units Number of elements

Reliability Table 408. Depends upon the form and data that are used to determine the number of elements, of the reliability in determining age since construction, installation, repair, or repositioning, and the reliability with which the threshold reference of useful life has been calculated for each type of element in the network of study.

[PA2-V9] Threshold, in years, of residual useful life of the distribution network elements being evaluated.

Definition Residual useful life is understood as the number of years left before the number of breaks, leaks, or malfunctions of pressure or water quality exceed a threshold that justifies their continued repair.

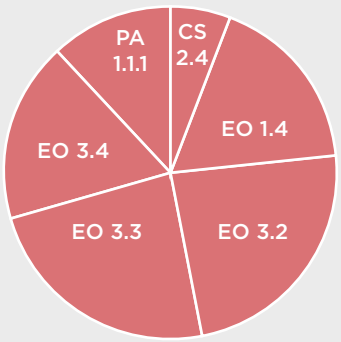
Calculation The useful life in which it is not convenient (profitable) to repair an element can be determined as an average reference value for all types of elements or may have been established for each type of element based on previously identified variables (such as typical diameter of a valve or joint, etc.). The useful life is determined using a technical approach and is independent from that used for accounting and financial management purposes.The residual useful life will be the difference between the age of the components and their useful life.

Units years

Reliability Table 409

Evidence of deterioration, such as bursts and leaks

PA2.2 Evidence of deterioration, such as bursts and leaks



Type Indicators and Practices
Normalization Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	SQ 2.4	SQ 2.4	Supply continuity	T.12 and T.13	1
	OE 1.4	OE 1.4	Real losses in the water supply, transportation and distribution infrastructure	T.42 to T.44	3
	OE 3.2	OE 3.2	Number of bursts in transportation and distribution pipes	T.43 and T.50	4
	OE 3.3	OE 3.3	Number of bursts in service connections (connections up to private supply systems)	T.44 and T.45	4
	OE 3.4	OE 3.4	Expenditure on “corrective maintenance” of fixed physical assets linked to the water intake, treatment and distribution “system”	T.35 and T.36	3
+	PA1.1	PA1.1.1	Minimal global nocturnal flow in the areas that are directly within the distribution network.	T.13 and T.401	2

SQ2.4 Supply continuity

This assessment element evaluates service continuity based on the number of hours during which the "hydraulic conditions" at the point of connection to the distribution "system" at each "property" supplied are sufficient for use and consumption.

Definition — Number of hours during which "hydraulic conditions for use and consumption" have not been met for each "property" in the year of rating.

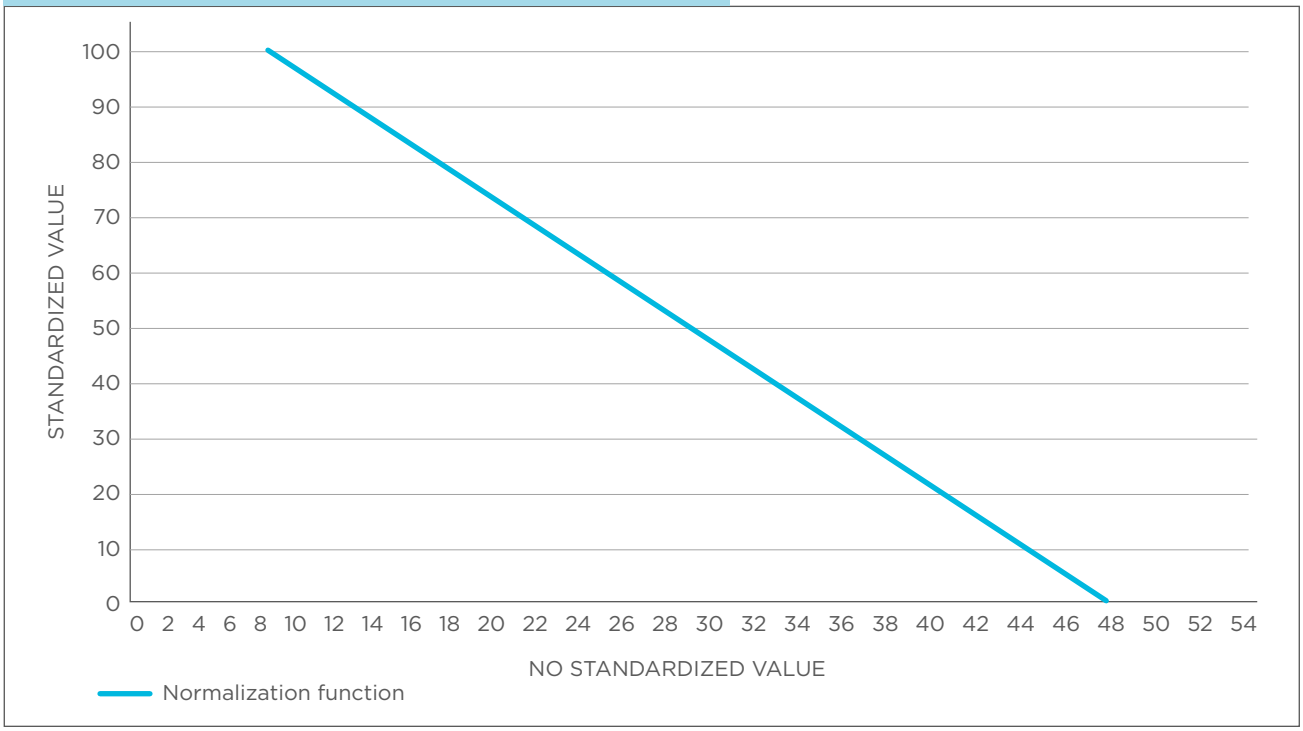
Type — Indicator

Service — Drinking Water

Glossary — System, Sufficient hydraulic conditions for use and consumption, Property

Formula — [CS2-V1]/[CS2-V2] Unit: hours

Normalization function



Variables

[CS2-V1] Total number of hours of interrupted supply

Definition — Total number of hours of interrupted supply or without the necessary "hydraulic conditions for supply and consumption" in each property throughout the year of rating. In "systems" in which continuous supply is generally not available, interruption hours will be applied to all properties located in the area that lacks such service.
Units — hours
Reliability — Table 12

[CS2-V2] Number of "properties" supplied

Definition — Number of "properties" supplied at the end of the year of rating.
Units — properties
Reliability — Table 13

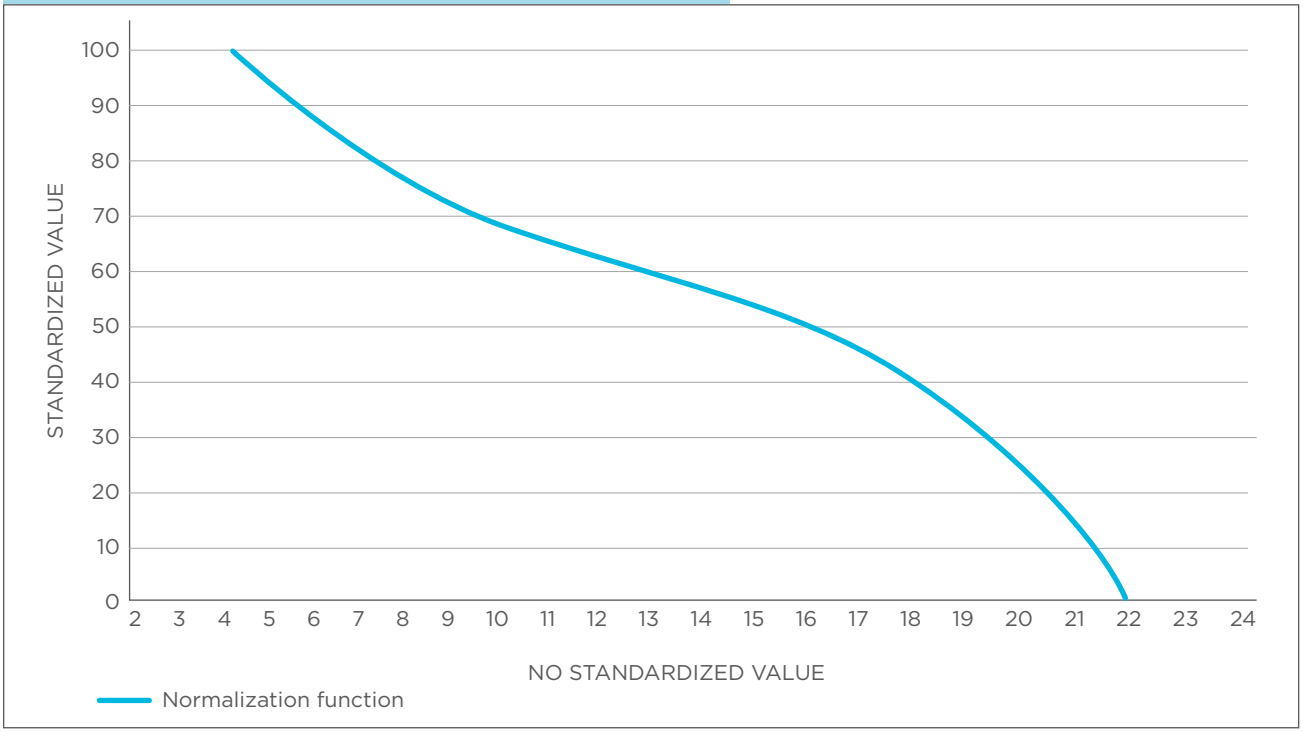
OE1.4 Real losses in the water supply, transportation and distribution infrastructure

Real losses refer to the volume of water exiting the supply and distribution infrastructure unintentionally and at unplanned network points without an established use or purpose.

Definition — Daily volume of physical water losses in the "geographical area to be rated" due to poor supply, transportation and distribution infrastructure condition or operation as a proportion of pipe length or number of service connections in the year of rating. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.
Type — Indicator
Service — Drinking Water
Glossary — Geographical area to be rated
Formula — **If connections density < 20**
([EO1-V3]/[EO1-V4]) Unit: m^3/km/day
If connections density >= 20
([EO1-V3]/[EO1-V5]) Unit: m^3/connection/day

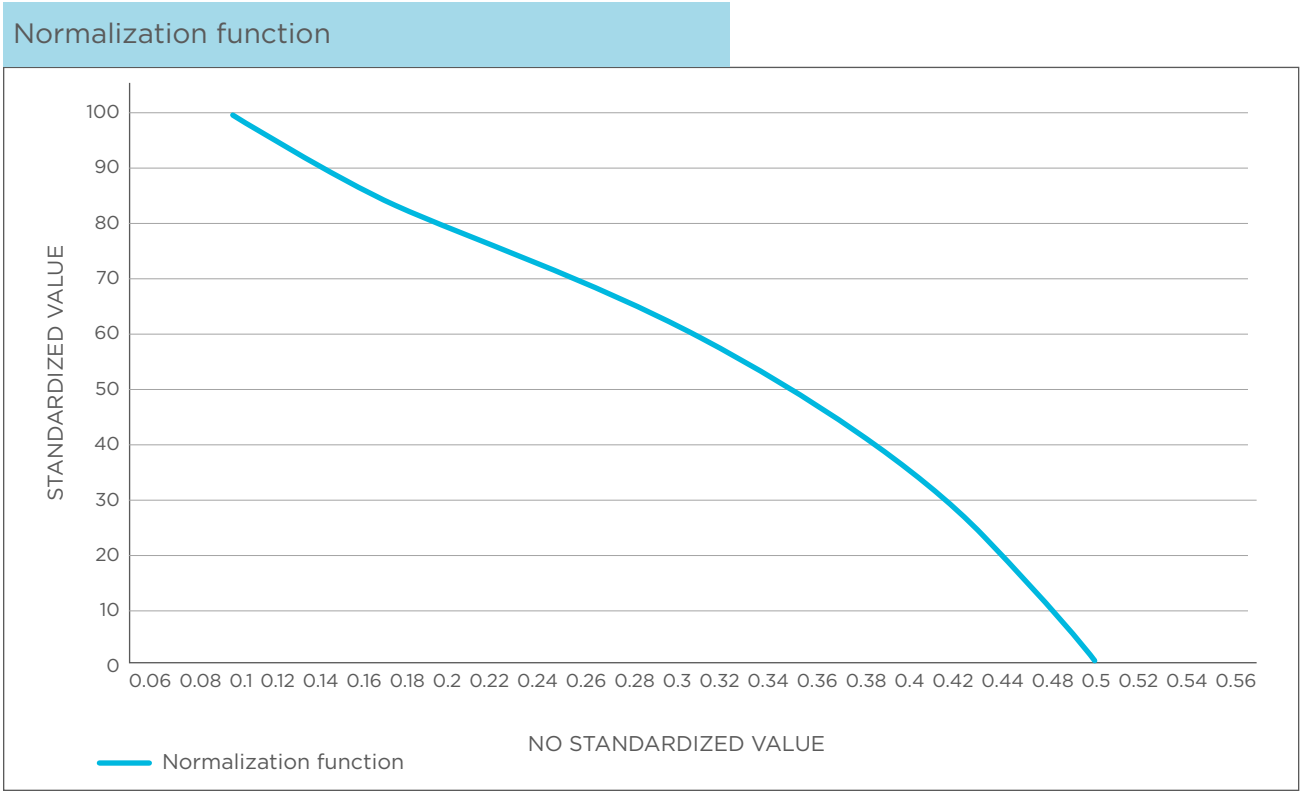
If connections density < 20

Normalization function



If connections density >= 20

Normalization function



Variables

[EO1-V3] Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation

Definition — Volume of water physically lost due to poor supply, transportation and distribution infrastructure condition or operation in the year of rating. It includes losses of both raw and treated water. This volume must be taken into account irrespective of whether losses are attributable to repaired bursts or hidden underground leaks.
Units — m^3/day
Reliability — Table 42

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.
Units — km
Reliability — Table 43

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition — Total number of drinking water service connections at the end of the rating year.
Units — connections
Reliability — Table 44

OE3.2 Number of bursts in transportation and distribution pipes

Definition — Annual number of reported bursts in transportation or distribution pipes per kilometer of such pipes in the "system". The average of the year of rating and the 2 preceding years.

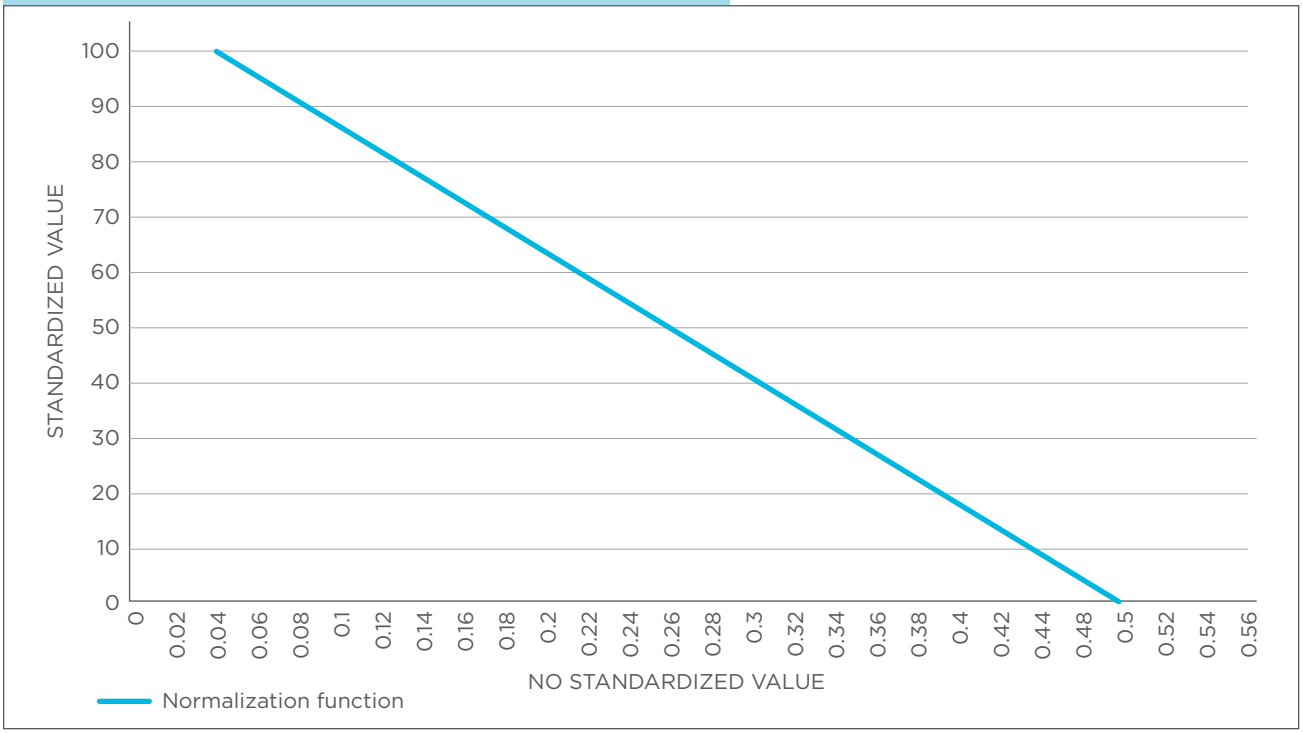
Type — Indicator

Service — Drinking Water

Glossary — System, Geographical area to be rated

Formula — [EO3-V1]/[EO1-V4] Unit: Nº/km

Normalization function



Variables

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.
Units — km
Reliability — Table 43

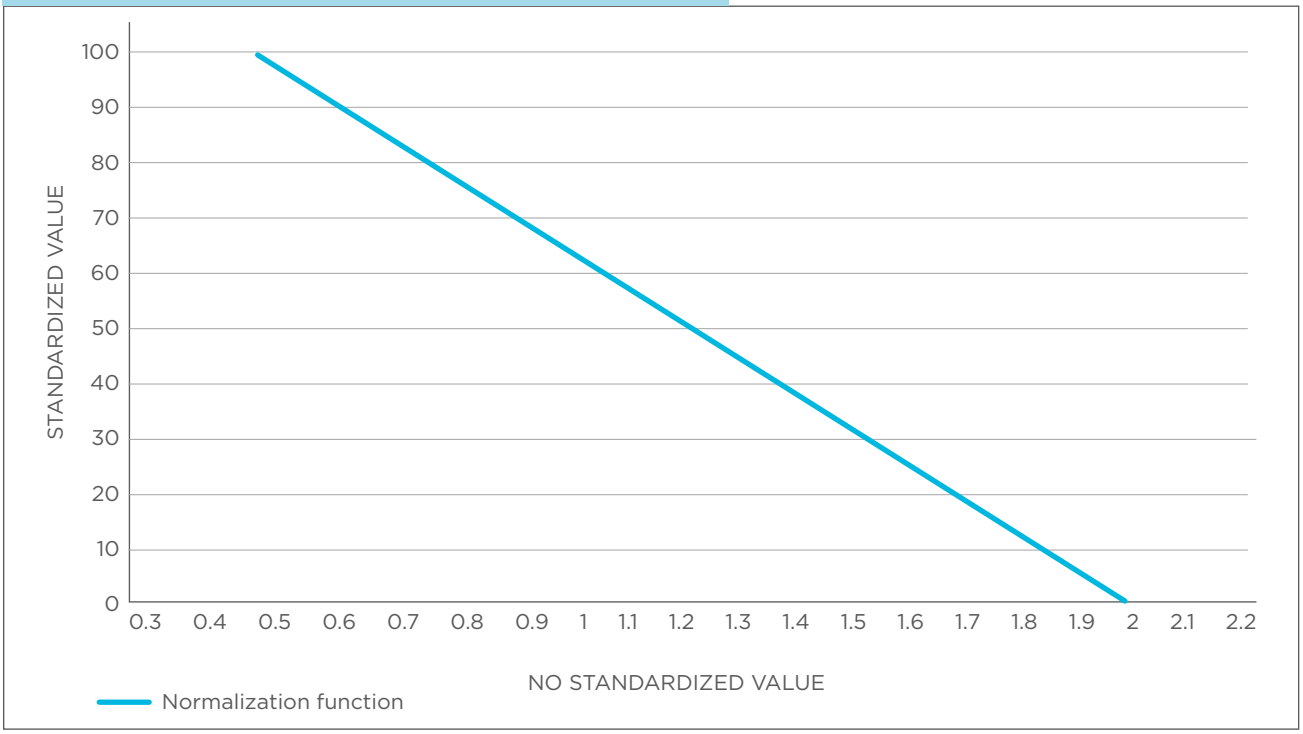
[EO3-V1] Annual number of known bursts in transportation or distribution pipes

Definition — Annual number of known bursts in transportation or distribution pipes (average of the year of rating and the 2 preceding years).
Units — no
Reliability — Table 50

OE3.3 Number of bursts in service connections (connections up to private supply systems)

Definition — Number of reported bursts per 100 connections (average of the year of rating and the 2 preceding years).
Type — Indicator
Service — Drinking Water
Glossary —
Formula — ([EO3-V2]/[EO1-V5])*100 Unit: Nº/100 connections

Normalization function



Variables

[EO1-V5] Total number of drinking water service connections at the end of the year of rating

Definition — Total number of drinking water service connections at the end of the rating year.
Units — connections
Reliability — Table 44

[E03-V2] Annual number of known bursts in connections

Definition — Annual number of known bursts in connections (average of the year of rating and the 2 preceding years)
Units — no.
Reliability — Table 51

OE3.4 Expenditure on "corrective maintenance" of fixed physical assets linked to the water intake, treatment and distribution "system"

Considers expenditure on all "corrective maintenance" performed on the water intake, treatment and distribution "system", including "incident" resolution, as a proportion of the value of the corresponding assets. It includes repair of bursts, as well as all other incidents that affect service. Infrastructure replacements not programmed in the renewal plans will be counted as corrective maintenance. Compensation costs for damages due to anomalies will also be included. If a specific policy exists, the annual cost of the policy will be added. Expenses for the year of ratingand asset values at the beginning of the financial period will be considered.

Definition Percentage representing annual expenditure on "corrective maintenance" of the fixed physical assets linked to the water intake, treatment and distribution "system" as a proportion of their gross value (except land) at the beginning of the year of rating. The average for the year of rating and the two preceding years is considered.

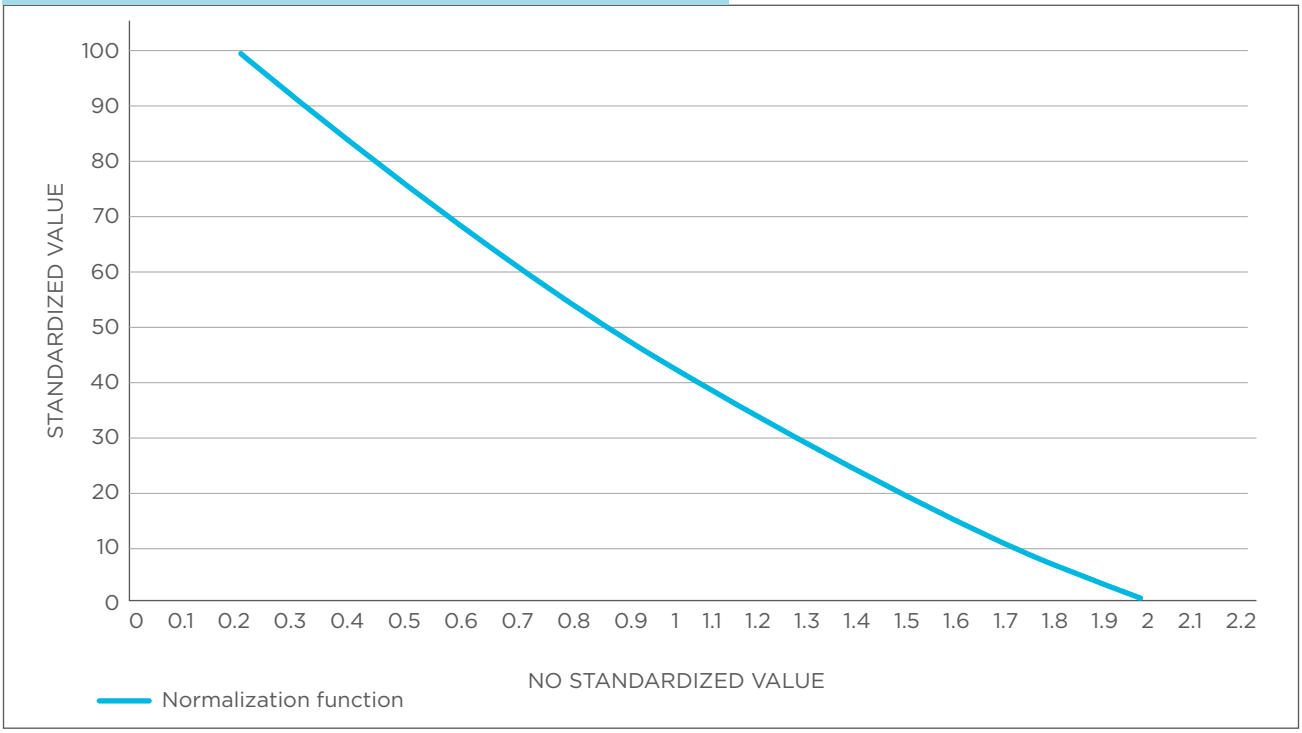
Type Indicator

Service Drinking Water

Glossary System, Incident, Corrective maintenance, Geographical area to be rated

Formula Formula: ([EO3-V3]/[EP3-V2.1])*100 Unit: %

Normalization function



Variables

[EO3-V3] Total annual expenditure on all "corrective maintenance" performed on water intake, treatment and distribution "systems"

Definition — Total annual expenditure on all "corrective maintenance" performed on water intake, treatment and distribution "systems", including incidents resolved, replacement not programmed in renewal plans, compensation for damages to third parties, and specific insurance policies.

Units — financial statement currency

Reliability — Table 35

[EP3-V2.1] Gross value of the fixed physical assets linked to the water intake, treatment and distribution "system"

Definition — Gross value of the facilities, equipment and infrastructure linked to the water intake, treatment and distribution "systems" in the "geographical area to be rated" (except land), including infrastructure not owned by the utility in the case that the utility is responsible for its replacement and maintenance costs. The gross value must match the gross value entered in the accounts at the beginning of the year, including value adjustments if applicable.

Units — financial statement currency

Reliability — Table 36

PA1.1.1 Minimal global nocturnal flow in the areas within the distribution network.

An orienting parameter with respect to the real losses that can exist within a distribution network. This parameter is most useful when it refers to a small zone or area, such as a measured sector or district, where there is more detail and precision in the registered flow values and in water consumption activity in low-consumption periods. It is a parameter that can help describe a system, especially when sufficient information is available, even reflecting annual average values of the entire distribution area (minus the parts of the distribution network that regulate nocturnal tank flows), and estimating minimum net night flows at different times of the year.

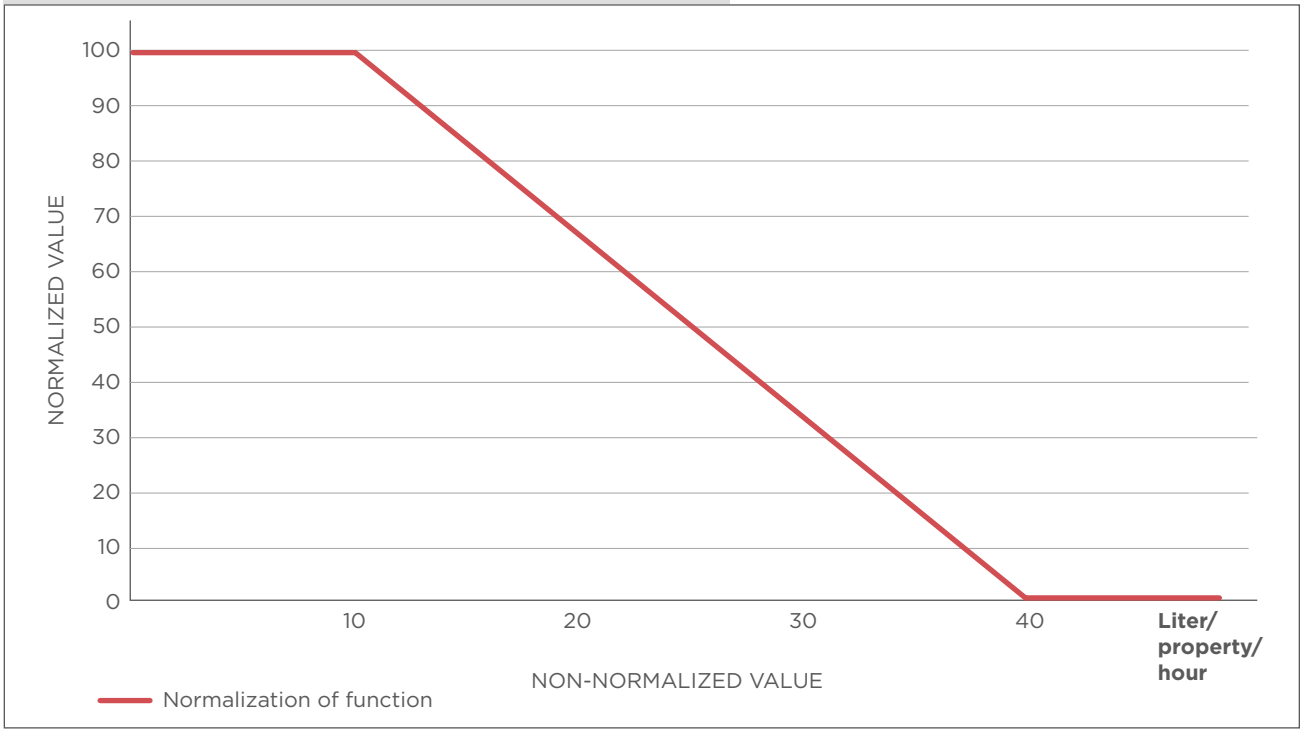
Definition — Minimum nocturnal flow throughout the year, in the whole supply area, divided by the number of properties supplied.

Type — Indicator

Service — Potable Water

Formula — [PA1-V1]/ [CS2-V2]

Normalization of function



Variables

[PA1-V1] Minimal nocturnal flow in the direct distribution areas

Definition — The flow that is entering the direct distribution systems without passing through tanks or other components that regulate and can store nocturnal flows. This value can only be determined if measurement and recording elements are available, measuring at least hourly, at all points along the distribution network where water is supplied directly. If a network is completely sectorized, the value will be the sum of the night values for all sectors. If the network is not sectorized, the value will be the sum of night flow values registered in all the distribution inputs and deposit outputs.

Calculation — Average value of the sum of flows recorded at all inputs to the direct distribution network between 2 and 4 a.m.

Units — liters/hour

Reliability — Table 401

[CS2-V2] Number of “properties” supplied

Definition — Number of “properties” supplied at the end of the year of rating.

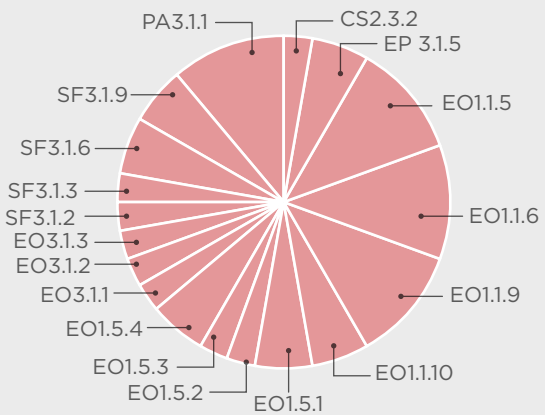
Units — properties

Reliability — Table 13

Policies, practices, and techniques for the management of losses

PA3.1 Planning and design practices

The result of the grouped and weighted characterizations of the set of practices that have a long-term vision for losses management.



Type ——— Indicators and Practices
Normalization ——— Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	SQ2.3	SQ2.3.2	GIS tools are available to support isolation, repair and resolution of “contingencies” in supply and distribution “systems”.	T.3	1
	PE3.1	PE3.1.5	Fixed physical asset management is specifically reflected in the utility’s strategic plan (see ME1) and a unit is assigned responsibility for it.	T.34	2
	OE1.1	OE1.1.5	Information on the location of all points of use and consumption is available in a geographical database of the distribution infrastructure.	T.3	4

AR	Group	Element	Description	Reliability	Weight
	OE1.1	OE1.1.6	Distribution networks are sectored and inflow volumes to sectors are measured frequently (at least once an hour). Sector scope does not exceed 10,000 “properties”. This practice is only considered to be complied with if more than 90% of network length is sectored.	T.3	4
	OE1.1	OE1.1.9	A procedure, unit or specific plan exists for reducing uncontrolled water. It includes, in addition to metering of all use and consumption, reduction of water use and consumption that does not generate revenue.	T.6	4
	OE1.1	OE1.1.10	Reliability indicators exist for measurements of flow supplied to sectors and to the whole “system”.	T.6	2
	OE1.5	OE1.5.1	A geo-referenced database exists for recording drainage, tank-emptying and filter-washing operations.	T.3	2
	OE1.5	OE1.5.2	A detailed criterion exists for determining volumes lost in each operation based on the length of the operation which loses water and working pressures or on occasional flow rate measurements.	T.6	1
	OE1.5	OE1.5.3	A system exists for recording substitution or installation of new infrastructure that enables evaluation of the water used in infrastructure start-up.	T.3	1
	OE1.5	OE1.5.4	A procedure or plan exists for explicit reduction of water used in operation.	T.3	2
	OE3.1	OE3.1.1	Geo-referenced databases (GIS) for all infrastructure are available.	T.3	1
	OE3.1	OE3.1.2	A unit is specifically responsible for maintaining and updating infrastructure information in the GIS.	T.6	1
	OE3.1	OE3.1.3	Procedures are used to ensure updating of information in the GIS regarding infrastructure characteristics and include a commitment to update within a stipulated timeframe.	T.6	1

AR	Group	Element	Description	Reliability	Weight
	FS3.1	FS3.1.2	The user register and classification is updated within 10 days of establishment of a service agreement or of deactivation of a connection.	T.94	1
	FS3.1	FS3.1.3	A user register exists that includes information concerning user type, service status (active/inactive), meter data, “property” data and other information necessary for billing the service.	T.33	1
	FS3.1	FS3.1.6	Services are billed monthly or bimonthly or payments are received with this regularity if bills are issued less frequently.	T.93	2
	FS3.1	FS3.1.9	A policy exists for detecting and regularizing fraud in its various forms (meter calibration, detection of illegal connections, detection of false information regarding type of use or any other variable that influences tariffs) and, in the case that estimated losses attributable to users exceed 10% of unbilled water volume, systematic operations are carried out to detect illegal connections. If an estimate of losses attributable to users is not available, it is assumed that these amount to more than 10% of unbilled water volume.	T.97	2
	PA3.1	PA3.1.1	Percentage of the distribution network that is permanently sectorized	T.410	4

PA3.1.1 Percentage of the distribution network that is permanently sectorized

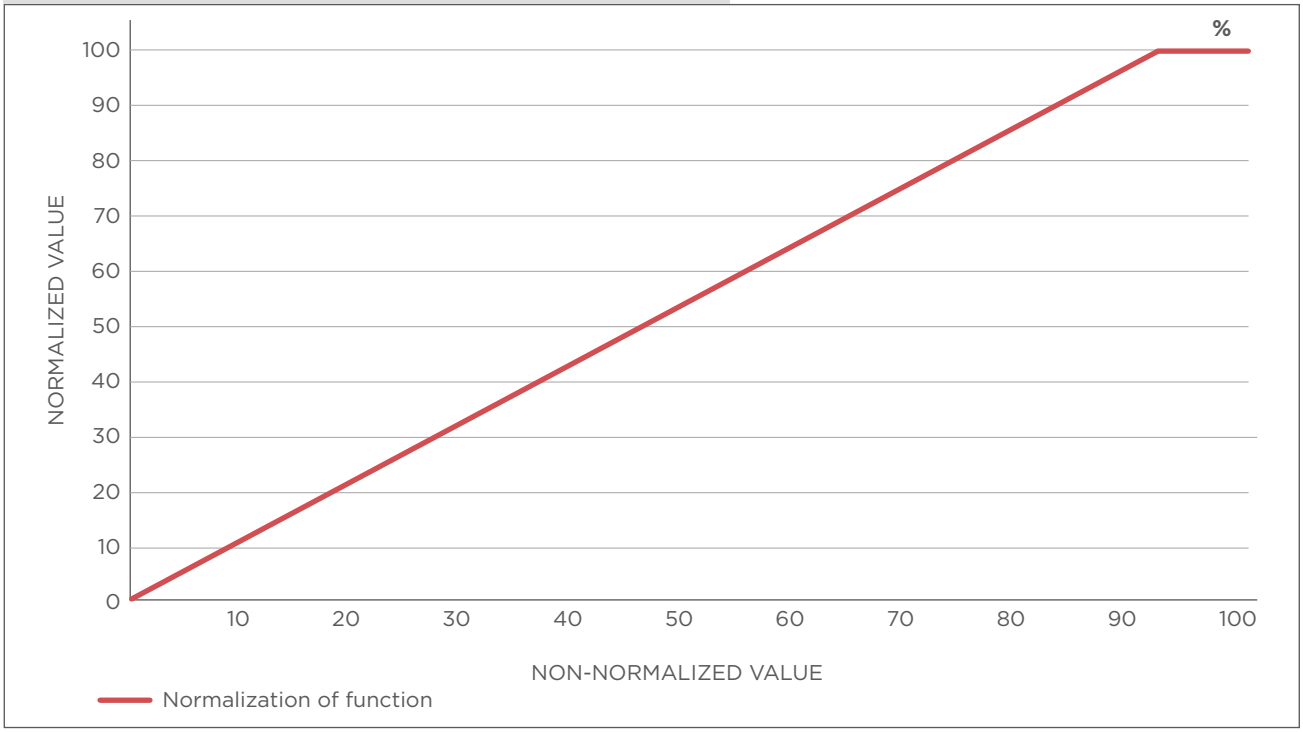
Description — This parameter evaluates the level of total losses management within a distribution network according to the degree of compartmentalization and monitoring by zone within the entire network. The parameter is based on the measurement of the degree of implementation of the sectorization technique (dividing the service area into zones, sectors, or districts where flow balances can be measured, at least hourly). Sectors should have a maximum size of 10,000 properties supplied, so that the information provided can be useful for a detailed analysis of balances and so that information can be captured about minimal nocturnal flows consumed in the sector. This parameter allows quantification of the degree to which implementation of AquaRating practice EO1.1.6 has occurred, when it has not been complied with fully.

Type — Indicator

Calculation — Calculated using the percentage relationship between the length of the permanently sectorized distribution network and the length of the total distribution network.

Formula — [PA3-V1] / [EO1-V4] * 100

Normalization of function



Variables

[PA3-V1] Length of the permanently sectorized distribution network that is being evaluated

Definition — It is understood that the set of pipes (without accounting for the length of connections to users) is part of a permanently sectorized distribution network that is structured in independent, compartmentalized hydraulic components in a way that allows the measurement and control of the flow of main inputs and outputs (without taking into account the outputs that correspond to individual use and consumption). Only valid sectors will be considered: for the purposes of this variable, this means those that have a maximum supply size of 10,000 properties with a flow record of at least hourly frequency.

Units — Km

Reliability — Table 410. Will vary between 0 and 1 and will be quantified based on the evidence of the existence of a sectorization management system in terms of the sector maintenance and control of their closeness or isolation and the reliability of their flow balance measurements.

[EO1-V4] Length of supply, transportation and distribution pipes

Definition — Length of supply, transportation and distribution pipes in the "geographical area to be rated" and for operation and maintenance of which the utility is responsible (at the end of the rating year). It includes both pipes that transport raw water and those that transport treated water. It excludes the length of service connection pipes.

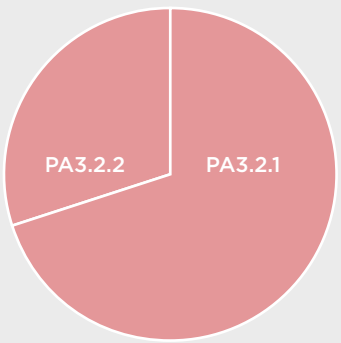
Units — Km

Reliability — Table 43

PA3.2 Generic losses management practices

This parameter aims to synthesize in a single value, the set of practices and techniques for managing real and operational losses.

It will be the result of the grouped and weighted characterization of the evaluation of the management and practices related to both real and operational losses.



Type ——— Group of Indicators and Practices
Normalization — Weighted by each element

AR	Group	Sub-group	Description	Weight
	PA3.2	PA3.2.1	Management of real losses	7
	PA3.2	PA3.2.2	Practices for the management of operational losses	3

PA3.2.1 Management of real losses

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.2.1	EO1.3	EO1.3.1	The service provider has an entity that is responsible for real losses management, or has a well-defined procedure for action.	T. 2	1
	PA3.2.1	EO1.3	EO1.3.2	There is a procedure for estimating real losses volumes, using standard criteria (such as those provided by IWA, or something similar, differentiating apparent and real losses, and authorized and unauthorized uses) for estimating uncontrolled water components, and at least monthly calculation of real losses values.	T. 6	3
	PA3.2.1	EO1.3	EO1.3.3	The efficiency of different techniques for detecting, locating, and repairing real losses is analyzed and compared for each sector in which the uncontrolled water balance is assessed.	T. 2	1
	PA3.2.1	EO1.3	EO1.3.4	Reference levels and action items are established to guide the practices and scope of the search for and reduction of real losses (assessment and monitoring to occur, at minimum, on an annual basis).	T. 2	2

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.2.1	EO1.3	EO1.3.5	The reduction of real losses is part of the planning process and goals when it comes to infrastructure maintenance/repair and pressure management policies.	T. 2	2
	PA3.2.1	EO1.3	EO1.3.6	References and records of water losses incidents are available in geographic databases.	T. 6	2
	PA3.2.1	EO1.3	EO1.3.7	Real losses assessments are made for the area being rated, supported by (at minimum) balances and minimum flow tests for the entire area, or for the sum of smaller areas that comprise the zone being rated.	T. 6	1
	PA3.2.1	EO1.3	EO1.3.8	Reliability indicators are available for the minimum nocturnal flow measurements supplied to sectors where they are recorded and used for losses management purposes.	T. 2	1
	PA3.2.1	EO1.3	EO1.3.9	Monitoring procedures (with at least daily frequency) are available, with variations in average and minimum flows taken at the sector level to report losses reduction initiatives.	T. 6	1

PA3.2.2 Practices for management of operational losses

The value that results from the grouped and weighted characterization of the group of elements that represent operational and management practices for operational losses.

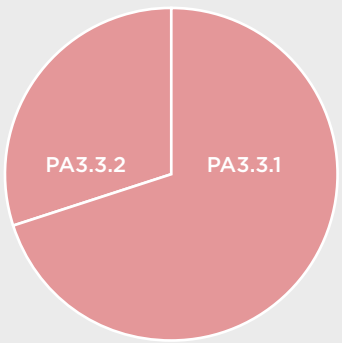
AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.2.2	CS2.3	CS2.3.1	24-hour availability of specific human and material resources for the management of contingencies within supply and distribution systems.	T. 5	2
	PA3.2.2	CS2.3	CS2.3.2	Availability of GIS tools to help isolate, repair, and resolve contingencies in supply and distribution systems.	T. 3	2
	PA3.2.2	CS2.3	CS2.3.3	24-hour availability of early warning systems: remote control and receipt of warnings for supply and distribution systems.	T. 3	2
	PA3.2.2	EO1.5	EO1.5.1	Availability of a system with a geo-referenced database for recording drainage operations, tank emptying, and filter washing.	T. 3	1
	PA3.2.2	EO1.5	EO1.5.2	Availability of detailed criteria to determine the volumes lost in each process, based on the duration of the process, with water losses and operating pressure or periodic flow measurements.	T. 6	1
	PA3.2.2	EO1.5	EO1.5.3	Availability of a registration system for replacing or installing new infrastructure to make it possible to evaluate water that is used.	T. 3	1

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.2.2	EO1.5	EO1.5.4	Existence of a procedure or plan for explicitly reducing the water used in operational processes.	T. 6	2
	PA3.2.2	EO1.5	EO1.5.5	Availability of a system that contrasts expected and actual flows, which is used at the zone or sectoral level to validate operating water balances.	T. 6	1

PA3.3 Active management practices

This parameter aims to synthesize in a single value, the set of practices and techniques to manage the infrastructure that comprise the distribution network.

It will be the result of the grouped and weighted characterization of the evaluation of policies for the repair of distribution network infrastructure and for their maintenance and management.



Type ——— Group of Indicators and Practices
Normalization ——— Weighted for each element

AR	Group	Sub-group	Description	Weight
	PA3.3	PA3.3.1	Policies for infrastructure repair and fixed asset management	7
	PA3.3	PA3.3.2	Fixed physical asset management practices	3

PA3.3.1 Policies for infrastructure repair and fixed asset management

The result of the grouped and weighted characterization of the set of repair and replacement practices for the infrastructure that comprise the distribution networks.

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.3.1	PE3.1	PE3.1.1	Records exist of existing infrastructure and its condition survey of fixed assets' operational capacities and condition (good, fair or poor).	T.33	5
	PA3.3.1	PE3.1	PE3.1.2	A plan exists for maintenance and replacement of fixed physical assets based on failure risk analysis, costs, etc.	T. 2	4
	PA3.3.1	OE3.1	OE1.3.5	Real losses reduction is one of the considerations and objectives of infrastructure renewal and pressure management policies.	T. 2	3
	PA3.3.1	OE3.1	OE3.1.11	A line of research or analysis is conducted on the performance and service life of the equipment and infrastructure.	T. 6	1

PA3.3.2 Fixed physical asset management practices

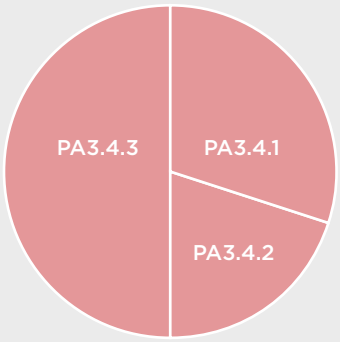
Reflects in an integrated way the assessment of the practices of asset management and maintenance within the distribution network, taking into acount the financial records related to the repair/replacement of these assets.

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.3.2	PE3.1	PE3.1.1	Records exist of existing infrastructure and its condition survey of fixed assets' operational capacities and condition (good, fair or poor).	T.33	1
	PA3.3.2	PE3.1	PE3.1.2	A plan exists for maintenance and replacement of fixed physical assets based on failure risk analysis, costs, etc.	T. 2	2
	PA3.3.2	PE3.1	PE3.1.3	Up-to-date handbooks exist, and are used, detailing operation and maintenance of fixed physical assets.	T. 6	0.2
	PA3.3.2	PE3.1	PE3.1.4	Corresponding staff are trained to manage the fixed physical assets.	T. 4	0.2
	PA3.3.2	PE3.1	PE3.1.5	Fixed physical asset management is specifically reflected in the utility's strategic plan (see ME1) and a unit is assigned responsibility for it.	T. 34	0.2
	PA3.3.2	PE3.2	PE3.2	Annual investment in replacement of fixed physical assets	T.35 and T.36	7

PA3.4 Monitoring and control practices

This parameter aims to synthesize in a single value the set of practices and techniques used to monitor and control the operation of the distribution network, along with the input, output, and individual consumption flows, as well as the techniques used to analyze all available information.

This parameter is the result of the grouped and weighted characterization of the evaluation of the practices of monitoring commercial losses, flows, and hydraulic parameters, as well as general information analysis.



Type ——— Group of Indicators and Practices
Normalization —— Weighted by each element

AR	Group	Sub-group	Description	Weight
	PA3.4	PA3.4.1	Practices of monitoring and controlling commercial losses	3
	PA3.4	PA3.4.2	Practices for monitoring flows, consumption, and orienting parameters related to losses quantities	2
	PA3.4	PA3.4.3	Analytic practices and valuation of monitoring information	5

PA3.4.1 Practices of monitoring and controlling commercial losses

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.4.1	OE1.1	OE1.1.1	Individual water flow rate or volume-metering devices (micro-metering) are installed at all points of use and consumption and these are read and the data recorded at least once a quarter.	T. 1	2
	PA3.4.1	OE1.1	OE1.1.2	Water flow rate or volume-metering devices are installed at all “entry points to the water supply system” and these are read and the data recorded at least once an hour.	T. 1	3
	PA3.4.1	OE1.1	OE1.1.3	Policies exist for dimensioning and renewing individual metering devices (micro-metering) that focus on maintaining the error levels or confidence intervals established in the regulations and on homogenizing metrological classes.	T. 6	1
	PA3.4.1	OE1.1	OE1.1.4	Policies exist for dimensioning, renewing and verifying water flow rate or volume-metering devices at the “entry points to the system” that focus on maintaining the error levels or confidence intervals established in the regulations and that tend to homogenize classes, types and brands.	T. 6	1
	PA3.4.1	OE1.1	OE1.1.5	Information on the location of all points of use and consumption is available in a geographical database of the distribution infrastructure.	T. 3	1

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.4.1	OE1.1	OE1.1.6	Distribution networks are sectored and inflow volumes to sectors are measured frequently (at least once an hour). Sector scope does not exceed 10,000 “properties”. This practice is only considered to be complied with if more than 90% of network length is sectored.	T. 3	1
	PA3.4.1	OE1.1	OE1.1.7	Distribution networks are sectored and inflow volumes to sectors are measured frequently (at least once an hour). Sector scope does not exceed 10,000 “properties”. This practice is only considered to be complied with if more than 90% of network length is sectored.	T. 6	2
	PA3.4.1	OE1.1	OE1.1.8	Water supply and controlled consumption balances for all sectors are calculated and documented at least once a month, with consumption being calculated pro rata if consumption records are required for greater time intervals.	T. 6	1
	PA3.4.1	OE1.1	OE1.1.9	A procedure, unit or specific plan exists for reducing uncontrolled water. It includes, in addition to metering of all use and consumption, reduction of water use and consumption that does not generate revenue.	T. 6	1
	PA3.4.1	OE1.1	OE1.1.10	Reliability indicators exist for measurements of flow supplied to sectors and to the whole “system”.	T. 6	1

PA3.4.2 Practices for monitoring flows, consumption, and orienting parameters regarding losses quantities

This value will be the result of the grouped and weighted characterization of the set of flow and consumption monitoring and control practices that are used in the area that is being evaluated.

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.4.2	SQ2.3	SQ2.3.3	Early warning mechanisms are available 24/7 (remote control and receipt of warnings referring to supply and distribution “systems”).	T.3	3
	PA3.4.2	OE1.1	OE1.1.1	Individual water flow rate or volume-metering devices (micro-metering) are installed at all points of use and consumption and these are read and the data recorded at least once a quarter.	T. 1	5
	PA3.4.2	OE1.1	OE1.1.2	Water flow rate or volume-metering devices are installed at all “entry points to the water supply system” and these are read and the data recorded at least once an hour.	T. 1	5
	PA3.4.2	OE1.1	OE1.1.3	Policies exist for dimensioning and renewing individual metering devices (micro-metering) that focus on maintaining the error levels or confidence intervals established in the regulations and on homogenizing metrological classes.	T. 6	3

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.4.2	OE1.1	OE1.1.4	Policies exist for dimensioning, renewing and verifying water flow rate or volume-metering devices at the "entry points to the system" that focus on maintaining the error levels or confidence intervals established in the regulations and that tend to homogenize classes, types and brands.	T. 6	3
	PA3.4.2	OE1.3	OE1.3.8	Reliability indicators exist for measurements of minimum night flow rates supplied to sectors or to points where they are recorded and used for losses management.	T.2	2
	PA3.4.2	OE1.3	OE1.3.9	Procedures exist for monitoring (at least once a day) fluctuations in average and minimum flow rates at sector level to support losses reduction actions.	T.6	3
	PA3.4.2	OE3.1	OE3.1.4	A remote control system exists that relays the operational status of at least 20% of maneuverable devices and equipment positioned in strategic parts of the "system".	T.3	2
	PA3.4.2	FS3.1	FS3.1.1	Billing is based on measurement (meter reading) for at least 99% of billed users.	T.93	4

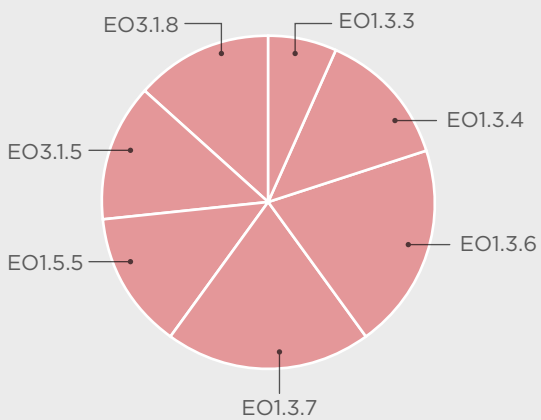
PA3.4.3 Analysis and evaluation practices related to monitoring information

The result of the grouped and weighted characterization of the set of practices used to analyze available information alongside the information collected during monitroing.

AR	Sub-group	Component	Element	Description	Reliability	Weight
	PA3.4.3	OE1.1	OE1.1.7	Water supply and controlled water consumption balances for the entire supply network are calculated and documented at least once a quarter.	T. 6	3
	PA3.4.3	OE1.1	OE1.1.8	Water supply and controlled consumption balances for all sectors are calculated and documented at least once a month, with consumption being calculated pro rata if consumption records are required for greater time intervals.	T. 6	5
	PA3.4.3	OE1.3	OE1.3.1	A utility unit is responsible for managing real losses or a well-defined operating procedure exists.	T.2	5
	PA3.4.3	OE1.3	OE1.3.2	A procedure exists for estimating real losses volumes based on standard criteria (IWA or similar, with differentiation between apparent and real losses and between authorized and unauthorized consumption) to estimate uncontrolled water components. Real losses volumes are computed at least once a month.	T.6	5

PA3.5 Practices for detecting and locating hidden leaks

The result of the grouped and weighted characterization of the practices used to detect and locate hidden leaks.

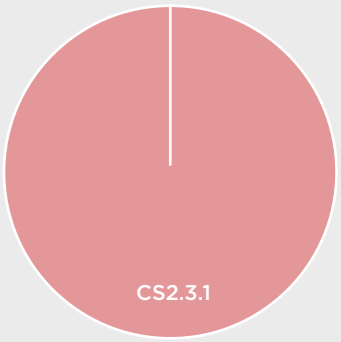


Type Group of Indicators and Practices
Normalization Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	OE1.3	EO1.3.3	The efficiency of different techniques used to detect, locate and repair sources of real losses is analyzed and compared for each sector or zone in which uncontrolled water balances are calculated.	T.2	1
	OE1.3	EO1.3.4	Performance levels and reference parameters are determined in order to guide practice and scope of identifying and reducing real losses (evaluation and tracking at least once a year).	T.2	2
	OE1.3	EO1.3.6	References and records of water losses “incidents” are available in geographical databases.	T.6	3
	OE1.3	EO1.3.7	Evaluation of real losses for the geographical area to be rated is based, at the very least, on balance contrasting and minimum flow rates for the entire geographical area or for the sum of smaller areas that make up the geographical area to be rated.	T.6	3
	OE1.5	OE1.5.5	A system exists for contrasting expected and real flow rates at zone or sector level and is used to validate operational water balances.	T.6	2
	OE3.1	OE3.1.5	An early warning system exists to identify “incidents” (remote control, sectoring, online indicators).	T.3	2
	OE3.1	OE3.1.8	An integrated system exists to manage anomaly reporting and resolution linked to the operation and warnings and complaints areas.	T.3	2

PA3.6 Practices for the repair of bursts and leaks

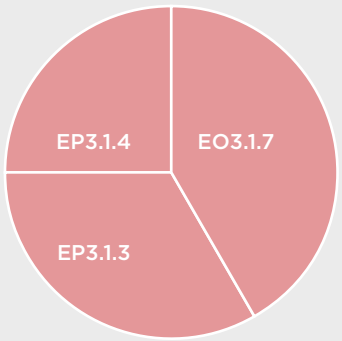
The result of the grouped and weighted characterization of the practices for repairing bursts and leaks, once they are detected and found.



Type ——— Group of Indicators and Practices
Normalization — Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	SQ2.3	SQ2.3.1	Specific human and material resources are available 24/7 to manage “contingencies” in water supply and distribution “systems”.	T.5	10

PA3.7 Operational practices focused on losses management



Type ——— Group of Indicators and Practices
Normalization ——— Weighted by each element

AR	Group	Element	Description	Reliability	Weight
	OE3.1	OE3.1.7	A system to manage pressure in the distribution network is available and implemented.	T.3	5
	PE3.1	PE3.1.3	Up-to-date handbooks exist, and are used, detailing operation and maintenance of fixed physical assets.	T.6	4
	PE3.1	PE3.1.4	Corresponding staff are trained to manage the fixed physical assets.	T.4	3

Appendix

A. Reliability Tables

Reliability Tables incorporated into the AquaRating evaluation system

Table 1:

Reliability Levels		Factor
1	Existence of equipment cannot be verified.	0
2	Equipment exists physically, it can be verified that it has the indicated characteristics and that the rated utility is authorized to use it (property, invoice, delivery note, rent receipt or other evidence).	0.6
3	In addition to fulfilling the requirements for level 2, operation manuals and personnel trained to use and maintain the equipment exist.	0.7
4	In addition to fulfilling the requirements for levels 2 and 3, calibration of at least 60% of the equipment is certified (by an accredited laboratory in the case of equipment for measuring physical and chemical parameters) and accuracy is systematically verified.	0.8
5	In addition to the fulfillment of requirements for levels 2 and 3, for 100% of the equipment, calibration is certified (by an accredited laboratory in case of equipment for measuring physico chemical parameters) and accuracy is systematically verified.	0.95
6	In addition to fulfilling the requirements for levels 2, 3 and 5, it is part of the instrumentation audited, at least internally, according to an accreditation standard.	1

Table 2

Reliability Levels		Factor
1	The practice is not documented.	0
2	The practice is documented, but there is no evidence of its application either in the rating year.	0.5
3	The practice is documented and evidence exists of its application in the rating year.	0.7
4	The practice is documented, and evidence exists of its application at the rating year as well as in the calendar year preceding that date.	1

Table 3

Reliability Levels		Suma
1	Documents describing the system exist, as do handbooks for its use and maintenance.	0.25
2	Staff are available to use and maintain it.	0.25
3	It is permanently installed on all relevant workstations or can be accessed from them.	0.25
4	Records of its systematic use exist.	0.25

Table 4

Reliability Levels		Factor
1	There is no evidence of its application.	0
2	Evidence exists of its application at the year of rating or the calendar year preceding that date.	0.7
3	Evidence exists of its application at year of rating as well as in the calendar year preceding that date or in the 2 calendar years preceding the year of rating.	1

Table 5

Reliability Levels		Factor
1	There is no evidence of its application.	0
2	Evidence exists of its application in the year of rating.	0.7
3	Evidence exists of its application in the rating year.	0.8
4	Evidence exists of its application in the rating year as well as in the calendar year preceding that date.	0.9
5	Evidence exists of its application in the year of rating as well as in the 2 calendar years preceding that date.	1

Table 6

Reliability Levels		Factor
1	The practice is not documented.	0
2	The practice is documented, but there is no evidence of its application.	0.5
3	A documented procedure exists and evidence exists of its application.	0.7
4	A documented procedure exists and evidence exists of its application in the year of rating	0.8
5	A documented procedure exists and evidence exists of its application in the year of rating as well as in the preceding calendar year.	0.9
6	A documented procedure exists and evidence exists of its application in the year of rating as well as in the 2 preceding calendar years.	1

Table 12

Reliability Levels		Factor
1	No documented records exist.	0
2	Paper records exist of "incidents", complaints, programmed service stoppages and service interruptions (including estimates of the number of properties affected).	0.5
3	GIS records exist of "incidents", complaints, programmed service stoppages and service interruptions (including estimates of the number of properties affected).	0.8
4	GIS records exist of "incidents", complaints, programmed service stoppages and service interruptions (including precise details of the number of properties affected).	1

Glossary ——— Incident

Table 13

Reliability Levels		Factor
1	No documented records other than census data exist.	0
2	Paper records of users and properties served exist.	0.5
3	Computerized records of users exist, indicating type and property for all users.	0.8
4	GIS records of connections exist, indicating associated properties and linked to the distribution network and the "incident" management system.	1

Glossary ——— Incident

Table 33

Reliability Levels		Factor
1	It cannot be corroborated or it was approved more than 4 years ago.	0
2	It is available and was approved between 3 and 4 years ago.	0.5
3	It is available and less than 3 years old, but it is not up to date at the end of the year of rating.	0.7
4	It is available and less than 3 years old and it is up to date at the end of the year of rating.	1

Table 34

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	Management of fixed assets is considered in the strategic plan's guidelines and there is a function related to this area in one of the organization's units.	0.6
3	Management of fixed assets is considered in the strategic plan's guidelines and objectives and a unit in the organization is currently in charge of this area.	1

Table 35

Reliability Levels		Factor
1	No separate accounting records exist for investment in replacement of or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets or the data come from incomplete or unaudited financial statements or from audited financial statements receiving either a disclaimer of opinion related to this indicator or an adverse opinion.	0
2	Separate accounting records exist for investment in replacement of or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets and financial statements are audited by external auditors (“registered” or non-registered), but definition or identification of these expenditures does not meet the “criteria established in the International Accounting Standards (IAS 16)” or the auditors’ report contains a qualified opinion related to this indicator.	0.3
3	Separate accounting records exist for investment in replacement of or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets and definition or identification of these expenditures meet the “criteria established in the International Accounting Standards (IAS 16)”, but it is not possible to verify their “consistency<-90. with the financial statements audited by external auditors (“registered” or non-registered).	0.5
4	Separate accounting records exist for investment in replacement of or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets, definition or identification of these expenditures meet the “criteria established in the International Accounting Standards (IAS 16)” and their amount is “consistent” with the financial statements audited by non-”registered” external auditors who have issued a disclaimer of opinion not related to this indicator.	0.7
5	Separate accounting records exist for investment in replacement of or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets, definition or identification of these expenditures meet the “criteria established in the International Accounting Standards (IAS 16)” and their amount is “consistent” with the financial statements audited by “registered” external auditors who have issued a disclaimer of opinion not related to this indicator.	0.8
6	Separate accounting records exist for investment in replacementof or for expenditure on “corrective”/”preventive” maintenance of fixed physical assets, definition or identification of these expenditures meet the “criteria established in the International Accounting Standards (IAS 16)” and their amount is “consistent” with the financial statements audited by non-”registered” external auditors who have issued an unqualified opinion related to this indicator.	0.9

Reliability Levels		Factor
7	Separate accounting records exist for investment in replacement of or for expenditure on "corrective"/"preventive" maintenance of fixed physical assets, definition or identification of these expenditures meet the "criteria established in the International Accounting Standards (IAS 16)" and their amount is "consistent" with the financial statements audited by "registered external auditors" who have issued an unqualified opinion related to this indicator.	1

Glossary Preventive maintenance, Corrective maintenance, Registered external auditors, Criteria established in the International Accounting Standards (IAS 16), Consistency of accounting information not originating from the financial statements

Table 36:

Reliability Levels		Factor
1	The financial statements are incomplete or unaudited, or are audited and include either a disclaimer of opinion related to the fixed physical assets or an adverse opinion.	0
2	Financial statements audited by external auditors ("registered" or non-registered) that include either a qualified opinion related to the fixed physical assets, or ancillary records for the fixed assets "consistent" with the financial statements.	0.3
3	Financial statements audited by external auditors ("registered" or non-registered) that include either a disclaimer of opinion not related to the fixed physical assets, or ancillary records for the fixed assets "consistent" with the financial statements. The criterion for determining the fixed physical assets' value is based on the acquisition cost model, one of the options established in the International Accounting Standards.	0.5
4	Financial statements audited by external auditors ("registered" or non-registered) that include either a disclaimer of opinion not related to the fixed physical assets, or ancillary records for the fixed assets "consistent" with the financial statements. The criterion for determining the fixed physical assets' value is based on the revaluation model, which is the other option established in the International Accounting Standards.	0.6
5	Financial statements audited by non-"registered" external auditors that include an unqualified opinion related to the fixed physical assets, or ancillary records for the fixed assets "consistent" with the financial statements. The criterion for determining the fixed physical assets' value is based on the acquisition cost model, one of the options established in the International Accounting Standards.	0.7

Reliability Levels		Factor
6	Financial statements audited by “registered” external auditors that include an unqualified opinion related to the fixed physical assets, or ancillary records for the fixed assets “consistent” with the financial statements. The criterion for determining the fixed physical assets’ value is based on the acquisition cost model, one of the options established in the International Accounting Standards.	0.8
7	Financial statements audited by non-”registered” external auditors that include an unqualified opinion related to the fixed physical assets, or ancillary records for the fixed assets “consistent” with the financial statements. The criterion for determining the fixed physical assets’ value is based on the revaluation model, which is the other option established in the International Accounting Standards.	0.9
8	Financial statements audited by “registered” external auditors that include an unqualified opinion related to the fixed physical assets, or ancillary records for the fixed assets “consistent” with the financial statements. The criterion for determining the fixed physical assets’ value is based on the revaluation model, which is the other option established in the International Accounting Standards.	1

Glossary ——— Registered external auditors, Consistency of accounting information not originating from the financial statements

Table 40

Reliability Levels		Factor
1	No metering or micro-metering records exist.	0
2	Meter readings are recorded at least once a year.	0.33
3	Meter readings are recorded at least once a quarter. Real readings (without need for estimate) represent more than 90% of total readings.	0.9
4	Meter readings are recorded at least once every two months. Real readings (without need for estimate) represent more than 90% of total readings. Systematic practices exist to verify measurement reliability.	1

Table 41

Reliability Levels		Factor
1	No gauging records exist of intakes or introductions into the system.	0
2	Gauging records are taken at all “entry points” into the “system” at least once a year.	0.25
3	Gauging records are taken at all “entry points” into the “system” at least once a month.	0.75
4	Gauging records are taken at all “entry points” into the “system” at least once a day by remote monitoring systems.	0.9
5	Gauging records are taken at all “entry points” into the “system” at least once a day by remote monitoring systems. Gauging equipment calibration practices exist.	1

Glossary ——— System, Entry point into the drinking water supply system

Table 42

Reliability Levels		Factor
1	Real losses are estimated without access to any of the following information: data on water input into the “system”, metered individual consumption (or calculated from a representative statistical base), or criteria for calculating uncontrolled water components.	0
2	Estimates based on balances and uncontrolled water components are made for the entire “system” at least once a year.	0.5
3	Estimates based on balances and uncontrolled water components are made once a month and calculations are substantiated by documented criteria or empirical references.	0.9
4	Estimates are based on balances and uncontrolled water components and calculations are substantiated by documented criteria or empirical references and compare equal reading periods for volumes supplied and consumed at the sector level.	1

Glossary ——— System

Table 43

Reliability Levels		Factor
1	No documented records exist.	0
2	Managed pipes are mapped on paper.	0.3
3	Managed pipes are recorded in a GIS. Systematic information maintenance and updating protocols do not exist.	0.8
4	Managed pipes are recorded in a GIS. Systematic information maintenance and updating protocols exist.	1

Table 44

Reliability Levels		Factor
1	No documented records exist.	0
2	Managed pipes are mapped on paper.	0.33
3	Computerized records exist of managed pipes and connections. Systematic maintenance and updating protocols do not exist.	0.66
4	Managed pipes and connections are recorded in a GIS. Systematic maintenance and updating protocols exist for information linked to customer management.	1

Table 45

Reliability Levels		Factor
1	No operation records exist.	0
2	Records of all operations performed on the infrastructure exist, but there is no data about their duration or the estimated volume used.	0.5
3	Records of all operations performed on the infrastructure exist, including data about their duration or the estimated volume used.	0.9
4	Records of all operations performed on the infrastructure exist, including data about their duration and the estimated volumes used based on reference measurements, working pressures and drain dimensions.	1

Table 50

Reliability Levels		Factor
1	No documented records exist.	0
2	Paper records exist of bursts, “incidents” and repairs.	0.33
3	Computerized records exist of bursts, “incidents” and repairs.	0.66
4	Records of distribution infrastructure, bursts, “incidents” and repairs exist in a GIS and are classified by type, origin and responsibility.	1

Glossary ——— Incident

Table 51

Reliability Levels		Factor
1	No documented records exist.	0
2	Paper records exist of bursts, “incidents” and repairs.	0.33
3	Computerized records exist of bursts, “incidents” and repairs.	0.66
4	Records of connections, distribution infrastructure, bursts, “incidents” and repairs exist in a GIS and are classified by type, origin and responsibility.	1

Glossary ——— Incident

Table 93

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	The practice is documented, but no evidence exists of its application.	0.5
3	Evidence exists of its application in the last billing period of the year of rating	0.8
4	Evidence exists of its application in the last 3 billing periods of the year of rating.	0.9
5	Evidence exists of its application in the last 6 billing periods of the year of rating.	1

Table 94

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	The practice is documented, but no evidence exists of its application.	0.5
3	The practice is documented and evidence exists of its application in the billing period preceding the rating date.	0.7
4	The practice is documented and evidence exists of its application in the 3 billing periods preceding the rating date.	1

Table 95

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	The practice is documented, but no evidence exists of its application.	0.5
3	The practice is documented and evidence exists of its application at the end of the year of rating.	1

Table 96

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	The practice is documented and evidence exists of its application at the end of the year of rating.	1

Table 97

Reliability Levels		Factor
1	Cannot be corroborated.	0
2	The practice is documented, but no evidence exists of its application.	0.5
3	Evidence exists of application of the policy to at least one of the forms of fraud in the last month of the rating year. Moreover, in the case that estimated losses attributable to users surpassed 10% of unbilled water volume, evidence exists that at least 2 procedures to detect illegal connections were carried out in the rating year.	0.7
4	Evidence exists of application of the policy to at least 2 of the forms of fraud in the last month of the year of rating. Moreover, in the case that estimated losses attributable to users surpassed 10% of unbilled water volume, evidence exists that 3 procedures to detect illegal connections were carried out in the rating year.	0.9
5	Evidence exists of comprehensive application of the fraud detection policy in the month preceding the rating date. Moreover, in the case that estimated losses attributable to users surpassed 10% of unbilled water volume, evidence exists that 3 procedures to detect illegal connections were carried out in the rating year or that 4 were carried out the previous year.	1

Table 98

Reliability Levels		Factor
1	No record exists.	0
2	Paper records.	0.5
3	Computerized records not integrated with the accounting system.	0.8
4	Computerized records integrated with the accounting system.	1

B. New Reliability Tables incorporated into the current Focused Analysis

Table 401

Reliability Levels		Factor
1	No records are available from 2-4 a.m. in more than 10% of direct entries or in more than 20% of total estimated values.	0
2	A maximum of 20% of values are estimated from 2-4 a.m. in all sectors.	0.5
3	Records are available from 2-4 a.m. at all distribution entry points (or in all sectors, if more than 90% of the network is sectorized), with at least one record per month for each point.	1

Table 402

Reliability Levels		Factor
1	No evidence	0
2	There is evidence of having typified operations with risk of generation of leaks or burst in transient episodes. The classification must be based on the use of transient recording equipment by the company to identify the location, extent, and intensity of the burst or leak.	1

Table 403

Reliability Levels		Factor
1	No information is available regarding calibrated models or flow characterization.	0
2	When pressures have been determined using mathematic models of networks using calibrations and updates with more than an annual frequency.	0.5
3	When pressures have been determined using mathematic models of the work, calibrated and updated at least annually, with flow data collected on hourly, daily, and seasonal bases, at least at the zone or sectoral level.	1

Table 404

Reliability Levels		Factor
1	There is no evidence that information from all sectors has been used systematically.	0
2	There is evidence of use of information from the sectorized network, apart from maintenance and control of measurement reliability.	0.5
3	There is evidence of a sectorization management system with respect to system maintenance, control of their connections, and the reliability of their flow balance measurements. Reliability is only maximized when there is a system for managing the se,ctorized network and evaluating the flow balance reliability measurements or minimal nocturnal flows.	1

Table 405

Reliability Levels		Factor
1	No evidence	0
2	Evidence that studies have been carried out to determine the specific useful life of the pipes that comprise the distribution network that is being evaluated.	1

Table 406

Reliability Levels		Factor
1	No evidence	0
2	When the following elements are in evidence: (i) a database of pipelines and user connections with GIS support that is complete and updated; (ii) that has information on the date of construction, repair, or replacement of connections.	0.7
3	When there is a database of pipelines and connections to users with GIS support that is complete and updated, that has information on the date of construction, repair, or replacement of connections, and that they have determined the values of useful life thresholds with specific studies for the network being studied.	1

Table 407

Reliability Levels		Factor
1	No evidence	0
2	Evidence exists that studies have been conducted to determined the useful life of the connections	1

Table 408

Reliability Levels		Factor
1	No evidence	0
2	When the following elements are present: (i) a database of pipelines and connections to users with GIS support that is updated and complete; (ii) that has information regarding the date of construction, installation, repair, or replacement of all connections.	0.7
3	When there is a database of pipelines and connections to users with GIS support that is updated and complete, that has information on the date of construction installation, repair, or replacement of all connections, and they have determined the useful life thresholds with studies that are specific to the network in question.	1

Table 409

Reliability Levels		Factor
1	No evidence	0
2	Evidence exists from the studies that have been carried out to determine the useful life of the components	1

Table 410

Reliability Levels		Factor
1	There is no evidence of the systematic use of information from all of the sectors	0
2	There is evidence of the use of information from the sectorized network, apart from maintenance and control of measurements' reliability	0.5
3	There is a management system for the sectorized network and a mechanism for evaluating the reliability of the flow balance measurements or minimum nocturnal flows	1

Table 411

Reliability Levels		Factor
1	No documented record.	0
2	Paper mapping of managed pipelines.	0.33
3	Computerized record of the pipelines and elements of the distribution managed. No maintenance protocols and systematic update.	0.66
4	Registration in GIS of the pipelines and elements of the distribution managed. With maintenance protocols and systematic updating of information related to customer management.	1

Glossary

Access
Having, whether on the land or in the home, a guaranteed minimum volume of drinking water that exceeds 40 liters, per person, per day. Households with a home connection but are supplied water that is not considered potable or which is not supplied at minimum volume, will not be counted as having access.

Scope of action to be evaluated
Refers to the activities of provision of water and/or sanitation services, defined by the entirety of the service stages and functions included in the provider's mandate(s) for the provision of the qualifying services.

Scope of Evaluation
Scope to which AquaRating applies, which is defined both as the scope of activity and the territorial scope.

Territorial Scope of Evaluation
Refers to the territory in which the provider is responsible for providing water and/or sanitation services, as defined in the provider's mandates(s) for qualifying services.

Supply-demand balance
Refers to the comparison of water demand and system's supply at a specific point, typically at the potable water purification plant. This concept is also used to refer to balances that are relevant to specific facilities and that may involve flow rates in one or more of the following measures: annual average, daily maximum, or hourly maximum.

Sufficient hydraulic conditions for use and consumption
Values of the pressure, water quality, and flow parameters that make it possible to consume the water in each connection within the contracted terms or within the terms that are established in relevant regulations.

Active connections
Physical connections of individuals to the network of drinking water and/or sanitation services that are managed by the provider. There must be at least one user per connection, but multiple users can access the same connection.

Contingency
Circumstance in which the conditions and factors that establish the terms of service have been modified and, as a result, may interrupt service continuity or quality.

Emergency
An unforeseen or unplanned event that can significantly impact the quantity or quality of water and/or sanitation services. It can be minor and local or major and extensive. It can originate in natural causes (earthquakes, hurricanes, floods, forest fires, droughts, freezes, etc.) or by human action (error, transportation accidents, vandalism, civil unrest, terrorism, etc.).

In real time
For the purposes of the present document, "in real time" refers to data transmission with time lags of less than one minute.

Zero-value invoices
Invoices that are issued without values billed for service provision.

Incident
Change in the characteristics or operating conditions of any element of a system that has caused a change in the conditions of the service that is provided.

Corrective maintenance
Inspection and repair actions that are carried out as a result of a malfunction, anomaly, or incident that has been detected or about which the service provider has been notified, that can impact the operation or normal provision of service.

Preventive maintenance
Inspection and repair actions that are carried out on a scheduled basis, in advance of the detection or notification of any anomaly or malfunction.

Bodies of water
Bodies of water are understood as parts of the hydrographic network that have homogeneous characteristics in terms of flow parameters and their biological, physical, and chemical qualities.

Representative sample of supply quality
A representative sample of supply quality corresponds to each area that is served by a drinking water treatment station (or to a supply source that does not require treatment), and that corresponds to a population that is equal to or less than 10,000 residents. In areas supplied to populations greater than 10,000 residents, the sample is considered representative when it is taken for every 10,000 residents supplied, and with an equivalent geographical distribution.

Property
Each of the homes, businesses, or industries that receive service and are identified individually in the census of homes or comercial activities in the records and databases of the service provider.

Owner (of the service provider)
Individual or private or public legal entity that exercises the rights of the owner in relationship to the provider (including rights of alienation, use, and usufruct, among others). The term "owner" usually applies to all private, legal organizations or companies. It is a characteristic of a company that has one or more owners who exercise the rights of associate owners. The term "owner" does not seem adequate to designate who exercises control over the provider, and should be replaced by "representative of the competent state." It should be noted that in a republic or state, it is the sovereign citizen who delegates the administration of law to the representatives of the state and who delegates to them the exercise of the right of the owner in the case of publicly owned companies.

Corrective maintenance protocol
Written specification of the verifications, actions, and entities who are responsible for carrying out the resolution of an anomaly or problem (identifying the who, where, how, and when).

Preventive maintenance protocol
Written specification of the actions required (who, when, where, how) and the entities required to carry out verification of the state of operation of equipment and facilities, and initiate relevant corrective actions, when needed.

Entry point to the drinking water supply
Each of the points of the drinking water supply infrastructure that are capable of incorporating water into the system through catchments in surface or underground water. The possibility of exporting water from the evaluated system is taken into consideration, which will translate into negative flow values. The water may be raw or treated based on the point of the network where it enters and the conditions of water that is captured or imported.

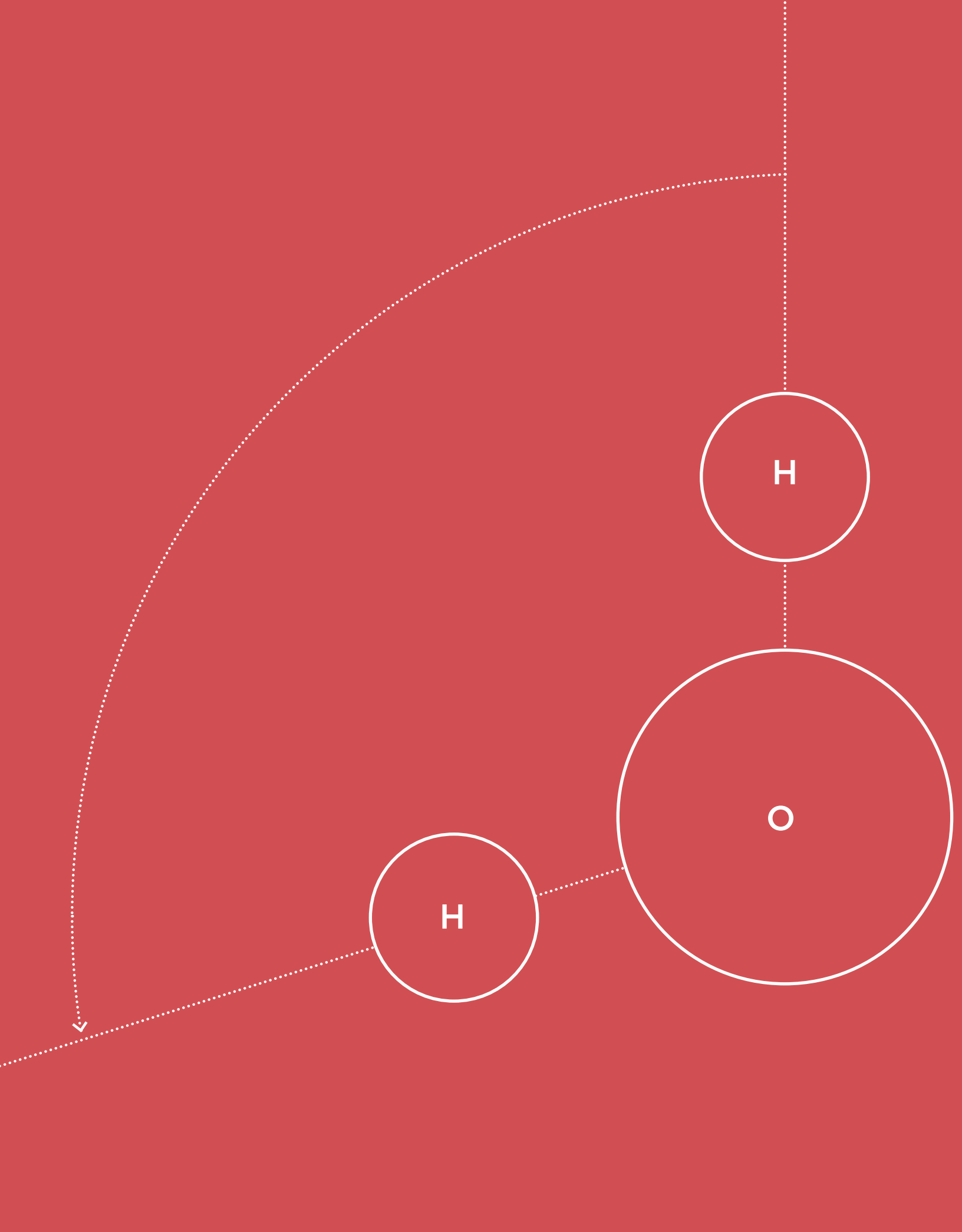
Points susceptible to control
All of the points within the surface or subterranean hydrographic network where environmental regulations establish conditions for the maintenance of environmental flows, or the quantitative or qualitative characteristics of water discharges, sludge, and other emissions. The transport of waste is considered its own point of interest.

System
Comprised of infrastructure, installations and equipment that are actually used or are available to use for providing water supply services (residual water collection) in a part of or for the entire service coverage area, which has both topological and hydraulic continuity. A system is always related to the territory of its service environment.

Registered user
Individual service user who is listed in a registry or database.

Active users
Users who are registered by the provider for the use or consumption of potable water services and/or sewerage services, who are actually actively receiving services.

Water volume introduced into the system
Total volume of water introduced into the supply and distribution system, whether captured via natural means or imported from other systems.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