TECHNICAL REPORT

# ISO/TR 24514

First edition
2018-05

# Activities relating to drinking water and wastewater services — Examples of the use of performance indicators using ISO 24510, ISO 24511 and ISO 24512 and related methodologies

*Activités relatives aux services de l'eau potable et de l'assainissement — Exemples d'utilisation d'indicateurs de performance à l'aide l'ISO 24510, l'ISO 24511 et l'ISO 24512 et des méthodologies associées*



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 224, *Service activities relating to drinking water supply, wastewater and stormwater systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.



# Introduction

## 0.1 General

This document is a companion document to ISO 24510, ISO 24511 and ISO 24512 and was originally to be developed with the thought that many organizations (water utilities, regulators, users' associations) would benefit from examples illustrating how the performance indicator methodology and the performance indicators, such as those described and illustrated in the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224, have been applied by a variety of organizations. Please refer to ISO 24510, ISO 24511 and ISO 24512 for guidance on the process and concepts[1],[2],[3]. However, there are many similar and parallel methodologies measuring the performance of organizations, not least of which are several "benchmarking" methodologies, some of which are described in this document. Therefore, this document provides examples of quantification practices and processes for measuring organizational performance.

Performance indicators as developed by ISO TC 224 are intended to be used primarily within water utilities, often over time, to demonstrate progress towards achieving high-level corporate objectives. In practice, these indicators are also being used to indicate projected benefits that could be achieved with changes in investment strategies or operations. Benchmarking, on the other hand, is used primarily to demonstrate the efficiency of operations, particularly by sharing information between comparable organizations often with the identification of best practices related to the particular operation being benchmarked. Used in a time series, all can also be applied to demonstrating progress towards meeting objectives and demonstrating continuous improvement. What is confusing is that both can use exactly the same metric, i.e. a numerator using one data set, and a denominator using another data set. For example, energy used/megalitre of water produced.

Figure 1 illustrates the basic similarities in the use of a typical metric for the internal uses linked to achieving corporate objectives (performance indicators) and how benchmarking (as described in ISO 24523[11]) enables information sharing on metrics and ultimately sharing of best practices. Both methodologies are intended to assist in continuous improvement and to measure achievement of objectives.

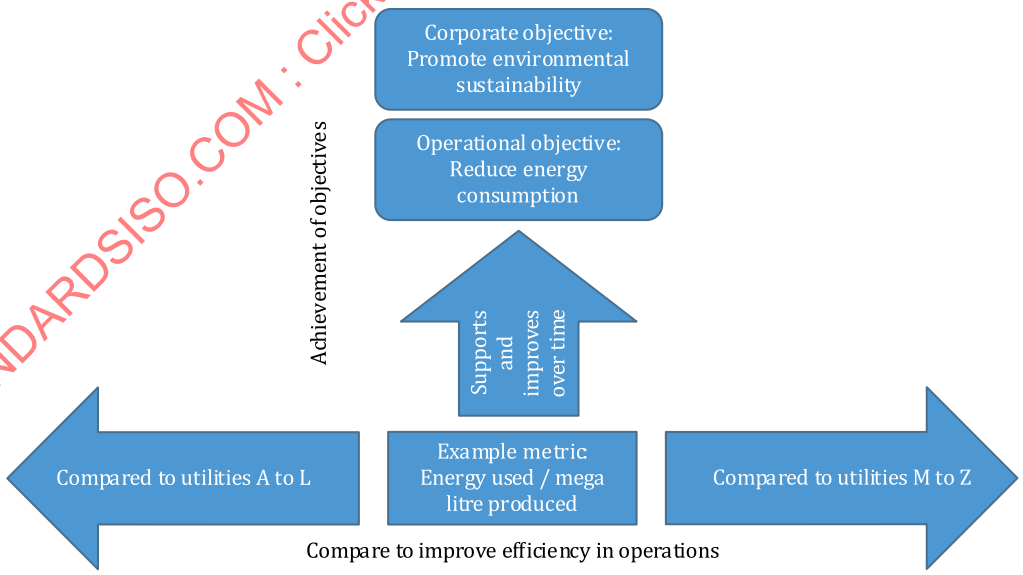



**Figure 1 — Illustration of uses of performance metrics.**

Within the field of organizational assessment or measurement, there are several terms that are regarded at least informally as being interchangeable. These include "performance indicators", "performance measures" and "benchmarks". The first is the preferred terminology of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224. The terminology describing the process for utilizing "performance indicators" and "performance measures"

tends to be “assessment”. The terminology describing the development and utilization of “benchmarks” is “benchmarking”. The end result can be the same: both result in the calculation of a metric that indicates the status achieved in respect of performance of a particular function or activity. However, these terms are used to achieve subtly different purposes. Performance indicators are normally used to measure activities within a single organization where the basis of calculation does not change from year to year and, at least in the ISO standards referenced, are directly related to organizational objectives at the corporate level.

Benchmarking is intended to encourage and allow comparison between organizations providing similar services in a defined context. Such methodologies often serve to measure achievement of operational objectives (which are necessarily a subset of corporate objectives and which support the achievement of the corporate objectives). That is, the elements comprising the numerator and the elements comprising the denominator should be identical between the organizations being compared. The benchmarks will enable comparison of organizations in common and defined fields, but are not necessarily directly or closely linked to the high-level corporate objectives. ISO 24523 provides information on the benchmarking process[11].

A distinction between the performance indicator methodology and the benchmarking methodology is that while performance indicator comparison can be an essential part of benchmarking, performance assessment is a crucial part of benchmarking. Therefore, benchmarking is a way to apply the ISO 2451X standards. However, “benchmarking” differentiates from pure performance indicator comparisons through additional and continuing work steps, in particular “analysis” and “implementation” (see ISO 24523, Table 1[12]), leading to performance improvement.

The purpose of this document is to provide practical examples based on real life applications for the consideration of utilities using the guidelines in ISO 24510, ISO 24511 and ISO 24512, and also to indicate examples of where other metrics are employed for regulatory and other purposes.

This document should encourage and assist utilities, particularly small and medium-sized organizations, when using ISO 24510, ISO 24511 and ISO 24512, to think and communicate clearly about the meaning and use of performance indicators.

### 0.2 Summary of the methodology of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224

The series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 provide guidance for water utilities that wish to demonstrate that they are meeting their broad social and other objectives as established by top management. These often reflect objectives established implicitly or explicitly in legislation which may govern the delivery of water services. The series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 contemplate a three-step process. Step 1 is to determine water utilities’ strategic objectives. Such objectives in the case of water and sanitation services explicitly include promoting public health, protecting the environment and providing for a sustainable service. Step 2 asks what service criteria are to be used to determine if the objective is being met. The final step asks what metrics should be used to demonstrate that the criteria are being achieved.

For example, Table 1 may represent these three stages in respect to the objective of promoting public health.

**Table 1 — Example of the performance indicator steps employed within the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224**

| Objective<br>(Step 1 – define) | Service criteria<br>(Step 2 – how to measure) | Indicator<br>(Step 3 – establish a metric) |
|---|---|---|
| Promoting public health | Delivering safe drinking water | Percentage of delivered water quality tests that meet regulated requirements |



### 0.3 Purpose of the applications

In many countries, governments require that utilities (both public and private) report on their performance, in a unified and consistent manner. For example, all countries within the OECD are committed to such a policy and have established requirements for public sector utilities to publish annual reports indicating measures of their performance. The purpose of this policy and program is to provide assurances to the population that these utilities are effective in their activities (typically showing the economic efficiency of the activity in terms of cost/unit of output. For associations representing member utilities (sometimes in the public sector but often in the private sector) the association establishes methodologies for reporting on a uniform basis the performances achieved by the members. The purpose of this may often be to demonstrate good corporate citizenship and may include indicators of environmental protection, or consumer relations. For individual utilities (again for both public and private utilities), the purpose of calculating performance measures may be principally for internal purposes (e.g. reporting to management, demonstrating continuous improvement, or demonstrating the need for investment in new technology or for repair of infrastructure).

Regardless of the purpose for which the practice of measuring and reporting performance was established, benefits are obtained and shared with all stakeholders. In addition, all the metrics developed can be associated with organizational objectives and purposes.

# Activities relating to drinking water and wastewater services — Examples of the use of performance indicators using ISO 24510, ISO 24511 and ISO 24512 and related methodologies

**IMPORTANT — The examples in this report are included only because they illustrate the use of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 or similar requirements or practices of assessment or benchmarking.**

Value judgements expressed in these examples relate to the relative benefits for each example and reflect decisions made specifically by the management of the utilities in the examples. No endorsement is given by ISO/TC 224 to

a) those decisions,

b) the data used, or

c) their conformity with other ISO standards or non-ISO practices or requirements.

No endorsement is given by ISO/TC 224 to any organization or their practices.

No utility's particular application of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 or the parallel measurement requirements or practices is recommended because the management of each utility has selected the application most suited to its needs. No endorsement is given by ISO/TC 224 of the choices made by individual utilities or the relative merits of these different applications of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224.



## 1 Scope

This document provides several examples of varying complexity which illustrate the use and intent of the performance assessment methodology set out in ISO 24510, ISO 24511 and ISO 24512. The document also provides examples of the parallel and similar practices for measuring performance or establishing benchmarks as found in various institutional circumstances. These examples represent practices in a range of utilities (e.g. small, medium and large water utilities; water utilities from developed and developing countries; water utilities in both the public and private sectors; government and non-governmental agencies; and utilities with and without certified management systems). They are drawn from many geographical locations.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**benchmark**
single value, representing an accepted reference value derived either from comparisons among participants or from literature, used for orientation

Note 1 to entry: The benchmark may be determined collaboratively or individually.

Note 2 to entry: By clustering, different benchmarks can occur for different peer groups.

[SOURCE: ISO 24523, 3.2]

**3.2**
**indicator**
parameter, or a value derived from parameters, which provides information about a subject matter with a significance extending beyond that directly associated with a parameter value

Note 1 to entry: Adapted from OECD works on “Core sets of indicators for environmental performance reviews”[11].

Note 2 to entry: Indicators can refer to context, conditions, means, activities or performances.

**3.3**
**measure**, noun
value resulting from measurement and the process used to obtain that value

[SOURCE: ISO 9241-11:1998, 3.11]

**3.4**
**performance**
measurable result

Note 1 to entry: Performance can relate either to quantitative or qualitative findings.

Note 2 to entry: Performance can relate to the management of activities, processes, products, services, systems or organizations.

[SOURCE: ISO/IEC Directives Part 1 and Consolidated Supplement — 2017 (8th edition), Annex SL, Appendix 2, 1605 3.13]

**3.5**
**performance measure**
means used to assess the system performance, typically by diagnostic or relative performance methods

[SOURCE: ISO TR 19358:2002, 2.6, modified — term made singular.]

**3.6**
**process**
set of interrelated or interacting activities that use inputs to deliver an intended result

Note 1 to entry: Whether the "intended result" of a process is called an output, product or service depends on the context of the reference.

Note 2 to entry: Inputs to a process are generally the outputs of other processes and outputs of a process are generally the inputs to other processes.

Note 3 to entry: Two or more interrelated and interacting processes in series can also be referred to as a process.

Note 4 to entry: Processes in an organization are generally planned and carried out under controlled conditions to add value.

Note 5 to entry: A process where the conformity of the resulting output cannot be readily or economically validated is frequently referred to as a "special process".

Note 6 to entry: In benchmarking, organizational and technical processes and combinations of both of them are considered. A process within the meaning of benchmarking comprises a combination of one task with one plant/ one object (e.g. operate sewer network, treat wastewater, treat drinking water, provide domestic connection, further train staff, purchase material).

[SOURCE: ISO 9000: 2015, 3.4.1, modified — Note 6 to entry replaced.]

# 4 Format for the examples provided in this document

## 4.1 General

Examples illustrating the application of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 or the parallel alternative methodologies are provided in Annexes A to D. The contents of these examples are generally organized under the headings given from 4.2 to 4.5. However, where full information on the practice or requirement is not available at the time of publication of this document, summary information and a bibliographical reference have been supplied.

Please note, the Annexes distinguish between methodologies and requirements established by international organizations (Annex A), national regulatory bodies (Annex B), associations or groups of utilities (Annex C), or individual utilities (Annex D).

## 4.2 Name of the organization

This section simply provides the identity of the organization offering its experience.

## 4.3 Background of the organization

This section briefly describes the organization and its history. The purpose is to provide a context for understanding how the performance assessment methodologies of the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224, or similar requirements or practices of assessment or benchmarking, were applied. It is also intended to provide suitable information for a reader of this document to relate his or her own organization to the organization described in the example.

## 4.4 Objective for making use of performance indicators

This section includes a description of the purpose of the organization when implementing the requirement to develop and report the use of performance indicators whether conforming to the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 or similar requirements or practices of assessment or benchmarking.

## 4.5 Performance indicator methodology

This section provides a short description of each step followed in the methodology. Tables and figures may be attached to illustrate the process.

## 4.6 Summary of the experience

This section includes a summary of any lessons learned by the organization from the production of performance indicators whether conforming to the series of standards on the topic of activities relating to drinking water and wastewater services produced by ISO/TC 224 or other similar practices of assessment or benchmarking applied, as the case may be. It may also include the organization's conclusions on its future expanded application of the practice of assessment or benchmarking.

# Annex A
(informative)

# International organizations

## A.1 European Environment Agency[1] — Purposes of performance indicators

European policies are increasingly focused on preserving the Earth's limited resources in a sustainable manner, while minimizing impacts on the environment. This is included in the resource efficiency and green economy agendas. In order to obtain knowledge on the actual pressure on the aquatic environment from water abstractions and emission of pollutants, and for assessing urban water management, we need to extend the knowledge base beyond compliance with current legislation. With the aim of improving the European level knowledge base in urban water management in the resource efficiency context, the European Environment Agency (EEA) hosted an expert meeting jointly organized with leading water associations in Europe. This event framed the context and discussed topics related to the exploitation of data already available with water utility associations and benchmarking networks beyond what is currently reported via institutional frameworks for implementing legislation.

EU-level assessments of the resource efficiency or environmental performance of water utilities are not currently as holistic as they could be. There is considerable reporting of environmental data concerning water already in place, from the local to the EU level. However, these reporting obligations are primarily concerned with the water quality parameters applicable to drinking water and treated urban wastewater. The parameters are related to compliance with the EU directives pertaining to the achievement of drinking water standards, urban wastewater collection and treatment requirements, and receiving water quality objectives.

As outlined in the EEA report 'Towards the efficient use of water resources in Europe'[5] economic production cannot be sustained if it requires excessive water use and burdens natural resources. It is thus essential that water uses and efficiencies are also considered in water management practices, including: the actual pressures in the aquatic environment from water abstractions, the resulting emissions of pollutants, and the energy consumption/recovery from managing the urban water cycle.

This report follows on from the discussions in the expert meeting on how the organizations and networks involved in urban water management can share their knowledge bases to support environmental and resource efficiency policies and technical improvements. The availability of this knowledge base could create a more comprehensive approach to assessing Europe's water resources and threats. It could also enable a comparison of the environmental performance of different water utilities, monitor progress over time, and aid the implementation of novel environmental technologies.

In its response to the European Citizen's Initiative "Right2Water", the European Commission committed to exploring the idea of benchmarking water quality and will cooperate with existing initiatives to provide a wider set of benchmarks for water services. This significantly contributes to improving the transparency and accountability of water service providers by giving citizens access to comparable data on the key economic, technical and quality performance indicators of water operators. The information provided in this report, although having a specific focus on environmental performance based on data from voluntary benchmarking exercises, can be a useful contribution to this debate.



1) The following texts (but not the subheadings) are excerpts from the Executive Summary of the EEA Technical Report No. 5/2014[4].

## A.2 International Benchmarking Network of Water and Wastewater Utilities (IBNET) of the World Bank Group, Global Water Practice (www.ib-net.org)

### A.2.1 Background of the organization

The World Bank is a development institution providing financial resources for development in more than 150 countries and territories. The World Bank Water Global Practice is in charge of development, implementation, supervision and assessment of projects related to water. The investment directly into water and sanitation utilities constitutes roughly 60 % of Water Global Practice operations and is just above one billion dollars a year for the last 10 years.

Performance and search for good utilities was always a key topic of interest of the World Bank activities in the water sector. In order to do that, the World Bank established the International Benchmarking Network of Water and Wastewater Utilities (IBNET) within the Bank's Water and Sanitation Program. Client governments develop standard indicators and maintain data to efficiently allocate financial resources and develop sector improvement programs that address water and wastewater services for all consumers, including the poor. IBNET provides a fact-based framework to measure the performance of a service provider and set the standard for water sector performance assessment. IBNET provides governments, utilities and the public with a clear and objective picture of water services and utility performance.

### A.2.2 Objective for making use of performance indicators

The following are the objectives for encouraging the development, use and publication of performance indicators (benchmarks):

— Support utilities and their staff in evidence-based performance and data quality improvement;

— Help governments make informed decisions based on clear evidence in the water sector, thus improving water and sanitation services for all, including the poor;

— Maintain a leading role in setting standards for the performance assessment of municipal water utilities as well as a leading role in collecting and disseminating data on water utilities, including information on tariff structures and systems, cost-recovery and financing;

— Help generate evidence to promote good governance and improved capability, accountability and responsiveness of water and sanitation services providers through development and implementation of the performance information availability to the public they serve; and

— Develop new tools for performance assessment to include process indicators, and performance assessment for small utilities and sanitation services. By developing new performance assessment tools, IBNET will help generate more demand for benchmarking data, and will improve knowledge on the current status and development trends of the water supply of sanitation products and services.

### A.2.3 Performance indicator methodology

Standard toolkit developed followed the 1996 International Water Association (IWA) Start-Up tool for utilities performance assessment. Please see details at www.ib-net.org/ and https://database.ib-net.org/DefaultNew.aspxh.

The IBNET tariff database that may also be relevant and of interest: https://tariffs.ib-net.org.

### A.2.4 Summary of the experience

IBNET is **the largest publicly available database covering water utilities,** providing performance data from over 5 000 utilities in 130 countries. Over 75 percent of the utilities in the database have provided more than four years of performance information, making it increasingly possible to look into

performance trends at the utility and sector levels[2]. It is *de-facto* used as a reporting standard in more than 40 countries.

As of now, the World Bank widely uses IBNET for its work and about 20 projects with total lending of $1,1 billion have IBNET in its performance monitoring structure.

**Table A.1 — 20 bank projects using or planning to use IBNET as an official monitoring tool**

| Project | Project size |
|---|---|
| Albania | $18 million |
| Belarus | $60 million |
| Danube programme | $5 million |
| Honduras | $35 million |
| Macedonia | $20 million |
| Moldova | $20 million |
| Mozambique | $180 million |
| Nigeria | $250 million |
| Russia | $200 million |
| South Pacific | $20 million |
| Tajikistan | $12 million |
| Ukraine | $100 million |
| Vietnam | $150 million |
| Total | $1,07 billion |
| NOTE Spill over to other donors (Swiss DA, USAID, GIZ, KfW, AusAID and ADB). | |

## A.3 ISO TC 268, sustainable cities and communities

### A.3.1 Scope

The scope of this TC includes standardization in the field of sustainable development in communities, including requirements, guidance and supporting techniques and tools to help all kind of communities, their related subdivisions and interested and concerned parties become more resilient and sustainable and demonstrate achievements in that regard. The proposed series of International Standards will thus encourage the development and implementation of holistic, cross-sector and area-based approaches to sustainable development in communities. As appears in the program of work, it will include management system requirement, guidance and related standards.

### A.3.2 Water sectors covered

While ISO 37120[6] covers many aspects of city services, those relevant to the water services sector include:

Wastewater:

a) percentage of city population served by wastewater collection;

b) percentage of the city's wastewater that has received no treatment;

c) percentage of the city's wastewater receiving primary treatment;

d) percentage of the city's wastewater receiving secondary treatment;

e) percentage of the city's wastewater receiving tertiary treatment.

2) Funding from DFID (UK Department for International Development) in 2004 supported a strong drive for data collection through technical assistance agreements concluded with many different organizations across the world.



Water and sanitation:

a) percentage of city population with potable water supply service;

b) percentage of city population with sustainable access to an improved water source;

c) percentage of population with access to improved sanitation;

d) total domestic water consumption per capita (litres/day);

e) total water consumption per capita (litres/day);

f) average annual hours of water service interruption per household;

g) percentage of water loss (unaccounted for water).

# Annex B
(informative)

# National regulatory organizations

## B.1 Angola — National Water Board, Ministry of Energy and Water of Angola

### B.1.1 Background of the organization

The National Directorate for Water (hereafter referred to as NDW) is the executive service of the Ministry of Energy and Water whose aim is to study, prepare, implement and monitor the water supply, water resources and sanitation policies[3)]. The NDW has, among others, the following duties directly related to the implementation of Performance Indicator Systems:

— Prepare and coordinate the development of the water supply and sanitation national policy. Ensure its implementation and monitoring.

— Promote and coordinate the development of standards, regulations and technical specifications for the design, construction, operation and monitoring of water supply and sanitation systems.

— Propose studies whose aim is to establish tariffs to the water supply and sanitation services.

— Establish, coordinate and promote inspections, supervision and systematic monitoring of the water supply and sanitation systems operation.

— Promote the collection, management and dissemination of information concerning (...) the water supply and sanitation.

### B.1.2 Objectives for making use of performance indicators

In the 2012–2017 program, the Government of Angola committed itself to achieve the following goals regarding the water supply and sanitation:

a) Ensure coverage levels up to 100 % in urban areas and 80 % in rural areas;

b) Ensure effective monitoring of water quality for human consumption, with high standards, service levels up to 70 % in urban areas and 40 % in rural areas;

c) Carry out an institutional reform in the sector, ensuring the creation of a Water Supply Management Entity in each of the Provinces.

The National Development Plan 2013–2017 (the main strategic document of the Government of Angola) aimed: *to promote, on a sustainable basis, drinking water supply to the population; water for the productive sector as well as adequate sanitation services. For this specific purpose, the National Development Plan declared as a priority: 3. Ensure efficient operation of the systems and continuing with the creation of the Management Entities, according to the institutional development of the sector.*

Based on the strategic plans of the Government of Angola, the NDW set as a goal: *establish guidelines for systematic collection and processing of information by the managing entities of water supply systems, in order to establish and oversee the minimum standards of operation of systems*.

3) Presidential Decree No. 116/14 of 30 May, establishing the Organic Law of the Ministry of Energy and Water.

Consequently, the implementation of performance indicator systems was included in presidential decrees used to create and appoint the Boards of Directors of the Benguela, Lobito, Malange, Bié, Huambo, Cuanza Norte, Uíge and Cunene Water Supply and Sanitation Companies[4]:

ARTICLE 28 — MANAGEMENT PRINCIPLES:

The management of EASBIE-EP (Empresa de Águas e Saneamento do Bié – Empresa Pública) should be conducted in order to match the State's economic and social policy with the technical, economic and financial viability of the company.

In guiding the management of the company, the following principles and objectives should be observed:

— Meeting targets and using indicators established by the State;

— The Company's production process should be constantly improved, ensuring the systematic improvement of the quality of services provided and its productivity.

ARTICLE 34 – ACCOUNTABILITY:

1. Annually, as at 31 December of each year, the following financial statements must be prepared:
   a. Board of Directors' Report;
   b. Analytical balance sheet and income statement.
2. The documents referred to in the preceding paragraph must be supplemented with other elements of interest in order to assess the situation of the company, in particular:
   a. Annexes to the balance sheet and the income statement;
   b. Schedules showing the extent of implementation of the business plan and budget; and
   c. Other significant indicators of company activities and status.

### B.1.3 Performance indicator methodology

Under the Service Contract No. 2010/241-326 — "Technical Assistance to the National Directorate of Water Supply and Sanitation of the Ministry of Energy and Water" – funded by the European Union under the 10th European Development Fund (EDF), one of the activities of the expected Result 2 involved the development of:

1. A proposal for a Quality of Services Indicators Report, including a manual for the implementation among the public/ private organizations responsible for the water supply; and
2. A reference framework for the quality of services indicators.

Figure B.1 outlines the methodology used in the implementation of the water services performance indicators in Angola. The main steps are described in the subsequent paragraphs.



4) Benguela (EASB-EP): Presidential Decree No. 394/13. Cunene (EASC-EP): Presidential Decree No. 395/13. Bié (EASBIÉ-EP): Presidential Decree No. 403/13. Malanje (EASM-EP): Presidential Decree No. 404/13. Lobito (EASL – EP): Presidential Decree No. 405/13. Cuanza Norte (EASKN – EP): Presidential Decree No. 418/13. Huambo (EASH – EP): Presidential Decree No. 8/14.

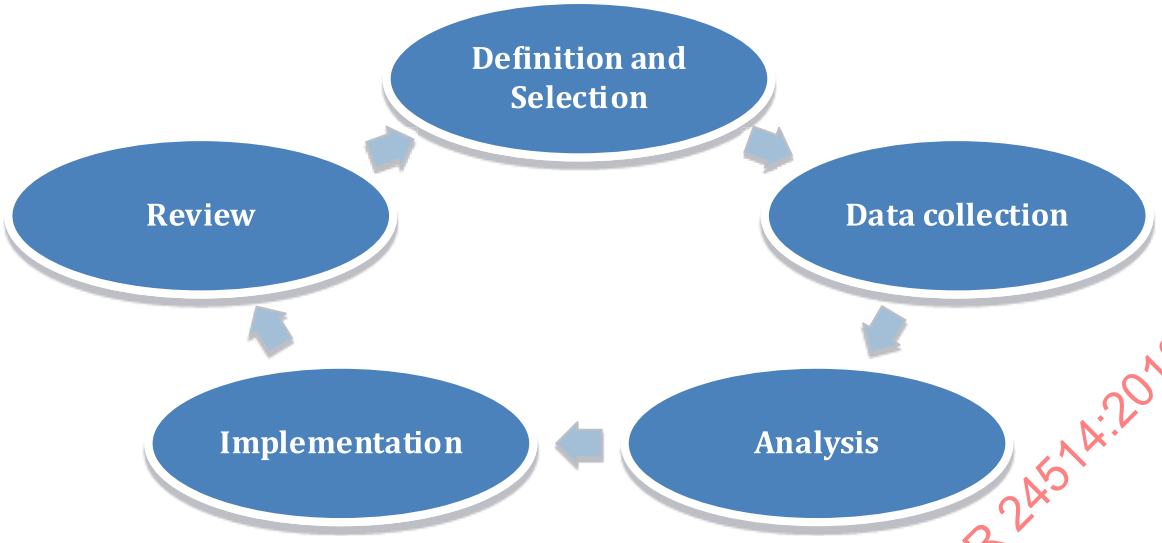



**Figure B.1 — Methodological flow chart**

A) **Definition and selection**

In order to have tools for evaluating the performance of the Management Entities in respect to the regulation's objectives, two groups of performance indicators were defined:

— Indicators that reflect the best interests of the users (SERVICE LEVELS): this group of indicators is intended to assess the safeguard level of the users' interests, particularly in terms of service accessibility and quality with which it's provided; this group is subdivided into the two aspects mentioned: service accessibility and quality of service to the users.

— Indicators that reflect the sustainability of the management entity (TECHNICAL): this group of indicators is intended to assess the economic and technical sustainability safeguard level of the management entity and its legitimate interests, regardless of its public, private or hybrid nature; this group is subdivided into commercial, operational and human resource aspects.

The proposed indicators' framework considers the main aspects that have been identified for the several existing management entities, as well as the aspects that were considered most relevant to the future water supply management entities that will be established. The proposed framework is shown in Figure B.2.

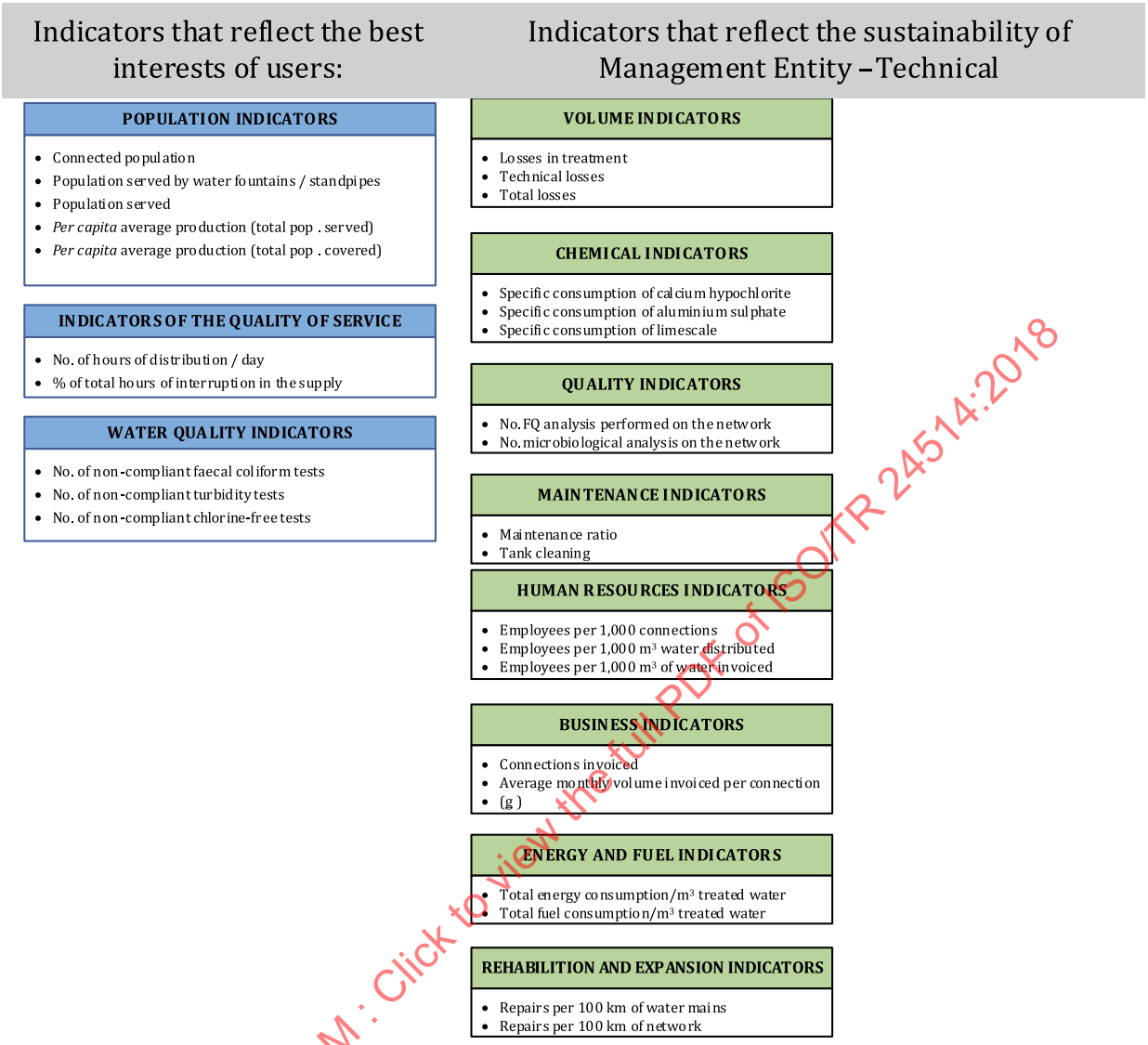



**Figure B.2 — Proposed indicator framework**

B) **Data collection**

The NWD proposes to carry out a monthly reporting plan (see Figure B.3) including the performance indicator report, is an effective way to compile information that will enable four objectives to be achieved.

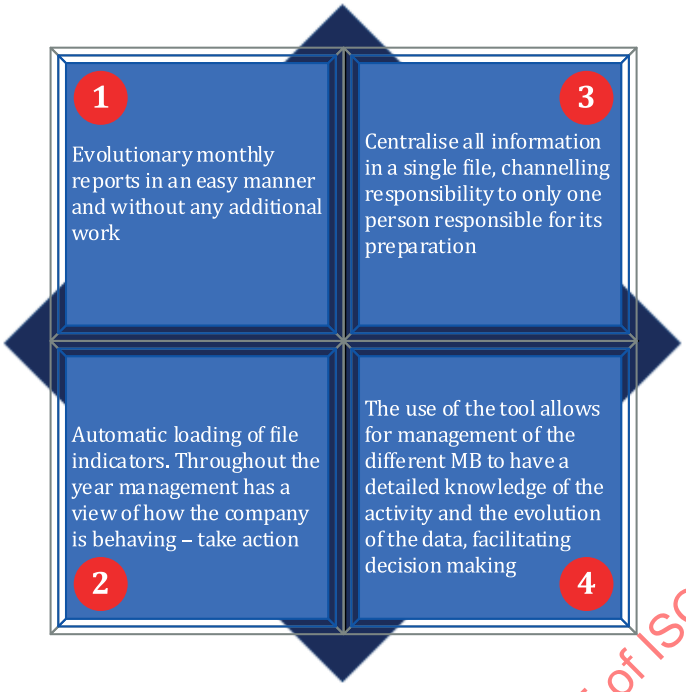



**Figure B.3 — Schematic of monthly reporting plans**

C) **Implementation**

The management entity needs to collect and compile a set of internal and external data regarding the operation of the company and the system. The several areas of the entity must ensure the timely delivery of data regarding its area of operation. The data should be as accurate as possible to ensure reliable information and subsequently an accurate analysis of the situation of the entity.

The data from several areas of the entity should be used to feed the monthly activity reports of the entity and its performance indicators database.

Figure B.4 illustrates the structure of the proposed information flow and the deadlines to ensure that on the 12th of each month the reports are compiled, made and delivered to the top management.

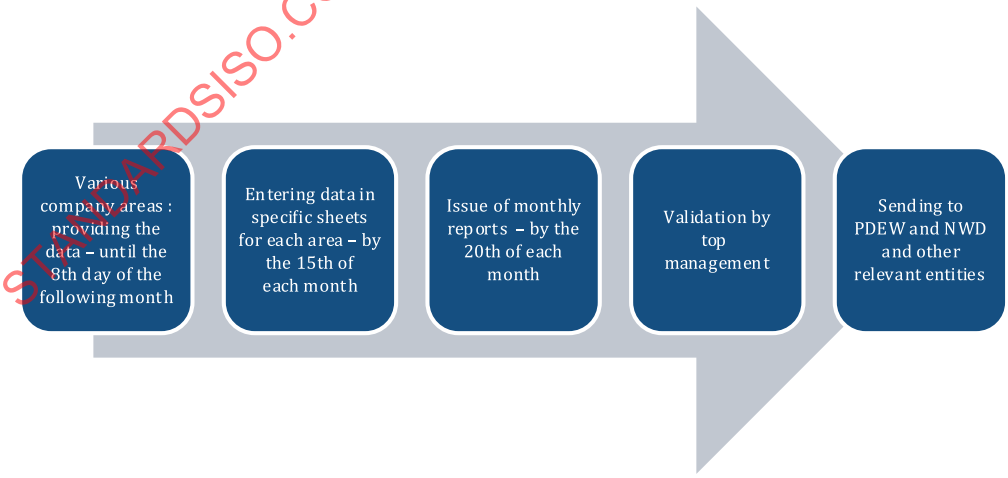



**Figure B.4 — Proposed information flow**

### B.1.4 Summary of the experience

Regarding the implementation of the indicators system, the only province that is currently implementing and using the developed tools is the Lunda Sul. According to the Provincial Director of Energy and Water the Indicator System developed has the following difficulties and challenges:

| Difficulties encountered: | How were they supported: |
|---|---|
| — The main difficulties were related to the length of the report, the different data to be inputted and in principle, for its supposed complexity.<br>— Obtaining the desired data was also one of the greatest difficulties, given the dispersion of the data sources.<br>— The fact that data collection, classification and data entry from all areas was done by only one person.<br>— The time taken for entering the data was far too long. | — After experiencing the initial difficulties inherent to the new system, it was decided to create small tables from the main table and distribute them to all areas.<br>— The creation of small work teams, at the end of the month where each team presents the results to the person responsible for entering the data. |

Figure B.5 illustrates that, regardless of the difficulties and challenges, the DPEA of Lunda Sul identified the advantages of using the proposed system.

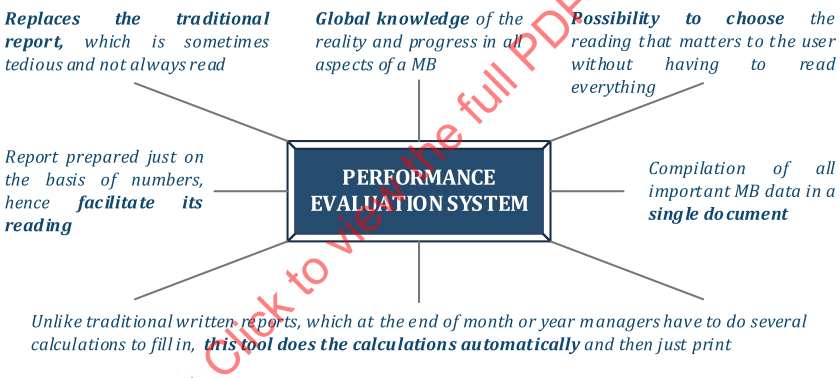



**Figure B.5 — Advantages of the proposed system**

## B.2 CANADA — Ontario Municipal Affairs and Housing, Government of Ontario

### B.2.1 General

The information for this example was drawn from the following URL:

http://www.mah.gov.on.ca/Page297.aspx Ministry of Municipal Affairs and Housing, Municipal Performance Measurement Program (MPMP).

### B.2.2 Background of the organization

The Ministry of Municipal Affairs and Housing is a Ministry (Department) of the Government of Ontario, Canada and administers 47 statutes including particularly:

Ministry of Municipal Affairs and Housing Act: https://www.ontario.ca/laws/statute/90m30

Establishes the Ministry and outlines the Minister's powers. Gives the Minister general responsibility for Ontario's housing policy and programs and responsibility for the Acts the Ministry administers.

Municipal Act, 2001: https://www.ontario.ca/laws/statute/01m25

Provides for the structure of single, upper and lower tier municipalities, and sets out their basic powers including the ability to regulate (e.g. licensing), provision of services, finances and roads.

Municipal Affairs Act: https://www.ontario.ca/laws/statute/90m46

Sets out powers of the Ministry with respect to overseeing municipal activities.

The goal of the Ministry of Municipal Affairs and Housing is an Ontario made up of safe and strong communities with abundant green space, thriving and prosperous economies, and a range of housing choices.

To achieve these objectives the Ministry works with municipal partners and community stakeholders to develop policies and standards that promote and support local governments to plan, manage and invest in their communities.

### B.2.3 Objective for making use of indicators

#### B.2.3.1 Background

Performance measurement is both an accountability tool and a means of continuously improving performance. This practice is fundamental to high-quality services and clear government accountability, key priorities for the Ontario government.

The Municipal Performance Measurement Program (MPMP) was introduced for the 2000 reporting year. This program requires municipalities to collect specific data on core service areas, submit their data to the province and report to their constituents on the results.

#### B.2.3.2 Objectives

Objectives of the program are to:

1. provide a tool to assess how well municipal services are delivered;
2. improve performance: measuring the efficiency (cost) and effectiveness (quality) of local services;
3. strengthen local accountability to taxpayers and promote greater understanding of municipal responsibilities by the taxpayer; and
4. provide a systematic resource that allows municipalities to share information on performance and learn better/new practices from each other.

#### B.2.3.3 Results

The program:

1. promotes local government transparency and accountability;
2. requires municipalities to collect data to measure their performance in the core municipal service areas;
3. provides municipalities with useful data to make informed municipal service level decisions while optimizing available resources; and
4. is an initiative designed to provide taxpayers with useful information on service delivery and municipalities with a tool to improve those services over time.

#### B.2.3.4 Conditions of the program

All Ontario municipalities are required to report MPMP efficiency and effectiveness measures for services provided by their municipality. More than 55 performance measures are reported in thirteen service areas:

— drinking water

— fire services

— land use planning

— libraries

— local government

— parks and recreation

— police

— roads

— solid waste

— storm water

— transit

— wastewater

— building services

Municipalities are required to report MPMP results to the province through the Financial Information Return by May 31st following each reporting year. Municipalities must also publish results for local taxpayers by September 30th using a format of their own choosing. Municipalities may use the optional templates provided by the Ministry for local reporting.

### B.2.4 Performance indicator methodology

#### B.2.4.1 Calculating the efficiency measures

Efficiency measures generally examine cost per unit, while effectiveness measures examine progress towards non-monetary goals.

Operating costs are used as the numerator for all efficiency measures in the Municipal Performance Measurement Program. These operating costs include both the direct costs attributable to the service and also a share of the indirect costs of general government program support based on costs for a service area as a percentage of total municipal operating costs.

The denominator consists of total units, such as households, megalitres, tonnes or kilometres.

The resulting efficiency measure is expressed as: cost/unit.

NOTE MPMP defines operating costs as selected categories of operating costs less revenue received from other municipalities. Subtracting revenue received from other municipalities isolates expenditures pertaining to the reporting municipality. The operating cost categories used are: salaries, wages and employee benefits, materials, contracted services, rents and financial expenses, external transfers, inter-functional adjustments and the allocation of general government – program support. Long-term debt charges and transfers to reserves and reserve funds are not included in the numerator to ensure that the manner in which a municipality finances its capital projects does not affect performance measurement results.

### B.2.4.2 Calculating the effectiveness measures

Commonly identified quality factors are used in the numerator (e.g. number of main breaks, number of treatment plant bypasses, number of boil water advisories), whereas the denominator comprises some relevant reference point, for example the size of the applicable infrastructure, a timeframe.

### B.2.4.3 Required measures of performance

The following table sets out the required measures of performance to be reported both to the Ministry of Municipal Affairs and Housing, and communicated to the residents of the municipalities.

| Service area | Objective | Type of measure | Measure |
|---|---|---|---|
| **Wastewater (sanitary and combined sewage)** | | | |
| Wastewater collection | Efficient municipal wastewater collection services | Efficiency | Operating costs for the collection of wastewater per kilometre of wastewater main |
| Wastewater treatment and disposal | Efficient municipal wastewater treatment and disposal services | Efficiency | Operating costs for the treatment and disposal of wastewater per megalitre |
| Wastewater collection, treatment and disposal (integrated systems) | Efficient municipal wastewater treatment system (integrated systems) | Efficiency | Operating costs for the collection, treatment and disposal of wastewater per megalitre (integrated systems) |
| Wastewater main backups | Municipal sewage management practices prevention of environment and human health hazards | Effectiveness | Number of wastewater main backups per 100 km of wastewater main in a year |
| Wastewater bypasses treatment | Municipal sewage management practices prevention of environment and human health hazards | Effectiveness | Percentage of wastewater estimated to have bypassed treatment |
| **Storm water** | | | |
| Urban storm water management | Efficient urban storm water management | Efficiency | Operating costs for urban stormwater management (collection, treatment, disposal per kilometer of drainage system) |
| Rural storm water management | Efficient rural storm water management | Efficiency | Operating costs for rural stormwater management (collection, treatment, disposal per kilometer of drainage systems) |
| **Drinking water** | | | |
| Water treatment | Efficient municipal water treatment | Efficiency | Operating costs treatment of drinking water per megalitre |
| Water distribution | Efficient municipal water distribution | Efficiency | Operating costs for the distribution of drinking water per kilometer of water distribution pipe |

| Service area | Objective | Type of measure | Measure |
|---|---|---|---|
| Water treatment and distribution (integrated systems) | Efficient municipal water system (integrated systems) | Efficiency | Operating costs for the treatment and distribution of drinking water per megalitre (integrated systems) |
| Boil water advisories | Water is safe and meets local needs | Effectiveness | Weighted number of days when a boil water advisory issued by the Medical Officer of Health applicable to a municipal water supply was in effect |
| Water main breaks | Improve system reliability | Effectiveness | Number of water main breaks per 100 km of distribution system in a year |

### B.2.5 Summary of the experience

#### B.2.5.1 General

Over time the program has helped municipalities develop a common set of data to compare their own performances and costs year to year and in relation to similar municipalities. However, local conditions vary. Accordingly, in some cases, the performance measurement data reported by municipalities may also vary, reflecting differences that may not be included in the reported data (although the program allows municipalities to provide comment in their reports to taxpayers).

As examples, here are some factors that might influence a reported result:

— Type of government (upper tier, lower tier, single tier or separated city);

— Geography (northern versus southern);

— Age of infrastructure;

— Population (rural vs. urban);

— Community priorities and service levels (e.g. household garbage pickup twice rather than once a week);

— Organizational form (centralized versus decentralized administration); and

— Accounting and reporting practices.

#### B.2.5.2 Analytical tools used

The Municipal Performance Measurement Program addresses both the efficiency and effectiveness of municipal service delivery. Municipalities should concentrate on both aspects because there is often a trade-off between the two. For instance, a municipality might be able to reduce its unit costs to the lowest level in the province — but only by providing a quality of service that taxpayers find unacceptably low. Similarly, a municipality could provide the highest quality service in the province – but only by means of tax rates or user fees that make the municipality uncompetitive in the long term. Thus, efficiency and effectiveness measures are needed to ensure a balanced approach to service delivery. There are several ways to improve overall performance by making trade-offs between efficiency and effectiveness:

— Increasing effectiveness by increasing unit cost;

— Increasing effectiveness while holding unit cost constant or reducing unit cost;

— Keeping effectiveness constant while reducing unit cost; and

— Reducing unit cost by reducing effectiveness standards.

Most municipalities would likely view the second method as the most preferable and the last method the least preferable, but all methods represent opportunities for improving overall performance.

Performance measurement encourages municipalities and taxpayers to ask why actual performance differs from planned performance.

The principal analytical practices include:

1. Comparing performance results with other municipalities (being careful to understand the context of the other municipality which can include: geographical size and economies of scale, urban versus rural, mountainous versus plains, age of the infrastructure and degree of automation);
2. Comparing planned and actual performance;
3. Comparing current with past performance;
4. Conducting a trend analysis over time; and
5. Comparing actual performance with projected technological design performance.

#### B.2.5.3 Conclusions

Government today is very complex, so it is important that elected officials and public servants inform taxpayers what the government plans to achieve, what it is actually accomplishing and what public services cost. With this information, taxpayers can make informed decisions about the level of services they desire. This notion of accountability is fundamental to the democratic form of government.

Measuring performance and setting targets effectively establishes an understanding between municipal staff and council, under which all parties develop a clearer understanding of the expected results or standards for each service area. The result is a shared accountability framework between staff and council, which benefits everyone. It helps focus council's decision-making and helps municipal staff understand the level and type of service delivery required. For the most part, municipalities already serve their taxpayers well, and that is something the public has a right to know. Performance measurement demonstrates to taxpayers how they are being served and the value they are receiving for their tax dollars.

Government programs exist to provide services and improve the quality of life. Performance measurement identifies ways for municipalities to provide high-quality, efficient and effective services.

Performance measures can be used to create new incentives and rewards to stimulate staff creativity and productivity. A growing number of municipalities have pursued this approach. In fact, many municipalities have been able to cut costs while maintaining or even improving service because they implemented the creative ideas of staff directly involved in service delivery.

Performance measures can help municipalities develop budgets that are based on realistic costs and benefits, not just historical patterns. Performance measurement can also improve the monitoring of municipal budgets by measuring whether the budget and expected service levels are being met.

Performance measurement is not new. It has been in place for several years in different forms in many jurisdictions around the world. Every country in the Organization for Economic Cooperation and Development (OECD) has a policy at the national level supporting performance measurement.



## B.3 PORTUGAL — The Water and Waste Services Regulation Authority (ERSAR)

### B.3.1 Background of the organization

ERSAR is the Portuguese regulation authority for drinking water supply, wastewater management and municipal waste management services and the national authority for drinking water quality. It aims to ensure adequate protection for consumers and users of water supply, wastewater and waste services by promoting the quality of service rendered by the utilities and guaranteeing socially acceptable pricing, materialized in the following principles: essentiality, indispensability, universality, equity, reliability and cost efficiency associated with the quality of service. ERSAR is committed to ensure that there is equity and transparency in access to the water and waste services and their operation and respective

contractual relationships, as well as consolidating an effective public right to general information regarding the sector and each utility. It also contributes to the implementation of government policies.

According to its organic law, ERSAR's regulation model is composed of three action plans: on a first level, the structural regulation of the sector, which consists in contributing to a better organization and to the clarification of the regulatory rules; on a second level, the regulation of the utilities' behaviour, monitoring throughout the life cycle the utility compliance with legal and contractual requirements, economic issues, the quality of service, the quality of drinking water and the interface with consumers; on a third level, auxiliary regulatory activities, including the preparation and the regular dissemination of information and technical support to the utilities.

The regulation of the quality of service is done by assessing the performance of the various utilities following a set of indicators related to each service. In partnership with the National Civil Engineering Laboratory (LNEC), ERSAR has developed one set of 20 performance indicators (PI) for each service which was applied from 2004 to 2010, only to the concessions subject to regulation – "1st Generation of the quality of service assessment system".

In 2011 and also with the technical support of LNEC, ERSAR introduced the "2nd Generation of quality of service assessment system" to all water utilities in Portugal. This second generation, composed of 16 PI for each service, has evolved from the experience gathered during the eight years application of the first generation of PI. Both generations were inspired by the performance indicators published by IWA regarding the water supply and wastewater management services.

Following the publication of the new strategic plans approved for the water and waste sectors in Portugal, namely PENSAAR 2020 and PERSU 2020, respectively, ERSAR carried out a deep reflection in order to align the assessment system with the strategic measures and targets established in those strategic plans. In this context, ERSAR developed a new generation of performance indicators adapted to the 2020 horizon, the "3rd generation of the service quality assessment system". In parallel, benefitting from the experience of five annual cycles of universal regulation, some concepts and indicators were also reviewed and adapted, resulting in a set of 14 indicators for each service.

The 3rd generation of the quality of service assessment system aims to guarantee the continuous improvement of the service provided to users by the utilities, within a framework of a regular and efficient operation of the public service, adopting the best available standards of service.

### B.3.2 Objective for making use of performance indicators

The quality of service provided is an essential aspect of the utilities' activity, particularly in terms of user satisfaction, protection of public health and the environment.

The regulation of the quality of service aims to improve the effectiveness and efficiency of the water and waste services. It helps to ensure compliance with public service obligations, in terms of universal access to services, adequacy of the quantity, quality and continuity of services and efficiency of the utilities.

This regulation is done by assessing the performance of the various utilities following a set of indicators related to drinking water supply, wastewater management and urban waste management services, allowing ERSAR to regulate by benchmarking. The benchmarking process enables the establishment of baselines and the definition of best practices, creating an artificial competitive environment within the sector.

### B.3.3 Performance indicator methodology

ERSAR has defined one set of 14 quality of service indicators for each of the services regulated. Some performance indicators are addressed to assess the utilities' efficiency, as others are shaped to measure the utilities' effectiveness.

The set of indicators used for drinking water supply services assessment are:

— Protection of user interests

  AA01 – Service coverage

  AA02 – Affordability of the service

  AA03 – Service interruptions

  AA04 – Safe water

  AA05 – Reply to written suggestions and complaints

— Utility sustainability

  AA06 – Cost recovery ratio

  AA07 – Connection to the service

  AA08 – Non-revenue water

  AA09 – Mains rehabilitation

  AA10 – Mains failures

  AA11 – Adequacy of human resources

— Environmental sustainability:

  AA12 – Real water losses

  AA13 – Standardised energy consumption

  AA14 – Proper sludge disposal

The key performance indicators (KPIs) used for wastewater management services assessment are:

— Protection of user interests:

  AR01 – Service coverage

  AR02 – Affordability of the service

  AR03 – Flooding occurrences

  AR04 – Reply to written suggestions and complaints

— Utility sustainability:

  AR05 – Cost recovery ratio

  AR06 – Connection to the service

  AR07 – Sewer rehabilitation

  AR08 – Sewer collapses

  AR09 – Adequacy of human resources

— Environmental sustainability:

  AR10 – Standardised energy consumption

  AR11 – Accessibility to the wastewater treatment

AR12 – Emergency control discharges

AR13 – Compliance with discharge permit

AR14 – Proper sludge disposal

The main differences between the 2nd and the 3rd generation are listed below:

— the infrastructure asset knowledge and management index was revised and divided into two indices: Infrastructure Knowledge Index (IKI) and Infrastructure Asset Management Index (IAMI). These both indices include the assessment of all buried and non-buried infrastructures (as mains, sewers, water treatment plants, wastewater treatment plants, reservoirs, pumping stations, network accessories) and require more detailed information regarding each infrastructure. The score will distinguish if the information support is paper, CAD or equivalent software or geographic information system;

— the current Flow Measurement Index (FMI) for the wastewater systems was revised and it was developed an equivalent index for the water supply service;

— it was introduced a new index, the Infrastructure Value Index (IVI) that can be seen as a weighted average of the residual lives of the infrastructure components, where the weights are the component replacement costs;

— a further step was taken regarding the determination of the water balance, namely through the mandatory report of some items of the water balance (unbilled unmetered consumption, unauthorized consumption and metering inaccuracies).

Annually is carried out a quality of service regulation cycle applicable to close to 400 utilities providing public water and waste services, independently of their holding and management models (bulk, retail or integrated service).

In each cycle, in the period following the reference year of evaluation, all the regulated utilities should send to ERSAR the internal and external data necessary for their assessment, as well as their self-evaluation of the quality of the data in terms of accuracy brackets, reliability of the information source and the files and other documentation needed for validation. The information required should be sent until a pre-defined date and using the quality of service regulation module from the information system.

In a first approach, ERSAR will carry out the validation of the results sent by each utility, which will allow the detection of any processing errors and inconsistencies through cross analysis and validation of the data supplied. As a second step, ERSAR will continue to validate the data sent by the utilities and verify its reliability through local audits, which should result in audit reports signed by the representatives of ERSAR and endorsed by the respective utility. Once this step has finished and until a pre-defined date, ERSAR will process the data and proceed to interpret it through calculation of the KPI. To each KPI evaluation is given one of three colours (red, yellow or green), with resemblance to the traffic lights, with regard to the defined reference values and intervals and the existing contextual factors.

After the audition period, ERSAR will open a contradictory period, sending the utility the respective indicators, contextual factors used and the preliminary interpretation of the results. The utilities have a pre-defined period to submit comments or suggest the correction of the assessment, suitably justified. Based on information which has been validated, ERSAR will process the definitive data and interpret the results, ascertaining the definitive values of performance indicators.

ERSAR will publicly disclose the results of this regulatory component through an annual report on water services, for professional use, and through interactive apps for non-professional use, on its website (www.ersar.pt/en).

### B.3.4 Summary of the experience

The quality of service assessment and benchmarking are two complementary tools that promote transparency and accountability to the water sector. The benchmarking process enables the

establishment of baselines and the definition of best practices, creating an artificial competitive environment within the sector. Benchmarking regulation helps utilities to monitor their performance, comparing between the expected and the real performance results and between current and past performance results, to set performance expectations and to identify and prioritize improvement opportunities.

On the other hand, as the benchmarking results are published and publicized, it enables utilities to gain an independent perspective about how well they perform compared to other utilities with similar operating conditions.

Its importance lies not only in providing an important instrument for utilities' quality of service regulation, but also in allowing users the fundamental right of accessing reliable and easy to understand information regarding the quality of service provided to users.

The Portuguese experience reveals that benchmarking regulation is a powerful regulating tool that can lead to the improvement of the utilities' performance, as it naturally compels utilities to overcome their own performance or to achieve the same results that their peers have achieved. Not less important, it also contributes to the improvement of the quality of the information reported by the utilities.

Nearly thirteen years after its implementation, this system remains a key tool for regulation, recognized by the Portuguese water and waste services' stakeholders. In fact, this system welcomed many contributions and comments sent by the water and waste services utilities during the consultation period, whose professional and constructive collaboration is much appreciated, highlighting the growing maturity of the industry and their sense of responsibility towards society.

# Annex C
(informative)

# Associations or groups of organizations

## C.1 BRASIL — Federal University of São Carlos (UFSCar)

### C.1.1 General

Federal University of São Carlos (UFSCar), Centre of Exact Sciences and Technology (CCET), Civil Engineering Department DECiv) and the research group in Management and Technology in Environmental Sanitation Systems (GeTec SAM).

### C.1.2 Background of the organization

UFSCar is located in São Paulo State and aims at effective educational actions, research and extension projects. The Department of Civil Engineering (DECiv) is part of the Centre of Exact Sciences and Technology (CCET) and it is responsible for the course of Civil Engineering in undergraduate and graduate levels (Master and Doctorate degrees). The research group in Management and Technology in Environmental Sanitation Systems (GeTecSAM) has undertaken various research activities in the field of urban infrastructure systems and management in sanitation systems, in which the issue of water supply has a strong impact.

The group is dedicated to studies of actions to improve and manage water supply systems in Brazil.

The GeTecSAM Group is up to date with the discussions on ISO 24512:2007 since its publication in 2007 and participated in the translation of the Brazilian version, which resulted in ISO 24512:2007. In this sense, the group has undertaken research on a sub-basin in the State of São Paulo, Brazil, with an estimated population of 1,6 million inhabitants, encompassing 15 cities. In this sub-basin, there are 22 Water Treatment Plants (WTP), with flow rates ranging from 10 L/s to 1 500L/s that have complete water treatment systems, and which generate waste in decanters and filters.

It is noteworthy that Brazil, with a population of just over 200 million inhabitants, still has numerous problems in the management of water treatment and supply. According to Pesquisa Nacional de Saneamento Básico (PNSB) (2008), Brazil has about 6 000 WTPs. The water treatment plants are considered industries and generate waste. Thus, the environmental and technological management of WTPs should be in line with the prerogatives established in ISO 9001, ISO 14001, ISO/IEC TR 18001, ISO 24510, ISO 24511 and ISO 24512.

For continuous improvement, it is vital that managers have knowledge and take action to provide the population with quality water, while generating less waste and less environmental impact. Consequently, the establishment of indicators to assist management is fundamental. In this sense, ISO 24512:2007 provides possibilities for elaborating and discussing indicators that help in this improvement.

Unfortunately, the dissemination and knowledge of ISO 24512:2007 in Brazil are insufficient. Therefore, efforts to improve information accessibility to managers of water services are required.

### C.1.3 Objective for making use of performance indicators

The purpose of this study is to gather existing data on waste generated in Water Treatment Plants (WTP) in a sub-basin in the state of São Paulo, Brazil, that would allow the development and implementation of indicators in line with ISO 24512:2007. The proposed indicators aim to support benchmarking and management programs related to waste generated in WTPs.

### C.1.4 Performance indicator methodology followed

Firstly, a form was elaborated to collect data on 22 Water Treatment Plants (WTP) located in 15 cities of a sub-basin in the State of São Paulo, Brazil.

The data collected was analysed and systematized. It was divided in two categories: management and benchmarking indicators; and general data to be used as context information, in accordance with ISO 24512:2007.

Based on the guidelines and recommendations in ISO 24512:2007 and on the data that can be considered as variables for using indicators, the following indicators were developed and used to evaluate waste generated in WTPs. See Figure C.1 for the methodological procedures followed.

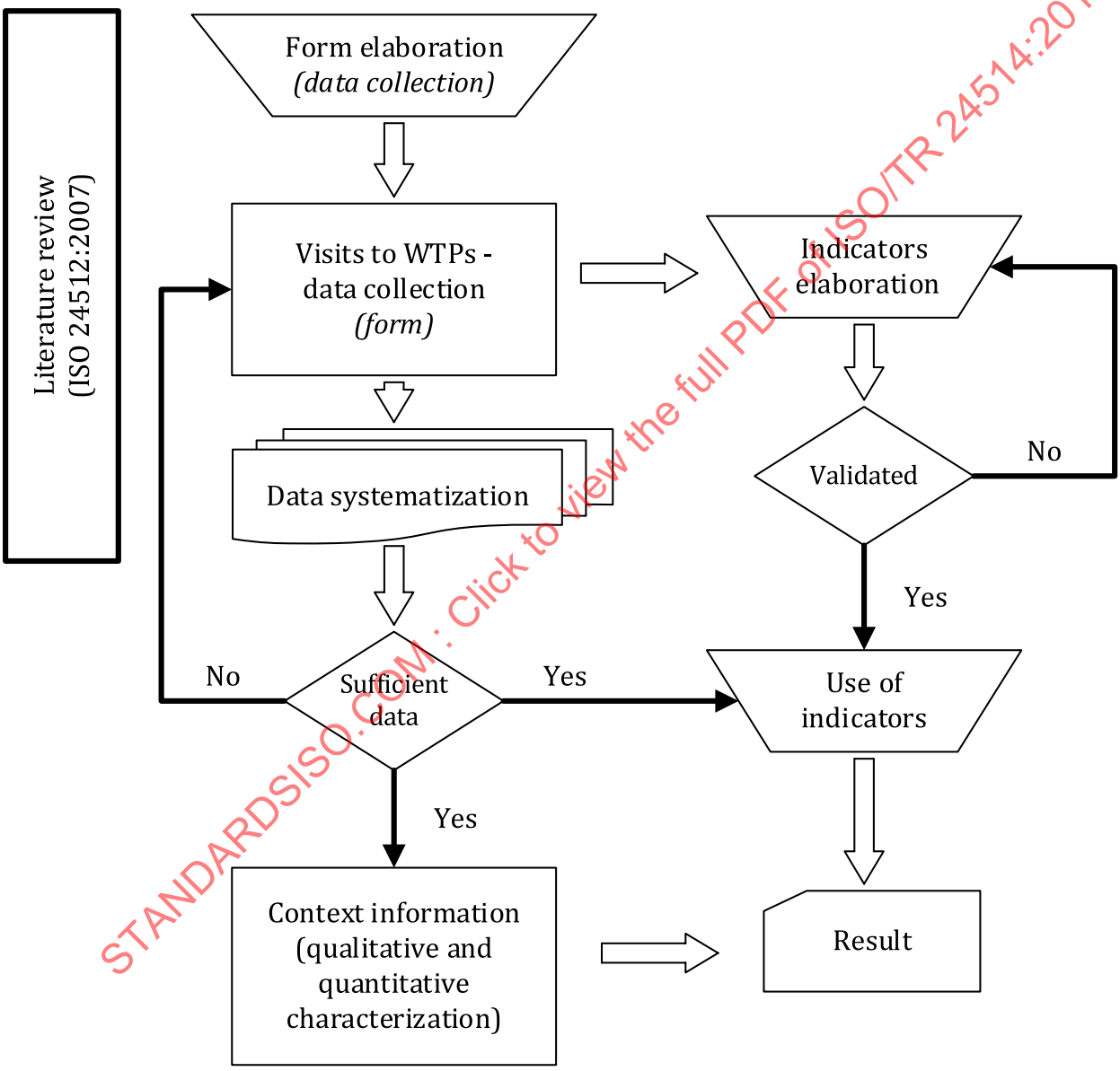



**Figure C.1 — Methodological procedures flowchart**

In this context, indicators were developed and proposed based on the principles of ISO 24512:2007, in which the indicators are parameter-derived values. These indicators are expressed as variables ratios, which provide information beyond the value directly associated with a parameter. The indicators were called individual indicators (Iin), due to the fact that they reflect and point the individual results of each water treatment plant, and can be compared in different WTPs.

The waste considered in this study is the Sludge and the Filter Backwash Water (FBW), generated by decanters and filters of WTPs.

The indicators used to assess the characterization and destination of waste (sludge and FBW) generated in each of the 22 analysed WTPs to aid waste management is shown in Table C.1.

**Table C.1 — Indicators used to assess the characterization and destination of waste generated in Water Treatment Plants (WTPs)**

| Code | Individual Indicator — WTP waste (Iin) | Unit |
|---|---|---|
| **Iinl** | Characterization level of generated sludge | Un (0 to 3) |
| **Iin2** | Level of raw sludge destination | Un (0 to 3) |
| **Iin3** | Level of dewatering/drying of raw sludge | Un (0 to 3) |
| **Iin4** | Characterization level of FBW | Un (0 to 3) |
| **Iin5** | Destination level of FBW | Un (0 to 3) |
| **Iin6**[a] | Destination level of solid waste from STS* | Un (0 to 3) |
| **Iin7**[a] | Destination level of liquid waste from STS* | Un (0 to 3) |

[a] Indicator used only in WTPs with a STS (Sludge Treatment System) or similar, in other words, in WTPs with systems of treatment/dewatering/thickening of sludge.

Each indicator is detailed in accordance with the guidelines of ISO 24512:2007, as shown below for the first indicator (Iinl).

Indicator Code: **Iinl**

Indicator Name: **Characterization level of generated sludge**

**Definition:** Characterization and classification level of generated sludge according to NBR 10.004/2004.

**Calculation Rule: 0 =** not applicable (no sludge characterization); 1= quantifies sludge (measures/estimates generated sludge); 2 = quantifies and analyses quality, however it does not classify sludge according to NBR 10.004/2004; 3 = quantifies and classifies sludge according to NBR 10.004/2004.

**Unit:** un

The proposed indicators were used in 22 WTPs, making it possible to assess the quantification, characterization and destination of sludge and filter backwash water (FBW) generated in each treatment plant and, in a broader context, to analyse the various stations located in the same hydrographic basin.

Table C.2 shows the results of the use of the seven proposed individual indicators **(Iinl, Iin2, Iin3, Iin4, Iin5, Iin6 and Iin7).** In Table C.2 these indicators are presented by colour scale, facilitating the viewing and interpretation of results.

**Table C.2 — Results of the use of individual indicators for WTPs waste**

| Indicator tame | Characterization level of generated sludge | Level of raw sludge destination | Level of dewatering/ drying of raw sludge | Characterization level of FBW | Destination level of FBW | Destination level of solid waste from STS | Destination level of liquid waste from STS |
|---|---|---|---|---|---|---|---|
| **Unit** | **Un (0 to 3)** | **Un (0 to 3)** | **Un (0 to 3)** | **Un (0 to 3)** | **Un (0 to 3)** | **Un (0 to 3)** | **Un (0 to 3)** |
| **WTP code** | **Iinl** | **Iin2** | **Iin3** | **Iin4** | **Iin5** | **Iin6** | **Iin7** |
| **W1** | **0** | **0** | **0**[w] | **1** | **0**[w] | NA | NA |
| **W2** | **0** | **0** | **0** | **0** | **0** | NA | NA |
| **W3** | **0** | **0** | **0** | **0** | **0** | NA | NA |

[a] The WTP sludge is sent to a WWTP (Wastewater Treatment Plant) equipped with a mechanical system.

**Table C.2** *(continued)*

| Indicator tame | Characterization level of generated sludge | Level of raw sludge destination | Level of dewatering/ drying of raw sludge | Characterization level of FBW | Destination level of FBW | Destination level of solid waste from STS | Destination level of liquid waste from STS |
|---|---|---|---|---|---|---|---|
| Unit | Un (0 to 3) | Un (0 to 3) | Un (0 to 3) | Un (0 to 3) | Un (0 to 3) | Un (0 to 3) | Un (0 to 3) |
| WTP code | Iinl | Iin2 | Iin3 | Iin4 | Iin5 | Iin6 | Iin7 |
| W4 | 0 | 0 | 0 | 0 | 0 | NA | NA |
| W5 | 1 | 0 | 0 | 0 | 0 | NA | NA |
| W6 | 0 | 0 | 0 | 1 | 0 | NA | NA |
| W7 | 3 | 0 | 0 | 0 | 0 | NA | NA |
| W8 | 3 | 2 | 2[a] | 3 | 2 | NA | NA |
| W9 | 1 | 0 | 0 | 1 | 0 | NA | NA |
| W10 | 1 | 0 | 0 | 1 | 0 | NA | NA |
| W11 | 1 | 0 | 0 | 1 | 0 | NA | NA |
| W12 | r– | 3 | 3 | 2 | 3 | 1 | |
| W13 | 0 | 1 | 1 | 1 | 2 | 0 | 3 |
| W14 | 0 | 1 | 1 | 1 | 2 | 0 | 3 |
| W15 | 0 | 0 | 0 | 1 | 0 | NA | NA |
| W16 | 0 | 0 | 0 | 0 | 0 | NA | NA |
| W17 | 0 | 0 | ...- 0 | 0 | 0 | NA | NA |
| W18 | 0 | 3 | 2 | 0 | 3 | 2 | 3 |
| W19 | 0 | 0 | 0 | 1 | 0 | NA | NA |
| W20 | 0 | 0 | 0 | 1 | 0 | NA | NA |
| W21 | 0 | 0 | 0 | 1 | 0 | NA | NA |
| W22 | 0 | 0 | 0 | 1 | 2 | NA | NA |

[a] The WTP sludge is sent to a WWTP (Wastewater Treatment Plant) equipped with a mechanical system.

| Caption |
|---|
| NA |
| 0 |
| 1 |
| 2 |
| 3 |

**NA — lot applicable** (There is not a system of dewatering of sludge at the WTP)

**0**: Indicator value 0 (zero) — POOR

**1**: Indicator value 1 (one) — AVERAGE

**2**: Indicator value 2 (two) — GOOD

**3**: Indicator value 3 (three) — EXCELLENT



### C.1.5 Summary of the experience

The indicators proposed in this study are able to provide a strategic view of the water system. The analysis reveals the great challenge that managers will face in Brazil (despite the restricted area under consideration). It is noteworthy that the region (sub-basin) studied is one of the most developed in Brazil and is part of a hydrographic basin encompassing 66 cities. The Gross Domestic Product (GDP) of the 66 municipalities that are part of this basin, approximately R$ 180 billion, is the sixth economy in Brazil.

The results show that in the vast majority of the 22 WTPs analysed, the sludge generated in decanters is not even effectively controlled, quantified and characterized. This factor inconveniences the application of indicators, improvement actions and management of this waste. The common practice noted in this sub-basin is the destination of the WTP sludge without treatment into water resources,

violating the current environmental legislation in Brazil (Law 9.605/1998 and Law 9.433/1997). The use of indicators reveals that none of the WTPs analysed reuses or reutilizes the generated sludge.

Considering the presented panorama, Brazil will face enormous challenges to improve its management of water treatment systems (ISO 24512:2007). This generates numerous prospects in the field of discussion and training of managers for the effective improvement of the operational aspects of WTPs in relation to the generated waste.

Thus, the GeTec SAM group recommends the continuation of this study to propose and apply the indicator use methodology, expanding it to other regions.

## C.2 CANADA — National Water and Wastewater Benchmarking Initiative

### C.2.1 General

The information for this example was drawn from the following URL:

http://www.nationalbenchmarking.ca/

and the August 31, 2013 Public Report found on that site.

NOTE Due to the confidentiality agreement with the member utilities, individual data pertaining to each of the utilities is confidential and therefore not identified or available in the Public Report. The purpose of the report is to provide an overview of the performance of the participating utilities within the contexts of productivity, reliability, labour, environment, financial efficiency and infrastructure reliability as these pertain to sustainability.

The National Water and Wastewater Benchmarking Initiative is operated by AECOM Inc. Under Project #60272783.

### C.2.2 Background of the organization

This project was developed by AECOM, a major engineering consulting firm, in response to a need for Canadian municipal water and wastewater utilities to measure, track and report on their utility performance. It was initiated in 1997 and overtime has involved a partnership involving 53 wastewater utilities, 50 water utilities and 28 storm water management programs. The partnership now represents 43 of Canada's leading municipalities and regional districts (approx. 50 % of Canadian utilities from coast to coast, generally with service populations greater than 50 000) and represents over 60 % of the Canadian population.

While fundamentally a high-level metric benchmarking process, the initiative has developed into a network and information base for Canada's most progressive municipal utilities.

The referenced website presents information about the project, and is the focal point for project related communication for member municipalities (through the Members Only section).

### C.2.3 Objective for making use of indicators

#### C.2.3.1 Background

Benchmarking, in the context of this initiative, is the ongoing process of comparing products, services and practices with those of similar organizations. It focuses on wastewater collection and treatment systems, water treatment and distribution systems and stormwater management systems. The ultimate goal is to continuously improve quality and performance.

The tools developed through the initiative provide an ability to compare different utilities' norms and standards, and helps utility managers to achieve continuous progress towards the utility's goals. But benchmarking and the data collection alone do not provide performance improvement; it is the cycle of monitoring trends in key business functions, variance calculation, goal setting and the implementation

of action plans that makes performance improvement possible – and allows managers to take proactive steps to avoid and resolve issues in their operating environments.

### C.2.3.2 Project objectives

Benchmarking can help utility managers to achieve continuous performance improvement towards the utility's goals. The objective of the benchmarking project is thus to develop a high-level tool or model that the majority of Canadian water and wastewater utilities can use for managing and monitoring their performance. The tool provides an ability to compare utilities' norms and standards. But benchmarking and the data collection process alone will not provide performance improvement; it is the cycle of monitoring, variance calculation, goal setting and implementation of action plans that closes the gap towards performance improvement. By monitoring trends with benchmarked data in key business functions, managers can take proactive steps to avoid and resolve issues in the operating environment.

A key distinguishing factor of this benchmarking project is the way the data is collected, through on-site visits by qualified and trained staff in close association with key utility staff. This ensures the quality of all utility information and "apples-to-apples" comparison.

The Utility Management Model (http://nationalbenchmarking.ca/utility-mgmt-model.htm) and the benchmarking methodology developed provides infrastructure managers with the means to link their goals, strategies, performance measures and performance monitoring/reporting. In turn, this approach provides managers with the basis on which to strive for superior performance through continuous improvement.

### C.2.3.3 Objectives within the initiative

The seven goals that define good performance according to the NWWBI are:

1. provide reliable and sustainable infrastructure;
2. provide accessible and sufficient infrastructure (capacity);
3. meet service and performance requirements at minimum sustainable cost;
4. protect public health and safety;
5. provide a safe and productive work environment;
6. have satisfied and informed customers; and
7. protect the environment and minimize environmental impacts.

In all, the NWWBI benchmarks approximately 70 performance measures for each of the water and wastewater treatment, water distribution and wastewater collection utilities, and approximately 25 performance measures for the stormwater and drainage utilities.

Table C.3 sets out the scope of these goals and their related performance measures (PM).

**Table C.3 — Goals and related performance measures**

| Goal | Water | Wastewater | Stormwater |
|---|---|---|---|
| 1. Provide reliable and sustainable infrastructure. | **12 PMs: e.g.**<br>Capital Reinvestment / Replacement Value | **18 PMs: e.g.**<br>Length CCTV Inspected mains / 100km | **4 PMs: e.g.**<br>Length of Eroded Stream / Length of Streams |
| 2. Provide accessible and sufficient infrastructure (capacity). | **4 PMs: e.g.**<br>No. of Hours of Storage Capacity at Average Daily Demand (ADD) | **3 PMs: e.g.**<br>% of Design Average Annual flow (AAF) Utilized | **4 PMs: e.g.**<br>Stormwater Fees/ Serviced Population |
| 3. Meet service and performance requirements at minimum sustainable cost. | **23 PMs: e.g.**<br>O and M Cost/ Ml Treated | **37 PMs: e.g.**<br>Per-Unit Biosolids Cost | **3 PMs: e.g.**<br>O and M + Indirect Costs/ 100 km Length of Drainage |
| 4. Protect public health and safety. | **9 PMs e.g.**<br>Length of Main Cleaned/ Total Length | **5 PMs e.g.**<br>Number of Reported Surcharges / per year | **4 PMs e.g.**<br>Value of Damage due to Flooding/ Serviced Population |
| 5. Provide a safe and productive work environment. | **8 PMs e.g.**<br>No. of sick Days Taken per Full Time Equivalent (FTE) employee | **4 PMs e.g.**<br>No. of Accidents / 1 000 Labour Hours | **3 PMs e.g.**<br>No. of Training Hours for Storm Water Employees/ Employee |
| 6. Have satisfied and informed customers. | **2 PMs e.g.**<br>No. of Water Quality Complaints / 1 000 Customers | **2 PMs e.g.**<br>No. of Odour Complaints / 1 000 Customers | **2 PMs e.g.**<br>Are There Stormwater Regulations? |
| 7. Protect the environment and minimize environmental impacts. | **3 PMs e.g.**<br>Volume of Treated Water / Total Volume of Raw Water | **3 PMs e.g.**<br>Kg BOD Discharged to Environment per Capita | **3 PMs e.g.**<br>No. of Beach closures/ year |
| **Total number of performance measures/service sector** | **61** | **72** | **23** |

For each performance measure, the program has defined the numerator and denominator in specific terms in order to ensure accuracy of calculation and to facilitate inter-utility comparisons.

### C.2.3.4 Benefits of participating

Being a member of the Canadian National Water and Wastewater Benchmarking Initiative there are several benefits that the partnership can bring to the participating utilities.

Aside from access to the tools and data that help the utility become a better utility or help the maintenance managers improve their competence, there is the network of 43 Canadian city utilities which includes utility managers, operators, financial and GIS personnel who are eager to share their industry experience.

### C.2.3.5 Conditions of the program

All the data and water, stormwater and wastewater access databases (containing up to 10 years of information) are available to all participants with a confidentiality agreement on content for reports to council or public documents.

## C.2.4 Performance indicator methodology

Participation at the annual Summary Workshop is a great opportunity to build the networks and allow participants to work together in “roll-up your sleeves” sessions designed to address key issues at the

forefront of the industry; examples include maintenance productivity, succession planning and asset management.

The Summary Workshop and Task Forces elements of the program are valuable, integral components of the project methodology at key milestones for several reasons:

— they assist collaboration between Canadian water, wastewater and stormwater utilities;

— they generate open discussion, provide group decision-making which leads to consensus on key issues directing the industry;

— they assist in identifying potential strategies and actions that can improve performance; and can provide participants with the opportunity to further discuss process benchmarking issues beyond the Summary Workshop; and

— the program "Help Desk" feature helps participants ask questions of the group through facilitated survey issuing, or polling the group on similar experience or expertise.

### C.2.5 Summary of the experience

#### C.2.5.1 General

The initiative has been in place for more than 10 years, and has grown from an initial four members to 46. The scope of the program has expanded to 150 Performance Measures over the three service sectors, each developed through a peer-based consensus method.

#### C.2.5.2 Conclusion

One of the most important steps in closing the loop from benchmarking to performance improvement is analysis and investigation of the results. Through the extensive use of the benchmarking data, the project has helped participants **identify performance improvement opportunities**, and has sometimes helped them formulate action plans to address these opportunities: for example, wastewater treatment optimization, and maintenance management program optimization.

#### C.2.5.3 Annex of Developed Performance Measures

For the Water and Wastewater performance measures, these are sub-grouped into three general sections:

1. those relative to the utility;
2. those relative to treatment; and
3. those relative to either distribution or collection systems.

Those relative to storm water are not sub-grouped.

The performance measures developed relate to the seven goals described above and shown as examples in Table C.4, which provides the complete list of performance measures for Water Utilities as developed for the 2013 Report.

**Table C.4 — Water utilities**

| Section | Goal | Performance Measure |
|---|---|---|
| Utility | Sufficient Capacity (Sustainable infrastructure) | Number of Hours of Treated Water Storage Capacity at Average Day Demand |
| | Minimum sustainable cost | Cost of Water Quality Monitoring / Population Served |
| | | Cost of Customer Billing / Service Connection |
| | | (Total Water Operating Cost + Cost of Bulk Water Purchased)/ Population Served |
| | | Water Rate for a Typical Size Residential Connection using 250 $m^3$/ year |
| | Protect the environment | Cost of Water Conservation Program/Population Served |
| | | Number of Days of Water Restrictions |
| | | Per Capita Average Day Consumption for Residential Customers |
| | Satisfied customers | Cost of Customer Communication/Population Served |
| | | Number of Water Quality Customer Complaints/1 000 People Served |
| | Public health | Number of Boil-Water Advisory Days * Capita Affected/ Population Served |
| Distribution | Provide Reliable Service and Infrastructure | Number of Main Breaks / 100 km Length |
| | | % of Valves Cycled |
| | | % of Inoperable or Leaking Valves |
| | | Non-Revenue Water (L/connection/day) |
| | | % of Hydrants Checked and Inspected |
| | | % of Inoperable or Leaking Hydrants |
| | | Number of Emergency Service Connection Repairs and Replacements/Number of Service Connections |
| | | Number of Unplanned System Interruptions/100 km Length |
| | | 5 Year Running Average Capital Reinvestment/ Replacement Value |

**Table C.4** *(continued)*

| Section | Goal | Performance Measure |
|---|---|---|
| | Meet Service Requirements with Economic Efficiency | Number of Field FTEs/100 km Length |
| | | Number of O&M FTEs/100 km Length |
| | | Number of In house Metering Field FTEs/1,000 Meters |
| | | Total Operating Cost with Actual Indirect Chargeback ('000)/ km Length |
| | | O&M Cost ('000)/km Length |
| | | Pump Station O&M Cost ('000)/Total Pump Station Horsepower |
| | | Pipes O&M Cost ('000)/km Length |
| | | Metering O&M Cost/# of Meters |
| | | Pump Station Energy Consumed kWh / Total Pump Station Horsepower |
| | | Cost of Fire Hydrant O&M/# of Fire Hydrants |
| | | Unplanned Maintenance Hours / Total Maintenance Hours |

**Table C.4** *(continued)*

| Section | Goal | Performance Measure |
|---|---|---|
| | Provide a Safe and Productive Workplace | Number of Field Accidents with Lost Time/1 000 Field Labour Hours |
| | | Number of Lost Hours Due to Field Accidents/1 000 Field Labour Hours |
| | | Number of Sick Days Taken per Field Employee |
| | | Total Available Field Hours / Total Paid Field Hours |
| | | Total Overtime Field Hours / Total Paid Field Hours |
| | | % of Field Employees Eligible for Retirement per Year Category |
| | Have Satisfied and Informed Customers | Number of Water Pressure Complaints by Customers/1 000 People Served |
| | Protect Public Health and Safety | % of Main Length Cleaned |
| | | Average Value for Turbidity (NTU) |
| | | Number of Total Coliform Occurrences |
| | | Average Value for THMs (mg/L) |
| Water treatment | System Reliability | 5 Year Running Average Capital Reinvestment/Replacement Value |
| | Sufficient Capacity | Average Day Demand/Existing Water Licence Capacity |
| | | Number of Days the Plant Operated at > 90 % Capacity |
| | Minimum Sustainable Cost | Number of Field FTEs/1 000 ML Treated |
| | | Number of O&M FTEs/1 000 ML Treated |
| | | O&M Cost/ML Treated |
| | | Total Operating Cost with Actual Indirect Chargeback/ML Treated |
| | | Energy Consumed in kWh/ML Treated |
| | | Chemical Cost/ML Treated |
| | | Unplanned Maintenance Hours/Total Maintenance Hours |

**Table C.4** *(continued)*

| Section | Goal | Performance Measure |
|---|---|---|
| | Public Health | Median Value for Turbidity (NTU) |
| | | Number of Occurrences of Total Coliforms |
| | | Median Value for Nitrates (mg/L) |
| | Safe and Productive Workplace | Number of Field Accidents with Lost Time/1 000 Field Labour Hours |
| | | Number of Lost Hours due to Field Accidents/1 000 Field Labour Hours |
| | | Number of Sick Days Taken per Field Employee |
| | | Total Available Field Hours/Total Paid Field Hours |
| | | Total Overtime Field Hours/Total Paid Field Hours |
| | | % of Field Employees Eligible for Retirement per Year Category |
| | Protect the Environment | % Residuals |

Table C.5 provides the complete list of performance measures for Wastewater Utilities as developed for the 2013 Report.

**Table C.5 — Wastewater Utilities**

| Section | Goal | Performance Measure |
|---|---|---|
| Utility | Minimum sustainable cost | (Total Wastewater Operating Cost + Regional Wastewater Operating Cost)/Population Served |
| | | (Total Wastewater Operating Cost + Regional Wastewater Operating Cost)/Volume Treated |
| | | 2011 Sewer Cost for a Typical Size Residential Connection using 250 $m^3$ of water /year |
| | Safe and Productive Workplace | Number of Field Employees Eligible for Retirement per Year/ Category |
| Collection systems | System reliability | Number of Blocked Sewers/100 km Length |
| | | % of Blocked Sewers that were Repeat Occurrences * |
| | | % of Length Cleaned |
| | | Number of Pump Station Failures/Number of Pump Stations |
| | | 5 Year Average Emergency Sewer Repairs/100 km Length |
| | | % of Inoperable or Leaking Hydrants |
| | | % of Length CCTV Inspected |
| | | 5 Year Running Average Capital Reinvestment/Replacement Value |
| | Sufficient Capacity | Number of Connections with Sanitary Flooding/1 000 Service Connections |
| | | Number of Blocked Service Connections/1 000 Service Connections |
| | | Number of Reported Overflows due to Capacity/100 km Length |

**Table C.5** *(continued)*

| Section | Goal | Performance Measure |
|---|---|---|
| | Minimum Sustainable Cost | Number of Field FTEs/100 km Length |
| | | Number of Linear FTEs/100 km Length |
| | | Number of O&M FTEs/100 km Length |
| | | Total Operating Cost with Actual Indirect Charge-back ('000)/km Length |
| | | O&M Cost ('000)/km Length |
| | | Pump Station O&M Cost/Pump Station Horsepower |
| | | Pump Station O&M Cost/Pump Station Horsepower |
| | | Pipes O&M Cost ('000)/km Length |
| | | Unplanned Maintenance Hours/Total Maintenance Hours |
| | | Cost of Cleaning (hydraulic)/Length Cleaned |
| | Safe and Productive Workplace | Number of Sick Days Taken per Field Employee |
| | | Total Available Field Hours/Total Paid Field Hours |
| | | Total Overtime Field Hours/Total Paid Field Hours |
| | | Number of Field Accidents with Lost Time/1 000 Field Labour Hours |
| | | Number of Lost Hours due to Field Accidents/1 000 Field Labour Hours |
| | | % of Field Employees Eligible for Retirement per Year Category |
| | Satisfied Customers | Number of Wastewater Related Customer Complaints/1 000 People Served |

**Table C.5** *(continued)*

| Section | Goal | Performance Measure |
|---|---|---|
| Wastewater treatment | System Reliability | 5 Year Running Average Capital Reinvestment/Replacement Value |
| | Sufficient Capacity | % of Design Average Annual flow (AAF) Capacity Utilized |
| | Minimum Sustainable Cost | Number of Field FTEs/1 000 ML Treated |
| | | Number of O&M FTEs/1 000 ML Treated |
| | | Total Operating Cost with Actual Indirect Charge-back/ML Treated |
| | | O&M Cost/ML Treated |
| | | Energy Consumed in kWh/ML Treated |
| | | Cost of Purchased Energy/ML Treated |
| | | Unplanned Maintenance Hours/Total Maintenance Hours |
| | Protect the Environment | Number of Regulated Tests Out of Compliance |
| | | kg of BOD Discharged to the Environment per Capita |
| | Safe and Productive Workplace | Number of Sick Days Taken per Field Employee |
| | | Total Available Field Hours/Total Paid Field Hours |
| | | Total Overtime Field Hours/Total Paid Field Hours |
| | | Number of Field Accidents with Lost Time/1 000 Field Labour Hours |
| | | Number of Lost Hours Due to Field Accidents/1 000 Field Labour Hours |
| | | % of Field Employees Eligible for Retirement per Year Category |
| | Satisfied Customers | Number of Odour Complaints/1 000 People Served |

Table C.6 provides the complete list of performance measures for Stormwater Utilities as developed for the 2013 Report.

**Table C.6 — Stormwater**

| Goal | Performance Measure |
|---|---|
| Environment | % of Urban Catchment Area that Received Water Quality Treatment |
| | % of Catch Basin Sumps Cleaned (mechanical) and % of Catch Basins Inspected |
| | Cost of Stormwater Monitoring Program/km$^2$ of Catchment Area |
| | % of Effective Impervious Area |
| Obtain sufficient funding | Urban Field FTEs/100 km of Sewer and Urban Ditches |
| | 5 Year Running Average Capital Reinvestment / Replacement Value |
| Meet Service Requirements with Economic Efficiency | Urban O&M Cost ('000)/km of Sewer and Urban Ditches |
| | Pump Station O&M Cost ('000)/Total Pump Station Hp |
| | Total Stormwater O&M Cost ('000)/km of Sewer and Urban Ditches |
| | Overtime hours/Total Paid Field Hours |
| | Unit Cost of Catch Basin Cleaning ($/cb cleaned mechanically) |
| | Unit Cost of Storm Sewer Cleaning in $ per km |
| | Number of Emergency Sewer Repairs per 100 km of Storm Sewer Length |

**Table C.6** *(continued)*

| Goal | Performance Measure |
|---|---|
| Ensure Adequate Capacity to Protect Life and Property | Number Rainfall Events > Minor/Major Design Storm |
| | Number of Sewer Blockage Removals/100 km of Sewer |
| | % of Sewer Length Cleaned |
| | % of Ditch Length Cleaned that can be Cleaned — Stormwater Systems with Ditches |
| | Number of Visual Inspections of Pump Stations / # of Pump Stations |
| Provide a Safe and Productive Workplace | % of Manholes Visually Inspected |
| | Total Available Field Hours/Total Paid Field Hours |
| | Number of Sick Days Taken per Field Employee |
| | Number of Field Accidents with Lost Time/1 000 Field Labour Hours |
| Have Satisfied and Informed Customers | Number of Stormwater Related Customer Complaints/1 000 People Served |
| | Cost of Stormwater Education Program/1 000 People Served |

## C.3 FRANCE — Aquaplus UIE (Union des Industries de l'Eau- Association of French Water Industries)

### C.3.1 Background of the organization and Charter

AQUAPLUS (http://www.aquaplus-info.com/en/) represents all the actors in the water sector who are engaged in promoting sustainable development and meeting the following criteria:

— If you are a water professional and would like to be recognized for your commitment to Sustainable Development practices, the Aquaplus Committee is sanctioned to confer the Aquaplus Firm Label.

— If you are the client and you seek recognition for a project that represents outstanding achievement in the water sector in terms of sustainable development, the Aquaplus Committee may award the Aquaplus Trophy.

— If you are a local authority and you are responsible for a water or sanitation service which presents excellent results in terms of Sustainable Development, the Aquaplus committee may award you the Label Aquaplus Service.

The Aquaplus label and the trophy are awarded if a process of sustainable development has been demonstrated throughout the continuum of the water cycle and they are designed for all actors in the water sector, both local communities and Water professionals (companies or public and private agencies).

The Aquaplus approach encourages signatories of the charter to make progress by requiring them to comply with collective commitments and to acquire or develop systems of quality, safety and environmental management systems.

The Aquaplus approach may lead to an award of the Aquaplus label for water professionals.

It aims to encourage holder of the Aquaplus label to further integrate sustainable development into their activities and foster trust among the commissioning client, the architect and the end user.

The Aquaplus process also rewards exemplary achievements by conferring the Aquaplus Trophy. The commissioning client applies for the trophy distinction with the assistance of all partners involved.

The Aquaplus outstanding project Trophy honours actors in the water sector for their achievements in sustainable development at all phases of the project from the definition of requirements through design and construction to commissioning.

### C.3.2 Commitments of Signatories

**1 — Duties**

Beyond the strict observance of laws and regulations, the actors in the water sector undertake to contribute actively to the preservation and improvement of water and to the improvement of the quality of the environs through processes, infrastructures and works they implement.

They must seek to improve the quality of the services they provide by placing them in a process of sustainable development and optimal management of the resource.

**2 — Information between the various actors**

The water professionals must provide the commissioning client written documentation on processes, infrastructure and equipment. These help to inform stakeholders about their operation, safety, quality, the continuous reduction of levels of visual, noise and olfactive pollution, subject to use and maintenance according to manufacturer's recommendations.

The water professionals must provide the best cost-effectiveness ratio so that the commissioning client, in agreement with various stakeholders, can make management decisions, suited to the context of the installations.

**3 — Environmental Protection**

The actors in the water sector commit to promote water systems optimizing water consumption and other environmental requirements including control of energy consumption, and noise and olfactive emissions, the management of industrial risks and integration into the environment.

**4 — Agreement with the network approach**

The water companies are members of a network and commit to recognize and take into account the common standards adopted by the other actors in this sector.

Water actors pledge to take into account innovative approaches developed by other professional stakeholders (e.g. suppliers, service providers) in making their choices.

**5 — Professional Responsibility**

The water professional acts in the interests of both his customers and users. The actions must demonstrate respect for man and his environment.

The water company agrees to assign actors with the necessary skills and level of organization required for the execution of a project. The water company pledges to hold subcontractors and suppliers to these same standards and must advise, develop and install systems whose results have been validated.

**6 — Liabilities towards employees**

The water professionals are committed to apply and enforce continuously the rules of hygiene and safety.

They must provide appropriate training for their employees with regards to the procedures of quality, environment and safety systems.

**7 — Safety of goods and people**

The signatory water companies undertake to implement and enforce the rules of hygiene and safety. They must provide the rules and precautions to take for the safety of the equipment provided.

The signatory water companies agree to abstain from the use of products that threaten public health, including long-term public safety after intervention of the company, according to known risks at the time of the intervention and going forward throughout the life of the installation subject to appropriate maintenance.

The signatories' water professionals must provide documents permitting the reporting and identification of plants to public authorities and local communities and must facilitate the transparent delivery of information.

**8 — Environmental Control**

The facilities proposed by the signatories' water actors must be exemplary not only in terms of design, but also in terms of operating and maintenance costs.

To meet this requirement for information, the documents and information supplied by water professionals should disclose all elements necessary for a complete understanding of the project.

In particular, the documents transmitted must specify all suggestions to improve the design of facilities with regard to the environment in all senses of that term.

Facilities must respond to sustainable development criteria. At the very least, energy consumption controls and processes for the optimal management of waste water and of its recovery must be specified with numerical values whenever technically feasible.

The water professionals undertake to provide detailed and realistic financial forecasts based on feedback. At the request of the decision-maker, the water professionals commit to provide the technical elements needed to define the expected depreciation periods.

The operating criteria must be presented to commissioning clients and contractors so as to permit them to use this information as determining factors in the choice of projects and / or significant balancing elements.

Whatever the agreement concluded between the water professionals and the clients (public or private authorities), the company assuming all or part of maintenance support must meet the criteria previously mentioned for energy, waste and other impacts on the environment.

In particular, they will work to maintain the facilities permanently operational.

**9 — Transparency requirements**

The transparency of the professional water signatory also must cover both the identity and the powers of all actors on the project, the extent of their mission, as well as all information sent to decision-makers, owners and the main contractors and to their co-contractors, subcontractors and suppliers.

**10 — Guarantee of independence**

Water actor signatories are required to avoid conflict of interest situations in which they become both "judge" and "party".

**11 — Financial Commitments**

The water professional's signatories assert that their financial proposals comply with applicable standards and industry rules.

They must propose the best price by seeking optimization of their costs in the interest of all economic partners.

**12 — Communication**

Every water utility partner of a "Service achievement award" may use this reference in its communications. Such communications must respect the scope of the certificate. It should not be confused with the Aquaplus Label or the Aquaplus Trophy.

### C.3.3 Objective for making use of performance indicators — The Label AQUAPLUS Service

The Label Aquaplus service is open to any local authority, whose water or sanitation service is managed by a public or a private operator and presents excellent results in terms of sustainable development.

This label may be awarded in two different activities: Drinking Water and Sanitation.

Prerequisites:

— to fulfil and publish the indicators of the service relative to public water and sanitation services – SISPEA (http://www.services.eaufrance.fr/);

— to show good performances at least several environmental and management criteria; and

— to comply with the regulatory requirements related to water and sanitation services.

### C.3.4 Performance indicator methodology

The Label Aquaplus Service is awarded after verification of the application by the Aquaplus Committee and confirmation by an on-site inspection of the assessment criteria on:

— quality of the service for the user: user information and participation, social access to drinking water, etc.;

— management of the service: financial and human resources management, performance and sustainable management of equipment;

— environmental Quality of the service: protection of water resources, environmental friendly actions, etc..

To be awarded, the application must demonstrate at least 75 % of the maximum number of points.

The Label Aquaplus Service is awarded for a period of 5 years.

The application forms (in French) can be downloaded from http://www.aquaplus-info.com/en

### C.3.5 Summary of the experience

This Aquaplus service label has been implemented since 2013. Its overall strategy is in line and make reference to ISO 24510, ISO 24511 and ISO 24512.

ONEMA (L'agence francaise pour la biodiversité) (see http://www.onema.fr) and French Water Industry are willing to expand this label which is a very promising tool to valorise the production of indicators by utilities and to award them for their good achievements.

# Annex D
(informative)

# Individual utilities

## D.1 ARGENTINA — Aguas de Santiago SA

### D.1.1 Background of the Organization

Aguas de Santiago SA has since 1997, been given and held the licence to supply the water and wastewater services in eleven localities of the Province of Santiago del Estero. The service is provided to approximately 520,000 inhabitants.

Initially the customers of Aguas de Santiago SA did not accept the fact that a licensed organization instead of municipal institutions would provide the service. There were a number of protest marches which led to a decision of the Board and Management of Aguas de Santiago to initiate the application of the process and methodology of ISO 24510 — Service to Users. The goals of this activity were improving the relationship with the users, understanding their needs and reducing to the minimum the differences between their expectations and the strategic guidelines of the supplier of the service.


### D.1.2 Objective for making use of performance indicators

The specific objectives of this activity were to identify possible performance indicators which would measure the level of satisfaction of the users with the service, identify areas of improvement and to demonstrate the responsiveness of the organization to users' needs and expectations.

In order to proceed, guidelines for user satisfaction were established, which were then included in the Vision and Mission statements. The differences between user expectations and performance achieved became strategic guidelines for the supplier of the service. See Figure D.1.

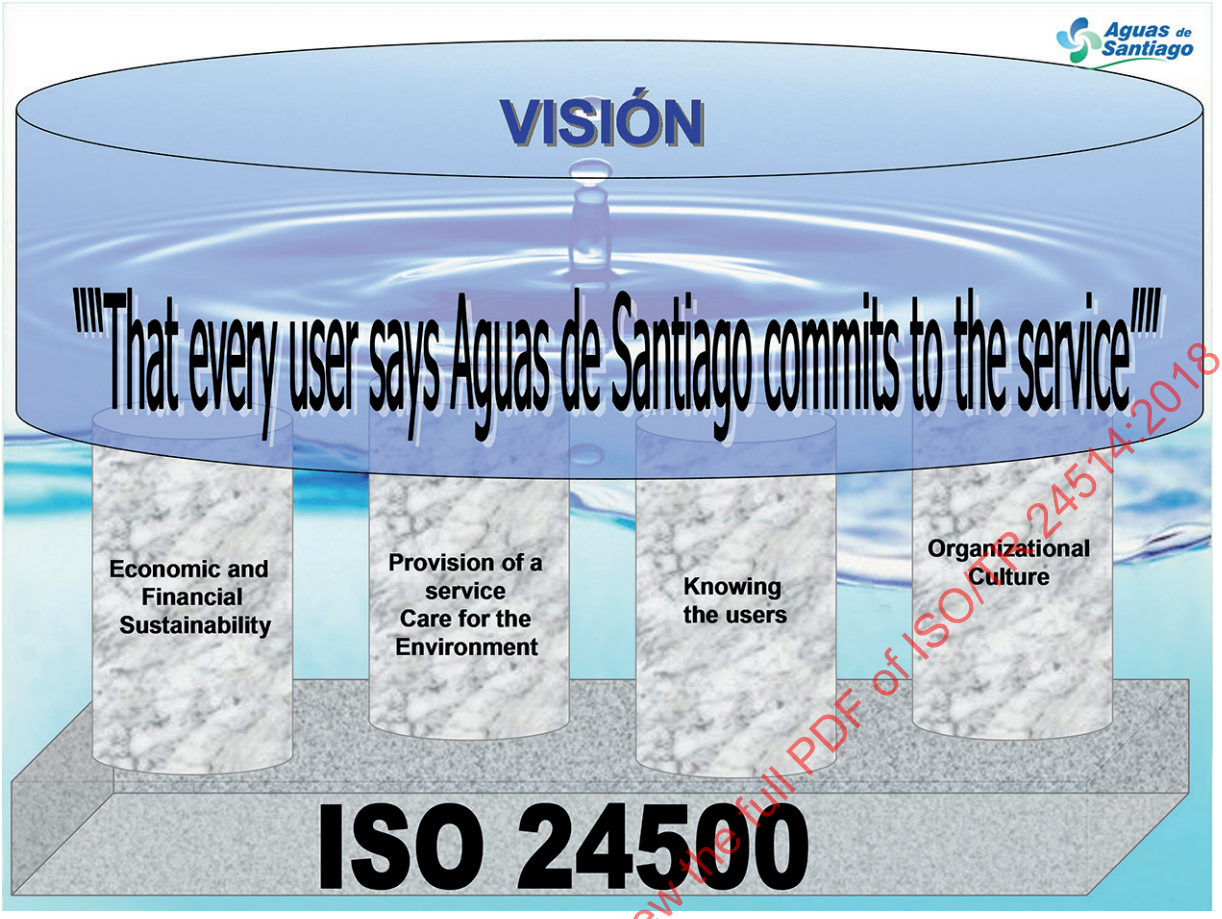



**Figure D.1 — Vision statement**

### D.1.3 Performance Indicator Methodology

The method of proceeding involved establishing and implementing a number of discrete steps:

a) Appointment of a Project Coordinator and designation of teams formed by Area and Senior Managers;

b) Providing training courses on ISO 9001 and workshops on the ISO 24500 series of standards. This training was provided first to the managers of the organization who, in turn, instructed the staff under them);

c) Development and distribution of a document containing the description of Aguas de Santiago relevant to each element in the standard. This task was carried out in a series of weekly meetings with all the Senior Managers. The objective was to analyse each element in ISO 24510 and determine how to place it within the context of the organization;

d) Development and implementation of a worksheet in which aims, goals, actions, assessment criteria and indicators (see Figure D.2) were defined. This worksheet was used for each element in the Standard, and was accepted by the work teams defined in step a);

e) Development and implementation of a GANT Diagram to represent the sequence in which the elements and their corresponding actions will be executed;

f) Measurement: determination of the chosen Performance indicators;

g) Implementation of the defined actions for each element in the worksheets;

h) Assessment of the results: meetings took place every three months with the Senior Managers involved and with the presence of the Top management to analyse the results and define as necessary, new actions and/or re-establish the aims and goals determined for each element of the program.

At the end of the year 2012, the Board (Top management) and the Senior Managers decided to begin the application of ISO 24511 and ISO 24512. The methodology which was followed was similar to that used for the ISO 24510.

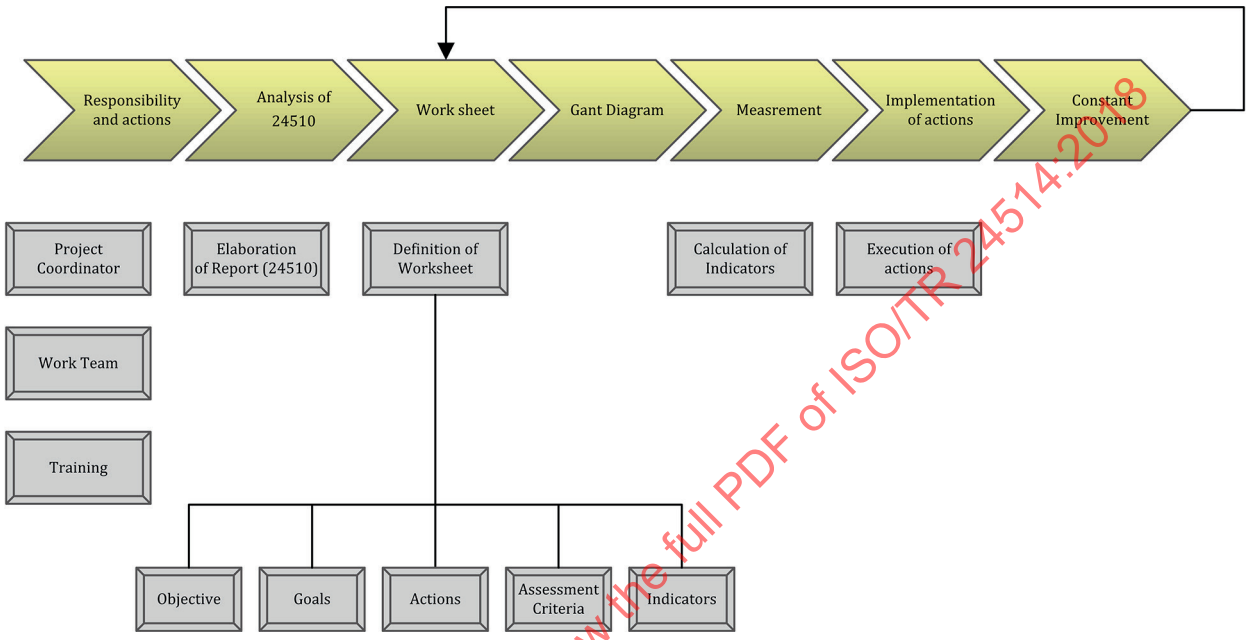



**Figure D.2 — Definition of the content of each workshop**

A summary example of a worksheet for the public health objective is shown in Figure D.3.

| Objective: Protection of Public Health | | |
|---|---|---|
| **Goal 1**: Reduce the amount of obstructions in comparison to the previous period. | **Action**: Define and execute a plan that ensures that the Vactor Truck will conduct a program of regular maintenance of the sewer system. | **Assessment Criteria**: Minimizing obstructions in the drainage network. |
| | **Timeframe of implementation**<br>First trimester 2013 | **Indicator**: Number of blockage removals carried out in Zone 1 during the trimester |
| | **Responsible department**<br>Department of Sewers / Systems Department | **Data**: Number of complaints for sewers problems solved by the resolution code "31" (unblocking in drainage network). |
| | **Resources**: Hidrojet Truck, Vactor Truck. The Systems Department defines a new process in the Management Information System that allows the registration of the programmed works and also the kilometres swept according to the worksheet. | **Processing**: Number of Work Orders resolved by Code 31 a month |
| | | **Frequency**: Every three months. |

**Figure D.3 — Example of a worksheet**

### D.1.4 Summary of Experience

Aguas de Santiago found in ISO 24510 a tool to reflect the knowledge and experience developed over many years. Besides being aligned with the strategic vision of the organization, this standard provides guidelines for measuring the success of management and is the basis for the definition of objectives to meet the needs and expectations of users.

Applying ISO 24510 encouraged the identification of current problems in the services provided and the identification of improvement opportunities through an integral and systematic review of every step of the process, while analysing each action involved in it and re-defining the procedures associated with each element of the standard.

The defined methodology involved the creation of inter-disciplinary teams which contributed to a collaborative atmosphere, to the generation of ideas, a sense of belonging and an attitude favouring change reflected in the process of continual improvement.

Apart from that, and although the standard does not specify it, Aguas de Santiago considered it valuable to define goals for each objective, allowing the quantification of them so that they could be later compared to the performance indicators.

In order to carry out the process of continual improvement, meetings were scheduled every three months for Top management and the senior staff involved, where the results of the indicators were analysed by comparing them with the defined goals. This allowed the specification of new actions and a discussion on the need to re-define goals prioritizing those elements in the standard which have an effect on the Vision and Mission Statements of the Organization.

The internalization of the work with the standard meant that in localities where it had not been applied, new guidelines were taken into consideration related to different elements. One example was the creation of the sewage network in *Termas de Río Hondo*, on which occasion visits to users were made and they were given material with information and advice on the use and appropriate conservation of the services in their homes.

The methodology of ISO 24510 was applied with the standards ISO 24511 and ISO 24512. In this sense, it was considered appropriate to prepare only one report on the application of both standards ISO since the Organization provides water and wastewaters services.

In the report, one chapter was devoted to Management and Operation together with the Identification of the Physical and Management Components.

Due to the experience gained with the application of ISO 24510, it was considered appropriate to include an annex in the report in which goals, actions and indicators with their defined rules of calculation are dealt with.

The strategies defined and implemented in the operation of this project served to consolidate the vision of the organization, to enhance the general objective of strengthening the relationship with the users and also contributed to improve and achieve economic and financial sustainability, to improve the provision of the service (according to the indicators), to consolidate organizational culture (elimination of work conflicts) and to move forward significantly in the knowledge of the users and their expectations of the service.

Thanks to this experience, the Board of the organization considers that the application of the standard constituted a valuable experience since it represents a Tool of Operational Management, which can be used in future projects. Needless to say the success of its application requires the serious commitment of all the organization, especially of its managers.

## D.2 ARGENTINA — Aguas De Corrientes S.A

### D.2.1 Background of the organization

Since 1991, Aguas de Corrientes SA is the concessionaire of service provision of potable water, also collection and treatment of waste water in 13 cities of the Province of Corrientes - Argentina: Corrientes City, Saladas, Bella Vista, Curuzú Cuatiá, Monte Caseros, Mercedes, Santo Tomé, Esquina, Goya, Santa Lucia, Yapeyú, Empedrado and Paso de los Libres.

They also provide, indirectly, drinking water to town San Luis del Palmar through an aqueduct that extends along Provincial Route 5.

Coverage reaches 180 846 households supplied with drinking water and 146 649 sewer connections.

On September 1, 1991, the company takes possession of water services that were provided by AOSC (Administration of Sanitary Works Corrientes). From that moment, AOSC, becomes Regulator, who has a regulatory framework consisting of: The law of creation of the Entity, Bidding Terms and Conditions for Invitation for Bids, Regulatory Decrees and Contract concession services.

The concession period is thirty-five years, ending in 2026.

### D.2.2 Objective for making use of performance indicators

In August 2010, Aguas de Corrientes begins the process of implementation of ISO 24510, ISO 24511 and ISO 24512, specific international standards for water utilities. The decision was taken by the

management of the company formed by co stakeholders from Corrientes, as a guide to improve the processes and as a tool to demonstrate compliance with contractual requirements.

The first contact with the standards was very successful due to clarity and versatility, emphasizing that they could be adapted to the situation and characteristics of the service in each of the 13 locations where Aguas de Corrientes has the concession.

### D.2.3 Performance indicator methodologies followed

In the first stage of implementation, which was revision and positioning, a general manager and general coordinators were appointed. Working groups composed of staff from different areas with processes in common were formed. Each group conducted a review of current situation versus standards, with the guidance of coordinators.

From the review report, the company board defined the scope of certification and planned the implementation of standards, revised company policy, formulated objectives and communicated to staff the implementation of standard.

An intensive training was conducted, by IRAM staff coordinators and then made regional training workshops.

With the above work method, service components and processes were identified, determining the key processes: business, management of drinking water and wastewater.

After that, the following activities were carried out:

a) identifying physical and management components. Planning processes;

b) review of procedures and implementation of workflows, flowcharts, job and responsibilities profiles;

c) definition of performance indicators, evaluation criteria, slide rules, responsible for measuring and reference values; and

d) planning, monitoring and measuring of indicators.

The implementation began in December 2010 with the first measurement of indicators, which were calculated monthly, thereafter the following took place:

e) performance evaluation vs. objectives;

f) management review;

g) planning of improvement actions;

h) approval of action plans; and

i) implementation of actions/follow up.

At the beginning of the implementation, five representative indicators of the main processes were defined; afterwards, new indicators were defined, some of them are part of the monthly directory report: Water quality indicator (examples are shown in Figure D.4), supplied pressure, odours in the sewer system, repair response times claims of lost water and wastewater obstructions (examples are shown in Figure D.5), and others are specific processes (e.g. sensory water quality).

The indicators were selected based on user requirements, contractual goals of the concession contract and technical and operational requirements that will determine the need for monitoring in terms of their impact on the quality of services.

User expectations, complaints and inquiries received special attention, a system of telephone surveys conducted through the contact centre was implemented; surveys are reviewed periodically at

Board meetings, the results demonstrate users' conformity with the service, who largely manifest improvement as well as highlight the importance of this mechanism for follow up on complaints.

Since the implementation up to now, the methodology and the selected indicators were to be reviewed and adapted to the requirements of Aguas de Corrientes SA directory of contractual requirements and actions to be taken.

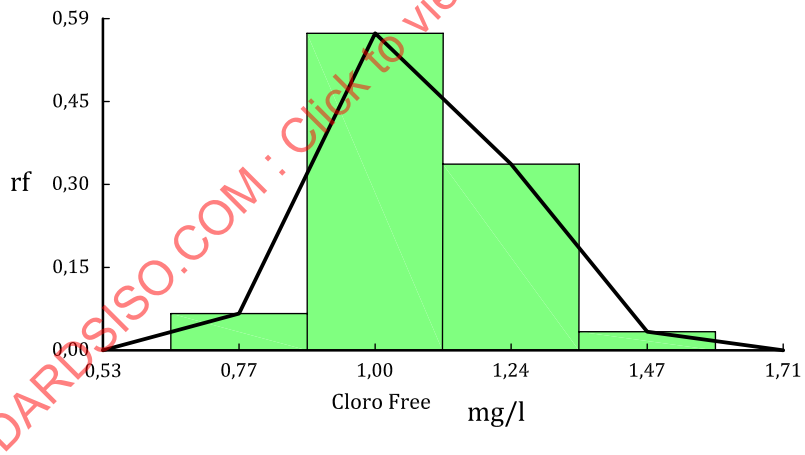
The administration is currently working with a group of indicators presented in Table D.1.

**Table D.1 — Indicators of Aguas Corrientes SA**

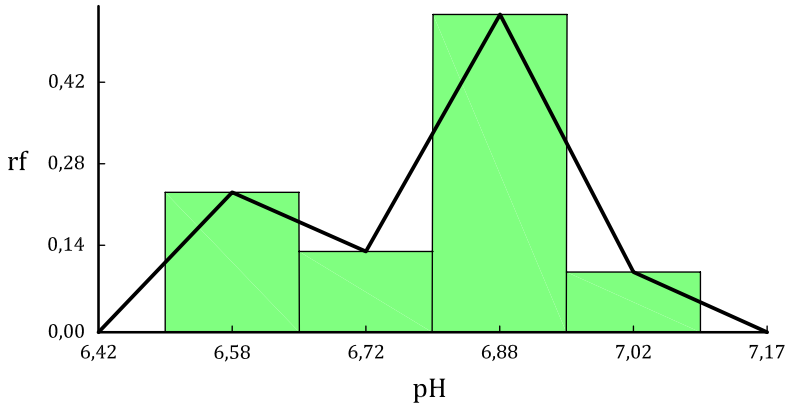
| Name | Objective | Measures | Indicator |
|---|---|---|---|
| **Energy water board** | Control of power consumption in drinking water system | Kw/h/drinking water system | kw/h/$m^3$ water driven |
| | | | $/kw/h |
| | | | $/$m^3$ water pumped |
| **Wastewater board energy** | Control of power consumption in wastewater system | Kw/h/wastewater system | kw/wastewater connection |
| | | | $/kw/h |
| | | | $/wastewater connection |
| **Chemicals dash** | Control of chemical used in the water purification process | Kg of chemical/ drinking water system | Kg chemical/1 000 $m^3$ |
| | | | $ chemical/month/ drinking water system |
| **Board volumes** | Control water volumes | Picked up, driven and read volumes / drinking water system | Picked up volumes / month ($m^3$) |
| | | | Pumped volumes /month ($m^3$) |
| | | | Read volumes ($m^3$) |
| | | | % not read |
| **Volumes of wastewater board** | Control wastewater volumes | Wastewater volumes/ wastewater system | Wastewater volumes collected ($m^3$/month – $m^3$/day) |
| | | | Wastewater volumes treated ($m^3$/month – $m^3$/day) |
| | | | Wastewater volumes / user/day ($m^3$) |
| **Indicator water connections** | Check compliance with contractual targets water connections | Number of water connections | Total water connections/ water supply system |
| **Indicator of waste water connections** | Check compliance with contractual targets wastewater connections | Number of wastewater connections | Total wastewater connections/wastewater system |
| **Ranges of consumption** | Determine number of connections for water consumptions range | Number of accounts consumptions range/ water supply system | Number of accounts / water supply system in consumptions ranges 0 $m^3$; 1 $m^3$ to 5 $m^3$; 6 $m^3$ to 10 $m^3$; 11 $m^3$ to 15 $m^3$; 16 $m^3$ to 20 $m^3$; 21 $m^3$ to 30 $m^3$; 31 $m^3$ to 50 $m^3$; 51 $m^3$ to 100 $m^3$, 100 $m^3$ to 300 $m^3$; >301 $m^3$ |

**Table D.1** *(continued)*

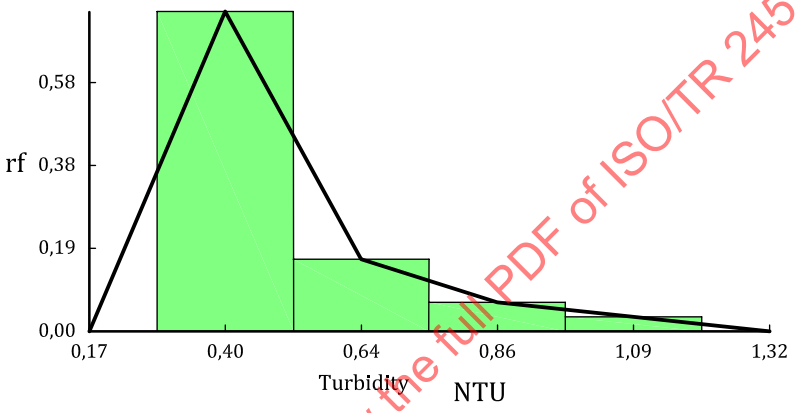
| Name | Objective | Measures | Indicator |
|---|---|---|---|
| **Length of piping drinking water distribution wastewater collections** | Determine the length of pipe water distribution and wastewater collections | Length of pipe water distribution (m) | Length of pipe water distribution (m)/month |
| | | Length of pipe wastewater collections (m) | Length of pipe wastewater collections (m)/month |
| **Water quality indicator** | To assess compliance with contractual parameters *in situ* | Cloro free (mg/l) | Average |
| | | | Relative frequency (rf) |
| | | | Medium Mediana |
| | | Turbidity (NTU) | Coefficient of variation |
| | | | Minimum value |
| | | pH | Maximum value |
| | | | Asymmetry |
| **Water quality indicator** | To assess compliance of parameters: *in situ*, bacteriological and number of contractual samples | Cloro free (mg/l) | 100 – (Total parameter out of spec × 100)/total parameters out of specification.<br>Parameters: chlorine, turbidity, pH, tot coliforms, faecal coliforms, No. of samples required |
| | | Turbidity(NTU) | |
| | | pH | |
| | | Number of samples | |
| | | Total coliforms (NMP/100 ml) | |
| | | Faecal coliforms (NMP/100 ml) | |
| | | Aeruginosa Pseudomonas | |




**a) Cloro free drinking water point of delivery**




**b) pH Drinking water point of delivery**




**c) Turbidity drinking water point of delivery**

**Figure D.4 — Examples of Measuring Quality Indicators of Drinking Water**

Aguas Corrientes has established a daily program of working with the so-called "traffic light of steps" dashboard indicators with established response times for specified requirements. This task is carried out by the central claims of Aguas Corrientes (contact center) and sent by mail to process owners. The information is presented as a table, where colours are identified with response times have elapsed since the beginning of the measurement day requirement. This board is accompanied with procedures or pending requirements, informing: locality and section thereof, type of step (requirement) and the assigned code number procedure, date of entry and intervening area or sector. Example shown in Table D.2.

**Table D.2 — "Traffic Light of Steps" de Aguas de Corrientes S.A.**

| Complaint | Code | Response time | Coding |
|---|---|---|---|
| **Low pressure** | 1002–1003 | <24 H | |
| | | <48 H | |
| | | >48 H | |
| | | >3 D in red | |
| **Repairs: water loss** | 100–1001 | <72 H. | |
| | | <10 D | |
| | | >10 D | |
| | | >3 D in red | |

**Table D.2** *(continued)*

| Complaint | Code | Response time | Coding |
|---|---|---|---|
| **Repairs: obstruction of wastewater** | 1101–1102–1103 | <48 H | |
| | | <10 D | |
| | | >10 D | |
| | | >3 D in red | |
| **Requirements: notes received** | 0100–2000 | <72 H | |
| | | <10 D | |
| | | >10 D | |

### D.2.4 Case Study: Implementing Water Safety Plans (WSP)

The management of Aguas de Corrientes SA has decided to follow up the directives described in the WSP Handbook: protection of public health, the implementation of water safety plans in the guidelines of the World Health Organization.

This includes a comprehensive approach to risk assessment and risk management covering all stages of the supply system from catchment to consumer distribution. Based on this assessment improvement actions are organized, taking into account the priority of risks and critical limits of monitoring, which are more demanding than the contractual framework to ensure this way provision of water in quantity and quality sufficient to satisfy consumer, considering the protection of public health and consumer acceptability

In this sense, in 2014 we were visited by evaluators of the Pan American Health Organization (PAHO), who conducted an assessment of the risk matrix as well as a visit to the University of Saladas; after which they made suggestions and recommendations that are already working.

### D.2.5 Summary of the experience

The concession given to Aguas Corrientes has a number of areas which present a variety and complexity problems:

— Populations served are very different.

— Varying coverage areas.

— Drinking water service: different water sources (surface and groundwater) with varying volumes and different physicochemical and microbiological characteristics, which suggests that the services vary from one place to another.

— Sewage services: with characteristics, unique to each locality. Different treatment plant effluent (activated sludge stabilization ponds) rollover treated effluent from different streams.

— Differing climatic and socio-environmental characteristics.

The definition of indicators to compare and reflect the reality of service in each locality has been a challenge for the company and a task of constant review, in which the objectives have always been: verify compliance with contractual requirements, satisfaction of users and stakeholders as well as to have a tool for decision making by the board. In this context, it can be concluded **that ISO 24510, ISO 24511 and ISO 24512 were a useful tool management services, making decisions based on indicators, improvement planning and monitoring plans through indicators.**

The implementation of the standard had an impact at national and international level, the experience of Aguas de Corrientes SA was presented at the 8th plenary of ISO/TC 224 held in the Austrian Standard Institute in Vienna-Austria (May 2011) as an example of implementation of providers of water and sanitation services that have implemented elements of ISO 24510, ISO 24511 and ISO 24512.

Nationally, the experience of Aguas Corrientes SA was exhibited in the International Workshop on Assessment and Management of Water Services — ISO 24510, ISO 24511 and ISO 24512, organized by IRAM, ISO and COFES in March 2011 and November 2012.

## D.3 CANADA — EPCOR Water Services Inc. (EWSI)

### D.3.1 Background of the Organization

EPCOR Water Services Inc. (EWSI) falls within EPCOR Water Canada. EWSI provides water treatment and water distribution and transmission within the City of Edmonton, Alberta, Canada. The wastewater treatment provided includes wastewater treatment services within the City of Edmonton. The City of Edmonton has a population approaching 900 000 persons.

EPCOR operates under requirements set by the City of Edmonton Performance-Based Rates Regulation (PBR) – City of Edmonton Bylaw 15816 – EPCOR Water Services and Wastewater Treatment Bylaw.

### D.3.2 Objective for making use of performance indicators

The principal objective is to provide annual updates to The City of Edmonton on the operational and financial results for water services and wastewater treatment services provided within Edmonton by EPCOR Water Services Inc. These services are provided pursuant to Bylaw 15816, the EPCOR Water Services and Wastewater Treatment Bylaw. This Bylaw prescribes Performance Based Regulation (PBR) for water services and wastewater treatment services within Edmonton for the 2012-2016 PBR terms.

Water System Service Quality is measured by the results of five indices prescribed in the Bylaw. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all five performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard. For some performance measures, such as main breaks, a lower-than-standard score represents performance above standards. For other measures, such as the Planned Construction Factor, a higher score indicates better performance. Accordingly, to provide for greater clarity, actual outcomes have been noted as “Exceeded Standard” if the actual outcome was better than the standard or “Below Standard”, if the actual outcome was worse than the standard.

The framework includes performance criteria which provide assurance to customers that water and wastewater treatment system service quality will not be sacrificed to keep rates low. EWSI faces financial penalties if performance measures are not met. EWSI’s results on the performance criteria are audited by an independent accounting firm.

The PBR conceptual framework (see Figure D.5) encompasses PBR rates, performance measures and return on equity. EWSI operates within this PBR framework over a 5-year term as approved by City Council, ensuring capital and operating cost decisions provide a balance with operational performance and return on equity.

Water’s operational performance is evaluated using the five performance measure indices prescribed in the Bylaw. Twenty-one individual measures are included.

Wastewater’s operational performance is evaluated on a similar basis to Water, except that the individual performance measures making up each performance index are tailored to wastewater treatment operations. Thirteen individual measures are included.