ANNEX IV – CONCESSION TECHNICAL SPECIFICATIONS

SUMMARY

1 INTRODUCTION

This report contains the description of the operating activities to be conducted by the CONCESSIONAIRE in the operation of the various units that make up the water supply (SAA) and sewage (SES) systems in the CONCESSION AREA.

To that end, the document describes the main operating routines typical for each type of facility/unit of the water supply and sewage systems.

It is worth mentioning that this ANNEX must be understood as a collection of general guidelines, which aim to standardize practices and conduct within the scope of the operation of water supply and sewage systems, in order to achieve the service and performance targets as well as good practices in the engineering, administration, commercial, financial and socio-environmental areas.

The actions, strategies and investments required to attain the established targets must be presented by the CONCESSIONAIRE in a Master Plan, covering each municipality of the CONCESSION, during the 35 (thirty-five) years of its duration, in compliance with the ARSAP regulatory authorities.

The specific operational routines will be detailed by the CONCESSIONAIRE through Operation and Maintenance Manuals for each of the existing operational facilities, as well as the monitoring of the results obtained.

Finally, this ANNEX also addresses other general aspects, such as: master plan, corporate governance and compliance, user awareness, maintenance deadlines – user interface, integrated information system, operational control center, energy efficiency optimization program, technical and consumer registration program, water loss control and reduction program, water metering program, personnel training and qualification program, contingency plans, fraud elimination programs, socio-environmental programs and the pending Conduct Adjustment Agreements.

2 TECHNICAL OBLIGATIONS IN PROJECTS AND CONSTRUCTION

Conceptually, a Standard is a document established by consensus and approved by a recognized body, which provides rules, guidelines or minimum characteristics for activities or their results, for the purpose of obtaining an optimal degree of ordering in a given context.

The standard is, in principle, of voluntary use, but is almost always used because it represents the consensus on the state of the art of a given subject, obtained among specialists of the stakeholders.

The development of the projects and construction of the various units that make up the water supply and sewage systems must follow the standards issued by the Brazilian Association of Technical Standards (ABNT) applicable to each case, in their most recent versions. Some of these standards are highlighted below:

- NBR 5.681/80 – Technological Control of Execution and Landfills in Building Works.
- NBR 6.122/80 – Foundation Design and Execution.
- NBR 6.146/80 – Electrical equipment enclosures – Protection – Specification
- NBR 7968/83 – Nominal diameters in sanitation piping in the areas of the distribution networks, water mains, sewage collection networks and interceptors.
- NBR 6.459/84 – Soil – Determination of the Liquidity Limit.
- NBR 6.493/84 – Use of Fundamental Colors for Industrial piping.
- NBR 9.648/86 – Study of sewage system design.
- NBR 9.649/86 – Sewage collection network design.
- NBR 9.814/86 – Sewage collection network execution.
- NBR 10.844/89 – Building rainwater installations.
- NBR 12.207/92 – Interceptor sewer design.
- NBR 12.208/92 – Sewage lift station design.
- NBR 12.209/92 – Sewage treatment plant design.
- NBR 12.215/91 – Water main design for public supply.
- NBR 12.211/92 – Study of public water supply system design.
- NBR 12.213/92 – Surface water abstraction design for public supply.
- NBR 12.214/92 – Water pumping system design for public supply.
- NBR 12.216/92 – Water treatment plant design for public supply.
- NBR 12.266/92 – Design and execution of ditches for laying water, sewage or urban drainage pipes.
- NBR 12.586/92 – Water Supply System Registration.
- NBR 12.587/92 – Sewage System Registration.
- NBR 7.195/93 – Occupational Safety Colors.
- NBR 7.678/93 – Safety in the Execution of Construction Works and Services.
- NBR 7.229/94 – Design, construction and operation of septic tank systems.
- NBR 12.217/94 – Water distribution reservoir design for public supply.
- NBR 12.218/94 – Water distribution network design for public supply.

- NBR 13.133/94 – Execution of topographic survey.
- NBR 12.655/95 – Concrete – Preparation, control and receipt
- NBR 5.626/98 – Cold water building installations.
- NBR 7.367/98 – Design and laying of rigid PVC pipes for sewage systems.
- NBR 8.160/99 – Building sewer systems.
- NBR 14.565/99 – Basic procedures for preparing cabling projects.
- NBR 5.419/01 – Protection of structures against lightning strikes.
- NBR 6.484/01 – Execution of Simple Soil Recognition Surveys.
- NBR 14.039/03 – High voltage electrical installations (from 1.0 kV to 36.2 kV).
- NBR 6118/04 – Design and execution of reinforced concrete works.
- NBR 10.004/04 – Solid waste.
- NBR 7.362/05 – Rigid PVC Tube with Elastic Joint for Sewer Collector.
- NBR 6.118//04 – Concrete structure design – procedure.
- NBR 5.410/05 – Low Voltage Electrical Installations.
- NBR 12.212/06 – Well design for groundwater abstraction.
- NBR 7.212/12 – Ready-mixed concrete procedure.
- NBR 12.655/15 – Portland cement concrete.

For any services not covered by national technical standards, it is necessary to consider the criteria and parameters indicated in international standards or specialized bibliography, which must be authorized for use by the regulatory agency.

In the event that there is no applicable technical standard, national or international, the CONCESSIONAIRE may apply the solutions of its expertise, ensuring adherence to the Master Plan of the municipality involved and compliance with the Performance Indicators as well as due approval from the regulatory agency.

3 TARGETS

3.1 Service Targets

The service targets established in the Project are 99% for the water supply system and 90% for the sewage system. The targets were defined for the urban areas of the municipalities to be served, encompassed by the CONCESSION AREA.

The year that each municipality must reach the stipulated targets is calculated according to the current service rate and the urban population of the municipality. The following Table 1 contains the service targets for the SAA and SES of the localities covered, with year 1 being the year when the CONCESSION begins. The service percentage is broken down annually for each municipality in ANNEX III – PERFORMANCE INDICATORS AND SERVICE TARGETS.

Table 1 – Year of concession for meeting the SAA and SES universalization targets for the municipalities

Municipality	Concession year for meeting the target		Municipality	Concession year for meeting the target	
	SAA	SES		SAA	SES
Amapá	11	18	Oiapoque	11	18
Calçoene	11	18	Pedra Branca do Amapari	11	18
Cutias	4	18	Porto Grande	11	18
Ferreira Gomes	11	18	Pracuúba	11	18
Itaubal	7	18	Santana	7	17
Laranjal do Jari	8	18	Serra do Navio	11	18
Macapá	8	17	Tartarugalzinho	11	18

Note 1: ARSAP, through [Note/Opinion] XXX/2021, agreed with the extension of the deadline provided for in §9, art. 11 of Federal Law 11.445/2007.

3.2 Water Loss and Water Metering Targets

The total water loss target (physical loss and apparent loss) is 30%, being measured as of the 5th year of the AGREEMENT. Its decrease over 9 years was considered, and the loss reduction target is measured annually.

Physical or actual loss refers to the volume of water made available in the system by the water operator that is wasted during the distribution process, while the apparent or commercial water loss is the volume of water that, despite the water distribution reaching the end consumer, the product is not charged properly, either due to technical problems in water meter measurement, lack of measurement or consumer fraud.

The expected water meter index is 100% for all locations, to be reached gradually over 2 years for Macapá and Santana, and 3 years for the other municipalities, after taking over the SYSTEM, without, however, this parameter being a Performance Indicator.

ANNEX III – PERFORMANCE INDICATORS AND SERVICE TARGETS contains tables on the annual water loss ratio.

4 ADDITIONAL INVESTMENTS

The funds from the INVESTMENT ACCOUNT may be used for the following purposes:

- To fund the execution of investments, such as the execution of works and purchase of equipment, as determined by the STATE, provided they refer to:

a) Quantitative and qualitative expansion of sewage and water supply services rendered in the MUNICIPALITIES, but outside the CONCESSION AREA; and

b) Urbanization of the MUNICIPALITIES, including through investments in asphalting, which are timely for the purpose of mitigating the risk indicated in sub-clause 33.4.25 of the AGREEMENT.

- To fund the restoration of the CONCESSION's economic and financial rebalancing as provided for in sub-clause 33.8.3 of the AGREEMENT.

The investments to be made in these areas will not be quantified for the purposes of calculating the universalization targets detailed in ANNEX III – PERFORMANCE INDICATORS AND SERVICE TARGETS.

The funds for the execution of the additional investments are limited to the amount set forth in Clause 50 of the AGREEMENT.

4.1 Guidelines for the execution of additional investments

Additional investments must be made as of year 3 of the CONCESSION, over a period of 10 (ten) years, according to the following distribution:

- years 3 to 7: the amount to be invested per year will correspond to 5% (five percent) of the amount referring to additional investments;
- years 8 to 13: the amount to be invested per year will correspond to 15% (fifteen percent) of the amount referring to additional investments.

The minimum annual investment limit of BRL 3,000,000.00 (three million Brazilian reais) must be observed. In the event that this amount is higher than the allocation of the aforementioned percentages, the minimum amount for the incidence of the percentages set forth above on the value of ADDITIONAL INVESTMENTS must be respected.

As of year 2 of the CONCESSION, the CONCESSIONAIRE will align with the STATE on an annual basis which investments will be made as additional investments in the following year.

Following this alignment, the CONCESSIONAIRE will prepare the ADDITIONAL INVESTMENT PLAN, informing how it intends to proceed with investments in the regions defined by mutual agreement.

The CONCESSIONAIRE must submit the ADDITIONAL INVESTMENT PLAN within 90 (ninety) days after definition by the STATE, for analysis and approval by the REGULATORY AGENCY within a maximum period of 60 (sixty) days from its submission.

The REGULATORY AGENCY may propose changes to the submitted plan, which should be discussed with the CONCESSIONAIRE. The TECHNICAL COMMITTEE can settle any disputes that arise due to divergences.

After the conclusion of the planning and as the CONCESSIONAIRE begins to make the additional investments planned for the respective year, there will be a process for rendering of accounts by the CONCESSIONAIRE, for monitoring by the REGULATORY AGENCY regarding the effective realization of the investments and disbursement of the amounts defined in this ANNEX, and the REGULATORY AGENCY may use an INDEPENDENT CERTIFYING ENTITY, observing the guidelines of ANNEX VIII – PROVISIONS FOR HIRING INDEPENDENT VERIFYING AND CERTIFYING ENTITIES, pursuant to the procedure set forth in item 4.2 of these Specifications.

The inspection of additional investments made will be conducted by the STATE, which may use the support of the REGULATORY AGENCY, as well as the procedure set forth in item 4.2 of these Specifications.

The works conducted by the CONCESSIONAIRE must be reverted, after their conclusion, to the STATE, CAESA or MUNICIPALITIES, depending on which entity is responsible for the operation or maintenance of the available infrastructure. The CONCESSIONAIRE shall forward to the STATE, within 90 (ninety) days after the completion of the works conducted, 3 (three) complete and definitive copies of the written and drawn parts ("as built" drawings), in electronic and printed form that allows their reproduction according to the applicable technical standards. The STATE will have up to 60 (sixty) days to point out any inconsistencies or technical problems in the works received, which must be corrected by the CONCESSIONAIRE. After the indicated period of 60 (sixty) days, the STATE shall not have any right of recourse with respect to the delivered works.

If the CONCESSIONAIRE proves that it did not make the annual investments due to a fact not attributable thereto, the unused funds may, by determination of the STATE, be deposited by the CONCESSIONAIRE in the INVESTMENT ACCOUNT, to be handled exclusively by the FINANCING AGENT and in compliance with the provisions in ANNEX IX – DRAFT REFERENCE FOR CONSTITUTION AGREEMENT AND ACCOUNT MANAGEMENT.

4.2 Guidelines for monitoring of investments by the independent certifying entity

In order to make additional investments, which will be accompanied by the INDEPENDENT CERTIFYING ENTITY, the following guidelines must be observed.

The investment implementation must be preceded by the preparation of an investment schedule designed by the CONCESSIONAIRE, to be submitted to the STATE and to the REGULATORY AGENCY within 90 (ninety) days from the approval of the ADDITIONAL INVESTMENT PLAN, for analysis and approval by the REGULATORY AGENCY, with the support of the INDEPENDENT CERTIFYING ENTITY, within 30 (thirty) days of its submission.

The schedule must be of a physical-financial type, establishing each of the structures to be implemented, as well as their necessary accessory facilities, considering the control needs by the INDEPENDENT CERTIFYING ENTITY.

The purpose of the investment schedule will be to set forth the detailed planning for the realization of the investments provided for in this item 4.2, which may be a schedule for each investment item, and must contain:

- Preliminary design for the works, observing the relevant standards of the Brazilian Association of Technical Standards (ABNT);
- Reference budget for the execution of the preliminary design for the works

The investment schedule will be analyzed by the REGULATORY AGENCY, with a supporting expert opinion from the INDEPENDENT CERTIFYING ENTITY, for the purpose of justified deliberation for its approval, within 30 (thirty) days, and the divergences of the PARTIES and/or the REGULATORY AGENCY in relation to the design of the investment schedule may be resolved by the TECHNICAL COMMITTEE, under the terms of the AGREEMENT.

Once the investment schedule, preliminary project for the works and reference budget are approved, it will be up to the CONCESSIONAIRE, within 90 (ninety) days, to prepare the executive project for the execution of the works contained in the preliminary project, as well as the detailed final budget for this purpose, for the purpose of submitting them for analysis by the REGULATORY AGENCY for its deliberation, supported by the INDEPENDENT CERTIFYING ENTITY, within 60 (sixty) days. The REGULATORY AGENCY will be responsible for verifying compliance with the investment schedule, and may use the services of the INDEPENDENT CERTIFYING ENTITY.

Once the executive project and the respective final budget have been approved by the REGULATORY AGENCY, their content will be binding and of mandatory compliance by the CONCESSIONAIRE in the execution of the additional investments, and any technical failures or inadequacies of the project or delays in its execution will be at the CONCESSIONAIRE's risk, not giving rise to any change in the values of the approved binding budget for the purposes of certification of the volume of investment applied in the works. All the necessary resources for the effective execution of the planned works, including the elaboration of projects, budgeting and obtaining the necessary licenses, should be counted as additional investments.

Once the additional investments have been made, the CONCESSIONAIRE undertakes to issue the operating report within 60 (sixty) days, showing the amount actually invested and the works carried out and delivered.

The REGULATORY AGENCY will request the INDEPENDENT CERTIFYING ENTITY to examine the report submitted by the CONCESSIONAIRE, in order to assess the volume of investments made by the CONCESSIONAIRE and to present a conclusive opinion as to the correspondence of the volume of investments made with the obligations set forth in these Specifications.

Failure to use, in whole or in part, the funds referring to ADDITIONAL INVESTMENTS for a given year, due to a fact attributable to the CONCESSIONAIRE, or a lack of correspondence of the volume of investments made by the CONCESSIONAIRE with the obligations set forth in the ADDITIONAL INVESTMENT PLAN and in this AGREEMENT, backed by the opinion of the INDEPENDENT CERTIFYING ENTITY and based on the analysis of the REGULATORY AGENCY, in this AGREEMENT and in the ADDITIONAL INVESTMENT PLAN, may give rise to the application by said agency on the CONCESSIONAIRE of sanctions set forth in sub-clause 35.1.1, 35.1.2, 35.1.3 and 35.1.4 of the AGREEMENT.

The REGULATORY AGENCY will have a period of up to 180 (one hundred and eighty) days from the receipt of the report to recognize and certify the investments, including the financial amount corresponding to such investments, pursuant to art. 42, § 2, of Federal Law No. 11.445 / 2007.

Once the investments are concluded, provided they correspond to the content of the executive project and the previously approved investment schedule, the REGULATORY AGENCY, supported by the opinion of the INDEPENDENT CERTIFYING ENTITY, will definitively certify the volume of investments made by the CONCESSIONAIRE, taking the amounts contained in the final budget previously approved by the REGULATORY AGENCY as a reference.

In order to conduct the technical assessment of the conformity of the investments referred to in this item 4.2 and their correspondence with the previously approved executive project, the INDEPENDENT CERTIFYING ENTITY, as well as the REGULATORY AGENCY, will have unrestricted access to the construction site facilities, based on prior communication to the CONCESSIONAIRE.

In the event of disagreement by the STATE or the CONCESSIONAIRE in relation to the investment values that are recognized by the REGULATORY AGENCY, the conflict resolution mechanisms provided for in the AGREEMENT may be activated.

5 WATER SUPPLY SYSTEMS

The water source for water supply systems can be surface or underground.

The first case, which is usually referred to as a standard conventional water supply system, consists of the following main units: surface abstraction, adduction, water treatment plant, reservoirs, distribution networks and individual property connections. Adduction can be subdivided into raw water supply and treated water supply. Depending on local topographic conditions, there are also pumping or discharge stations for pumping water.

In the second case, surface abstraction is replaced by a well, and the treatment usually consists of disinfection and fluoridation of the water.

The following are descriptions of the existing types, their purposes and main operating routines, by unit, and it should be noted that the CONCESSIONAIRE must provide a detailed description of the specific operational routines in the Operation and Maintenance Manuals for each of the existing operational facilities.

5.1 Water source

Water sources are surface or underground fresh water used for human consumption or for the development of economic activities. Water sources include: rivers, lakes, dams, groundwater and aquifers.

The increased demand for water, unorganized land use, inadequate land and water use practices, lack of sanitation infrastructure, removal of vegetation cover, erosion and silting of rivers and streams and industrial activities that develop without complying with environmental legislation, among other factors, contribute to the increasing degradation of water sources.

The permanence of the adversities detailed above compromises the quality of the water, exposing a significant portion of the population to diseases. Thus, the watersheds must receive specific attention, with the adoption of legal measures and development of management tools for protection, planning and use, in order to adapt the urban planning of the hydrographic basins to the uses of the water body.

5.1.1 Operational Routines for a Water Source

The operation of a source is basically restricted to protecting the quality of its waters. Thus, the necessary measures must be adopted so that no externalities to the water source environment can alter or compromise the quality of the water. In this sense, although it is not a regulatory obligation or resulting from Brazilian legislation, it is common to surround the areas of the springs, as well as to protect the gallery forests of the water courses used as sources of supply.

Thus, the main operational routine of a water source refers to the performance of periodic inspections in the area of the hydrographic basin, conducted for the purpose of identifying activities or situations that may compromise the water quality from the supply source used. The main benefit of this health surveillance of the water sources is the savings in the treatment of the supply water, due to the more rational use of chemical products. These inspections must be carried out every 90 days, or in shorter periods depending on the occupation of the basin area.

5.2 Abstraction

Abstraction is the installation of a water system for the purpose of removing water from the supply source. There are two types: surface water and groundwater.

Surface abstraction is conducted in springs, rivers, lakes or dams, the water being removed by gravity or by means of a pumping system.

Groundwater abstraction is conducted by means of wells, with water generally being removed from the water table by motor pumps installed at the water level and sent to the surface by pipes.

Surface Abstractions

In the preparation of surface abstraction projects, which must comply with NBR 12.213/92, some quantitative and qualitative characteristics of the water sources used must be evaluated, of which the following stand out: (i) survey of hydrological data of the basin or nearby basins; (ii) survey of fluviometric data of the water course being studied and information on water level fluctuations during periods of drought and flood; (iii) physical, chemical and bacteriological characteristics of the water; (iv) location in the basin of current and potential pollution focal points; (v) any costs of expropriation; and (vi) availability of electricity to power the sets of motor pumps.

Still in the context of surface abstractions, it is important to observe the following aspects:

- Ensure the necessary conditions for the entry of water at any time of the year;
- Periodic cleaning of level dams, water intake and sand boxes;
- Ensure, to the greatest extent possible, the best water quality from the source through actions to recover and protect surface water sources;
- Ensure the operation and protection against damage and obstructions;
- Favor economy for the facilities;
- Facilitate operation and maintenance over time;
- Properly plan the execution of structures next to or in the water, in order to facilitate possible expansions;

- Periodic maintenance of floating ferry structures and other equipment, which may exist in the abstractions;
- Provide flood protection; and
- Provide road accessibility throughout the year, regardless of the rainfall regime.

Groundwater Abstractions

With regard to groundwater abstractions, which must comply with NBR 12.212/06, they can be shallow wells or cisterns, manually excavated and lined with bricks or concrete rings, which draw water from the water table at depths on the order of 20 meters and if intended for small consumption.

For use in public supply, groundwater abstractions are conducted by means of deep tubular wells, geologically located, drilled with a drilling rig and diameters ranging from 4" to 36" and depth of up to 200 meters. After drilling, they are cleaned to remove mud and other excavation residues. These wells are lined with tubes to support the walls and have filtration devices made from slotted tubes for the passage of water. In addition, the wells also have a pre-filter, formed by filling the area between the lining/filter and the wall of the well with gravel, whose function is to stabilize fine sediments. Complementing the structure, cement paste is injected in the upper portion between the lining and the well wall to prevent polluted water from entering, and a concrete slab is installed for sanitary protection, fused to the site at the well entrance.

5.2.1 Operational Routines for Surface Abstraction

Generally, a surface abstraction is made up of the following devices:

- Dams or spillways to maintain the level or to regulate the flow;
- Water intake units with devices to prevent the entry of floating or suspended materials in the water;
- Devices to control water entry at different levels;
- Devices to promote bottom discharge, in the case of dams;
- Suction wells and pump houses for the installation of lifting assemblies, when necessary.

The operation of a surface abstraction is subject to the quality of the water drawn from the source. Due to the variation of the ambient temperature, there is a recirculation of the water layers of a body of water due to the alteration of the water density, thus promoting an inversion of the sedimentary material at the bottom of the abstraction, causing the water to have different physical characteristics (color and turbidity) at different depths. Thus, the main operational routine is associated with the definition of the water intake to be used, when there are gates installed at different depths in the abstraction device.

In accumulation reservoirs, due to the fact that they function as large sedimentation ponds, a high concentration of sedimentary materials can occur close to the dam; in these situations, the bottom discharge of the reservoir or dam should be operated, in order to clean the area around the water intake, thus ensuring lower concentrations of turbidity for the water withdrawn from the abstraction. This is a purely operational procedure and is not subject to regulatory requirements or inspections. However, to ensure its practice as a preventive measure, the activity must be provided for in the Operation and Maintenance Manual for the operational facility, to be developed by the CONCESSIONAIRE.

5.2.2 Operational Routines for Groundwater Abstraction

Before coming online, the deep tubular wells are subjected to a development phase, which aims to increase the natural hydraulic conductivity in the vicinity of the well, the selective removal of fine sediments and the correction of damage to the aquifer due to drilling (compaction, bridging, etc.). The development phase stabilizes the sandy formation around the well, increasing its porosity and permeability. To that end, periodic maintenance must be performed in the well protection area (fences, floors, gates and easels).

Pumping equipment used to remove water from tubular wells includes:

- **submerged pump** – used for pumping medium and large flow rates (greater than 3 m^3/h), with varying depths; works with three-phase power; is installed inside the well by means of an eductor tube (type of ejector that works like a jet-type fluid pump) and a cable that connects the pump to an electrical panel on the surface;
- **injection pump –** used for pumping small and medium flow rates with varying depths; usually works with three-phase power or fuel; it is installed with an injector nozzle (or foot valve) inside the well through two pipes (a thin injector tube and a thick eductor tube), which connects the injector nozzle to the pump that is outside the well;
- **centrifugal pump –** used for pumping small flow rates at low depths; works with three-phase power or fuel; it is installed outside the well by means of a single pipe (a thin eductor tube) that comes out of the well directly to the pump; and
- **compressor –** from an external engine (compressor), compressed air is injected into the well through a small diameter pipe (air injector); the injected air causes the water to rise to the surface through another tube of larger diameter (eductor tube).

The first operational routine for a groundwater abstraction refers to the pumping test designed to determine the exploitation flow from the well (**Q**) and the hydrodynamic parameters related to the static and dynamic levels. The **Static Level (NE)** is the depth of the water level inside the well, when it has not been pumped for a significant period of time; **Dynamic Level (ND)** is the depth of the water inside the well when it is pumping. The difference between the

static and dynamic levels represents the **Drawdown**, that is, how much the water level went down inside the well when it came online.

The operations of activating the electrical commands for the start of operation of the pumping equipment depend on the levels of the reservoirs that receive the supply from the wells. Thus, according to the demand of the system served, the level control devices of the reservoirs that receive the production from the wells must be calibrated with specific set-points in order to automatically activate the start of the well motor pump sets. Telemetry is optional, however, highly recommended.

5.3 Adduction

Adduction or the water main is the pipe that connects the abstraction to the treatment plant and/or the treatment plant to the reservoirs or the distribution network, without the existence of derivations to supply distribution networks or individual property connections. The adduction project must comply with NBR 12.215/91.

As for the nature of the transported water, the water mains can be for raw water, when they connect the abstraction to the water treatment plant or treated water mains, when they connect the water treatment plant to the reservoirs or the distribution network.

As for the energy to move the water, the water mains can be gravity-driven (free or forced duct) or boosted, when the water is transported through pumping.

Different types of materials can be used in the execution of water mains. The choice of the most suitable material depends on some aspects, of which the following stand out:

- do not interfere with the physical and chemical properties of the water;
- change in roughness over time (fouling);
- Watertightness;
- Chemical and mechanical resistance;
- Resistance to water pressure (static, dynamic and transient);
- Savings (cost of piping, installation, construction aspects, corrosion protection needs, maintenance, etc.).

Thus, the most common materials for water mains are: Steel, Ductile Cast Iron, High Density Polyethylene (HDPE), Polypropylene, PVC and Fiberglass Reinforced Polyester.

Steel water mains have the following advantages: high resistance to internal and external pressure; watertightness due to the fact that the joints are welded; availability of various diameters; competitive price mainly in larger diameters and pressures. Disadvantages include: little resistance to external corrosion; precautions for transportation and storage; care with thermal expansion; dimensioning of the tube walls for collapse.

Regarding Ductile Iron piping, the following points stand out: they are available in 16 diameters, ranging from 50 to 1,200 mm; availability of tubes measuring 6 and 8 meters long; availabilities in classes K-7, K-9 and 1 Mpa; ductility and resilience; internal lining with cement mortar; and external coating with zinc and bituminous paint.

As for non-ferrous tubes, it is worth mentioning: light and flexible; watertightness; chemical and abrasion resistance; less roughness; low speed (transient); without internal or external coating; and length limited by transport with up to a hundred meters without joints (submarine emissaries).

The main special and protective devices for a water main are:

- Flow meters and pressure controllers;
- Gate valves and butterfly valves to control operation;
- Plungers for eliminating and admitting air;
- Pressure reducing valves (PRV);
- Transition tanks for interfaces between pumped and gravity-driven water mains;
- Bottom discharges for cleaning the mains; and
- Hydraulic transient protection equipment – water hammer arrestors, hydropneumatic reservoirs, balancing chimney, one-ways, among others.

5.3.1 Operational Routines of a Water Main

The main operational routine of a water main is focused on its filling process. The raw or treated water mains must be watertight and make it possible to transport the water in a safe and economical manner. Whereas the pipeline is full of air when empty, its loading process to come online must be carried out with a great deal of care, promoting the filling of the water main with water slowly, so that the existing air can be gradually expelled by the plungers installed in the upper center line of the pipe. In the case of pipes fed by pumping, this process must be even more careful, and all the plungers and discharges of the line must be opened during their filling, in order to guarantee the complete removal of the air.

Another important operational routine refers to steel water mains, where occurrences of negative pressure can cause the pipeline to collapse. Thus, weekly inspections must be performed on hydraulic transient devices, in order to ensure their operation in the event of water hammer strikes in the lines or interruption of electric power, paralyzing the pumping systems. This is a purely operational procedure and is not subject to regulatory requirements or inspections. However, to ensure its practice as a preventive measure, the activity must be provided for in the Operation and Maintenance Manual for the operational facility, to be developed by the CONCESSIONAIRE.

Considering the need to maintain the piezometric line of the water main within the desired pressure ranges, or those established by hydraulic modeling, an important operational routine

is the verification and eventual calibration of the pressure reducing valves (PRVs) existing in the supply lines and the periodic maintenance of connections, valves, plungers and relief devices, where applicable.

In order to maintain the quality of the adducted water, another operational maneuver concerns the performance of periodic discharges to clean the pipes, thus promoting the removal of any solid materials deposited in the lower center line of the pipes.

Additionally, periodic inspections must be conducted to control losses and immediately correct leaks.

5.4 Water Treatment

The Water Treatment Plant (WTP) is a facility that makes it possible to purify the water withdrawn from the water sources, adapting its quality to the potability standards established by the Ministry of Health, Annex XX of Consolidation Ordinance No. 5, dated 10/03/17, and that must comply with NBR 12.216/92, and thus make it suitable for consumption.

Thus, water treatment is conducted to fulfill several aspects:

- **Hygiene –** removal of bacteria, protozoa, viruses and other microorganisms, harmful substances, reduction of excess impurities and high levels of organic compounds;
- **Aesthetics –** correction of color, taste and odor; and
- **Economic –** reduction of corrosivity, color, turbidity, iron and manganese.

Public utilities must always provide healthy, good quality water. Therefore, treatment must only be adopted and carried out after its necessity has been demonstrated and, whenever it is applied, it must include only the processes essential to obtain the desired water quality.

The need for treatment and the required processes must then be determined based on health inspections and the results of analyses (physical-chemical and bacteriological) representative of the water source to be used as a supply source.

A conventional water treatment plant, with a full cycle, is composed of the following steps:

- **Oxidation –** the first stage of the treatment process, consisting of mixing chlorine in the water to oxidize the metals which are dissolved there, mainly iron and manganese;
- **Coagulation and Flocculation –** the water is mixed with a coagulant that has properties that help to form gelatinous flakes; in these stages, the impurities present in the water are grouped by the action of the coagulant, in larger particles (flakes) that can be removed by the decantation process; flocculation consists of stirring the water with the help of rotating blades or passing through baffle plates, favoring the formation of flakes; the most used reagents are aluminum sulfate and

ferric chloride; occasionally, if the water is acidic, with pH values <7, a pH correction is made before the addition of the coagulant, with the addition of a solution of hydrated lime or sodium carbonate;

- **Decantation –** in this stage, the water slowly passes through the decanters (usually tanks of rectangular shape) and the flakes formed are separated by gravity;
- **Flotation with dissolved air –** in addition to decanting, the flakes can also be removed from the water by the flotation process, being collected in collecting gutters;
- **Filtration –** after passing through the decanters, the water goes to the filters, where the impurities that remained in the water are removed; the filter consists of a porous granular medium, usually sand or activated carbon, of one or more layers, installed over a drainage system, capable of retaining and removing impurities still present in the water;
- **Disinfection –** although it is already clean at this stage, the water still receives chlorine to eliminate germs harmful to health and guarantee the quality of the water in the distribution networks and reservoirs; ozonation and exposure to ultraviolet radiation are also used in the disinfection process;
- **Correction of the pH –** in this step, if necessary, more hydrated lime is added to correct the pH of the water; this action aims to protect the pipes of the distribution networks and homes against corrosion or fouling;
- **Fluoridation –** once the treatment process is completed, the water receives a dose of the fluorine compound (fluorosilicic acid), a requirement of the Ministry of Health; the presence of fluoride in the water prevents tooth decay, especially in the period of tooth formation, which spans from pregnancy to the age of 12.

Still in the context of water treatment, it is worth noting that the water drawn from deep wells, in most cases, does not need a complete treatment, usually just chlorine disinfection and fluoridation and, occasionally, the removal of iron and manganese, depending on the water quality of the underground source.

Thus, the definition of the treatment process will depend on the quality of the raw water extracted from the water source, whether surface or underground.

The legislation that regulates the water potability standard for human consumption and that must be observed by the Concessionaire during the term of the Agreement is Annex XX of **Consolidation Ordinance No. 5/2017**, of the Ministry of Health. This Ordinance *"establishes the procedures and responsibilities related to the control and surveillance of the quality of water for human consumption and its potability standard, and provides other measures."*

5.4.1 Operational Routines for Water Treatment

Within the water treatment activity there are several permanent operational routines that ensure the effectiveness of the process, among which the following can be highlighted:

- **Control of inlet flows into the WTP –** in order to control the volumes produced by the treatment process, WTP operators need to control and record the inlet flows into the treatment facility; these flows can be measured by macro-gauges installed in the inlet pipes at the ETA or through measurements made on the Parshall flume, which is usually installed at the entrance to the plants;
- **Water quality control at the entrance of the WTP –** in order to guide the concentration and dosages of the coagulants applied at the water inlet to the facility, at certain times, WTP operators must collect samples of the affluent raw water or supervise the proper functioning of the system for collecting and transporting raw water to the plant's control laboratory;
- **Preparation of coagulant solution tanks –** based on the concentrations established by the WTP control laboratory, operators must prepare the coagulant solution tanks used in the treatment process for dosing in raw water, at the inlet to the plant (preferably in the turbulence zone of the Parshall flume);
- **Coagulant dosage control –** operators must verify, at certain times, the proper functioning of the devices or pumps (control of their automation) for the application of the chemicals used as coagulants; this occurs at certain times depending on the variation in the quality of raw water;
- **Control of the flocculation and decantation process –** at certain times, WTP operators must evaluate the flake formation process in order to control the effectiveness of the application of the coagulants, the speed of the flocculation process and the behavior of the decantation system. The test for determining the optimum amount of coagulant to be used in order to obtain the best flocculation is called the jar test;
- **Control of the running of the filters and the washing process –** according to pre-established rules, WTP operators must monitor the evolution of head losses in the filtration system to determine the optimum time for the filtration runs and to define when to wash the filters;
- **Cleaning and discharge process for the decanters –** in accordance with the procedures established in the WTP Operation Manual, at certain times, WTP operators must conduct a full washing cycle of all the tanks and flumes of the decanters and the corresponding discharge of the accumulated sludge at the bottom of the tanks; the disposal of the discarded sludge must be assessed by the supervision of the WTP operation to ensure that the operation is environmentally adequate;
- **Filter washing process –** according to the routines established for WTP operation and in accordance with the set points defined for the maximum head losses, the

operators must conduct the procedures established in the WTP Operation Manual to perform the washing of the filtration units;

- **Disinfection process control** – at certain times, WTP operators must conduct an assessment of the chlorine dosing systems used for disinfection, for possible identification of leakage points and immediate correction;
- **Control of the fluoridation process and final pH correction** – at certain times, WTP operators must evaluate the dosing systems for fluorosilicic acid, used for fluoridation, and the dosing systems for hydrated lime, for pH correction, any identification of leakage/clogging points and immediate correction;
- **Periodic preventive maintenance of pumps and dosers, control panels, valves and other WTP equipment** – according to the procedures established in the WTP Operation Manual.

5.5 Reservoirs

After being treated in the WTPs, the water is stored in closed and waterproofed reservoirs, which can be underground (buried and semi-buried), supported or elevated, depending on their position in relation to the ground, in which different volumes are provided according to technical standards. The reservoir project must comply with NBR 12.217/94.

Reservoirs are important for maintaining regular supply in a system, even when it is necessary to shut down a production unit for maintenance interventions. In addition, the reservoirs are essential to meet extraordinary demands that can occur during periods of intense heat.

Depending on the location in the system, the reservoirs can be upstream (before the distribution network) and downstream or overflow (after the network).

The upstream reservoirs are characterized by the following particularities: all water distributed downstream passes through them; their inlet is above the maximum water level and the outlet at the minimum level; they are dimensioned to keep the flow and head of the adduction system constant.

The downstream reservoirs are characterized by the following particularities: they store water in periods when the network's supply is higher than demand, to complement the supply when the situation is reversed; they reduce the physical height and the initial diameters of the upstream network; they have only one pipe serving as the inlet and outlet of the flows.

The distribution reservoirs are sized so that they have the capacity to accumulate a useful volume that meets the equilibrium, emergency and firefighting demands.

The equilibrium reserve is so named because it is accumulated at times of least consumption to compensate at times of the greatest demand, that is, as consumption is fluctuating and the adduction flow is constant, especially in adductions by pumping, at times when the consumption is lower than demand, the reservoir fills so that in the hours when

consumption in the network is higher, the volume accumulated previously compensates for the deficit in relation to the incoming flow.

To determine the firefighting reserve, check with the local Fire Department. With the official rules of the Fire Department and the ABNT standards, the urban occupation of the area can be used to estimate the volume to be stored in the reservoir destined to fighting fires in the locality.

The emergency volume is intended to prevent the distribution from collapsing whenever there are unforeseen accidents with the adduction system, for example, a lack of energy or a rupture of the water main piping. Then, while the problem is being remedied, the volume stored for emergency supplies, also known as accident reserve, will compensate for the lack of water entering the reservoir, preventing consumers from experiencing a water shortage.

5.5.1 Operational Routines Associated with Reservoirs

The reservoirs must be watertight and protected to avoid contamination of the water after it has been properly treated.

In general, the operational routine associated with the reservoirs concerns the feeding process of these units. When the reservoir is supplied by means of a treated water main, by gravity, originating from a treatment plant, the maximum level of the reservoir is controlled by the WTP; when the supply is carried out by means of a treated water main, by pumping, the maximum level of the reservoir is controlled by the pumping station that is conducting the supply.

In this way, the operational routines are limited to inspections at specific times to verify the safety and inviolability conditions of the unit, the state of the concrete and metallic structures and the occurrence of leaks in the reservoir drains. Thus, the following minimum actions must be taken by the CONCESSIONAIRE to guarantee such conditions:

- Control of the automation system, where applicable;
- Periodic maintenance of connections, valves, level indicators, and all the existing equipment in the structure; and
- Periodic inspections to ensure watertightness and loss control.

Since they are units that represent the maintenance of the quality distributed in a supply system, the reservation centers must be well protected against the improper access of individuals outside the service provider.

They must be periodically emptied for cleaning and disinfection, a routine that must be performed in periods of less water consumption.

5.6 Distribution Networks

The distribution system is the set formed by the reservoirs and distribution network, sub-water mains and pump stations that receive water from distribution reservoirs, while the distribution network is a set of pipes and their accessory parts designed to place the water to be distributed to consumers, continuously and at points as close as possible to their needs. The distribution network project must comply with NBR 12.218/94.

Also important is the concept of distribution flows, which is the distributed consumption plus the losses that normally occur in the distribution pipes. Distribution piping is the conduit of the distribution network to which the consumers' building connections are made. This piping can be classified into main ducts, those which, by hypothesis of calculations, allow water to reach the entire distribution network, and secondary ducts, which are other pipes connected to the main ducts.

Another fundamental concept concerns pressure zones. In distribution networks, they are each of the parts in which the network is subdivided in order to prevent the minimum dynamic and maximum static pressure from exceeding the recommended and pre-established limits. It is important to note, then, that a network can be divided into as many pressure zones as are necessary to meet the technical conditions to be met, and it is essential to keep the records up to date.

Conventionally, the pressure zones in potable water supply networks are located between 15 and 50 mca (meters of water column), tolerating up to 60 mca in up to 10% of the area, and up to 70 mca in up to 5% of the same zone, as maximum static pressure, and up to 10 mca in 10% of the area, and up to 8 mca in up to 5% of the same zone for minimum dynamic pressure.

Usually the distribution networks are made up of main pipes, also called trunk or master pipes, fed directly by an upstream reservoir, or by an upstream and downstream reservoir, or even directly from the water main with a downstream reservoir. The secondary lines branch from these main lines, from which practically all of branches for the building extensions come out.

The water distribution system must simultaneously meet the state firefighting system stance, more specifically the fire reserve volumes, the location of hydrants and the minimum diameter of the distribution network for their installation.

The CONCESSIONAIRE shall also ensure the minimum residual chlorine concentration of 0.2 mg/L in the distribution network and, for that purpose, it shall provide water collection points in the distribution network in quantity and sampling periodicity as established in Annex XX of Consolidation Ordinance No. 5, dated 10/03/17. If necessary, it must install and operate water re-chlorination systems in the water distribution network.

5.6.1 Operational Routines Associated with Reservoirs and Distribution Networks

The distribution network is not only comprised of pipes and connections. It also includes special parts that allow its functionality and the satisfactory operation of the system, such as maneuvering valves, plungers, discharges and hydrants, requiring, at certain times, maintenance of the equipment existing in the networks, such as valves and plungers. Closed circuits have closing valves in strategic locations, enabling possible repairs or maneuvers in downstream stretches. In secondary ducts, these valves are located at the shunt points of the main duct.

Most operational routines in a distribution network are associated with it on stream, which requires a thorough system loading process to prevent air pockets from causing any breach.

At some points, discharge valves should be installed to enable drainage of upstream stretches in case of repair. These valves may be replaced by hydrants. In these cases, the site should be meticulously identified and drained to prevent exhausted water from returning and contaminating the system. At the highest points, suction cups should be installed to purge any air accumulated inside the pipe.

Accordingly, periodic inspections of the distribution network should be carried out on a repetitive basis within the operational routine, with the aim of locating leaks that are difficult to identify, repairing any breaches and immediately fixing the identified leaks. In these cases, once the ruptured stretch is identified, the grid should be isolated by closing the control valves and discharging the networks using the discharge valves available. Re-entry on stream should be done with the unloading valves still open to prevent the return of water stored in open ditches to perform repairs. If necessary, water will be discharged into the system to remove any contamination in the pipes.

The monitoring of the quality of distributed water in terms of residual chlorine content should meet the quantity and frequency of sampling as set out in Annex XX of Consolidation Ordinance No. 5. dated 10/03/17, including in terms of residual chlorine content.

These and any other procedures that the CONCESSIONAIRE may deem appropriate must be described in the Operation and Maintenance Manual, to be prepared by each operator. This Manual should be aligned with the integrated information system to enable monitoring of the entire operation.

5.7 Individual Property Connections

The individual property connection is an installation that connects the distribution network to the internal plumbing system of each consumer. Installed together with the connection, water meters control, measure, and record the amount of water consumed at each property, in order to reduce waste, disclose water losses, and provide a fair basis for charging for the service. To this end, water meters should be replaced periodically, at ages defined according to the conditions and technology of the park installed in each period, and with efficiency criteria evaluated in line with the Regulatory Agency.

5.7.1 Operational Routines Associated with Building Connections

The only routines associated with building connections relate to their deployment, which must comply with the service provider's installation standard and, perhaps, the identification and fixing of leaks and irregularities that may occur in the branch that services the building.

5.8 Water Pump Stations

The pump stations are composed of sets of pumps and accessories that lift the piezometric quota of the water transported in public supply services, thus enabling the supply to regions with higher quotas. In addition, the pump stations are intended to transport water to more distant points and to increase the flow in the duct lines. The water pump project should meet the requirements of the Brazilian Standard – NBR No. 12.214/92.

Impediments to the project include the increase in operating expenses arising from electric power expenditure and vulnerability to interruptions and failures in power supply. In addition, it requires specialized operation and maintenance, increasing personnel and equipment costs even further.

5.8.1 Operational Routines Associated with Pump Stations

In view of the technological complexity of the equipment and facilities of a pump station, the operational routines are specific for each facility and, therefore, should comply with the procedures established in the Operation and Maintenance Manual of each unit.

These procedures generally provide for the verification of gasket leaks, preventive maintenance and periodic replacement of pumps, control boards and starting devices, and other parts subject to wear and tear, measurement of vibration in engines, amperage and voltage control of electrical equipment and pump operating time, control of pump automation systems, adoption of energy efficiency optimization techniques and periodic discharge and cleaning of suction wells, if any.

5.9 Water Quality Control Routines

The physical, chemical and bacteriological characteristics of water are associated with a series of processes that occur in the water body and its drainage basin. In a water supply system, treatment processes are designed to turn the water potable and therefore suitable for human consumption.

As previously mentioned, the quality of water distributed in a supply system must meet the potability standards established by the Brazilian Ministry of Health, provided for in Annex XX of Consolidation Ordinance No. 5/2017, which originated from Ordinance No. 2.914, dated 12/12/2011. These potability patterns, which consider several parameters associated with the physical, chemical and bacteriological characteristics of water, are evaluated and controlled at two different times: (i) usually, at the outflow from water treatment plants or after simplified treatment (disinfection and fluoridation); and (ii) at random points of the distribution network.

5.9.1 Water Quality Control in Treatment Units

There are several routines for controlling the treatment process in water treatment stations. To this end, most facilities are equipped with process control laboratories that oversee the evolution of water quality through each step of the treatment process.

As water enters the treatment units, the physical parameters relating to color, pH and turbidity are verified in order to guide the application of coagulants (e.g., aluminum sulfate or ferric chloride and hydrated lime) and bacteriological parameters occasionally for pre-disinfection using chlorine, when deemed necessary, depending on the concentration of algae and microorganisms; after the filtration stage, the physical parameters of color and turbidity are evaluated once again to verify the efficiency of this treatment step; finally, at the outflow of the treatment process, all the physical-chemical and bacteriological parameters provided for in Annex XX of Consolidation Ordinance No. 5/2017 of the Ministry of Health are analyzed.

It is worth noting that the following dosages are carried out in the water at the exit of the treatment station:

- Chlorine, as a disinfectant, at a dosage sufficient to maintain the bacteriological quality of the water (usually not exceeding 2.0 mg/l, to keep a residual content required to eliminate any contamination in the distribution network);
- Hydrated lime or other alkaline material, to correct the pH, making the distributed water neutral or alkaline, thus preventing corrosion in distribution network and household installations; and
- Fluoride, as a cleaning agent for the prevention of dental caries (usually, the fluorosilicic acid is dosed at 0.8 ppm).

Within the context of monitoring the water quality in supply systems, it is worth noting that the regulatory control of the CONCESSIONAIRE is carried out based on the compliance performance indicator, provided for in the Performance Indicator Report, considering the parameters of color, odor, turbidity and residual chlorine in the treated effluent.

An Operation and Maintenance Manual should be created in to ensure the quality of the water to be distributed, and must include the following minimum activities:

- Availability of local laboratory and testing of controls, in each stage of the process, until the stage in which the final treated water is made available;
- Definition of the periodicity of operational control routines and analyzes;
- Setting of parameters for defining the time between each cleaning of the operating units and procedures for these cleaning activities;
- Routines for storage and preparation of chemicals;
- Routines for inspecting the useful life of reagents;
- Routines for measurement and calibration ofequipment.

5.9.2 Water Quality Control in Distribution Networks

Water quality control in distribution networks is one of the requirements for analyzing water potability, provided for in Annex XX of the Consolidation Ordinance No. 5/2017 of the Brazilian Ministry of Health. The Ordinance defines a Sampling Plan that establishes, for each type of evaluation (physical, chemical or bacteriological), the minimum number of samples and the frequency of collection, depending on the population supplied by the system and the size of the distribution network (ANNEX XI, XII, XIII, XIV and XV).

The minimum residual chlorine content in the distribution network is 0.2 mg/L.

6 SEWAGE SYSTEMS

According to the Brazilian Association of Technical Standards (ABNT), a sewage system is the set of conduits, facilities and equipment intended to collect, transport, condition and route only the sanitary sewage to a convenient final disposal site, in a continuously and hygienically safe manner, consisting of sewer branch that services individual properties, sewage collection and transportation network, sewage treatment and adequate final disposal of the treated effluent and the sludge resulting from the treatment. The design of the sewage system must comply with NBR 9.648; the sewage treatment project must comply with NBR 12.209/92; the pump station project must comply with NBR 12.208/92; the intercepting sewer project must comply with NBR 12.207/92; the final outfall project must comply with NBR 12.207/92, and the collection network and branch must comply with NBR 9.649/86. All standards are from the Brazilian Association of Technical Standards – ABNT.

The following is a description of the main operational routines, and it should be noted that the CONCESSIONAIRE must provide a detailed description of the specific operational routines in the Operation and Maintenance Manuals, for each of the existing operational facilities.

6.1 Operational Routines Associated with Sewer Branches that Service Individual Properties and Sewage Collection Network

The periodic clearance of the pipe is the only standard operating routine required for sewer branches that service individual properties and sewage collection networks. Thus, it is necessary to perform periodic cleaning of inspection wells (PVs, poços de visita) and stretches of the system with a low slope level and/or a track record of a high number of maintenance and immediate clearance, eliminating overflows in the system and branches, hence the importance of maintaining the records up-to-date.

Since this is an absolute separator system, with treatment at the end of the process, under no circumstances will the introduction of rainwater be allowed. To ensure this requirement, the service provider undertakes to:

- When approving and executing the internal plumbing connections of the individual property, check the existence of appropriate conditions for the collection and run-off of rainwater;
- Separate existing sewage networks that discharge sewage into rainwater networks/galleries, route them and interconnect them to the trunk sewer;
- When connecting the sewage collection network to the trunk sewer, check if there is no rainwater flowing into the system;
- Fully separate the sewage system and the rainwater system; and
- Adjust existing connections to meet previous topics.

To protect the system against the introduction of foreign objects, all inspection chambers must be provided with airtight and plug-in covers.

In order to ensure the requirements for protection of the public sewage system, when approving and executing the internal plumbing connections of individual properties, the service provider must verify the existence of appropriate conditions for meeting the aforementioned requirements.

Inspectors of the service provider must carry out inspections periodically and in case of any suspected abnormality in the operation of the piped sewage system of the individual property.

In order to meet any requirements provided for in specific municipal laws, the pavements and roadways must be restored to the same conditions prior to the intervention, unless prior agreement with the city.

6.2 Operational Routines Specifically Associated with Trunk Sewer

Gravity trunk sewers, interceptors, and outfalls only require periodic inspections to determine the need for repairing or cleaning the sewer. The inspection wells and lines should be cleaned whenever silted up, which can be checked by surveying the bottom of the well, or when they have crusts of fat or other materials.

At the service provider’s discretion and as convenient, periodic preventive cleanings may be scheduled to reduce the likelihood of clogging.

In the event of lines located by the banks of a river/stream, the service provider should periodically clean the area by removing vegetation, thus enabling access to inspection wells and chambers.

In the event of any clogging identified and reported by users, cleaning and clearance teams should be assigned to identify the causes and fix the problem. This service ranges from a simple clearance by pressure-jet equipment to the replacement of the damaged stretch.

In instances where identification occurs during the preventive maintenance process, the services are scheduled and executed in conformity with the requirements of each case.

6.3 Operational Routines for Sewage Lift Stations

For sewage lift stations, the operational routines must follow the procedures established by the Unit’s Operation and Maintenance Manual and are analogous to the routines described for water pump stations, with all sanitary precautions, as highlighted below:

- Pump automation control and maintenance;
- Adoption of energy efficiency optimization methods;

- Periodic reading of electrical quantities (amperage, voltage) and the uptime of pumps;
- Preventive maintenance on pumps, control boards and starting devices; and
- Periodic discharge and cleaning of grids and suction wells, and sand traps, if any; to this end, a device for the removal and movement of pumps should be provided.

6.4 Operational Routines of Lift Pump Pipelines

Lift pump pipelines transport the sewage to the Sewage Treatment Plant, Sewage Lift Station, or to some inspection well at the nearest sub-basin, and are key components for the system in question, which must be operated according to its specifications. Control of the quality, quantity, and run-off speed of the transported sewage may be required to ensure proper operation of this system.

Therefore, the service provider should also perform periodic inspections on the lift pump pipeline to check the need for repairs, maintenance and cleaning.

In order to streamline the operation and maintenance of the system, the project usually provides for the installation of valves along the lift pump pipeline, at the points where the lifts connect to the single pumping, in the interconnection boxes. Such valves can isolate both the lifts and the stretches between the lifts, facilitating the maneuvers for discharging and cleaning the network.

The isolation of a stretch of the lift pump pipeline can be performed after shutting down the lifts associated with this particular stretch, by closing of the valves of the interconnection boxes; these valves should be closed slowly to avoid disruptions in the hydraulic system of the sequential stretch, in case it is on stream.

It is worth noting that the project usually provides for discharges along the lift pump stretches with the purpose of emptying the line, in addition to suction cups for air flow. Both the emptying and filling of lift pump pipelines must be done gradually, so that the pipe is fully filled with air – in the case of discharge – and the air is fully removed from the pipe – in the case of filling of the line –, thus avoiding damage to the pipe.

The walls of the lift pump pipelines in operation usually start accumulating sediments with time; in this case, when cleaning the pipes, the service provider is advised to use Cleaning PIGs devices to scrap the pipes. This device is placed into the line through a launcher installed in the manifold of the lift and, by means of hydraulic propulsion, it travels the entire stretch to be cleaned until it reaches its final point, which can be an inspection well or chamber.

Periodic maintenance of connections, valves and suction cups of lift pump pipelines should also be stipulated.

6.5 Operational Routines for Sewage Treatment Plant

The operational routines for sewage treatment plants should be aligned with the procedures established in the specific unit's Operation and Maintenance Manual, the most common being removal of the material collected in the grid and sand trap for final destination, control of the age of the sludge, the oxygen content in the vent stations, the concentration of solids in the vent tanks and the sedimented sludge, preparation of chemicals and verification for dosage adjustments, automation of pumps and dosing equipment, periodic preventive maintenance on pumps and dosing agents, UV lamps, control boards, valves, and other equipment at the water treatment station, the quality of the raw effluent treated for final destination, periodic discharge and cleaning of reactors and decanters, and preparation and application of the Sludge and Solid Waste Management Plan, among others.

Quality control in a sewage system is associated with the quality of the effluent from the Sewage Treatment Plants, final disposal of which usually occurs in a watercourse.

In this respect, Resolution No. 357, dated 03/17/2005, of the National Environment Council (CONAMA), provides for the sorting of water bodies and environmental guidelines for their classification, and establishes the requirements and standards for effluent disposal. In turn, CONAMA Resolution No. 430, dated May 13, 2011, provides for the requirements and standards for the disposal of effluents, complementing and amending CONAMA Resolution No. 357.

The main control parameters are: (i) the Biological Oxygen Demand (BOD), which corresponds to the amount of oxygen consumed in the decomposition of organic matter by biological processes, measured in mg/L O_2; (ii) the Chemical Oxygen Demand (COD), which assesses the amount of dissolved oxygen (DO) consumed in an acid medium, which leads to the decomposition of organic matter, whether or not it is biodegradable, measured in mg/L O_2; and Total Suspended Solids (TSS), which represents the concentration of solids present in a sample, which may be in suspension or decanted.

All analyzes must be performed according to the latest publication of the Standard Methods for the Examination of Water and Wastewater, edited by the American Water Works Association.

Within the context of monitoring the quality of treated sewage, it is noteworthy that the regulatory control of the CONCESSIONAIRE is carried out based on the Compliance Performance Indicator, provided for in ANNEX III - PERFORMANCE INDICATORS AND SERVICE TARGETS, considering the parameter of $BOD_{5,20}$ in a compound sample in the treated effluent.

The CONCESSIONAIRE shall complete a technical study, within 2 (two) years of the signature of the AGREEMENT, to assess the possibility of using the organic sludge generated in the Sewage Treatment Plants (ETEs) it operates as biogas and organic compound.

In the case of Barra ETE and others in a similar situation, the aforementioned utilization can only occur after receipt of the contaminating sludge is interrupted, such as that originating from the River Treatment Units – UTRs.

7 GENERAL ASPECTS

7.1 Binding obligations

The CONCESSIONAIRE shall observe, at least, the following legal instruments or legislation that replaces them:

- Principles and guidelines of Federal Law No. 11445, dated January 5, 2007, which regulates the national guidelines for basic sanitation and for the federal basic sanitation policy and Regulatory Decrees No. 7217/2010 and No. 9254/2017;
- Principles and guidelines of Federal Law No. 14,026, of 07/15/2020, which updates the legal framework for basic sanitation, among other provisions;
- Principles and guidelines of State Law No. 005/1994, which establishes the Environmental Protection Code of the State of Amapá;
- Quality control of the water distributed in the operated systems must meet the legal requirements, provided for in Annex XX of the Consolidation Ordinance No. 5/2017, of the Brazilian Ministry of Health;
- Effluent disposal from sewage treatment plants must comply with CONAMA Resolution No. 430/2005, dated 05/13/2011; and
- The systems must be operated in compliance with federal labor and occupational safety legislation.

7.2 Master Plan

The CONCESSIONAIRE shall develop a Master Plan for each municipality, within a period of up to 18 (eighteen) months of taking over the SYSTEM, considering the main actions to achieve the targets presented in chapter 4 of this ANNEX, as specified in a construction plan, time schedule and the applicable investments required to be developed within the CONCESSION AREA, which enable the efficient management of the investments planned for the expansion and improvement of the water and sewage systems, as well as the control of the achievement of the expected service targets.

In addition, the Master Plan shall also consider the development of corporate governance measures, explained below and the establishment of regulatory controls, necessary to maintain the balance of the AGREEMENT.

The REGULATORY AGENCY shall have 90 (ninety) days to comment on it. If the REGULATORY AGENCY does not comment on it, the Master Plan shall be deemed approved.

7.3 Corporate Governance and Compliance

Nowadays, companies' transparency is increasingly demanded by the market and society, it is important that the CONCESSIONAIRE observes the concepts of governance and compliance while conducting its activities, in order to ensure its sound management and business reputation.

Governance refers to how companies are managed, which includes policies, regulations, culture and processes. In this respect, it is essential that the CONCESSIONAIRE develops the following instruments: (i) the Services Regulation, approved by the CONCESSION AUTHORITIES, standardizing all company processes; and (ii) its main policies, such as Personnel, Environmental, Acquisitions, Asset Control, Billing, Investments, and others – duly explained, known and followed by all employees.

Corporate governance addresses the relationship between internal stakeholders – partners, directors and board of directors – and external stakeholders – inspection, regulatory and government bodies. In a nutshell, it gathers the strategies a provider has to demonstrate its value. Accordingly, governance encompasses actions aimed at strengthening the company's reputation, ensuring the internal benefits of working with ethical and competitive regularity for being known as an honest and trustworthy company.

In turn, compliance is the way to ensure that the CONCESSIONAIRE's management and positioning follow the current standards, respecting the commitment to ethics and truth. A compliance program implies a guarantee that the laws and regulations for operations are strictly fulfilled. The CONCESSIONAIRE, when developing compliance concepts, is responsible for identifying faulty points in its activity and resolving them. Thus, the company's image is strengthened regarding to how seriously and dutifully it conducts its operations.

In this respect, the CONCESSIONAIRE shall develop a compliance policy, observing the applicable laws, and provide thorough information to all stakeholders, through the internet and other means of communication.

7.4 User Awareness

Wheres the proper functioning of a sewage system largely depends on the proper use of the facilities by the benefited USERS, an important phase of the SYSTEM OPERATION refers to the process of sanitary education and awareness of the USERS.

This is one of the most important steps to achieve the maximum benefit from the installed facilities, for as long as possible. The CONCESSIONAIRE shall prepare a Social Communication and Environmental Education Program, aiming at raising USERS' awareness and, therefore, fostering their collaboration. The Program shall be drafted within 3 months after the beginning of the OPERATIONS [•]. It must be approved by the CONCESSION AUTHORITIES before its disclosure to the public and may follow the following methodology:

- **Disclosure of the Regulation** – may be through the publication of a booklet or leaflets, which must be sent free of charge to USERS, preferably together with the first bill for the collection of sewage charges.
- **Discussion on the Sewage matter** – the discussion on the sewage matter may occur directly, through lectures, or indirectly, through the distribution of explanatory leaflets.
- **Direct Discussion** – may be through recurrent lectures and round tables, for the dissemination and debate on the matters related to domestic sewage. They may be targeted at specific groups, such as: primary and secondary schools; neighborhood associations and community leaders.
- **Indirect Discussion** – may be through the periodic distribution of informative leaflets, containing information such as the importance of a sewage system and how it works, how to prevent clogging and other damages to the system, pollution of water sources and other specific topics deemed appropriate. Leaflets may be distributed along with the bill for the collection of sewage charges, in schools and other places deemed advisable.

It is important to stress the possibility of using more direct communications with USERS, through apps, e-mail or messaging channels. This information process may even include other information relevant to the USER, such as: average monthly water consumption; comparison of average consumption with standard groups; incentives for the rational use of water; and warnings of possible leaks in internal building installations, in the event of out-of-average consumption.

7.5 Maintenance Deadlines - USER Interface

Whereas it is necessary that stoppage interventions to maintain water and sewage systems affect USERS as little as possible, it is important that the CONCESSIONAIRE implements adequate structures for the execution of such services. These structures shall be scaled and implemented to deliver the services within previously established deadlines. In this respect, it is worth mentioning that such deadlines are deemed as regulatory requirements, subjecting the service provider to notifications and fines, in cases of non-compliance.

An Ombudsman channel, website and *app* must be created and disseminated to allow the consultation of information and the submission of complaints/service requests.

In this sense, in a nutshell, it is the responsibility of the CONCESSIONAIRE: (i) to implement a Call Center, open 24 hours, to handle, at no cost, requests for services and

information from the CONCESSION'S USERS; (ii) to implement in each served municipality, at least one physical store, for USERS' face-to-face assistance; (iii) to implement an online service system for USERS on the internet; (iv) to scale and structure maintenance teams appropriate to the size, quantity and types of services; (v) to provide the maintenance teams with tools, equipment, vehicles and materials, necessary for the execution of the SERVICES; (vi) to execute the SERVICES within a previous schedule, remotely following and monitoring the teams in the field; (vii) to implement a performance management system for the services conducted, calculating indicators and establishing the necessary adjustments.

All service channels must follow the resolutions of Decree No. 6523/2008, regarding the time taken to assist USERS or definitions established by the REGULATORY AGENCY.

7.5.1 Fulfillment of Request and Complaint Deadlines

This refers to meeting deadlines to respond to complaints and/or service requests, which must comply with the deadlines established in ANNEX III – PERFORMANCE INDICATORS AND SERVICE TARGETS. These services include, at least: a) Water connection; b) Repair of water leaks; c) Easel repair; d) Local or fill-scale water shortage; e) Sewer connection; f) Unclogging sewage networks and branches; g) Occurrences related to repaving; h) Inspection of water quality; i) Inspection of water shortage/low pressure; j) Resumption of the water supply due to lack of payment; k) Resumption of the water supply at the request of the USER; l) Occurrences of a commercial nature (reading review, analysis of documentation and conditions for granting a social tariff); m) Relocation of water branch; n) Easel removal; o) Replacement of a water meter at the request of the USER.

To this end, the CONCESSIONAIRE shall establish, at least, the following procedures:

- Provision of personnel, vehicles and tools necessary for the fulfillment of requests;
- A computerized system for the registration of Service Orders (SO), with the progress track until resolution, in order to inform the applicant and the regulator about the fulfillment of deadlines; and
- Statistical management report with a summary of compliant and non-compliant deadlines.

With regard to corrective maintenance, timeliness in the correction of failures is of utmost importance, as it indicates the perception and assessment of the USER before the SERVICE provided. Therefor, in the part referring to corrective maintenance, the CONCESSIONAIRE must propose, at least, the following terms:

Service	Service deadline
Water or Sewage Connections	5 business days
Repairs or unclogging water and sewage networks and branches in locations with an urban population of up to 100,000 inhabitants	24 h
Repairs or unclogging water and sewage networks and branches in locations with an urban population greater than 100,000 inhabitants	48 h
Sewage Pumps	8 hours
Water meter replacement (except pool renewal)	2 (two) business days
Inspection of building water or sewage connection	8 (eight) business days
Repaving roads or sidewalks	2 business days
Other services to USERS*	2 business days

* “Other services to USERS” are additional services, referring to requests for services by USERS, which may generate new demands.

The time elapsed between the request for the service by the user and the date of its effective completion is defined as the service deadline.

All leak occurrences, those reported by USERS and those identified by the CONCESSIONAIRE itself, must be recorded in the integrated information systems and with access available to the REGULATORY AGENCY.

7.6 Integrated Information System

In order to enable full operation management and maintenance of the entire water and sewage infrastructure, the CONCESSIONAIRE shall develop and implement an integrated information system that accounts for the main stages of the operation, maintenance and selling of the systems.

In this respect, Operation and Maintenance Manuals for the units that are components of the existing water and sewage systems shall be prepared, considering the as-built of the facilities, the performance and control indicators and a detailed description of the operation and maintenance routines of the units. Regarding the Maintenance segment, corrective,

preventive and predictive measure routines (maintenance based on the state of the equipment) shall be considered.

As a result of the Integrated Information System, an Integrated Management System shall be implemented, encompassing the system's operational and maintenance activities.

7.7 Operational Control Center

7.7.1 OCCs in the served locations

The CONCESSIONAIRE shall design and implement as many Operational Control Centers (OCC) as feasible in each location of operation, which allows remote supervision of the existing systems, by obtaining the main data and quantities by telemetry, from the online analysis in models previously developed and remote decision-making and real-time execution, via remote control.

The Operational Control Center implies the implementation of a measurement and automation infrastructure, which considers flow, pressure and level meters, control valves and other equipment necessary for the supervision and remote control of the existing systems.

The OCC must be structured to operate 24/7 and, in addition to monitoring the functioning status of the water and sewage systems, it must, through a closed-circuit television system (CCTV), carry out continuous surveillance and monitoring of the units, preserving the integrity of the facilities against invasions and depredations.

The CONCESSIONAIRE shall install sensors in the operational units, preferably in the:

a) Substations and Units in General – electrical variables (voltage, current, power), rotation, operating status, bearing temperature, vibration, level sensors and overflows, as well as a motion sensor and a remote control, must be controlled via a supervisory system;

b) Surface Water Abstraction, Wells, Pumps, Water Treatment Plants and Reservoirs – sensors must be installed at characteristic points to monitor flow rates, allow control operations in situations of operational normality, as well as during emergencies;

c) Rivers, Abstraction Dams and Treated Water Reservoirs – level sensors to allow viewing the volume available in the units;

d) Pipelines and Distribution Network – flow and pressure sensors at strategic points, macro-meters and pressure regulating valves to allow managing and balancing pressure and flows of the distribution system;

e) Water meters – it is appropriate that micro-measurement be by telemetry and integrated with the OCC controls;

f) Water Treatment Station Plant and Wells – a set of sensors must be installed for monitoring variables defined for each type of equipment of the following types: electrical variables (voltage, current, power etc.), hydraulic variables (flow, pressure etc.), mechanical variables (rotation, vibration temperature) and treatment parameters (residual chlorine, pH, color, turbidity, hardness and specific conductivity). Environment control (motion sensor and video camera) at the main operating points that are an integral part of the treatment process with remote control from the OCC to allow managing the operation through a supervisory system;

g) Collecting Network and Interceptor – flow sensors must be installed at characteristic points to monitor flows, especially in periods of exceptional discharges (rain etc.), to allow control operations in situations of operational abnormality, and level sensors in strategic PV to anticipate possible overflows;

h) Sewage Pumping Stations – level, flow and pressure sensors must be installed in the discharge lines; and

i) Sewage Treatment Station Plant – a set of sensors must be installed for monitoring variables defined for each type of equipment of the following types: electrical variables (voltage, current, power etc.), hydraulic variables (flow, pressure etc.), mechanical variables (rotation, vibration temperature) and treatment parameters (DO, BOD, SS etc). Environment control (presence sensor and video camera) at the main operating points that are an integral part of the treatment process with remote control from the OCC to allow managing the operation through a supervisory system.

7.8 Energy Efficiency Optimization Program

Since energy is the second most relevant operating expense in the rendering of water and sewage services, the CONCESSIONAIRE must implement an Energy Efficiency Optimization Program with measures to reduce unit consumption (R$/$m^3$) and specific consumption (KWh/m^3) at in-service facilities.

Within this approach, the CONCESSIONAIRE must appraise the technical and financial feasibility of migrating the existing units to the Free Electric Energy Market Environment to reduce expenses with this important operational intake. Depending on the hydraulic characteristics of the systems, perhaps the UTILITY should also evaluate the opportunity for self-generation of energy.

On the other hand, in order to reduce the specific consumption indicator, measures should be implemented with the aim of upgrading and increasing the operational performance of the in-service electrical equipment, such as retrofit of motor pump sets, switchboards, control panels, and the installation of frequency inverters, among other actions.

7.9 Technical and USER Registration Program

In order to maintain the accuracy of data about the operational infrastructure in operation and about USERS of the SERVICES, the CONCESSIONAIRE must have ongoing routines in place for updating the technical records of operating assets of the CONCESSION and USERS.

In this respect, the systems should be georeferenced with a GIS (Geographic *Information* System), while the registration of USERS must be interconnected with the geographical databases of water distribution and sewage collection systems and with the commercial billing and collection system, within 2 (two) years from taking over the SYSTEM.

The deployment of ongoing routines for updating the information arising from the deployment of new systems (as-built), as well as data collected during network maintenance interventions, will enable the continuous updating of the registration databases of the infrastructure. Likewise, the systematic updating of USER information upon reading of meters and issuance of monthly bills will ensure the reliability of USER data and an effective billing and collection process.

7.10 Water Loss Reduction and Control Program

In view of the high water loss ratios of water supply systems, the CONCESSIONAIRE shall develop and implement a Water Loss Reduction and Control Program comprising measures to mitigate physical losses, including the implementation of flow, pressure, and level macrometers to measure all hydraulic quantities; deployment of pressure reducing valves; deployment of data loggers for obtaining and storing operational data*;* sectorization of distribution networks; micro metering programs; deployment of Measurement and Control Districts (DMCs); inspection and elimination of invisible leaks (leak detection using geophone), and other loss reduction measures, in addition to micro measurement universalization.

From time to time, due to the aging of the networks, of the materials used, and the operational conditions, the service provider must evaluate the feasibility of replacing older pipes and sewer branches that service individual properties featuring frequent breach and leaks.

Also within the context of losses, it is imperative for the CONCESSIONAIRE to operationalize the water systems based on findings from hydraulic modeling, which ensure the efficient operation of the systems in proper flow and pressure conditions.

Loss reduction targets are set out in the ANNEX III – PERFORMANCE INDICATORS AND SERVICE TARGETS.

7.11 Water Metering Program

The existence of a water meter in an internal plumbing connection enables not only the fair charging of consumption, but also the dissemination of practices for rational use of water.

With this approach, water supply systems should preferably be 100% water metered, and the installed meters should be working properly. To this end, the CONCESSIONAIRE shall develop programs consisting of at least the following activities: (i) installation within 2 years for Macapá and Santana and 3 years for the other municipalities, from taking over the SYSTEM,of water meters in all unmeasured connections; (ii) replacement within up to 5 years of all water meters featuring reading incidents – water meter reading stalled, blurred dome, damaged meter, etc.; (iii) scheduled replacement of all water meters that have exceeded their useful life – usually around 7 years – taking into account the technical provisions of manufacturers; (iv) programmed replacement of water meters that have exceeded their consumption recording capacity, as per previously established limits; and (v) installation of water meters equipped with remote reading transmission devices, for recording and monitoring consumption of connections of large consumers.

In addition to the aforementioned requirements, the CONCESSIONAIRE shall also have (i) adequate minimum stock in place to ensure that no new connection is deployed without a meter; (ii) operational installations with benches for performing measurement tests and calibration of meters; and (iii) standardized procedures for performing commissioning and quality tests in water meter manufacturing plants, in the event of bids for the purchase of new water meters.

The ongoing implementation all previously described measures will help the CONCESSIONAIRE reduce apparent water losses, by eliminating consumption sub-measurements and curbing waste.

7.12 Staff Development and Training Program

As a way to ensure that the activities within the sphere of CONCESSION are carried out in accordance with the best practices established in the operation and maintenance manuals, the CONCESSIONAIRE shall develop a comprehensive Training Program aimed at developing the technical skills of its employees.

The Program should comprise actions at the various levels of service, thus contributing to increased productivity, improved performance, fewer errors within operational routines, reduced costs, higher yield, motivated people and teams, and less accidents during working hours.

7.13 Contingency Plans

In view of the priority and indispensable nature of provision of water and sewage services, the CONCESSIONAIRE shall develop Contingency Plans for strategic units, with defined responsibilities within the organization for the operation of these systems in emergency situations.

With this approach, Contingency Plans should consider: (i) risks that may stall the systems and effects resulting therefrom;(ii) in the event that the risk materializes, the measures to be taken to attenuate its effects; and (iii) the measures to be taken to prevent the occurrence of risks.

Contingency Plans should objectively describe the measures to be taken in emergency situations, and are intended to train, organize, expedite, and standardize the measures required in control responses and for tackling abnormal occurrences. Thus, the Plans address the consequences of a claim and prevent other claims from arising as a result of the conditions created.

Once the risks are identified, the Plans should structure strategies, gather human, technical and logistical resources, and disseminate and train the organization through emergency drills.

7.14 Anti-Fraud Program

With the aim of optimizing the billing and collection process, the CONCESSIONAIRE shall implement programs for detecting and eliminating illegal connections and other commercial fraud. These frauds are identified through average consumption analyses, comparisons of CONCESSION AREAS, tests on the sewer branches that service individual properties to identify the existence of by-pass or fraud in water meters, and by visual inspection.

The systematic implementation of this type of investigation, its disclosure within the CONCESSION sphere and the application of fines, inhibits the dissemination of the practice among USERS.

7.15 Social and Environmental Programs

Social and Environmental Programs can be defined as management tools that can enhance the positive impacts of a given enterprise while mitigating/controlling negative impacts.

These programs originate from environmental licensing, and are based on a continuous improvement rationale and on the ISO 9001 and 14001 standards.

Within this approach, the CONCESSIONAIRE shall implement Environmental Education; Water Quality Control; Effluent Quality Control; and Dam Safety programs, among others. The

development and implementation of these programs should be described in their respective manuals and should comply with respective best practices and technical standards.

7.16 Environmental Guidelines

The development of projects, deployment, and operation of Water Supply Systems and Sewage System projects require compliance with the environmental guidelines in force provided for by laws and regulations at the federal,state and municipal levels, and with requirements set out in best practices and by the relevant environmental agencies. The CONCESSIONAIRE must comply with such provisions in connection with the ventures for which it will be held environmentally liable.

For all accountability and liability effects, the CONCESSIONAIRE is objectively responsible for providing civil remedy for environmental liabilities arising during the legal term of the AGREEMENT and related to its fulfillment.

In addition to the obligations related to the legality of operations, the CONCESSIONAIRE undertakes to adopt best practices for use and preservation of natural resources.

7.16.1 Environmental Licenses and Permits

For environmental regularity purposes, all the infrastructure and activity in the process of implementation and/or in operation by the CONCESSIONAIRE must comply with the legal requirements for licensing, permits, certifications, records and grants required at the federal, state and municipal levels, for continued validity of this set of documents, and with the respective guidelines (such as technical and validity requirements).

At the expiry of the term of the AGREEMENT, the CONCESSIONAIRE must return the facilities fully regularized, with environmental licenses and grants valid for a minimum period of 6 (six) months, or with the petition for renewal filed within the legal time frame.

7.16.2 Regularization

In many cases, the license is pending approval due to the need for improvements in units or in specific technical studies that support the technical requirements of licensing agencies.

The CONCESSIONAIRE must take all the necessary action to fully regularize these facilities and the operation, which may range from identifying and providing remedy to any existing liabilities to fully obtaining all licenses, permits, or grants from the authorities concerned.

CAESA and SEMA have signed an ENVIRONMENTAL COMMITMENT TERM (TCA, Termo de Compromisso Ambiental) in order to regularize all licenses pertaining to existing SYSTEMS.

Through this TCA, SEMA authorizes, throughout the term thereof, the operation of systems and infrastructures, refraining from imposing any administrative fines arising from

non-compliance with environmental legislation within the sphere of the regionalized provision of the SERVICES in the MUNICIPALITIES as set out in the AGREEMENT.

The regularization process should start within 06 (six) months from the onset of OPERATIONS OF THE SYSTEM, and the CONCESSIONAIRE must take action to meet the agreed provisions, which comprise the following phases:

1. Phase I: Diagnosis and Planning.
2. Phase II: Implementation.
3. Phase III: Regularization of environmental licenses and issuance of Grants for Use of Water Resources.
4. Phase IV: Maintenance and Continuous Improvement.

Any costs related to fines and fees of environmental liabilities prior to the date of the transfer of operational responsibility to the CONCESSIONAIRE shall be borne by CAESA, even if discovered after the SYSTEM OPERATION was transferred.

CAESA shall also bear all costs related to liabilities, indemnities, and conditions of any nature arising from the TCA signed to remedy such environmental liabilities prior to the date of the transfer of operational liability.

The CONCESSIONAIRE shall bear all costs related to mitigating, corrective, and compensatory measures, notary and other fees, studies and projects, renovations or expansion required for environmental regularization and not directly related to pre-existing liabilities.

The TCAs signed between the parties are attached to these SPECIFICATIONS (appendices 1 to 4), and the CONCESSIONAIRE may opt to abide by these instruments, as per the provisions of the TCAs.

7.16.3 Renewal

Upon transfer of the SYSTEM OPERATION, the CONCESSIONAIRE must submit the request for change of ownership of all existing licenses, permits, or grants.

Thereupon, the CONCESSIONAIRE shall be solely responsible for renewing these licenses and their continued validity.

7.16.4 Infrastructure Expansion

The CONCESSIONAIRE is solely responsible for complying with environmental regulations associated with the expansion of the infrastructure of the systems.

7.17 Environmental Licensing Process

The process for obtaining the environmental licenses for Water Supply Systems and Sewage Systems, by the CONCESSIONAIRE, consists of submitting a request to the relevant environmental agency, according to the stage of development.

The UTILITY shall verify the licensing jurisdiction according to the activity to be developed, the size of the venture, the polluting potential, and the reach of the environmental impact. Thus, the license may be requested at the federal (Brazilian Environmental Institute – IBAMA), state (State Environmental Agency – SEMA) or municipal (Municipal Department of Environment) levels.

The CONCESSIONAIRE shall meet the environmental requirements in allstages of licensing of the projects under its environmental responsibility.

7.18 Use Grant Process

Water collection and effluent discharge activities are regulated by grants for collection of water and grants for discharging of effluents.

The grants for water bodies are issued at the state level by the State Environmental Agency – SEMA and, at the federal level, by Brazil's National Water Agency – ANA.

The CONCESSIONAIRE shall meet the requirements in all stages of application for grants for ventures under its environmental responsibility.

In the case of existing grants, the CONCESSIONAIRE must arrange registration in its stead.

7.19 OPERATION AND MAINTENANCE MANUALS

- Bellow

is a description of the information minimally necessary, non-restrictively, which should be included in the operation and maintenance manuals that will be prepared by the CONCESSIONAIRE,

comprising the operational, maintenance, and safety/emergency procedures for carrying out the activities, including the component units of the Water Supply and Sewage Systems.

The guidelines must be straightforward and no double entendre, enabling the operator to understand fully the message being conveyed. Where necessary, warning signs should be highlighted to draw the attention of operators in the event that an activity is likely hazardous.

The manuals should also include illustrations/photos to help readers understand the wording and should be available to all USERS in the workplaces.

Maintenance activities must be divided into three categories: Preventive, Corrective and Emergency.

The information in the operation and maintenance manuals is as follows:

- Hygiene and safety precautions;
- Environmental and personal accident control plan;
- Contingency plan;
- Technical standards used in design and construction;
- Description of the general and operational characteristics of the systems;
- Project records and sketches;
- Manufacturers' manuals;
- List and technical characteristics of the equipment;
- Description of the main issues arising in each of the units and measures to tackle them;
- Description of operational routines in the system process units, namely water treatment and sewage stations;
- Demonstrate the procedures to be adopted at the onset of operation and decommissioning of each unit of the systems;
- Time schedule of periodic reviews to be carried out with the aim of performing preventive operation/maintenance;
- Describe the team and the minimum equipment to be assigned/allocated for the operation/maintenance of each unit of the system, according to size and degree of automation;
- Sheets or forms with the relevant data of each equipment (flow, pressure, voltage, engine amperage, uptime, vibration, etc.) and other relevant data including the frequency in which the data sheets must be filled in, weather conditions, odor in the units, etc. In addition to this information, the data sheets shall cover occurrences significant for the operation, such as equipment failure, duration of operation, power outage and length of outage, and if possible, the causes of these problems;
- Guidelines for operators to be observed during the inspection of systems aiming at the execution of a preventive operation/ maintenance, such as: watertightness, leaks, abnormal noise, vibration, operability and the finishing of all civil works, the operability and finishing of electromechanical systems, pipe supporting devices, etc.;

- Monitoring plan of the distribution network for investigation and corrective action in instances of non-compliance with water potability standards, through adoption of protocols of conduct for detection and corrective actions, including the preparation of a plan that ensures periodic evaluation of the system, effective operational monitoring, and management and communication.