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ISO/TC 224 / SC

Title

Service activities relating to drinking water supply systems and wastewater systems - Quality criteria and performance indicators

Secretariat **AFNOR**

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

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Foreword

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

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

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

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

ISO 24511 was prepared by Technical Committee ISO/TC 224, *Service activities relating to drinking water supply systems and wastewater systems - Quality criteria of the service and performance indicators*.

Introduction

0.1 General

Water constitutes a worldwide challenge for the 21st century, both in terms of the management of available water resources and the provision of access to drinking water and sanitation for the world's population. The United Nations (UN) in 2002 recognized that access to water is an essential human right, and in conjunction with national governments, it set ambitious goals "Millennium Development Goals" to increase access to drinking water and wastewater services particularly in developing countries. International conferences on sustainable development and water (e.g. the World Summit on Sustainable Development in Johannesburg in September 2002 and the third World Water Forum in Kyoto in March 2003) stressed this issue and the UN agencies (i.e. WHO, UNESCO, etc.) have developed recommendations and programs to advance this framework.

In addition to public health protection, the sound management of the drinking water and wastewater utilities (hereinafter referred to as "water utilities") is an essential element of the integrated management of water resources. Sound management practices of these utilities will contribute, both quantitatively and qualitatively, to sustainable development.

Water utilities contribute to social cohesion and economic development within a community and the quality and efficiency of service have implications for virtually all activities of the society. They also enhance environmental protection through integrated management of water resources and the principles of sustainable development.

Because water is considered both an "economic" and "social" good, the management of water utilities should be transparent to and inclusive of stakeholders, identified according to the local context. The stakeholders should be involved in both setting service objectives and assessing the adequacy and efficiency of service delivery. The stakeholders involved in water services include among others: users, national and/or regional and/or local public authorities charged with the regulation and oversight of the water services, public or private operators of the water utilities, non governmental organisations (NGOs), research organisations, laboratories and special interest groups. The relationship among stakeholders vis-à-vis water services varies around the world. In many countries, there are bodies that have responsibility (in whole or in part) for overseeing water service activities, whether or not the utilities are publicly or privately owned or operated and whether or not they are strongly regulated or self regulated.

Examples of these bodies include:

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

— associations of the services themselves (i.e., national or regional drinking water or wastewater associations),

— autonomous bodies seeking to play a public and/or oversight role (e.g., organizations of concern such as non-governmental organizations) and

— water users and customers.

This standard does not prescribe the respective roles of various bodies/stakeholders nor define required processes for local, regional, or national bodies that may be involved in the provision of water services. In particular, the standard does not interfere with the free choice of the responsible bodies regarding the general organisation and the management of their utilities. The standard is applicable to publicly and privately owned and operated utilities alike, and does not favour any particular ownership or operational model.

The organisation of water utilities falls within a legal and institutional framework specific to each country. The Ministerial declaration from the Third World Water Forum recommends, in this respect, that governments endeavour to reinforce the role of local public authorities, particularly as regards the ensuring of adequate water services.

The aim of the water utilities is to cover everybody in their area, and to provide users the continuous supply of drinking water and the collection and treatment of wastewaters, under economic and social conditions that are acceptable both for users and responsible bodies. Water utilities should comply with the requirements of relevant authorities and meet specified expectations, while ensuring the long-term sustainability of the service. In a context of scarcity of resources, including financial resources, it has to be ensured that the investments made in installations are appropriate and that necessary attention is given to proper maintenance and effective use of the installations. This will contribute to the efficient operation of the water utilities and to the optimisation of available resources.

The aim of this standard is to provide the relevant stakeholders with guidelines for improving the service and the management of water utilities, consistent with the overarching objectives fixed by the international intergovernmental organizations noted above and by the national competent authorities. The standard is intended to facilitate dialogue between the stakeholders, enabling them to develop a mutual understanding of the functions and tasks that fall within the scope of water utilities.

The following standards provide guidelines for defining and assessing service to users, and for managing drinking water and wastewater utilities.

The following ISO standards address:

ISO 24510 – Service activities relating to drinking water and wastewater – Guidelines for the service to users (service oriented standard)

ISO 24512 - Service activities relating to drinking water and wastewater – Guidelines for the assessment of drinking water services and the management of utilities (management oriented standard)

ISO 24511- Service activities relating to drinking water and wastewater – Guidelines for the assessment of wastewater services and the management of utilities (management oriented standard)

The ISO 24511 and ISO 24512 standards set out in sequence a description of water services and briefly describe the physical (infrastructural) and managerial (institutional) components of utilities. Core **objectives** for water services considered to be globally relevant at the broadest level are set out followed by guidelines for the management of the utilities. These are then related to examples of possible actions that may be taken to achieve the objectives. Each action can also be characterized by related **service assessment criteria**. Finally, for each service assessment criterion there is a range of possible **related performance indicators** that might be used to assess the performance of the service.

The object of the ISO 24510, ISO 24511 and ISO 24512 standards is not to lay down systems of specifications supporting direct certification of conformity, but to give guidelines for continuous quality improvement of the management of the water utilities.

Implementation of these ISO standards does not depend on adoption of the ISO 9000 and/or ISO 14000 series standards. Nevertheless, these guidelines are consistent with and supportive of those management systems standards. These guidelines are also consistent with the principle of the "plan-do-check-act" (PDCA) approach: they link, through a dynamic and interactive process, general methods and tools for developing locally-adapted specifications and objectives, together with the management components and activities, necessary for assessing performance. Implementation of an overall ISO 9001 and/or ISO 14001 management system may facilitate the implementation of these guidelines, and conversely, these guidelines may help to achieve the technical provisions of the ISO 9001 and ISO 14001 standards for organizations choosing to implement them.

Use of these standards is voluntary in accordance with ISO rules. The standards are sufficiently flexible and allow adaptation according to local, regional or national needs.

The recommendations given in the standards are focused on functions, on results and on general organization without insisting on the means, in order to permit the broadest possible use of the standards, while respecting the cultural, socio-economic, climatic and legal variations of the different countries and regions of the world. As a consequence, it should be understood that the expectations of local users may be impossible to meet due to factors such as climate conditions, resources availability, and the difficulties relating to the economic sustainability of the water services, particularly regarding financing and the users' ability to pay for improvements. These conditions may restrict the implementation of some provisions of the standards in developing countries. Efforts should therefore be focused on the identification of priorities and the provisions of the standards that assist with implementing the priorities.

Following these principles, defining service coverage is a political choice, and resulting performance can only be assessed regarding the targeted value.

These standards, and more specifically the performance indicators (PI's) given as examples, should not in any case be considered as a prerequisite or condition for the implementation of a water policy or for the financing of projects or programs.

In order to assess and improve the services and to ensure proper monitoring of implementation, the stakeholders may establish an appropriate number of performance indicators (PI's), selecting them from the examples given or developing other relevant performance indicators taking in account the methodology described in the standards. The PI's should relate to the objectives for which they are defined and be used to set required or targeted values. In order to meet the principle of adaptability to local contexts, the standards also indicate procedures and tools facilitating local implementation, but do not impose any specific indicator or any minimum value or performance range. The use of PI's is only one of the possible support tools for continuous improvement.

Finally, the standard is not aimed at defining specifications concerning the quality of the drinking water supplied or the wastewaters discharged: this falls within the responsibility of the national or international public authorities; nor does address specifications for the design and construction of the installations and equipment, or with the methods for analysing the quality of the waters.

0.2 Wastewater systems

Wastewater systems are built, and operated, mainly to protect the public health and the environment. The type of wastewater system should be chosen and adapted in context with the density of the population, climatic conditions and the technical/socio-economical ability of the responsible body to implement it, operate it and maintain it. It should be cost effective and should permit phased development to overcome the financial constraints while not compromising the stated objectives.

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

1 Scope

This standard provides guidelines for assessment of the services related to the management of wastewater utilities.

Wastewater in this standard includes sanitary and industrial wastewater allowed to be discharged into a sewer system outside buildings, as well as sanitary waste in undiluted form, sanitary wastewater combined with storm water and storm water that does not include sanitary wastewater.

This standard addresses wastewater systems in its entirety but it is also applicable to systems at any level of their development (e.g. pit latrines, on-site systems, networks, treatment facilities).

This standard includes:

— the definition of a language common to different stakeholders,

— definitions of the characteristics of the elements of the service according to the customer expectations,

— a list of requirements to be fulfilled for the operation and maintenance (management) of a wastewater utility,

— a list of service assessment criteria and related examples of performance indicators, all without setting

— any target values or thresholds.

This standard specifically excludes:

— methods of design and construction of wastewater systems,

— regulating management structure and methodology of wastewater service activities of operation and management,

— regulating the content of contracts or sub-contracts.

Basic principles of this standard are given in Annex A.

2 Terms and definitions

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

NOTE The list of terms given below is common to ISO/CD 24510, 24511 and 24512.

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

NOTE The term accuracy, when applied to a set of test results, involves a combination of random components and a common systematic error or bias component.

[ISO 5725-1: 1994]

2.2
affordability
ability to be economically bearable by the **users** (2.41)

NOTE The affordability may be estimated through the level of prevailing charges for water services in relation to the available income of targeted social groups of cons umers.

2.3
assessment
process (2.27), or result of this process, comparing a specified subject matter to relevant references

2.4
asset
capital good used for the provision of the **service** (2.38)

EXAMPLES Tangibles assets: buildings, pipes, wells, tanks, treatment plants, equipments, hardware; intangible assets: software, databases.

NOTE 1 Assets may be tangible or intangible.

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

2.5
asset management
the processes that enable a **water utility** (2.44) to optimise the cost of providing, maintaining and disposing of infrastructure assets for specified **performances** (2.24)

2.6
availability
extent to which a **water utility**'s (2.44) infrastructure asset, resources and employees enable effective provision of **services** (2.38) to **user** (2.41) as specified

2.7
community
one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organisations or groups, having interests in the area where the **service** (2.38) is provided

2.8
confidence grade
assessment (2.3) of the **quality** (2.28) in terms of **accuracy** (2.1) and reliability

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

NOTE In wastewater systems, connection is synonymous with drain.

2.10
coverage
extent to which a **water utility**'s (2.44) assets allow **services** (2.38) to **users**

2.11
customer
user (2.41) who has a direct or indirect relation by means of a **service agreement** (2.39) with the **water utility** (2.44)

2.12
drinking water
water intended for human consumption

2.13
drinking water system
infrastructures
infrastructures necessary for supplying **drinking water** (2.12)

2.14
effectiveness
extent to which planned activities are realised and planned results achieved

[ISO 9000: 2000]

2.15
efficiency
relationship between the result achieved and the resources used

[ISO 9000: 2000]

2.16
environment
surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

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

[ISO 14001:2004]

NOTE 2 For the application of the standard, environment is considered as a specific stakeholder.

2.17
infrastructure
system of tangible fixed assets needed for the operation of a **water utility** (2.44)

NOTE Adapted from ISO 9000: 2000.

2.18
interruption
situation where the **service** (2.38) is not available

NOTE Interruptions may be planned or unplanned.

2.19
maintenance
set of activities aimed at keeping or restoring an asset in order to perform required functions in specified conditions

NOTE Maintenance is a combination of technical, administrative and managerial activities.

2.20
management
coordinated activities to direct and control an organisation

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

[ISO 9000: 2000]

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

[ISO 9000: 2000]

NOTE A management system of a drinking water and/or wastewater utilities can include different management systems, such as a quality management system, a financial management system or an environmental management system.

2.22
on-site facility
set of physical assets necessary for supplying **drinking water** (2.12) or collecting and treating **wastewater** (2.42) without connection to a utility

2.23
operator
person or organisation, which performs day-to-day activities necessary for the provision of the **service** (2.38)

NOTE 1 There may be one or several operators for a given service. For example, distinct operators for installations operation, billing and recovering service.

NOTE 2 The operator may be legally distinct or not from the responsible body.

2.24
performance
achievements of an activity, a **process** (2.27) or an organization

2.25
point of delivery
point of entry
physical fixed interface beyond which the utility is not legally responsible

EXAMPLES A connection box, a meter, the limit between public and private property.

NOTE The point of delivery is generally defined in the service agreement.

2.26
point of use
physical fixed interface where the **user** (2.41) normally takes the water for the intended use

EXAMPLES A tap, a public drinking fountain.

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

NOTE 2 The point of use may be the same as the point of delivery, for example in the case of a public drinking fountain.

2.27
process
set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2000]

2.28
quality
degree to which a set of inherent characteristics fulfils **requirements** (2.34)

[ISO 9000: 2000]

NOTE Clearly distinguish between quality of the product (drinking water or treated wastewater) and quality of the service; this standard does not define the product quality.

2.29
quality management system
management system (2.21) to direct and control a **water utility** (2.44) with regard to **quality** (2.28)

NOTE Adapted from ISO 9000:2000.

2.30
registered customer
customer (2.11) for whom relevant information is recorded by the **responsible body** (2.36) or **operator** (2.23)

2.31
rehabilitation
operation on an infrastructure restoring its initial level of **performance** (2.24)

NOTE Adapted from EN 752-5: 1997.

2.32
relevant authority
competent authority
body entitled to lay down policies and legal framework and/or to check the compliance with these rules, concerning activities of **water utilities** (2.44)

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

NOTE The relevant authorities fix the general legal framework for the organization of the drinking water and wastewater utility, with which the water utilities (i.e. the responsible bodies and their operators) have to comply.

2.33
repair
action on a non-conforming product, equipment or facility to make it acceptable for the intended use

NOTE 1 Adapted from ISO 9000: 2000.

NOTE 2 Repair includes remedial action taken on a previously conforming product to restore it for use, for example as part of maintenance.

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

NOTE 4 Repair may be planned (preventive maintenance) or due to emergency.

2.34
requirement
need or expectation that is stated, generally implied or obligatory

[ISO 9000: 2000]

NOTE "generally implied" means that it is custom or common practise for the drinking water and/or wastewater utilities, the users of the service and other interested parties, that the need or expectation under consideration is implied.

2.35
residues
sub-products resulting from the different processes applied to **drinking water** (2.12) or **wastewater** (2.42)

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

NOTE Residues may be liquid, solid or mixed.

2.36
responsible body
body which has the overall legal responsibility for providing drinking water and/or wastewater services and for establishing the policy and the general organization of the relevant **water utility (2.44)**, for a given geographic area

EXAMPLES A regional or local government, a city, a public agency, a private company.

NOTE 1 The responsible body can be public or private.

NOTE 2 The responsible body may operate directly the system with its own means or entrust a contractor for the operation.

2.37
restriction
situation where the service does not meet the availability conditions specified in the **service agreement** (2.39)

NOTE Restrictions may be planned or unplanned.

2.38
service
result of a **process** (2.27)

NOTE 1 Adapted from the definition of "product" given in ISO 9000: 2000

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

NOTE 3 Service is the result of at least one activity necessarily performed at the interface between the supplier and user and is generally intangible. Provision of a service can involve for example the following:

- activity performed on a customer supply tangible product (e.g. wastewater),
- activity performed on a customer supply intangible product (e.g. processing new connections demands),
- delivery of an intangible product (e.g. delivery of information), and
- creation of ambience for the user (e.g. customer reception offices).

2.39
service agreement
establishment of an accord between the **registered customer** (2.30) and the **water utility** (2.44) on the conditions of service provisions

EXAMPLE A contract.

NOTE It may be implicit or explicit.

2.40
stakeholder
person or group or organization having an interest in the performance or success of an organization

EXAMPLES Users and building owners, responsible body, operator, employees of the operator, external product suppliers and providers of other services, contractors, communities, consumers and environmentalist associations, relevant authorities, financial institutions.

NOTE 1 Adapted from the definition of "interested party" given in SO 9000: 2000

NOTE 2 For the application of the standard, environment is considered as a specific stakeholder.

2.41
user
end user
person, group or organization, that benefits from drinking water delivery or from service of collecting and/or treating its effluents

NOTE 1 Users are a category of stakeholder.

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

2.42
wastewater
water affected by human activities and storm waters, discharged to the **environment** (2.16) or sewer

NOTE This includes sanitary and industrial wastewater allowed to be discharged into a sewer system outside buildings, as well as sanitary waste in undiluted form, sanitary wastewater combined with storm water, and storm water that does not include sanitary wastewater.

2.43
wastewater system
infrastructures
infrastructures necessary for collecting and treating **wastewater** (2.42)

2.44
water utilities
the overall processes, activities and means necessary for supplying **drinking water** (2.12) or collecting and treating **wastewater** (2.42) and providing the associated **services** (2.38)

3 Components of wastewater systems

3.1 General

A wastewater system consists of components for collection, transport, treatment, and disposal/ re-use of wastewater as well as collection, transport, treatment and disposal/re-use of residues removed from wastewater.

3.2 Types of wastewater systems

The systems can be centralised, decentralised for a small system (subsystem) or on-site.

Schematic presentations showing the wastewater systems and the relations between the various components are shown in Annex B.

Depending on the extent of the development of the wastewater services in particular country or area, there may be only a few of the above mentioned components of the system utilised (e.g. only collection, disposal).

3.3 Centralised/decentralised systems

3.3.1 Collection and transport

Components of the centralised system for collection and transport of wastewater are:

— collection by drains;

— sanitary/storm/combined sewers and auxiliaries;

— pumping and storage facilities;

— overflow structures;

— monitoring/sampling/measuring/remote control facilities;

— storage and retention basins;

— gravity sewers;

— pressure/vacuum sewers;

— interceptors/trunk sewers.

3.3.2 Treatment

Wastewater treatment can include for centralised/decentralised systems:

— treatment inlet holding tanks;

— septage receiving facilities;

— treatment facility inlet structures;

— monitoring/sampling/measuring/remote control facilities;

— preliminary/primary/secondary/advanced treatment and reuse/disposal facilities;

— discharge facilities;

— odour control facilities;

— energy recovery facilities;

— storm water overflow treatment facilities.

3.4 On-site-systems

3.4.1 Collection

On-site equipment can include

— pit latrine;

— tank;

— bulk liquid carrier.

Transportation methods of wastewater or sludge include

— manually emptied storage tank;

— vacuum emptied storage tank;

— small bore (diameter) system.

3.4.2 Treatment

For on-site-systems:

— grease trap;

— septic tank;

— upflow anaerobic sludge blanket (UASB) reactor;

— wetland/lagoon/pond system;

— soakaways;

— reed beds;

— evaporation beds;

— composting toilet.

3.5 Disposal of residues

Residue disposal system can include

— residues handling/conditioning facilities;

— residue reuse/disposal facilities;

— disposal buried in situ;

— dumping site.

4 Objectives for the wastewater utility

4.1 General

The responsible body should establish the objectives, associated service criteria and performance indicators for a wastewater utility, taking into account the legal requirements of the relevant authorities as a basis and the expectations of the users and other stakeholders in conjunction with its operators. Figure 1 below, illustrates relevant relationships between stakeholders for establishing objectives.

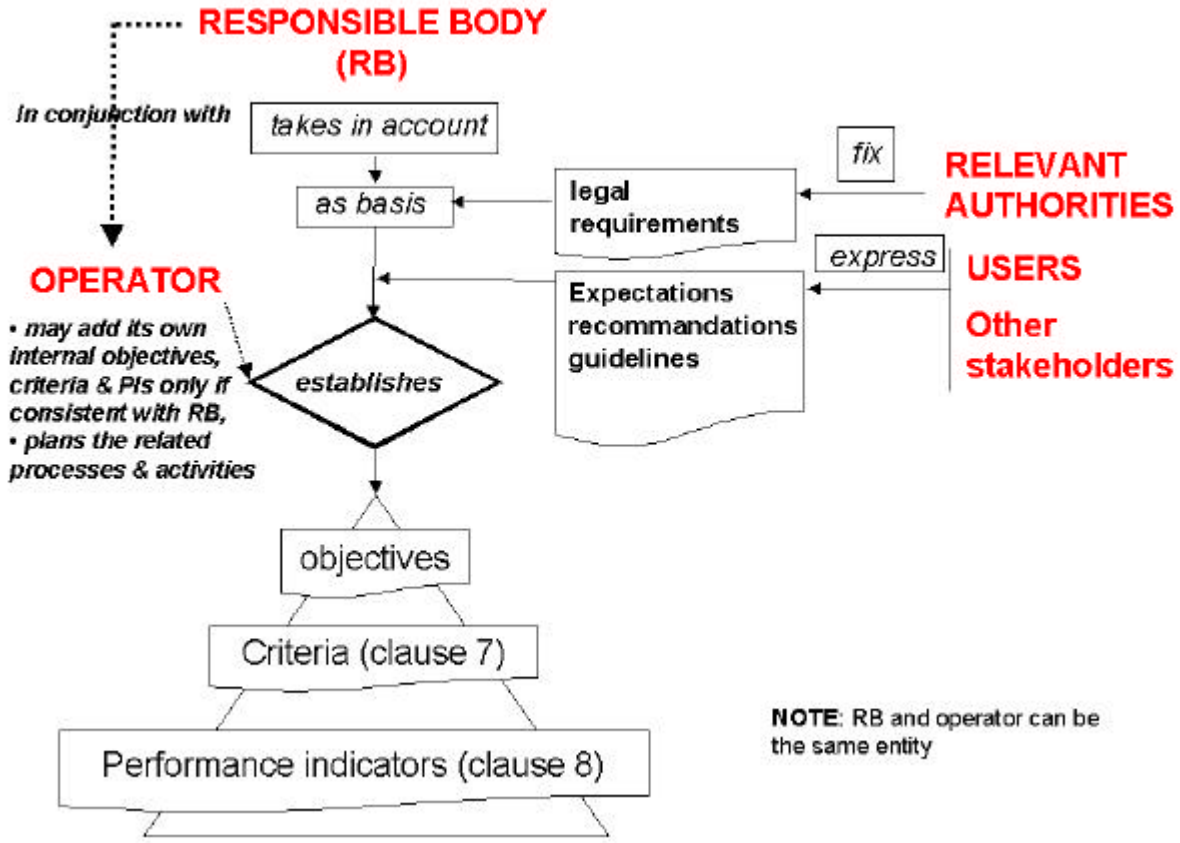


Figure 1 — Relevant relationships between stakeholders for establishing objectives

Management of wastewater utility needs

— formulation of objectives and service assessment criteria,

— targeting the service assessment criteria by the use of a set of performance indicators,

— evaluation of the performance by measuring and assessment.

Affordability for customers should be a general condition to develop the objectives for the management of a wastewater utility.

Objectives are generally defined for a certain geographic area.

Objectives need to be expressed in the form of service assessment criteria.

The following objectives (4.2 to 4.5) are considered to be the principal objectives for wastewater utilities. Possible actions that a wastewater utility can undertake to achieve these objectives are shown in Annex C.

4.2 Protection of public health

The primary objective of a wastewater utility is to ensure the safe collection, treatment and disposal of wastewater for the protection of human health and safety.

4.3 Protection of the natural environment

An objective of a wastewater utility is to ensure the safe collection, treatment and disposal of wastewater for the protection of the natural environment including:

— preservation/conservation of natural resources;

— control of overflows;

— preservation of flora and fauna.

4.4 Protection of the built/public environment

An objective of a wastewater utility is to ensure the safe collection, treatment and disposal of wastewater for the protection of the built/public environment including:

— value to users and user safety;

— technical value and maintainability;

— functionality and value for the future;

— pollution prevention;

— minimizing the effect of flooding on the service;

— control of flooding;

— amenity value (e.g., value for recreational uses).

4.5 Promotion of sustainable development

An objective of a wastewater utility is to promote sustainable development through:

— avoidance of transferring shortcomings in time and space;

— closing natural cycles of resources;

— avoidance/reduction of pollution of natural resources;

— separation between clean and polluted flows and resources;

— control of the pollutants at the source instead of end-of-pipe.

In considering strategic priorities for water management, distinction can be made between quantitative and qualitative aspects. Quantitative aspects of water management for the promotion of sustainable development comprise, in decreasing order, principles of:

1) efficient use;

2) retention and reuse;

3) discharge.

Qualitative aspects of water management for the promotion of sustainable development comprise, in decreasing order, principles of:

1) recycling and prevention;

2) separation (of polluted flows from non-polluted flows);

3) removal of pollutants.

5 Management components of a wastewater utility

5.1 General

It is recommended that the wastewater utility establishes an integrated management system that would encompass all the management components for providing the wastewater utility.

Management of a utility requires the integrated management in various fields:

— activities and processes,

— resources,

— customer relations,

— information,

— assets,

— environment,

— risks.

5.2 Activities management

There are many individual activities and processes within a wastewater utility. These are undertaken at many different levels within the hierarchy of the organisation. Activity and process management includes: policy-making, strategy formulation, regulatory compliance, internal and external coordination, and operations and controls.

5.3 Resources management

Wastewater utilities normally have the following resources that should be managed:

— personnel (human resources),

— material and equipments (non-fixed asset, e.g. spare parts, vehicles, chemicals. Assets are also considered in 6.4 below),

— financial (costs and benefits), and

— natural resources (e.g. land).

5.4 Asset Management

Wastewater utilities have tangible and intangible assets. Management of the assets includes: maintenance of the up-to-date system inventory, monitoring and registration of data of the condition of the system, planning, maintaining or rehabilitating the system optimising depreciation and reinvestment, and performing risk management.

5.5 Customer relations management

A wastewater utility is essentially present to serve its customers. Customer relation's management is equally critical to the success of the utility and includes: identification of customer needs and expectations, customer service (registration and handling of complaints, customer accounting/billing, and communication, education and information). Special consideration should be given to achieving customer satisfaction (see ISO 24510).

5.6 Information management

In all wastewater services, information management is becoming increasingly important and a feature of regulatory control programs. Information management includes: data management (acquisition, evaluation, registration and updating of data). Increasingly, information is required to be communicated transparently to users and other stakeholders.

5.7 Environmental management

The planning of the development of the wastewater system can be based on a long-term strategy for environmental protection, by improving step by step the wastewater system taking into account the population and urbanisation development, the safeguard of public health and mitigation of flooding hazards.

5.8 Risk management

Risk management comprises proactive approaches taken to assure the continuity of the service in emergency situations, e.g. natural disaster (earthquake, extreme weather events, etc.) and technological and other accidents. Further, proactive measures include the prevention or response to criminal acts of vandalism or terrorism.

6 Guidelines for the management of wastewater utilities

6.1 General

The organisation's management structure should be designed to ensure the correct, effective and efficient planning, implementation, monitoring and checking of all tasks, processes and activities. It should encompass the full range of services or functions provided.

The mission of the wastewater utility is to collect, transport, treat, dispose and/or reuse wastewater and its residues addressing all the components of the management of the wastewater utility as stated in clause 5 in order to fulfil the objectives as stated in clause 4.

Process management of and within wastewater utilities should be carried out using the four point "plan-do-check-act" scheme, which involves planning of activities (plan), implementation of the plan, (do), data collection and monitoring (check), assessment and decision on possible changes needed to improve the performance (act).

Centralised and on-site wastewater services should be improved and monitored to ensure the protection of water resources and of the receiving environment from pollution and to ensure maximum recovery and reuse of wastewater.

6.2 Organisation

6.2.1 General

The wastewater utility should provide a well-structured documentation of its hierarchy and organisation of workflow.

Periodic reviews of the management system should be carried out to ensure its continual improvement.

Managers and supervisors should check all mandatory or legal requirements for their proper application.

Should they detect non-conformity or deviation in the hierarchical and workflow organisation and/or the documented regulations, they should initiate immediate remedial action.

Management capability is required.

Financial capability and funding should be adequate to provide for operational and capital requirements.

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

6.2.2 Hierarchical organisation and responsibilities

The operator should define all tasks, competences and the ensuing responsibilities relating to the activities pursued by the wastewater utility. The management structure and organisation should be clearly defined to establish responsibilities to ensure that all activities are completed correctly.

6.2.3 Organisation of work flow

The wastewater utility should define the sequence of all essential operations required for the proper performance of its tasks, processes and activities on the basis of its hierarchical organisation (see clause 5), ensuring that both internal cooperation and the interfaces resulting from the integration of third-party organisations are organised in a harmonious manner. More detailed working instructions

should be given whenever required to ensure the proper and expert handling of individual activities, adhering to applicable national generally accepted requirements or practices.

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

6.2.4 Business documents and records

Suitable documentation for all tasks and activities as set out in clause 5 should be prepared to furnish proof that they have been carried out properly and expertly.

Managers and supervisors should check these records at regular intervals.

All supervision and checking activities should be documented.

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

The documents concern for example:

— plans and system documentation;

— operating instructions, diaries and records;

— financial records;

— test records, proof of maintenance;

— wastewater analysis, effluents and sludge quality;

— contractual and legal affairs, and

— measures respecting employees.

6.3 Planning and construction

The planning of the adaptation, the development and the construction of the wastewater system should be based on a long-term strategy for environmental protection, by improving step by step the wastewater system taking into account the population and urbanisation development, the evolutions of the expectations, changes in the mandatory and legal requirements, the safeguard of public health and mitigation of flooding hazards.

6.4 Operations and maintenance

6.4.1 General requirements

Operations and maintenance concern the assets of the wastewater system and include:

— Service connection (control of quality of installation of the connection; control of the impact of industrial connections),

— Collection and transport (inspection and assessment of conditions of sewers and drains, rehabilitation of sewers and drains, inspection of the on-site system at each emptying or residue removal operation),

— Treatment, reuse (if possible) and disposal or discharge of the wastewater and residues.

The wastewater operator should develop a plan for operations and maintenance strategy covering both proactive and reactive activities.

The activities and responsibilities of the wastewater operator should cover the aspects listed below:

— operations (actuating, switching, controlling open and closed-control loops),

— operational efficiency controls,

— maintenance (servicing, inspection, rehabilitation, repair),

— monitoring of wastewater and residue quality and quantity,

— commissioning (stopping, re-commissioning, decommissioning) may be in conjunction with the responsible body,

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

— documentation.

6.4.2 Technical activities

6.4.2.1 Wastewater treatment facilities

The management of treatment and other processes with the wastewater utilities should be undertaken in a manner that optimises the use of equipment and resources involved.

Each unit of the wastewater treatment facilities should be operated according to its specifications. The proper operation of the treatment facilities may require in particular:

— adjusting the treatment and the type and volume of reagents used, to the characteristics of the wastewater or residues,

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

— controlling the elimination of waste and of by-products,

— controlling the efficiencies of the processes and establishing and monitoring critical control points.

6.4.2.2 Wastewater transportation system

Wastewater can be transported by different means (pipelines, road tankers, etc.).

6.4.2.3 Emergency provisions

The continuity of the wastewater utility to users is a priority for protecting public health and environment, therefore the operator should be prepared to take the necessary steps to deal with emergency situations. When service is interrupted, the service should be restored as soon as possible.

For emergency situations, in order to minimise the negative impacts on the wastewater service the operator should work out an emergency plan based on a risk assessment.

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

On the basis of the risks previously analysed and classified, preventive actions should be worked out and economically evaluated.

6.4.3 Support activities

6.4.3.1 Purchasing equipment, materials and products

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

Clear and precise specifications should be produced and conformity assessed.

For the execution of the tasks and activities, professional and appropriate equipment should be available to employees.

6.4.3.2 Contractual and legal affairs

All rights, permits and contracts (supply contracts, customer contracts, etc.) should be managed properly. Specific attention should be paid to discharge consents, rights to lay sewers, easements for treatment and disposal facilities.

6.4.3.3 Accounting/billing

The accounting system should be comprehensive of all costs including environmental and resource costs. If charged for the provision of wastewater, fees may reflect the full or partial costs of the wastewater utility, according to applicable social policies. The calculation of the fee should be transparent.

6.4.3.4 Human resources

The wastewater utility should make sure that all employees are educated, trained and qualified for the tasks to be carried out.

6.4.3.5 Protection of labour

The operator should provide a safe environment, appropriate equipment (e.g. personal safety equipment) and work procedures. The personnel concerned should receive instruction on worker safety. Attention should be paid to the occupational health for all personnel with respect to specific risk in operating wastewater systems.

6.4.3.6 Outsourcing

When outsourcing work, the overall responsibility should remain with the wastewater utility.

Therefore, the utility should make sure that the third-party involved:

— meets all the necessary personnel and material requirements,

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

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

7 Service assessment

7.1 General considerations

Generally, assessment is a process which, as every process, should be managed explicitly and clearly define the objectives of the process**,** the scope of the assessment, the responsible organisation, the parties involved, the model or method to be followed, the resources needed, the frequency and activating event, and the users of the results.

There are a great variety of possible assessments, depending on the features listed above. For example, there is performance assessment, within a reduced or wide scope (e.g. environmental performance assessment), conformity assessment, risk assessment, and audits, etc. If not precisely specified, the concept of assessment may induce risks of confusion or conflicts between the interested parties.

A distinction should be made between the results of an assessment and the use and interpretation of these results. It is recommended that when an assessment is launched, the parties interested and the relevant decision-makers share a common understanding of the nature and the criteria of the decisions which are expected to flow from the results of the assessment.

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

EXAMPLE Review [ISO 9000:2000 - 3.8.7] or an environmental performance evaluation [ISO 14031:1999 - 2.9].

As with every process, an assessment process should be periodically reviewed and improved, regarding its objectives, its efficiency and its effectiveness (i.e. concept of plan–do–check–act).

When the responsibilities of the control of the assessed system are shared between several stakeholders, the interpretation of the results of an assessment may be very sensitive if used for the analysis of the responsibilities. The more complex the system the more difficult the interpretation. the greatest caution is therefore recommended.

An overall assessment policy for an organization should encompass all of the various management systems and procedures. Self-assessment is, considered a procedure defined and controlled by the body responsible for the subject matter of the assessment and should be included in every management component, aiming at closing the cycle linking objectives to results.

The assessment policy should be attentive to the overall efficiency and effectiveness of the various assessments, avoiding duplications.

7.2 Considerations relating to wastewater services

This standard is only a guideline; it is not a specification, the compliance with which one of the stakeholders could want to check. It is not a tool for certification, but presents general guidelines aimed at encouraging the definition and the implementation of good practices for the management of wastewater utility.

Due to the diversity of legal, institutional and managerial systems for the management of water utilities, it is not possible to specify assessment procedures in this standard.

Whenever possible, the assessments should be focused on performance and on the satisfaction of users and not on the means and detailed organization implemented for meeting the objectives.

The recommendations relating to assessment differ between service to users and management of the utility.

For service to users, the objectives and criteria recommended in the relevant standard are strictly focused on the performances of the service at the interface between the utility and the user. It is recommended that assessment processes should focus only on performance and effectively involve the users in the processes.

For management issues, the general recommendation of focusing on performance criteria is also applicable; nevertheless, some activities do not fit well with direct measurement of their performance. In such cases indirect assessment of the performance can be accomplished through the evaluation of some management systems such as risk management, and asset management.

If, at a geographically relevant level (country, region, city,), adapted specifications can be established for the management of the water utility, then these specifications should also include provisions concerning assessment processes.

When the responsible body and the operator(s) are not the same legal body, attention is drawn to the importance of some general recommendations made above, regarding the difficulties and the dangers of trying to determine responsibilities from inadequate assessments processes.

In such a case, concerning service to users, the responsible body and its operator should be considered as one unique entity.

Concerning management of the utility, self-assessment should be integrated in every process. When assessment processes are common to both the responsible body and the operator, the conditions of such assessments should be precisely defined by the relevant authorities or by contract between these two parties.

7.3 Service assessment criteria

Service assessment criteria can provide a basis for the assessment of the service provided to the user and/or the management activities of the utility. The necessary service assessment criteria should be selected according to the objectives and requirements of interest as determined by stakeholders under local conditions.

Service assessment criteria are the link between objectives and performance indicators.

Table 1 below shows for one of the objectives proposed in clause 4, possible service assessment criteria. More examples are given in Annex D.

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

EXAMPLE Protection of public health

Possible service assessment criteria:

— safe discharge of wastewater

— enough hydraulic capacity for transport

— safe operation of the wastewater system

8 Performance Indicators

8.1 General

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

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

8.2 Performance indicators systems

8.2.1 General

A performance indicator system comprises a set of performance indicators, context information and variables.

8.2.2 Performance indicators

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

Each performance indicator should:

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

— be assessed from variables that can be easily measurable at a reasonable cost,

— contribute to the expression of the level of actual performance achieved

— in a certain area,

— allow for a clear comparison with targeted objectives and simplify an

— otherwise complex analysis,

— be verifiable,

— be simple and easy to understand, and

— be objective and avoid any personal or subjective appraisal.

Performance indicators are typically expressed as ratios between variables. These ratios may be commensurate (e.g. %) or non-commensurate (e.g. $/m3). In the case of non-commensurate ratios, the denominator should represent one dimension of the system (e.g. number of service connections; total water main length; annual costs). This allows for comparisons through time, or between systems of different sizes.

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

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

Examples of performance indicators and how to calculate them are provided in informative Annex D. Additional information on performance indicators and grading systems for performance indicators are provided in Annex E. Reference to existing relevant performance indicator systems is provided in the Bibliography.

8.2.3 Variables

Each variable should:

— fit the definition of the performance indicator or context information it is used for,

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

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

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

— whenever possible be collected from official sources, and

— be essential for the performance indicator assessment or interpretation.

8.2.4 Context information

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

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

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

8.3 Quality of the information

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

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

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

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

8.4 Example of a performance indicator

Performance indicators are relevant to service assessment criteria which are the link to. The example below shows, for one of the objectives proposed in clause 4, possible performance indicators relevant to one of the service assessment criteria shown in 7.3. More examples are given in Annex D.

EXAMPLE Objective: **Protection of public health**

Possible service assessment criteria:

— safe discharge of wastewater

— enough hydraulic capacity for transport

— safe operation of the wastewater system

Performance indicator: safe operation of the wastewater system

Number of accidents related to the operation of the wastewater system per utility per year

Annex A
(informative)

Basic principles of the standard

The figure A.1 below shows the linkage between the contents of the ISO Standard and the relationship of the standard to other guidance or related documents or requirements.

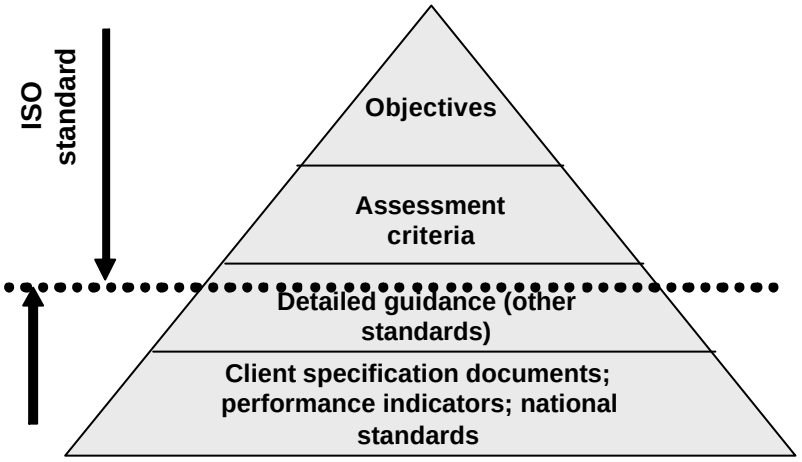


Figure A.1 — Level of detail of the standard

Figure A.2 below illustrates the relationship between activities of the relevant stakeholders and determination of the assessment elements of the standard.

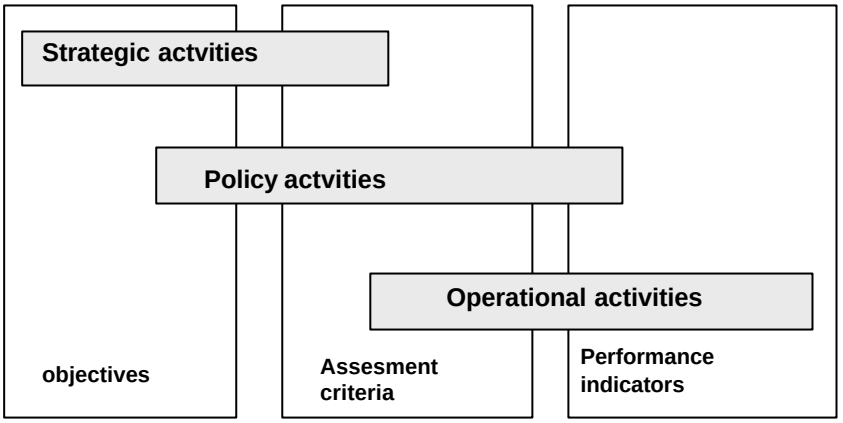


Figure A.2 — Relation between objectives, assessment criteria and performance indicators and related activities

The following figure A.3 integrates schematically figures A.1 and A.2 to show the relationship between activities and the level of details in the standard.

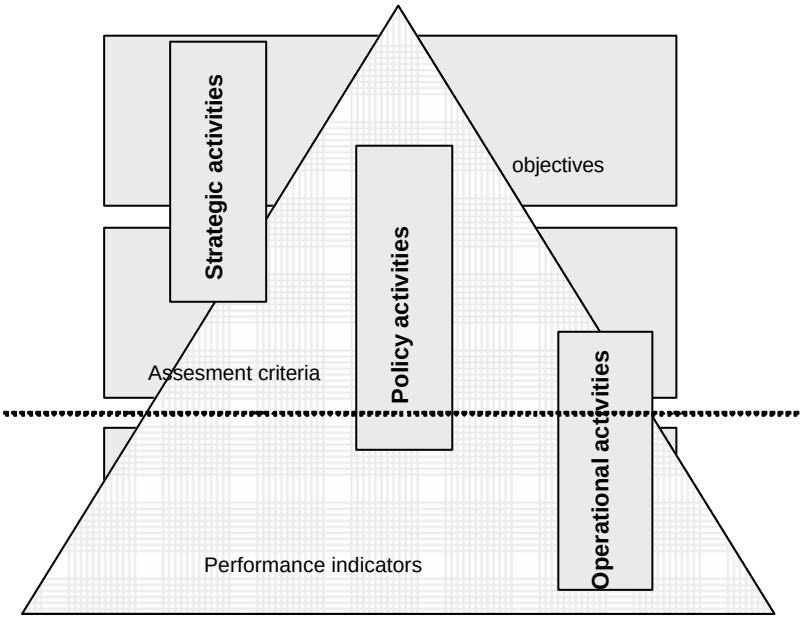


Figure A.3 — Relation between activities and level of details of the standard

The following figure A.4 indicates the relationship between inputs, outputs and the management of the service.

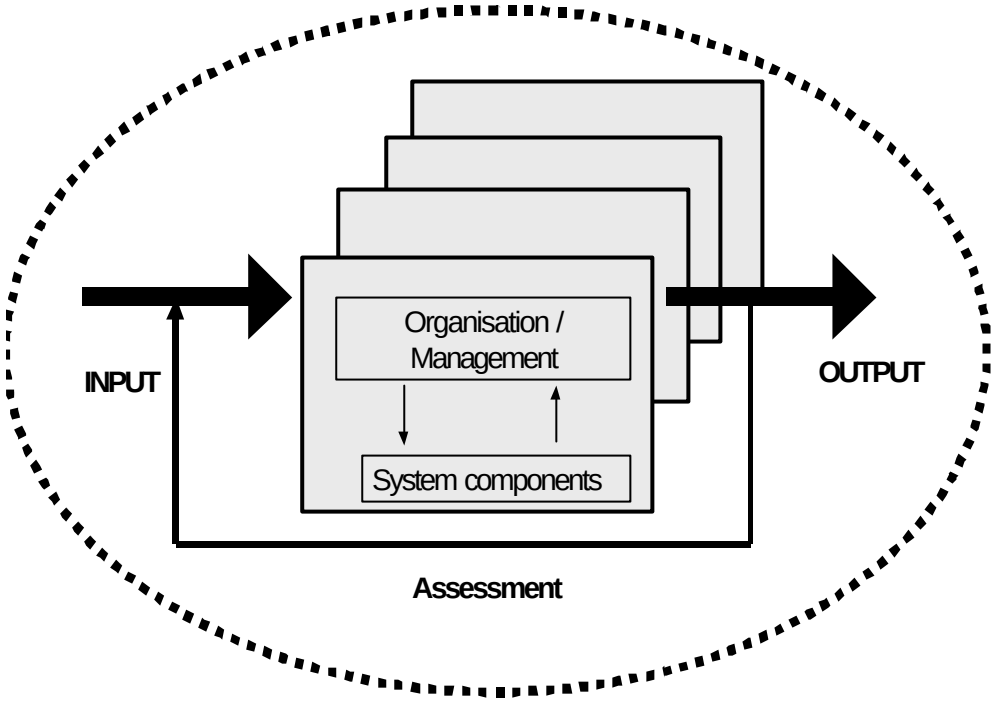


Figure A.4 — General model for water services

Annex B
(informative)

Schematics of wastewater systems

B.1 Components of wastewater system

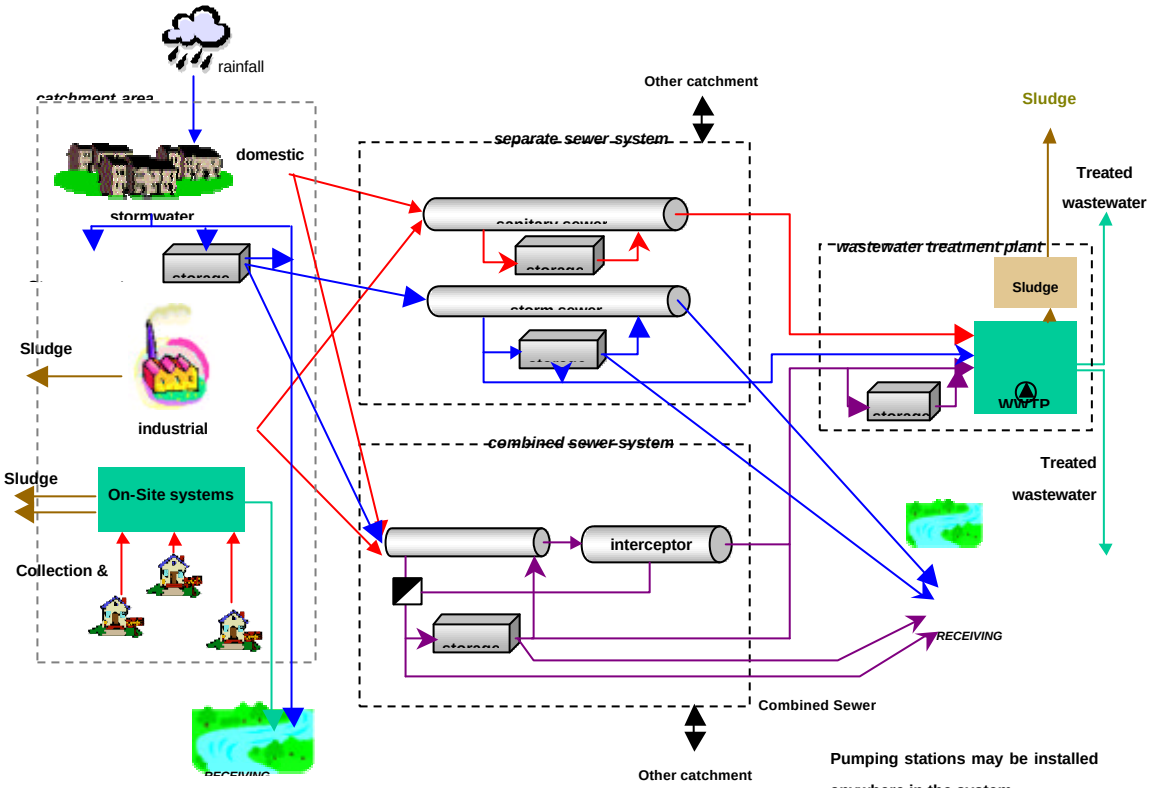


Figure B.1 — Components of wastewater systems

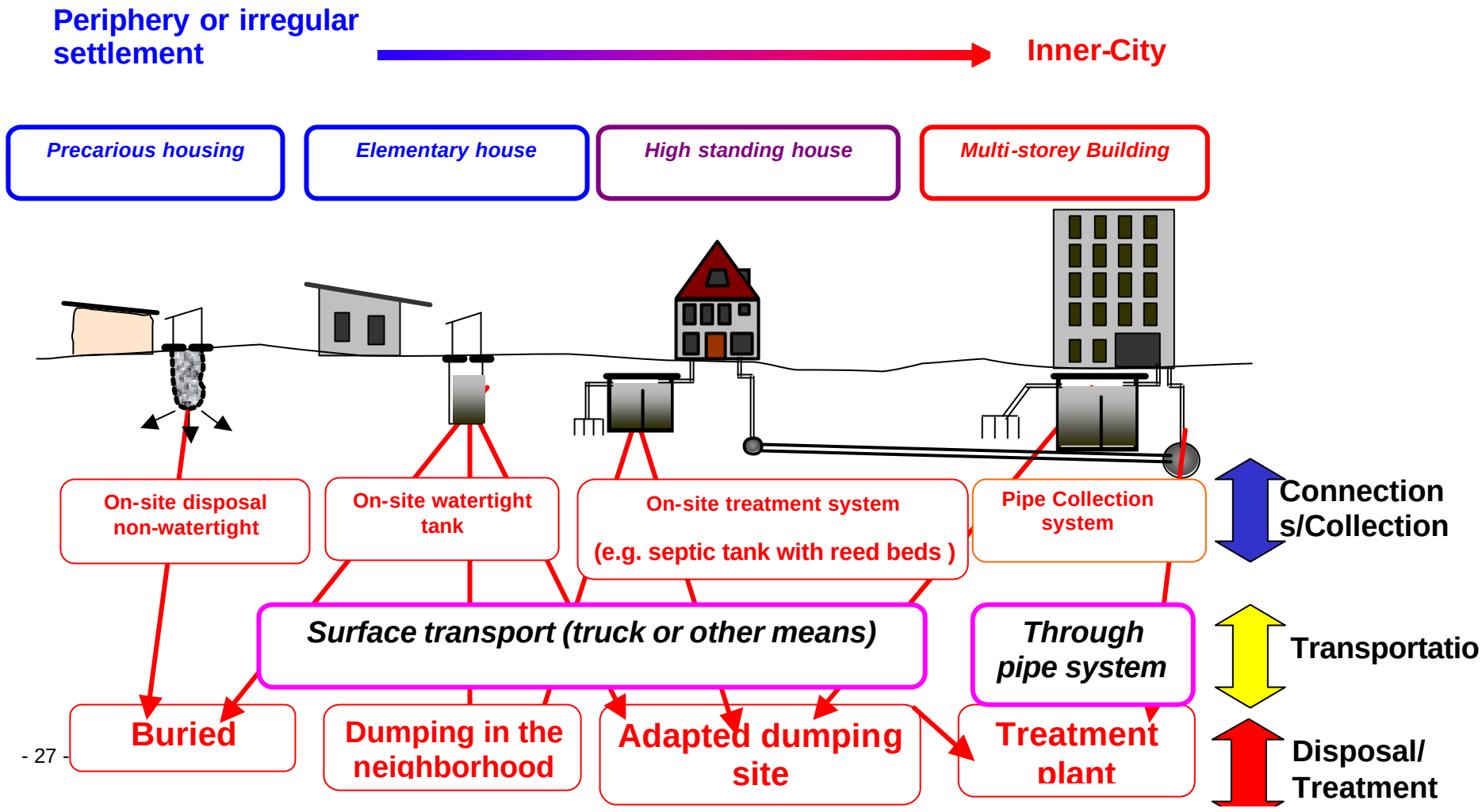
NOTE 1 Source of the schematic: IWA Performance Indicators for Wastewater Services, MBP 2003 (see Bibliography).

NOTE 2 Depending on the extent of the development of the wastewater services in particular country or area, there may be only a few of the shown components of the system utilized (e.g. only collection, disposal).

B.2 Types of wastewater system

NOTE Source of figure B.2: based on a scheme from Hydroconseil, France, 2002.

Figure B.2 — Types of wastewater systems



Annex C
(informative)

Possible actions to achieve wastewater service objectives

C.1 Regarding personnel (human) resources

— maintain and secure health and safety of personnel;

— employ appropriate personnel for appropriate jobs in consideration to their technical competencies and skills;

— ensure that personnel comply with laws/bylaws/regulations;

— train personnel to upgrade their abilities;

— provide training for personnel to improve their abilities;

— place qualified personnel in compliance with laws/bylaws/ regulations;

— instruct personnel to behave in good faith in relation to customers.

C.2 Regarding financial resources (cost and benefit)

— develop a clear and fair service charge structure;

— develop applicable revenue sources to ensure cost recovery and long-term sustainability of wastewater treatment services;

— develop a service charge structure reasonable to different customers that accounts for local economic considerations and revitalization efforts;

— ensure long-term soundness of systems while considering cost-effectiveness;

— conduct asset inventory preparation and update/forecast of new assets;

— maintain sound finances under long-term management projections;

  — analyze management conditions using appropriate methods while considering regional characteristic;

  — continue cost reduction efforts.

C.3 Regarding customer relations management

— identify and meet user/costumer needs;

— respond to users/customers complaints and opinions swiftly and appropriately;

— provide users/customers with communication opportunities to express their opinions;

— give considerations to people in neighbouring communities to gain their support;

— organize events using the wastewater facilities;

— participate as volunteers in local events;

— provide understandable and transparent information for users/customers.

C.4 Regarding environmental protection and conservation of water resources

— contribute to sustainable Integrated Water Resources Management policies;

— act as a responsible stakeholder in basin institutions;

— promote Integrated Water Resources Management in water projects;

— control and limit pollution in the flows of water returning to nature;

— protect water quality in public water bodies;

— protect and conserve water sources for drinking;

— provide sound water cycle by reuse of treated wastewater;

— operate wastewater systems with considerations for the global environment;

— educate users/customers on environmental management concerns, and also not to discharge substances adversely affecting wastewater systems or the environment;

— optimize energy efficiency and minimize environmental loads;

— minimize consumption of electric power in wastewater systems;

— comply with local rules and regulations and consider customer requirements;

— ensure users/customers comply with requirements to connect to wastewater systems, including limitations on:

  — water quantity and quality of final effluent;

  — exhaust gas, noise, vibration and odours coming from wastewater systems;

  — disposal and reuse of sludge;

— minimize the impacts of combined sewer overflow (CSO);

— take care of diffused pollutants in rainwater from separate sewer systems;

— maximize utilization of sludge and by-products;

  — use as energy source;

  — recycle as fertilizer for greenery and agricultural lands;

  — recycle as construction materials;

— organize good practices for sludge disposal, reuse of by-products and waste.

C.5 Regarding operations and maintenance of wastewater systems

— conduct systematic operations and preventive maintenance, including repairs, for stable service quality and prevention of accidents;

  — measures against ageing to preserve sound systems;

  — prevent any subsidence due to pipe collapse;

— maintain stable water quality of final effluent against fluctuation of water quality and quantity in influent;

— limit impact of disasters and accidents;

  — provide information to related organizations;

  — establish systems to cope with leakage and inflow of toxic, hazardous or explosive substances;

  — prepare for earthquake;

  — operate and maintain rainwater drainage systems properly for flood control;

  — develop a plan to secure public health based on possible damage from earthquakes;

— improve service quality by developing and introducing new technology;

— monitor the processes of wastewater treatments;

— guide the management of industrial discharge into sewer in accordance to laws/bylaws/regulations, information and education campaigns;

  — provide monitoring system for inflow of hazardous substances into wastewater systems;

— maintain backup systems to avoid overflow and to maintain quality level of final effluent when pump and treatment systems are out of order;

— reduce infiltration and exfiltration in wastewater systems.

Annex D
(informative)

Examples of service assessment criteria and related performance indicators

D.1 General

In the following text examples of service assessment criteria and performance indicators (PI's) are given with regard to:

— collection and transport,

— treatment,

— disposal/reuse of effluents/ residues, and

— sustainability of services.

D.2 Examples of wastewater service assessment criteria and related performance indicators for collection and transport

D.2.1 Examples of wastewater service assessment criteria

— coverage (population served within the area);

— capacity;

— resistance of the slab (number of accident per year per household)

— quality of the on-site equipment (number of curative operation per year per household)

— hydraulic capacity;

  — sedimentation;

  — flooding;

  — overflow;

— condition;

  — tightness (e.g., infiltration, exfiltration);

  — corrosion;

  — structural integrity;

— operation and management;

  — safety of personnel;

  - inspection (including wrong connection);
  - inflow control (including quantity and quality, indirect discharge control);
  - maintenance;
  - disposal of residues;
  - reuse;
  - man-power;
  - nuisances control (e.g. presence of flies, odour)
  - rehabilitation (repair + renovation + replacement);
  - assets protection;
  - meeting future requirements (e.g., expansion, legal requirements);
- monitoring;
  - discharge consents (input to the sewer system and to the environment/overflows);
  - flow and quality monitoring
  - Rodent control
  - Pumping stations failures.

D.2.2 Examples of related performance indicators

- surcharging (e.g., number of surcharges per sewer length);
- flooding (e.g., number of flooding events per unit of time);
- weight of sediment removed per sewer length;
- percentage of sewer system inspected per unit of time;
- percentage of sewer system cleaned per unit of time;
- overflow (e.g., frequency, volume, and contaminant loading);
- pumping stations failures (e.g. nº pumping stations failures, per year and per length of sewer)
- system effectiveness (e.g. nº overflows per length of sewer);
- percentage of volume collected versus volume delivered to treatment.

D.3 Examples of wastewater service assessment criteria and related performance indicators for treatment

D.3.1 Examples of wastewater service assessment criteria

- coverage (population served within the area);
- quantity of incoming wastewater;
- quality/concentration of contaminants /pollutants in incoming wastewater;
- treatment capacity;
  - hydraulic capacity;
  - pollutant removal capacity;
  - residues treatment capacity;
- condition;
  - Structural integrity;
  - equipment redundancy;
  - environmental impact;
- operation and management;
  - safety of personnel;
  - safety of users
  - inspection;
  - maintenance;
  - disposal of residues;
  - wastewater reuse;
  - residues reuse;
  - energy efficiency (use savings and reuse);
  - man-power;
  - chemicals;
  - odour control;
  - rehabilitation (repair + renovation + replacement);
  - assets protection;
  - meeting future requirements (e.g., expansion, legal requirements);

  - Effectiveness of the cesspool emptier system (e.g. time between request and intervention)

- monitoring;
  - discharge consents (into the environment);
  - flow and quality monitoring.

D.3.2 Examples of related performance indicators

- percentage of treated wastewater;
- energy consumption for wastewater treatment (e.g., per population equivalent);
- wastewater quality tests carried out in compliance with requirements;
- sludge quality tests carried out in compliance with requirements;
- wastewater treatment utilisation (current loading rate versus design capacity);
- inspection of equipments (e.g., frequency);
- personnel training (e.g., in confined spaces).

D.4 Examples of wastewater service assessment criteria and performance indicators for disposal/reuse of effluent/residues

D.4.1 Examples of wastewater service assessment criteria

Effluents and residues from treatment facilities (discharge consents):

- quantity and quality of effluent discharge into the environment or for reuse;
- quantity and quality of effluent discharge into an appropriate site;
- quantity and quality of residues (sludge utilization or disposal);
- quantity and quality of other environmental emissions (including odours, other emissions, noise and vibration).

D.4.2 Examples of related performance indicators

- number of non-compliant quality /quantity tests for effluent discharge;
- number of non-compliant quality/quantity tests for residues;
- number of non-compliant quality/quantity tests for other environmental emissions;
- wastewater reuse;
- sludge utilization;
- solid waste from grit and grease separators and screens;
- sediments from on-site systems (e.g., septic tanks).

D.5 Examples of wastewater service assessment criteria and performance indicators for sustainability of service

D.5.1 Examples of wastewater service assessment criteria

— Social aspects, including stakeholders participation and affordability;

— Economic aspects, including cost recovery;

— Environmental aspects including preventive measures based on the implementation of protection plans.

D.5.2 Examples of related performance indicators

— Wastewater fee as a percentage of family income;

— Institutionalised consultation of stakeholders/users (number of meetings/year)

— Total cost coverage (revenues versus costs)

— Debt service ratio (annual debt service /annual revenues)

Annex E
(informative)

Performance indicators and related components - An example of a confidence-grading scheme

E.1 General

The quality of input data should be therefore assessed in terms of its accuracy and reliability: The accuracy accounts for measurement errors in the acquisition of input data.

NOTE 1 No measurement device is completely accurate, and some of the data to be used to assess the performance indicators may have been obtained by less accurate methods.

The reliability accounts for uncertainties in how reliable the source of the data may be.

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

E.2 Reliability bands

E.2.1 A - Highly reliable

Actual	Data based on sound records, procedures, investigations or analyses that are properly documented and recognized as the best available assessment methods.
Forecasts	Based on extrapolations of high-quality records covering or applicable to 100% of the service's area, kept and updated for a minimum of five years (the forecast will have been reviewed during the reporting period).

E.2.2 B - Reliable

Actual	Generally as in band A, but with minor shortcomings, e.g.: some of the documentation is missing, the assessment is old, or some reliance on unconfirmed reports or some extrapolations are made.
Forecasts	Based on extrapolations of records covering or applicable to more than 50% of the service's area, kept and updated for a minimum of five years. The forecast will have been reviewed during the previous two years.

E.2.3 C - Unreliable

Actual	Data based on extrapolation from a limited sample for which band A or B is available.
Forecasts	Based on extrapolations of records covering more than 30% of the service's area. The forecast will have been reviewed during the previous five years.

E.2.4 D - Highly unreliable

Actual	Data based on unconfirmed verbal reports and/or cursory inspections or analysis.
Forecasts	Based on extrapolated information not complying with bands A, B or C.

E.3 Accuracy bands

Accuracy is defined as the approximation between the result of a given measurement and the (conventionally) correct value for the variable to be measured. The accuracy bands presented below are based on the system adopted in England and Wales.

They are to be applied to the measurement and not to the measuring equipment - for example, in some cases the equipment may be highly accurate but is used out of range. Whenever the measurement accuracy cannot be assessed, it should be graded as greater than 100%.

The accuracy bands suggested are:

4) Better than or equal to +/- 1%

5) Not band 1, but better than or equal to +/- 5%

6) Not bands 1 or 2, but better than or equal to +/- 10%

7) Not bands 1, 2 or 3, but better than or equal to +/- 25%

8) Not bands 1, 2, 3 or 4 but better than or equal to +/- 50%

9) Not bands 1, 2, 3, 4 or 5 but better than or equal to +/- 100%

X) Values which fall outside the valid range, such as > 100%, or small numbers.

E.4 Overall confidence grades

The confidence grades (c.g.) will be an alphanumeric code, which couples the reliability band and the accuracy band, for instance:

A2 - Data based on sound records etc. (Highly Reliable, Band A) which is estimated to be within +/- 5% (Accuracy band 2).

C4 - Data based on extrapolation form a limited sample (Unreliable, Band C), which is estimated to be within +/- 25% (Accuracy band 4).

The reliability and accuracy bands would form the matrix of confidence grades shown below (table E.1):

Accuracy Bands (%)	Reliability bands			
	A	B	C	D
[0; 1]	A1	++	++	++
[1; 5]	A2	B2	C2	++
[5; 10]	A3	B3	C3	D3
[10; 25]	A4	B4	C4	D4
[25; 50]	++	++	C5	D5
[50; 100]	++	++	++	D6
NOTE: '++' indicates confidence grades that are considered to be incompatible				

Table E.1 — Matrix of confidence grades

Confidence grades should be assessed for every water service and for every indicator, and the corresponding results reported as follows:

Year	Result	*'short description'* PI1	*'short description'* PI2	*'short description'* PI3	*'short description'* *PI4*	*'short description'* *PI5*	*'short description'* *PI…*
1996	*PI* c.g.	*20%* *B3*	*87%/year* *[C4]*	*34/m^3* *A2*	*40/km sewer* *A1*	*55%/year* *B3*	*45%* *A3*
1997	*PI* c.g.	*21%* *A2*	*86%/year* *B3*	*30/m^3* *A1*	*45/km sewer* *B1*	*65%/year* *B2*	*45%* *B2*
1998	*PI* c.g.	*23%* *A1*	*84%/year* *C2*	*31/m^3* *A1*	*42/km sewer* *A3*	*67%/year* *[B4]*	*45%* *A2*
1999	*PI* c.g.	*23%* *B2*	*85%/year* *A3*	*26/m^3* *A3*	*40/km sewer* *C1*	*68%/year* *C2*	*45%* *C1*
...	...	...	...	...	...	...	...
NOTE: '[ ]' means that the original values were corrected by the audit							

Table E.2 — Reporting of confidence grades (c.g.) for a sequence of years

To make it possible for comparisons to be carried out between services, confidence grades should be chosen appropriately and applied consistently. The descriptions outlined above are minimum values expected, to achieve the quality of information stated.

Clearly, "A1" or "A2" confidence grades can be achieved for some input variables, although they may not be generally attainable. Services are encouraged to aim for a grade of "B2" (i.e. good or excellent) or better.

Confidence grades can only be estimated directly for the variables. Based on these, PI confidence grades can either be assessed either quantitatively or, at least, qualitatively.

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