WATER SUPPLY STATUS IN RURAL AREAS OF THE MEKONG DELTA AND DEVELOPMENT MEASURES

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ABSTRACT

Rural people in the Mekong Delta (MD) use surface water from rivers and canals for daily activities; and in areas far from the canals, people use rainwater for cooking and drinking. In certain areas, people use shallow layered groundwater and deep layered groundwater from drilled wells 80m – 100m deep. The quality of water used in daily activities of rural people is almost uncontrolled. Somewhere water supply systems are used, but they have been built over many periods, certain ones for over 50 years ago, thus having a lot of damage and many deposits, causing loss of pressure and huge loss of water. The issue of repairing, replacing and installing more water supply networks in urban areas is facing lots of financial, technical difficulties.

Keywords: surface water, Mekong Delta, water supply

1 INTRODUCTION

The Mekong Delta consists of 13 provinces and cities, with a total population of 18 million people, amounting to 20% of Vietnam's population, of which more than 80% live in rural areas. At present, the percentage of rural population that is able to use standard-level water is low (36.52%), in certain areas, people hardly find clean water and have to buy water for use from farther areas at high prices. Given such situation, it is necessary to have an overall assessment of the actual status of water supply in rural areas, and propose water supply solutions in order to meet the Water Supply Targets in rural areas of the National Strategy for Clean Water Supply and Environmental Sanitation in rural areas [1]. This article makes presentation about: the actual status of water supply in rural areas in the MD; the analysis, assessment, identification of issues arising from the actual status of water supply and the proposal of comprehensive solutions to develop water supply activities for rural areas in the MD.

2 ACTUAL STATUS OF WATER SUPPLY IN RURAL AREAS IN THE MD

Water sources for domestic supplies in the MD's rural areas involve rivers, wells and rainwater: the annual fresh water flow from the Mekong River's upstream is about 475 billion cubic meters distributed mainly in the areas along the Tien River and Bassac River; groundwater sources have a total daily exploitation capacity of about 22.5 million cubic meters; and average annual rainfall of 1,600 mm in the delta provides an amount of 80 billion cubic meters of rainwater per year. Although the surface water source is exuberant, it is not yet widely used for domestic supply. The major concerns about the source consist in pollution by agricultural practices in the watershed, and salinization which make the source both difficult and costly to treat [1 - 2]. Groundwater is mainly used for domestic supplies in almost all rural areas of the delta due to rather good quality and simple treatment. Rainwater is being used in the whole areas but not much [3].

At present, there are four types of water supply/exploitation in the Mekong Delta for daily use: (1) using water from centralized water supply works; (2) exploiting groundwater for use by way of pump wells/dug wells; (3) using rain water; (4) using water from rivers and canals. According to statistics of the Center of Clean Water Supply and Environmental Sanitation in Rural Areas of the MD in 2015 there are 75.82% of the rural population in the MD having access to clean water, of which only 36.52% meet the water supply standard of Vietnam QCVN 02: 2009/ BYT [4]. The ratios of water supply in provinces/cities in rural areas of the MD and the ratios of water supplied that meet the QCVN 02: 2009/BYT [4] are shown in Table 1.

Tab. 1: Ratios of water supply in provinces/cities in rural areas of the MD

No.	Provinces/ Districts	Population	Ratios of water supply in provinces/cities (%)					Percent of water supplied meeting QC 02: 2009/ BYT
			Total	Water supplied from centralized water supply works (1)	Exploiting groundwater by way of pump wells/ dug wells (2)	Using rainwater (3)	Using water from rivers and canals (4)	
1	Long An	1.196.731	89.80	63.24	17.13		9.21	11.60
2	Tiền Giang	1.434.705	84.55	74.93	6.35	2.63	0.64	55.05
3	Bến Tre	1.080.237	76.00					32.00
4	Trà Vinh	947.010	66.00	26.16	39.94	6.42		40.00
5	Vĩnh Long	869.320	73.00	37.00				37.00
6	Đồng Tháp	1.482.850	63.44	43.82	3.3		16.32	43.82
7	Cần Thơ	778.552	71.46	39.00	27.5	2.4	3.7	57.76
8	Hậu Giang	579.235	82.57	15.21	50.1	7.82	9.44	44.96
9	Sóc Trăng	1.173.241	87.20	28.88	56.41	1.92		28.51
10	Bạc Liêu	696.776	74.36	7.7	60.18			52.00
11	Cà Mau	988.937	78.00	7.8				0
12	Kiên Giang	1.372.208	74.66	14.94	47.15		12.57	27.51
13	An Giang	1.567.282	57.02	42.70	4.56	0.67	9.82	48.82
Total		**14.167.084**	**75.82**					**36.52**

Source: Center of Clean Water Supply and Environmental Sanitation in Rural Areas of the MD, 2015

According to the statistics in Table 1, across the rural areas of the MD, the ratios of water supply are divided into specific categories as follows: the ratio of water supply from centralized water supply works (group 1) amounting to 34%, a high percentage compared to the national average which is 32%; the ratio of water supply from separate pump wells/dug wells (group 2) amounting to 34%; the ratio of water supply from rainwater (group 3) amounting to 4.2%; and the ratio of water supply from rivers, canals (group 4) which is 3.62%. The waterworks operations differ from one another depending on residential patterns and the availability of water source in the locations. Rather populated communities in Long An, Tien Giang uses most CWWS types (63-75%), while in the dispersedly populated areas of the Hau Giang, Soc Trang, Bac Lieu provinces, people mainly use their household wells (50-60%). The detailed information on the actual status of water supply grouped by types of water supply is presented as follows:

2.1 Centralized water supply works (CWWS), groups

The total number of CWWS in the whole rural areas of the MD is 4260, which have mainly been invested in the years 2000 to 2010. The population characteristics in rural areas of the MD is that the population developed along rivers and canals, so the density of rural population is not high, therefore the scales of CWWS are small correspondingly (smaller than the scale of CWWS in the Red River Delta and in North Central areas).

With respect to the scale of CWWS: there are 3 groups:

(1) Small scale (< 10 m^3/h): common in most provinces, representing large proportion in the Long An, Tien Giang, Dong Thap, Can Tho and Hau Giang provinces.

(2) Medium scale (10-30 m^3/h): appear in most provinces but representing a small proportion, mostly in the Vinh Long, Dong Thap, Can Tho, Soc Trang, Bac Lieu and Ca Mau provinces.

(3) Large scale (> 30 m^3/h): very few in the Ben Tre, Vinh Long and An Giang provinces.

With respect to water resources for exploitation

In the provinces as Ben Tre, Vinh Long, An Giang, water sources for CWWSs are deep wells. Both surface and underground waters are used for CWWSs in other provinces such as Tra Vinh, Dong Thap, Can Tho, Hau Giang and Kien Giang. The underground water is used much more in comparison with the surface one.

With respect to water treatment technology:

For water resources being surface water, the water treatment technology is shown in Figure 1. For water resources being ground water, there are two commonly used technical schemes as presented in Figure 2 and Figure 3 [5 - 6].

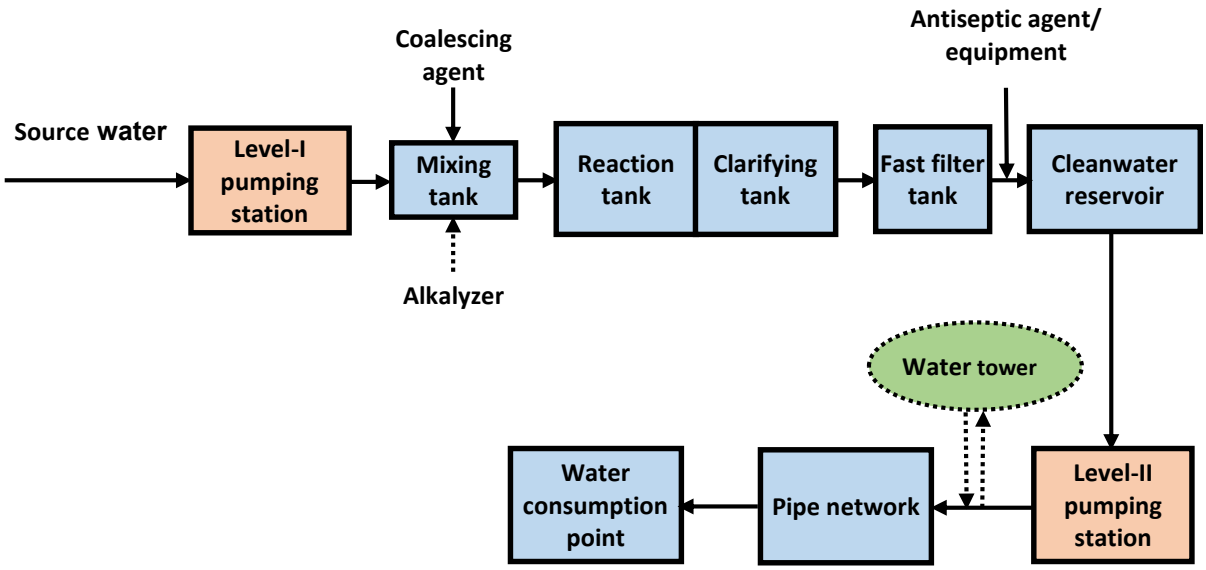

Fig. 1 Flowchart of the system and technology for processing surface water

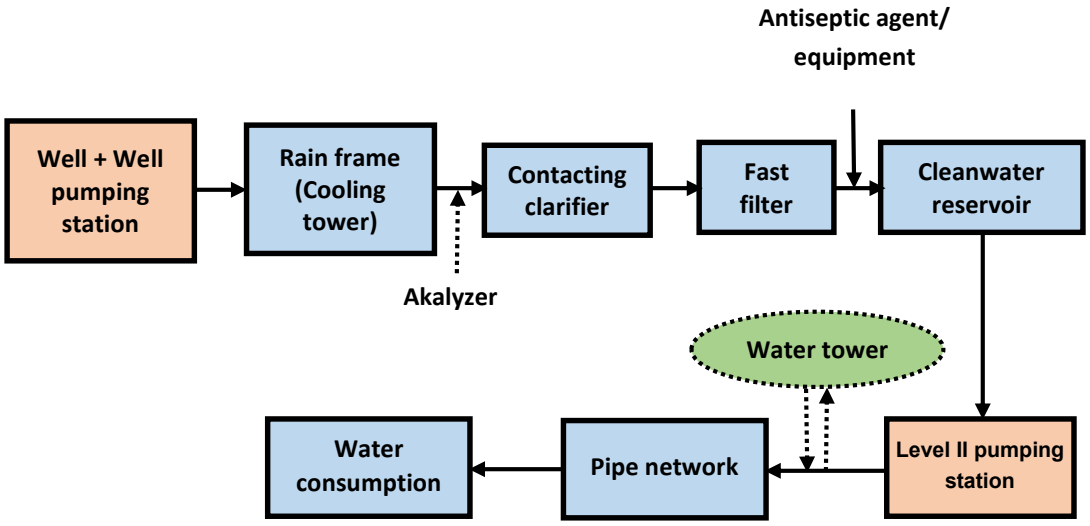

Fig. 2 Flowchart of the system and technology for processing groundwater

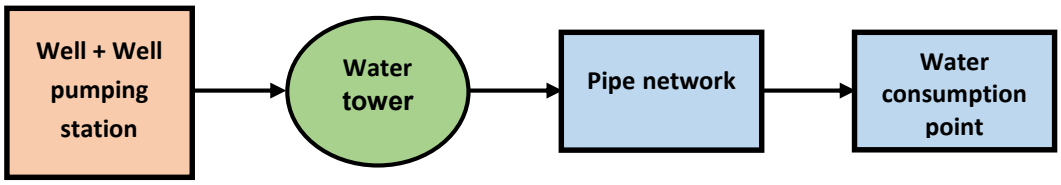

Fig. 3 Flowchart of a simple groundwater supply system

Management model: there are 5 models of the management of water supply stations in rural areas: (1) Center of Cleanwater and Environmental Sanitation/state-owned enterprises: available in most provinces, common in Can Tho, Hau Giang, Soc Trang, Bac Lieu, Vinh Long and Ben Tre; (2) private enterprises: popular in Long An, Tien Giang, Dong Thap, An Giang; (3) community/cooperative groups: common in Long An, Tien Giang, Tra Vinh, Dong Thap, Ca Mau; (4) co-operatives: available in provinces but at low proportion; (5) joint stock enterprises: available in provinces but at very low proportion.

Among the above water supply management models, each model has different advantages and disadvantages depending on many factors, where Model 1 is considered the best due to regular monitoring, supporting investments from various capital sources, responsible for the management and development of rural water supply for a whole province, thus investments in difficult areas and remote areas is paid more attention [7]. In terms of sustainability, Model 2 is more promising because all decisive factors are concentrated on the enterprises, so if the enterprises do well, people may have benefits from that. However, since enterprises using this model operate under the Enterprise Act and are dominated by the profit factor, they do not often choose to invest in difficult or remote areas [8]. Therefore, in order to encourage the development of this model, Vietnam should have preferential policies for its operation (preferences on land use tax, preferential loan, tax exemption, etc.) [9].

2.2 Pump wells/dug wells, group 2

According to statistics from the Center of Cleanwater and Environmental Sanitation in Rural Areas of the MD in 2015, the total number of small and separate wells (pump wells/dug wells) is 779,503. This form of water supply has flourished in the MD since 1995 due to simple techniques of drilling/ digging wells, low costs and acceptable water quality. However, many wells that are improperly exploited and managed can cause pollution to the groundwater sources and difficulties in the management of water resources.

2.3 Rainwater sources, group 3

Rainwater harvesting and storage for domestic water supply are common in most rural areas of the MD. In the previous time, rainwater was the only freshwater source for the areas where water sources are affected by salt intrusion or alum (coastal areas of the Bạc Liêu, Cà Mau, Kiên Giang provinces; wetlands area in Plain of Reeds, and Long Xuyen Quadrangle). Rainwater is used now in many areas with dispersed population where centralized water supply systems are not available (Tien Giang, Ben Tre, Tra Vinh, Vinh Long, Hau Giang, Kien Giang). Rainwater properly collected and caught has good quality and is used for daily activity purposes. However, harvesting and storage tools for rainwater has still poorly developed, which could not provide enough water volume for dry season [7].

2.4 Household scale, group 4

The model of use of water from river and canal sources is mainly applied in households living near rivers and canals, in areas where surface water is not salinized, where centralized water supply systems are not available and underground water is difficult to exploit or is affected with alum. This model is commonly used in some localities of the provinces of Vinh Long, Dong Thap, Hau Giang and An Giang. However, an important thing is that households only preliminarily treat the water source by settling alum in water to make it clear without pasteurizing and treating it to remove other impurities, thus the water sources do not meet the criterion of a supply of water for daily use.

3 SOLUTIONS FOR THE DEVELOPMENT OF WATER SUPPLY IN RURAL AREAS OF THE MD

3.1 Objectives of water supply in rural areas

The objectives of water supply in rural areas of the National Strategy for Supply of Cleanwater and Environmental Sanitation in rural areas in Vietnam and the Mekong Delta [9] Water Supply Development Plan up to 2020, with a view to 2030, specify that: by 2020: the ratio of water supply for daily use in rural areas shall reach 85% with the water supply standard of 60 liters/person/day and night, of which 45% of the water supplied shall meet the QCVN 02: 2009/BYT standard[10]; by 2030: the ratio of water supply for daily use in rural areas shall reach 100%, with a water supply standard of 80 liters/person/day and night, of which 80% of the water supplied shall meet the QCVN 02: 2009/BYT standard[10].

3.2 Demand for water to use in daily activities in rural areas

Demand for water to use in daily activities in rural areas in the MD is calculated on the basis of construction standards imposed by TCXDVN 33:2006 [10] water supply, pipeline network and construction works, a design standard according to which the water supply ration in rural areas shall be 60 liters/person/day by 2020 and 80 liters/person/day by 2030. According to the calculation of the ration of water supply and the projection on population development up to 2020 and 2030 in rural areas of the Mekong Delta, the total demand for water used in daily activities in rural areas in the MD shall be about 1.7 to 2.23 million m^3/day and night by 2020 and about 3 million m^3/day and night by 2030 [2].

3.3 Proposal of a plan for the development of water supply in rural areas of the MD

The proposed water supply plan shall base on: actual status of water supply in rural areas in the MD; characteristics of water sources and ability to exploit the same; population distribution, living standards, customs and habits and other natural and socio-economic conditions. The important issues arising in water supply in the rural area of the MD may be identified as follows:

- Major concerns about water resources including surface water pollution with difficulties in quality control and treatment, groundwater degradation due to over exploitation, poor usage and wasting of rainwater;
- The number of centralized water supply works is limited; separated household water supplies occupy the majority. This makes it difficult to meet the water supply standards;
- The Mekong Delta has suffered quite significant impacts of global climate change, especially increased inundation, drought and salinization. These effects are now seriously threatening the water security of the Mekong Delta [2]

A plan for the development of water supply in rural areas of the Mekong Delta is recommended as follows:

***Developing water supply sources*:** Making the most from the exploitation of on-site water sources, prioritizing the exploitation of surface water that has good quality, enhancing the exploitation of surface water sources in water freshened areas as a replacement for groundwater sources that has unassured quality.

In the areas where there is no source of groundwater, and the surface water is of unstable quality and is salinized on certain days in year/certain hours in a day, the solution of exploitation of surface water and the use of freshwater detention reservoirs shall apply. In the hours of ebb tide, when the salinity of water in rivers and canals is below permitted limits, freshwater is pumped into reservoirs. The water in detention reservoirs will be used during the hours when the water is not directly exploited from rivers and canals. In such case, the volume of the detention reservoir depends on the capacity of the water supply station, the flow regime and the salinity of rivers and canals, and the time during which pumping is stopped due to saline effect on the rivers and canals.

In areas where surface water is polluted, rural households often use surface water after preliminarily treating it with alum which fails to ensure hygiene factor and thus affects their health. Therefore, it is necessary to use various ways to get clean water including proper surface water treatment at home and rainwater usage with installing appropriate harvesting and storage equipment.

In areas with good groundwater sources, the planning and management of underground water exploitation is required so that the development of models of use of water from small and separate wells of households is in accordance with planning. In addition, it is necessary to conduct surveys of certain wells which are damaged or no longer used so that technically proper filling may apply in order to protect groundwater sources and defend against salt intrusion.

***Scale of water supply works and plans*:** Prioritizing the development of the model of acentralized water supply plant/station to ensure that water supply meets the requirements for quality and improves people's living conditions [1].

- Building brand new or renovate/upgrade and expand centralized water supply works, prioritizing the development of centralized water supply works in the following priority order: large (> 30 m^3/h), medium (20-30 m^3/h), small (> 10 m^3/h), limiting the development of centralized water supply facilities which scale is < 10 m^3/h.
- Developing centralized water supply works in difficult, deep-lying and remote areas where the rates of use of supplied water is low.
- In line with the progress of irrigation works, salinity preventing and water freshening works, to build centralized water supply stations at inter-communal, inter-regional levels to exploit sources of freshened surface water. For localities with good surface water sources, to prioritize the exploitation of centralized water supply at medium and large scales using surface water. Only such groundwater sources that have good quality should be exploited at small scale by/for centralized water supply works to supply water to dispersed clusters of population.
- With respect to localities where both groundwater and surface water sources are salinized, the optimal solution is to build large-scale centralized water supply facilities to exploit surface water from distances to supply both urban and rural areas, at inter-district and inter-communal levels. The water sources and selected sites for water exploitation: on main rivers, water must have good quality, without salinity all year round.
- For dispersedly populated, deep-lying and remote areas, it is necessary to enhance the development of rainwater collecting and catching works/freshwater collecting and storing works and apply proper treatment so as to ensure the quality for catering, and for daily activities purposes.

Technical measures

Conducting research on the application of advanced water treatment technologies, at reasonable prices, to ensure the quality of water output to meet water supply standards, and making investments in the form of module in order to save the resources, avoid waste and improve investment efficiency [1].

For medium and large scale centralized water supply works, investments in water towers shall not continue due to high investment budget and maintenance costs while the effects of the regulation of pressure and supplementation of water sources at power cut are ineffective, instead switching to use switchboard systems operated by frequency modulation, equipped with back-up generators to ensure automatic operation and 24/24 hours continuous supply of water, as soon as the power cut happens. The system plan with water towers shall only apply to small scale centralized water supply works.

Developing the research and application of salt water treatment works to serve small-scale water supply for clusters of population living in the coastal and island areas where freshwater sources are not available. Saltwater treatment technologies to be applied shall have such management and operation regime that is not overly complex and at acceptable cost, which is comparable to the plan of investment in rainwater collecting and reserving works.

Operational management

Improving the efficiency of the tasks of management, operation and maintenance of centralized water supply facilities. The operation and exploitation management must be carried out by individuals and organizations that have expertise in water industry.

Strengthening the inspection, supervision and evaluation of water supply activities in rural areas.

Continuing to develop the model of Center of Cleanwater and Environmental Sanitation/State owned enterprises that manage water supply facilities, further developing the model of private enterprises, but also requiring the supervision and management of quality of water supply sources.

There should be measures to promote socialization activities in the sector of water supply, policies to enhance the participation of private organizations and economic sectors in the development of water supply in rural areas in accordance with the National Strategy on Water Supply & Environmental Sanitation in rural areas.

3.4 Respond to global climate change

To deal with increasing impacts of global climate change on the MD such as inundation, drought and salinization, it is important to set up and implement a comprehensive water security program for the whole area. The major measures may be as follows: to build rather large reservoirs/ponds with enough fresh water volume to regulate the flow during dry season and prevent salinisation in case of prolonged drought; to develop rainwater

harvesting and storage facilities at widely spatial scale in the rural areas; to preserve and protect groundwater resources.

4 CONCLUSIONS

Water supply activities in rural areas of the Mekong Delta have shown strong development in recent years. However, in order to achieve the Water Supply Targets/Objectives under the National Strategy on Clean water and Environmental Sanitation in rural areas [9], there must be specific solutions which have to be implemented in combination and synchronization. A number of major solutions proposed for application are as follows: water supply in the Mekong Delta shall prioritize the development of centralized water supply model, upgrading and increasing the capacity of existing water supply facilities to meet additional requirements for on-site water supply; building brand new and upgrading and expanding centralized water supply stations, prioritizing the development of centralized water supply works in the order of: large-, medium- and small-scale; prioritizing the development of centralized water supply in difficult, deep-lying and remote areas where the ratio of water supply is low.

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