

CHAPTER 10

CONCLUSIONS AND RECOMMENDATIONS

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10.1 Conclusions of Feasibility Study

For the of reasons outlined below, the proposed priority projects can be assessed as feasible.

Throughout the planning process of the water supply system improvement works for the 1st Stage Project, continuous attention was paid by the JICA Study Team to ensure that any improvement works to be proposed can be implemented, operated and maintained within the level of technical skills and engineering capacity currently available in Vientiane and in Laos PDR. It is therefore expected that the priority projects can be implemented within the time frame envisaged, and that the project, once it has been implemented, can be managed on a sustainable basis.

The water resources available from the Mekong River required for the expansion of the exiting Kaolieo Treatment Plant has been confirmed as having the necessary quantity to meet the additional raw water requirement for the proposed Kaolieo Treatment Plant (44,000 m³/day including unavoidable loss within the plant).

The priority projects will increase the supply capacity of the NPVC water supply system from the present 100,000 m³/day to 140,000 m³/day. This drastic increase in supply capacity is expected to alleviate the chronic water shortage situation in Vientiane. The priority projects also includes the rehabilitation of the existing Kaolieo Treatment Plant to secure its function for several decades, and the improvement of the existing Chinaimo Treatment Plant for stable water transmission and distribution to the whole service area including Dongdok area where severe water shortage occurs. Additional transmission pipelines and distribution pipelines also will be installed under the priority project so as to distribute additional treated water from the expanded Kaolieo Treatment Plant.

10.2 Recommendations on Further Steps

10.2.1 Engineering Aspect

(1) Coordination with AFD Study

Unfortunately, because the procurement procedures of the AFD consultants to execute the study on the distribution system and household connections were delayed, the timing of the completion of the studies by JICA and AFD are not coordinated. The AFD study concerning the distribution system

will be continued until middle of year, 2004.

During the stages of the master plan and feasibility study by the JICA, JICA Study Team and AFD consultant have exchanged information to maintain the consistency of these two studies. The feasibility study is to be completed by the time of submission of this report, the Lao PDR is recommended to coordinate with the AFD and AFD consultant about the AFD study conforming to the results of the JICA study.

(2) Coordination with the AFD Training Centre Project at Chinaimo Treatment Plant

Construction of an additional distribution reservoir at the Chinaimo Treatment plant is planned as part of the 1st Stage of this project in this feasibility study. On the other hand, the NPVC will commence the detailed design and construction of the training centre at the Chinaimo Treatment plant. Since the detailed design has not yet commenced, the NPVC could not confirm the exact location of the training centre in the Chinaimo Treatment plant premises. The Lao PDR is recommended to secure and reserve the land space required for the additional distribution reservoir at the Chinaimo Treatment plant. It should be noted that the improvement of the Chinaimo Treatment plant including the construction of the additional reservoir is indispensable to transmit a stable water to the northern part, of Vientiane, in particular, the Dongdok area. Water shortage problems in the Dongdok area is one of the biggest issues and to solve this issue, the improvement of the Chinaimo Treatment plant was planned by separating the transmission and distribution systems, including the construction of an additional reservoir.

(3) Careful Consideration on River Bank Protection at the Intake of Kaolieo Treatment Plant

To minimize turbulent flow and damage of the existing river bank, the intake pipe type intake facility was proposed by this study which will not create an obstacle for the water flow at the Kaolieo Treatment plant. However, for both sides upstream and downstream, of the new intake facility, river bank protection should be implemented to secure the planned lifetime of the new and existing intake facilities. The type of the river bank protection will be decided during the detailed design of the project. It should be discussed among the MCTPC and DCTPC which have responsibility of the river bank protection of the Mekong River. It also recommended to refer the results or recommendations of the river bank protection project which is under implementation by JICA. The river bank protection project will provide a good example of the river bank protection near the Kaolieo Treatment Plant.

(4) Reduction of UFW

Water supply conditions will be improved by the implementation of the projects. Increased pressure in the distribution system will secure a stable and continuous supply to the whole service area. Therefore, as a side effect, water leakage will increase after completion of the 1st Stage of the project. It is strongly recommended that the NPVC concentrate fully on leakage detection for visible leakages upon completion of the 1st Stage Project. In the current situation, many underground leakages are not found because of low supply pressure. Upon improvement of water supply pressure, these underground invisible leakages will become above ground, visible leakages. This will be a chance to find and repair current underground leakages. If the leakage repairing work is not implemented by the NPVC, the ratio of UFW will increase rapidly from the pressure increase in the system. To implement necessary actions against increasing leakages, it is recommended to do a budgetary arrangement and staff assignment for the leakage repair work.

At the completion of the 1st Stage of the project in 2007, the total production capacity of the system will be 140,000 m³/day, the same as the daily maximum water demand in 2007. This means that from the time of completion of the 1st Stage, production capacity will be less than the water demand until 2012, when the 2nd Stage of the project will be completed. Reduction of UFW and water conservation promotion, which is discussed below, will be a key factor for the alleviation of water shortages up to 2012.

For the reduction of UFW, the JICA will carry out project type cooperation for capacity building. As part of the cooperation, a Japanese expert in UFW reduction will be assigned and will be of great help for the future the NPVC UFW reduction activities.

To prevent leakage, pressure control in the distribution system is indispensable. To conduct pressure control, the NPVC should know the pressure distribution in the service area. It is recommended to establish fixed pressure monitoring points at the same places as the water quality monitoring points as described below, and pressures should be measured periodically. Based on the pressure records from these fixed monitoring points, valve adjustment should be conducted to avoid extreme high pressure and to stabilize pressure distribution in the service area.

The definition of unaccounted-for water (UFW) is difference between total distributed water quantity and total metered water quantity at customers' connections. Therefore, water quantity equivalent to unpaid water bill, which is not paid by customer, is not included in the UFW. Needless to say, the unpaid water quantity should also be reduced as reduction of the UFW.

(5) Monitoring water quality and quantity

Quality of the NPVC services should be monitored by itself in aspects of quality and quantity. The sound operation of the water supply system will be achieved by feeding back actual situations of the NPVC services. To understand the actual situation, the monitoring of its services are invaluable. Water quantity of production, transmission, and distribution from the respective treatment plants should be always measured and recorded. The quantity data is the basis of the evaluation of UFW conditions and the financial situation of the NPVC.

Water quality should be analyzed at the respective treatment plants to decide the adequate chemical dosage rates and to supply safe water to customers. Water quality monitoring is recommended not only at the treatment plant, but also at service connections periodically selected within the service area. The NPVC is recommended to select several tens of fixed point for monitoring residual chlorine and other necessary water quality indices. These results should be disclosed to customers so as to raise the awareness of the safety of the distributed water.

(6) Adequate Operation and Maintenance

Although individual staff are doing good job at the existing treatment plants, many functions of the treatment plant are not effective because of the lack of overall coordination among different sections of the treatment plant. The role of coordination or management by a management level higher than technicians or workers, such as engineer level or manager level is very important. Furthermore, maintenance work seems to be conducted in an allopathic manner. Once the condition of equipment demands attention, it is only then that, maintenance work is done. However, equipment usually requires periodical maintenance, such as lubrication in order to prevent malfunction.

The above mentioned engineering or managerial level staff should prepare periodical maintenance schedules with the required frequency, such as daily, monthly, and yearly for the necessary maintenance work.

A water transmission system independent from the connected distribution pipelines will be established after completion of improvement work at the existing Chinaimo Treatment Plant. Water from the Chinaimo Treatment Plant will be transmitted through the independent transmission line to far north end of the service area. Hourly fluctuations of water levels of reservoirs including elevated tanks should be recorded and relayed to operators of the transmission pumps. The operator of the transmission pumps will be able to operate the pumps to secure water transmission to the northern area referring to the data of the water level fluctuation, pressure and the flow quantity at the outlet of the pumps. Based on the water level fluctuation data, valve adjustment will also be required.

Comparing the water level pattern of the respective reservoirs, valves on pipes should be adjusted, closing the valve on pipeline to always fulfilled reservoir or open the valve on the pipeline to always low water level reservoir.

(7) Recruiting and training of additional staff

Additional staff for the expanded Kaolieo Treatment Plant and the expanded pipeline system will be required. It is recommended to start arrangements for recruiting additional staff and provide training for them. The training program is presented in the previous chapter.

(8) Feasibility Study and Review of the Master Plan will be required

Upon completion of the 1st Stage, a feasibility study will be required for the 2nd Stage for its successful implementation. At the same time, a review of the master plan will also be required. The master plan is the long term plan, and the Vientiane water supply situation will change because of unforeseen factors. Therefore, the master plan should be reviewed at every turning point during the progress of the water supply development.

The scale of the 2nd Stage is rather large for international institutions, or the Lao PDR's own funding even though the economic and financial viability is confirmed. Therefore, in order to adapt the 2nd Stage Project to an appropriate capital investment scale, efforts in water conservation and the reduction of UFW are indispensable by the NPVC. After completion of the 1st Stage of the project, a feasibility study will be required to implement the 2nd Stage. During the feasibility study for the 2nd Stage, the scale of the 2nd Stage will be reviewed. If the situation is that the maximum water demand is reduced by the promotion of water conservation, and the reduction of UFW is greater than estimated by the study, implementation of the 2nd Stage will be able to be divided into two phases, a production increase of 30,000 m³/day in two phases, or to reduce the planned increase to 50,000 m³/day from 60,000 m³/day. Such modifications of scale to the 2nd Stage will reduce the financial impacts to the NPVC. These options for the scale of the 2nd Stage should be reviewed during the feasibility study for the 2nd Stage.

(9) Coordination with Road Improvement Project by the Japan's Grant Aid

The project to improve the road passing through the centre of the city including the Luang Prabang Road in front of the Wattai International Airport is an on-going project by the Japan's Grant Aid. The priority project includes the installation of distribution mains of about 1.6 km along the Luang Prabang Road. If the implementation of the pipeline installation takes place after the road construction is completed, the new road constructed by the Japan's Grant Aid should be demolished and restored. It is planned for the construction works for road improvement will start in 2004 and it

will take about 2 years. Therefore, depending on the timing of each construction and the coordination between the road project and this project, it is a possibility to construct the two projects at the same time.

10.2.2 Institutional Aspect

(1) Expansion of autonomous status of General Manager

The NPVC is responsible for the management and operation of water supplies, and these management and operation systems are based on commercial principles. The operation and maintenance of these systems are conducted in accordance with performance indicators (PI). An enterprise is required to achieve the targeted performances, and the achievements of these performances are the responsibility of the General Manager as the senior manager of the enterprise. To achieve the set performances requires a certain amount of autonomous status for the General Manager. It is desirable to fix the range of autonomous status as broad as possible. The Prime Ministerial Decision (37/PM 1999) also describes that the NRW level should be maintained at less than 30%, the efficiency of collecting water bills should be targeted at 90%, and the O & M by NPSE should be in accordance with PIs, such as water use efficiency, water quality, reliability of supply, staff utilization and the level of consumer complaints. The NPSE's various PIs described above will not be achieved if the GM's, the representative of NASE, autonomous status is not fully secured. Autonomy goes hand in hand with the ability of the General Manager to exhibit strong leadership and management skills.

According to Article 11 (Regulation of Enterprise, 1999), the Administrative Council (AC) shall supervise the GM, but not directly join to manage the daily operations of the GM, except if the GM is a member of the AC.

The GM is usually appointed as a member of the AC, therefore the GM is usually in the position for the AC to supervise the daily work of the GM. The supervision of the GM by the AC includes orders in general, and this is not deemed to be a suitable method of business operations.

(2) Promotion of Public Private Partnership

As described in other sections, in the NPVC, the meter reading and water rate collection are both tasks which are carried out by staff as a single duty. These combined work duties seem to bring about a lower efficiency. For example, the staff / 1,000 connections ratio is high (16.1 staff to 1,000 connections, where in the average for 50 other SE Asian cities is 11.8). The UFW and the NRW are

also high in comparison to other cities (33 : 39 / 35 : 40).

Considered from a view point of an efficiency oriented corporate management, reforms will be necessary, to be taken in various managerial phases. It is considered that one of the measures, PPP is worth studying as a reform which could be adopted.

(3) Reconsider the roles of a Drinking Water Factory

The NPVC factory produces 3 kinds of bottled water (in sizes of 20, 0.95 and 0.5 litre) from the NPVC. The water is treated using an advanced processing system (using a ceramic membrane) and the NPVC sells the product to customers. Comparing the charge of 0.5 litre bottled water produced in the factory (583 Kip) to the domestic water rate of 1m³ (219 Kip), we find a difference of approximately 5,000 times between the prices of the two commodities.

The mission of a water supply utility is to supply safe and potable water to the inhabitants of the community, and not low quality water which one cannot drink without boiling. The supply of water which one cannot drink without boiling is unsatisfactory, compared with the stated mission of the water utility. A continuous effort and a large amount of investment will be necessary to improve such a situation. The production and sale of bottled water seems to weaken such an effort. It is considered that water quality is sufficient when it meets the guidelines of the WHO. It seems unnecessary to produce special quality water named Crystal, when the price is taken into account.

It is considered that an effective alternative to bottled water is the improvement of the quality of tap water. If a domestic customer can drink tap water directly without boiling the water, they will be reluctant to buy expensive bottled water which can cost as much as 5,000 times that of utility water. In a situation where there are significant numbers of domestic customers using bottled water for drinking, and tap water for other purposes, the water utility is considered to be fulfilling their tasks inadequately. It is pointed out that a high infant mortality in Lao is connected with the insufficient supply of safe water, and it with this information in mind that it is necessary to examine the role of the water service again. This should be considered as a long-term subject.

10.2.3 Water Conservation and Water Demand Management

In a situation of severe water shortages, the appropriateness and cost effectiveness of demand-side solutions must be considered and emphasized, along with supply-side augmentation options. Attention must be devoted to managing the increasing demand for water to achieve a sustainable long-term balance between water availability and water requirement in an equitable manner.

The comprehensive programme for water demand management includes four major measures with sub-measures as followed:

- Water conservation measures, which include 1) leakage detection, 2) reduction of illegal connections, 3) in-house retrofitting, 4) out-of-house water saving measures.
- Water pricing measures, which involve 1) water metering, 2) tariff structure.
- Information and education measures, which include 1) awareness raising, 2) public involvement, 3) in-school education.
- Legal measures, which include 1) rules and regulations that form the basis of the WDM policy, 2) regulations on the resale of water

Measures for water conservation and water demand control taken by the WASA/NPVC are considered and selected, through discussion among counterpart staff and the JICA study team based on the participatory analysis made with various stakeholders in the PCM (Project Cycle Management) workshop. The detailed strategy and action plans for the water conservation and water demand control were further incorporated into the “NPVC’s Challenge for Water Conservation / Water Demand Control” (See Volume VI, Annex 27). These emphases and recommendations were given for the immediate introduction of the following measures.

- Introduction of pricing measure
- Introduction of information and education measures, which includes (a) public involvement, (b) raising awareness, (c) public education for water demand management / water conservation.
- Introduction of legal measures for governmental institutions, and raising social pressure for these institutions
- Re-clarification of domestic and non-domestic use in governmental institutions
- Reduction of unaccounted-for water (UFW)
- Improvement of customer services and public relations

(1) Introduction of pricing measures

Water pricing measure is one of the most effective measures for water demand management and water conservation, with an introduction of a progressive block tariff system, or increasing tariff system. Thus, it is recommended for the WASA/NPVC to formulate an appropriate tariff structure in an equitable manner which is sensitive to the needs of the poor, taking into consideration any adverse effects of the implemented changes. It should be emphasized that the effectiveness of the measures is assured in combination with an extensive awareness raising campaign among consumers.

(2) Introduction of information and education measures

1) Public Involvement

Involvement of consumers in the planning, implementation, and monitoring of water conservation and water demand control programmes is essential. Conditions and problems of concern for both the consumer and provider can be exchanged in the workshops and meetings, and can be incorporated into a programme in a comprehensive manner. Thus, it is suggested that the NPVC/WASA form a formal advisory group for the development of an efficient, effective, and acceptable program for the public. Members of the advisory group will be composed of representatives of the governmental organization concerned, staff from the WASA/NPVC, representatives from major interest groups, and local professionals and consultants.

2) Raising Awareness

Awareness issues shall be emphasized particularly when dealing with difficult decisions like the introduction of new pricing measures (i.e. introduction of progressive tariff structure). For any issues of public policy, the public is more likely to accept such a difficult decision if it is well aware of the commitment and effort of the service provider for the provision of improved services in a cost effective way. The specific needs and opportunities are identified through the study, for the increase of public awareness in the following areas.

- The NPVC's commitment to the management, operation and maintenance of the public water supply service
- The adoption of the user pay principle in management, operation and maintenance of the public water supply service
- The NPVC's efforts to provide safe water (improved water quality)
- Understanding of water as a common and vital commodity for life, but also a limited resource

3) Public Education for Water Demand Management / Water Conservation

Public education is certainly one of the most important instruments for achieving a successful

campaign for water conservation and water demand management. Thus, a stepped implementation plan for public education is recommended for the NPVC/WASA, of which details are described in 4.3.1, (3) 2) (c), public education for water demand management and water conservation.

(3) Introduction of legal measures

A considerable amount of water loss and wastage is observed particularly in the government institutions, which also ignore accumulated water bills and arrears. In this situation, the loss and wastage of water is amplified by a lack of awareness of those institutions and their staff on water conservation, while disconnection of supply as countermeasure is often hindered by political will and pressure. Thus, it is recommended to formulate government regulations that form the basis of water demand management and water conservation particularly for those government institutions in the long term. On the other hand, an increase of public pressure, by disseminating information on the amount consumed and wasted by those government institutions is also an effective measure to change political attitudes.

(4) Re-clarification of domestic and non-domestic use in government institutions

It is realized that some government institutions are categorized as non-domestic users. These institutions distribute large quantities of water to be provided for staff accommodation in their residential areas, while accumulating large amounts of water bills and arrears. It is also assumed that officers and staff in those government residential areas are not water-saving consciousness since many government institutions have a policy to subsidize the staff's water bills. Thus, the re-classification of domestic and non-domestic users in government organizations should be made, and use in their residential areas and accommodation should be regarded as domestic use. These measures should be followed by the introduction of individual meter reading and billing systems, whether or not those bills are subsidized by those governmental institutions. The regular procedures for non-payment of arrears, such as disconnection, should be taken for those institutions and individuals if unacceptable arrears are amassed. This can also have the effect of applying pressure on the government organization to pay the bill in situations where they have a policy of subsidizing bills.

(5) Reduction of unaccounted-for water (UFW)

Reduction of unaccounted-for water (UFW) is the most acute and first priority action within the water demand management strategy. The NPVC, as the water supply service provider, should strive to supply water efficiency and effectively, taking the necessary steps to reduce leakage and illegal connection to its water network, while developing and implementing measures to promote water conservation and water demand management as described previously.

Although a two-year action plan for the reduction of UFW has been formulated, it is regarded as a preparatory plan to put the UFW reduction works carried out by the NPVC on track. These plans have to be further developed into a long-term plan. The requirements of the subsequent actions taken by the NPVC for the reduction of UFW are identified through the projection of the expected water pressure increase caused by the implementation of the priority projects selected in the master plan. These staged series of actions are further explained in 4.2.2, Reduction of Unaccounted-for Water (UFW).

In the process of the reduction of UFW, the detection of illegal connections is also extremely important, with the assumption that there are a considerable number of illegal connections which attribute to a higher ratio of UFW.

(6) Improvement of consumer services and public relations

Having no specific section for customer service and public relations, the NPVC is hindered in their attempts to increase users' awareness and seek their cooperation for the public water supply service. The public water supply service will become viable and sustainable when there is a mutual confidence between the two groups, and cooperation is increased between the service provider and consumers.

The improvement of customer service and public relations become indispensable in the efforts to increase public awareness and encourage the cooperation of users in the water supply service in particular, when some crucial decisions are taken, such as the introduction of new pricing measures and the campaign for water conservation and water demand management. Disclosure of information by the media, and the publication of an annual report, with information such as the financial status and the utilization of the collected revenue, is another measure to increase the transparency of the service provider, thus increasing the users' awareness and cooperation.

It is repeatedly emphasized however, that the improvement of public relations, of which information flows are often one sided from the service provider to consumers, alone can not increase the awareness and cooperation of users without the provision of improved services and the mitigation of consumers dissatisfaction of the service.

The study revealed that consumers dissatisfactions are concentrated on "the manner in which defects are repaired", "the manner of public relations", "water quality", "the manner of notice", and "the quantity and pressure of water provided". Improvement of public relations will build mutual

confidence and the cooperation of users only along with the mitigation of those dissatisfactions and claims by a swift response and provision of countermeasures, and by consumers placing a higher value on the services provided and utilizing the service in a responsible manner.

10.2.4 Financial Aspect

(1) Common characteristics of the cost recovery policy for the NPVC

The NPVC has to make all members in the company have a common characteristic of cost recovery. As discussed in the financial analysis, it is hard work for the NPVC to attain full cost recovery for the proposed project by the end of the project life. Thus, all members have to have a correct understanding of the cost recovery process, and to carry out their duties to realise the target of full cost recovery. In particular, the NPVC must improve its financial conditions indicated in the master plan. Furthermore, it is important that every section of the NPVC performs the financial issues extracted from the financial analysis for cost recovery.

(2) Consensus of the water tariff between all stakeholders in the water supply operations

A rising water tariff for every water consumer is indispensable for the process of the proposed project. The tariff structure was designed to start at the present water tariff level, and to raise the water tariff in accordance with the household income, in order to attain the full cost recovery policy. Then, financial incentives are essential to ensure the participation in the proposed project of all stakeholders. In the context of the water supply project, the participants include: the government, who guarantee the financial source, the project entity (NPVC), which runs the project, water users (domestic and non-domestic users) of the project outputs, the lenders, who lend money for the capital investment, and the suppliers of inputs to the project.

10.2.5 Environmental Aspect

The Initial Environmental Examination (IEE) and the Environmental Impact Assessment (EIA) were conducted as part of this study. Both the IEE and the EIA have been carefully evaluated for possible impacts on the environment which might be derived from the implementation of the priority projects. These evaluations indicated that the project can be implemented and maintained without adversely affecting the environment throughout the stages of construction and operation, with implementation of the recommended mitigation measures.

10.2.6 Project Implementation

The water shortage situation in Vientiane is in a state where it is expected that it will become worse every year. Therefore, it is strongly recommended to implement the priority projects as recommended in the Feasibility Study. The Lao PDR side is recommended to initiate budgetary arrangements to finance the project implementation.

For the implementation of the projects, it is recommended to establish Project Implementation Unit (PIU), which will consist of representatives from WASA, DHUP, MCTPC, NPVC and DCTPC.