BS ISO 24511:2024

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of ISO 24511:2024. It supersedes BS ISO 24511:2007, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CB/503, Drinking water and wastewater service levels.

A list of organizations represented on this committee can be obtained on request to its committee manager.

The attention of users is drawn to the existence of legislation or regulatory requirements that may override some provisions of this British Standard; in particular, to the legislation or regulatory requirements of the following:

- The Water Industry Act 1991 (as amended) and the Water Act 2014 (as amended);
- The Scottish Water (Objectives: 2021 to 2027) Directions 2020 (as amended) and the Water Industry (Scotland) Act 2002 (as amended); and
- The Water and Sewerage Services (Northern Ireland) Order 2006 (as amended).

UK users of this standard are encouraged to seek out up-to-date advice from appropriate regulatory authorities.

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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.

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 document 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).

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This document was prepared by Technical Committee ISO/TC 224, *Drinking water, wastewater and stormwater systems and services*.

This second edition cancels and replaces the first edition (ISO 24511:2007), which has been technically revised.

The main changes are as follows:

— the objectives modified to adjust to current challenges faced by water utilities;

— changes in terms and definitions to reflect the unified terminology of ISO/TC 224 as specified in ISO 24513;

— the list of key performance indicators in Annex E modified.

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.

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Introduction

0.1 Water issues: global context and policies framework

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

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

While substantial progress has been made in increasing access to clean drinking water and sanitation, billions of people – mostly in rural areas – still lack these basic services. Worldwide, one in three people does not have access to safe drinking water, two out of five people do not have a basic hand-washing facility with soap and water, and more than 673 million people still practise open defecation.[25]

The COVID-19 pandemic has demonstrated the critical importance of sanitation, hygiene and adequate access to clean water for preventing and containing diseases. According to the World Health Organization, handwashing is one of the most effective actions you can take to reduce the spread of pathogens and prevent infections, including the COVID-19 virus. Yet billions of people still lack safe water sanitation and funding is inadequate.[25]

A projected 40 % shortfall in freshwater resources by 2030, coupled with a rising world population, has the world careening towards a global water crisis. Recognizing the growing challenge of water scarcity, the UN General Assembly launched the Water Action Decade on 22 March 2018 to mobilize action that will help transform how we manage water.[25]

The UN's Sustainable Development Goal 6, "Ensure availability and sustainable management of water and sanitation for all", sets targets to be achieved by 2030, including: achieve universal and equitable access to safe and affordable drinking water for all, improve water quality, increase water-use efficiency across all sectors, implement integrated water resources management at all levels and expand international cooperation and capacity building at that.[25]

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

— clear definition of the roles of the different stakeholders;

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

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

— regulation for water withdrawal and wastewater discharge;

— information to the users and the communities;

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— the use of advanced and upcoming equipment and data-handling technologies for enhancing the efficiency of the services as stated in the proposed revision of ISO 24510[5].

— planning for the water utility services to be able to cope with climate change effects on the availability and quality of the water utility resources to maintain service level required, as stated in ISO 24540[14].

0.2 Water utilities: general objectives

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

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

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

Examples of such stakeholders include:

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

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

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

— users and associations of water users.

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

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

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

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0.3 City services and quality of life

In many cases, water utilities are service providers of cities. The concept of smart cities has been explored in literature of recent years, while ISO/TC 268, *Sustainable cities and communities*, standardizes the field of sustainable cities and communities to help interested parties measure their performance. ISO 37120[18] introduces indicators to measure the performance of cities, some of which relate to water and wastewater. This document intends to complement the indicators and methodologies depicted in ISO 37120[18], while introducing a holistic perspective of the water sector in the smart city.

0.4 Objectives, content and implementation of this document

The objective of this document is to provide the relevant stakeholders with guidelines for assessing and improving the service to users and with guidance for managing water utilities, consistent with the overarching goals set by the relevant authorities and by the international intergovernmental organizations noted previously. This document also intends to provide relevant stakeholders with guidelines to help deal with recent developments in the field of water services management, such as climate change, higher user and regulatory demands and the development of advanced technologies, mainly data mining and analysis, communications and digitization. Newly available technologies can be used to protect against risks that stem from the use of cyber communications. This document 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.

Using key performance indicators (KPIs) will be a promoter for ongoing improvements and eventually initiate the use of new and more efficient technologies, procedures and preventive approaches.

The group of standards addressing water services consists of ISO 24510[5] (service-oriented), this document and ISO 24512[6] (all being management-oriented).

ISO 24510[5] addresses the following topics:

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

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

— guidelines for satisfying users' needs and expectations;

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

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

This document, ISO 24512[6] and ISO 24536[13] address the following topics:

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

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

— guidelines for the management of the water utilities;

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

The performance indicators presented in this document, ISO 24510[5], ISO 24512[6] and ISO 24536[13] are simply for purposes of illustration, because assessing the service to users cannot be reduced to a single or universal set of performance indicators.

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

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

The guidelines given in this document, ISO 24510[5] and ISO 24512[6] focus on users' needs and expectations and on the water services themselves, without imposing a means of meeting those needs and expectations, the aim being to permit the broadest possible use of this document, ISO 24510[5] and ISO 24512[6] while respecting the cultural, socio-economic, climatic, health and legislative characteristics of the different countries and regions of the world. It should therefore be understood that, in the short-term, it is not always possible to meet the expectations of local users. This can be due to factors such as climate conditions, resource availability and difficulties relating to the economic sustainability of the water services, particularly regarding financing and the users' ability to pay for improvements. These conditions can limit the achievement of some objectives or restrict the implementation of some recommendations in developing countries. However, this document is drafted with such constraints in mind and, for example, allows for differing levels of fixed networks and the need for on-site alternatives. Notwithstanding the need for flexibility in terms of engineering and hardware, many recommendations in this document, such as consultation mechanisms, are intended to apply universally.

In order to assess and improve the service to users and to ensure proper monitoring of the improvements, an appropriate number of performance indicators (PIs) or other methods for checking conformity to requirements can be established. The use of performance indicators is only one of the possible support tools for continuous improvement. Stakeholders can select performance indicators from the examples given or develop other relevant performance indicators, taking into account the principles described in this document, ISO 24510[5] and ISO 24512[6]. The performance indicators logically relate to the objectives for which they are defined through the assessment criteria and are used to measure performance. They can also be used to set required or targeted values. This document does not impose any specific indicator or any minimum value or performance range. It respects the principle of adaptability to local contexts, facilitating local implementation.

While it is in no way intended that this document, ISO 24510[5] and ISO 24512[6] and more specifically the performance indicators given as examples, be considered as a prerequisite or condition for the implementation of a water policy or for the financing of projects or programmes, they can serve to assess progress towards policy goals and the objectives of financing programmes.

The objective of this document, ISO 24510[5] and ISO 24512[6] is not to lay down systems of specifications supporting direct certification of conformity but to provide guidelines for the continuous improvement and assessment of the service. Use of this document, ISO 24510[5] and ISO 24512[6] is voluntary, in accordance with ISO rules.

This document, ISO 24510[5] and ISO 24512[6] are consistent with the principle of the "plan-do-check-act" (PDCA) approach: they propose a step-by-step process, from identifying the components and defining the objectives of the utility to establishing performance indicators, with a loop back to the objectives and to the management, after having assessed the performances. Figure 1 summarizes the content and application of this document. Implementation of this document, ISO 24510[5] and ISO 24512[6] does not depend upon adoption of ISO 9001[1] and/or ISO 14001[2]. Nevertheless, this document, ISO 24510[5] and ISO 24512[6] are consistent with those management system standards. Implementation of an overall ISO 9001[1] and or ISO 14001[2] management system can facilitate the implementation of the guidelines contained within this document, ISO 24510[5] and ISO 24512[6]; conversely, these guidelines can help to achieve the technical provisions of ISO 9001[1] and ISO 14001[2] for organizations choosing to implement them.

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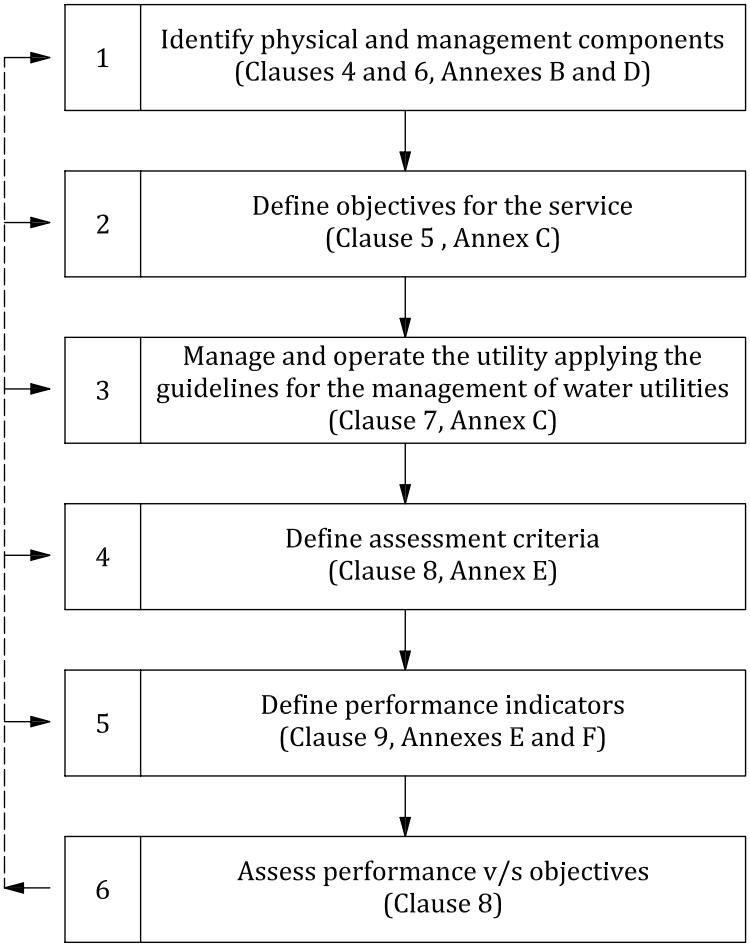

Figure 1 — Implementation actions and sequence

0.5 Wastewater services

Wastewater systems are built and operated mainly to protect 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, environmental requirements for treatment and the technical or socio-economical ability of the responsible body to implement it, operate it and maintain it. It should be cost-effective and sustainable, as well as permitting phased development to overcome the financial constraints while not compromising the stated objectives.

Operationally, the broad objectives of a utility are to provide wastewater collection services on a continuous or at least-intermittent basis (depending on the service mechanism chosen), meeting the related capacity requirements. Methods of wastewater treatment and or disposal should correspond to the chosen collection system.

Appropriately treated wastewater is eventually returned to the environment and can have significant impact on both quantity and quality of natural water resources.

Effective and safe management of residues resulting from wastewater treatment, including their final disposal or reuse, is becoming increasingly important due to concerns about both environmental protection and resource conservation.

Since it often has a lifetime stretching over several human generations, wastewater infrastructure should demonstrate intergenerational equity. Consequently, a wastewater utility, regardless of ownership, is public in nature and will be subject to public scrutiny and policy. Other criteria, such as cost or affordability and service sustainability, are addressed in appropriate clauses of this document.

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

1 Scope

This document provides guidelines for the management of wastewater utilities and the assessment of wastewater services.

This document is applicable to publicly and privately owned and operated wastewater utilities but does not favour any particular ownership or operational model.

NOTE 1 Wastewater is always generated when water is used or consumed. Accordingly, sources of wastewater can be residential, industrial, commercial or institutional. Collected storm water or (melted) snow can also be considered as wastewater, as it often carries contaminants and pathogens picked up from air or ground surfaces on its way to a collection system. In certain circumstances, especially in undeveloped areas, sanitary waste is collected in an undiluted form.

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

The following are within the scope of this document:

— the definition of a language common to different stakeholders;

— objectives for the wastewater utility;

— guidelines for the management of wastewater utilities;

— service assessment criteria and related examples of performance indicators, all without setting any target values or thresholds.

The following are outside the scope of this document:

— methods of design and construction of wastewater systems;

— regulation of the management structure and the methodology of wastewater service activities of operation and management;

— regulation of the content of contracts or subcontracts;

— topics related to the systems inside buildings, between the point-of-discharge and the point-of-collection.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24513, *Service activities relating to drinking water supply, wastewater and stormwater systems — Vocabulary*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24513 and the following apply.

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

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

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

3.1
accuracy
closeness of agreement between a measure and the accepted reference value

Note 1 to entry: The term "accuracy", when applied to a set of measures, involves a combination of random components and a common systematic error or bias component.

[SOURCE: ISO 24513:2019, 3.7.10]

3.2
assessment
process or result of this process, comparing a specified subject matter to relevant references

[SOURCE: ISO 24513:2019, 3.712]

3.3
community
one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organizations or groups, having interests in the area where the *service* (3.9) is provided

[SOURCE: ISO 24513:2019, 3.1.8.5]

3.4
confidence grade
assessment (3.2) of the quality in terms of *accuracy* (3.1) and reliability

[SOURCE: ISO 24513:2019, 3.7.13]

3.5
coverage
extent to which the assets of a *water utility* (3.13) allow *services* (3.9) to *users* (3.10), within its defined area of responsibility

[SOURCE: ISO 24513:2019, 3.3.38]

3.6
Geographical Information Systems
GIS
in the strictest sense, a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e., data identified according to their locations

[SOURCE: ISO 23611-6:2012, 3.3.1, modified — Note 1 to entry has been deleted.]

3.7
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".[24]

Note 2 to entry: Indicators can refer to context, conditions, means, activities or *performances* (3.8).

[SOURCE: ISO 24513:2019, 3.9.10]

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3.8
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 [including *services* (3.9)], systems or organizations.

[SOURCE: ISO 24513:2019, 3.9.1]

3.9
service
output of an organization with at least one activity performed between the organization and, in the first place, its *user* (3.10) and, in the second place, a stakeholder

Note 1 to entry: The dominant elements of a service are generally intangible.

Note 2 to entry: Service involves activities and processes within an organization (utility), at the interface with the user, to establish user requirements as well as upon delivery of the service and can involve a continuing relationship.

Note 3 to entry: Provision of a service can involve, for example, the following:

— an activity performed on a user-supplied tangible product [e.g. *wastewater* (3.11)];

— an activity performed on a user-supplied intangible product (e.g. processing new connection requests);

— delivery of an intangible product (e.g. the delivery of information in the context of knowledge transmission);

— the creation of ambience for the user (e.g. in reception offices).

Note 4 to entry: A service is generally experienced by the user and can be monitored by one or more stakeholders.

Note 5 to entry: The word “service” in common English can also refer to the entity providing the actions related to the subject in question, as is implicit in such phrases as “bus service”, “police service”, “fire service” and “water or wastewater service”. In this context and usage, “service” implies the entity that is delivering the service, for example “the public transport of passengers”, “the provision of public security”, “fire protection and response” and “delivering drinking water or collecting wastewater”. If “service” can be understood in this way, “water service” becomes synonymous with “*water utility* (3.13)”.

[SOURCE: ISO 24513:2019, 3.3.7]

3.10
user
DEPRECATED: consumer
person, group or organization that benefits from drinking water delivery and related *services* (3.9), *wastewater* (3.11) service activities, stormwater service activities or reclaimed water delivery and related services

Note 1 to entry: Users are a category of stakeholder.

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

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

[SOURCE: ISO 24513:2019, 3.1.8.4]

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3.11
wastewater
water arising from any combination of domestic, industrial or commercial activities, surface runoff and any accidental sewer inflow or infiltration water and which can include collected stormwater, discharged to the environment or sewer

Note 1 to entry: The definition of wastewater in this document also includes sanitary waste in the non-liquid form (i.e. solid or undissolved or not soluble).

Note 2 to entry: Wastewater can flow in separate or combined sewer systems.

Note 3 to entry: Collected storm water can carry contaminants and pathogens picked up from the air or ground surfaces.

[SOURCE: ISO 24513:2019, 3.2.2.2, modified — Notes 1, 2 and 3 to entry have been added.]

3.12
wastewater system
asset system providing the functions of collection, transport, treatment and discharge of *wastewater* (3.11) and wastewater residues

[SOURCE: ISO 24513:2019, 3.5.12.3]

3.13
water utility
whole set of organization, processes, activities, means and resources necessary for abstracting, treating, distributing or supplying drinking water, for collecting, conveying, treating, disposing of or reusing *wastewater* (3.11) or for the control, collection, storage, transport and use or disposal of stormwater, and for providing the associated *services* (3.9)

Note 1 to entry: Some key features for a water utility are:

— its mission, to provide drinking water services or wastewater services or the control, collection, storage, transport and use of stormwater services, or a combination thereof;

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

— its responsible body;

— the general organization with the function of operator being carried out by the responsible body, or by legally distinct operators;

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

Note 2 to entry: Drinking water utility addresses a utility dealing only with drinking water; wastewater utility addresses a utility dealing only with wastewater; stormwater utility addresses a utility dealing only with stormwater.

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

Note 4 to entry: In common English, “water service” can be used as a synonym for “water utility”, but this document does not recommend using the term in this way.

[SOURCE: ISO 24513:2019, 3.3.1]

4 Components of wastewater systems

4.1 General

A wastewater system generally comprises:

— wastewater source;

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— collection and transport of wastewater and residues removed from wastewater;

— treatment of wastewater and disposal of residues;

— storage, transport and disposal or reuse.

See Annex A, A.1, A.2 and A.3.

NOTE Treated wastewater for drinking is a separate item covered under ISO 24512[6] but is the principal focus of ISO/TC 282, *Water reuse*.

4.2 Types of wastewater systems

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

NOTE On-site systems are further discussed in ISO 24521[11] and ISO 24525[12].

Schematic presentations showing the wastewater systems and the relations between the various components are shown in, A.2 and A.3.

Depending on the extent of the development of the wastewater services in a particular country or area, the nature of the system components can vary. For on-site systems, only one or a few of the previously mentioned components of the system may be used (e.g. only collection, disposal). See A.3.

4.3 Centralized systems

4.3.1 Wastewater source

Wastewater sources and the volume of wastewater affect the composition of the wastewater and the nature of the treatment facility required to produce effluent able to meet environmental discharge or recycled water quality requirements. Wastewater sources include industrial, commercial, residential and stormwater. Industrial wastewater is typically the most difficult to treat, having a wide range of organic or inorganic constituents.

The polluter pay principle requires placing a cost on contaminants introduced into wastewater by industrial wastewater contributors and is a useful mechanism to minimize difficult-to-treat inputs and allow cost recovery for treatment of these components. Commercial and residential wastewater is more consistent and typically lower in organic and inorganic contaminants.

Stormwater, where it is collected in the same pipes as wastewater or delivered concurrently to a wastewater treatment plant, has the effect of diluting the organic components of the wastewater and potentially introducing additional inorganic contaminants.

4.3.2 Transport from source to treatment

The wastewater collection and transport system consists of networks with connections to the various wastewater sources. Such networks are furnished with the necessary equipment (e.g. gates, weirs, pumps) to achieve the collection and transport function. In some cases, centralized systems will receive wastewater (treated or untreated) or separated residues from neighbouring centralized systems for further processing. In combined wastewater systems, the wastewater will be augmented with stormwater.

The systems may be pressurized (with positive or negative pressure) or the wastewater may flow by gravity. Sewerage flowing through wastewater pipework is likely to generate both odours and noxious gases which should be controlled through effective ventilation, gas scrubbers or filters, or through dosing of chemicals into the wastewater.

Centralized wastewater treatment systems frequently receive and accept septage from on-site systems. This septage is transported normally by road vehicles operated by independent transport enterprises.

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Components of the centralized system for collection and transport of wastewater can include:

— drains;

— sanitary, storm or combined sewers and auxiliaries, including:

  — gravity sewers;

  — pressure or vacuum sewers;

  — interceptors or trunk sewers;

  — storage and retention basins;

— pumping and storage facilities;

— overflow structures;

— bulk liquid carriers;

— in-network wastewater condition monitoring and sampling systems;

— odour control units;

— chemical dosing systems;

— drop structures and mixing structures (designed to avoid gas generation).

4.3.3 Treatment

Treatment of sanitary or municipal wastewater and the separated wastewater residues can include several stages, depending on the nature (quality and quantity) of the wastewater source and the disposal environment (i.e. the nature and size of the receiving body of water for liquids that are not reused) and disposal method for residues that are not reused. Treatment stages can include mechanical treatment for removal of larger debris such as rags and grit, as well as settling and removal of suspended solids, biological treatment for removal of the dissolved organic contaminants, removal of nutrients such as nitrogen and phosphorus and disinfection of final effluents to remove or inactivate pathogens such as bacteria and viruses. In general, treated wastewater effluent is disposed of by direct discharge to a receiving body of water, infiltrated to land or reused.

Wastewater treatment can include for centralized or decentralized systems:

— lagoon or pond treatments (for small populations);

— treatment inlet holding tanks;

— septage receiving facilities;

— treatment facility inlet structures;

— monitoring, sampling, measuring or remote control with analysis, process and feedback facilities;

— preliminary, primary, secondary or advanced treatment and reuse or disposal facilities;

— discharge facilities or outfall structures;

— odour control facilities;

— energy recovery facilities;

— combined sewer overflow (CSO) treatment facilities;

— storm water treatment facilities.

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4.3.4 Storage, transport and distribution

In general, treated wastewater effluent is disposed of by direct discharge to a receiving body of water, infiltrated to land or reused. In doing this, the wastewater may be temporarily stored in open lagoons or tanks to buffer flows, particularly where the wastewater is being reused.

4.3.5 Disposal of residues

Residues may be produced at a number of stages in the wastewater treatment process. Disposal of large volumes of untreated sludge or salts from reverse osmosis processes can pose a threat to the environment.

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

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

— transfer to a treatment facility;

— return to source water body;

— deposit at landfill sites;

— reuse, if possible.

NOTE ISO/TC 275 is developing a series of standards regarding the treatment and use of (wastewater) sludges.

4.4 On-site-systems

4.4.1 Wastewater source

On-site wastewater treatment systems are typically designed to treat, dispose of, disperse or reuse domestic wastewater in areas where centralized sewerage systems are not viable or currently not available.

NOTE ISO 24521[11] and ISO 24525[12] can assist in designing and operating on-site wastewater treatment.

4.4.2 Collection and transport

On-site systems can include a wastewater collection network within the site. On-site systems may also be connected to central systems by direct physical means or by transport vehicles.

On-site equipment for the collection of sanitary waste or wastewater can include:

a) pit latrine;

b) tank;

c) holding basin;

d) organic separators;

e) skimmers.

In some cases, the on-site collection system is only a temporary holding tank for transportation to a centralized treatment system and is usually done by tanker. In this case, transportation of sanitary waste, wastewater or wastewater residues from on-site systems to a centralized treatment plant includes:

— manually emptied storage tank;

— vacuum emptied storage tank;

— small bore (diameter) system.

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4.4.3 Treatment

On-site treatment systems components can include:

— grease traps;

— septic tanks;

— anaerobic reactors;

— wetlands, lagoons or pond systems;

— soakaways;

— reed beds;

— evaporation beds;

— composting toilet;

— chemical injection systems;

— electrochemical treatment;

— bioreactors;

— Ultrafiltration (UF) or Reverse osmosis (RO) membrane systems;

— disinfection.

4.4.4 Storage, transport and distribution

Treated wastewater from the on-site treatment system may be infiltrated directly in the soil (from pit latrines) but more frequently passes through a series of on-site pipes to a storage lagoon or tank prior to discharge into the surrounding soil, reuse or land application.

For the efficient operation of bio-reactors, on-site systems require regular maintenance of the system to remove accumulated residuals and the liquid portion. Septage pumping is carried out by specialized vehicles (some with de-watering capability) to transport the residues to a central treatment plant for disposal.

4.5 Disposal or reuse of residues

Residues, after their processing using methods such as dewatering to reduce their volume, may be incinerated or sent by surface transport vehicles to a landfill site for permanent storage or burial.

Residues are increasingly finding reuse markets. Wastewater residues may be reused for soil enhancement or fertilizer purposes (whether or not mixed with other organic residuals) or may be used as an energy source through incineration with heat recovery.

Residue processing and disposal system can include:

— residues handling or conditioning facilities, such as:

  — stabilization tanks (e.g. aerobic or anaerobic digesters with possible biogas recovery);

  — conditioning facilities (for physical and or chemical conditioning of residues);

  — dewatering or drying facilities;

  — composting facilities;

— residue reuse or disposal facilities, including:

  — thermal destruction (e.g. incineration, gasification, with possible heat recovery);

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