Analysis and Research on the Maintenance Funds of Rural drinking water safety Projects

Meiyun An¹, Shuijun Li²* and Liu Liu³
¹,³Guizhou Proincial Water Conservancy Research Institute, Guiyang, Guizhou,China
²Power China Guiyang Engineering Corporation Limited, Guiyang, Guizhou,China
¹,³email: anmeiyun123@163.com, ²*email: lishuaijun_gyy@powerchina.cn

Abstract. Since the reform and the opening up, Guizhou has made great achievements in rural drinking water safety projects, creating well-being for the farmers, but how to ensure the long-term and effective performance of the project has always been a major problem in the management and protection of the project. It takes Guizhou province as an example, and concludes that maintenance expenses are the main factor restricting the long-term operation of projects, from the investigation results of different types, scales and modes of projects in typical regions. In order to ensure the long-term operation of projects, the article carries out the research and analysis of the project maintenance funds to provide reference for the management and protection of rural drinking water safety projects in mountainous areas.

1. Introduction
Rural drinking water safety is an important indicator of the "3+1 guarantee"[1] for poverty alleviation, and it is also a public infrastructure to solve rural residents' drinking water safety and improve the happiness index of the broad masses of farmers. However, how to ensure the long-lasting benefits of drinking water safety projects and solve the problem of difficult management and protection has always been a hot spot in Guizhou Province. Based on the in-depth investigation of the status quo of typical projects in Guizhou province and the analysis of existing problems in the operation management and maintenance process after the construction of projects, concluding that maintenance funds are the bottleneck to restrict the benign and sustainable development of projects. In order to ensure the long-term effective and stable operation of drinking water safety projects, the author estimates the cost of maintenance funds and puts forward countermeasures and suggestions to ensure the implementation of the cost and promote the long-term operation of projects, according to the characteristics of the projects in Guizhou.

2. Basic situation of rural drinking water safety in Guizhou Province

2.1. Construction of projects
Since the construction of the drinking water safety project, Guizhou has gone through four stages successively, namely "Aspiration Project", "Rural drinking water Solution Project", "Rural drinking water safety Project" and "Rural drinking water safety consolidation and improvement Project". According to statistics, from 2005 to the end of 2015, a total of 13.329 billion yuan was invested to solve the problem of safe drinking water for 25.28 million rural residents and 2.22 million teachers and students in rural schools. Moreover, Guizhou also launched a project to consolidate and upgrade
the safety of drinking water in rural areas during the 13th Five-Year Plan period, which solved 4.4595 million people by 1.428 billion yuan. Up to now, it has implemented 66,700 drinking water safety projects, what basically covered the whole province and the penetration rate of tap water has reached 88%. Meanwhile, the water supply management system has been basically established, and the drinking water problem of rural residents has been basically solved[3].

2.2. Conditions of the operation management
In Guizhou, the special terrain and provincial conditions, which decided the characteristics of rural drinking water safety projects, such as large quantity, wide distribution, large coverage of the masses, and complex types of projects[4-5]. Even so, it has also actively explored management according to local conditions, and formed a diversified management mode for the management and protection work after project construction, in recent years. However, due to cause of the large dispersibility of projects and the shortage of management and protection funds, the specialized management, enterprise operation and market operation of drinking water safety projects in the whole province have not been fully popularized. At present, only some projects with tens of thousands of tons or more can be managed by corporatization, while most of the rest are managed by water stations, village committees or farmers' water associations. These projects are clearly defined the management and their responsibilities, however, the inadequate implementation of the management and protection funds and the unsatisfactory collection of water charges, that cause most of the managers are voluntary management, lacking professional skills, and cannot meet the daily management and maintenance requirements.

3. Investigation of typical sample projects
3.1. Selection principle
In order to make this research analysis more practical and survey project types more comprehensive and representative, that combining with the actual survey of drinking water safety, the paper makes some requirements for the research objects of water supply projects in this research work. The requirements as follows:

- According to the current statistical coverage of rural drinking water safety water supply projects of the Ministry of Water Resources, drinking water safety projects are usually divided into four categories, namely, water supply projects of more than 1,000 tons, projects of more than 1,000 tons and less than 1,000 tons, centralized projects of less than 1,000 tons and decentralized projects. Therefore the typical sample projects which will be investigated should be follow the four types of projects, in order to categorize the survey data.

- The typical sample projects are selected as the rural drinking water safety water supply projects that have been completed and are in normal operation, with the implementation of management and protection mechanism, which can collect water fee and run well.

- Considering the water diversion way and project layout of Guizhou drinking water safety projects, the centralized water supply project which will be selected as a typical sample project should include the auto-flow and water-lifting projects in towns and rural areas, while the decentralized water supply project should include the auto-flow and water-lifting projects in which the small water cellar for self-use is built jointly with farmers but the water supply population is less than 20 people.

3.2. Screening of typical sample projects
According to the above project research requirements, the paper screened 150 feedback survey tables to eliminate the water supply projects which did not meet the requirements. Eventually, getting a total of 84 typical water supply projects that were well built and operated in the province from 1986 to 2019 were obtained, including relevant data information such as maintenance funds. The specific situation of the investigation is shown in Table 1.
4. Problems of rural drinking water safety projects

Combined with the general survey of drinking water safety projects and the analysis of the investigation results of these typical sample projects, the common problems commonly existing in drinking water safety projects in Guizhou are summarized as follows:

- The benign operation management and protection mechanism are not well developed. The special topography of Guizhou makes the distribution of rural drinking water projects scattered, which makes it difficult to realize large-scale operation and professional management, and difficult to manage the projects after construction. In addition, the lack of funds for post-construction management and protection makes a considerable part of the post-construction management and protection of the project more likely to be implemented in documents rather than in practice, and the project operation and management is poor. And many built projects which are influenced by the lack of benign operation management mechanism, seriously affect the normal operation of the project, reduce the normal service life of the project.

- Shortage of maintenance funds. Maintenance funds and water charges are the main and important sources of funds to maintain the long-term benign operation of rural drinking water safety projects. However, from the survey and survey results, because of the reasons such as multi-faceted water supply points, long water supply pipeline, small supply scale, and large investment in early construction, the local governments have weak ability to subsidize financial funds. In addition, since rural water supply service objects are mainly farmers, the collection of water fee in actual implementation is directly affected by the low rural income and farmers’ lack of energy and commodity awareness, which makes it difficult to collect water fee in rural areas, and even some areas cannot collect water fee. The benign operation of the project is inseparable from the post-construction pipe protection, which also needs the support of funds, but the shortage of funds makes it difficult to realize the maintenance of drinking water project.
Low level of professional management technology. Most of the rural drinking water safety projects in Guizhou province are under ten thousand tons and small in scale and scattered, which makes it difficult to achieve professional management. So most of the project management personnel in the actual project maintenance work have not received professional training and their technical management level and maintenance ability are low, which cannot meet the daily maintenance and maintenance requirements. At the same time, due to the low level of rural economy and the difficult rural conditions, it is difficult to attract more professional technical personnel and expand professional management team.

Traditional concept of water use. The main service target of drinking water safety project is rural residents, but most rural residents' concept of water use has not been completely changed. On the one hand, the residents' commodity awareness of water is relatively weak. On the other hand, guizhou is located in the Yunnan-Guizhou Plateau region, where precipitation is abundant and there are many mountain springs, what makes the residents more willing to use mountain springs without paying water fee than low-priced tap water. In a word, the traditional concept of water use greatly affects the actual water supply and the rate of water charge.

5. Calculation and analysis of maintenance funds for drinking water safety projects

Based on the results of this survey, the paper referred to "Depreciation Rate and Major Repair Rate of Fixed Assets of Water Conservancy Project Water Supply" [6], which published by Ministry of Water Resources and Power and Ministry of Finance in 1985, and combined with the actual operation of the project, management personnel pay rate, repair rate and daily maintenance repair rates take 2.89%, 1.44% and 1.3%. Respectively, calculated that the per capita salary of the management and maintenance personnel required by the project to cover the population is 12 (yuan/person per year), the per capita big repair cost is 6 (yuan/person per year), and the per capita daily maintenance cost is 5.4 (yuan/person per year), that is, the maintenance fund for population per capita covered 23.4 (yuan/person per year). Taking the calculation of the results, concluded that the demand fund for the maintenance of water supply project in Guizhou province with an annual cycle was 88.5 million yuan, including 453.85 million yuan for the annual compensation of management and nursing personnel (see Table 2 for the calculation contents). Suppose the provincial maintenance fund is 10 yuan /person per year, the provincial level shall arrange the subsidy fund of 378.21 million yuan per year, and the remaining part is less than 506.79 million yuan, which shall be partly subsidized by the central fund and partly raised by the city, state and county local governments. Finally, by establishing the central, provincial, municipal and county levels of rural drinking water safety project maintenance and maintenance fund guarantee mechanism, the management and maintenance personnel and the project maintenance and maintenance will be subsidized to ensure the benign operation of rural drinking water project in Guizhou province, and also provide reference for similar projects.

| Project coverage population | The composition of maintenance and maintenance funds | Among them: provincial finance | State funds + municipal (state) county local self-raised funds |
|----------------------------|---------------------------------------------------|-------------------------------|--------------------------------------------------|
|                            | The annual salary for management staffs | Overhaul cost | Daily maintenance fee | Subtotal | Ten thousand yuan/year | Ten thousand yuan/year | Ten thousand yuan/year |
| Ten thousand people         | Ten thousand yuan/year | Ten thousand yuan/year | Ten thousand yuan/year | Ten thousand yuan/year | 3782.0816 | 45385 | 22692 | 20423 | 88500 | 37821 | 50679 |
6. Conclusions and recommendations

Through the calculation of rural drinking water safety project's maintenance funds, not only can we know the need for project maintenance funds in advance, but also can plan the funds in advance, so as to strengthen the guarantee of funds, strengthen the implementation of funds, and ensure the effective operation of the project. Also, in order to comprehensively promote the sustainable development of rural drinking water safety project and form a virtuous cycle mechanism of "raising water with water" as soon as possible, the following Suggestions and measures are proposed in view of the current situation and existing problems of rural drinking water safety in Guizhou Province:

- Actively carry out pilot programs and explore practical management and protection mechanisms. Throughout the province, from doing good, different size, different types of drinking water safety engineering as a pilot, explore the effective management mode and regulation, using the maintenance maintenance and sources of funds, guarantee mechanism, etc., accumulate experience, and establish the typical, play an exemplary role, thus to point with surface, constantly promote to other areas.

- Actively carry out pilot programs and explore practical management and protection mechanisms. Selecting different scales and types of drinking water safety projects from areas where have done better in all province as the first pilot to explore the effective management mode, methods of sources of maintenance funds, supervision of the use of funds and safeguard mechanism, etc. Meanwhile, accumulating experience, setting up model, playing exemplary roles, thereby with dot belt area to spread ceaselessly to other area.

- Expand funding channels and strengthen funding support. Due to the different economic levels in different regions, the channels for obtaining project maintenance funds by means of government subsidies and water fee extraction are too single, and the water fee collection is unstable and easily affected by various factors. So it need to innovative the incentive mechanism, which can attract social forces, broaden the access channels of funds, strengthen the guarantee of funds. As well we should make full use of local preferential policies to give preferential policies and financial support to areas in difficulty, practically implement the safety maintenance project of drinking water, and ensure the long-term effective and stable operation of the project.

- Expand the professional team and strengthen the professional technical force. Innovation post welfare conditions, attracting more professional and technical personnel into the engineering maintenance team, to reverse the lack of professional situation. At the same time, strengthen the training of professional knowledge and practical operation ability, improve the technical level of maintenance personnel, and strengthen the maintenance personnel's routine maintenance and regular inspection of engineering equipment, so as to achieve the long-term, healthy and sustainable operation of rural drinking water safety project.

- Increase publicity to improve rural residents' concept of water use. Compiling rural drinking water safety project publicity manual, popularizing rural drinking water safety knowledge among rural residents in plain language and pictures, to enhance residents' awareness of drinking water safety project and attention to drinking water health safety. In order to reverse the traditional concept of water consumption of rural residents and enhance the enthusiasm of residents to pay water fees. Through multiple channels of publicity and popularization, it need multiple channels to publicize and popularize.

Acknowledgments
This work was supported by the Scientific Research Foundation of Guizhou Province, China (Grant No. KT201816 and KT201819).

References
[1] Wu Haikuan, An Meiyun. Analysis on the management assessment results of Guizhou rural drinking water safety Project[J]. Water Conservancy Planning and Design, 2019(10): 44-46.
[2] Fei Jiyong. Simple analysis of operation management Mode of Rural drinking water safety Project in Guizhou Province[J]. China Water. 2020(13):60-61.

[3] Chen Zhiying. Effect and management countermeasures of rural drinking water safety construction in Guizhou Province[J]. Modern Agricultural Science and Technology. 2012(13):228-229.

[4] Zhang Qingming, He Xiaofei. Analysis on the long-term operation of rural drinking water safety project from the perspective of maintenance and maintenance fund guarantee[J]. China Water. 2014(05):31-33.

[5] Zhang Qingming, He Xiaofei. Practice and Thinking of establishing maintenance Fund for Rural Drinking Water Safety Project[J]. Water Resources Development Research[J].2011(06):24-26.

[6] Ministry of Water Resources and Power and Ministry of Finance(1985). Depreciation Rate and Major Repair Rate of Fixed Assets of Water Conservancy Project Water Supply. https://www.shui5.cn/article/1e/42736.html.