

# Chapter 10

## Rural Water Management



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**Abstract** In 1960, only 6% of the rural population had an adequate water supply system. At present rural water coverage has increased to 53%; however, considering only concentrated and semi-concentrated rural towns, 88% the rural population has access to water supply systems. This increase is the result of Chile's national Rural Potable Water (APR) program, which has provided rural water infrastructure to concentrated and semi-concentrated rural towns. This infrastructure is managed by user committees or cooperatives, which operate and invest in maintenance, improvement and expansion of the systems. Over time several APR have presented problems in supplying potable water in quantity, quality and continuity. This is due to the lack of management capacity. This chapter presents an overview of Chile's national Rural Potable Water (APR) program and identifies its actual challenges and necessary reformulations.

**Keywords** Chile · Rural water sanitation · Rural water supply

### 10.1 Introduction

Beginning in the 1960s, a large portion of the rural population did not have access to drinking water. During this decade, only 6% of Chile's rural population had a potable water supply system, which had significant consequences for public health. The infant mortality rate, which was 120.3 deaths per thousand children under 1 year old (Kaempffer and Medina 2006) was higher than rates in countries with a lower socio-economic development (Castañeda 1996). In addition, 8.6% of infant mortality was caused by illnesses of the digestive tract (Castañeda 1985).

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In response to limited access to drinking water in rural areas, the Rural Potable Water Program (PAPR in its Spanish acronym) was born in 1964. The infrastructure provides rural potable water (APR) to concentrated<sup>1</sup> and semi-concentrated<sup>2</sup> rural towns, which must comply with the methodology and evaluation standards established by the Ministry of Social Development (MDS).<sup>3</sup> The infrastructure's administration, operation, and maintenance were turned over to APR<sup>4</sup> committees and cooperatives which already existed or were newly created for this purpose. The Program also invests in system improvement and expansion as necessary. Finally, consulting, training, and supervision will be provided to aid the work of the committees and cooperatives through each APR system's respective Technical Unit (UT), the concessionaire of Regional Water Supply Services.

The APR program considers the population living in rural areas in broad terms as a potential population. This is slightly larger than a "rural" population according to its official definition (INE), which is used by the MDS for its Socioeconomic Description (CASEN) surveys.<sup>5</sup>

Since its founding until 1964, the program has provided APR infrastructure to 1685 concentrated and semi-concentrated towns (Fig. 10.1), serving 1,900,000 beneficiaries and increasing the rural APR coverage from 6% in 1960 to 53% by the year 2014<sup>6</sup> (Donoso et al. 2015).

The rural sector's supply of potable water has fallen under the purview of APR organizations. These organizations, comprised mainly of committees and cooperatives, number 1685<sup>7</sup> throughout Chile (Fuster et al. 2016). Community-based management has allowed members of the organizations to administrate, operate, and

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<sup>1</sup>Minimum concentration is defined as a population of 100/150–3000 inhabitants and a concentration of at least 15 homes per kilometer in the potable water network.

<sup>2</sup>Having at least 80 inhabitants and a concentration of at least eight homes per kilometer in the future network.

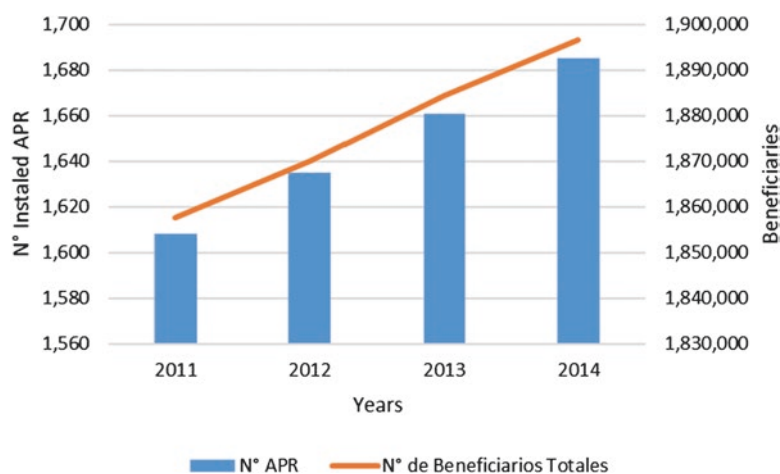
<sup>3</sup>Since 2015, the "scattered" rural population expanded to encompass the entire rural population. A scattered rural population is defined as having at least 80 inhabitants and a concentration of at least eight homes per kilometer in the future network.

<sup>4</sup>The APR committees and cooperatives organize their beneficiaries into groups and are responsible for the administration, operation, and maintenance of APR systems. They manage the APR systems' operational, accounting, and community organization aspects.

<sup>5</sup>INE does not directly define rural, but only defines it in negative terms in terms of what is not "urban". An "urban area is defined as a group of homes with a concentration of upwards of 2000 inhabitants, or between 1001 and 2000, when 50% or more of the population is involved in secondary or tertiary economic activities. In special cases, in areas where there are centers for tourism and recreation and more than 250 homes but the population requirement is not met, these are considered as 'urban entities.' As such, an urban area is comprised of urban entities" (Donoso et al. 2015). Anything outside these definitions would be understood as rural (having less than 2000 homes, or having between 1001 and 2000 homes where less than 50% of the population is involved in secondary or tertiary economic activities, except for tourism and recreation centers hosting over 250 homes).

<sup>6</sup>Coverage is calculated without considering the concentrated rural towns served by the program which are defined as urban according to the CASEN/INE classification.

<sup>7</sup>New APR systems are always being set up so this number may change with time.



**Fig. 10.1** Number of towns and beneficiaries with rural water supply systems (APR) (Donoso et al. 2015)

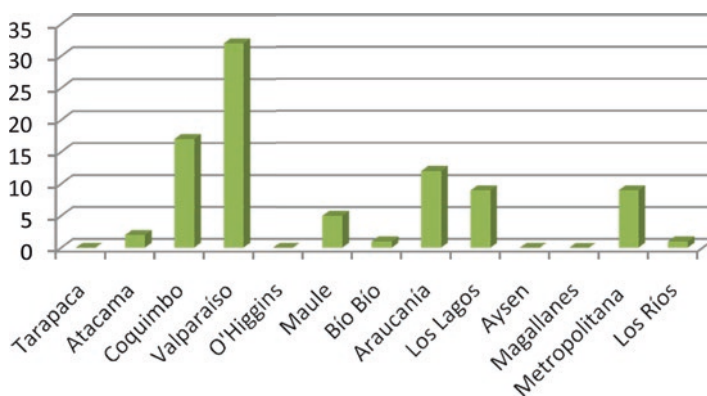
maintain potable water services. However, they have not been without problems in terms of the water quantity, quality, and continuity.

In terms of service continuity, more than half of APRs report at least one unscheduled water outage in the past 6 months (Fuster et al. 2016). APR committees and cooperatives are also responsible for ensuring that water quality is up to par with the Chilean Standard No. 409. To guarantee the safety of drinking water, APR committees and cooperatives must monitor the quality of water provided. Eighty-four percent of committees and cooperatives have monitored the bacteriological quality of their drinking water supply within the past five (5) years, but 9.3% have not done any such analysis during this time period (Donoso et al. 2015).

Furthermore, the APRs' ability to respond to scarcity during times of drought has become increasingly relevant. APRs supplied with lorries because of the 2015 drought represent 6% of the total. It is estimated that about 200 thousand people living in rural areas receive a variable and insufficient quantity of water, according to minimum standards established by the OMS.

As seen in Fig. 10.2, the majority of APRs affected by a lack of water in their supply sources are located in regions that experience prolonged droughts: Coquimbo Region and Valparaíso.

In addition, aspects of these systems must be improved in order to provide a permanent service with high standards; Trenkle (2012) states that the APR committees and cooperatives have administrative, technical, and financial deficiencies. These organizations' technical and administrative functions must be improved (Fuster et al. 2016). This is to say that problems with the servicing of the drinking water supply managed by the Committees and Cooperatives are mainly associated with organizational administrative issues.



**Fig. 10.2** Number of APRs supplied with tank trucks 2015 (Donoso et al. 2015)

In addition, Law 20.998 (Gobierno of Chile 2016) was recently passed, regulating rural water supply services and delegating new responsibilities to the APR organizations. In this context it is relevant to consider the current status of these organizations, especially given their great diversity countrywide. Areas for improvement should be studied in order to improve management and thus the organizations' ability to provide drinking water and confront new sanitation challenges.

## 10.2 Legal Aspects of Organizations Managing Rural Drinking Water

Once created, APR systems are managed by one of two types of administrative entities: committees and cooperatives. These community organizations are comprised of the same people who receive the water supply. They fulfill an important social and solidarity-based role, which benefits the organizations' members. The main objective of these entities is the administration, operation, and maintenance of the drinking water systems in order to provide water supply to their local recipients. According to the new standards, these organizations will start taking on new duties in the future, including the collection, disposal, and treatment of wastewater. Many have already started these tasks with the support of the government.

### 10.2.1 Rural Drinking Water Committees

The APR committees are governed by the Law 19,418 on "Neighborhood Meetings and Community Organizations" (Gobierno of Chile 1995). The law states that the organizations must be not-for-profit and that members may only participate as

volunteers. Membership in a committee cannot be denied to any person who is interested in joining, as long as they comply with the requirements established in the law and the committee statutes.

The “poverty privilege” statute gives committees certain benefits such as being exempt from taxes, municipal and fiscal dues, and being required to pay only 50% of the costs of notarial proceedings, real estate registrars and archivists.

Committee members must select board members to be the system administrators. Board members have a 2-year term, after which they are eligible for reelection.

Committees may be dissolved by the unanimous agreement of members with voting rights, the expiration of their legal status, having less than the minimum number of members, or for infringement of the organization’s statutes.

### ***10.2.2 Rural Drinking Water Cooperatives***

The APR cooperatives are governed by Law 19,832 on General Cooperatives (Gobierno of Chile 2004); specifically, Title III’s application to Service Cooperatives.

Cooperatives are “associations which, according to the principle of mutual help, have the objective of improving the life conditions of their members,” which can be applied to any service or activity.

These have a legal personality, which means that unlike committees, they are not exempt from taxes, dues, and municipal patents and taxes; however, the law provides for a 50% discount on all contributions, taxes, fees, and other dues to the Treasury.

To administrate drinking water systems, cooperatives must conform to the General Stakeholders Meeting, elect a Board of Administration and Supervision Committee, and have a Manager. The General Stakeholders Meeting consists of a meeting of members in which each has the right to a vote. The Board of Administration is responsible for the management of social businesses and represents the cooperative both judicially and extra-judicially. The Manager is the executor of agreements and instructions coming from the Board of Administration. Finally, the Supervision Board is responsible for accounting, inventory, and other financial actions taken by the Board of Administration.

The General Cooperatives Law allows surplus to be distributed among the associates, allocating it towards service improvement or contributions to other institutions for local development.

In this legal context, both cooperatives and committees have an important social impact. With the government’s heavy investment for more than five decades and the organizations’ management of the potable water systems, safe drinking water has reached a significant portion of Chile’s rural population. This is why it is relevant to understand the role played by other state institutions in the functioning of APR systems.

### ***10.2.3 Major Entities Involved in APR Operation***

#### **10.2.3.1 Ministry of Public Works**

The Ministry maintains a close relationship with the APR organizations mainly through the Hydraulics Works Department (DOH in its Spanish acronym), which provides technical and administrative support as well as trainings. It also oversees and regulates water rights associated with APR through the General Water Department (DGA in its Spanish acronym). The supervisory powers of the Ministry of Public Works (MOP) over the APR organizations is limited, while its administrative and promotional functions have a wider scope.

The DOH is responsible for the APR program. The DOH supervises the operation and management of APR organizations through a regional water supply operator, UT. The UT provides operational and technical support as well as management support to the APR organizations through annual/biannual visits from specialists.

#### **10.2.3.2 Rural Drinking Water Subdirectorate**

The Subdirectorate for Rural Potable Water (SDAPR in its Spanish acronym) was placed under the purview of Ministry of Public Works when it was created in November 2011 to replace the Sanitary Programs Department. The SDAPR implements actions based on the PAPR, managing and promoting the development of APR organizations, but is not involved with wastewater sanitation in rural areas. It does not have oversight or regulatory powers over the APRs, nor does it carry out audits on technical or administrative management. Thus, no rights or obligations have been formally established, except minimal standards on water quality and continuity of service (Villaroel 2012).

Its functions and powers, detailed in Exempt Resolution No. 7.904-11 and No. 2.696-14, include

1. Planning PAPR investment initiatives, developing and proposing budget projects each year;
2. Following up on budget implementation and financial control of projects in the regions and at a national level;
3. Developing and proposing policies for APR functioning;
4. Establishing procedures for continuous program management improvement;
5. Coordinating and managing agreements with sanitation businesses;
6. Monitoring and evaluation.

They also regulate program management, (according to institutional commitments) collective performance agreements, the management improvement program (PMG in its Spanish acronym), and the creation of governmental programs and presidential commitments.

### 10.2.3.3 Funding Organizations

Two major institutions fund APR development: the MOP acting through the Hydraulics Works Department (DOH) with the annual budget; and the Regional Governments (GORE), operating through the National Regional Development Fund (FNDR) and the Rural Infrastructure Provision Fund (FPIR in its Spanish acronym). These funds can often be associated with the Subsecretariat for Regional Development (SUBDERE) (SAPAG 2014).

Based on the PAPER, the SDAPR implements the budget in accordance with the Budget Act. This budget is presented by the Treasury Department and approved annually by National Congress. Among its many functions, the SDAPR is responsible for the development of project portfolios, which are carried out in each region according to their specific needs:

1. New systems for rural towns that meet program requirements
2. Maintenance, growth, and improvement of existing systems
3. Relocation planning and changes in regulations for units receiving water services.

The objective of the FNDR is to finance regional development programs and projects. These resources are administrated by each region's GORE, which is also empowered to choose projects to fund.

The FPIRs are state funds annually provided for APR projects, which are then allocated by the respective GORE. Technical supervision is carried out by the DOH.

The Undersecretariat for Regional Development (SUDERE) has authority over the FNDR in the distribution of funding throughout the country in accordance with the Public Sector Budgetary Act. It is also involved in loans between the Inter-American Development Bank, the World Bank, and the Chilean government (Balbontín et al. 2017).

Other funding sources for APR systems include the President of the Republic's Social Fund, which is managed by the Subsecretary of the Interior's social fund. Municipalities have the power to tender or execute community infrastructure/equipment projects through the Urban Improvement Fund.

### 10.2.3.4 Ministry of Health

Supervisory powers fall on other public entities, such as the Ministry of Health (MINSAL in its Spanish acronym) and MOP, through the DOH, DGA, SISS.

The supervisory unit over water monitors drinking water and sewage projects, specifically their location, layout, technical, and sanitary aspects. It also inspects APR organizations for water purification, residual chlorine, and sample analysis (bacterial and physicochemical).

When compliance failures are discovered, the organizations will not be fined or sanctioned. Rather, the supervisory unit will provide recommendations and

corrective measures with deadlines for their correct implementation (SAPAG 2014; Villaroel Bloomfield 2012).

### 10.2.3.5 Technical Support Institutions: Water Supply Operators

Water and sanitation services planning in Chile's urban areas falls under the auspices of water supply and sanitation operators (WSS) both private and public, which must operate according to the General Law of Sanitation Services Law, DFL No. 382, from the Ministry of Public Works (Gobierno of Chile 1988). APR organizations are exempt from the DFL No. 382 standard because they are outside the zoning definition of urban territories.

The WSS companies facilitate support through the UTs to the committees and cooperatives in each region. These are contracted by the DOH to perform technical and administrative assistance and to facilitate trainings.

Water quality monitoring through sample analysis is generally undertaken by private companies and labs belonging to health organizations to monitor the water's bacteriological and physicochemical status. These are inspected by the regional Health Service.

Evaluations of these institutions by APR committees and cooperatives have been relatively positive. According to Fuster et al. (2016), UTs were positively evaluated in 65% of cases, and the DOH received a 56.4% approval rating. These evaluations of the UT and DOH are relevant from a management perspective in which the State has a secondary role. The APR organizations say that the UTs should continue doing their current work or that the DOH could do the UTs' work. These results demonstrate the clear need for a secondary entity to play a supportive role in the running of APR systems.

## 10.3 Situation of Rural Potable Water Organizations (APR)

The current status of APR system infrastructure depends on how long they have been operating. The majority of APR systems (66.1%) started operations between 1981 and 2005, while 16.4% began before 1980. The number of new APR organizations being created has gradually declined as greater coverage has been achieved. The average age of current APR systems is 23 years. It is to be expected that these require improvements and constant maintenance in order to be able to provide quality services to their population.

At the same time, an organization's ability to run its own APR system is mainly dependent upon its economic ability to address needs for facility maintenance/renovation and having the human resources necessary to undertake the task of providing drinking water to its members.

Since an organization's economic capacity comes from its profits from supplying water, self-sufficiency largely depends on the quantity of homes receiving water



(the number of units served by the organization) and the rates charged for this service. Nationally, 63% of APR systems serve fewer than 250 units, which does not generate enough revenue to pay for their own investments and costs and thus become self-sustaining<sup>8</sup> (Navarro et al. 2007; Donoso et al. 2015).

However, as pricing is unregulated, each APR organization has their own mechanisms for price setting. This lack of regulation makes it difficult to evaluate whether expected revenues system operations are sufficient to cover expenses.

There is also a cultural factor which affects the organizations' ability to procure adequate resources: a certain resistance to upgrading user rates. In a community context, raising the rates of service can have an impact on the relationships between an organization's officers and members. This factor may affect the decision to charge a higher rate which would establish the organization's economic self-sufficiency. For this reason, only about 50% of APR organizations apply an annual rate increase. This percentage decreases as the number of units served increases.

Thus, approximately 65.1% of APRs would have revenues higher than their operational costs, though only 29% of APRs state that they are able to cover all costs of operation, administration, maintenance, equipment replacement, and system expansion (Fuster et al. 2016). This explains why only 43% of APR systems installed since the beginning of the program have undergone improvements. It is clear that a problem of the APR system is that a certain number of these systems are not financially self-sufficient currently. The organizations with the best performance are those with a higher number of units served.

When management faces problems such as not being able to acquire the resources and hire the staff necessary to operate the system, both the delivery process and water purification are affected. This is why the water purification and delivery processes taking place in rural areas should not be considered as technical capacities but rather as a system in which management and economic capability affect delivery.

Generally speaking, the APR organizations function well in terms of their ability to successfully deliver water to users. Seventy-eight percent of these systems have no problems in their distribution network and 88% are without issues in the acquisition and storing of water (Fuster et al. 2016). Despite these high percentages, more than half of APRs have experienced unplanned water outages in the past 6 months (Fuster et al. 2016; Villaroel Bloomfield 2011).

In 2013 and 2014, unplanned water shortages were experienced by a respective 20.3% and 23.7% of existing APRs. This affected 29.07% and 32.3% of the total population relying on APR systems. However, these figures are still lower than those of other Latin American countries. Triana Soto (2013) states that many countries in the region have an irregular drinking water supply. Sixty percent of rural populations with rural potable systems in Latin America receive an irregular supply. In some countries, this figure rises to 95%.

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<sup>8</sup>Donoso et al. (2015) states that using fixed rates allows 75% of the organizations to cover the costs of operation, maintenance, and minor repairs, and that 57% of existing systems have never undergone such improvements.

In terms of water purification, organizations currently demonstrate a high level of compliance with standards. 94.6% of the organizations carry out residual chlorine sampling, 88.7% conduct physicochemical analysis, and 92.6% perform bacteriological analysis (Fuster et al. 2016). Thus, 87.2% of organizations have a sanitation operations authorization.

Although national access to drinking water has increased significantly in rural areas and water purity is very good, supply continuity is an uncertain variable in the management system. One indicator of this weakness in APR management is that, though 86% of them claim to have a system maintenance and improvement plan, only about 50% have carried out the work promised in their plan.

Besides the organizations' economic capacity, another relevant aspect of APR functioning concerns the level of education reached by the officers who manage these systems. More than 65% of officers possess a level of education that is equal to or superior to a high school education (Fuster et al. 2016).

Another aspect affecting general functioning of the organization has to do with how long the APR officer has been in the position. Most officers have been in their position for a long enough time to be knowledgeable about the system's operations and maintenance. However, considering their educational level, it is to be expected that external support is necessary to improve efficiency, quality of service, and other aspects of management such as effective technology use.

## 10.4 Law 20,998 for the Regulation of Rural Water Services

Until 2016, access to water in rural areas was not governed by a legislation specific to rural water services. In 2016, Law 20,998 (Gobierno de Chile 2016) which regulates rural water services was promulgated. This created the Subdirectorate of Rural Health Services (SSR in its Spanish acronym) as an extension of the MOP's Dirección de Obras Hidráulicas (DOH). SSR will be responsible for carrying out studies, community management, investments in drinking water and sanitation, projects in sanitation and drinking water, and developing a registry of operators.

Once the law is implemented, APR committees and cooperatives must have a license, which is valid for 5 years. To be granted a license they must certify the following:

1. Water Rights (WRs);
2. The quantity, quality, and continuity of their water supply;
3. Reserve funds as a guarantee of service;
4. An investment plan approved by the Subdirectorate;
5. Approval of financial statements by the Subdirectorate;
6. A positive report on management by the Subdirectorate;
7. An approved pricing schedule.

APRs that do not comply with these requisites will be given an additional 5 years to do so. To reapply, they must have an action plan approved by the Subdirectorate. If they are out of compliance with the action plan, the license will expire.

Licenses will also expire if tasks from the investment plan are not implemented or are out of compliance with the action plan.

One important aspect of the new law establishes that pricing should at least account for recoup of operating costs. However, the law does not require pricing to cover maintenance costs nor the different costs of investment and replacement. This is concerning because it makes it very likely that the same issues with an irregular water supply will continue into the future due to a lack of proper APR maintenance.<sup>9</sup>

One area, which still needs defining, is the content of regulations stipulating the procedures outlined in the new law. The regulations should define and explain the procedures required in order to apply for a new license and the conditions which would cause expiration of said license. These procedures, which remain undetermined, will be key to implementation of the new law.

## 10.5 Opportunities for Improvement

Although the APR organizations show high performance indicators in the various aspects of providing drinking water to rural populations, certain aspects could be improved in order to deliver a more sustainable and quality service. In particular, administrative aspects, which would allow these systems to function more profitably, need work.

In general, all indicators of APR economic and managerial capacity tend to improve in relation to the number of units served. Thus it can be seen that a certain level of structural development exists which allows service delivery while leaving room for improvement, especially in smaller organizations.

In terms of management ability, which affects both task performance and the level of dependence on outside institutions, there is a training gap in APR leadership. Training would allow leadership to improve their own ability to manage their systems so that they can be self-sufficient and cost effective. This would also reduce the current dependency on the DOH and UT which is viewed as a weakness in management.

The law presents new complexities which focus on the weakest structural aspects through sanitizing residual waters. These challenges should be addressed through further training so long as APR organizations remain dependent on UTs or the DOH. The problem is that many of these organizations do not have the economic resources needed to fund this type of professional development.

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<sup>9</sup>Art. 57, Law 20,998.

There is also a cultural element affecting the issue. Within the organization, members will have to take on new responsibilities, which may become problematic if they experience difficulty adapting to new situations. The current educational level of officers may be a restrictive factor for members trying to take on new job functions. For this reason, it is recommended that an educational threshold be established for officers to ensure that they have the tools needed for the tasks associated with the delivery of potable water.

Although organizations have done maintenance work and/or have made improvements in the past, these are not sufficient to keep up the system. Maintenance plans with timelines over a year are necessary to ensure system continuity, before system failures can cause water outages.

On the other hand, to provide quality water service, potable water must comply with current quality standards. One important aspect of compliance with current legislation has to do with whether the organization has a sanitation operations authorization. Here another gap can be seen, as at least 13 of every 100 APR organizations do not have the sanitation operations authorization needed for potable water delivery (Fuster et al. 2016).

The current status of sanitation infrastructure is even more complicated, with only 11% of organizations claiming to have a sewage system (Saavedra 2013). This shows the vulnerability of the vast majority of organizations, which do not have an adequate wastewater management system, especially when only 9.45% have a treatment system for wastewater.

All these tasks require economic resources. Management capacity becomes even more precarious inasmuch as economic resources become scarce. The situation requires new mechanisms to improve the pricing structure, especially for smaller APRs. The goal is for organizations to be able to recover the costs of delivery so they can provide a continuous, quality, sustainable potable water service without needing to seek help from the government.

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