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SYSTEMS REFERENCE DELIVERABLE

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Smart city use case collection and analysis – Water systems in smart cities – Part 1: High-level analysis

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SMART CITY USE CASE COLLECTION AND ANALYSIS – WATER SYSTEMS IN SMART CITIES –

Part 1: High-level analysis

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The text of this Systems Reference Deliverable is based on the following documents:

Draft	Report on voting
SyCSmartCities/351/DTS	SyCSmartCities/359/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Systems Reference Deliverable is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63301 series, published under the general title *Smart city use case collection and analysis – Water systems in smart cities*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
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INTRODUCTION

The construction of a smart city can create benefits for a society and its stakeholders. Water is a critical resource to support urban development and its sustainable use is recognized as a UN Sustainable Development Goal. Water infrastructure development, water management efficiency, water supply resilience, and the safe operation and use of water are important focal areas for IEC SyC Smart Cities.

This document focuses on water systems management, specifically water security whether directly from a natural source or via man-made infrastructure. Information and communications technologies (ICT) and electro-technologies can provide greater visibility and control, however their application does depend on the characteristics of individual water markets. Technology is not a panacea for resolving all issues and problems.

A gap exists in effective coordination and clear orientation and how industry and stakeholders are engaged within it.

Major stakeholders of water management and use include citizens, the water authority (government), and organizations (associations, business groups, utility companies). Each stakeholder has different and competing interests, market relationships and touch points to water system infrastructure, processes, operations, management and use.

Modelling these complex interactions into a systems architecture is a valuable exercise in understanding the issues, gaps and opportunities for sustainable water management.

This document focuses on use case collection and analysis to elicit requirements to support technical committees such as ISO/TC 224 and ISO/TC 147 in preparing sustainable water management standards for cities and communities.

This document also seeks to inform IEC technical committees to enable them to provide the technical standards needed.

SMART CITY USE CASE COLLECTION AND ANALYSIS – WATER SYSTEMS IN SMART CITIES –

Part 1: High-level analysis

1 Scope

This part of IEC 63301 provides an overview of water systems in smart cities, establishes a general approach for use case collection and analysis, and identifies major stakeholders and application areas for high-level analysis of water systems.

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 terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
water system
open system that manages the capture, cleanliness, flow, storage, consumption, re-use and disposal of water resources

Note 1 to entry: A water system covers water environment, water supply, water consumption, water draining and water recycling, representing a multi-dimensional open system engaging nature, human behaviour, and socio-economics.

Note 2 to entry: A city is only directly responsible for part of a water system, and coordinates with other agencies working on the water environment.

3.2
smart water system
water system that uses information and communications technology to monitor and automate operations, deliver supply in response to demand and manage its re-use and disposal in efficient ways

Note 1 to entry: The data collection through the sensors allows near real-time management of a water service system.

Note 2 to entry: Data analytics support planning, predicting, accurate management and intelligent control and appropriate decision-making of a water service system.

Note 3 to entry: A smart water system supports safe and effective operation of a water system under all conditions.

3.3
use case
specification of a set of actions performed by a system, which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system

[SOURCE: ISO/IEC 19505-2:2012, 16.3.6]

3.4
use case template
form which allows the structured description of a use case in predefined fields

[SOURCE: SG-CG/M490/E:2012-11, 3.2]

3.5
actor
entity that communicates and interacts

[SOURCE: IEC 62559-2:2015, 3.2, modified – Note 1 to entry has been deleted.]

3.6
grouping
group of actors in order to organize an actor list

3.7
stakeholder
individual, group or organization that has an interest in an organization or activity

Note 1 to entry: Usually a stakeholder can affect or is affected by the organization or the activity.

3.8
scenario
possible sequence of interactions

[SOURCE: SG-CG/M490/E: 2012-11, 3.10]

3.9
business case
use case which provides justification for undertaking a project, programme or portfolio, through evaluating the benefit, cost and risk of alternative options

3.10
high-level use case
HLUC
use case which describes a general requirement, idea or concept independently from a specific technical realization like an architectural solution

[SOURCE: SG-CG/M490/E: 2012-11, 3.4]

4 An overview of water system

4.1 Basic mechanism

4.1.1 Coupling characteristic

The water system is an open systematic compound characterized by coupling between natural water system and economic and social (human) activities, as shown by Figure 1.

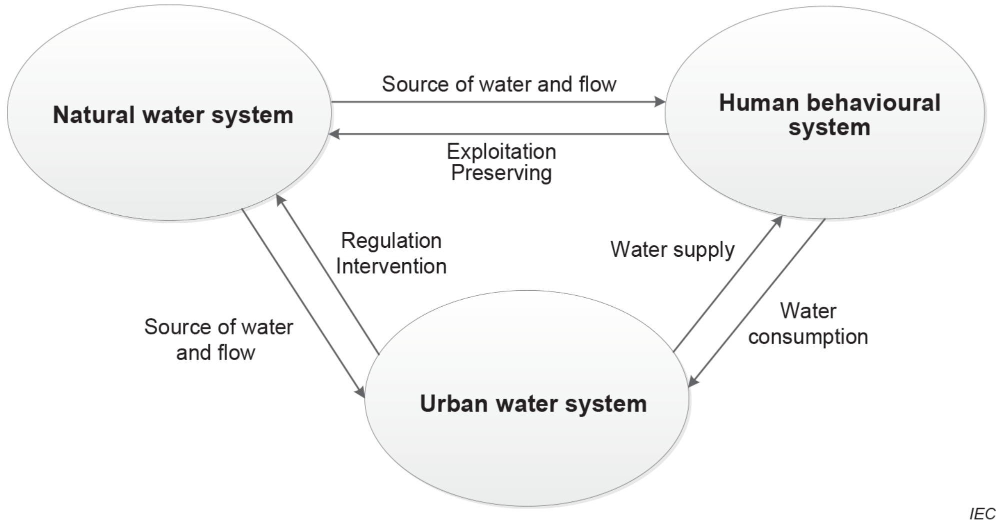

Figure 1 – Coupling characteristic of water system

Natural water system supplies water resources and water environments for human, animal and plant consumption, while also placing constraints on human behaviours as a result of flooding, drought, and soil erosion. Careful proactive management of water is important to sustain natural water resources use. This requires a combination of modern infrastructure and environmental preservation to supply resources to urban communities, protect the natural environment through effective and timely regulation and intervention, which is the very essence of the urban water system.

Such a trilateral coupling characteristic of the water system constitutes the very basics for the analysis of any water-related activities.

4.1.2 Integrality

According to Von Bertalanffy's General System Theory, the system as a whole is more than the sum of individual constituting parts, and the integral function of the system prevails over the aggregation of sectoral functions. When it comes to water system, it is important that a mentality of integrality is upheld, with the operation of water environment, water source, water consumption, water draining, and water recycling organized holistically, emphasizing general performance and effectiveness of the water system.

In short, the smooth and optimized operation of the water system relies on coordinated and efficient operation of each block joined together as a whole.

4.1.3 Dynamism

The operation of water system is closely linked to local ecological, economic, and social conditions, as determined by the basic coupling characteristic. The study of water system is therefore set on a dynamic course of evolution, affected by contemporary technological, socio-economic backgrounds.

For this document, the study of water system is carried out against the backdrop of smart city, so that fundamental ideology and concepts of smart city are brought into deliberation in this document.

4.2 The ecosystem

For the water system, the conducting of human activities cannot be segregated from the status of natural water system, in other words, the operating of water system follows the natural laws for raw water as well as socio-economic rules for water utilization.

The major constituting blocks and interactions within water system are demonstrated in Figure 2, ranging from natural water resources to social and economic factors related to water.

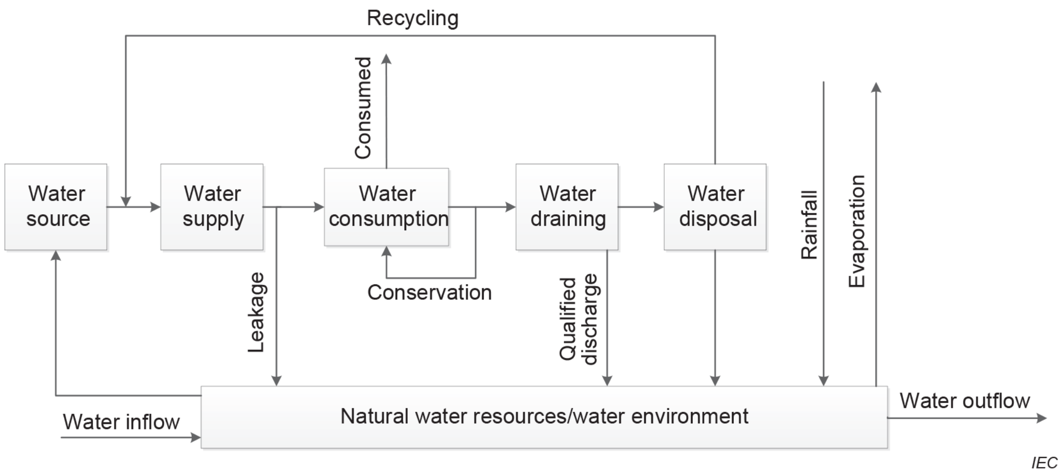

Figure 2 – A simple anatomy of water system

From the perspective of participating actors, the anatomy of water system given by Figure 2 can be further enriched to engage several groups of actors (groupings), as given by Figure 3.

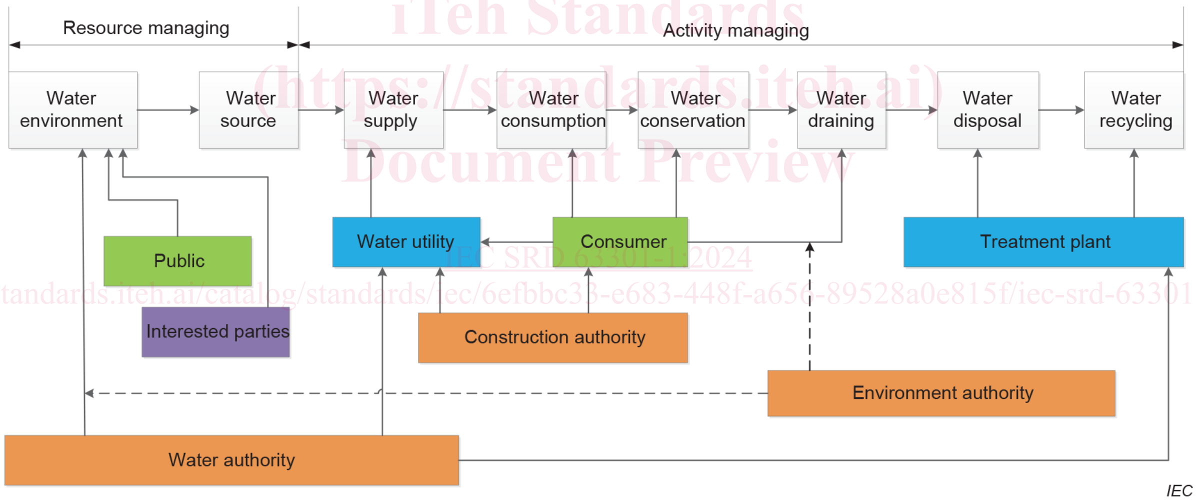

Figure 3 – Stakeholders within water system

As depicted by Figure 3, generally four groups of stakeholders can be identified for water systems:

- Authority: in charge of general water management.
- Public and consumer: directly engaged in water consumption, water conservation, water draining, and takes a big interest in environmental issues.
- Water utility and water treatment: accountable for important processes of water supply, water disposal, and water recycling.
- Interested parties: economic and social entities whose operational activities have an impact on the water environment, for instance, agriculture, mining, construction, manufacturing, energy supply, recreation.

See Annex A for a full list of stakeholders.

5 Approach for use case collection and analysis

5.1 General

A top-down approach is adopted in the process of use case collection and analysis described in this document, following the general methodology specified by the IEC 62559 series. See Figure 4.

At the beginning of use case collection and analysis, a general study of water system is needed, the purposes of the work of system study include identifying sub-systems, identifying basic stakeholder needs, and forming materials for sub-system analysis as use case prototypes.

Use case building starts from breaking down stakeholder needs and developing use cases using the templates.

Use cases can be arranged in database, based on which a set of common requirements can be identified for water system so as to scope out a family of standards.

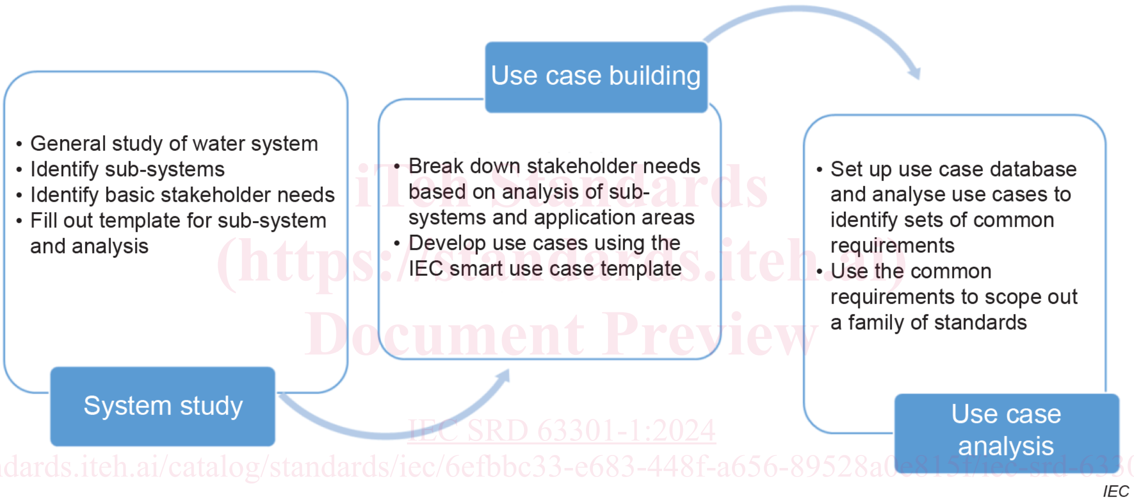

Figure 4 – Approach for use case collection and analysis

5.2 User stories

User stories are based on an initial stakeholder statement of need and corresponding actions and outcome under certain circumstances. An example sentence is as follows:

"As a municipal government officer, when I am monitoring the water supply and water intake in the city, I need to collect water storage reservoir and water inlet water quantity, water quality monitoring data, thus I can have a comprehensive and intuitive grasp of the city's water resources."

The key words are "As a" (Title), "when I am" (Situation), "I need to" (Motivation), "so that" (Outcome).

6 Use case template consideration

6.1 Template for high-level use cases

High-level use cases are provided in the following format, see Table 1.