No.

BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR THE GROUNDWATER DEVELOPMENT IN RURAL PART OF NORTHERN PROVINCES

IN

THE SOCIALIST REPUBLIC OF VIETNAM

JANUARY 2002

Japan International Cooperation Agency (JICA)

Docon Co. Ltd., Japan

Pacific Consultants International, Japan

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PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct a basic design study on the Project for the Groundwater Development in Rural Part of Northern Provinces and entrusted the study to the Japan International Cooperation Agency (JICA).

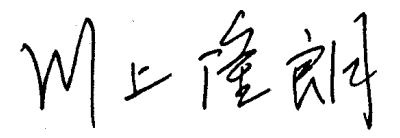
JICA sent to Vietnam a study team from 31 May to 9 July, 2001.

The team held discussions with the officials concerned of the Government of Vietnam, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Vietnam in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Socialist Republic of Vietnam for their close cooperation extended to the teams.

January 2002



Takao Kawakami
President
Japan International Cooperation Agency

January 2002

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Groundwater Development in Rural Part of Northern Provinces in the Socialist Republic of Vietnam.

This study was conducted by the joint venture between Docon Co., Ltd. and Pacific Consultants International, under a contract to JICA, during the period from May 2001 to January 2002. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Vietnam and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Hideki Yamazaki
Project Manager,

Basic Design Study Team on
the Project for the Groundwater Development in
Rural Part of Northern Provinces
The Joint Venture between Docon Co., Ltd. and
Pacific Consultants International

Location Map of Project Sites

THAI NGUYEN		NINH BINH		THANH HOA	
1	Hoa Thuong	5	Dong Phong	8	Vinh Thanh
2	Dong Bam	6	Quang Son	9	Vinh Loc
3	Thinh Duc	7	Yen Thang	10	Dinh Tuong
4	Nam Tien			11	Van Ha (Thieu Hung)
				13	Van Thang

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Abbreviations/Acronyms

BD or B/D	Basic Design
BHN	Basic Human Needs
CERWASS	Center for Rural Water Supply and Environmental Sanitation
DANIDA	Danish International Development Assistance
DARD	Department of Agriculture and Rural Development
E/N	Exchange of Notes
FD	Financial Department
FR or F/R	Final Report
FS or F/S	Feasibility Study
GDP	Gross Domestic Product
IEC	Information, Education and Communication
JICA	Japan International Cooperation Agency
MARD	Ministry of Agriculture and Rural Development
M/D	Minutes of Discussions
MOC	Ministry of Construction
MOF	Ministry of Finance
MP or M/P	Master Plan
MPI	Ministry of Planning and Investment
NRWSS	National Rural Water Supply and Sanitation
ODA	Official Development Assistance
O&M or O/M	Operation and Maintenance
PC	People's Committee
P-CERWASS	Provincial CERWASS
PMU	Project Management Unit
RWSS	Rural Water Supply and Sanitation
S/W	Scope of Work
UNICEF	United Nations Children's Fund
VND	Vietnamese Dong
WB	World Bank
WATSAN	Water Supply and Sanitation
WMU	Water Management Unit

Exchange Rates (August 2001)

US$ 1.00 = 123.46 JP Yen

US$ 1.00 = 14,732 VND

Summary

The Socialist Republic of Vietnam is located in the east of the Indo-China region, facing the South China Sea to the east, and bordering to Laos and Cambodia to the west and China to the north. The land area of the country is 331,688 km2 and with the population of 77.7 million people (January 2000), and the population growth rate is 1.24% per annum. The distribution of the population is 24% at the urban area and remaining 76% in the rural area. Per capita Gross National Product (GNP) in Vietnam is US$ 340 (year 1998) but GNP in rural area remains at a half of it.

In Vietnam, development of local infrastructure has been placed on a high priority. The first target in the water supply sector was to supply safe water to 80% of rural people by the year 2000. In rural areas, domestic water is usually taken from shallow dug wells, surface water of rivers, streams and ponds, and even rains water. Securing clean water throughout the year is difficult because of contamination of water source and water shortage in dry seasons; as a result clean water supply has reached only 9% of people, and it causes much difficulties to maintain the health of people and social development in rural areas.

Considering the shortage of clean water and health situation, water supply agencies of Ministry of Construction (MOC) and Ministry of Agriculture and Rural Development (MARD) formulated "National Rural Clean Water Supply and Sanitation Strategy up to Year 2020" in 1997-98 with assistance of Danish International Development Assistance (DANIDA); which was then authorized in August 2000 as a basic policy of a sector for rural water supply and sanitation.

In January 1998, both the Governments of Japan and Vietnam agreed the Scope of Work (S/W) regarding the Project for the Groundwater Development in Rural Part of Northern Provinces in consideration of the above national basic policy and program; and JICA carried out the study during August 1998 to November 1999. The study was composed of groundwater development survey in 20 communes in five northern provinces and formulation of the water supply master plan (M/P) towards the year 2010, and the feasibility study (F/S) on 15 communes selected among the M/P areas.

The Government of Vietnam in July 1999, requested for the Japan's Grant Aid on the priority project implementation formulated in the F/S. The major content of the request was the construction of water supply facilities in 15 communes of the F/S sites. Further, an additional request of supply of well construction machinery was offered in August 2000 and this request was included in the project.

In response to the above requests, the Government of Japan decided to conduct a basic study, and JICA sent a study team to Vietnam to confirm the background, contents and scope of the requests from 31 May to 9 July 2001. After

they returned to Japan, the team carried out further studies and completed a draft basic design report taking justification of the contents requested and formulation of the suitable facilities and equipment plan for consideration. Then, the mission was sent to Vietnam in order to discuss the draft basic design from 9 December to 20 December 2001. The project component was finalized on the basis of the result of the study and the discussion. The outline of the project to be implemented by the Japan's Grant Aid scheme is as follows:

Although the project sites requested by the Vietnamese Government were originally 15 communes, two of them were excluded from the project due to possibility of the water supply system scheme by other waterworks agency, and another commune was also excluded due to bad quality of groundwater. Consequently, the project is to cover 12 communes. Each commune's service population and supply capacity are given in the following table.

Service Population and Capacity of Each Commune (For year 2005)

Province	Commune	Total Population in 2005 (person)	Service Population in 2005 (person)	Service Rate (%)	Daily Maximum Supply (m3/day)	Treatment Plant and Purpose
Thai Nguyen	No.1: Hoa Thuong	10,120	7,760	76.7	770	Yes (Removal of Mn and Fe)
	No.2: Dong Bam	6,020	6,020	100	600	Yes (Removal of Mn and Fe)
	No.3: Thinh Duc	6,900	3,457	50.1	350	No
	No.4: Nam Tien	6,948	4,518	65.0	450	Yes (Removal of Mn)
Ninh Binh	No.5: Dong Phong	10,798	9,890	91.6	980	No
	No.6: Quang Son	8,192	5,090	62.1	510	No
	No.7: Yen Thang	9,296	8,790	94.6	870	No
Thanh Hoa	Nos.8& 9: Vinh Thanh &Vinh Loc	13,000	13,000	100	1,290	Yes (Removal of Mn)
	No.10: Dinh Tuong	6,997	6,360	90.9	630	Yes (Removal of Mn and Fe)
	No.11: Van Ha (Thieu Hung)	7,272	7,272	100	720	Yes (Removal of Mn)
	No.13: Van Thang	6,786	3,230	47.6	320	No
Total		92,329	75,387	81.7	7,490	6 Plants

The facilities to be constructed during the project are those for intake, treatment, distribution and house connections. The groundwater is taken from a deep well through a submersible pump, treated where required, and chlorinated. The chlorinated water is stored in a reservoir tank and distributed through an elevated tank by gravity flow. The flow chart is: Deep well → Intake submersible pump → Pump chamber → Transmission pipeline → (Treatment facilities) → Chlorination → Reservoir tank → Distribution pump → Elevated tank → Distribution pipelines → Block service pipelines → Service pipes → House connections.

Regarding water treatment, construction of facilities to treat iron/manganese is proposed in the case the excessive amounts of concentration were detected in the groundwater. The treatment facilities will be constructed in 6 sites as stated in the table above. As to the deep wells construction, the existing JICA's test wells constructed at the M/P study stage are planned to be used for the production wells in the project as much as possible.

The content of distribution facility and service pipe facility are listed in the following table. Service pipe facility consists of block service pipes, house connection pipes, water meters and so on. Although those materials are to be supplied by the Grant Aid, the Vietnamese side is responsible for installing them in order to complete the water supply systems. The scope of work of the Grant Aid is up to the installation of distribution pipelines.

Distribution and Service Facilities

Commune	Reservoir tank (m3)	Elevated tank (m3)	Distribution Pipelines (300-50 mm) (m)	Block Service pipes (OD 40 mm) (m)	Service pipes (OD 20 mm) (m)	Water meter (ND 13 mm) (Numbers)
No.1: Hoa Thuong	260	35	17,910	22,760	37,000	1,850
No.2: Dong Bam	200	25	14,180	16,280	28,800	1,440
No.3: Thinh Duc North Area South Area	 50 70	 6.3 8.5	 6,650 in total	 8,100 in total	 16,600 in total	 830 in total
No.4: Nam Tien	150	20	13,490	15,340	21,600	1,080
No.5: Dong Phong	330	40	11,070	16,770	47,200	2,360
No.6: Quang Son	170	22	9,310	11,260	24,400	1,220
No.7: Yen Thang	290	-	12,120	12,020	42,000	2,100
Nos.8 & 9: Vinh Thanh & Vinh Loc	430	55	13,520	15,970	62,000	3,100
No.10: Dinh Tuong	210	26	6,960	11,860	30,400	1,520
No.11: Van Ha (Thieu Hung)	240	30	10,910	13,200	34,600	1,730
No.13: Van Thang	110	13	6,330	6,030	15,400	770
Total	12 Nos.	11 Nos.	122,450	149,590	360,000	18,000

Regarding the supply of well construction machinery, the equipment was decided in consideration of deep well construction work in the project and the groundwater development program of CERWASS in northern provinces. The equipment items are one unit each of well drilling machine (rig), supporting equipment for the rig and workshop.

The implementing agency for the project is CERWASS under MARD promoting the development of rural clean water supply and sanitation. During the construction stage, Project Management Unit (PMU) will be established in the Central CERWASS and it shall manage overall project implementation.

For the operation and maintenance (O/M)) of the facilities, Water Management Unit (WMU) shall be established in

each P-CERWASS for operation and maintenance of the facilities. Water supply management shall stand on a self-supporting financial basis. Water tariff system is decided at a level of Provincial People's Committee in each province. Water charge is set based on the O/M costs and it is assumed to be 14,400 VND/month/household in Thai Nguyen, 8,800 VND in Ninh Binh, and 12,800 VND in Thanh Hoa. Since the charge is within 15,000 VND/month/household, which is affordable to people meaning the self-supporting financial status for O/M of water supply systems is feasible.

For the implementation of the project, the Vietnamese side is to budget 1.45 million US$ as the counterpart fund, in addition to the Japan's Grant Aid finance.

The project is to be implemented in three stages. The First Stage is composed of the supply of well drilling machinery and construction of water supply systems in No.5 Dong Phong, No.6 Quang Son, No.7 Yen Thang and No.11 Van Ha (Thieu Hung); and the Second Stage of construction in No.1 Hoa Thuong, No.2 Dong Bam, No.3 Thinh Duc and No.4 Nam Tien, and the Third Stage of construction in Nos.8&9 Vinh Thanh & Vinh Loc, No.10 Dinh Tuong and No.13 Van Thang.

The each stage will require 12 months for the project implementation including the detail design period; thus the whole project of the three stages will take 36 months in total for completion.

Upon completion of water supply facilities, the households can receive safe water stably throughout 24 hours a day, and peoples' living standard will be remarkably improved in the water use; furthermore, water-borne diseases will be certainly decreased since bacteria including coli-forms are to be killed by chlorination in the treatment process. Beneficiaries of the project are 75,400 persons.

CERWASS, the implementing agency of the project, can construct deep wells, taking groundwater as important water source, with its own effort using machinery supplied by the project.

The construction work of the house-connection service pipes is under the responsibility of the Vietnamese side. The project will not be completed without the house connection work; this shall be completed without delay by the Vietnamese effort. The O/M costs of water supply facility shall be covered with monthly water charge to be paid by consumers, commune people. The understanding and cooperation of the Vietnamese Government and the commune people is indispensable for the proper utilization of the benefits of the project.

BASIC DESIGN STUDY REPORT
THE PROJECT FOR THE GROUNDWATER DEVELOPMENT
IN RURAL PART OF NORTHERN VIETNAM
SOCIALIST REPUBLIC OF VIETNAM

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Chapter 1 Background of the Project

1.1 National Programs and Rural Water Supply Development Programs

(1) Local Development Program

Local Development Program (1996 - 2000) in Vietnam has been promoted based on the following policy:

- High priority on the local development
- Establishment of sound local economy based on the competition principle
- Stepwise progress of the program and improvement of welfare and conditions of local peoples
- Strengthening of environmental view in the planning and execution
- Promotion of management by local peoples and restriction of the government role

In the program, priority was placed on the local infrastructures. As to water supply, targets were to supply safe water to 80% of rural community and to 13,000 primary schools.

(2) National Rural Clean Water Supply and Sanitation Strategy up to Year 2020

In rural areas, domestic water is usually taken from surface water of rivers, springs and ponds, shallow groundwater and rain water. However, securing clean water at all times is difficult because of the pollution of water source and scarce water in dry seasons. Clean water supply has reached only 9% of people in rural areas; and it causes much difficulties to maintain the health condition of people and social development in rural areas.

Considering such actual conditions, water supply agencies such as Ministry of Construction (MOC) and Ministry of Agriculture and Rural Development (MARD) formulated “National Rural Clean Water Supply and Sanitation Strategy up to Year 2020 (RWSS)” in 1997-98 with assistance of Danish International Development Assistance (DANIDA). The Vietnamese Government approved it in August 2000 for authorization as the basic policy of a sector for rural water supply and sanitation.

The objectives of water supply in RWSS are the following:

- By the year 2020, all rural people will use clean water of national quality standards with at least 60 liters/capita/day, and
- By the year 2010, 85% of rural population will use clean water with 60 liters/capita/day

In order to achieve the objectives, towards sustainable operation and finance of the water supply business, the following approaches are needed.

- Decision of facilities' grade, technology and operation method which meet the user's needs
- Information , education and communication (IEC) to people prior to planning and construction
- Establishment and strengthening of local organization for operation and maintenance (O/M)
- Financial strengthening and establishment of beneficiary's burden system of water charges; and care to the social weak such as poor people
- Development and application of appropriate technology for project implementation

(3) Rural Water Supply Development Program

Currently the Vietnamese Government promotes the main program of WATSAN (Water Supply and Sanitation) which started in 1982 with assistance of UNICEF.

Total investment during 1991-97 for rural water supply was about 54 million US$ including the international agency's aids; among them WATSAN program invested its 80%. In this program, UNICEF fund occupied 56% of the total investment; thus role of UNICEF was remarkable in rural water supply sector. By the WATSAN program, 168,100 water supply facilities were constructed in total during 1982-96. In 1996, among the above, 18,600 facilities were constructed in the whole country. The grade of the facilities was 100 million VND (about US$ 6,700) at the maximum for one commune on the financial aspect, and 120 persons of beneficiaries on technical aspect, comparatively small scale. Its standard system consisted of a tube well pipelines with gravity flow, and tanks or jars for rain water storage.

Table 1.1 Investment for Rural Water Supply (Unit : Million US$)

Program and Finance Source	Central Government	Provincial Government and Beneficiaries	International Aids and Others	Total
WATSAN Program	7.01	11.16	23.30	41.47
Other Programs	5.65	0.07	5.88	11.61

Source: NRWSS Economic and Financial Situation, June 1998
Note: International aid in WATSAN Program was UNICEF.

1.2 Contents of the Groundwater Development Project in Rural Part of Northern Provinces

In January 1998, the both Government of Japan and Vietnam agreed the Scope of Work (S/W) regarding the Project for the Groundwater Development in Rural Part of Northern Provinces; and JICA carried out the study during August 1998 - November 1999. Contents and outlines are as follows:

(1) Objectives and Contents of the Study (1998-99) on the Groundwater Development

1) Study on the groundwater potential in 20 communes in the five northern provinces of Hanoi, Thai Nguyen, Ninh Binh, Thanh Hoa and Ha Tinh
2) Formulation of the Master Plan (M/P) for groundwater development program and water supply systems, with the target year of 2010
3) Feasibility Study (F/S) for the priority communes
4) Technology transfer to counterpart staff by way of the study

(2) Master Plan (M/P)

1) Target of the Plan

To supply clean water through house-connections with pipelines to 149,000 people in 20 communes in 5 northern provinces, with 23,030 m3/day in total.

2) Level of Water Supply Facilities
   - 24 hours continuous service
   - Water source : Groundwater
   - Sterilization : To be done by chlorination
   - Treatment : Removal of iron and manganese, when they are more excessive than the drinking water standards

3) Facility Planning

The system will be composed of groundwater source (deep well), treatment facilities and distribution facilities (reservoir / elevated tank and distribution pipelines).

4) Implementation Program

The implementation organization will be CERWASS. It will manage planning, designing and construction work and transfer of facilities to communes.

5) Organization

The project will be executed within the framework of the present rural water supply policy in Vietnam. In order to smooth management of the project, Project Management Unit (PMU), Central Training Team (CTT) and other organization will be newly established.

6) Finance

Water tariff will be recognized among the commune, prior to the construction of facilities. Unit water rate will be 1,800 - 4,500 VND/m3, and this will be 3 - 6 % of household's income, if one household uses 11 m3

per month.

7) Strengthening of Organization and Sanitary Campaign

For the sustainable O/M of facilities, strengthening of organizations will be executed with training in each level of the province and commune. In communes, activity of IEC to promote the importance of clean water will contribute to health and sanitary improvement will be executed.

8) Investment Cost

The total investment cost was estimated at about 225 Billion VND (US$ 16.2 Million)

(3) Feasibility Study (F/S) on the Priority Communes

1) Selection of Priority Communes

Among 20 communes studied in the Master Plan, 15 communes were selected for the Feasibility Study, excepting 5 communes (4 communes in Ha Tinh Province and 1 commune in Thanh Hoa Province) which had difficulty of groundwater development in aspects of water quality and water production.

2) Policy of Facility Planning

The water supply system is to be independent one in each commune However, Vinh Loc Town and Vinh Thanh Commune will have a combined single system for common use due to topographical situation.

3) Treatment Facilities

Water treatment facilities will be planned in order to remove iron and manganese.

4) Project Cost

The priority project (15 communes with 14 systems) will cost 191 Billion VND (US$ 13.7 Million) in total on the international price basis. If it is implemented by the Japan's Grant Aid Scheme, it will be 2,378 Million Japanese Yen.

5) Financial Analysis

As a result of the financial analysis, it was confirmed that in all communes annual water sales would be more than annual expenses for O/M; and the project would be financially feasible. However, a commune population density of which is low will need operation fund in the first several years.

6) Project Evaluation

The project shall be implemented considering social benefits. However, O/M of water supply facilities shall be discussed and confirmed within the commune and implementation of the project shall be based on the

consensus of the commune people.

1.3 Vietnamese Request of the Japan's Grant Aid Scheme for the Implementation of the Groundwater Development Project in Rural Part of Northern Provinces

(1) Original Request

The Government of Vietnam requested in July 1999, the Japan's Grant Aid on the project implementation formulated in the F/S of JICA. The contents of the request are as follows:

1) Prime Objectives

Improvement of sanitary circumstances and living conditions in the northern part of Vietnam

2) Project Target

Increase of coverage of public water supply systems for domestic use in the northern part of Vietnam

3) Output of the Grant Aid Project

Construction of the water supply systems in the communes

4) Project Areas and Population Benefited

Project area: 2 communes in Hanoi suburbs, 3 communes in Ninh Binh Province, 4 communes in Thai Nguyen Province and 6 communes in Thanh Hoa Province; 15 communes in total

Beneficiaries: About 113,000 people in 15 communes

5) Contents of the Project

- Request to the Government of Japan

  Facilities: Deep wells, treatment facilities and distribution facilities in 15 communes
  Equipment: Pipes, pumps, water meters for the above

- Vietnamese Input and Activities

  Input: Transportation of materials and supply of water quality analysis equipment
  Activities: 40 persons of each Provincial CERWASS
  (Annual budget = US$ 8 Million in the whole country in 1999)

(2) Additional Request of Equipment

After the above request, the additional request of supply of well construction machine ("rig") was offered in August 2000 from Vietnam to the Government of Japan. Although this request was deemed to be handled by another Grant Aid scheme, it was agreed between the both Governments in August 2001 that this request be studied within the framework of the current project. The outline of the request is as follows:

1) Well Construction Machine

Well construction machine (Rig) (2 units), tools (2 units), high air compressor (2 units), accessories (2 units), air lift facility (2 unit) and spare parts (2 units)

2) Supporting Equipment for the Above

Cargo truck with crane (2 units), water tank truck (2 units), double-cabin small truck (2 units), pumping test equipment (1 unit), logging equipment (1 unit) and spare part (1 unit)

3) Mobil Workshop Truck (1 unit)

1.4 Implementing Agencies Related to Water Supply Sector

Administration of water supply sector in Vietnam is to be made by the Government of Central or Provincial. The central government has responsibility on policy decision and technology training for water supply; and the provincial governments on administration and implementation. Rural water supply is managed by the Ministry of Agriculture and Rural Development (MARD), and urban water supply by the Ministry of Construction (MOC). MARD takes care of water supply and sanitation in rural communes with population less than 30,000. Other related agencies are the Ministry of Planning and Investment (MPI) and the Ministry of Health (MOH). Implementing agencies related to rural water supply sector are mentioned below:

(1) Ministry of Agriculture and Rural Development (MARD)

The organization of MARD is divided into State Management Department establishing policies and approving projects, Administration Department dealing with administration matters, accounting, financing and public relations, and Research and Training Agency Under the State Management Department, there is the Water Management and Irrigation Section dealing with water resources management and development. Groundwater development is approved by the Section. International Cooperation Section in Administration Department treats coordination of agencies related to projects and regulates implementing contents. CERWASS is organized under the MARD.

(2) Ministry of Planning and Investment (MPI)

MPI controls and approves implementation of projects, decides financing plan and manages project funds. This is the agency of reception and management for ODA projects.

(3) Ministry of Health (MOH)

MOH stipulates drinking water quality standards and manages water quality control for domestic use water.

(4) Center for Rural Water Supply and Environmental Sanitation (CERWASS)

CERWASS was founded in 1982 based on the program of the United Nation's Water and Sanitation Decade. At first, CERWASS was one of UNICEF's counterpart organizations, and its main role was implementation of projects with international assistance. At present, however, the following roles are under the responsibility of CERWASS.

- Planning of rural water supply and environmental sanitation
- Control and distribution of budgets for the above
- Cooperation and adjustment with Ministries concerned, UNICEF and international agencies
- Technical training of personnel staff for rural water supply and sanitation

The Central CERWASS is composed of five departments with 88 staff in total. The Provincial CERWASS stands in each province and has responsibility of implementation and maintenance of water supply systems under supervision of the Central CERWASS. Staff of the Provincial CERWASS counts 2,500 in the whole country.

The roles of the five departments of the Central CERWASS are as follows:

- Investment and Planning Department:
  Planning and operation of projects, preparation of project budget for Provincial CERWASS, and management of projects related to UNICEF and international aid agencies
- Technological and Capital Construction Department:
  Approval of the Provincial CERWASS's projects and cooperation with the Water Resources and Irrigation Department of MARD
- Environment and Communication Department:
  Cooperation with the Provincial CERWASS, IEC activities, and environmental care of agriculture
- Materials and Technical Transfer Station:
  Control of construction materials and machinery, test and analysis of construction materials and water quality, and test of new technology and technical training
- Administration Department:
  Management of personnel and budget, and administrative matters

(5) Provincial CERWASS

Provincial CERWASS (P-CERWASS) is set under Department of Agriculture and Rural Development (DARD) in the Provincial People's Committee and supervised administratively by the Central CERWASS. P-CERWASS implements projects and supports communes in operation and maintenance after transfer of facilities constructed.

Standard organization of P-CERWASS is composed of Sections of Administration, Technical, Finance & Accounting, and Planning and Materials. Several teams of Drilling work are organized in the Planning and Materials Section.

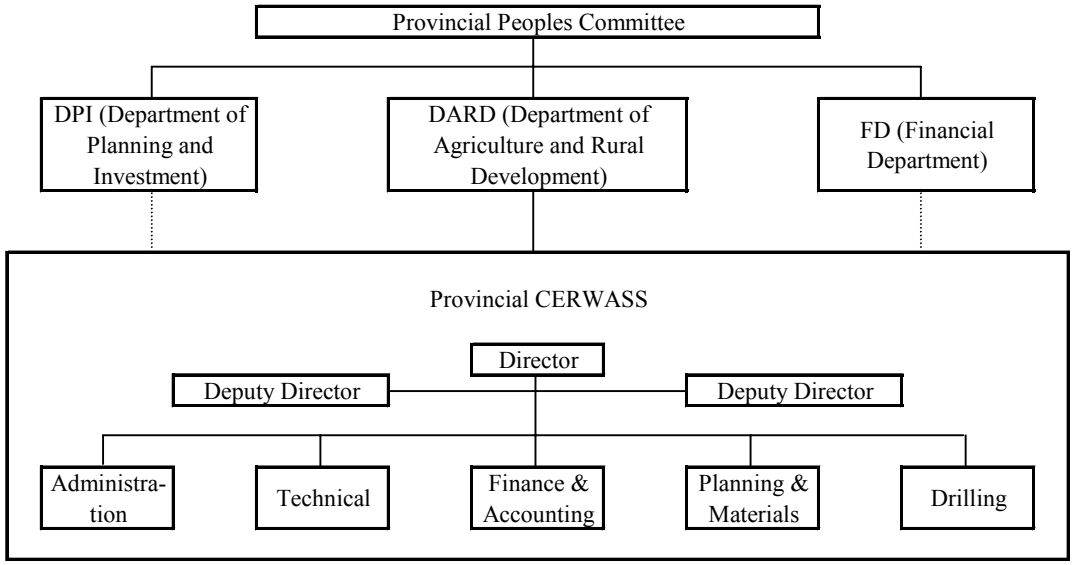

Fig. 1.1 Organization of Ninh Binh CERWASS

(6) P-CERWASS of the Project Requested

1) Organization

Organization of three Provinces of Thai Nguyen, Ninh Binh and Thanh Hoa is the almost same to each other, and the organization of Ninh Binh P-CERWASS is shown in Fig.1.1.

2) Personnel

Staff and engineers in three P-CERWASS are given in the following table.

Table 1.2 Personnel of 3 Provincial CERWASS

Province	Number of Personnel	Number of Engineer
Thai Nguyen	40	4
Ninh Binh	41	8
Thanh Hoa	40	7

In addition to the above, there is a drilling and maintenance team which in general consisted of leader (1), drilling advisor (1), mechanic (1), technical support (2-3) and driver (1).

3) O/M Facilities and Well Construction Machine

There is O/M facilities in each P-CERWASS and Central CERWASS, consisting of office, parking lot, workshop and warehouse. The present well drilling machine (Rig) is listed below.

Table 1.3 List of Well Construction Machine (Rig)

Provincial/Central CERWASS	Rig	Drilling Depth	Drilling Diameter	Number	Year Procured
Thai Nguyen	XY-1 (China)	100 m	46 – 110 mm	1	1993
Ninh Binh	XY-1 (China)	100 m	46 – 110 mm	1	1993
Thanh Hoa	XY-1 (China)	100 m	46 – 110 mm	1	1993
	Longyear (Canada)	100 m	Small	1	Before 1985
Central CEWRASS	XG-100 (China)	100 m	100 – 169 mm	1	1993

4) Finance

Most of rural water supply projects is financed by the Central Government through MRAD. Application to budget is presented from the Central CERWASS to the Ministry of Finance (MOF) through MARD; and the budget is provided to P-CERWASS through the Department of Finance (DOF) in each Province. The Provincial People's Committee (PC) is given budget by MOF. The budget is disbursed to water supply projects directly by the Provincial PC or through the commune. In the Province where financial matter is not affordable, however, provision of budget and/or labor force is required from the communes.

Recent budget for projects in 3 Provincial CERWASS is shown in the following table. Usually administration cost is about 10% of the project budget.

Table 1.4 Project Budget in 3 Provincial CERWASS

Provincial CERWASS	Year	Budget (Million VND)
Thai Nguyen	2000	1,539
	1999	887
	1998	456
Ninh Binh	2000	860
Thanh Hoa	2000	1,755
	1999	1,837
	1998	1,022

Financial allocation for public water supply systems consisting of intake facilities for groundwater or surface water, raw water transmission facilities, water treatment facilities, elevated tanks or reservoirs and distribution pipelines constructed in 3 Provinces is on the following table. Allocation to beneficiaries is

about 20%, individual house connection cost (pipe materials and installation).

Table 1.5 Financial Allocation for Water Supply Projects in 3 Provinces (Unit: Million VND)

Province	Number of Facility	Project Budget	Breakdown of Budget				
			Central	UNICEF	Province	District	Beneficiary
Thai Nguyen	6	1,026	587 57%	108 (11%)	173 (17%)	0 (0%)	158 (15%)
Ninh Binh	6	3,058	1,572 (51%)	643 (21%)	30 (1%)	0 (0%)	813 (27%)
Thanh Hoa	11	2,222	1,533 (69%)	328 (15%)	60 (3%)	65 (3%)	236 (26%)
Total	23	6,306	3,692 (59%)	1,079 (17%)	263 (4%)	65 (1%)	1,207 (19%)

Source: Provincial CERWASS Offices

(7) People's Committee

Local People's Committees (PC) stand in Province, District and Commune respectively. The Provincial PC has the Department of Agriculture and Rural development (DARD) and plans water supply project's budget and disburse it. One of the important roles of Provincial PC is to decide water tariff. Commune's PC carries out O/M for water supply facilities constructed by CERWASS and others.

1.5 Outline of the Project Area

1.5.1 Administrative Unit

Administrative units in Vietnam are categorized by 4 levels (*cap*): Central (Level A) and locals (Province: Level B, District: Level C, and Commune: Level D). High level of local administration is 57 Provinces and 4 Cities under the Central Government (Both Level B), and at the next comes Rural District, City and Town under Province in Level C. Under the Rural District, there exist Town under District and Commune in both Level D. Furthermore, there are Precinct and Commune (both Level D) in City or Town under the Province. A commune is composed of villages *(thon*) or hamlets (*xom*), the minimum unit. The administrative unit in the project area is categorized as shown Table 1.6. All of the project sites belong to Level D (Refer to Table 2.1).

Table 1.6 Administrative Unit in 3 Provinces

Administrative Level	Level B	Level C			Level D		
Vietnamese English	*Tinh* Province	*Huyen* Rural District	*Thanh pho truc thuoc tinh* City under Province	*Thi xa* Town	*Phuong* Precinct	*Thi tran* Town under District	*Xa* Commune
Number of Administrative Unit	Thai Nguyen	7	1	1	22	13	145
	Ninh Binh	6	-	2	11	5	128
	Thanh Hoa	24	1	2	18	31	581

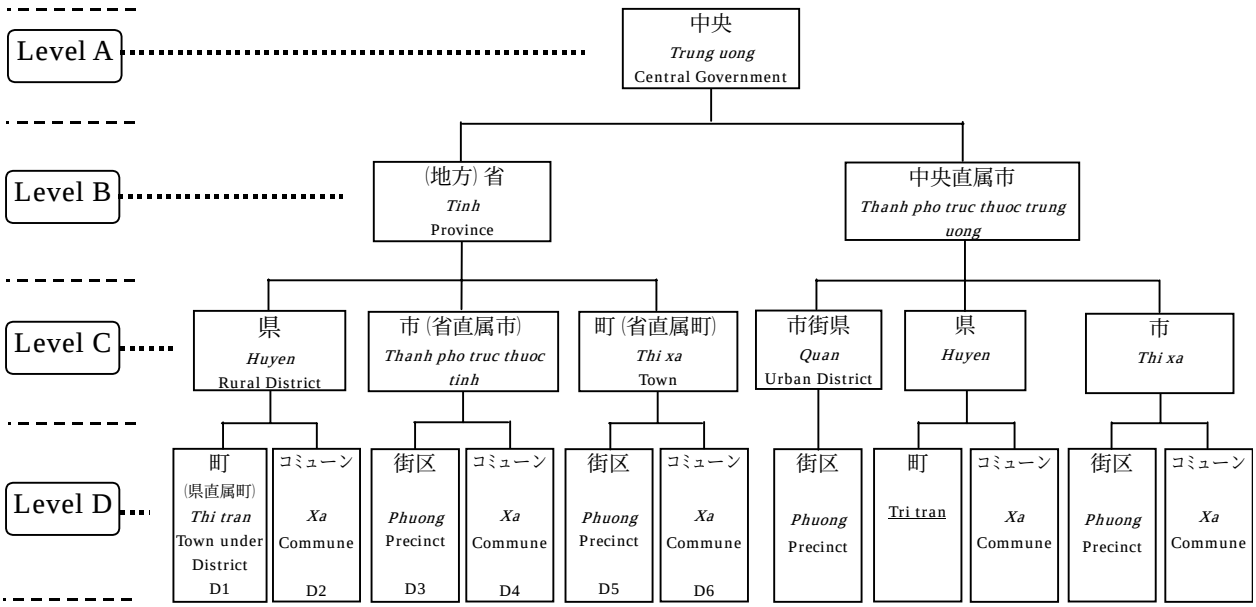

Fig. 1.2 Administrative Structure of Vietnam

1.5.2 Natural Conditions

(1) Topography

The country of Vietnam is topographically divided into four regions: namely, Northern Highlands, Red River Delta, Annamese Highland and Coastal Plains, and Mekong River Delta. The project sites are located in the Northern Highlands and Mekong River Delta. Four communes in Thai Nguyen Province, northern Hanoi, are situated on flat lands in mountainous areas and hilly areas. As for three communes in Ninh Binh Province, in

south of Hanoi, Yen Thang Commune is located on a coastal plain with hilly areas, while Quang Son Commune on a hilly area, and Dong Phong Commune on an intermountain basin. In Thanh Hoa Province, Vinh Loc Town and Vinh Thanh Commune are located on an alluvial plain along the Ma River. Dinh Tuong Commune is located on a flood plain between Ma River and Chu River. Van Ha Town (Thieu Hung Commune) is on the left side of Chu River whereas Thieu Do Commune on the right bank of Chu River, and Van Thang Commune on a alluvial plain and hilly areas along the Muc River.

(2) Meteorology

Vietnam is tropical in the south and subtropical in the north, which is frequently subject to subtropical monsoons. The project sites is in subtropical zone. Heavy rains brought by the monsoon fall from May to September in the northern part. The annual rainfall is .2,050 mm in Thai Nguyen, 1,861 mm in Binh Binh and 1,729 mm in Thanh Hoa. Hanoi, located among the above provinces, takes 1,684 mm annual rainfall, comparatively less. Temperature in Hanoi is 23.0 C degree on annual average; and 16.6 C degree on minimum monthly average, and 28.8 C degree on maximum monthly average. Annual average evaporation is 957 mm in Thai Nguyen, 852 mm in Ninh Binh and 816 mm in Thanh Hoa. It is small in February-March and large in May - July.

Thai Nguyen Province and Ninh Binh Province is located in the Red River basin, and Thanh Hoa Province in Ma River. The Red River is the second largest river in Vietnam and originates in China and flows into Vietnam from northwest to southeast. Out of 169,000 km2 of the total catchment area, about a half area (87,400 km2) lies in Vietnam. The red River Delta, which has an area of 17,000 km2, occupies about 20%of the basin that falls in Vietnam. The Ma River originating from Lai Chau and Son La Province of Vietnam as well as Laos, flows from Son La Province to Thanh Hoa Province through Laos. Its total catchment area is 28,490 km2, in which an area of 17,810 km2 falls in Vietnam. The mean annual discharge is 20.1 billion m3.

(3) Geology and Hydrogeology

Thai Nguyen Province

In the communes of Hoa Thuong and Dong Bam, limestone of the Carboniferous period to the Permian period, and sandstone and shale of the Triassic period are distributed complexly. Suitable aquifer is formed in limestone having developed fracture zones or caves among the stratums.

In the communes of Thinh Duc and Nam Tien, sandstone and shale of the Triassic period are distributed. These stratums could be aquifer at fracture zones with a lot of cracks, but water production rate is less than aquifer of the limestone.

The Quaternary period stratum, covering basement rock, distributes in the province and the thickness is less than 20 m. In the commune of Thinh Duc (J-4) and Nam Tien (J-3), groundwater is taken from sand or gravel layers of the Quaternary period.

Ninh Binh Province

Basement rock of the three communes in the province mainly consists of limestone of the Triassic period. Groundwater production rates change remarkably according to the quantities of fracture zones and existence of plugging matters (gouge) in the fractures.

Surface layer of the Quaternary period is thin as it is less than 10 m thick in the communes of Dong Phong and Quang Son, but in Yen Thang commune it is thick as about 44 m.

The commune of Yen Thang has particular prominence as salt water has encroached in low zone of groundwater under low area of the rice field in the area.

Thanh Hoa Province

In five communes of Vinh Thanh, Vinh Loc, Dinh Tuong, Van Ha (Thieu Hung) and Thieu Do, alluvial plain is formed by the Ma River and the tributary Chu River. The Quaternary period stratum distributes thickly as the thickness of 20 - 50 m covering basement of limestone, sandstone and shale of the Triassic period.

Van Thang commune consists of alluvial plain formed by Muc River. Based on the existing well (J-8), layer of the Quaternary is thin as 6 m and groundwater is taken from the fracture-developed sandstone.

1.5.3 Socio-Economic Condition

(1) Economy

After 1990, Vietnam has changed from the planned economy to market economy; and the economy growth rate in recent 10 years is high as 9% per annum. However, per capita GNP was just US$ 340 in 1998. Particularly in rural areas, where 76% of Vietnamese population live, economy development is situated behind.

Three provinces of the project sites take per capita GDP of 2.13 - 2.48 million VND (US$ 151 - 175). It is 50% of the whole nation: only 20% of Hanoi GDP. Main activity is agriculture occupying 38 - 53% of the provincial's GDP; however, productivity of farmers is less than that of industry, construction or service businesses.

Table 1.7 GDP in Three Provinces (Year 1998)

Area	By Industry (Billion VND and %)				Per Capita GDP (Million VND)
	Agriculture & Fishery	Industry & Construction	Service	Total	
Thai Nguyen	901.7 (37.7%)	724.5 (30.3%)	765.9 (32.0%)	2,392.1 (100%)	2.28
Ninh Binh	1,002.6 (53.3%)	374.3 (19.9%)	505.3 (26.8%)	1,882.2 (100%)	2.13
Thanh Hoa	3,592.1 (42.0%)	2,016.4 (23.6%)	2,941.2 (34.4%)	8,549.7 (100%)	2.46
Whole Country	93,088.0 (25.8%)	117,803.0 (32.6%)	150,579.0 (41.6%)	361,468.0 (100%)	4.72
Hanoi	989.5 (4.3%)	8,314.7 (36.2%)	18,644.7 (59.5%)	22,948,9 (100%)	8.56

Source: Socio-Economic Statistical Data of 61 Provinces and Cities in Vietnam, 1999

(2) Socio-Economic Conditions

1) Status of Three Provinces

- Population

Population in the three provinces is given in the following table; population rural areas occupy 79 - 91%, and its rate is larger than the whole country's average. Population in a household is 4.2 persons/house. Among people in rural areas, more than a half of population has lived in the same commune for more than 30 years and most of them lives on agriculture.

Table 1.8 Population in Three Provinces (1999)

Area (Province)	Population (% of Vietnam)	Urban Area		Rural Area	
		Population	%	Population	%
Thai Nguyen	1,047,800 (1.37%)	219,900	21.0	827,900	79.0
Ninh Binh	885,000 (1.16%)	112,400	12.7	772,600	87.3
Thanh Hoa	8,474,500 (4.54%)	322,400	9.3	3,152,100	90.7
Whole Country	76,596,700 (100%)	18,081,600	23.6	58,515,100	76.4

- Main Industries

In the rural areas, agriculture is major industry. Rice is produced twice a year, in April and in September. In some communes where rice could not be produced such as Quang Son in Ninh Binh Province, sugarcane, tea, pineapples and so on are cultivated. In most of communes, they have cattle.

- Water Use

  As for water use, people take water from private shallow wells constructed in the house yards in most communes. Some communes have public shallow wells. In some areas, people take water from rivers or ponds. The existing water sources are generally bad in quality and sometimes dried up in hot seasons. Distance to water source is usually less than 25 m, but sometimes they take much time to public wells. In most households, water is kept in private storage jars. Usually water is drunk after boiling due to living habits. When a shallow well is dried up, people sometimes buy water from venders. Its price is 17,500 - 25,000 VND/m3.

- Health and Sanitation

  As for health and sanitation, communicable diseases parasite, liver trouble and so on are dominant. There happened cholera in some area. In houses, people wash hands before meals and after toilet, but such custom is seldom made. Vegetables are often washed with unsafe well water. Generally sanitary care is not enough. Due to lack of clean water, sometimes skin/eyes related diseases occur, and for women, sometimes infections also develop. Medical expense is comparatively large to household income, big burden to people. To this end, there exists mutual help system in communes.

2) Socio-Economy in the Project Sites

From baseline survey, workshop and interview survey, socio-economy in the project sites are found as follows: The survey results are shown in Appendices-6 and -7.

- Number of Households and Population

  Number of households and population is given in table 1.9. Among 13 communes, population differ by commune, 3,230 - 10,000.

- Main Industry and Income Source

  In the project sites, main industry is agriculture of rice production. Household income resulted from the baseline survey differ by commune to large extent; 130,000 - 1,250,000/month, averaging 461,400 VND/month. Percentage of electricity cost to household expenditure is 11.5 - 2.2 %, and medical cost in 13.3 - 0.5 %.

Table 1.9 Number of Households and Population

Province	Commune	Area (km2)	Number of Village	Number of Household	Population (Persons)
Thai Nguyen	No.1: Hoa Thuong	13.55	16	2,415	9,449
	No.2: Dong Bam	4.01	10	1,311	5,445
	No.3: Thinh Duc	18.37	25	1,547	6,236
	No.4: Nam Tien	9.30	11	1,500	6,339
Ninh Binh	No.5: Dong Bam	7.30	9	2,462	10,000
	No.6: Quang Son	37.00	12	1,700	7,500
	No.7: Yen Thang	11.56	15	2,200	8,350
Thanh Hoa	No.8: Vinh Thanh	4.38	8	1,500	6,000
	No.9: Vinh Loc	0.82	3	1,275	5,900
	No.10: Dinh Tuong	6.14	5	1,470	6,628
	No.11: Van Ha (Thieu Hung)	5.45	11	1,780	6,785
	No.12: Thieu Do	4.12	11	1,575	7,463
	No.13: Van Thang	9.10	11	1,570	6,536

Table 1.10 Household Income

Province	Commune	Main Industry	Household Income (VND/month)	Electricity Expense (VND/month)	Medical Expense (VND/month)
Thai Nguyen	No.1: Hoa Thuong	Agriculture (80%)	625,000	45,000 7.2%	50,000 8.0%
	No.2: Dong Bam	Agriculture (70%)	1,000,000	30,0030 3.0%	10,000 1.0%
	No.3: Thinh Duc	Rice production	130,000	15,000 11.5%	20,000 15.5%
	No.4: Nam Tien	Agriculture	500,000	20,000 4.0%	30,000 6.0%
Ninh Binh	No.5: Dong Bam	Rice and peanut	174,000	20,000 11.5%	20,000 11.5%
	No.6: Quang Son	Tea	320,000	15,000 4.7%	40,000 12.5%
	No.7: Yen Thang	Rice (100%)	225,000	20,000 8.9%	30,000 13.3%
Thanh Hoa	No.8: Vinh Thanh	Agriculture	600,000	20,000 3.3%	55,000 9.2%
	No.9: Vinh Loc	Agriculture and Services	600,000	20,000 3.3%	55,000 9.2%
	No.10: Dinh Tuong	Agriculture (100%)	-	35,000	27,500
	No.11: Van Ha (Thieu Hung)	Agriculture (100%)	1,250,000	28,000 2.2%	6,000 0.5%
	No.13: Van Thang	Rice	470,000	12,000 2.0%	20,000 4.3%
Average		461,405			

- Infrastructure

  Access conditions from major town of the province to communes are generally enough. The national roads or main roads with asphalt pavement lead to communes. Pavement coverage of roads in commune territory differ remarkably by commune. Public electricity has been supplied in almost all of communes. On the other hand, public water supply systems have not yet been constructed. The following table shows present conditions of roads and public electricity and major infrastructure.

Table 1.11 Infrastructure

Province	Commune	Distance from main town (km)	Travel time by car from the town (min)	Coverage of public electricity (%)	Roads in commune	
					Distance (km)	Pavement (%)
Thai Nguyen	No.1: Hoa Thuong	7	20	100	13	0
	No.2: Dong Bam	2	10	100	15	0
	No.3: Thinh Duc	10	25	95	30	0
	No.4: Nam Tien	30	30	98	15	0
Ninh Binh	No.5: Dong Bam	30	40	98	1.5	100
	No.6: Quang Son	24	30	90	37	40
	No.7: Yen Thang	15	15	100	25	72
Thanh Hoa	No.8: Vinh Thanh	45	80	95	4.2	0
	No.9: Vinh Loc	45	80	100	4.5	50
	No.10: Dinh Tuong	30	40	100	35	5
	No.11: Van Ha (Thieu Hung)	15	20	100	22.6	15
	No.13 : Van Thang	33	50	100	7.5	0

1.5.4 Present Water Use

(1) Existing Water Facilities

There are five types of water facilities in rural area in Vietnam:

1) Dug Well

Shallow dug wells with 5 - 10 m depth and 0.8 - 1.2 m diameters are used in many places as domestic water source in the project sites. The shallow wells are either covered or uncovered. Most wells are more or less contaminated with human activities and sometimes coliforms are detected. In areas where iron is much contained in the well water, small sand filters are sometimes used. The shallow wells tend to be dried up in dry seasons.

2) Rainwater Tank

The rainwater tank is for storage of rainwater coming from roofs by way of troughs and its capacity ranges 0.2 m3 - 10 m3. In rainy seasons, the rainwater is use for drinking, cooking, washing and bathing. Big tank is used in dry seasons for domestic water which was stored during rainy seasons.

3) Tube Well

The tube well is made by PVC pipes into boring a boring hole with 50 - 150 mm diameter. A hand pump or an electric pump is attached to the well. In most cases, diameter of the well is 50 mm.

4) Small Scaled Pipeline System

This is a rather simple water supply system with low construction, and it usually does not have treatment process. The water source is streams or springs in mountains which flow by gravity force for pipelines distribution. Other water source is rivers, ponds or tube wells to be pumped up for distribution.

5) Central Water Supply System

This system takes water from tube wells or surface streams. It is composed of system facilities for intake, transmission, treatment and distribution, and supplies water to at least 1,000 persons. In the case iron is contained in groundwater, it is usually removed by aeration tower method. The system is rather new to rural water supply and CERWASS started construction of this system in 1995. In the three provinces where the project sites are located, there 55 of the central water supply systems. Presently the maximum size of the system is for 500 households. In Thai Nguyen Province, 26 of the system are existing; all of them are maintained by each commune. In Ninh Binh Province, there exist 9 systems of which 6 systems are by agricultural organizations, two systems by the commune and Peoples Committee, and one by private. In Thanh Hoa Province, there exist 20 systems all of which are maintained by communes.

(2) Present Status of Water Supply and Problems

Present water use conditions and problems were surveyed through field reconnaissance and interview survey. It is summarized as below:

1) Four Communes of Hoa Thuong, Dong Bam, Thinh Duc and Nam Tien on Thai Nguyen Province

Almost all houses have their own private shallow wells in all communes. 80% of them are equipped with hand pumps made in Vietnam, some UNICEF type. Along the national roads, some shops have wells in 20 - 30 m depth with electrical pumps. In this area, water is not dried up in dry seasons but insufficient in quantity and quality. People use water for drinking and cooking after boiling. People eagerly expect safe

water and sanitary care of people is in high level.

2) Three Communes of Dong Phong, Quang Son and Yen Thang in Ninh Binh Province

   Almost all houses have private shallow wells, but some shallow wells are dried up during dry seasons. In that case, people take water from other houses having deeper wells. On the other hand, certain houses with rain water storage tanks use the rain water for drinking and cooking, due to the bad quality of shallow well water.

3) Six Communes of Vinh Thanh, Vinh Loc, Dinh Tung, Van Ha (Thieu Hung), Thieu Do and Van Thang in Thanh Hoa Province.

   Although shallow wells have been installed in all households, water contains much iron and simple filters often used for drinking and cooking purposes. Some shops along the national roads have deep wells of 25 - 35 meter depth equipped with electrical pump. Water level of shallow wells sometimes lowers down and yield of the well is insufficient. As for water quality, inhabitants are not satisfied with water quality, so, they boil water and use filters. Hence safe water is produced.