JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

HANOI PEOPLE'S COMMITTEE
THE SOCIALIST REPUBLIC OF VIET NAM

THE STUDY
ON
HANOI WATER SUPPLY SYSTEMS
IN
THE SOCIALIST REPUBLIC OF VIET NAM

FINAL REPORT

SUPPORTING REPORT

OCTOBER 1997

PACIFIC CONSULTANTS INTERNATIONAL
HOKKAIDO ENGINEERING CONSULTANTS CO., LTD.

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ESTIMATE OF PROJECT COST

Estimate of Base Cost : At 1997 Price Level

Currency Exchange Rate : US$ 1 = Dong 11,000

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ABBREVIATION

ADB	Asian Development Bank
AFW	Accounted-for Water
BHN	Basic Human Needs
BIDV	Bank for Investment and Development of Vietnam
BOT	Built, Operation and Transfer
CMEA	Council for Mutual Economic Assistance
DID	Densely Inhabited District
DOMAH	General Department of Meteorology and Hydrology
EIA	Environmental Impact Assessment
EPZ	Export Processing Zone
FDI	Foreign Direct Investment
FINNIDA	Finnish International Development Agency
FYE	Fiscal Year
HCMC	Ho Chi Minh City
HPC	Hanoi People's Committee
HWBC	Hanoi Water Business Company
HWBC No. 2	Hanoi Water Business Company No. 2
HWSC	Hanoi Water Supply Company
HWSEP	Hanoi Water Supply and Environment Project
HWSP	Hanoi Water Supply Program
IAS	International Accounting Standard
IE	Industrial Estate
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
MOARD	Ministry of Agriculture and Rural Development
MOC	Ministry of Construction
MOF	Ministry of Finance
MOH	Ministry of Health
MOI	Ministry of Industry
MOLISA	Ministry of Labor, Invalids and Welfare
MOSTE	Ministry of Science, Technology and Environment

MPI	Ministry of Planning and Investment
NWTS	National Water Tariff Policy Study in Vietnam
O&M Cost	Operation and Maintenance Cost
ODA	Official Development Assistance
OECF	The Overseas Economic Cooperation Fund
RPHC	Readjustment Planning for Hanoi City 2020
SB	State Bank
SE	State-owned Enterprise
SSWSC	Soc Son Water Supply Company
TUPWS	Transportation and Urban Public Works Service
UDWWD	Urban Drainage and Waste Water Disposal System
UFW	Unaccounted-for Water
UPI	Hanoi Urban Planning Institute
URENCO	Hanoi Urban Environment Company
URP	the National Institute for Urban and Rural Planning
VND	Vietnamese Dong
WBE	Water Business Enterprise

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CHAPTER 1 INTRODUCTION

1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Hanoi, the capital city of Vietnam, is located in the upper stream of the Red River Delta. The city area including 5 suburban districts is 924.5 km2 with a population of 2,394,887 (1995).

The city is undergoing rapid urbanization with high population growth rate in recent years. However, It is rather undeniable that the city virtually lacks environmentally and sanitarily acceptable water supply systems to meet its urbanization and growth of population.

With regard to the water supply network covering the urban districts, improvement and expansion of the system have been implemented under the Hanoi Water Supply Project (FINNIDA assistance) since 1985. The project has made continuous efforts for improving the Hanoi water supply over a decade.

In 1993 the project formulated a water supply master plan up to 2010, which covered only the urban districts. The plan is to be partly implemented with the World Bank financing.

Although another augmentation of water supply was made in 1995 through a Japanese grant aid project in Gia Lam District, the suburban districts still remain excluded from the master plan 2010.

In consideration of recent urbanization and foreign investments, Hanoi needs a more comprehensive master plan which covers the whole area of Hanoi city including the estranged suburban districts.

With this background, the Study on Hanoi Water Supply Systems (hereinafter referred to as "the Study") was undertaken by Japan International Cooperation Agency (JICA) responding to the request made by the Government of Vietnam. The Scope of Work for the Study was signed between JICA and the Government of Vietnam on 16th January, 1995.

1.2 OBJECTIVES OF THE STUDY

The objectives of the study are :

(1) to establish an overall and strategic master plan covering the whole administrative Hanoi City area with the planning target year 2010

(2) to conduct a feasibility study for the priority projects identified in the master plan.

1.3 STUDY AREA

The study area covers 924.5 km^2 consisting of the five (5) urban districts (Ba Dihn, Hoan Kiem, Hai Ba Trung, Dong Da, Tay Ho) and five (5) suburban district (Than Tri, Tu Liem, Dong Anh, Soc Son and Gia Lam) in Hanoi City (April 1996).

Location of the study area is shown in Fig. 1.3-1.

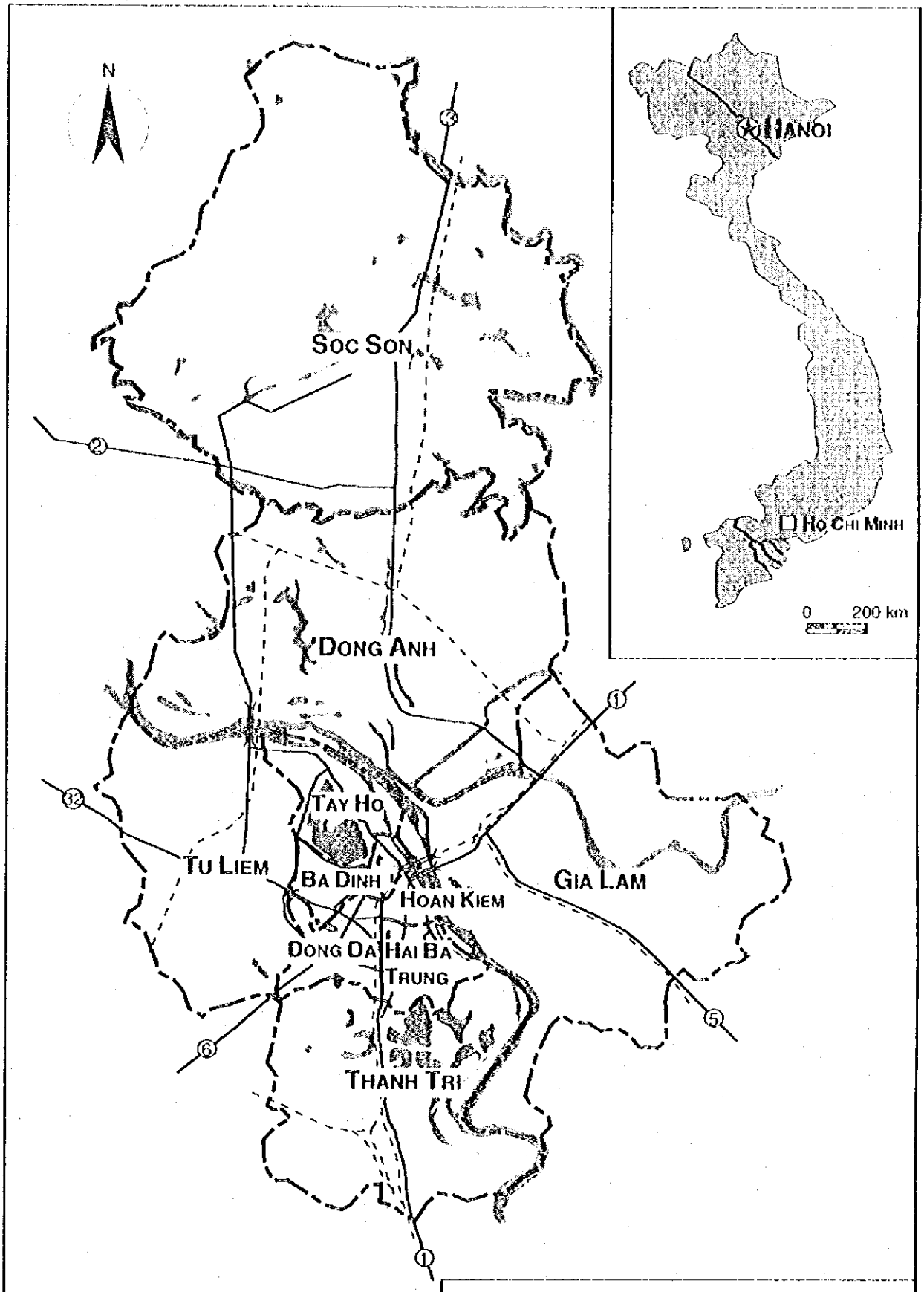


Fig. 1.3-1 Study Area

1.4 STUDY ORGANIZATION

1.4.1 General Organization

The overall concept of the organizational relation is as shown in Fig. 1.4-1.

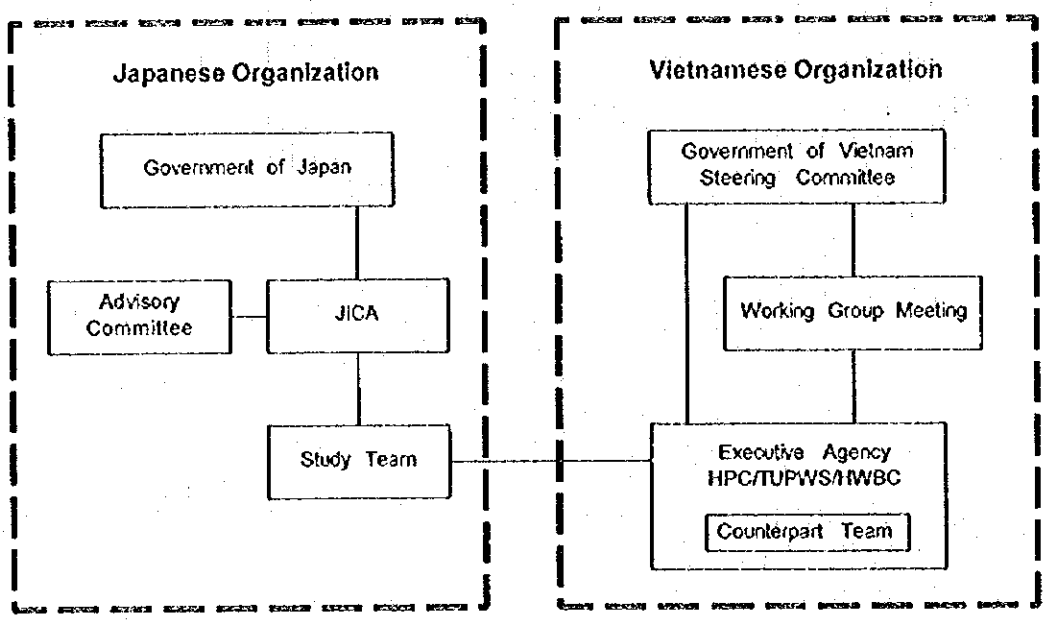


Fig. 1.4-1 The organizational Relations

Notes :

JICA	: Japan International Cooperation Agency
MPI	: Ministry of Planning and Investment
HPC	: Hanoi People's Committee
TUPWS	: Transportation and Urban Public Works Service, Hanoi
HWBC	: Hanoi Water Business Company
Working Group Meeting	: The meeting held with the related agencies and organizations such as Ministry of Construction, Ministry of Agriculture and Rural Development, Ministry of Industry of Vietnam, and World Bank and UNICEF

1.4.2 Japanese Organization

The Japanese Organization consists of both the Study Team under JICA and the Advisory Committee for JICA.

(1) The Members of the Study Team

Name	Field in Charge
OKAGA Toshifumi	Team leader and water supply planning
YAMAZAKI Hideki	Water supply facility planning
YASUDA Makoto	Hydrogeology / Hydrology / Groundwater development planning
SAKAI Hitoshi	Institution building / Management
SEKI Kazunori	Urban planning / Social analysis
NARITA Motoo	Economic and financial analysis
KURIHARA Tsutomu	Water quality analysis / Environmental impact assessment
UMEZAWA Ko	Water leak protection planning
TOHDA Naoto	Coordinator for general affaires

(2) The Members of the Advisory Committee

Name	Field in Charge	Present Post
MAGARA Yasumoto	Chairman	Professor, Hokkaido University, Japan
OMURA Yoshiki	Member	Water supply Specialist, Institute for International Cooperation, JICA

1.4.3 Vietnamese Organization

The organization consists of the Counterpart Team, to the JICA Study Team, and the Steering Committee, with general coordination of the Hanoi People's Committee.

(1) The principal members of the Counterpart Team

Name	Field in Charge	Position
Trinh Kim Giang	Group leader	Manager of HWBC
Ngo Thi Bich	Group leader	Manager of HWBC
Tran Lan Huong	Water supply planning	HWBC
Thruong Ngoc Anh	Water resources development	HWBC
Bui Thi Khanh Toan	Institution/Management	Chief of Accountant, HWBC
Nguyen Kim Dung	Urban planning	HWBC
Do Lan Huong	Environment/Water quality analysis	HWBC
Nguyen Thu Nga	Financial analysis	HWBC
Truong Cong Thanh	Water supply facility planning	HWBC
Nguyen Phuong Dung	Water supply facility planning	HWBC

(2) The Members of the Steering Committee

Name	Position
Do Hoang An	Vice Chairman of HPC
Nguyen Quang Lan	Deputy Director of Foreign Economic Relation Department, HPC
Pham Dang Sy	Director of Financial and Planning Department, HPC
Vu Hoan	Deputy Director of Dept. of Science, Technology & Environment, HPC
To Anh Tuan	Deputy Director of Chief Architect Office, HPC
Phan Tu Trong	Deputy Director of Cadastrial Department., HPC
Nguen Ngoc Toan	Deputy Director of Construction Department, HPC
Pham Hai	Director of Local Department, MPI
Dao Dung Anh	Deputy Director of Planning and Economical Department, MOF
La Van Mau	Deputy Director of Planning and Investment Department, MOI
Vu Dinh Khoa	Deputy Director of Planning and Architecture Department, MOC
Phan Xuan Su	Deputy Director, MOARD
Truong Chi Tan	Deputy Director, MOSTE
Phan Hung	Expert, Government Office
Pham Quoc Truong	General Director, TUPWS
Bui Van Mat	Director, HWBC

Notes :

MOF	Ministry of Finance
MOI	Ministry of Industry
MOC	Ministry of Construction
MOARD	Ministry of Agriculture and Rural Development
MOSTE	Ministry of Science, Technology and Environment

1.5 REPORTS

The study reports prepared are as follows :

1 Executive Summary
2 Main Report
3 Supporting Report
4 Data Book

This Supporting Report comprises of four appendices. Report A corresponds to Part I of the Main Report, which explains contents of the Study and Background information on the study area. Report B is details of the Master Plan study. Report C is the Feasibility Study on the priority project. Report D is recommendations.

CHAPTER 2 PRESENT CONDITIONS

2 PRESENT CONDITIONS

2.1 SOCIO-ECONOMIC CONDITIONS

2.1.1 Overview

(1) Main sources of data are: a) Vietnam: Transition to a Market Economy, IMF paper, March 1996; b)The Economic Development Policy in the Transition toward a Market-Oriented Economy in Viet Nam, Macroeconomy, JICA Draft Final Report, March 1996; c) Asian Economies 1996, Economic Planning Agency, Japan, June 1996; d) Vietnam Economic Review No.2 (32) 1996, State Bank of Vietnam.

(2) Almost a decade has passed since Vietnam has concerted the efforts of the transition. Now Vietnam stands on the entrance of a new era in its international relations and economic development. Its economy and finances have been reformed considerably (although Vietnam remains one of the poorest countries in Asia, with per capita GNP below US$270 in 1995 according to the Economic Planning Agency, Japan), and integrated into the world economy. The economy is now beginning to benefit from official development assistance (ODA) and foreign direct investment (FDI) significantly.

(3) In comparison with other economies in the transition, starting conditions in Vietnam were rather favorable. Especially in the southern part of the country, the legacy of the market economy was revived quickly because of relatively low integration with the former Council for Mutual Economic Assistance (CMEA). In addition, neighboring countries in Asia provided affluent markets for Vietnamese exports and were seeking to invest their savings into Vietnam. With firm determination by the Vietnam's authorities, structural reform and financial stabilization policies were implemented in a consistent manner. The sudden collapse of the CMEA or the withdrawal of USSR support accelerated the departure from the previous paradigms and the replacement by the market-oriented principles.

(4) Agricultural Sector reforms were implemented in a wide range. Private enterprises were encouraged. Prices, exchange rates and foreign trade were liberalized to greater extent. Besides, bank financing of the fiscal deficit was eliminated, a hard budget constraint was put on state enterprises, over liquidity was controlled, and the attractiveness of the local currency Vietnamese Dong (VND), as a fiscal asset was enhanced by adopting positive real interest rates.

All above factors joined together to draw out an incremental output, in comparison with the wide decline in other transition economies in general.

2.1.2 Recent Trends of Growth and Forecast

(1) Vietnam economy has achieved an impressive growth rate since 1992. The real GDP growth rate accelerated from 5.1% during 1985 - 89 to 9.5% in 1995.

Growth Rates and Other Indicators in Vietnam

	Fiscal Year	1985-1989	1990-1994	1993	1994	1995
Growth Rate						
Real GDP	%	5.1	7.3	8.1	8.8	9.5
Industrial Sector Output	%	5.7	10.5	13.1	14.0	14.2
Agricultural Sector Output	%	3.0	3.2	3.8	3.9	4.7
Service Sector Output	%	7.3	8.2	9.2	10.2	10.7
Retail Prices	%	257.3	34.4	5.2	14.4	12.7
Current Balance	$100 mil.	▲5.8	▲4.5	▲8.7	▲9.7	▲17.3
(per GDP)	%	(▲13.4)	(▲3.8)	(▲6.7)	(▲6.2)	(▲8.9)
Fiscal Balance*	$100 mil.					
(per GDP)	%	(▲7.7)	(▲4.8)	(▲6.2)	(▲2.4)	(▲5.5)
Domestic Savings/GDP	%	–	11.8	14.8	17.6	19.1

Source : Economic Planning Agency, Japan (Jun. 1996)
Note : * Central Government Base

(2) By sector, industrial sector output increased in 9.5% in 1995 after 8.8% in 1994. Agricultural output was 4.7% increase in 1995 compared to 3.9% in 1994. Services output rose to 10.7% in 1995 following 10.2% in 1994.

(3) Vietnam has had remarkable success in bringing inflation under control. The increase rate in retail prices declined from 257.3% in 1985 - 89 to 5.2% in 1993. But thereafter, despite continuing commitments inflation accelerated again. At the end of 1995, inflation rate stood at 12.7%, after rice price led hike of 14.4% in 1994. The inflation rate is expected to stay high in 1996 and it seems difficult to cut down the level below 10%.

(4) The recent report by State Bank of Vietnam in 1996 presented the following macroeconomic forecast. The report has two variants: one variant targets Vietnam's per capita income in the year 2025 is estimated US$ 1,872, which means to reach the present economic level of Thailand. The other variant targets GDP per capita of US$ 3,559 by 2025, which seems rather ambitious.

GDP Simulation

	1994	2000	2005	2010	2015	2020	2025
Variant 1							
GDP (billion US$)	15.5	26.1	41.6	65.8	100	150	220
average growth, 5 years		9.1	9.8	9.6	8.7	8.4	8.0
per capita GDP (US$)	214	320	466	677	952	1,337	1,872
Variant 2							
GDP (billion US$)	15.5	26.9	46.1	81.2	148.9	259.4	417.7
average growth, 5 years		9.7	11.4	12.1	12.8	11.7	10
per capita GDP (US$)	214	330	515	839	1,418	2,320	3,559

Source : Vietnam Economic Review No.2 (32) 1996, the State Bank of Vietnam

2.1.3 Reform of Industrial Sector and State Enterprises

(1) Before Doi moi, Vietnam's industrial sector had been supported by large - scale aids from the USSR. As the result of cease of the aids, industrial production declined by about 10% in the time of 1988 ~ 1991.

Many reform policies had took place, and had affected the performance of the industrial sector and the restructuring. Almost all industrial prices were liberalized by the end of 1988, except cement, steel, and electricity that remained controlled. In addition, the official exchange rate of the currency was devalued and aligned closely to the rate in the parallel markets, and the subsidies for export were eliminated as well as foreign currency earnings were partially allowed to be retained. Trades were liberalized by which allowed production enterprises to trade directly abroad.

(2) The state enterprises were reformed that focused on ensuring autonomy in decision making, releasing the enterprise from the constraints of the plan of the Central Government. Also to the private sector, some market oriented policies were undertaken such as providing access to credit, introducing non-discriminating taxation and commercial legislation. These policies have resulted in impressive output gains.

On the other hand, in this process, activity moved away from cooperatives and poorly managed state enterprises toward private enterprises and better-managed state enterprises. Several key heavy industries and some consumer oriented state enterprises was vivid, while smaller or local state enterprises were eventually bankrupted.

(3) As the result of restructuring, including the shedding of labor and the creation of joint ventures that attracted foreign investment and new technologies, enterprises' output performance strengthened dramatically. The state enterprises has become a net contributor to the budget.

2.1.4 Conditions of Capital Raising

(1) Most of the major countries in transition including Vietnam have been enjoying rapid increase in their foreign exchange reserves, however, in Vietnam the trade deficit has been widening for the past four years. These imbalance has been offset or more than offset by the increasing inflow of Foreign Direct Investment or ODA.

(2) Capital raising in international finance market by the government and private companies of developing countries is continuing and is inevitable. The order of magnitude has been FDI, private debt flows and portfolio investment.

(3) From the start, FDI was recognized to play a central role in the transformation of the Vietnam's economy. Approval of the FDI Law on the international standard at an early stage was a strategically important signal of the nature and direction of the reform process. Nevertheless difficulties and delays have arisen due to troublesome approval and licensing procedures, disbursements of investment commitments started to increase in 1991 according to the IMF paper. Now, Vietnam has one of the highest ratios of FDI to GDP in the world.

(4) FDI new commitments in 1994 boomed to nearly US$ 4000 million (disbursements $650 mil.), and in the first half of 1995, it has already attained the level exceeding the total record of 1994. There is a story that this might be temporary and might be worn off at least temporarily, following the track of measures recently taken by the government to depress speculation in the real estate market and ensure greater financial discipline.

(5) It is expected that FDI will play an increasingly important role in the modernization and growth of the Vietnam's economy. In order to realize its purpose, Vietnam authorities have to make more efforts to improve FDI approval procedures and to be integrated with international communities such as ASEAN.

2.2 NATURAL CONDITIONS

2.2.1 Topography

The Red River delta is vast, approximately 150 km long and 80 km wide spreading in a northwest-southeast direction, reaching the Gulf of Tonking. The Red River, which originates in China and flows into the Gulf of Tonking, is the second largest river in Vietnam, with a catchment area of 169,000 km^2 and a length of 1,183 km, whose 86,560 km^2 and 510 km are in Vietnam, respectively. The study area, Hanoi City is situated on the upper part of the Red River delta and is about 100 km from the sea. Almost all the study area belong to the alluvial flat lowland of the delta with an elevation of around 10 m. The northernmost part of the study area which is in Soc Son district, however, belongs to the Tam Dao mountains and the highest peak reaches an elevation of 462 m.

The Red River flows from northwest to southeast in the southern part of the study area along the southern border of Dong Anh district and the western border of Gia Lam district. The Duong River, a branch river of the Red River flows from northwest to southeast in the northern part of Gia Lam. The Cau River and its tributary, the Cong River form the eastern border of Soc Son district, and the Ca Lo River which is also a tributary of the Cau River forms the southern border.

2.2.2 Meteorology

Table 2.2-1 shows monthly average meteorological values at Lang Station in Hanoi.

Vietnam might be assumed to be wholly within the zone of the tropical monsoon climate. The Red River delta, where Hanoi City is situated, however, is not strictly tropical in the climatological sense, as due to its exposure to cold northern air during the season of the north-east monsoon called "winter". Winter, which is usually from November to April, coincides with the dry season. The minimum average monthly temperature is 15.3 ℃ in January, while the average yearly one is 23.4 ℃. The total rainfall during the winter is 328 mm, which is less than 20 % of annual one of 1,794 mm. On the other hand, summer is the rainy season, the maximum average monthly temperature is 29 ℃ in June, the total rainfall during this season is 1,466 mm, which is more than 80 % of annual one.

Table 2.2-1 Monthly average meteorological values at Lang Station in Hanoi

Month	Temperature(℃)	Rainfall(mm)	Evaporation(mm)	Humidity(%)
JAN	15.3	18	68	84
FEB	17.6	36	51	79
MAR	19.2	31	55	91
APR	23.6	121	66	83
MAY	27.4	194	94	81
JUN	29.0	250	99	82
JUL	28.4	214	101	81
AUG	28.6	325	86	82
SEP	27.1	290	91	78
OCT	24.4	181	95	73
NOV	21.4	115	88	76
DEC	18.4	7	94	79
YEAR	23.4(Ave.)	1,794(Total)	938(Total)	81(Ave.)

(FINNIDA "Master Plan" '93)

* Meteorological values in Table2.2-1 are quoted from the " Water Master Plan, FINNIDA, 1993 ". The data period is not made clear and some discrepancies are found between the year values and the total values of every month. However, as the year values are estimated to have been used in the groundwater simulation analysis, these values are also used in this study as they are.

2.2.3 Hydrology

(1) General

The Red River is the largest river system in the north and second largest in the country. The total catchment area of the Red River is about 169,000 km^2, whose 86,560 km^2 is located in Vietnam. Its total length is 1,126 km, whose 556 km is in Vietnam. The Red River consists of three large rivers, Da, Thao and Lo rivers; all of them originate from high mountainous region in China. These rivers joint at Viet Tri and form the Red River. Fig. 2.2-1 shows the main rivers in and around the study area.

The long-term average annual run-off volume of the Red River at Son Tay is 118 billion m^3 according to water discharge of 3,740 m^3/s. Water of the Red River, however, has never been used for the public water supply of Hanoi City, because of the difficulties of intake and treatment owing to the large seasonal fluctuation of water level and the high turbidity.

The three main rivers in Soc Son district, Cau, Cong and Ca Lo rivers belong to the Thai Binh River system (39,000 km^2), though being included in the Red River basin (See, Fig. 2.2-2).

The largest river in Soc Son district is the Cau River, which originates in the highland region of Bac Thai province and flows along the eastern border of Soc Son district and down to the Doung River which is one of tributaries of the Red River. The average annual run-off volume of the Cau River at Thac Buoi is 1.6 billion m3.

The Cong River originates in the eastern slopes of Tam Dao mountains and joins Cau River at Trung Gia in the northern part of Soc Son. The total catchment area of Cong River is 951 km^2 and length 96 km and that of Cau River at Dap Cau, after joined Cong River, is 5,780 km^2 and length 255 km.

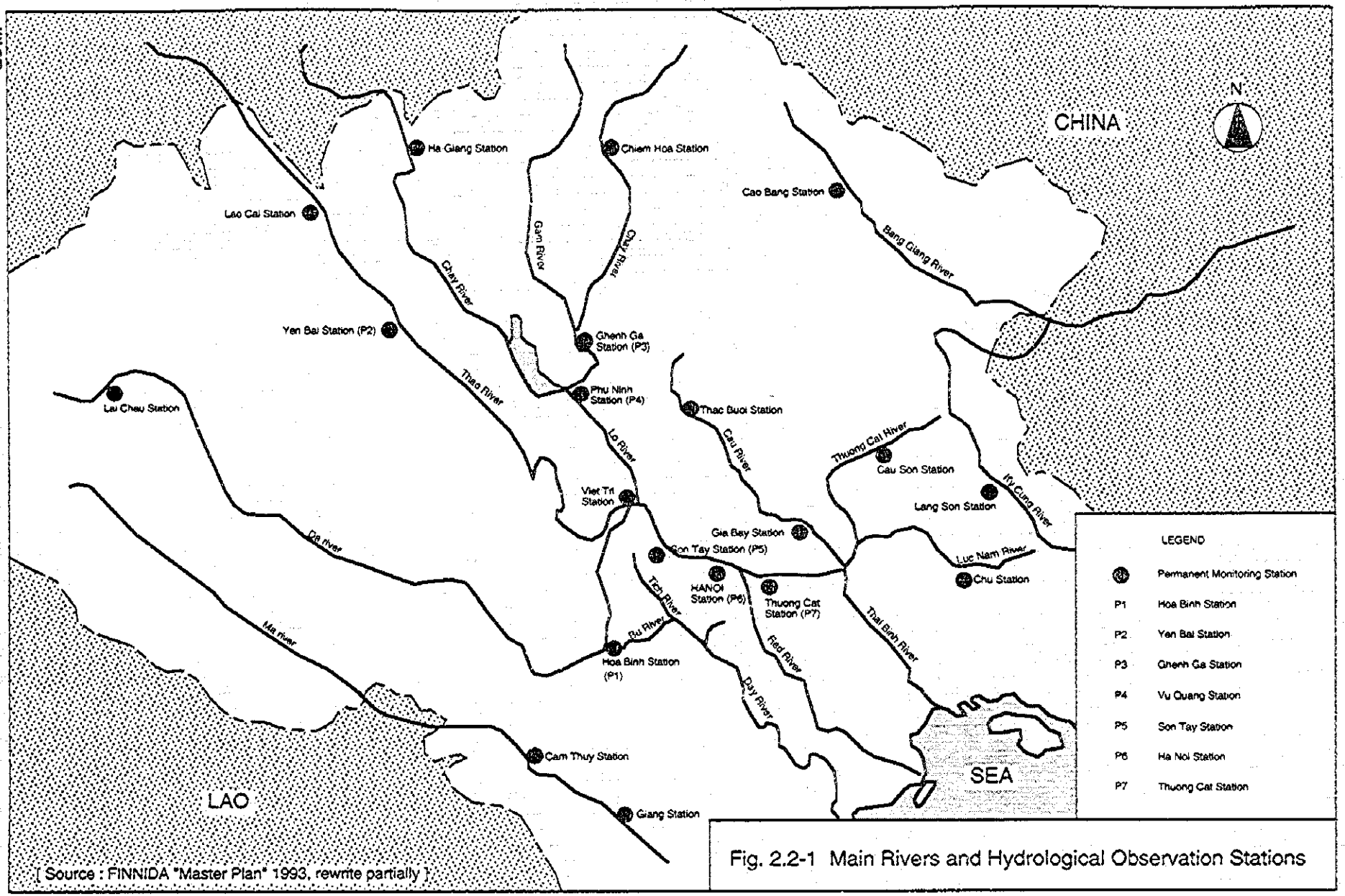
In the upper reach of Cong River, there is the Nui Coc Mountain Reservoir formed by an impounding dam. In dry season the flow of Cong River is efficiently regulated and used totally for irrigation. Cau River is also strongly exploited for

irrigation, therefore there is a strong conflict between irrigation use and other uses of water of both rivers.

The other tributary of Cau is the Ca Lo River which originates in Tam Dao mountains. It flows from west to east along the southern border of Soc Son district and joins Cau River at Phuc Loc Phuong. The total catchment area of Ca Lo River is 881 km^2 and length 69 km, whose 19 km is in the district. In dry season, Ca Lo River is recharged with groundwater. This phenomenon is found out with many crop out points in the river bank. The river is such strongly exploited for irrigation as the flow is zero in dry season and is heavily polluted with industry, population and agriculture.

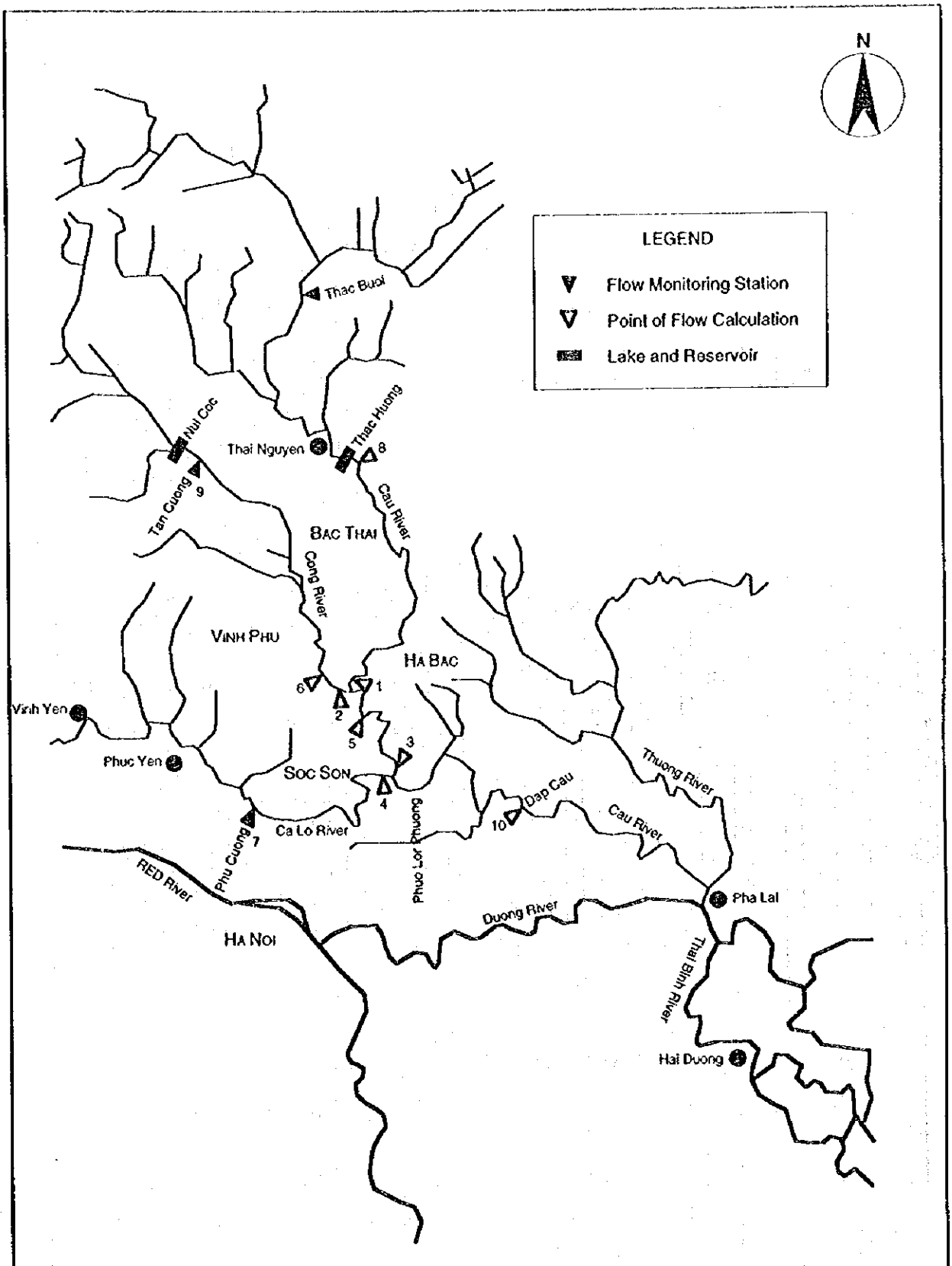
Water level observation has been going on since 1885 at Hanoi and since 1888 at Yen Bai. Since 1902 there has been relatively completed network of water level observation stations such as Hoa Binh, Tuen Quang, Doan Hung, Son Tay and Cau Duong. Water discharge measurements, however, were started in 1932. In the upriver area of the Thai Binh River system, observation data since 1960 at Thac Buoi in Cau River is the longest term data.

The report of "Evaluation and Prediction of Surface Water Resources in the Middle and Lower Red River" was completed by the Ministry of Water Resources (at present, integrated into the Ministry of Agriculture and Rural Development) in December 1991 under the FINNIDA assistance. The objects of this report were to evaluate of surface water quantity and quality during the period from 1980 to 1990 and to give preliminary prediction about the variation of surface water during the period from 1991 to 2000.



[Source : FINNIDA "Master Plan" 1993, rewrite partially]

Fig. 2.2-1 Main Rivers and Hydrological Observation Stations



[Source : FINNIDA "Soc Son Feasibility Study, 1995]

Fig. 2.2-2
Thai Binh River System and
Hydrological Observation Stations

(2) Hydrological conditions

1) Red River system

Table 2.2-2 and 2.2-3 show "Annual Flow Volume Distribution and Annual Flow Fluctuation" and "Proportions of Monthly Flow Distribution in a Year", respectively.

Table 2.2-2 Annual Flow Volume Distribution and Annual Flow Fluctuation (1902-1989)

River Station	Catchment Area(km^2)	Water Volume(km^3)	Discharge(m^3/s)		
			Mean	Maximum (Year)	Minimum (Year)
Da River Hoa Binh	51,800	55.4	1,760	2,180 (1971)	1,260 (1980)
Thao River Yen Bai	48,000	24.2	766	1,300 (1971)	583 (1981)
Lo River Phu Ninh	37,000	32.6	1,036	1,460 (1971)	749 (1977)
Red River Son Tay	143,600	118.0	3,740	5,090 (1971)	2,950 (1963)

(FINNIDA "Master Plan" '93)

Table 2.2-3 Proportions of Monthly Flow Distribution in a Year (%)

Month / Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Da R. Hoa Binh	2.7	1.9	1.7	1.8	3.6	10.9	20.4	23.2	14.5	9.0	5.8	3.8
Thao R. Yen Bai	3.6	2.8	2.8	2.9	4.5	9.6	14.5	30.3	15.7	11.5	7.4	4.8
Lo R. Phu Ninh	2.7	2.6	2.6	3.1	6.0	11.9	17.8	19.6	14.0	8.9	6.1	3.9
Red R. Son Tay	3.0	2.3	2.1	2.4	4.5	10.6	18.2	21.5	15.6	10.0	6.3	3.9

(FINNIDA "Master Plan" '93)

The annual run-off varies very little. Water volume in wet years is only two or three times larger than in dry years. Wet years and dry years occur alternately and two to three consecutive dry years are very seldom. The Red River and its tributaries have similar monthly flow pattern. All the rivers have the highest flow in August and the lowest in March.

2) Thai Binh River system

The average monthly and minimum daily flow at Thac Buoi, Tan Cuong and Phu Cuong stations are shown in Table 2.2-4.

Table 2.2-4 Monthly Average and Daily Minimum Flows of Cau R.(Thac Buoi), Cong R.(Tan Cuong) and Ca Lo R.(Phu Cuong) (m^3/s)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Thac Buoi: (1960-1985)													
Monthly Ave	12.5	11.0	11.4	22.8	43.5	82.1	104	134	96.6	48.7	29.0	15.6	51.1
Daily Min	6.1	5.7	4.3	4.8	4.7	5.4	9.1	17.7	12.5	12.9	10.0	6.15	4.3
Tan Cuong: (1965-1976)													
Monthly Ave	2.92	3.15	3.5	8.7	14.8	23.4	25.8	39.2	31.2	17.7	8.65	3.86	15.2
Daily Min	0.00	0.83	0.80	0.32	0.40	0.00	0.00	2.38	0.90	0.00	0.65	0.00	0.00
Phuc Cuong: (1965-1966, 1968-1975)													
Monthly Ave	4.61	6.39	6.51	15.4	23.6	46.3	50.5	74.6	64.3	34.7	12.6	4.23	29
Daily Min	0.90	1.44	1.39	1.32	2.13	4.21	0.00	0.00	9.80	9.05	1.18	0.60	0.00

(FINNIDA "Soc Son F/S" '95)

Both the Thac Buoi and the Tan Cuong station are very far upriver area from Soc Son district. Therefore, the probability flows at some selected points in the vicinity of Soc Son were calculated using the observed values at those two stations. Table 2.2-5 shows the calculated values. The location of points are shown on Fig. 2.2-2.

Table 2.2-5 Calculated Minimal Monthly Average Flow of Cau R., Cong R. and Ca Lo R. at Selected Points. (m^3/s)

Location		Probability					Location		Probability				
Point	km	95%	90%	80%	75%	50%	Point	km	95%	90%	80%	75%	50%
Cong River:							Cau River:						
9	110.0	0.10	0.10	0.10	0.10	0.10	8	102.0	0.10	0.10	0.10	0.10	0.10
6	60.0	0.29	0.36	0.46	0.50	0.70	1	52.5	2.08	2.26	2.52	2.64	3.23
2	52.5	0.36	0.45	0.58	0.63	0.88	1+2	52.0	2.45	2.71	3.10	3.27	4.11
Ca Lo River:							5	45.0	2.82	3.12	3.56	3.76	4.74
7	69.0	0.13	0.23	0.40	0.48	0.94	3	38.0	3.19	3.53	4.03	4.26	5.36
4	38.0	0.14	0.25	0.44	0.52	1.02	3+4	37.5	3.33	3.78	4.47	4.78	6.38
							10	0.0	5.78	6.19	6.80	7.10	8.54

* Location "km" means the distance from Point 10.

(FINNIDA "Soc Son F/S" '95)

The flows in Table 2.2-5 were calculated using linear interpolation between flow monitoring stations. Thus, the calculation method ignores the influence of shape and the nature of the catchment area. Further, the observation data used in the calculation is for the period before the construction of the Nui Coc reservoir, owing

to the lack of more recent period data. After completion of the reservoir in 1973, the water flows into the canals for irrigation in the Bac Thai province. The use of the irrigation water, however, is not considered in the calculation.

On the other hand, in northeast Vietnam, rivers with similar catchment area have a minimum monthly flow specific discharge of about 2 l/s/km^2. The minimum flow specific discharge monitored at Thac Buoi is of the same magnitude. The catchment area at the confluence of the Cau and the Cong River is about 5,100 km^2. Therefore, the minimum flow with 95 % probability would be about 10 m^3/s.

According to the information from "Department for Management of Water Resources and Irrigation Systems, Ministry of Agriculture and Rural Development" and "Irrigation Service of Hanoi, HPC", six(6) irrigation pumping stations are located at the Cau River in Soc Son district with total capacity of 6.5 m^3/s and their average pumping-days are 15 in every month except December.

Furthermore, these pumping stations have been never operated systematically but they have never experienced conflict among them since they were constructed (for 20-30 years).

Taking account of the information mentioned above, catchment area and rainfall data, the flow estimated with the specific discharge (the latter one:10 m^3/s) seems to be reliable.

2.2.4 Geology and Hydrogeology

(1) General

Fig. 2.2-3 shows Geological and Hydrogeological outline in the study area. Fig. 2.2-4 and Fig. 2.2-5 show Geological and Hydrogeological map and cross section.

The Red River delta is composed of deposits mainly transported by the Red River in the period of Quaternary, from the Pleistocene to the Holocene ages. These deposits reach average 80 m in thickness in the study area, although these are only 30 m in Soc Son district, and form good aquifers in their coarse-grained layers such as those composed of sand and gravel. The hills and mountains around the delta are mainly composed of Mesozoic (upper-middle Trias) rocks. The basement of the delta, however, is mainly composed of Tertiary (Pliocene) sediments.

This area contains two aquifers for groundwater resources. The one is distributed near the ground surface with 20-30 m thickness. This is the unconfined Holocene aquifer called upper aquifer (Qb) and is used for domestic water through shallow dug wells. In Soc Son district, however, almost all shallow dug wells are constructed in the stratum called upper Pleistocene confining layer, because the upper aquifer (Qb) is distributed scarcely. The other is distributed in 40-80 m deep with thickness of 40 m, although in 10-30 m deep with thickness of 20 m in Soc Son district and is underlain by the basement rocks directly. This is the confined Pleistocene aquifer called lower aquifer (Qa) and is used for public water supply and for industry through deep wells.

Hydrogeological Division K2 of the Geological Survey of Vietnam has studied the groundwater resources of Hanoi area especially intensively since 1989 under the FINNIDA assistance. The groundwater exploitation, groundwater levels and groundwater quality, as well as the environmental impacts of groundwater abstraction have been regularly monitored through the established network of about 160 observation wells. A computerized groundwater model also has been established, with which it is possible to simulate groundwater conditions in future. After few years of calibration and trial runs, the groundwater model has been established and it gives reliable data for the assessment of groundwater resources in Hanoi area, particuraly in the south and west side area of the Red River*, though it

is revised every year using new observation data.

Note(*): "the south and west side area of the Red River" in FINNIDA Master Plan '93 is almost coincide with "the south Hanoi (S.H)" in this study.

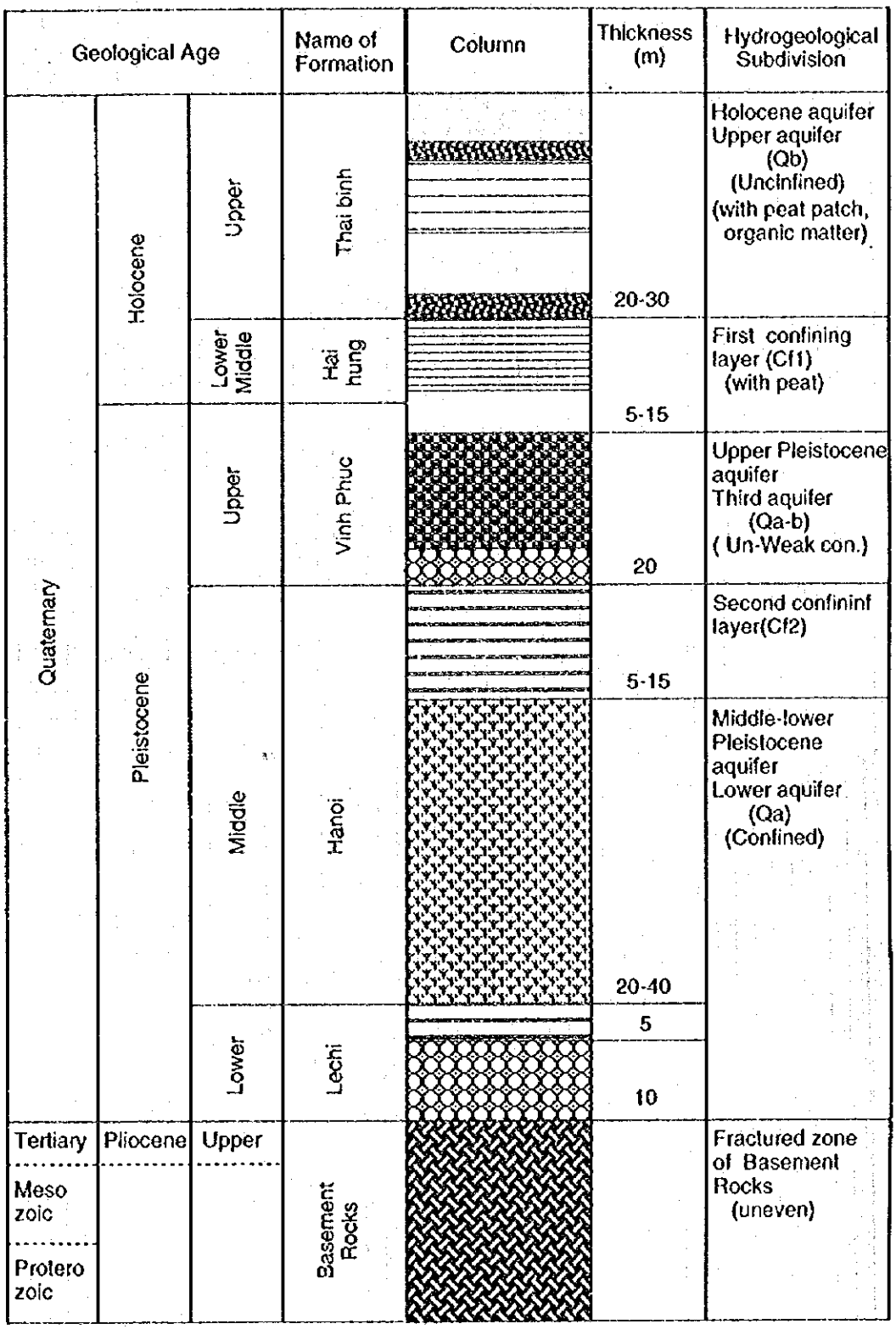


Fig.2.2-3
Geological, Hydrogeological Outline in the Study Area

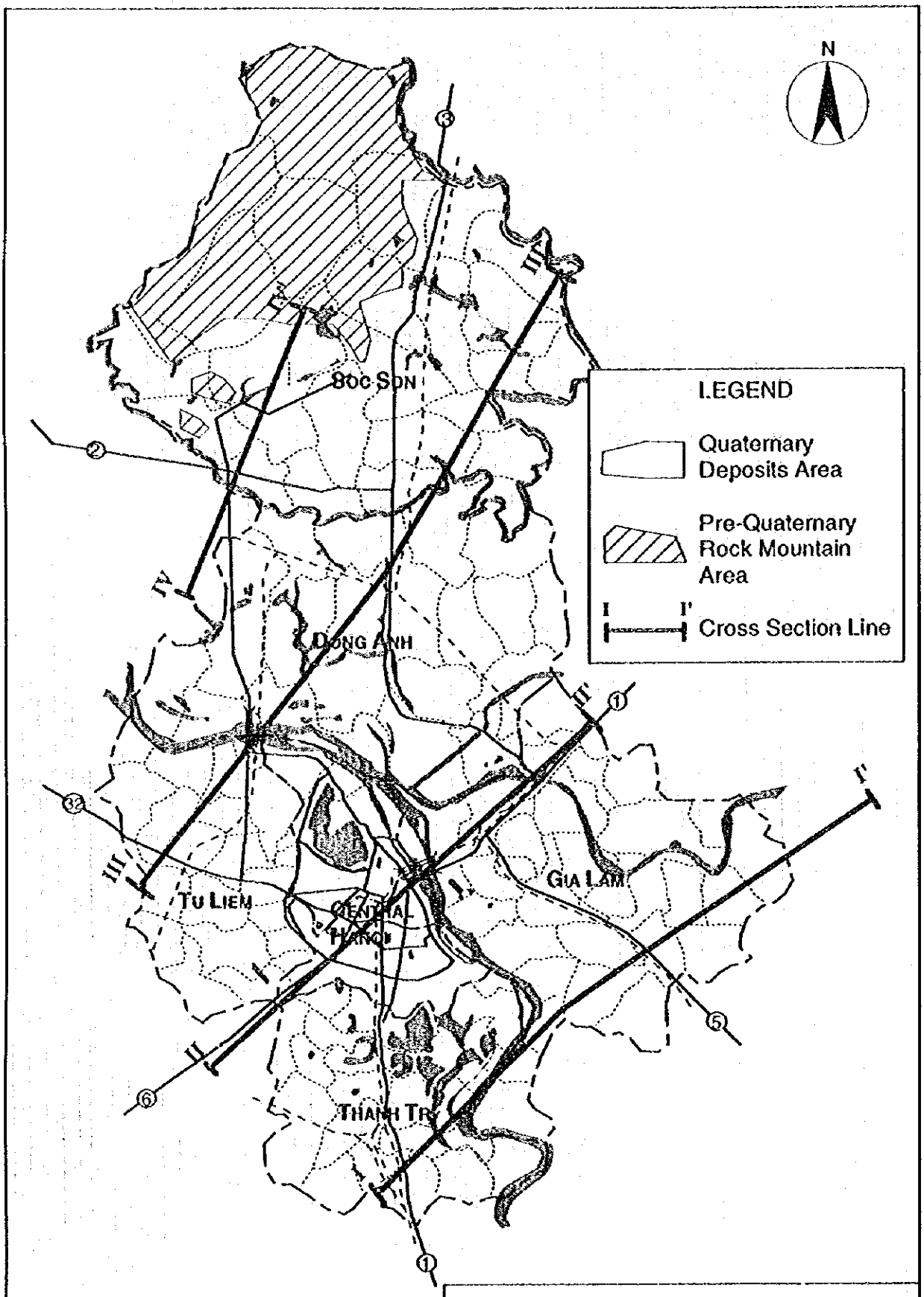


Fig. 2.2-4
Geological, Hydrogeological Map of the Study Area

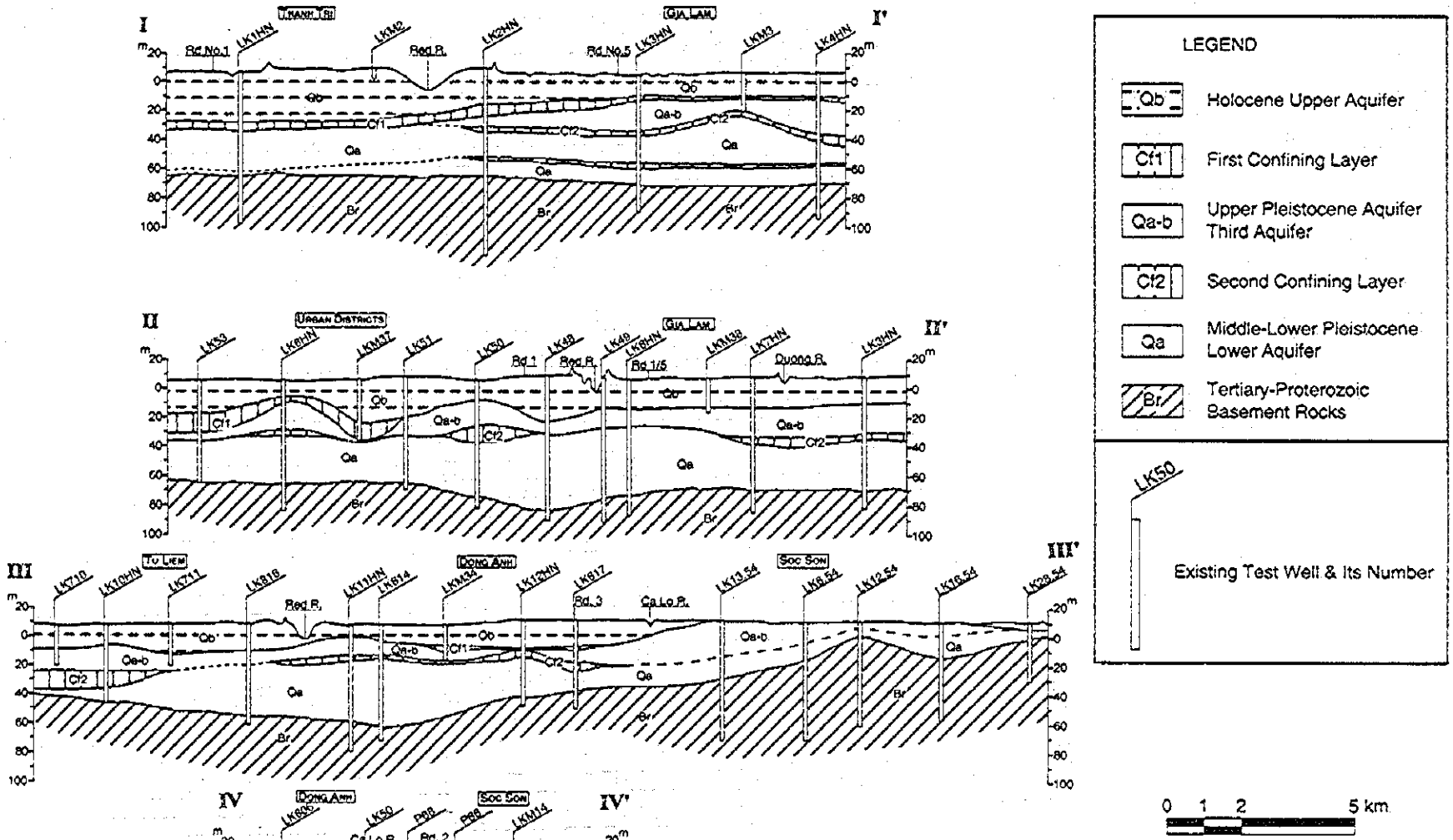


Fig. 2.2-5
Geological, Hydrogeological Cross Section in the Project Area

(2) Hydrogeological conditions

Hydrogeological outline in the study area is shown in Fig.2.2-3. Hydrogeological subdivisions are explained as follows.

1) Basement rocks (Br)

The basement of the delta is formed with Tertiary (Pliocene) sediments such as sandstone, conglomerates, siltstone, and claystone. The basement of the Quaternary deposits and the mountains in Soc Son district, however, are mainly composed of Mesozoic (upper- middle Trias) rocks such as sandstone, siltstone, claystone, riolite, etc. and Proterozoic metamorphic rocks such as crystal-limestone, quartzite, etc. Although fractured zone of these basement rocks hold water, the quantity is not enough for public water supply, generally.

2) Lower aquifer (Qa)

The Lower Aquifer, which is formed with the Lechi Formation overlying the basement rocks directly and with the lower part of the Hanoi Formation, is the main confined aquifer in the project area and extensively used for water supply purpose.

The Lechi Formation of Early Pleistocene age is mostly composed of layers of sand and gravel with well-rounded cobbles. At the top of formation there often is a thin silty layer separating this formation from the one above. The Hanoi Formation is of Middle Pleistocene age and its lower parts is composed of sand and gravel with cobbles and boulders.

The aquifer is 30-50 m thick generally. It is, however, 10-20 m thick and thinned out gradually toward the mountains in Soc Son district.

Average transmissivity of the aquifer in each area is as follows :

Table2.2-6 Average transmissivity of Qa in each area

Area	Transmissivity (m^2/s)	No. of data
Soc Son district	$4.25x10^{-3}$	4
Don Anh district	$7.00x10^{-3}$	29
Gia Lam district	$1.90x10^{-2}$	3
South Hanoi	$1.67x10^{-2}$	13

Fig. 2.2-6 and 2.2-7 show the contour lines of the piezometric heads of the Qa aquifer, measured at the observation wells, in rainy season (August) and in dry season (February), in 1995, respectively. The fluctuations of the piezometric heads between the two seasons are uneven from place to place. The maximum reaches to five(5) m and it can be seen along the right bank of the Red River. The depression zone of the piezometric head is formed around the line linking Mai Dich to Phap Van / Tuong Mai wellfields. The flow lines expected from the piezometric contour lines show the following characteristics.

a) General flows from upstream to downstream of the Red River and from the Red River to the land especially in rainy season.
b) Flows from the surrounding area to the depression zone.
c) Flows from the surrounding area to the Ca Lo River.

3) Second confining layer (Cf_2)

The upper parts of the Hanoi Formation is composed of mainly clayey silt layer and forms the second confining layer.

4) Third aquifer (Qa-b)

The Vinh Phuc Formation of Late Pleistocene age is in its lower part composed of gravel and cobbles mixed with silty clay and forms a third aquifer between the upper and the lower ones.

This aquifer is unconfined or weakly confined and its average transmissivity is $1.77 \times 10^{-3} m^2/sec$, that is the exploiting potential of this aquifer is low compared with the lower aquifer lying little deeper, therefore there are few exploiting wells targeting this aquifer.

In Soc Son district, this aquifer lies directly on the lower aquifer (Qa) and is widely distributed on the surface. This, however, is unreliable due to the difficulty of geological correlation.

5) First confining layer (Cf_1)

The upper and middle parts of the Vinh Phuc Formation, together with the Hai Hung Formation of Early to Middle Holocene age, form the first confining layer. The former is composed of clay, silty clay, and silt often with vegetable remains and the latter is clay, silty clay, sandy clay, silty layers and often peat layers.

6) Upper aquifer (Qb)

The upper aquifer, which is formed with coarse-grained parts of the Thai Binh Formation of the Holocene age, is an unconfined aquifer distributed widely near the ground surface and used for domestic water through shallow dug wells.

The Thai Binh Formation is divided into two(2) sub-formations, the lower and the upper. The lower one is composed of clays at the top underlain with clayey silt and at the bottom overlaid with sand, gravel, and cobbles. In this layer, patches of peat, mud and soil containing organic matters may occur. The upper one is composed of recent sediments of clay, clayey silt, sand and gravel.

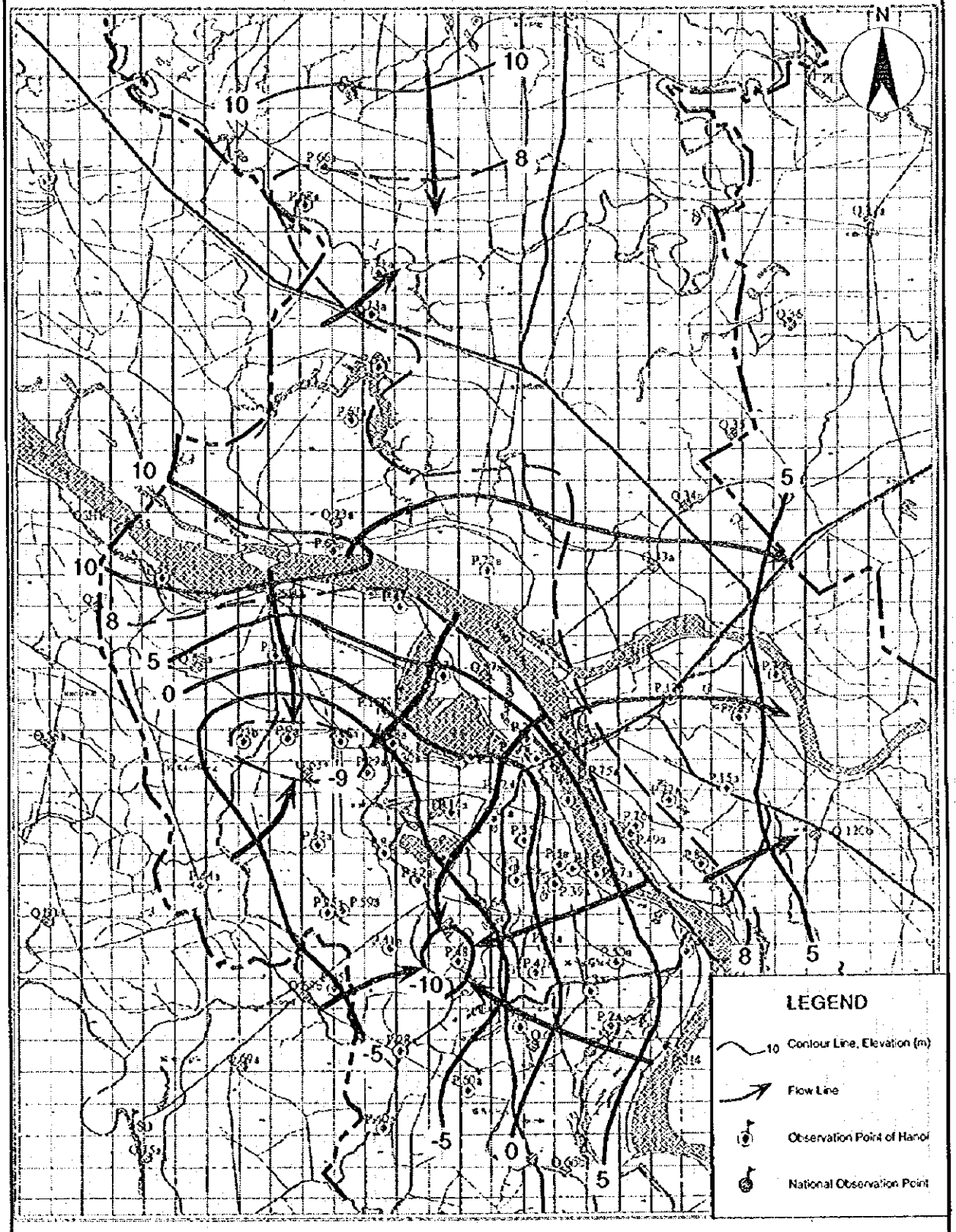


Fig. 2.2-6
Observation Wells and Piezometric Contour Line of Qa (Rainy Season 1995)

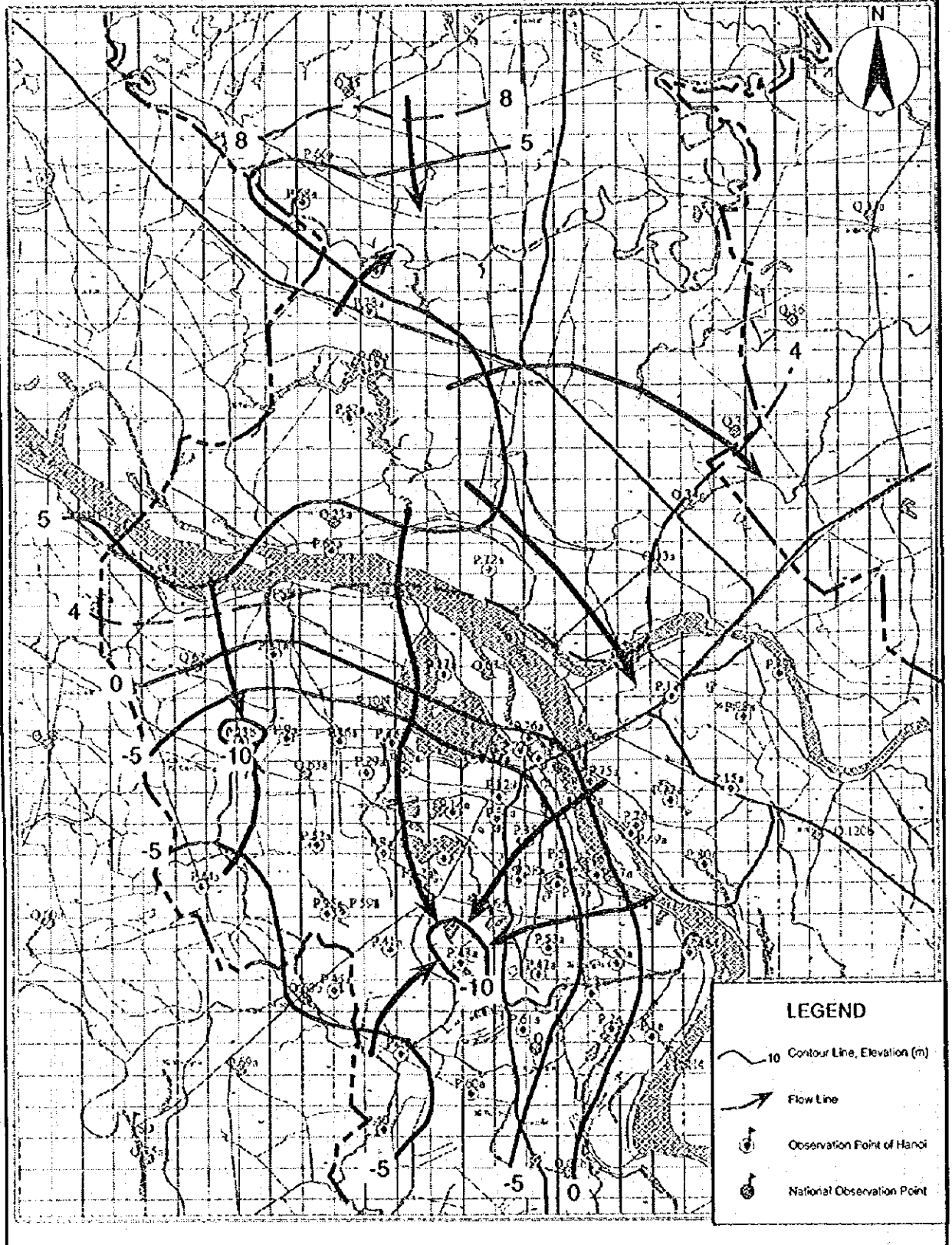


Fig. 2.2-7
Observation Wells and Piezometric Contour Line of Qa (Dry Season 1995)

2.3 OUTLINE OF WATER SUPPLY

2.3.1 Water Coverage and Population Served

(1) Introduction

For the recognition of the water supply situation in Hanoi, the current water coverage and the population served are important factors.

In order to confirm present service areas of public water supply, a few data showing present public water service areas were studied. The data are as follows:

- Water service area shown in "Water Master Plan of Hanoi City – 1992" prepared by HPC and FINNIDA. Its final report of the plan was issued in April, 1993.

- List of consumers registered in HWBC.

- Water distribution pipeline network map prepared for the water leakage survey in this Study referring to HWBC's data and "World Bank Program" which is shown in the final report of Hanoi Water Supply and Environment Project Feasibility Study issued in November, 1995.

As some discrepancies were found among these data, field reconnaissance were conducted with guide of Enterprises' persons in charge of collecting water charges. All information obtained from the existing data and the field reconnaissance were marked on a map with a scale of 1:25,000. Then, the water coverage map was formulated.

Population served was estimated by commune using a total population and a rate of water service according to the water coverage map.

Extent of water service areas and total areas populated were measured by each commune unit (phuong or xa) on the map, and the water service rate was calculated by commune. For some communes, the existing HWBC's data on service rate were used when these data are more likely and realistic than those calculated by the above mentioned manner.

(2) Water Coverage

The current service area is shown in Fig. 2.3-1. The water coverage administrated by HWBC and HWBC No.2 is appointed to three individual areas as shown below :

- Five urban and a part of two suburban districts administrated by HWBC
- A part of Dong Anh districts administrated by HWBC No. 2
- A part of Gia Lam district administrated by HWBC No. 2

(3) Water Supply Capacity

Total production capacity was 370,000 m3/day on the daily average basis, during the period of January-June 1996, to the estimated population served of 1,230,000.

The above production capacity consists of billed water (used for domestic, state utilities, business, small industries, etc.) and unaccounted-for water including physical leakage loss and administration loss.

From a viewpoint of overall factors such as population, size and economic activities of Hanoi, the production capacity of 370,000 m3/day (= 300 liters/day/capita including non-domestic use and water losses) is evaluated to be comparatively reasonable, comparing to the other major cities in the South-East Asian countries.

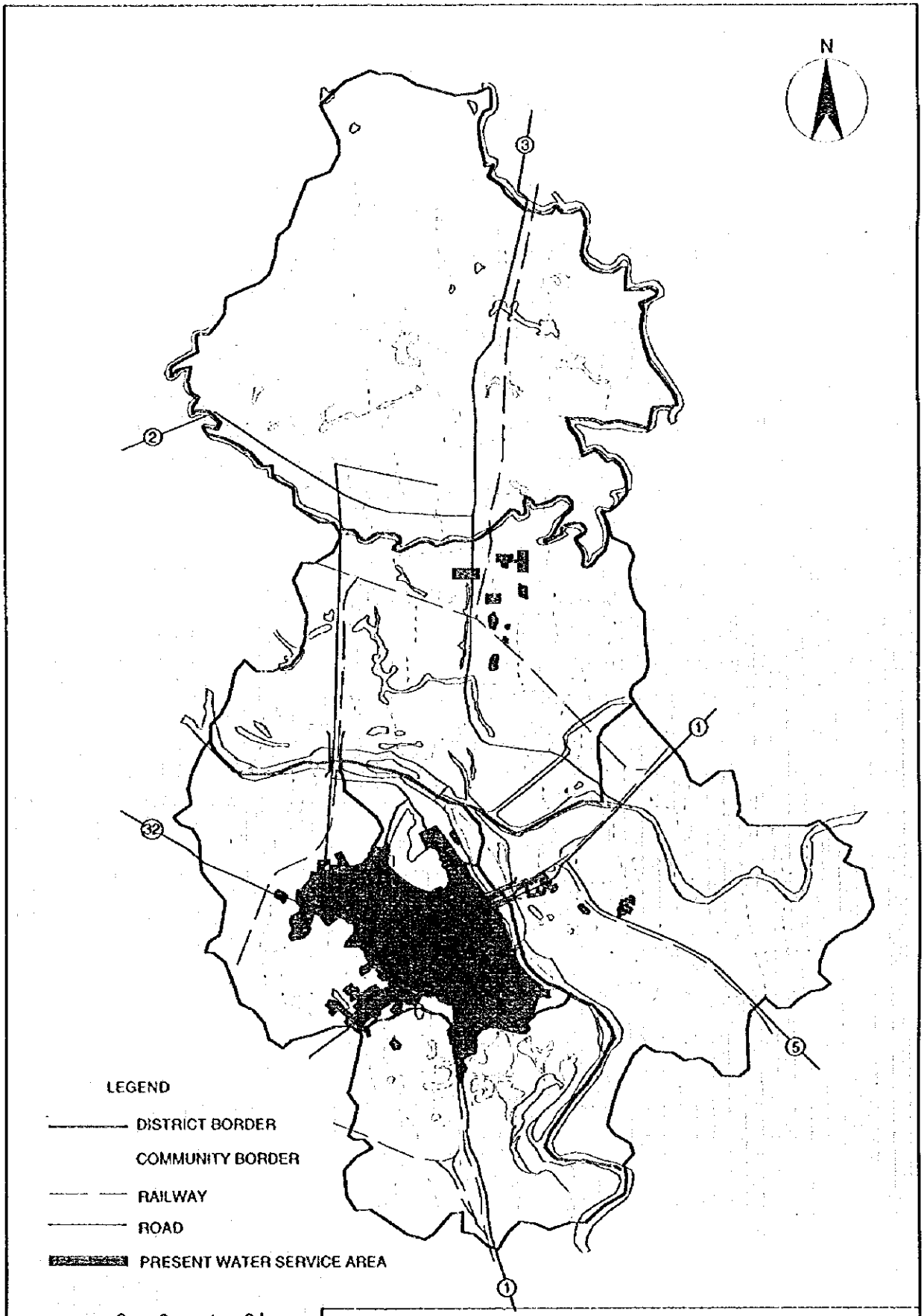


Fig. 2.3-1 Present Water Service Area (1996)

(4) Population Served

Present population served is shown in Table 2.3-1. The water service rate of the 5 urban districts (the core of Hanoi) including illegal connections amount to 94.4%. However, the water service rate in other 5 suburban districts is only less than 14%. Therefore, the rate of the whole city is calculated at about 53%.

There are three water service levels in the suburban area shown as below :

(a) In some densely inhabited areas, piped water supply systems are managed by Hanoi Water Business Company (HWBC). The water quality is higher and safer for drinking because water supply engineers control. The water service rate of these area is about 14%.

(b) The diffusion of hand pump is more than 50 % of population in rural areas. According to the criteria, a hand pump can supply water to 120 persons on average. Sometimes, the people can not be supplied with water in dry season due to shallow wells being dried up. The water of some shallow wells which are less than 10 m deep is contaminated by domestic sewage and livestock.

(c) In other rural areas, no water supply system is serviced. The people in the areas get domestic water from rain-water, irrigation ponds or channels. Their water consumption is quite a small volume.

Table 2.3-1 Present Population Served (Year 1995)

The North Hanoi

Area / District	Total Population	Piped Water System		Hand Pump System	
		Population Served	Rate	Hand Pump	Rate
DID	388,307	17,069	4.4%	195,000	50.2%
Soc Son	44,177	0	0.0%	14,040	31.8%
Dong Anh	132,039	4,914	3.7%	80,400	60.9%
Gia Lam	212,091	12,155	5.7%	100,560	47.4%
Rural	346,674	281	0.1%	190,920	55.1%
Soc Son	167,009	0	0.0%	86,160	51.6%
Dong Anh	89,190	0	0.0%	62,520	70.1%
Gia Lam	90,475	281	0.3%	42,240	46.7%
Total	734,981	17,350	2.4%	385,920	52.5%
Soc Son	211,186	0	0.0%	100,200	47.4%
Dong Anh	221,229	4,914	2.2%	142,920	64.6%
Gia Lam	302,566	12,436	4.1%	142,800	47.2%

Urban Area of the South Hanoi

District	Total Population	Piped Water System		Hand Pump System	
		Population Served	Rate	Hand Pump	Rate
Tay Ho	80,638	52,848	65.5%	29,880	37.1%
Ba Dinh	191,286	191,286	100.0%	0	0.0%
Hoan Kiem	193,504	193,504	100.0%	0	0.0%
Dong Da	351,974	318,457	90.5%	120	0.0%
Hai Ba Trung	347,289	343,990	99.1%	0	0.0%
Total	1,164,691	1,100,085	94.5%	30,000	2.6%

Suburban Area of the South Hanoi

Area / District	Total Population	Piped Water System		Hand Pump System	
		Population Served	Rate	Hand Pump	Rate
DID	381,028	151,702	39.8%	146,280	38.4%
Tu Liem	262,807	135,452	51.5%	98,280	37.4%
Thanh Tri	118,221	16,250	13.7%	48,000	40.6%
Rural	114,187	5,800	5.1%	99,120	86.8%
Tu Liem	28,735	4,200	14.6%	35,400	123.2%
Thanh Tri	85,452	1,600	1.9%	63,720	74.6%
Total	495,215	157,502	31.8%	245,400	49.6%
Tu Liem	291,542	139,652	47.9%	133,680	45.9%
Thanh Tri	203,673	17,850	8.8%	111,720	54.9%

2.3.2 Institution and Management

(1) Existing Institutional Framework in the Water Supply Sector of the Central Government

In urban areas each provincial authorities have been entrusted the direct power to implement the water supply sector by the central government. However, in suburban and rural areas the central government is essentially responsible for preparing national plans, approving regulation, implementing standards, allocating budgets on investment and project, engineering, designing and supervising some aspects of construction . Many administrative agencies of the central government are closely and unclosely related to the water supply. The following agencies of the central government are closely involved in the administration of water supply.

1) Ministry of Construction (MOC)

MOC is the main national agency responsible for water supply and sanitation in Vietnam. MOC plans, regulates, designs, and assists in the implementation of water supply and sanitation facilities. MOC prepares policies on construction management and urban and rural planning. It is responsible for approving and issuing design standards and regulations as well as technical and financial guidelines.

MOC is generally the principal government agency responsible for coordinating the design and implementation stage of ODA funded projects in the water supply and sanitation sector. One loan agreement for ODA funded projects have been signed and a project commences its implementation phase, MOC presides over the State Council for Cost Estimation. This council contains the same members as the State Council for project appraisal, but is chaired by MOC. It has a key role in approving the cost evaluation of alternative projects designs. At present, prices used in Vietnamese estimates for construction materials are generally set by MOC, which also provides the cost estimates to the Council.

2) Ministry of Finance (MOF)

MOF distributes the state budget to sectors and projects and monitors financial

expenditure against sectoral and individual project targets and goals. It prepares the annual state investment budget in consultation with the Ministry of Planning and Investment. It is appointed to negotiate and sign ODA loans.

3) State Bank (SB)

The State Bank is appointed to sign ODA loans too and is being used to disburse funds to water supply companies.

4) Ministry of Agriculture and Rural Development (MOARD)

MOARD regulates and monitors surface water, and is currently involved in the preparation of the Water Law.

5) Ministry of Industry (MOI)

MOI is responsible for conducting investigations and recommending development and use of natural resources underground, including groundwater.

6) Ministry of Health (MOH)

MOH promotes health education and monitors drinking water quality through the Department of Hygiene and Environment. The Institute of Hygiene coordinates the rural sanitation program.

7) Ministry of Science Technology and Environment (MOSTA)

MOSTA sets standards for water quality, research and environmental management as well as for water quality. It is eventually responsible for environmental monitoring of disposal of sewage, solid and liquid wastes.

8) General Department of Meteorology and Hydrology (DOMAH)

DOMAH is a ministry level agency responsible directly to the central government for assembling data and maintaining records on rainfall and runoff (stream flow).

9) Ministry of Labor, Invalids and Social Welfare (MOLISA)

MOLISA prepares and coordinates drinking water supply program in rural areas.

10) National Committee for Safe Water and Sanitation

This is a recent formed permanent agency for coordinating all rural water supply and sanitation programs. It is placed under MOC.

(2) Existing Institutional Framework in the Water Supply Sector of the Provincial Authorities

Provincial authorities are mainly responsible for the construction, operation and maintenance of urban water supply and sanitation system. The provincial authorities are also responsible for the financial management of the public water and sanitation services, and for setting water tariff.

1) Provincial People's Committee

Vietnam is divided into Provinces and Cities each with their own People's Committee (PPCs or CPCs). The PPCs and CPCs are directly under the control of the First Deputy Prime Minister. They are the public service organizations of the People's Councils, which are the elected bodies representing the people of the province.

The PPCs and CPCs have considerable authority and power to determine water supply and sanitation development policies, set targets for production and distribution of water and disposal of wastes, decide on local financial policies of the water supply companies. They are the key decision making body in each province for investment projects.

2) Water Supply Companies (WSCs)

Water supply services in provincial urban center are managed and operated by water supply companies, which are currently responsible to the PPCs through the director of the provincial Transportation and Urban Public Works Service in Hanoi, HCMC and Haiphong or the Urban Public Works Service for small towns.

Vietnam has embarked on a program of gradual transition from a planned economy to a market-oriented economy. In this new framework, it is proposed that enterprise management should be carried out through market mechanisms and incentives rather than direct government controls.

The key elements of the Doi Moi policy include that decentralization of state economic management, giving greater autonomy to state-owned enterprises in making decisions relating to production, distribution and financing. This policy movement has required institutional and organizational restructuring in water supply companies as well. Autonomy is defined as being able to conduct their business with less or without interference in their day to day activities and to have sufficient financial strength to meet all financial obligation. However the main effect of autonomy is understood to engender a business focus within the organization which, while still remaining social objectives, would result in improvement in the overall managerial, technical, financial efficiency.

(3) Hanoi Water Business Company

1) Brief History

The history of the water supply system in Hanoi can date back until 1894, when the French colony rulers constructed the first water supply system in Hanoi by using the surface water of the Red river to supply mainly French army. From the beginning of the 20th century, the geo-hydrologists had discovered water reservoirs having big reserve capacity which could supply sufficient water for the city at that time. The following water treatment plants were constructed, such as Yen Phu plant in 1909, Don Thuy plant in 1931, Bach Mai plant in 1936, Ngoc Ha plant in 1939, Ngo Si Liem plant in 1944, Gia Lam plant in 1953.

When the capital of Hanoi was liberated in October 1954, the water supply plants were transferred to the provincial government and to be named "the Hanoi Water Plant". Particularly in the initial period of the socialist industrialization, Hanoi having been promoted manufacturing and construction industries, the construction and renovation of water plants have been developed. However from 1964 to 1975 due to the destruction war, the water supply system was not constructed and renovated well, which has resulted in the present critical shortage of water supply to meet increasing water demand.

2) Legal Basis

WSCs in Vietnam operate under the auspices of PPCs or CPCs as set out in decree 388, September 1991, and supported by circular letter 34, November 1991. This decree was incorporated as part of the State Enterprise Law. Under this decree, WSCs should operate on a commercial basis and become accountable for their own business activities. Because, the central government and the provincial authorities are facing the fund shortage crisis. This results from the huge amount of investment requirement to social infrastructure (for example hospitals, schools, houses and so on) and the limits of governmental financing capability. WSCs can no longer rely on subsidies from the PPCs. For avoiding the fund shortage crisis in the governmental finance, the essential task at first will be to urge economic infrastructure related companies such as WSCs to retain internal funds through improved operating efficiency and cost reduction. Then, it will be important for WSCs to build on internal funds through the reasonable increases in water tariff.

Under the such situations, the Hanoi Water Business Company (HWBC) was reorganized from the Hanoi Water Supply Company (HWSC) in April 1994. The new company is a state economic enterprise, which is directly managed by Transportation and Urban Public Works Services (TUPWS) (Fig.2.3-2) which is a department of Hanoi People's Committee (HPC). The company's duties are defined by Hanoi People's Committee's Decree No. 564/QDUB as follows:

(a) to produce and sell treated water to,
(b) to produce and repair water pipes, water meters, mechanical products and special equipment to meet the demand of water sector to be authorized by HPC.

The company is responsible for coordination with local authorities and special inspection force to protect the groundwater resources and water supply systems,

(c) refining of the classification made by HPC and TUPWS, to prepare investments and projects at certain periods in accordance with Hanoi Water Planning, to cooperate with advisory group in order to have effective implementation of Hanoi Water Development Program,

(d) to manage funds (including loans), production development funds, and joint-venture resources with organizations and individuals in Vietnam and abroad according to the water development investment plan, to manage budgetary funds which are delegated by HPC and TUPWS.

The last sentence is more important, because it implicates that HPC and TUPWS guides to eliminate the subsidy's policy to HWBC. According to this guidance, HWBC will not be provided any budget more by TUPWS for new investment in the future.

The same HPC Decree permitted to establish the basic organization of HWBC as the director and some deputies, professional departments and divisions, water plants, water business enterprises and some supporting enterprises including construction and installation enterprises. These enterprises are defined as internal cost accounting units. Total staff number is 1789 at 15 March 1996.

TUPWS and ultimately HPC are still heavily involved in important decision-making (production targets, organizational structure, staffing levels, investment planning and water charges) of HWBC. Therefore, HWBC has not yet managed to free itself from the problem of limited delegation inherited from the planning economy. However, the important reorganization is the first step toward HWBC being provided responsibility for developing the institutional, organizational, managerial and financial structure as a commercially- oriented water entity. There will be refinements in the future, possibly some involving quite significant changes.

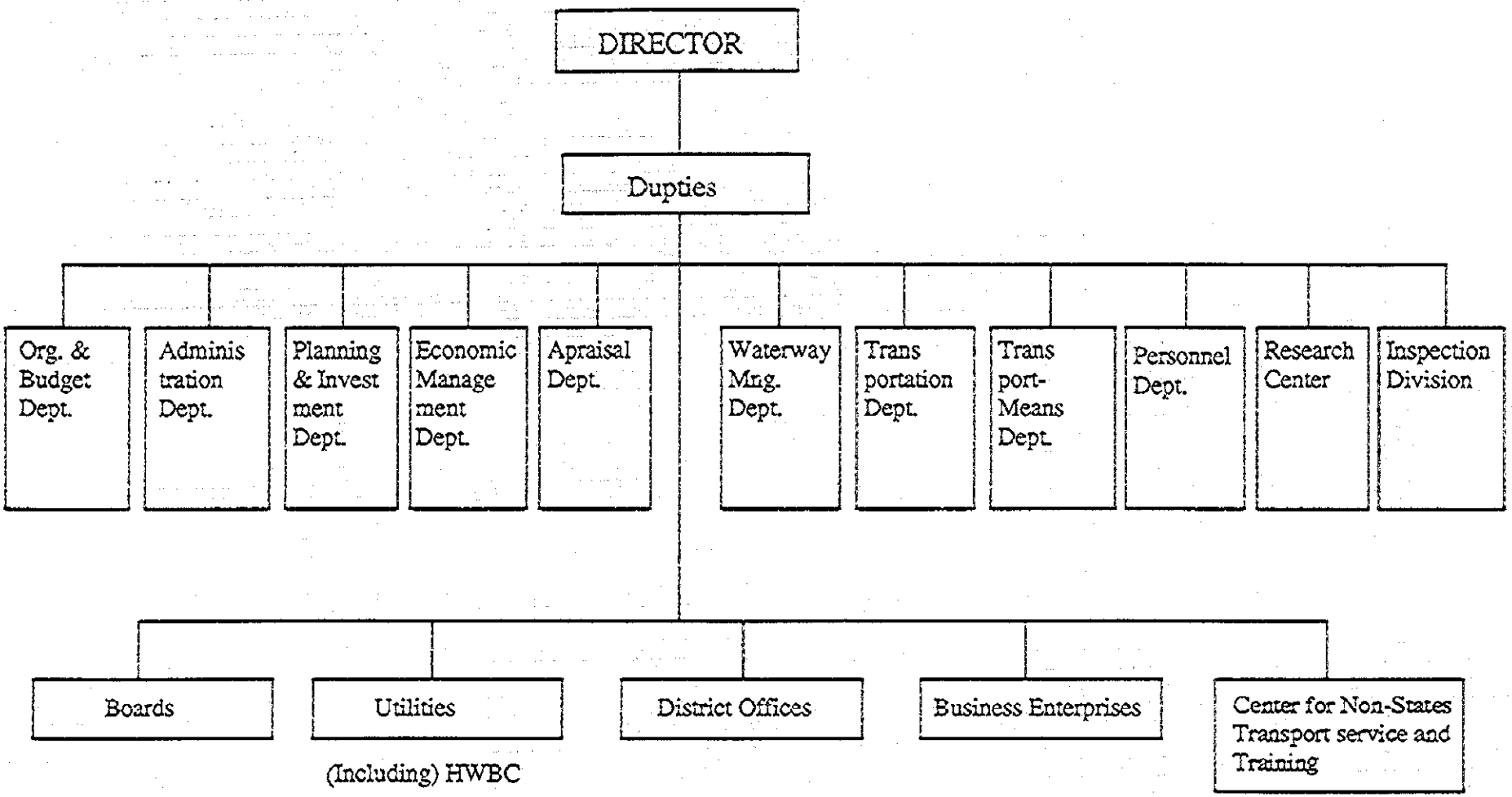


Fig. 2.3-2 Organization Chart of TUPWS (December 1995)

3) Operating Areas and Organization

The official operating area of HWBC in March 1996 consists of the four urban districts of Hoan Kien, Ba Dinh, Dong Da and Hai Ba Trung and the five suburban districts of Tu Liem, Gia Lam, Thanh Tri, Dong Anh, Soc Son. The organization chart of HWBC shows the eight water plants of Yen Phu, Luong Yen, Ngoc Ha, Tuong Mai, Ngo Si Lien, Ha Dinh, Mai Dich and Phap Van.

The Fig.2.3-3 shows also the six water business enterprises that are mainly engaged in collecting water revenue, carrying out the water-cut when consumer does not pay the water charge, repairing leakage network, installing meters, recording the initial data correctly and timely for introducing internal accounting. They are stationed at Hoan Kiem, Dong Da, Ba Dinh, Hai Ba Trung in urban districts and Tu Liem, Gia Lam in suburban districts. The water business enterprises are not legal enterprises but subordinate units of HWBC. After the introduction of the new organization in April 1994, there were some transfers of personnel including from headquarters staff into water business enterprises in February 1995.

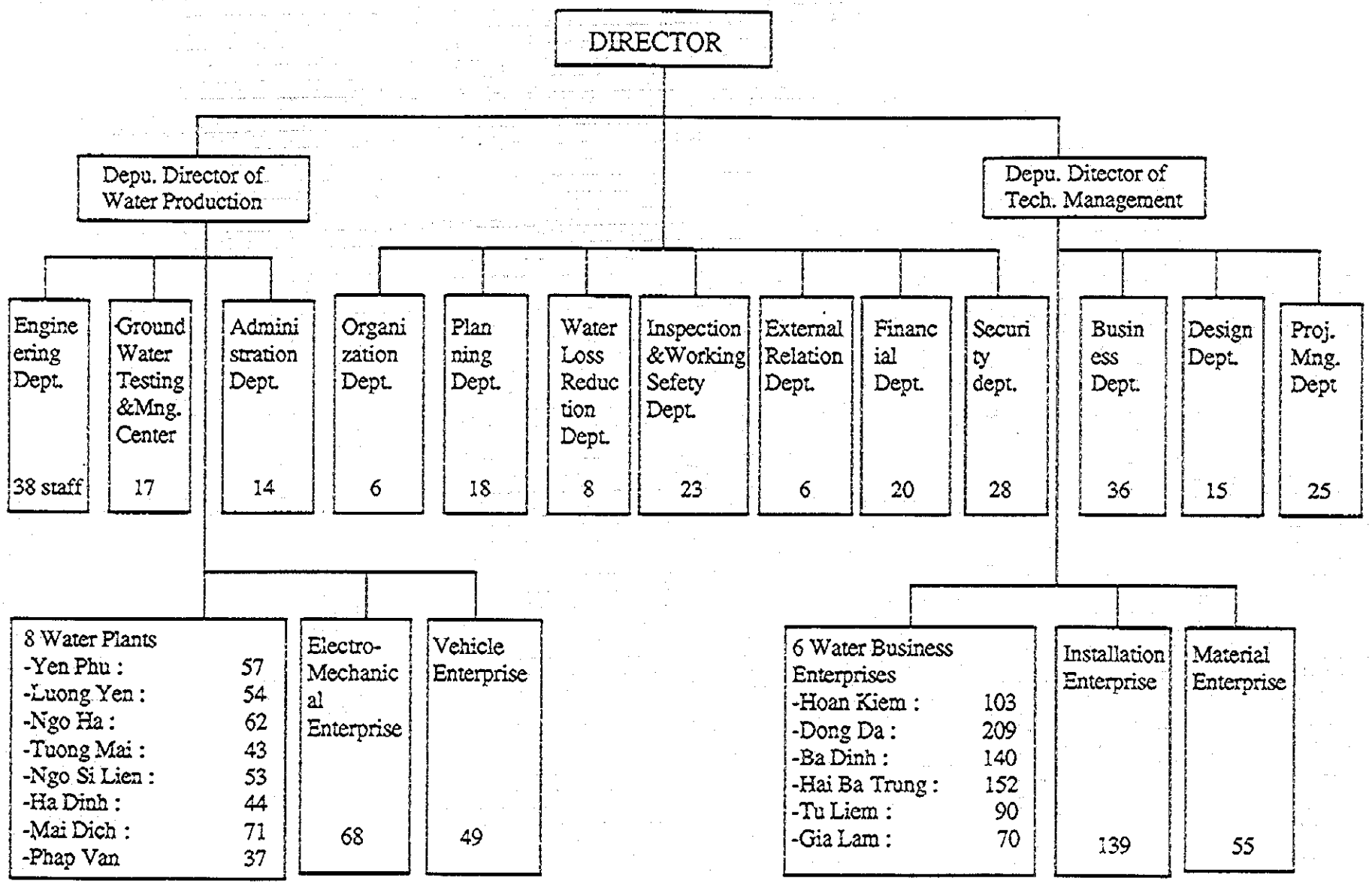


Fig. 2.3-3 The Organization Chart of HWBC (March 1996)

4) Present Organizational Issues pointed out by Foreign Advisory Teams

At first ADB has pointed out the following issues in the interim report for National Water Tariff Policy Study (November 1995).

(a) The most important is to reduce unaccounted water from the present level of approximately 70% of production. This results from not only physical problems but also managerial and organizational problems. If HWBC will not seek sufficient customer- oriented activities, HWBC will have the new entry of private water supplier to meet the quick water demand.

(b) Over-staffing, as means of providing employment is common in HWBC as well as in Vietnam. The director of the HWBC estimates that 800 positions or approximately 45% of total staff could be eliminated without affecting overall performance of the company. Over- promotion is also said to another issues, as evidenced by some of the very small departments. However, outright dismissal of surplus staff would have social consequence. Personnel transfer should be strengthened from over-staffing departments to marketing department including water business enterprises.

(c) There are on 15 March 1996 reported to be 185 staff with university degree (10% of the total staff) and 328 staff with college degree (18% of the total staff). This ratio seems to be much higher than that of Ho Chi Minh City Water Supply Company reported at 7% (university degree + college degree of the total staff). However these high level figures do not appear to be lack of staff competent to do many of the key tasks of a water company. Three in particular should be noted. The first is lack of experienced professionals in accounting and financial management, which will become important as the new system of accounts is introduced. The second is lack of engineering staff who is skilled in project analysis. The third is lack of engineering staff with design experience. Training support should be strengthened by the foreign official assistance.

(d) Salaries at present have to conform to the general guidance set by the Ministry of Labor. In addition, employees are paid bonuses based on achievement of roughly predetermined targets. As HWBC still operates at a low profitability, it has far less discretion in setting bonus levels than companies which are higher

profit. For example, the average monthly pay in HWBC is reported as 400,000 VND (Vietnamese Dong), while Da Nang Water Company employees average 1,000,000 VND. At these pay levels it will be difficult to attract or retain high quality staff, especially as more opportunities arise in the private sector.

(e) Lack of autonomy will prevent HWBC from becoming a self-sustaining company. Externally-imposed constraints (such as high staffing levels or low tariff) mitigate against efficiency and in reality, result in a lower level of service overall. Recent events have demonstrated that HWBC does not have the authority to dismiss any staff, even those found engaged in unprofessional conduct. If HWBC is to become commercially viable, it needs to be given sufficient management autonomy to operate efficiency. In principle, HWBC should have "hire and fire' authority, the power to set staffing levels in accordance with operational requirements.

At the same time the World Bank has reported the similar indication in the final report of the feasibility study (November 1995) as ADB did. Issues and countermeasures are as follows :

(a) High Unaccounted for Water

The most serious problem in the water supply service of Hanoi is the extremely high level of unaccounted-for water (UFW), defined as the proportion of water produced that is paid by consumers.

How much of UFW is caused by physical defects of the water supply system, and how much by inefficient administration and management of the system and customer relations is not well known. The most comprehensive study on the issue was done for the preparation of the Long Term Water Loss Reduction Plan (1993). In the plan it was concluded that administrative causes (billing, underestimation of use, illegal connections, overflow from tanks, etc.) stood for 40 - 45%, leakage for17- 20 %, and public taps and HWBC's own use for the remaining 10% of the 70 % UFW.

(b) Poor Institutional Performance

The feasibility study team considers the main causes for the poor institutional performance of the Hanoi Water Business Company to be too low salaries, over-staffing, weak skills and motivation of majority of the personnel, and old-fashioned corporate philosophy.

Salaries within HWBC must be brought up to levels that permit staff to survive without recourse to outside employment or to various forms of misappropriation of company property or revenues. Unless this is done, all sorts of abuses will continue, and efficient management is impossible. With increases in salaries should come greatly increased emphasis on accountability at present, there is a tacit acceptance that these abusive practices are inevitable, but in the future they should be grounds for penalties and sanctions (including dismissal).

Over-staffing will become a serious issue as salaries increase. Using the HWBC as a form of unemployment relief is not acceptable as a long-term policy. HWBC and its unit managers should have powers to hire and fire staff in accordance with their actual needs. Maintaining or increasing the number of staff can only be justified by a quite significant increase in the volume of services, especially in the number of metered consumer connections.

The skills of the personnel is another key factor limiting the institutional efficiency of the HWBC. Despite the HWBCs high staffing levels, the World Bank reports a lack of people competent to do many of the key tasks of a water utility. Both technical skills and managerial training needs to be provided, but there are certainly likely to be difficulties with senior staff who feel threatened by the greater fluency or knowledge of their subordinates. Training therefore needs to be carefully linked to in-house their discussions of better delegation.

The old-fashioned corporate philosophy could be taken as a common heading several major problems related to HWBC's overall operation:

(i) production-orientation gives actual provision of services a low priority;

(ii) lack of delegation leads to inefficient use of the time of managerial staff and to lack of motivation on the part of their subordinates;

(iii) lack of autonomy prevents HWBC from becoming a self-sustaining company.

Taken together, these mentioned institutional issues seriously hamper HWBC's development towards an effective and efficient, self-sustaining public utility.

(c) Low Service Level

A third major problem of the water supply service is the low standard of service provided to a high number of customers. Here "low standard of service" means unreliable or intermittent water supply, inadequate quantity or pressure of supply, or unsatisfactory quality of water. The easy way is to invest in new production capacity, which will certainly increase the availability of water to the system, but which quite easily leads to even higher water losses than what HWBC experiences, today. The more economical way is to invest in management improvements and network upgrading, to increase the portion of supplied water that actually reaches the customer. The World Bank feasibility study is actually proposing an approach where both these ways are used, in order to optimize the use of available resources, but at the same time to maximize HWBC's chances of achieving the desired improvements.

2.3.3 Financial Status of HPC, TUPWS, and HWBC

(1) Scope of Analysis

The financial analysis mainly focuses on the present financial condition of HWBC.

(2) Analysis on HWBC

1) Introduction

In the analysis of this section, original figures were mainly obtained from HWBC/ TUPWS, FINNIDA, and the World Bank mission. The main source of figures is the Finance Department of HWBC.

Since financial practices including accounting system in Vietnam are very much different from international standard, it is difficult to conduct international standard financial analysis of HWBC. As such analysis presented below was made on the basis of the available information.

Spreadsheets provided by the Finance Department of HWBC for the period of FYE 1991 to 1995 are attached in Appendix. (* There were several discrepancies in the financial statements. Figures were left uncorrected as originally provided unless clarified.)

2) Income Statement Analysis – Profitability

Profitability

	1991	1992	1993	1994	1995
Operating Margin /Total Revenues	11.1%	20.7%	5.4%	23.1%	21.3%
Electricity Cost / Total Revenues	53.4%	48.5%	60.5%	48.5%	45.2%
Depreciation / Total Revenues	6.0%	8.6%	N.A.	8.4%	6.8%
Interest / Total Revenues	-	-	-	-	-
Tax / Operating Margin	61.3%	22.2%	N.A.	16.9%	15.8%
Net Operating Profit / Total Revenues	-7.9%	3.7%	1.3%	1.3%	2.3%

From 1991 to 1995, Water Revenues of HWBC rose rapidly as high as 35.1% annual average. This is attributed to a) increased water consumption, b) tariff adjustment, c) inflation during the period, d) meter installation increase and e) improvement in bill collection system.

In the last five years profitability of the company was favorably improved as indicated by operating margin ratio 11.1% in 1991 to 21.3% in 1995, net operating profit ratio negative 7.9% to positive 2.3%.

Out of Operating and Maintenance Costs, the biggest component is Electricity Cost (45.2% of Total Revenues in 1995). Other Cost is 17.8% and Administration Cost 9.7%. Historical Electricity Cost by unit is shown below.

Electricity Cost by Unit

	1991	1992	1993	1994	1995
VND/kWh	120	230	480	550	550

According to HWBC Finance Department., more than half of Other Cost is used for repair of facilities and equipment.

Three problems should be pointed out regarding the profitability of HWBC.

A. Insufficient Maintenance

Operating margins have been positive and improving during the last five years. However, taking into account of the present water leakage conditions and the low water pressure in certain areas, appropriate maintenance costs have been too low to keep up the sufficient service.

B. Insufficient Depreciation Charges

On the financial statements of HWBC for the period, Fixed Assets depreciation charges did not squeeze the profitability of the company much, as low as 4 billion VND or 6.8% of Total Revenues in 1995.

Those depreciation charges have been clearly too low considering a) the corresponding inflation rate has been more than 200%, and b) major

replacements and new investments have been carried out outside the company's balance sheet under the HWSP. Thus proper revaluation of fixed assets is necessary to measure accurate financial position of HWBC. In April 1996 preliminary revaluation was carried out by HWBC and a fixed asset value of about 700 billion VND was estimated. As HWBC did not have adequate data on the prices of materials, facilities, and construction works, data from HWSP, bills of material purchase, and old documents of fixed assets of previous HWSC were used in calculating revaluation figure.

C. Uncollected Bills

In the financial statements of HWBC, uncollected bills have been included in the Revenues as an element of mixture of cash base and accrual base accounting. In case of non- payment, a collector at a WBE will repeatedly visit the customer, however, there is a limit in collecting bill under this primitive method. During the year 1995 average 2.0% of bill issued was uncollected. (Detail analysis is made in 2.3.4)

3) Balance Sheet Analysis -- Liquidity, Asset Turnover, & Capital Structure

Liquidity, Asset Turnover

	1991	1992	1993	1994
Sales / Net Plant	0.73	0.87	1.02	1.58
Accumulated Depreciation / Net Plant	0.78	0.78	0.89	1.12
Accumulated Depreciation / Depreciation	17.7	10.3	N.A.	8.4
Current Ratio	1.30	4.21	1.52	1.56
Quick Ratio	0.61	2.24	0.66	0.56
Account Receivables Days-On-Hand	42 days	43 days	60 days	40 days

On surface, HWBC's liquidity has been high (Current Ratio 1.56 in FYE 1994). But considering the relatively large inventories (Quick Ratio stood at 0.56 in FYE 1994) and low cash convertibility of Account Receivables, true liquidity could be deemed lower than appearance.

Net Plant Turnover has improved for 0.73 in FYE 1991 to 1.58 in FYE 1994 and Plant Age improved from 17.7 to 8.4 as well. However, given the benefits from FINNIDA's HWSP and underestimated depreciation figure, those figures cannot be deemed appropriate to expose real asset efficiency of HWBC.

Although current collection policy is 30 days allowance to settle a bill, Account Recievables Days-On-Hand has remained large like 40 days in FYE 1994. Further improvement in collection efficiency is required to meet the Financial Objective of less than 30 days given by the World Bank Project.

Capital Structure

	1991	1992	1993	1994
Short-Term Borrowings to Total Footing	2.1%	-	5.8%	4.1%
Long-Term Borrowings to Total Footing	-	-	-	-
Networth to Total Footing	85.9%	95.3%	78.0%	73.0%
Leverage	0.16	0.05	0.28	0.37

By appearance, HWBC has enjoyed ample Net Worth and low leverage. In FYE 1994 Net Worth accounted for 73.0% of total Footing and Leverage is as low as 0.37. However, in fact, this is mainly owing to a) subsidies from the Government, b) free use of assets contributed by HWSP, c) underestimation of depreciation and d) insufficient maintenance of buildings, machineries, and equipment.

Because in the past major investments were taken care by FINNIDA's HWSP and the Government, it was not necessary to borrow long term finances. The company borrowed small amount of short term loans (2 billion VND in FYE 1994) from the Industrial & Commercial Bank (Incombank) for working capital finance.

4) Cash Flow Analysis

Cash Flow

	1991	1992	1993	1994
NOPAT / interest	N.A.	N.A.	N.A.	N.A.
COPAT / interest	N.A.	N.A.	N.A.	N.A.

Although there have been some Short-Term Borrowings on the Balance Sheets, no concrete interest cost figures have been shown in the Income Statements provided by HWBC. According to the World Bank Final Report on the Hanoi Water Supply and Environment Project dated November 1995, there was 600 million VND interest cost in FYE 1993 which equals only 1.8% of Total Revenues. Therefore, in the past interest cost has not been a major financial burden to HWBC.

5) Fundraising Ability

Fundraising ability of HWBC has been weak. The company has a limited access to the financial market and the capital market. As stated in the World Bank Report "Vietnam: An Agenda for Financial Sector Development", printed in March 1995, in Vietnam because of premature financial system, State-owned Enterprises (SEs) have limited capability in introducing outside source funding and for this purpose basically they rely on State-owned Commercial Banks. In the case of HWBC, only the Incombank has disbursed loans to the company for short term such as three months. For longer term finance, HWBC might have asked the Bank for Investment and Development of Vietnam (BIDV), however, loan pricing has been too expensive for HWBC like more than 20 percent per annum.

6) Accounting System

In accordance with Decision No. 1141 issued in Jan. 11. 1995 by the Ministry of Finance of Vietnam, the New Accounting System has been officially applied to all enterprises of all economic sectors throughout the country from January 1, 1996. The new system is based on international accounting standard close to the American standard.

However, two problems should be pointed out in this matter.

a) Most staffs in HWBC were not yet familiar with the new system.

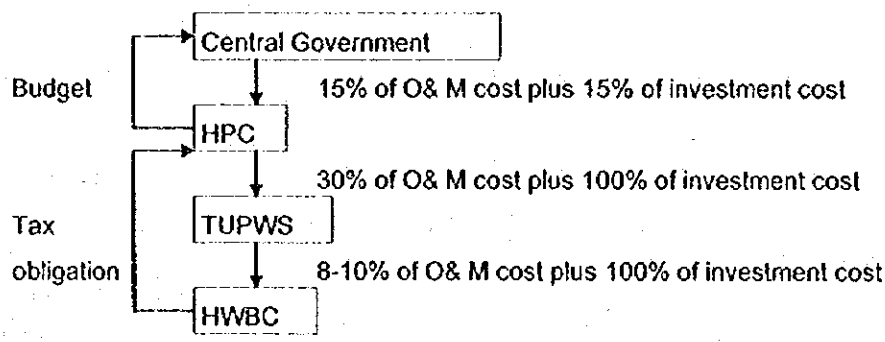
b) The new system is closer to the international accounting standard (IAS) than the previous socialism standard, but still different from the exact IAS.
The differences for example are summarized as below :

	New Accounting System	IAS
Chart of Accounts	Inflexible	Flexible
Depreciation Method	Only one method (Straight-line method)	More than five methods
Accrual Base Accounting	Cash base mixed	Accrual base accounting in strict form
Disclosure	Limited	Strictly required
Internal / External Control	Limited	Strictly required

(3) Analysis on HPC and TUPWS

In analyzing the creditworthiness of HWBC, it is essential to survey the flow of the subsidies. However, no written formal documents have yet been found stipulating about subsidy policy.

According to the interviews with senior officers in TUPWS in March 1996, the flow of the budget and subsidies in the past was as follows :



By ceasing subsidies, creditworthiness of HWBC have become more vulnerable than before due to the weak financial position or no self-financing situation as explained above.

(4) Conclusions on the financial position of HWBC

HWBC's financial position has not been that bad on surface, however, if applying international standard analysis, the company should be quite vulnerable meaning :

a) HWBC is not self-financing i.e. not covering O&M and capital costs.

b) the company is weak in fundraising i.e. commercial base funding cost would be very expensive, if any.

2.3.4 Billing and Collection System of HWBC — Administration Loss

(1) Introduction

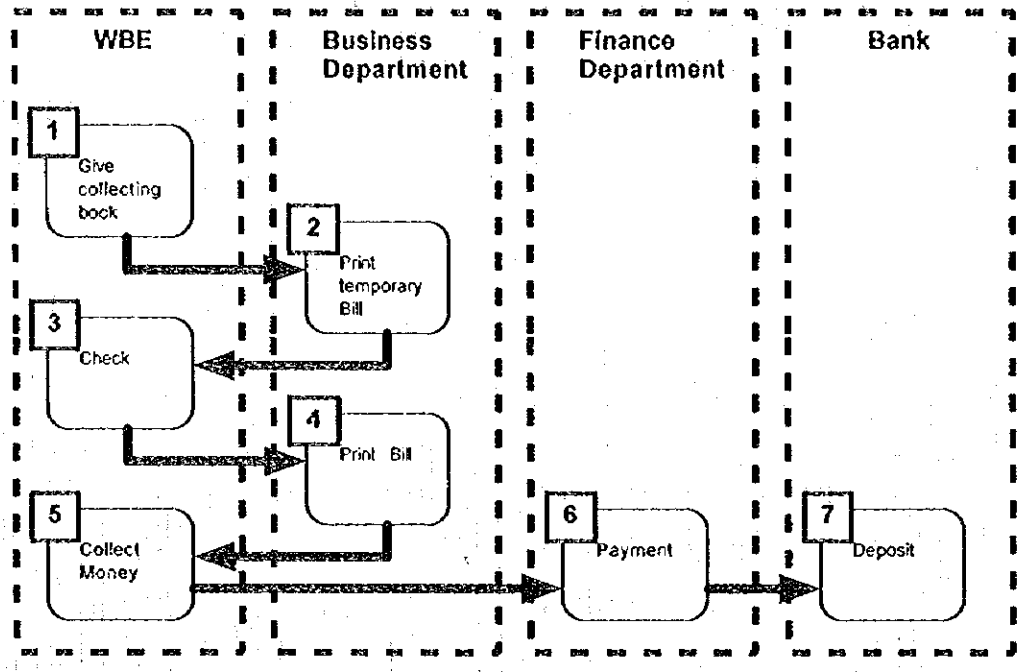
Same as any other water supply companies, water charges are the very main revenue source for HWBC. Therefore, billing and collection is one of the most important operations for the company.

As pointed out by the World Bank Final Report on the Hanoi Water Supply and Environment Project in November 1995 and FINNIDA's Final Report on HWSP in April 1993, tremendous efforts have been made to improve the billing and collection system of HWBC, but yet the company's system itself and the progress level of automation have not been enough.

The analysis in this chapter is mostly based on the data from the Business Department of HWBC. Additional references were from FINNIDA's Financial Advisor's Report, Final Report on Water Master Plan of Hanoi City and World Bank's Final Report.

(2) Billing and Collection Flow of HWBC

The following chart shows the flow of the operation of billing and collection as of April 1996 (based on the FINNIDA's Financial Advisor's Report and interviews with HWBC).



Explanation

1. Reader in a WBE reads meter and writes to book then sends it to Business Department to input to computer
2. The operator prints temporary bills then sends them to the WBE
3. Reader checks it then sends it to Business Department
4. The operator prints bills then sends them to the WBE
5. Collector in the WBE collects money (Cash or Check)
6. Pay to cashier in Finance Department
7. Depositing money to the bank

(3) Administration Loss

There have been several deficiencies in the process of billing and collection of HWBC which led to administration loss. Unaccounted-for water (UWF) ratio in concluded to be 71% which was composed of 25% physical loss and 46% administration loss (see "Water Leakage Report" in appendix). Administration loss is considered to be composed of the below four elements.

1) Illegal Connections

Statistical figure has not been available as of October 1996 for this category. But not only HWBC themselves but also outside experts claim illegal connections are main financial drains for HWBC. Illegal connections are mainly done among unregistered household customers and other individuals like job-seekers by connecting private pipes to the network without official permissions.

2) Excess Use over the Flat Rate

In case of no water meter installed, HWBC charges customer at the flat rate. For domestic customers the company charges at the assumption of 4 m^3 /capita / month in principle, and for non-domestic and foreign customers on negotiation basis.

Naturally flat rate is not a system to solicit customers to save water, thus excessive use could be considered common.

According to the data from HWBC's Business Department for February 1996, in terms of registered connection numbers, 65.6% of domestic customers are flat rate charged, and 43.2% of non-domestic customers, 53.0% of foreigners respectively.

* Grand total connection number in the service area by HWBC was 126,293 as of Feb. 1996. For detail, see the tables in 4) Defective Billing and Collection.

3) Waste of Water at Public Taps

HPC has been bearing charges for public taps, assuming 10% of total water production at the rate of 1,000 VDN / m^3.
Same as the case of flat rate use, consumers of public taps tend to use water excessively.

In June 1996, number of public taps is estimated some 700, and HWBC's policy is to convert the public taps into house connection by 10% annually to reduce waste of water.

4) Defective Billing and Collection

Defective Billing and Collection might be the biggest headache among administrative losses for HWBC. There are three types of defective billing and collection in HWBC: (A) no bill or zero bill, (B) incorrect billing (C) non-collection and partial collection

A. No Bill or Zero Bill

Table of Billing Situation as of Feb. 1996

Domestic Customers

District	Total of Connections	Total of Bill	Total of No Bill	Water Meter		Flat Rate	
				Bill	No Bill	Bill	No Bill
Ba dinh	27,062	19,407	7,655	9,004	2,716	10,403	4,939
Hoan kiem	11,039	8,719	2,320	941	268	7,778	2,052
Dong da	40,686	28,966	11,720	9,999	4,672	18,967	7,048
Hai Ba Trung	28,140	18,859	9,281	6,349	2,766	12,510	6,515
Tu Liem	12,991	7,912	5,079	2,967	1,852	4,945	3,227
Gia Lam	1,581	1,315	266	211	47	1,104	219
Total	121,499	85,178	36,321	29,471	12,321	55,707	24,000

Non-Domestic Customers

District	Total of Connections	Total of Bill	Total of No Bill	Water Meter		Flat Rate	
				Bill	No Bill	Bill	No Bill
Ba dinh	832	719	113	430	55	289	58
Hoan kiem	842	766	76	233	41	533	35
Dong da	970	868	102	709	79	159	23
Hai Ba Trung	687	568	119	234	45	334	74
Tu Liem	455	376	79	289	47	87	32
Gia Lam	98	83	15	39	6	44	9
Total	3,884	3,380	504	1,934	273	1,446	231

Foreign Customers

District	Total of Connections	Total of Bill	Total of No Bill	Water Meter		Flat Rate	
				Bill	No Bill	Bill	No Bill
Ba dinh	250	213	37	158	25	55	12
Hoan kiem	277	269	8	75	4	194	4
Dong da	175	153	22	112	10	41	12
Hai Ba Trung	208	184	24	37	7	147	17
Tu Liem	0	0	0	0	0	0	0
Gia Lam	0	0	0	0	0	0	0
Total	910	819	91	382	46	437	45

Source: HWBC Business Department

High proportion of non-bill or zero bill cases is found in HWBC operation. In February 1996, 29.9% of registered domestic connections was non-billed or zero billed, 13.1% of non-domestic and 10.0% of foreign connections respectively.

According to HWBC Business Department, there were several reasons:

a) In some connections no water to use was provided, thus no bill or zero bill occurs.
b) Due to inefficient internal coordination, although some customers signed up service agreements with HWBC, that information was not sent to Business Department thus no bill was issued.
c) Due to mechanical confusion, only one customer code could have been assigned to two households thus one of the households got no bill d)some meter reader did not do proper job to keep accurate record of meter (for example, in February put accumulated water usage volume figure in the book same as January, thus usage for February became zero)

B. Incorrect Billing

No concrete figures are available for incorrect billing. Two main reasons of incorrect billing were:

a) There were out of order meters in the area. Meters could show much lower volume than actually used. HWBC has been undertaking replacement into proper meters.
b) Readers in WBE's could mistakenly read water meters. As long as reading were done by human beings, those cases were inevitable.

C. Non-Collection and Partial Collection

Uncollected Bill of WBEs (VND)

WBE	Total of Uncollected Bill in 1995			Uncollected Bill in Jan/96	
	Total bill in 12 months	Uncollected bill in 12 months	Percent	Amount	Percent
Ba dinh	13,608,125,000	210,811,440	1.55	90,539,690	8.0
Hoan kiem	10,812,350,000	257,523,933	2.38	91,558,660	9.6
Dong da	16,040,462,000	243,586,755	1.51	89,414,620	6.6
Hai Ba Trung	11,056,219,000	273,615,972	2.47	114,371,200	12.4
Tu Liem	7,092,219,000	190,683,184	2.68	178,960,700	25.8
Gia Lam	1,280,611,000	28,075,800	2.19	33,098,600	32.4
Total	59,889,986,000	1,204,297,084	2.01	597,943,470	11.6

Source: HWBC Business Dept

In 1995 year average, uncollected amount of total bill accounted for only 2.0% which is significantly lower than the estimated some 10% indicated in the Final Report of World Bank in November 1995. As shown in the above matrix, uncollected bill in January is significantly higher than year average as collection effort for January water charge would be done in February thereafter.

Basically in HWBC organization water charges are collected by collectors in WBEs. Collectors physically visit each customer and collect charges by cash. From 1995 in some areas as a test case, a domestic representative has collected charges from other households in exchange for some incentive money rewards. In any case it is difficult to expect 100% collection in those circumstances.

As shown in the interview survey by JICA Study Team and the National Water Tariff Policy Study, affordability is not a big bottleneck, but willingness to pay is. In summary, low service level provided by HWBC is the problem. Based on the interviews with HWBC Business Dept. officers, customers did not pay at all or pay only partially of water charge because of (a) lack of enough water supply (e.g. low water pressure, etc.) (b) too high deemed flat rate in case of no meters (c) refusal to pay metered bill in case meter was out of order to show higher than actual volume.

From the viewpoint of financial aspects, overdue interest or penalty payment should be levyed theoretically, but not in use as of April 1997. Disconnection policy has not been strictly applied either.