Viet Nam

Ex-post Evaluation of Japanese ODA Grant Aid Project
"The Project for the Groundwater Development in Rural Part of Northern Provinces in Viet Nam"

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0. Summary

This Project is highly relevant to the country's development plan and development needs, both at the time of planning and at the time of ex-post evaluation. The Project was also in line with Japan's ODA policy at the time of planning. Hence, its relevance is high. The Development Study, which was conducted ahead of this Project, assisted this Project to narrow down the target area from 20 communes to 12 communes in light of needs and feasibility. Thus, the target area was properly selected. Efficiency is rated high since the expected output was obtained as planned within the planned project cost and period. This project has somewhat achieved its objective, namely the stable supply of safe water (population served and its percentage against the total population, maximum/average water supply amount per day, etc), and the provided equipment by this Project has been fully utilized. However, there are some minor problems; 1) some indicators are not up to the expectation in some communes; 2) non-revenue water rate is high in general; and 3) there is some room for improvement in water quality, therefore its effectiveness is fair. Some problems have been observed in terms of financial aspects and current status of operation and maintenance, therefore, sustainability of the project is fair. In light of the above, this Project is evaluated to be satisfactory.

1. Project Description

Project Location

Water Plant in Van Thang, Thanh Hoa

1.1 Background

The project target areas are located in the rural areas. As there was no public water supply facility in those areas in 2001, most residents used groundwater from shallow wells (five to ten meter depth), surface water from river, lake and ponds, and rain water. In the dry season which

lasts for six months, 20-80 % of the shallow wells dried up. Poor water quality of shallow wells caused water-borne diseases such as diarrhea, sore eye and skin diseases.

The Viet Nam's Rural Social and Economic Development Plan in 1996 highlighted the importance of the groundwater development in the five Northern Provinces. However, due to the lack of data regarding the needs and feasibility, the Government of Viet Nam (GoVN) and the Government of Japan (GoJ) signed an agreement on the Scope of Works of the Development Study for the Groundwater Development in the Northern Provinces.

The Development Study for Groundwater Development in the Rural Part of Northern Provinces was implemented between 1998 and 1999 with the following components: a) to investigate ground water quality and situations in the twenty communes[1]; b) to formulate a Master Plan for the groundwater development towards 2010; and c) to conduct a feasibility study[2] in the fifteen communes including this project's target areas. In order to achieve the groundwater development project in the above areas, GoVN requested GoJ for a grant aid project in July 1997.

1.2 Objective

The objective of this project was to provide stable supply of safe water in the total of eleven locations in the twelve communes[3]: four communes in Thai Nguyen Province, three communes in Ninh Binh Province and five communes in Thanh Hoa Province by drilling deep wells, constructing the water treatment facility, chlorination facility and distribution ponds and installing the distribution and house-connection pipes. The location of the project site and the project summary are shown in Figure 1 and Table 1.

1 The Master Plan planned to construct water plants by groundwater development from the beginning. As a result of groundwater survey, it was found that groundwater development was difficult in the five communes out of twenty communes, the four communes in Ha Tinh Province and Nong Cong Town in Thanh Hoa Province, because of insufficiency and salination of groundwater. Therefore, these five communes were removed from the target areas of this Project.

2 After the Feasibility Study, communes in the suburbs of Hanoi City were removed from the target areas of this Project due to the following reasons: 1) those communes were located in the target areas of the next phase of the water development project of Hanoi City; and 2) there was a high possibility that the water project would be managed by Hanoi Water Company, not by communes.

3 Thai Nguyen Province: Hoa Thuong, Dong Bam, Thinh Duc, Nam Tien, Ninh Binh Province: Dong Phong, Quang Son, Yen Thang, Thanh Hoa Province: Vinh Thanh, Vinh Loc, Dinh Tuong, Van Ha, and Van Thang. Because Vinh Thanh and Vinh Loc communes share one water plant, the number of water plants is eleven.

Figure 1 Location of Project Site

Table 1 Project Summary

Grant Limit/ Actual Grant Amount	2,056 million yen / 2,043 million yen
Date of Exchange of Notes	Term I: July 2002, Term II: July 2003, Term III: July 2004
Implementing Agency	Center for Rural Water Supply and Environmental Sanitation (CERWASS), Ministry of Agriculture and Rural Development (MARD)
Project Completion Date	Term I: February 2004, Term II: February 2005, Term III: January, 2006
Main Contractors	Construction: Hazama Corporation, Equipment: Mitsubishi Corporation
Main Consultants	Joint Venture: Docon Co., Ltd. and Pacific Consultants International
Basic Design	"Basic Design Study on the Groundwater Development Project in Rural Part of Northern Provinces" May 2001-December 2001
Detailed Design	July 2002- December 2004
Related Projects	Development Study "Groundwater Development in Rural Part of Northern Provinces" (1998-1999)

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko Miura, Global Link Management Inc.

2.2 Duration of the Evaluation Study

Duration of the Study: From December, 2010 to November, 2011.

Duration of the Field Study: From April 3rd to April 17th, 2011 and From July 4th to 15th July, 2011.

2.3 Constraints during the Evaluation Study

No particular constraint was identified.

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Relevance with the Development Policy of Viet Nam

At the time of planning, the objectives of the Viet Nam's "National Rural Water Supply and Sanitation Strategy up to 2020" approved in 2000 were the followings: 1) more than 85% of the rural people have access to the safe and clean water of 60ℓ/day per person by 2010; and 2) 100% of the rural people have access to the water of the same quality and the quantity by 2020.

At the time of ex-post evaluation, the above strategy remains as a basic policy. In addition, the National Target Program for Rural Water Supply and Sanitation (NTP) III for 2011-2015 was formulated in 2010. The NTP III outlined the following specific targets: 1) 95% of the rural people have the access to the safe and clean water of 60ℓ/day per person at least by 2015; and 2) more than 65% of the rural people have the access to the water of 60ℓ/day per person at least, which meets the QCVN02/2009-BYT (the national water quality standard applicable for water plants with the capacity of less than 1,000 m^3/day), by 2015.

3.1.2 Relevance with Development Needs of Viet Nam

At the time of planning, there was no public water supply facility in the target areas. Many families utilized shallow wells, water from lake, river, ponds and rain water. In the dry season which lasts for six months, 20-80 % of the wells dried up. Poor water quality of some shallow wells caused water-borne diseases such as diarrhea.

At the time of ex-post evaluation, some families use both tap-water from the project facility and other water sources. However, in dry season, because shallow wells dry up, more families utilize tap-water. In some areas, due to the bad quality of other water sources, some families use only tap-water or utilize tap-water for drinking and cooking. Therefore, there is a high needs for safe and clean water.

3.1.3 Relevance with Japan's ODA policy

At the time of planning, the top priorities of the Japan's ODA policy towards Viet Nam (2002) were human resource & institutional development, upgrade of economic infrastructure such as electricity and transportation, development of agriculture and rural areas, education & health and medical systems, and environment. Assistance for water supply in rural areas was included in the development of agriculture and rural areas, thus this Project was consistent with the Japan's ODA policy towards Viet Nam.

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4 A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, and D: Unsatisfactory.
5 ③:High, ②:Medium and ①:Low.

When some officials of the CERWASS were interviewed, they pointed that the durability and permanence of the facility and equipment could be identified as some reasons for the comparative advantage of Japanese assistance over the other donors in the water sector in Viet Nam.

This project has been highly relevant with Viet Nam's development plan, development needs as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

All facilities were constructed almost as planned by both Japanese and Vietnamese side. The facilities of water production capacity of 7,490 m^3/day in total were constructed as planned. The output of the project is shown in Table 2. Out of the total twenty two wells, nine wells which were dug as test wells in the Development Study are utilized as intake wells (40% of the total intake wells). Thirteen wells were newly constructed. The utilization of the existing facilities contributed to the efficiency of the project.

Table 2 Output (planned and actual)

	Planned	Actual
Japanese Side	- Deep wells, submersible intake pumps, pump houses, raw water transmission pipes - Treatment plants, chlorination - Reservoirs, distribution pumps, elevated tanks - Installation of distribution pipes - Block service pipes, house-connection service pipes, water meters (materials only) - Well-drilling equipment	Almost as planned. There is no cancellation or addition of outputs. The locations of some wells were shifted slightly and the conveyance/distribution pipes were extended or shortened slightly. Sludge removal bulbs were replaced by sludge removal pumps.
Vietnamese Side	- Land acquisition and leveling work - Access roads construction - Temporary land use for the storage - Construction of gates and fences - Public electricity supply works - Drainage works - Installation of block service pipes and house -connection services pipes and water meters	As planned

Source: Basic Design Report (2001) and Questionnaire Answer.

Signboard
(Dong Bam, Thai Nguyen)

Distribution Pump
(Hoa Thuong, Thai Nguyen)

Water Plant and Staff
(Nam Tien, Thai Nguyen)

3.2.2 Projects Input

3.2.2.1 Project cost

The Japanese Grant ceiling amount at ex-ante was 2,056 million yen and local funds equivalent to 179 million yen was to be provided by the Government of Viet Nam (GoVN) as counterpart funds. The actual cost was 2,043 million yen from the Japanese Grant and local funds equivalent to 163 million yen from the GoVN. The actual total project cost was within the plan (98.7% of the planned cost).

3.2.2.2 Project period

The planned project period was 36 months from July 2002to January 2006.

Both project period and the project cost were mostly as planned; therefore, the efficiency of the project is high.

3.3 Effectiveness (Rating: ②)

3.3.1 Quantitative effects

3.3.1.1 Operational and Effect Indicators

(1) Production Capacity, Maximum/Average Water Quantities and Facility Utilization Rate

The production capacity, maximum/average water quantities and facility utilization rate at the project site are shown in Table 3.

Table 3 Production Capacity and Maximum/Average Water Quantities

Province	Commune	Design Capacity (㎥/day)	Maximum Water Supply Amount (Actual) (㎥/day)	Maximum Facility Utilization Rate (Actual) (%)	Average Water Supply Amount (Target) (㎥/day)	Average Water Supply Amount(Actual) (㎥/day) (%) shows against the target	Average Facility Utilization Rate (Target) (%)	Average Facility Utilization Rate (Actual) (%)
Thai Nguyen	Hoa Thuong	770	770	100	569	569 (100%)	73.9	73.9
	Dong Bam	600	600	100	441	441 (100%)	73.5	73.5
	Thinh Duc	350	290	82.8	253	**190 (75%)**	72.3	**54.3**
	Nam Tien	450	400	88.8	331	300 (91%)	73.6	66.7
Ninh Binh	Dong Phong	980	840	85.7	726	710 (98%)	74.1	72.4
	Quang Son	510	243	**47.6**	373	**196 (52%)**	74.0	**38.4**
	Yen Thang	870	550	**63.2**	644	**500 (78%)**	74.0	**57.5**
Thanh Hoa	Vinh Thanh & Vinh Loc	1,290	1,100	85.3	953	782 (82%)	73.9	60.6
	Dinh Tuong	630	630	100	467	557 (119%)	74.1	88.4
	Van Ha	720	720	100	533	540 (101%)	74.0	75.0
	Van Thang	320	250	**78.1**	237	**167 (70%)**	74.1	**52.1**
Total		7,490	6,393 Against design capacity 85.4%	Average 85.7%	5,527 Against design capacity 73.8%	4,952 Against design capacity 66.1% Against Plan 89.6%	Average 73.8%	Average 64.8% Against Plan 87.8%

Source: Basic Design Report (2001) and Questionnaire Answer (2011).

At the time of ex-post evaluation, on average, the maximum water supply amount was 85.4% against the design capacity; the maximum facility utilization rate was 85.7%. Whereas the target average water supply amount was 5,527 m^3/day (73.8% against the design capacity), the actual was 4,952 m^3/day (66.1% against the design capacity), which

was 89.6% of the plan. Whereas the target average facility utilization rate was 73.8%, the actual was 64.8%, which was 87.8% of the target. Hence, on average, it can be concluded that the above indicators have been generally achieved.

On the other hand, three out of twelve communes (Quang Son, Yen Thang and Van Thang) did not reach eighty percent of the target in terms of the maximum water supply amount per day, and four out of twelve communes (Thinh Duc in addition to the above three communes) did not reach eighty percent of the target in terms of the average water supply amount per day. The common reasons why these communes could not reach even eighty percent of the target are the followings: 1) the population served did not grow as expected; and 2) the replacement of the existing water sources for the pipe-borne water did not happen as expected[6]. For the latter, one of the reasons can be that residents use bigger amount of water from existing sources than expected even after the project completion because the existing water sources in the four communes contain little amount of Manganese and Iron. According to the beneficiary survey, for example, five out of ten households in Thinh Duc use the tap-water for drinking, cooking and toilets while they use the water from shallow well for laundry and farming. Meanwhile, specific reason why the maximum water supply amount per day in Yen Thang remains as 63.2% of the design capacity is that one of the three wells is not functioning at the time of ex-post evaluation. Specific reason why the average water supply amount in Thinh Duc did not reach eighty percent of the target is that the intake water has been declining throughout the year compared with the time of project completion (Details are described in the section of sustainability).

(2) Population Served and the Accessibility Ratio to Portable Water

Table 4-6 show the target and actual figures of the population served and the percentage of the population served.

Table 4 Population served and percentage in the four communes in Thai Nguyen Province (Plan and Actual)

Indicators (unit)	2005 Target	2006 Actual	2007 Actual	2008 Actual	2009 Actual	2010 Actual
Population in the area (person)	29,988	30,204	30,424	30,555	30,867	31,144
Population served (person)	21,755	21,913	22,073	22,234	22,545	22,678
Percentage of population served (%)	72.5	73.0	73.2	73.2	73.5	73.3

Source: Target for 2005 is from the Ex-ante Evaluation Summary Sheet. The actual figures are from Thai Nguyen P-CERWASS.

6 At the time of the Development Study, it was expected that existing water resources would be utilized for farming and livestock and the pipe-borne water would be used for drinking, cooking and shower after the pipe-borne water is supplied. Upon the project completion, the actual consumption of the pipe-borne water was less than 60-70 L/day/person, which was expected at the Development Study.

Table 5 Population served and percentage in the three communes in Ninh Binh Province (Plan and Actual)

Indicators (unit)	2005 Target	2006 Actual	2007 Actual	2008 Actual	2009 Actual	2010 Actual
Population in the area (person)	28,286	23,734	23,740	23,756	23,770	23,839
Population served (person)	23,770	19,940	20,608	20,591	20,694	20,952
Percentage of population served (%)	84.0	84.0	86.8	86.7	87.1	87.9

Source: Target for 2005 is from the Ex-ante Evaluation Summary Sheet. The actual figures are from Ninh Binh P-CERWASS.

Table 6 Population served and percentage in the five communes in Thanh Hoa Province (Plan and Actual)

Indicators (unit)	2005 Target	2006 Actual	2007 Actual	2008 Actual	2009 Actual	2010 Actual
Population in the area (person)	34,055	30,120	30,425	30,683	30,972	31,278
Population served (person)	29,862	24,460	24,573	24,799	25,155	25,668
Percentage of population served (%)	87.7	81.2	80.8	80.8	81.2	82.1

Source: Target for 2005 is from the Ex-ante Evaluation Summary Sheet. The actual figures are from Thanh Hoa P-CERWASS.

Thai Nguyen Province achieved the target for 2005 regarding both population served and the percentage one year after the project completion in 2006. While the targeted accessibility ratio to portable water has achieved in Ninh Binh, the population served remained as low as 84% of the target. In Than Hoa, the population served remained 81.9% of the plan, and the actual accessibility rate was 81.2% against the target of 87.7%.

The communes, of which populations served went much below the target, are the followings: Quang Son was 64.6% of the plan (the actual population in the area was 49.3% of the plan); Van Thang was 83.1% of the plan (the actual population in the area was same the plan); and Vinh Thanh and Vinh Loc was 64.2%(the actual population in the area was 64.5% of the plan). The common reasons why these communes did not reach their targets may be that more residents continuously use the existing water sources such as wells, lakes/ponds and rain water than expected. Meanwhile, specific reasons are the followings. In Quang Son, at the time of planning, it was expected that staff of the cement factory and their families, approximately 2,000 persons, would receive the water by this Project facilities. However, at the time of ex-post evaluation, those people are receiving water from the plants constructed by the cement factory, thus the population served did not grow as expected. In addition, the surrounding area of the factory is located outside the current administrative area of Quang Son Commune, therefore the total population did not grow as expected.

In Vinh Thanh & Vinh Loc, at the time of planning, it was estimated that the population in the area would be 13,000 persons in 2005 based on the estimate of 11,900 persons in

2001[7]. However, according to the census by the two commune health posts in 2006, which were obtained at the time of ex-post evaluation, the population in the area is 9,070 persons. Due to the different data sources, exact gap analysis could not be conducted.

(3) Average Water Consumption per Person

Table 7 illustrates the average consumption of the pipe-borne water by the project facility per day per person. Out of twelve communes, five communes achieved the objective of providing 60 liters of portable water per day per person for Year 2010, which was set in the Strategy 2020. Four communes also achieved more than 80% of the target, although three communes did not reach 80% of the target. It can be judged that this indicator has been generally achieved.

Table 7 Average Water Consumption per Day per Person

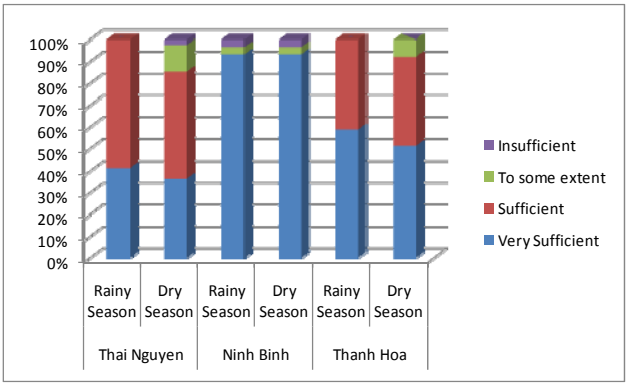
(unit: liter)

Province	Commune	2005	2006	2007	2008	2009	2010
Thai Nguyen	Hoa Thuong	NA	NA	NA	80	80	80
	Dong Bam	NA	NA	NA	60	60	60
	Thinh Duc	NA	NA	NA	52	52	52
	Nam Tien	NA	NA	NA	53	53	53
Ninh Binh	Dong Phong	30	35	45	79	79	80
	Quang Son	43	43	39	45	45	60
	Yen Thang	35	43	46	53	54	57
Thanh Hoa	Vinh Thanh & Vinh Loc	NA	NA	22	29	38	46
	Dinh Tuong	NA	NA	24	31	58	65
	Van Ha	52	58	60	54	60	57
	Van Thang	NA	NA	12	14	18	25

Source for the data between 2005 and 2007:
Ex-post evaluation by the Ministry of Foreign Affairs of Japan in 2008 (Original data: Ninh Binh P-CERWASS and Van Ha Commune), Source for 2008-2010: Questionnaire Answer by each P-CERWASS (2011).

Figure 2 shows the customers' satisfaction about the water quantity. According to the beneficiary survey, 80-90% households in all the three provinces responded that the water quantity was "Very sufficient" or "Sufficient". Thus, it can be said that customers are generally satisfied with the water quantity. In Ninh Binh Province, 93.4% respondents feel that water quantity is very sufficient both in rainy and dry season. On the other hand, in Thai Nguyen and Thanh Hoa Province, more respondents feel "very sufficient" in rainy season than in dry season. Some residents living away from the water plant in Thinh Duc and Nam Tien, Thai Nguyen Province, responded that the both water quantity and water pressure were insufficient in dry season.

7 Basic Design Report (Original data: Commune People's Committee).



Source: Beneficiary Survey (N=111) [8]

Figure 2 Customers' satisfaction about the water quantity

(4) Water Supply Hours

Before the project completion, there was no supply of pipe-borne water in the target area. At the time of planning, target water supply hours were not established. Water supply hours by each commune at the time of ex-post evaluation are summarized in Table 8.

Table 8 Water Supply Hours

(unit: hours)

Province	Commune	Dry Season	Rainy Season
Thai Nguyen	Hoa Thuong	20-22	12-24
	Dong Bam		
	Thinh Duc	6-10 (Peak hour in the morning, noon and evening only)	7-11(Peak hour in the morning, noon and evening only)
	Nam Tien	10.5 (Peak hour in the morning, noon and evening only)	16 (Suspension in the night time)
Ninh Binh	Dong Phong	17(5a.m.-9p.m.)	
	Quang Son	18(5a.m.-10p.m.)	
	Yen Thang	24	
Thanh Hoa	All communes	24	

Source: P-CERWASSs

After the project completion, water is supplied only in peak hours or water supply is suspended during the night time in the most target areas. Only in Thanh Hoa Province, water is supplied for twenty four hours. In Thinh Duc and Nam Tien, Thai Nguyen Province, water is supplied only six to sixteen hours. According to the beneficiary survey, three out of ten households in rainy season and eight out of ten households in dry season

8 The beneficiary survey was conducted in 10 communes out of 12 communes: 4 communes in Thai Nguyen Province, 4 communes in Thanh Hoa Province, and 2 communes in Ninh Binh Province. 48.6% of the respondents are male and 51.4% are female. The age of the respondents ranges from 31 to 83. The respondents are farmers, self-employers, government officials, teachers, housewives, and others. 84% of the respondents connected the pipe-born water in the same year of the project completion.

receive water less than six hours. Thai Nguyen P-CERWASS raised the following reasons why the water supply hours are short in its Province. The intake water has been decreasing since the project completion. Consequently, water is supplied by blocks in shifts and some households at the end of pipeline network cannot receive water. In addition, because the dry season lasted longer than usual in 2010 and the black-out was serious, pumps could not be operated sufficiently due to the black-out.

According to the beneficiary survey, even in Thanh Hoa, where 24 hour water supply area, about 68% residents receive water less than twenty hours. According to the Thanh Hoa P-CERWASS, because water pressure is not sufficient, water is supplied by blocks in shifts. As same as in Thinh Duc, pumps could not be operated sufficiently due to the frequent black-out in 2010.

(5) Non Revenue Water Ratio[9]

The Non Revenue Water (NRW) ratio in each commune is shown in Table 9. The NRW ratio of each commune in 2011 is between 35 and 51% except Van Ha Commune in Thanh Hoa Province and Quang Son Commune in Ninh Binh Province. The NRW ratio of these communes is judged high for the following reasons: 1) the NRW ratio of these communes is high compared with the ratio of the capitals in other neighboring countries; and 2) the pipes and water meters were newly installed by this Project, and thus the water leakage should be low. According to each P-CERWASS, the reasons for the high NRW ratio include the followings: 1) water leakage, 2) increase of defective meters, 3) aging of water pipes, and 4) steeling. The reasons vary from commune to commune. Water leaks were caused by the expansion of pipeline network after the project completion and by careless cutting of water pipes during the construction of new roads. Increase of defective water meters was caused by aging of pipes and by $CaCO_3$, which stick to water meter faces. One of the causes of water steeling is that users manipulate their household water meters because the household water meters are installed inside houses particularly in Ninh Binh Province.

On the other hand, the NRW ratio is low in Van Ha because water pipes installed by this Project were not cut by constructing new roads. Construction of new roads and the

9 Non revenue water (NRW) ratio is the ratio of the water that has been lost before it reaches the customer against the water that has been produced. The typical causes include water leakage due to over-aged distribution pipes, illegal connections to pipes, etc. The NRW ratio in the neighboring countries is as follows: 26% in Phnom Penh, 28% in Vientiane, 38% in Ho Chi Minh, and 40% in Dhaka (Data source: Water in Asian Cities, Utilities Performance and Civil Society Views, ADB, 2003. The figure is the data of 2001) . In Siem Reap, the NRW ratio is 34.6% in 2004(project commencement), 26.2% in 2006 (project completion), 12.1% in 2009 (ex-post evaluation) (Data: Ex-post Evaluation Report of the Project for Improvement of Water Supply System in Siem Reap Town", JICA, 2009). New water pipes were constructed and water meters were installed by this Project, and the executing agency has been conducting NRW measures.

installation of water pipes by the Project were carried out around the same time. In Quang Son, the NRW ratio is declining because the P-CERWASS has carried out preventive measure for leaks by replacing obsolete pipes and defective water meters. Dong Phong and Yen Thanh Commune are considering in re-installing house water meters outside each house in order to prevent water steeling.

Table 9 Non Revenue Water Ratio

(unit: %)

Province	Commune	2005	2006	2007	2010	2011
Thai Nguyen	Hoa Thuong	NA	NA	35	NA	37
	Dong Bam	NA	NA	32	NA	35
	Thinh Duc	NA	NA	37	NA	38
	Nam Tien	NA	NA	35	NA	36
Ninh Binh	Dong Phong	40(35)	42(33)	36(30)	38.7	38.6
	Quang Son	(37)	(33)	(33)	NA	25
	Yen Thang	(35)	(34)	(32)	NA	40
Thanh Hoa	Vinh Thanh & Vinh Loc	NA	NA	NA	NA	45
	Dinh Tuong	NA	NA	NA	NA	35
	Van Ha	NA	NA	15	NA	18
	Van Thang	NA	NA	NA	NA	51

Source: P-CERWASSs. The figures in () shows the data in the ex-post evaluation report by the Ministry of Foreign Affairs (Original data is from P-CERWASSs).

3.3.2 Qualitative Effects

3.3.2.1 Water Quality

Water quality is monitored by P-CERWASSs in Ninh Binh and Thanh Hoa while it is monitored by the Preventive Medicine Department in Thai Nguyen. Table 10 shows the national standards of some quality parameters and the monitoring results of water quality. The quality of treated water at the water plant fulfills the national standards in respect of these important parameters. However, attention is to be paid to the following two issues.

(1) High amount of Manganese in water in Van Ha and Dinh Tuong

Table 10 illustrates that the Manganese parameter did not fulfill the 2007 standards (less than 0.5mg/L) in 2008 and 2009 in Van Ha and Dinh Tuong. In addition, the parameter remained high (Van Ha: 1.4mg/L, Dinh Tuong: 0.9mg/L) in 2010, although the parameter was removed from the 2009 national standards. The increase of contained amount of Manganese was caused by the change of the raw water quality.

(2) The hardness of water in all the communes except Yen Thang

As Table 10 shows, hardness of water ($CaCO_3$) fulfills the national standards (less than 350mg/L in QCVN02/2009-BYT, less than 300mg/L in QCVN01) in all the communes.

However, the hardness of water is beyond 10-100 mg/L, which is generally perceived to be good in taste, in eight out of twelve communes.

Table 10 Monitoring Results of Quality of Treated Water at the Project Facility

(Unit: mg/L except pH)

Province	Commune	Parameters	2005 Standard (Note1)	2007	2008	2009	2009 Standard (Note2)	2010
Thai Nguyen	Hoa Thuong*	pH	6.8-8.5	7.0	7.0	7.3	6.8-8.5	7.6
		Iron	< 0.5	0.03	0.05	0.03	< 0.5	0.05
		Manganese	< 0.5	0.024	kph	<0.02	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.001
		CaCO3	NA	NA	NA	NA	< 350	**276**
	Dong Bam*	pH	6.8-8.5	7.0	7.0	7.1	6.8-8.5	7.3
		Iron	< 0.5	0.018	0.06	0.02	< 0.5	0.04
		Manganese	< 0.5	0.024	kph	<0.02	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.001
		CaCO3	NA	NA	NA	NA	< 350	**244**
	Thinh Duc	pH	6.8-8.5	7.0	7.0	7.4	6.8-8.5	7.3
		Iron	< 0.5	0.003	0.12	0.22	< 0.5	0.05
		Manganese	< 0.5	0.07	kph	0.18	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.001
		CaCO3	NA	NA	NA	NA	< 350	**108-112**
	Nam Tien*	pH	6.8-8.5	7.0	7.0	7.2	6.8-8.5	7.4
		Iron	< 0.5	0.03	0.06	0.11	< 0.5	0.06
		Manganese	< 0.5	0.024	kph	<0.02	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.001
		CaCO3	NA	NA	NA	NA	< 350	**146**
Ninh Binh	Dong Phong	pH	6.8-8.5	7.9	7.5	7.7	6.8-8.5	6.9
		Iron	< 0.5	0.1	0	0.05	< 0.5	0.09
		Manganese	< 0.5	0	0	0.35	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.0015
		CaCO3	NA	NA	NA	NA	< 350	**121**
	Quang Son	pH	6.8-8.5	8.0	7.7	7.0	6.8-8.5	6.2
		Iron	< 0.5	0	0	0	< 0.5	0.05
		Manganese	< 0.5	0	0	0.3	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.0014
		CaCO3	NA	NA	NA	NA	< 350	**79**
	Yen Thang	pH	6.8-8.5	8.0	7.5	7.3	6.8-8.5	6.2
		Iron	< 0.5	0	0	0	< 0.5	0
		Manganese	< 0.5	0	NA	0.15	NA	NA
		Arsenic	< 0.05	NA	NA	NA	< 0.05	0.001
		CaCO3	NA	NA	NA	NA	< 350	46
Thanh Hoa	Vinh Thanh & Vinh Loc*	pH	6.8-8.5	7.3	7.5	7.4	6.8-8.5	7.3
		Iron	< 0.5	0.1	0.1	0.05	< 0.5	0.02
		Manganese	< 0.5	0	0	0	NA	NA
		Arsenic	< 0.05	0	0	0	< 0.05	0
		CaCO3	NA	NA	NA	NA	< 300	**150**
	Dinh Tuong*	pH	6.8-8.5	7.6	7.5	7.5	6.8-8.5	7.5
		Iron	< 0.5	0.25	0.05	0.05	< 0.5	0.05
		Manganese	< 0.5	**0.3**	**0.5**	**0.7**	NA	**0.9**
		Arsenic	< 0.05	0	0	0	< 0.05	0
		CaCO3	NA	NA	NA	NA	< 350	**80**
	Van Ha*	pH	6.8-8.5	7.5	7.4	7.5	6.8-8.5	7.4
		Iron	< 0.5	0.25	0.05	0.05	< 0.5	0.1
		Manganese	< 0.5	**1.0**	**2.6**	**0.5**	NA	**1.4**
		Arsenic	< 0.05	0	0	0	< 0.05	0
		CaCO3	NA	**NA**	**NA**	**NA**	< 350	**150**
	Van Thang	pH	6.8-8.5	7.2	7.0	7.0	6.8-8.5	7.1
		Iron	< 0.5	0	0	0	< 0.5	0.1
		Manganese	< 0.5	0	0	0	NA	NA
		Arsenic	< 0.05	0	0	0	< 0.05	0
		CaCO3	NA	NA	NA	NA	< 350	**80**

Source: P-CERWASSs in Ninh Binh and Thanh Hoa, and Preventive Medicine Department in Thai Nguyen.

* shows the water plant with treatment facilities to remove Manganese and/or Iron.

Note 1: 09/2005/QD-BYT.

Note 2: QCVN01/2009-BYT is applied for the water plant of more than 1,000 m^3/day capacity (Vinh Thanh& Vinh Loc only for this Project). QCVN02/2009-BYT is applied for that of less than 1,000 m^3/day capacity.

<Customers' Perception about water quality>

According to the beneficiary survey, 12% respondents felt that the water quality is "very good"; 51% "good"; 37% "bad"; and 0% "very bard". Nine out of ten beneficiaries in Yen Thang responded "very good" because the water quality is good and the contained amount of $CaCO_3$ is as little as 46 mg/ℓ. All the respondents who felt "bad" pointed out the hardness of water as a reason for the low quality of water.

House water meter face blurred with $CaCO_3$ in Quang Son, Ninh Binh

Water pot with $CaCO_3$ scale in Quang Son, Ninh Binh

Water pipes with Manganese in Van Ha, Thanh Hoa (DN40mm)

3.3.2.2 Effective utilization of the well-digging equipment

The drilling-machine, which was procured by this Project during the Term I, was fully utilized for digging wells for the Project during the Term I and II. The equipment was provided to the CERWASS in October 2004. Between the project completion in 2006 and the ex-post evaluation in 2011, the total number of wells which were dug with the above equipment was fifty (8.3 wells per year in average) as shown in Table 11. In particular, the drilling machine is used in the northern provinces such as Thanh Hoa, Thai Nguyen, Vinh Phuc, Hanoi, Bac Ninh, and Son La, particularly for the purpose of water supply in rural areas.

Table 11 Size and number of the dug wells by the supplied equipment by year

Year	Size and number of wells	Number by Year
2006	82m x4, 80m x1, 94m x1	6
2007	102m x 2, 80m x 1, 55m x 4,	7
2008	65m x 3, 80m x 1, 59m x 1, 85m x 2, 95m x 1	8
2009	60m x 2, 80m x 1, 59m x 5, 100m x 2	10
2010	59m x 2, 100m x 1, 80m x 5, 35m x 1, 69m x 1	10
2011	45m x 3, 70m x 2, 80m x 4	9
Total		50

Source: CERWASS Center for Material Delivery and Technology.

This project has somewhat achieved its objective, namely the stable supply of safe water (population served and its percentage against the total population, maximum/average water supply amount per day, etc), and the equipment provided by this Project has been fully utilized. However, there are some minor problems; a) some indicators are not up to the expectation in

some communes; b) non-revenue water ratio is high in general; and c) there is some room for improvement in water quality, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts

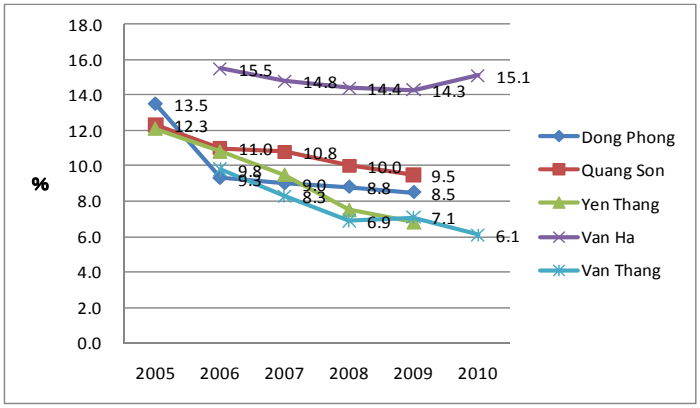
It could be concluded that the project has contributed effectively to the following two aspects directly as planned: a) the reduction in cases of water-borne diseases; and b) the reduction in time spent for fetching water.

3.4.1.1 Reduction in prevalence rate of water-borne diseases

Whereas the actual water-borne disease prevalence rate in the target area in 2001 was 39.5%[10], it was planned to reduce the rate to 20% by 2005. Figure 3 shows the trend of the water-borne diseases prevalence rate in five communes out of twelve communes, where data is available. The figure illustrates the prevalence rate is decreasing trend. In the three communes in Ninh Binh Province and Van Ha Commune where the project was completed in July 2003, it was confirmed that the target was achieved by 2005. The target was also achieved in 2006 in Van Thang commune where the project was completed in January 2006. According to the health posts in each commune, the number of cases in dysentery, diarrhea, sore-eye, skin problems is decreasing in the past years.

The prevalence rate in Dinh Tuong and Vinh Thanh & Vinh Loc commune were not obtained, but it was confirmed that the number of cases in the above communes are declining between 2006 and 2010. The data in the four communes in Thai Nguyen, both prevalence rate and the number of cases, were not obtained.

10 The baseline figures in each commune were not found in the basic design report, thus exact comparison is not possible.



Source for the three communes in Ninh Binh Province between 2005 and 2007:
Project-level ex-post evaluation study for water sector, Ministry of Foreign Affairs (MoFA) of the Government of Japan, 2007

Source for others:
Calculated from the number of population and water-borne disease cases provided by health posts in each commune.

Note: In the above report by MoFA, the prevalence rate in Van Ha between 2005 and 2007 were 12.0, 11.0, 10.0 respectively. This evaluation used the prevalence rate, which was calculated based on the population and the number of cases provided by the health posts in each commune.

Figure 3 Prevalence rate of water-borne diseases in the five communes

Meanwhile, in order to raise the awareness of hygienic practices such as washing hands before eating and after using toilets, Information, Education and Communication (IEC) activities have been carried out in the project target areas by P-CERWASSs, Province Preventive Medicine Departments, local authorities and health posts in each commune, and international organizations such as UNICEF. The number of flush toilets is also increasing in the target areas in the past few years. Table 12 shows the posession rate of flush toilets in the target area before and after the project.

Table 12 Possession rate of flush toilets in the target areas

(unit: %)

Province	Before the Project	After the Project
Thai Nguyen	41.5	87.8
Ninh Binh	20.0	96.7
Thanh Hoa	62.5	80.0

Source: Beneficiary Survey (111 households)

Therefore, together with the IEC activities and the access to fush toilets, the supply of portable water by the project facility is considered to have contributed to reducing the prevalence rate of water-borne diseases.

3.4.1.2 Reduction in the number of households which require fetching water

At the time of planning in 2001, the ratio of households which require fetching water from

outside[11] was 100%. The target for 2005 was 18%. Although there is no baseline data for the time required for fetching water, one of the beneficiaries in Hoa Thuong mentioned that she had to fetch water four times a day and it took twenty to thirty minutes per one time. After the project completion, it was confirmed that no household is required for fetching water according to the beneficiary survey. Thus, it is concluded that the target was achieved. However, even after the project completion, many users still use self-owned wells in their compound. If we consider it as "water fetching labor", the labor still exists.

As women were mainly responsible for water-fetching before the Project, it can be considered that women's burden in fetching water was reduced by the implementation of this Project.

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

No major negative impact on the natural environment such as land subsidence has been observed.

3.4.2.2 Land Acquisition and Resettlement

There was no resettlement of residents. The land acquisition process went smoothly.

3.4.2.3 Water supply outside the target area

It was found that a few residents in Dong Phong Commune and Vinh Thanh Commune had moved their houses near the water plants after the project completion. It was confirmed that new houses have been built near the water plants. The water plant in Dinh Tuong Commune in Thanh Hoa Province supplies water in the neighboring town, Quang Lao Town, Ven Dinh District, in dry season. In 2009, a town hospital was constructed, but it was found that the water supply was not sufficient for the needs of the hospital. Upon the request by the District CPC and considering the urgent needs, the water supply for the District was commenced.

In light of the above, it could be noted that in addition to the anticipated impacts (i.e. reduction in the prevalence rate of water-borne diseases, labor saving in water-fetching), unexpected impact such as water supply to a hospital outside the target area was also confirmed. No particular negative effects were observed.

11 This includes fetching water from shallow wells in their houses.

Beneficiary's House in Thinh Duc South, Thai Nguyen Province

New residential areas across the water plant in Dong Phong, Ninh Binh Province

Interview with the Health Post in Van Ha, Thanh Hoa Province

3.5 Sustainability (Rating: ②)

3.5.1 Structual Aspects of Operation and Maintenance

Upon the project completion, each Commune People's Committee (CPC) is responsible for the overall management of the project facilities in Ninh Binh Province[12] and Thanh Hoa Province. In Thai Nguyen Province, P-CERWASS is responsible for the management, but each water plant can decide the water supply hours. As shown in Table 13, required number of staff is assigned in each water station. The staff in Thanh Hoa Province is responsible for both operation and water charge collection, which leads to the cost-efficiency.

Table 13 Number of staff in each water plant (Plan and Actual)

(unit: persons)

Province	Commune	Plan			Actual		
		Operators	Staff for charge collection	Total	Operators	Staff for charge collection	Total
Thai Nguyen	Hoa Thuong	6	4	10	6	4	10
	Dong Bam	6	3	9	5	2	7
	Thinh Duc North	4	2	6	3	1	4
	Thinh Duc South	(Note 1)			4	1	5
	Nam Tien	6	3	9	5	3	8
	Sub-total	**22**	**12**	**34**	**23**	**11**	**34**
Ninh Binh	Dong Phong	4	5	9	9	0 (Note 2)	9
	Quang Son	4	3	7	3	5	8
	Yen Thang	4	5	9	5	0 (Note 2)	5
	Sub-total	**12**	**13**	**25**	**17**	**5**	**22**

12 Exceptionally, Ninh Binh P-CERWASS manages the water plant of Quang Son Commune after 2009. In 2009, 145 households in Village #6 and Village #7 of Quang Son Commune were transformed into Tam Diep Town. However, because it was predicted that the management such as water charge collection becomes complex, Ninh Binh P-CERWASS became to manage the water plant of Quang Son.

Thanh Hoa	Vinh Thanh & Vinh Loc	6	4	10	6+1 (Chief) Note 3	9
	Dinh Tuong	6	4	10	4	7
	Van Ha	6	7	13	8+1 (Chief)	3
	Van Thang	4	2	6	4	4
	Sub-total	**22**	**17**	**39**	**23**	**23**
Grand Total		**56**	**42**	**98**	**79**	**79**

Source: The figures for the plan are from the Basic Design Report (2001). The figures for actual are from the Questionnaire Answer (2011).

Note 1: 4 staff (2 staff x 2 shift) for the water plants without treatment facilities for iron and manganese and 6 staff (3 staff x 2 shift) for the water plants with treatment facilities.

Note 2: Village Heads collect charges in Dong Phong and Yen Thang.

Note 3: Staff in Thanh Hoa Province is responsible both for operation and water charge collection. In Dinh Tuong, water and electricity charges are collected together in each village.

3.5.2 Technical Aspects of Operation and Maintenance

Technical capacity for operation and maintenance can be considered to be satisfactory due to the following reasons:

1) the water plant was designed taking into account the technical level of the commune staff;
2) training has been provided by the Japanese consultants to the water plant staff between 2004 and 2005; and
3) when serious troubles which local operators cannot handle, plant managers of P-CERWASSs technically support their respective water plants.

Taking an example of Thai Nguyen Province, the number of staff who received training by this Project and who has been still working in the plants is summarized in Table 14. Approximately sixty percent of the original staff has still been working in the plants even five years after the training. The trained staff provides new staff with training by using the operation and maintenance manuals provided by this Project.

Table 14 the number of staff who received training by this Project and who has been still working in the plants in Thai Nguyen

(unit: persons)

Commune	Number	Remarks
Hoa Thuong	1 out of 4	
Dong Bam	3 out of 4	
Thinh Duc	5 out of 6	
Nam Tien	2 out of 4	1 staff was transferred to Hoa Thuong
Total	11 out of 18	12 out of 18

Source : Each water plant in Thai Nguyen Province

Regarding the well-drilling equipment provided by this Project, Japanese instructors provided local operators and technicians with on the job training (ten wells for 12 months in total)[13].

13 Source: Data from JICA.

Although six out of ten trained staff left the Material Center, the remained four staff trained other eight staff. Thus, twelve staff can operate the machines[14].

3.5.3 Financial Aspects of Operation and Maintenance

(1) Cash Flow Status of each commune

Cash flow statement of each commune in 2010 is shown in Table 15.

Table 15 Cash Flow of each commune (Unit: million VND)

Province	Thai Nguyen				Ninh Binh			Thanh Hoa			
Commune	Hoa Thuong	Dong Bam	Thinh Duc	Nam Tien	Dong Phong	Quang Son	Yen Thang	Vinh Thanh & Vinh Loc	Dinh Tuong	Van Ha	Van Thang
Total Income	938	549	179	351	514	271	315	453.5	379.2	482.9	68.4
Total Expenses	774	476	443	435	514	271	315	433.7	184.7	440.8	100.6
Personnel	NA	NA	NA	NA	154	149	85.2	231.4	85.4	212.8	48.1
O&M (Note)	NA	NA	NA	NA	132	43	201.6	199.7	95.1	225.3	52.5
Other Expenses	NA	NA	NA	NA	228	78	28.2	2.6	4.2	2.7	0
Balance	164	73	-264	-84	0	0	0	19.8	194.5	42.1	-32.2

Source: P-CERWASSs

Note: O&M includes electricity, chemicals, parts and others.

In Thai Nguyen, there have been surpluses from operating activities in Hoa Thuong and Dong Bam for the past three years. Although Nam Tien experienced deficit in 2010, there was surplus in 2008 and 2009. On the other hand, the operating expenses of Thinh Duc exceeded revenues in the past three years. There are three reasons: 1) revenue from water charge is very small from the beginning due to the small scale facility with the production capacity of 350 m^3/day; 2) both intake water and water amount have been decreasing since 2008 (average water amount per day is 190 m^3/day); 3) staff should be assigned for the both facilities in North and South, which double the cost for salary. However, the Province People's Committee in Thai Nguyen has provided subsidies in the past three years. Thai Nguyen P-CERWASS provided costs for drilling one new well in Hoa Thuong because the water level of the existing wells went down and the demand for water has been increasing. However, the budget required for constructing new wells in other three communes has not been secured.

According to the P-CERWASS in Ninh Binh, the target communes are trying to keep balance by reducing the salary per person. In Quang Son and Dong Phong, the cost for the replacement of broken pumps, unreadable water meters by $CaCO_3$ and parts of control panels were borne mainly by communes. However, the budget required for repairing the well, for replacing 240 water meters (30% of the total households) in Yen Thang and for supplying water for two new

14 Source: CERWASS Material Center.

villages[15] has not been secured.

In Thanh Hoa except Van Thang, there have been surpluses from operating activities for the past two-three years. On the other hand, the operating expenses of Van Thang exceeded revenues in the past three years. There are two reasons: 1) as same as Thinh Duc, revenue from water charge is very small from the beginning due to the small scale facility with the production capacity of 320 m^3/day; and 2) revenues from water charge are not increasing as expected because the population served (82.5 percent of the plan in 2010) and average water supply amount (167 m^3/day in 2010) are not growing as planned. However, Thanh Hoa P-CERWASS has provided subsidies in the past three years. Moreover, P-CERWASS covered the cost for the replacement of pumps in Van Ha and Dinh Tuong. On the other hand, the cost of the facility for removing manganese in Van Ha is estimated as two hundred million VND (approximately ten million JPY). This budget has not been secured yet.

In light of the above, there is no major problem with the daily operation cost because the Province People's Committee and P-CERWASS have provided subsidies as necessary. It is also expected that the financial status will recover if non-revenue water is reduced in the future. On the other hand, some communes manage the cost for the replacement of broken pumps, unreadable water meters and parts of control panels, but others do not. The budget required for the facility for removing manganese and for installing new pumps and pipes has not been secured. P-CERWASSs are currently considering applying for the Grant Assistance for Grassroots Human Security Projects.

The water tariff of each commune is shown in Table 16.

Table 16 Water Tariff of each commune

(unit: VND/ m^3)

Province	Commune	Households	Government Offices	Public facilities (Note)	Factories	Commerce/Services
Thai Nguyen	All communes	4,800	6,500	6,400	6,500	8,000
Ninh Binh	Dong Phong	3,800- 4,500	5,000	NA	5,000	5,000
	Quang Son	4,000	4,000	NA	4,000	4,000
	Yen Thang	3,500	3,500	NA	7,000	3,500
Thanh Hoa	All communes	3,000	5,000	5,000	5,000	6,000

Source: P-CERWASSs
Note: Parks, hospitals, schools, etc.

These tariffs are considered to be justifiable due to the following reasons: 1)water tariff in each commune has been revised properly along with the revision of electricity tariff (previous

15 There are approximately 186 households. Currently, the residents in the two villages use rain water.

revision was made in 2010 in all the communes); 2) the above tariffs are more or less the same as the national average of 3,500VND/ m^3in 2009 except Thai Nguyen; 3) income-expenses balance are kept in most of the communes except the communes where the number of the population served and the water production design capacity is extremely small; and 4) more than half of the respondents in the beneficiary survey feel that the tariff is reasonable in all the provinces as shown in Table 17; and 5) water charge collection rate is 100% in all the communes.

Table 17 Customer's Perception about the water tariff

(unit: %)

Province	Expensive	Reasonable	Cheap
Thai Nguyen	39.0	56.1	4.9
Ninh Binh	13.3	88.3	2.3
Thanh Hoa	12.5	65.0	22.5

Source: Beneficiary Survey (111households)

According to the beneficiary survey, 22.5 % of the consumers in Thanh Hoa Province felt that the water tariff was cheap whereas 12.5% felt expensive. On the other hand, 39% consumers in Thai Nguyen felt expensive whereas only 4.9% felt cheap. Similarly, in Ninh Binh Province, 13.3% consumers in Thai Nguyen felt expensive whereas 2.3% felt cheap. At the same time, as much as 88.3% of consumers in Ninh Binh felt reasonable. This result matches with the water tariff setting for (from 3,000VND/ m^3 in Thanh Hoa, from 3,500VND/ m^3 in Ninh Binh and 4,800VND/m^3 in Thai Nguyen).

3.5.4 Current Status of Operation and Maintenance (O&M)

The O&M status is good considering that five to eight years have already passed since the project completion. In all the target areas, P-CERWASS and communes made the best self-efforts both financially and technnically. However, the following issues have not been settled particularly due to the financial and technical constraints.

(1) Declining of water level of intake wells and reduction of intake water in the three communes in Thai Nguyen Province

Since 2008, water level of intake wells was declined in Nam Tien and Hoa Thuong in dry season and in Thinh Duc South througout the year. As a result, intake water and water supply is insufficient. Although clear cause-effect relationship has not been clarified through a study, one of the reasons could be the rapid urbanization and industrialization in the surburbs of Thai Nguyen City since 2008, according to the P-CERWASS. In 2009, P-CERWASS dug 70 mters-depth wells in Hoa Thuong, where demand for water has been rapidly increasing, with its own budget and started to supply water. However, budget for

digging new wells, well pumps, distribution pumps and distribution pipes for new wells in Thinh Duc South and Nam Tien has not been secured.

(2) Declining of water level of intake wells in Yen Thang and Dong Phong in Ninh Binh Province

Intake water from one of the three wells in Yen Thang started to decrease gradually, which brought inefficiency against the electricity charges. Although the reason is unknown, one of the reasons can be that routing of water sources were cut due to the heavy rain according to the P-CERWASS.

Because the dry season was longer than usual in 2010, the water level of the well became lower in Dong Phong. The position of the well pump was lowered from 25 meters to 42 meters below ground. Although the dry season in 2011 is not so serious as 2010, the water level of the well has not been back to the previous level. Because the position of the well pump was lowered, the exisitng 5.5 kw well pump cannot pump up water sufficiently. As there is only one well in Dong Phong, it is necessary to replace it with the one with higher capacity in order to secure water supply amount of 980 m^3/day by one pump.

(3) Change of water quality of raw water in Van Ha and Ding Tuong in Thah Hoa Province

The contained amount of Manganese in treated water in Van Ha and Ding Tuong is increasing compared with the time of project completion (See water quality in page 11). The parameter shows high value even after the treatment particularly in Van Ha (See picture in page 12). Because the service pipes are smaller than distribution pipes, it is difficult to remove the manganese inside the pipes. In oder to remove the manganese the staff cleans the pipes twice a year. At the time of the inspection of the Term I, it was found that the increase in contained manganese was caused by the change of raw water quality. The Japanese consultants considered several options for counter-measures. In the aspect of regular operation and maintenance, it was suggested to limit 6L/day of Hypochlorite (HCIO) for pre-treatment, not to inject HCIO for post-treatment, and to back-wash the filtering ponds everyday. The above O&M counter-measures have been tried for one month as recommended by the Japanese consultant, but there was no positive change. Then, Thanh Hoa P-CERWASS undertook other operational measures in the O&M aspect, but the situation has not been improved to the satisfactory level.Thanh Hoa P-CERWASS is planning to remove manganese by installing an oxidization equipment, but the required budget has not been secured.

With regards to the regular operation and maintenace, the following issue needs attention.

O&M manuals are not handy at the water plants in Quang Son and Yen Thang (Ninh Binh Province), and Thinh Duc and Hoa Thuong (Thai Nguyen Province). The manuals have still been kept by the Chairpersons of the Commune People's Committees since the project completion.

Some problems have been observed in terms of financial aspects and current status of operation and maintenance, therefore, sustainability of the project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This Project is highly relevant to the country's development plan and development needs, both at the time of planning and at the time of ex-post evaluation. The Project was also in line with Japan's ODA policy at the time of planning. Hence, its relevance is high. The Development Study, which was conducted ahead of this Project, assisted this Project to narrow down the target area from 20 communes to 12 communes in light of needs and feasibility. Thus, the target area was properly selected. Efficiency is rated high since the expected output was obtained as planned within the planned project cost and period. This project has somewhat achieved its objective, namely the stable supply of safe water (population served and its percentage against the total population, maximum/average water supply amount per day, etc.), and the equipment provided by this Project has been fully utilized. However, there are some minor problems; 1) some indicators are not up to the expectation in some communes; 2) non-revenue water rate is high in general; and 3) there is some room for improvement in water quality, therefore its effectiveness is fair. Some problems have been observed in terms of financial aspects and current status of operation and maintenance, therefore, sustainability of the project is fair. In light of the above, this Project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) In order to ensure proper O&M (technical sustainability)

In order to operate and maintain properly, it is recommended for the water plants of Quang Son, Yen Thang, Thinh Duc and Hoa Thuong to keep O&M manuals in practice, which were distributed to the Chairpersons of the Commune People's Committees upon the project completion, handy for daily use by placing them in operation rooms for easy reference.

(2) In order to secure intake water and to remove manganese (effectiveness)

In order to secure sufficient intake water by constructing new wells in Nam Tien and

Thinh Duc South, Thai Ngueyn Province, and to ensure safe water by removing manganese in Van Ha, Thanh Hoa Province, it is recommended that those relevant communes and P-CERWASSs make efforts in securing required budget from different sources such as assistance from national and provincial governments, and Human Security Grassroots Grant by the Japanese government.

(3) In order to reduce Non Revenue Water (effectiveness and financial sustainability)

In order to reduce Non Revenue Water (NRW), it is recommended to strengthen countermeasures for water leaks by replacing obsolete water pipes and defective water meters and to promote preventive measures for water steeling. It is recommended that N-CERWASS/P-CERWASSs discuss the possibility of training for reducing NRW for the operators in the target areas in cooperation with Hanoi Water Supply Center under the Ministry of Construction, Ninh Binh College and JICA. During the training, it is recommended to invite the engineer from Quang Son, which made remarkable effects in reducing NRW and to share his experiences by demonstrating specific examples. Additionally, in order for water plant staff to continuously practice what they have learned at the training, it is recommended for plant managers of each P-CERWASS to participate in the training and to provide technical support after the training.

4.2.2 Recommendations to JICA

(1)Assistance for securing intake water and removing Manganese properly (effectiveness)

In case that executing agencies apply for the Grant Assistance for Grassroots Human Security Projects, it is recommended for JICA to provide sufficient information regarding the implementation results of this Project and operation and maintenance situations in the target areas and to provide indirect support.

(2) Assistance for implementing training for reducing NRW (effectiveness and financial sustainability)

In case that executing agencies plan to conduct training, it is one of ideas that JICA clarifies the cost-sharing between JICA and executing agencies and provides technical and financial support when necessary.

4.3 Lessons Learned

<Indicator setting>

In the ex-ante evaluation summary of this Project, operational indicators and qualitative indicators were not included. In future similar projects, in order to evaluate more comprehensively, it is recommended that operational indicators such as maximum/average

water production amount and maximum/average facility utilization rate as well as qualitative indicators such as water quality standards be included.

In addition, although effect indicators such as population served and its percentage were included, the target was set only at the provincial level, not at the commune level. The baseline and targeted prevalence rate of water-borne diseases was set, but only the average of all the communes was indicated. It is recommended that target figure and target year be set by commune in order to evaluate taking account of different timing of project completion and different situations by communes.